

# INVT Flex Series I/O System User Manual



# Preface

## Overview

Thank you for choosing INVT Flex series I/O system.

INVT Flex series I/O system is a flexible, reliable, and efficient signal transmission system with a more reliable structural design. The system is able to access multiple standard communication networks, respond in microseconds, and is equipped with rich signal modules to meet various industrial automation needs while saving cabinet space, helping you develop more competitive personalized solutions.

## Target audience

Personnel with electrical professional knowledge (such as qualified electrical engineers or personnel with equivalent knowledge).

## About documentation obtaining

In addition to this user guide, you can also obtain product documentation and technical support from our website:

Visit [www.invt.com](http://www.invt.com), choose **Support** > **Download**, enter a keyword, and click **Search**.

## Change history

The manual is subject to change irregularly without prior notice due to product version upgrades or other reasons.

| No. | Change description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Version | Release date   |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------------|
| 1   | First release.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | V1.0    | September 2023 |
| 2   | <ul style="list-style-type: none"><li>Added description information to section 2.1.1.4.</li><li>Added section 2.3 EtherNet/IP communication coupler.</li><li>Added expansion module content to sections 3.1.2, 3.2.2, 3.3.2, and 3.9.</li><li>Added FK1200 related content to section 4.2.1.1.</li><li>Added five 32-point module models to section 4.2.2.1.</li><li>Added PROFINET communication coupler to section 5.4.1.</li><li>Added terminal definition and wiring content to sections 5.4.2.2, 5.4.3.2, 5.4.4.2, and 5.4.10.</li><li>Updated chapter 6 Communication coupler configuration.</li><li>Added chapter 8 EtherCAT functions.</li></ul> | V1.1    | August 2024    |
| 3   | <ul style="list-style-type: none"><li>Added section 2.4 ModbusTCP communication coupler.</li><li>Added section 6.4 ModbusTCP configuration</li><li>Added sections 6.1.1.9 Counting and measurement module (FL6002), 6.1.1.10 Counting and measurement module (FL6112), 6.1.1.11 Counting and measurement module (FL6121)</li></ul>                                                                                                                                                                                                                                                                                                                       | V1.2    | January 2025   |

| No. | Change description                                                                                                                                                                                                                                                                                                                                                                                                                                       | Version | Release date  |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------------|
|     | <ul style="list-style-type: none"> <li>Added sections 6.2.1.12 Analog input module—FL3404(8ADV), 6.2.1.13 Analog input module—FL3504(8ADI), 6.2.1.17 Counting and measurement module—FL6002-2ES, 6.2.1.18 Counting and measurement module—FL6112-2EI, and 6.2.1.19 Counting and measurement module—FL6121-1EI.</li> <li>Added chapter 7 Common functions of Ttools-IO software.</li> <li>Added appendix A Address mapping table instructions.</li> </ul> |         |               |
| 4   | <ul style="list-style-type: none"> <li>Added sections 3.9.3 FL5004 (08P08P), 3.9.4 FL5104 (08N08N), 3.12 Bridge detection module (FL332x) and 3.13 Dual-channel pulse output control module (FL7102).</li> <li>Modified the terminal wiring in sections 3.10.1 FL7200 (PWR), 3.11.1 FL6002 (2ES), 3.11.2 FL6112 (2EI), and 3.11.3 FL6121 (1EI_DF).</li> </ul>                                                                                            | V1.3    | November 2025 |

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# 1 Safety precautions

## 1.1 What this chapter contains

Read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the active power filter. Otherwise, equipment damage or physical injury or death may be caused.

We shall not be liable or responsible for any equipment damage or physical injury or death caused due to failure to follow the safety precautions.

## 1.2 Safety level definition

To ensure personal safety and avoid property damage, you must pay attention to the warning symbols and tips in the manual.

| Warning symbols                                                                    | Name    | Description                                                                               |
|------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------------|
|   | Danger  | Severe personal injury or even death can result if related requirements are not followed. |
|  | Warning | Personal injury or equipment damage can result if related requirements are not followed.  |

## 1.3 Personnel requirements

**Trained and qualified professionals:** People operating the equipment must have received professional electrical and safety training and obtained the certificates, and must be familiar with all steps and requirements of equipment installing, commissioning, running and maintaining and capable of preventing any emergencies.

## 1.4 Safety guidelines

| General principles                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <ul style="list-style-type: none"><li>• Only trained and qualified professionals are allowed to carry out related operations.</li><li>• Do not perform wiring, inspection or component replacement when power supply is applied. Ensure that all the input power supplies are disconnected before wiring and inspection.</li><li>• The product design is applied to indoor electrical environments at overvoltage category II. Ensure that the power supply system of the product has lightning protection devices to prevent lightning overvoltage from being applied to the power input or signal I/O terminals of the product so as to avoid equipment damage.</li><li>• Do not modify the product unless authorized; otherwise fire, electric shock or other injury may result.</li><li>• Prevent cables and other conductive parts from falling into the product.</li><li>• Do not contact the product with damp objects or body parts. Otherwise, electric shock may result.</li></ul> |

| Delivery                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <ul style="list-style-type: none"> <li>• Select appropriate tools for product delivery, and take mechanical protective measures like wearing safety shoes and working uniforms to avoid personal injury.</li> <li>• Protect the product against physical shock or vibration.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Installation                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|    | <ul style="list-style-type: none"> <li>• Do not install the product on inflammables. In addition, prevent the product from contacting or adhering to inflammables.</li> <li>• Do not run a damaged or incomplete product.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|    | <ul style="list-style-type: none"> <li>• Install the product in a lockable control cabinet of at least IP20, which prevents personnel without electrical equipment related knowledge from touching by mistake, since the mistake may result in equipment damage or electric shock. Only personnel who have received related electrical knowledge and equipment operation training can operate the control cabinet.</li> <li>• During installation, ensure that the modules are tightly connected and fastened. Insecure connection may cause problems such as communication failure and fall-off.</li> <li>• After installation, ensure that there are no obstructions on the vents of the product; otherwise, the chips of the product may be burned due to overheating and poor heat dissipation, which causes system control failure and misoperation.</li> </ul> |
| Wiring                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|  | <ul style="list-style-type: none"> <li>• Before wiring, clearly understand the necessary information including interfaces, power supply types, and specifications, and comply with relevant standards and requirements to ensure that the system wiring is correct.</li> <li>• To ensure personal safety and equipment use safety, reliably ground the product using cables with proper diameters and specifications.</li> <li>• Route the control signal and communication signal cables separately from cables with strong interference such as power cables.</li> <li>• Apply fastening means to long-distance or heavy cables.</li> </ul>                                                                                                                                                                                                                        |
|  | <ul style="list-style-type: none"> <li>• Cut off all power supplies connected to the product before performing wiring.</li> <li>• Before power-on for running, ensure that each module terminal cover is properly installed in place after the installation and wiring are completed. This prevents a live terminal from being touched. Otherwise, physical injury, equipment fault or misoperation may result.</li> <li>• Install proper protection components or devices when using external power supplies for the product. This prevents the product from being damaged due to external power supply faults, overvoltage, overcurrent, or other exceptions.</li> </ul>                                                                                                                                                                                           |

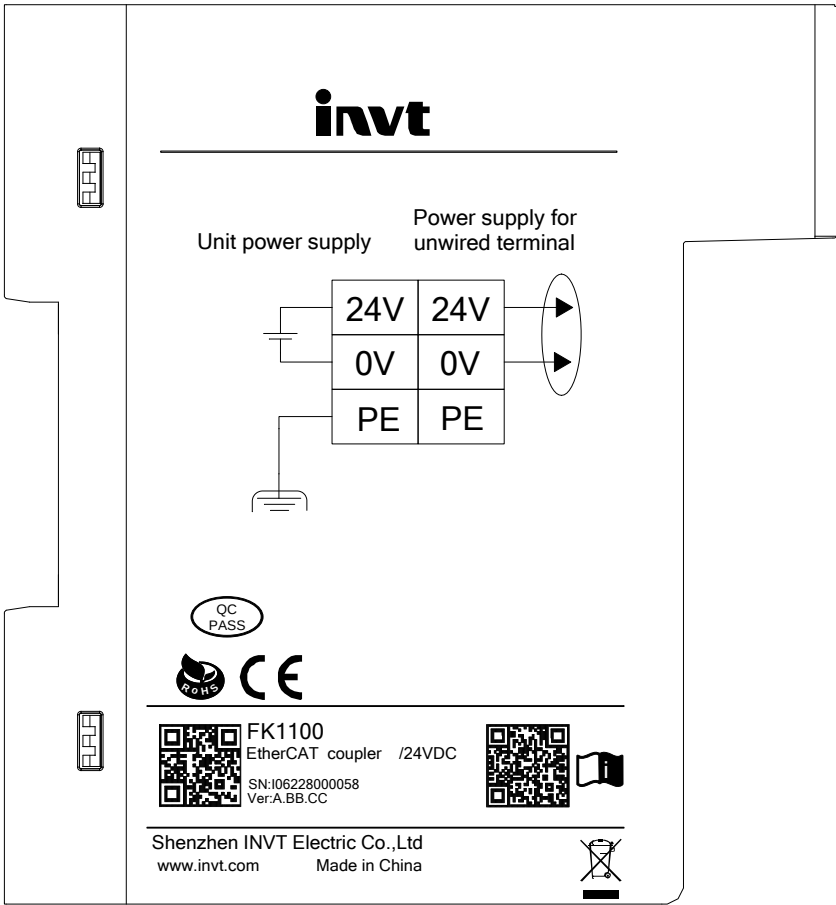
| Commissioning and running                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <ul style="list-style-type: none"> <li>Before power-on for running, ensure that the working environment of the product meets the requirements (See section 4.1.2 Installation environment and site for details), and a protection circuit has been designed to protect the product so that the product can run safely even if an external device fault occurs.</li> <li>When the output units such as relays and transistors of the product are damaged, the output cannot be controlled to be On or Off as configured.</li> <li>For modules or terminals requiring external power supply, configure external safety devices such as fuses or circuit breakers to prevent damage caused due to external power supply or device faults.</li> <li>In the external circuit of the product, configure an emergency braking circuit, a protection circuit, a circuit for interlocking between forward and reverse operations, and an anti-equipment-damage switch for interlocking between the position upper limit and lower limit.</li> <li>To ensure the safe running of equipment, design external protection circuits and safety mechanisms for output signals related to major accidents.</li> <li>Design proper external control circuits to ensure the proper running of equipment, since outputs may be out of control when the control circuit has an exception.</li> </ul> |
| Maintenance and component replacement                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  | <ul style="list-style-type: none"> <li>Keep the product and its parts and components away from combustible materials and ensure they have no combustible materials adhered.</li> <li>Before carrying out product maintenance or component operations, cut off all power supplies connected to the product.</li> <li>Prevent the screws, cables and other conductive parts from falling into the product during maintenance or component replacement.</li> <li>During maintenance and component replacement, take proper anti-static measures on the product and its internal parts.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Note</b>                                                                         | <ul style="list-style-type: none"> <li>Use proper torque to tighten screws.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Disposal                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  | <ul style="list-style-type: none"> <li>The product contains heavy metals. Dispose of a scrap product as industrial waste.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|  | <ul style="list-style-type: none"> <li>Dispose of a scrap product separately at an appropriate collection point and do not place it in the normal waste stream.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

# 2 Communication coupler specifications

## 2.1 EtherCAT communication coupler

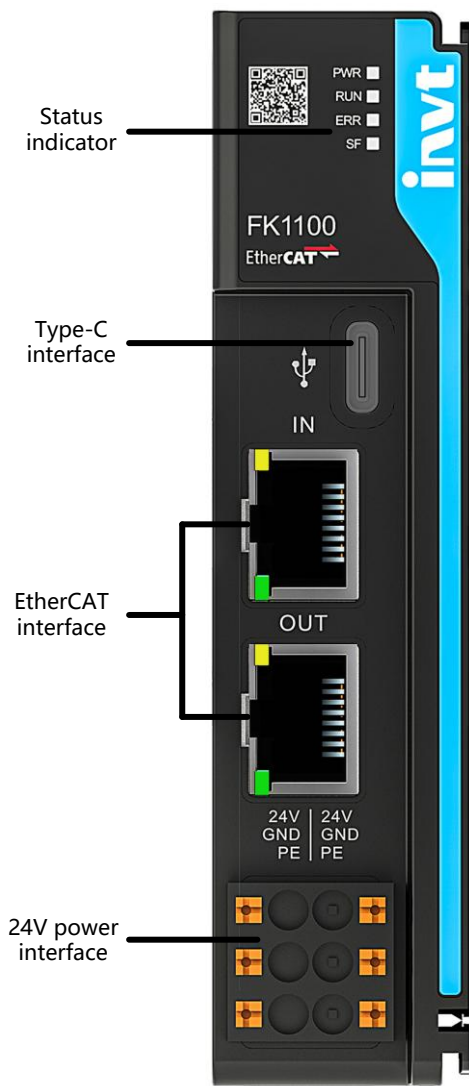
### 2.1.1 FK1100

#### 2.1.1.1 Basic information



| Model  | Ordering code | Description                                 | Applicable model                                           |
|--------|---------------|---------------------------------------------|------------------------------------------------------------|
| FK1100 | 11016-00005   | Communication coupler, EtherCAT; 4VDC; RoHS | Applicable to INVT and third-party EtherCAT master devices |

2.1.1.2 Component description



| Interface        |                              | Definition   |                                                                                                           |
|------------------|------------------------------|--------------|-----------------------------------------------------------------------------------------------------------|
| Status indicator | PWR: Power indicator (Green) | Off          | The power connection is abnormal.                                                                         |
|                  |                              | On           | The power connection is normal.                                                                           |
|                  | RUN: Run indicator (Green)   | Off          | The communication coupler module is in INIT state.                                                        |
|                  |                              | Blinking     | The communication coupler module is Pre-Operational state.                                                |
|                  |                              | Single flash | The communication coupler module is in Safe-Operational state.                                            |
|                  |                              | On           | The communication coupler module is Operational state.                                                    |
|                  | ERR: Fault indicator (Red)   | Off          | The EtherCAT communication is in normal state.                                                            |
|                  |                              | Blinking     | A status conversion command that cannot be executed has been received through the EtherCAT communication. |
|                  |                              | Single flash | The network is disconnected, and the communication coupler module encounters a synchronization error.     |

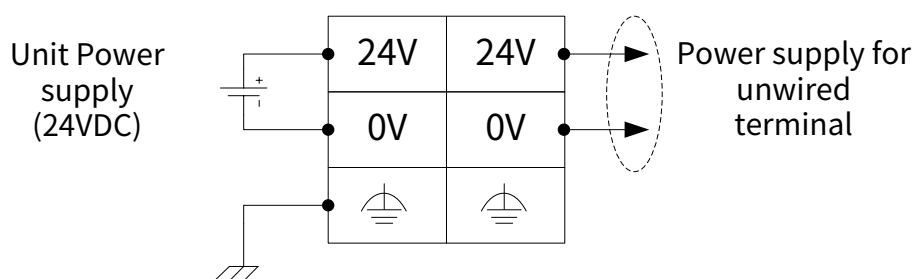
| Interface            | Definition                             |              |                                                        |
|----------------------|----------------------------------------|--------------|--------------------------------------------------------|
|                      | SF: Fieldbus fault indicator (Red)     | Double flash | A Watchdog error occurs in the EtherCAT communication. |
|                      |                                        | Off          | The equipment is running normally.                     |
|                      |                                        | Blinking     | Configuration error occurs.                            |
|                      |                                        | On           | A communication coupler FPGA fault occurs.             |
| USB type-C interface | Used for single board software upgrade |              |                                                        |
| EtherCAT interface   | IN: EtherCAT input port                |              |                                                        |
|                      | OUT: EtherCAT output port              |              |                                                        |
| 24V power interface  | 24VDC power input interface of module  |              |                                                        |

### 2.1.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal                                                                         | Left terminal | Right terminal | Right signal                                                                          |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------|----------------|---------------------------------------------------------------------------------------|
|  | 24V                                                                                 | -             | -              | 24V                                                                                   |
|                                                                                    | 0V                                                                                  | -             | -              | 0V                                                                                    |
|                                                                                    |  | -             | -              |  |

#### ■ Terminal wiring



### 2.1.1.4 Hardware specifications

| Item                                    | Specification                                                  |
|-----------------------------------------|----------------------------------------------------------------|
| Rated input voltage                     | 24VDC (20.4VDC–28.8VDC)                                        |
| Rated input current                     | 0.8A (Typical value at 24VDC)                                  |
| Backplane fieldbus output rated voltage | 5VDC (4.75VDC–5.25VDC)                                         |
| Backplane fieldbus output rated current | 2.5A (Typical value at 5VDC)                                   |
| Isolation                               | The input power is not isolated.                               |
| Power supply protection                 | Protection against overcurrent, reverse connection, and surges |



### 2.1.1.5 Software specifications

| Item                                  | Specification                                                                                                                                                                                                                                                                                            |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alias access                          | Supporting EtherCAT alias access and site alias setup on backend. Alias range: 1–65535<br> <b>Note:</b> The expansion modules connected behind the EtherCAT communication coupler do not support alias access or setup. |
| Quantity of input PDO                 | Up to 768 bytes                                                                                                                                                                                                                                                                                          |
| Quantity of output PDO                | Up to 768 bytes                                                                                                                                                                                                                                                                                          |
| Input mailbox size                    | Up to 128 bytes                                                                                                                                                                                                                                                                                          |
| Output mailbox size                   | Up to 128 bytes                                                                                                                                                                                                                                                                                          |
| Max. number of expansion modules      | 16                                                                                                                                                                                                                                                                                                       |
| Supported min. synchronization period | 512μs                                                                                                                                                                                                                                                                                                    |

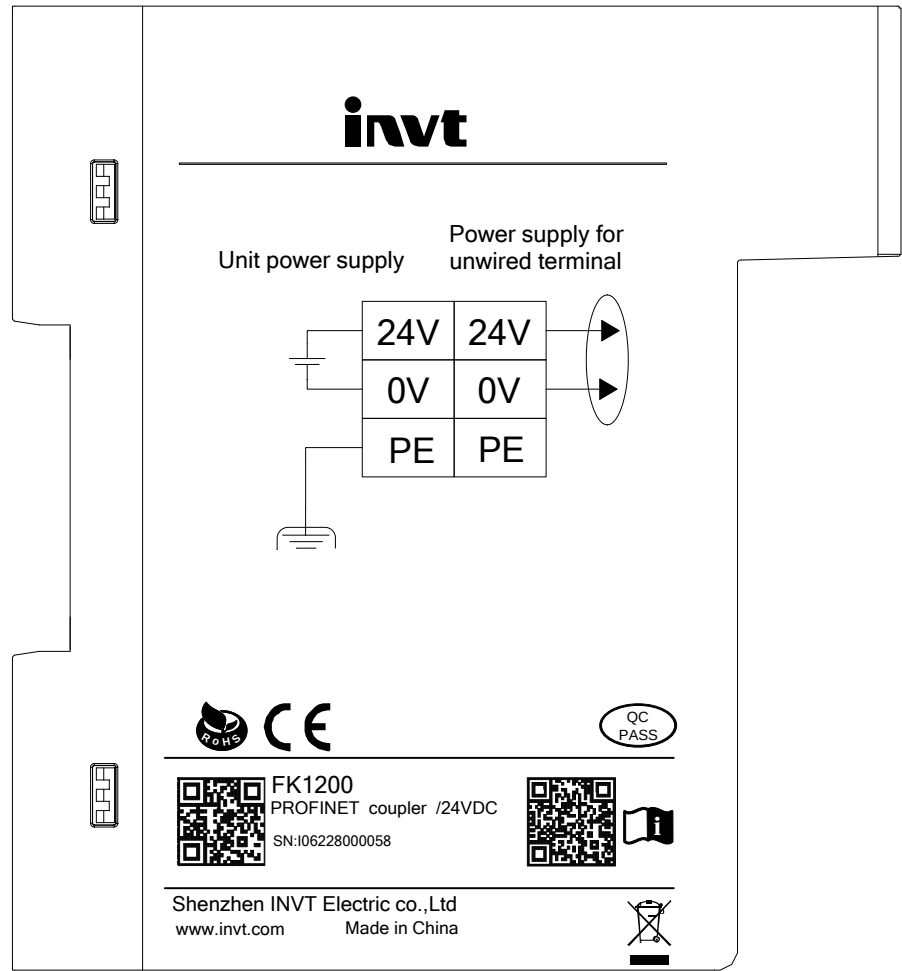
### 2.1.1.6 Environment requirements

| Item                                       | Specification                               |
|--------------------------------------------|---------------------------------------------|
| Working environment temperature            | -20°C–+55°C                                 |
| Working environment relative humidity (RH) | RH < 95%, no condensation                   |
| Storage temperature                        | -40°C–+70°C (RH < 90%, no condensation)     |
| Air                                        | No corrosive gas                            |
| Altitude                                   | Lower than 3000m                            |
| Pollution degree                           | Below degree 2                              |
| Immunity                                   | 2kV power cable compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                 |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2           |
| Vibration resistance                       | Compliant with IEC60068-2-6                 |
| Impact resistance                          | Compliant with IEC60068-2-27                |

## 2.2 PROFINET communication coupler

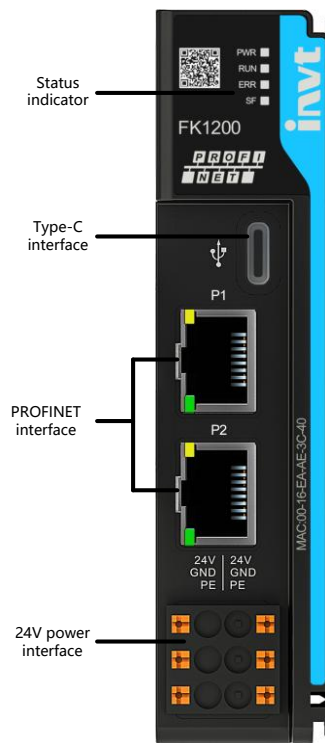
### 2.2.1 FK1200

#### 2.2.1.1 Basic information



| Model  | Ordering code | Description                                  | Applicable model                      |
|--------|---------------|----------------------------------------------|---------------------------------------|
| FK1200 | 11016-00012   | Communication coupler, PROFINET, 24VDC; RoHS | Applicable to PROFINET master devices |

2.2.1.2 Component description



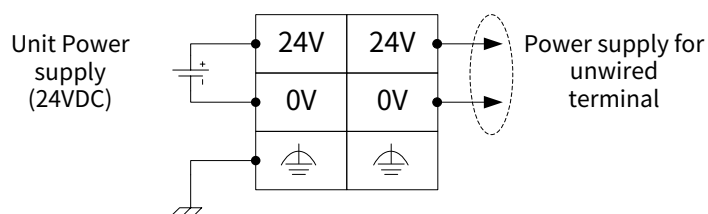
| Interface            | Definition                             |               |                                      |
|----------------------|----------------------------------------|---------------|--------------------------------------|
| Status indicator     | PWR: Power indicator (Green)           | Off           | The power connection is abnormal.    |
|                      |                                        | On            | The power connection is normal.      |
|                      | RUN: Run indicator (Green)             | Off           | Initial state                        |
|                      |                                        | Fast blinking | Waiting for connection/Connecting.   |
|                      |                                        | Slow blinking | Safe mode                            |
|                      |                                        | On            | The communication is normal.         |
|                      | ERR: Fault indicator (Red)             | Off           | In normal state                      |
|                      |                                        | Fast blinking | A communication fault occurred.      |
|                      |                                        | Slow blinking | An expansion module fault occurred.  |
|                      | SF: Fieldbus fault indicator (Red)     | Off           | The equipment running is normal.     |
|                      |                                        | Blinking      | Configuration inconsistency.         |
|                      |                                        | On            | An extended function fault occurred. |
| USB type-C interface | Used for single board software upgrade |               |                                      |
| PROFINET interface   | P1: PROFINET interface 1               |               |                                      |
|                      | P2: PROFINET interface 2               |               |                                      |
| 24V power interface  | 24VDC power input interface of module  |               |                                      |

### 2.2.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                 | Left signal                                                                       | Left terminal | Right terminal | Right signal                                                                        |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------|----------------|-------------------------------------------------------------------------------------|
|  | 24V                                                                               | -             | -              | 24V                                                                                 |
|                                                                                   | 0V                                                                                | -             | -              | 0V                                                                                  |
|                                                                                   |  | -             | -              |  |

#### ■ Terminal wiring



### 2.2.1.4 Hardware specifications

| Item                                    | Specification                                                  |
|-----------------------------------------|----------------------------------------------------------------|
| Rated input voltage                     | 24VDC (20.4VDC–28.8VDC)                                        |
| Rated input current                     | 0.8A (Typical value at 24VDC)                                  |
| Backplane fieldbus output rated voltage | 5VDC (4.75VDC–5.25VDC)                                         |
| Backplane fieldbus output rated current | 2.5A (Typical value at 5VDC)                                   |
| Isolation                               | The input power is not isolated.                               |
| Power supply protection                 | Protection against overcurrent, reverse connection, and surges |

### 2.2.1.5 Software specifications

| Item                               | Specification                                                        |
|------------------------------------|----------------------------------------------------------------------|
| Communication mode                 | RT mode                                                              |
| Min. communication period          | 1ms                                                                  |
| I&M data                           | From I&M0 to I&M3                                                    |
| PROFINET version                   | V2.43                                                                |
| Expansion capability               | Supporting 16 modules                                                |
| PROFINET interface quantity        | 2                                                                    |
| PROFINET switch function           | Supporting the function of networking                                |
| Supported open IE                  | TCP/IP, SNMP, and LLDP                                               |
| Alarm/Diagnosis/Status information | Supported. Function codes can be uploaded from the local to the PLC. |
| Physical layer                     | 100BASE-TX                                                           |
| Communication rate                 | 10Mbit/s (Standard Ethernet); 100Mbit/s (PROFINET)                   |
| Communication method               | Full duplex                                                          |

| Item                                                | Specification                          |
|-----------------------------------------------------|----------------------------------------|
| Topological structure                               | Linear, star, or tree topology         |
| Transmission medium                                 | Category-5 or higher network cables    |
| Transmission distance                               | Less than 100m between two nodes       |
| Startup with priority                               | Reserved                               |
| Port disabling                                      | Not supported                          |
| Supporting device replacement without configuration | Supported (PN module of the same type) |
| Restoring factory settings                          | Supported                              |

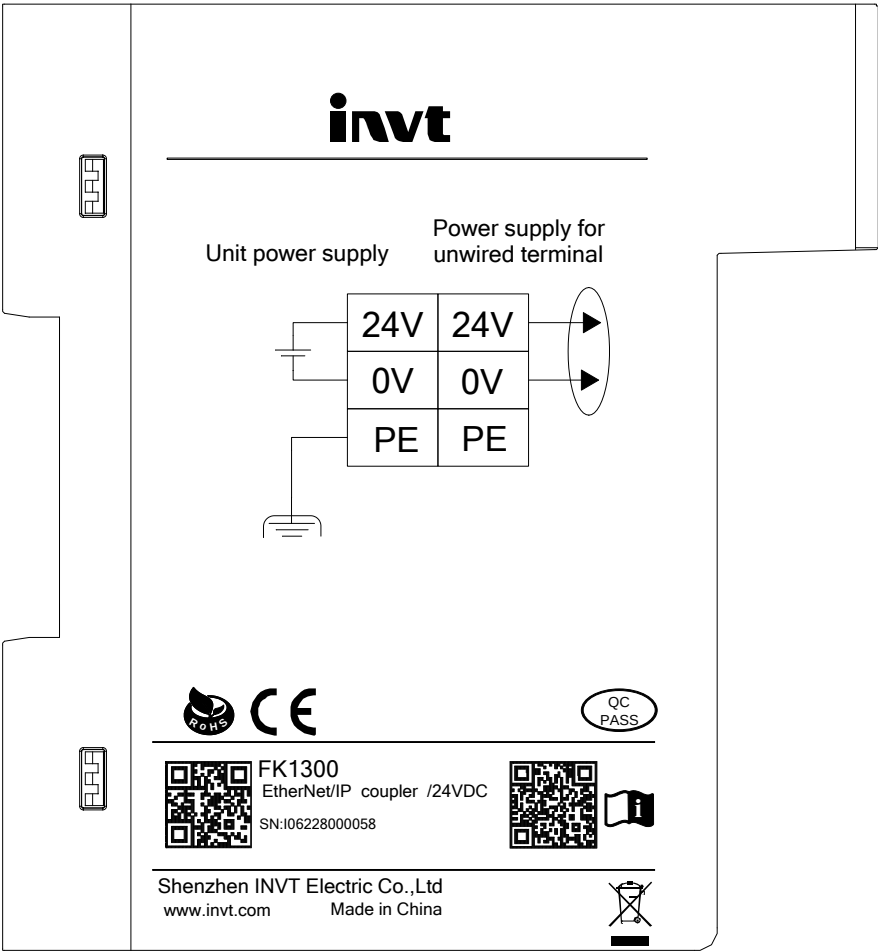
### 2.2.1.6 Environment specifications

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

## 2.3 EtherNet/IP communication coupler

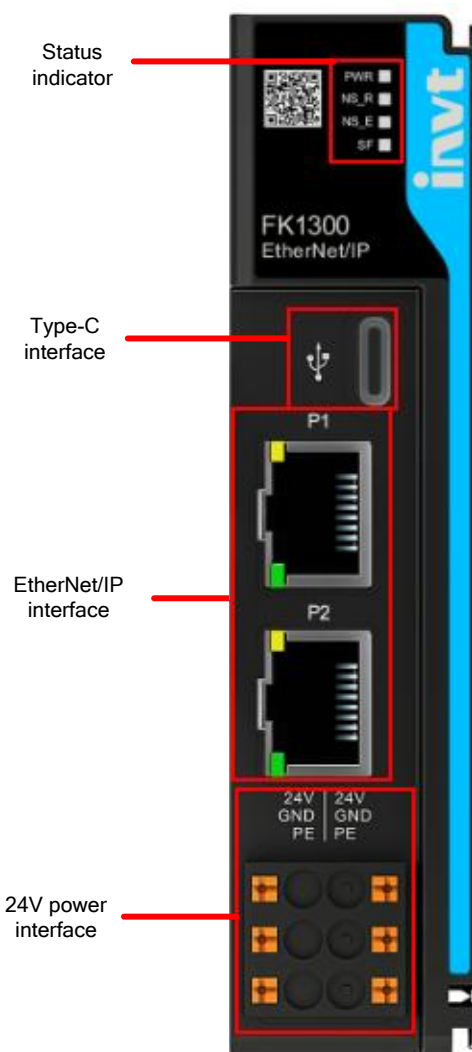
### 2.3.1 FK1300

#### 2.3.1.1 Basic information



| Model  | Ordering code | Description                                     | Applicable model                         |
|--------|---------------|-------------------------------------------------|------------------------------------------|
| FK1300 | 11016-00018   | Communication coupler; EtherNet/IP; 24VDC; RoHS | Applicable to EtherNet/IP master devices |

### 2.3.1.2 Component description



| Interface        | Definition                             |                   |                                                               |
|------------------|----------------------------------------|-------------------|---------------------------------------------------------------|
| Status indicator | PWR: Power indicator (Green)           | Off               | The power connection is abnormal.                             |
|                  |                                        | On                | The power connection is normal.                               |
|                  | NS_R: Network status indicator (Green) | Off               | No IP address configured, no Ethernet connection.             |
|                  |                                        | Blinking at 1Hz   | Not connected                                                 |
|                  |                                        | Steady on         | Connected                                                     |
|                  | NS_E: Network status indicator (Red)   | Off               | The network is working normally.                              |
|                  |                                        | Blinking at 1Hz   | Connection timed out.                                         |
|                  |                                        | Steady on         | Duplicate IP address                                          |
|                  | SF: Fieldbus fault indicator (Red)     | Off               | The device is normal.                                         |
|                  |                                        | Blinking at 1Hz   | Configuration error occurs.                                   |
|                  |                                        | Blinking at 0.5Hz | Exception in communication coupler MPU device initialization. |
|                  |                                        | On                | A communication coupler FPGA fault occurs.                    |

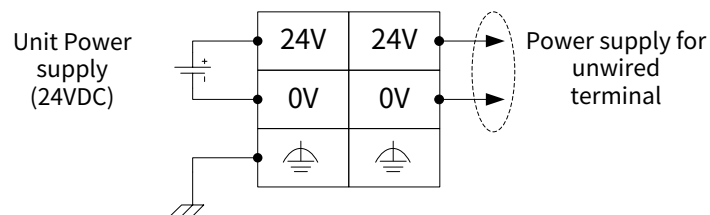
| Interface             | Definition                                                                                              |                                 |     |                                                                 |
|-----------------------|---------------------------------------------------------------------------------------------------------|---------------------------------|-----|-----------------------------------------------------------------|
| USB type-C interface  | For functions such as single-board software upgrades, EDS file export, and IP/MAC address configuration |                                 |     |                                                                 |
| EtherNet IP interface | P1 interface                                                                                            | Network port indicator (Green)  | Off | Link indicator, indicating Ethernet connection not established. |
|                       |                                                                                                         |                                 | On  | Link indicator, indicating successful Ethernet connection.      |
|                       |                                                                                                         | Network port indicator (Yellow) | Off | ACK indicator, indicating no data interchange.                  |
|                       |                                                                                                         |                                 | On  | ACK indicator, indicating data interchange performed.           |
|                       | P2 interface                                                                                            | Network port indicator (Green)  | Off | Link indicator, indicating Ethernet connection not established. |
|                       |                                                                                                         |                                 | On  | Link indicator, indicating successful Ethernet connection.      |
|                       |                                                                                                         | Network port indicator (Yellow) | Off | ACK indicator, indicating no data interchange.                  |
|                       |                                                                                                         |                                 | On  | ACK indicator, indicating data interchange performed.           |
| 24V power interface   | 24VDC power input interface of module                                                                   |                                 |     |                                                                 |

### 2.3.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                   | Left signal                                                                         | Left terminal | Right terminal | Right signal                                                                          |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------|----------------|---------------------------------------------------------------------------------------|
|  | 24V                                                                                 | -             | -              | 24V                                                                                   |
|                                                                                     | 0V                                                                                  | -             | -              | 0V                                                                                    |
|                                                                                     |  | -             | -              |  |

#### ■ Terminal wiring



### 2.3.1.4 Hardware specifications

| Item                                    | Specification                 |
|-----------------------------------------|-------------------------------|
| Rated input voltage                     | 24VDC (20.4VDC–28.8VDC)       |
| Rated input current                     | 0.8A (Typical value at 24VDC) |
| Backplane fieldbus output rated voltage | 5VDC (4.75VDC–5.25VDC)        |
| Backplane fieldbus output rated current | 2.5A (Typical value at 5VDC)  |



| Item                    | Specification                                                  |
|-------------------------|----------------------------------------------------------------|
| Isolation               | The input power is not isolated.                               |
| Power supply protection | Protection against overcurrent, reverse connection, and surges |

### 2.3.1.5 Software specifications

| Item                                 | Specification                          |
|--------------------------------------|----------------------------------------|
| Fieldbus protocol                    | EtherNet/IP                            |
| Fieldbus velocity                    | 10/100Mbps, self adaptive, full duplex |
| Max. number of I/O expansion modules | 32                                     |
| Max. number of output/input bytes    | Input: 504 bytes; Output: 504 bytes    |
| Network topology                     | Linear, star, tree topology, or ring   |

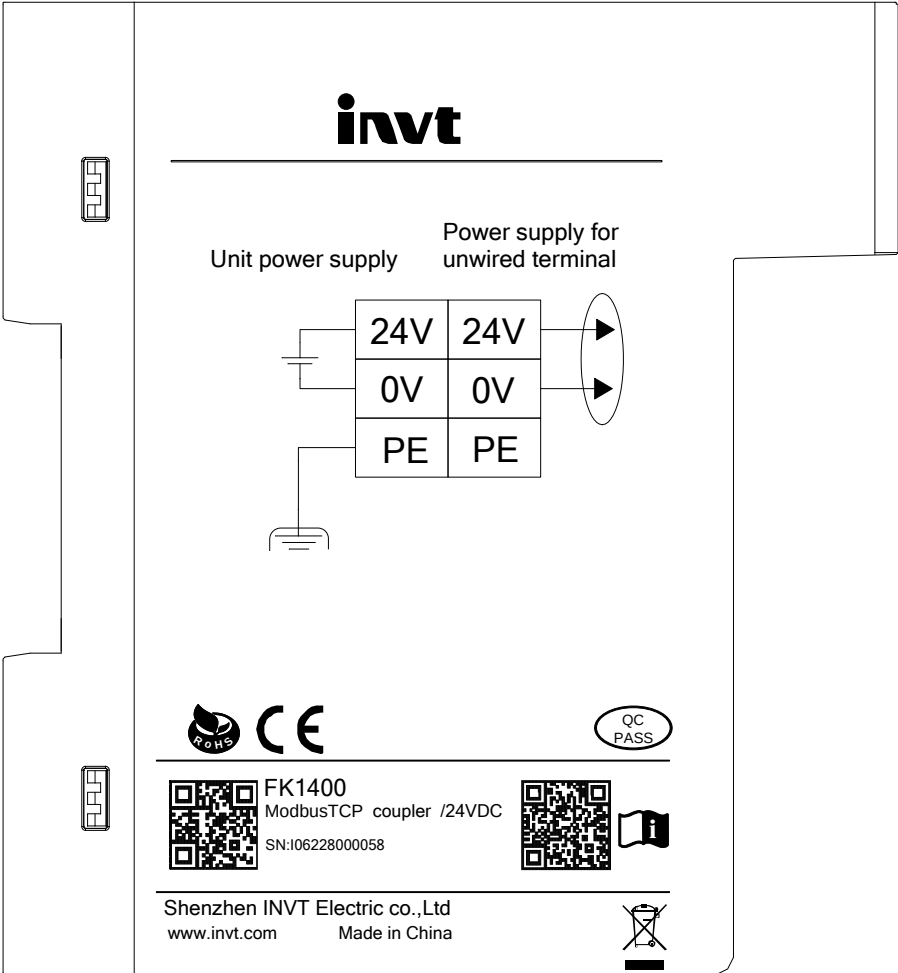
### 2.3.1.6 Environmental requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

## 2.4 ModbusTCP communication coupler

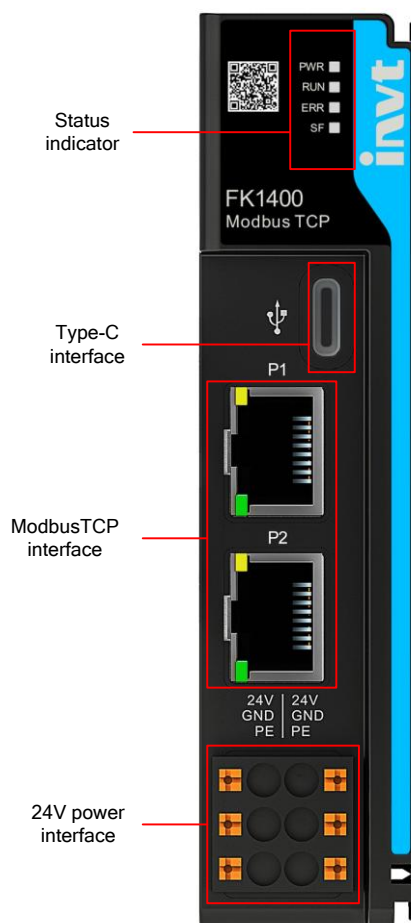
### 2.4.1 FK1400

#### 2.4.1.1 Basic information



| Model  | Ordering code | Description                                      | Applicable model                          |
|--------|---------------|--------------------------------------------------|-------------------------------------------|
| FK1400 | 11016-00029   | Communication coupler;<br>ModbusTCP; 24VDC; RoHS | Applicable to ModbusTCP master<br>devices |

### 2.4.1.2 Component description



| Interface            | Definition                                                                                              |                   |                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------|
| Status indicator     | PWR: Power indicator (Green)                                                                            | Off               | The power connection is abnormal.                                   |
|                      |                                                                                                         | On                | The power connection is normal.                                     |
|                      | RUN: Network operation status indicator (green)                                                         | Off               | Not connected to the network.                                       |
|                      |                                                                                                         | Blinking (500ms)  | Waiting for connection/Connecting.                                  |
|                      |                                                                                                         | On                | The communication is normal.                                        |
|                      | ERR: Network error status indicator (red)                                                               | Off               | The network is working normally.                                    |
|                      |                                                                                                         | Blinking (500ms)  | The network is disconnected abnormally after successful connection. |
|                      |                                                                                                         | On                | IP conflict.                                                        |
|                      | SF: System fault indicator (red)                                                                        | Off               | The equipment is normal.                                            |
|                      |                                                                                                         | Blinking (500ms)  | Configuration error occurs.                                         |
|                      |                                                                                                         | Blinking (1000ms) | Exception in communication coupler MPU device initialization.       |
|                      |                                                                                                         | On                | A communication coupler initialization failure occurs.              |
| USB type-C interface | For functions such as single-board software upgrades, EDS file export, and IP/MAC address configuration |                   |                                                                     |

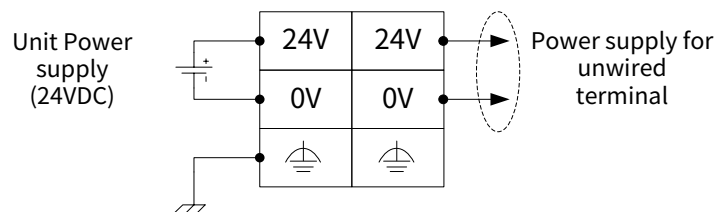
| Interface           | Definition                            |                                 |     |                                                          |
|---------------------|---------------------------------------|---------------------------------|-----|----------------------------------------------------------|
| ModbusTCP interface | P1 interface                          | Network port indicator (Green)  | Off | Link indicator, indicating not connected to the network. |
|                     |                                       |                                 | On  | Link indicator, indicating connected to the network.     |
|                     |                                       | Network port indicator (Yellow) | Off | ACK indicator, indicating no data interchange.           |
|                     |                                       |                                 | On  | ACK indicator, indicating data interchange performed.    |
|                     | P2 interface                          | Network port indicator (Green)  | Off | Link indicator, indicating not connected to the network. |
|                     |                                       |                                 | On  | Link indicator, indicating connected to the network.     |
|                     |                                       | Network port indicator (Yellow) | Off | ACK indicator, indicating no data interchange.           |
|                     |                                       |                                 | On  | ACK indicator, indicating data interchange performed.    |
| 24V power interface | 24VDC power input interface of module |                                 |     |                                                          |

### 2.4.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                   | Left signal                                                                         | Left terminal | Right terminal | Right signal                                                                          |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------|----------------|---------------------------------------------------------------------------------------|
|  | 24V                                                                                 | -             | -              | 24V                                                                                   |
|                                                                                     | 0V                                                                                  | -             | -              | 0V                                                                                    |
|                                                                                     |  | -             | -              |  |

#### ■ Terminal wiring



#### Note:

- The terminal PE must be properly grounded through the cable, with a grounding impedance of less than 4Ω.
- Try to configure an independent system power supply for the coupler to avoid mixing with the external field power supply of the expansion module.

**2.4.1.4 Hardware specifications**

| Item                                    | Specification                                         |
|-----------------------------------------|-------------------------------------------------------|
| Rated input voltage                     | 24VDC (-15%~+20%)                                     |
| Rated input current                     | 0.8A                                                  |
| Backplane fieldbus output rated voltage | 5VDC (4.75VDC~5.25VDC)                                |
| Backplane fieldbus output rated current | 2.5A (Typical value)                                  |
| Isolation                               | No isolation                                          |
| Power supply protection                 | Protection against reverse connection and overcurrent |

**2.4.1.5 Software specifications**

| Item                              | Specification                       |
|-----------------------------------|-------------------------------------|
| Max. number of client connections | 5                                   |
| TCP Keepalive                     | Enabled                             |
| Supported function codes          | 01/02/03/04/05/06/15/16/23          |
| IP address settings               | Set through the Ttools-IO software  |
| Diagnostic function               | Supported                           |
| Physical layer                    | 100BASE-TX                          |
| Communication rate                | 10M/100Mbps, self-adaptive          |
| Communication method              | Full duplex                         |
| Topological structure             | Linear, star, or tree topology      |
| Transmission medium               | Category-5 or higher network cables |
| Transmission distance             | Max. segment length is 100 meters.  |

**2.4.1.6 Environmental requirements**

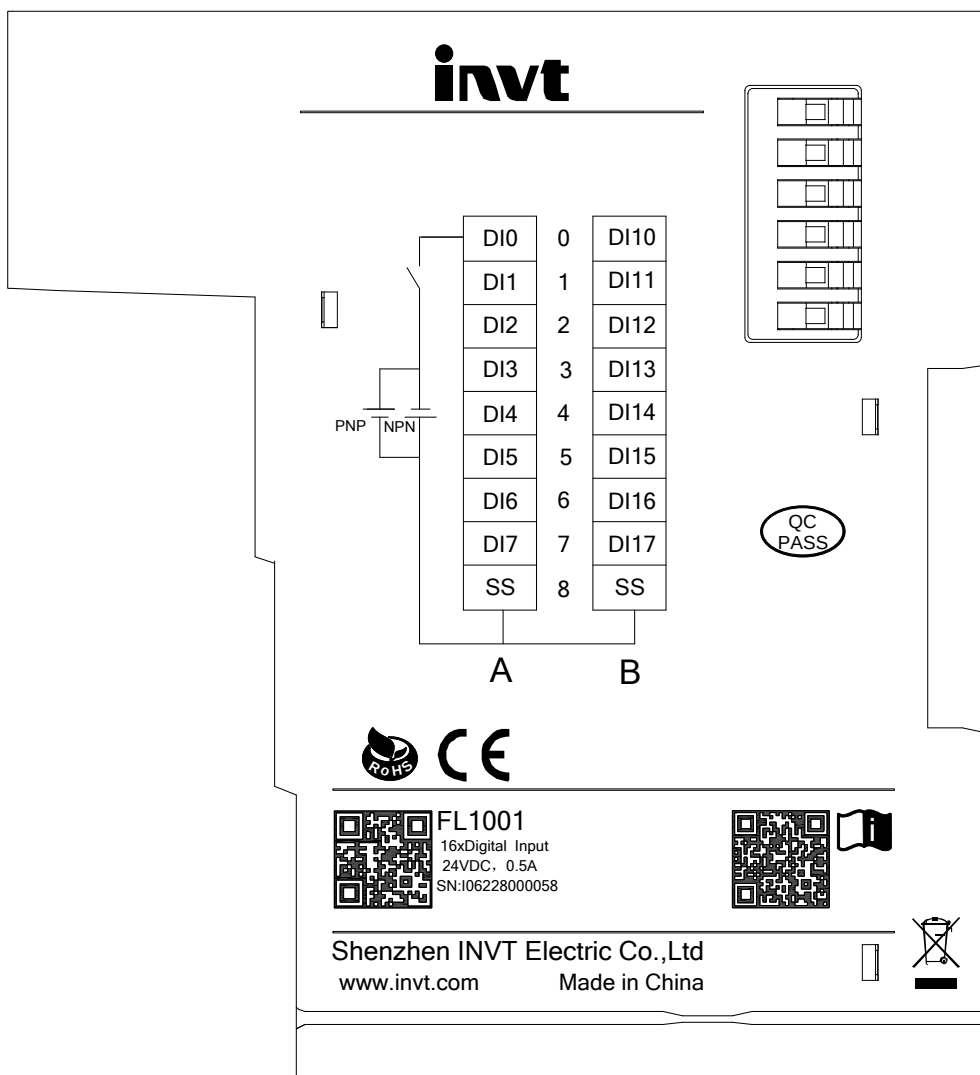
| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 2000m (80kPa)                     |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

## 3 I/O module specifications

### 3.1 Digital input module (FL100x)

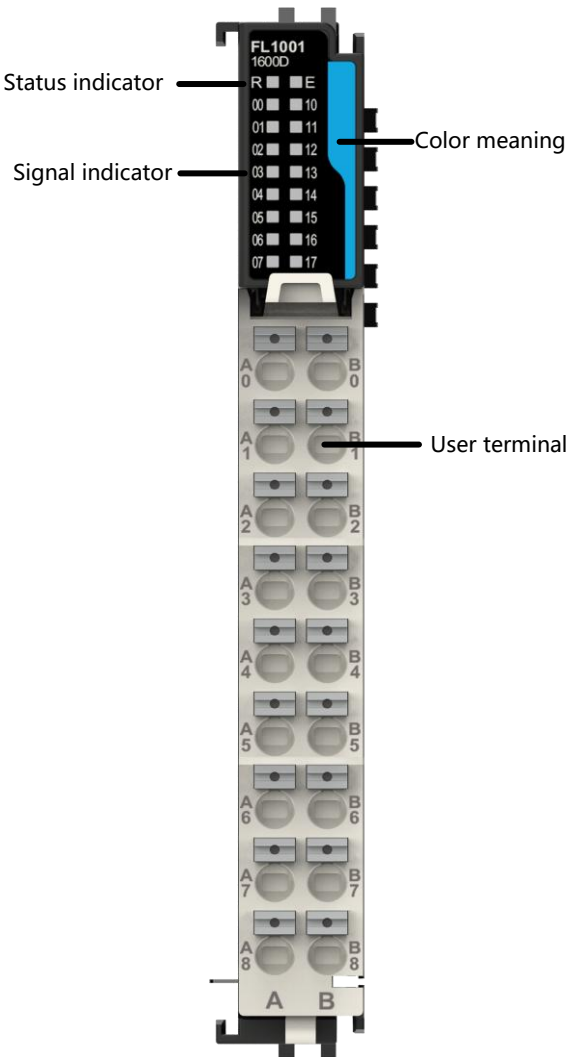
#### 3.1.1 FL1001 (1600D)

##### 3.1.1.1 Basic information



| Model  | Ordering code | Description                                                                                  | Applicable model                     |
|--------|---------------|----------------------------------------------------------------------------------------------|--------------------------------------|
| FL1001 | 11016-00004   | Digital input module, 16 channels, supporting the source and sink types, 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |

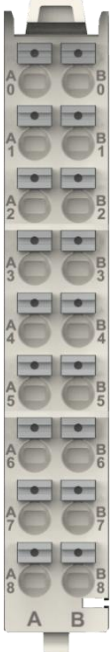
3.1.1.2 Component description



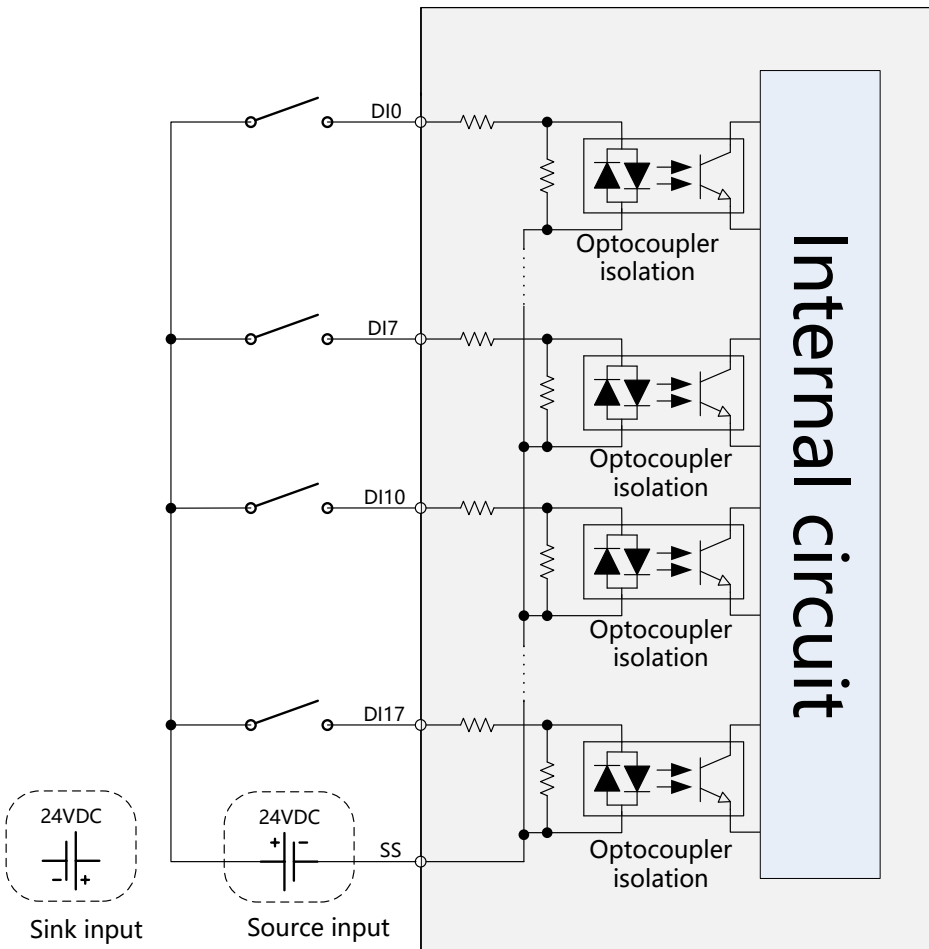
| Name             | Description                                                                         |                                                |                                                                                     |                                      |
|------------------|-------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|
| Status indicator | R: Yellow green                                                                     | Power-on/Run status indicator                  | On: The module is running.                                                          |                                      |
|                  |                                                                                     |                                                | Slow blinking (500ms): The module is establishing communication.                    |                                      |
|                  |                                                                                     |                                                | Off: The module is not powered on or it is abnormal.                                |                                      |
|                  | E: Red                                                                              | Module fault indicator                         | Fast blinking (100ms): The module is offline.                                       |                                      |
|                  |                                                                                     |                                                | Slow blinking (500ms): Incorrect parameter settings.                                |                                      |
|                  |                                                                                     |                                                | Off: The module works normally.                                                     |                                      |
| Signal indicator | 00–07: Green<br>10–17: Green                                                        | Each corresponds to a channel of input signal. | On: The input is valid.                                                             |                                      |
|                  |                                                                                     |                                                | Off: The input is invalid.                                                          |                                      |
| User terminal    | External wiring I/O terminal                                                        |                                                |                                                                                     |                                      |
| Color meaning    |  | Digital input                                  |  | Digital output (source, sink, relay) |
|                  |  | Analog input (voltage, current, thermocouple)  |  | Analog output                        |

3.1.1.3 Terminal definition and wiring

■ Terminal definition

| Schematic diagram                                                                 | Left signal | Left terminal | Right terminal | Right signal |
|-----------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DI0         | A0            | B0             | DI10         |
|                                                                                   | DI1         | A1            | B1             | DI11         |
|                                                                                   | DI2         | A2            | B2             | DI12         |
|                                                                                   | DI3         | A3            | B3             | DI13         |
|                                                                                   | DI4         | A4            | B4             | DI14         |
|                                                                                   | DI5         | A5            | B5             | DI15         |
|                                                                                   | DI6         | A6            | B6             | DI16         |
|                                                                                   | DI7         | A7            | B7             | DI17         |
|                                                                                   | SS          | A8            | B8             | SS           |

■ Terminal wiring





**3.1.1.4 Power supply specifications**

| Item                                | Specification                 |
|-------------------------------------|-------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)        |
| Fieldbus input power rated current  | 150mA (Typical value at 5VDC) |
| Terminal input power rated voltage  | None                          |
| Terminal input power rated current  | None                          |
| Terminal output power rated voltage | None                          |
| Terminal output power rated current | None                          |
| Hot swapping of module              | Not supported                 |

**3.1.1.5 Input specifications**

| Item                          | Specification                                                                                                                                                                            |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input type                    | Digital input                                                                                                                                                                            |
| Input mode                    | Source/Sink                                                                                                                                                                              |
| Input channels                | 16                                                                                                                                                                                       |
| Input voltage class           | 24VDC±10% (21.6VDC–26.4VDC)                                                                                                                                                              |
| Input current (Typical)       | 7mA (Typical value at 24VDC)                                                                                                                                                             |
| ON voltage                    | >15V                                                                                                                                                                                     |
| OFF voltage                   | <5V                                                                                                                                                                                      |
| Hardware response time ON/OFF | 100μs/100μs                                                                                                                                                                              |
| Software filter time          | Supported                                                                                                                                                                                |
| Input resistance              | Reference value is about 3.4kΩ.                                                                                                                                                          |
| Isolation                     | Optocoupler                                                                                                                                                                              |
| Input action display          | When the input is in driving state, the input indicator is on.                                                                                                                           |
| Input derating                | When each terminal is operating at 55°C, it is derated to 75% (with no more than 12 input points of ON at the same time), or the temperature drops by 10°C when all input points are ON. |

**3.1.1.6 Software specifications**

| Item                                          | Specification                                                                                                                                                              |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Software input filter time                    | Setting range: 1–65535 (default: 1000); unit: 10μs; 1000 indicates 10ms. Able to set two groups of filter parameter. Every eight channels use a group of filter parameter. |
| Input port exception detection and indication | None                                                                                                                                                                       |
| Input channel logic level configuration       | Not supported                                                                                                                                                              |
| Configuration of independent channel enabling | Not supported                                                                                                                                                              |

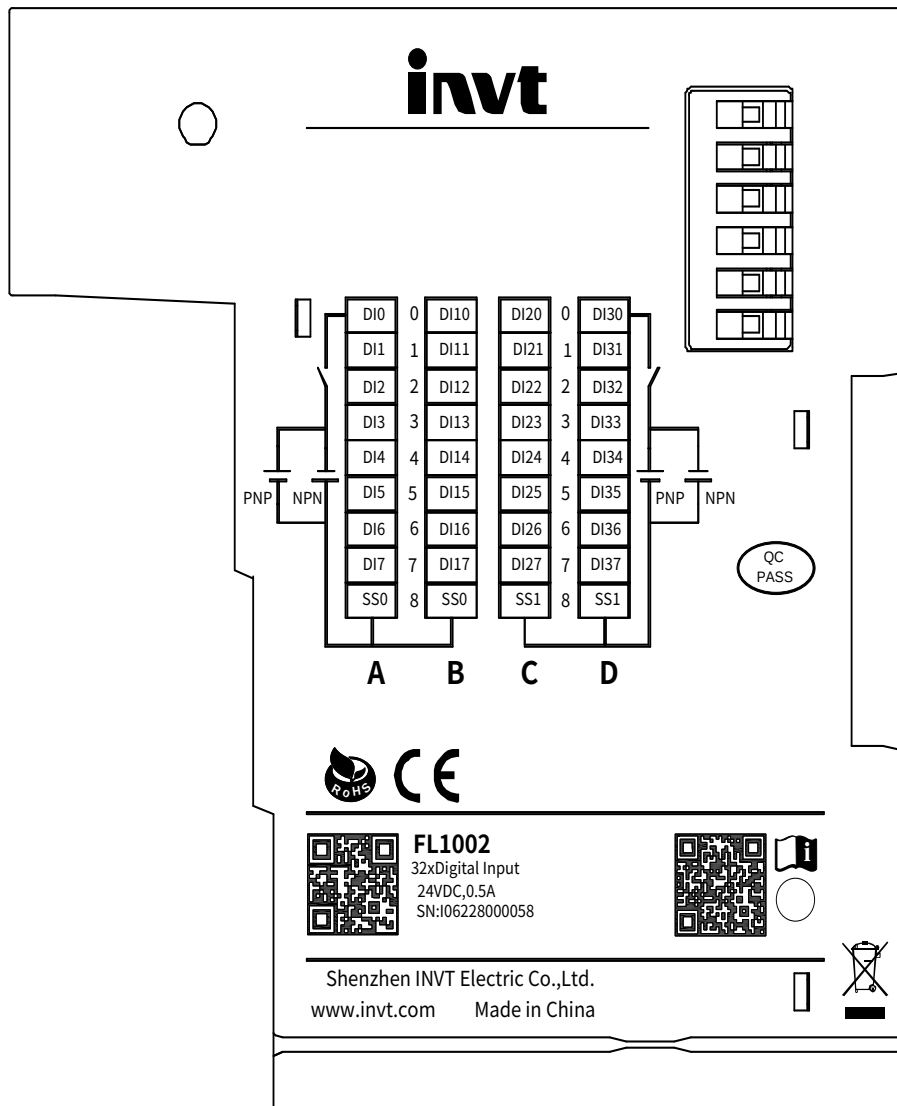
| Item                                 | Specification                                                                            |
|--------------------------------------|------------------------------------------------------------------------------------------|
| Configuration of diagnosis reporting | Diagnosis information will be uploaded by default.                                       |
| In stop mode                         | Output will not be refreshed, while input supports refreshing in Safe-operational state. |
| I/O mapping                          | Supporting the mapping method of bitwise access                                          |

### 3.1.1.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

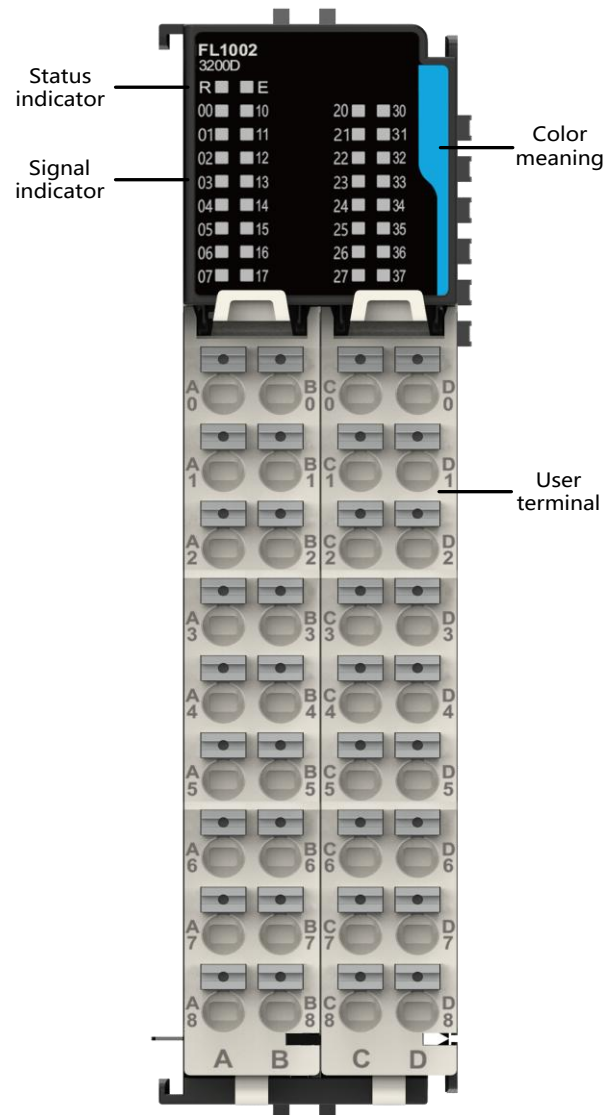
### 3.1.2 FL1002 (3200D)

#### 3.1.2.1 Basic information



| Model  | Ordering code | Description                                                                                  | Applicable model                     |
|--------|---------------|----------------------------------------------------------------------------------------------|--------------------------------------|
| FL1002 | 11016-00016   | Digital input module, 32 channels, supporting the source and sink types, 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.1.2.2 Component description

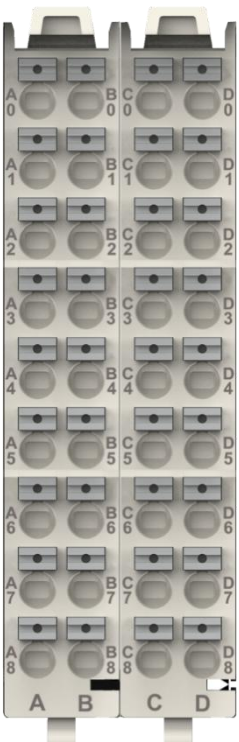


| Name             | Description                                  |                                                |                                                                  |
|------------------|----------------------------------------------|------------------------------------------------|------------------------------------------------------------------|
| Status indicator | R: Yellow green                              | Power-on/Run status indicator                  | On: The module is running.                                       |
|                  |                                              |                                                | Slow blinking (500ms): The module is establishing communication. |
|                  |                                              |                                                | Off: The module is not powered on or it is abnormal.             |
|                  | E: Red                                       | Module fault indicator                         | Fast blinking (100ms): The module is offline.                    |
|                  |                                              |                                                | Slow blinking (500ms): Incorrect parameter settings.             |
|                  |                                              |                                                | Off: The module works normally.                                  |
| Signal indicator | 00–07: Green                                 | Each corresponds to a channel of input signal. | On: The input is valid.                                          |
|                  | 10–17: Green<br>20–27: Green<br>30–37: Green |                                                | Off: The input is invalid.                                       |

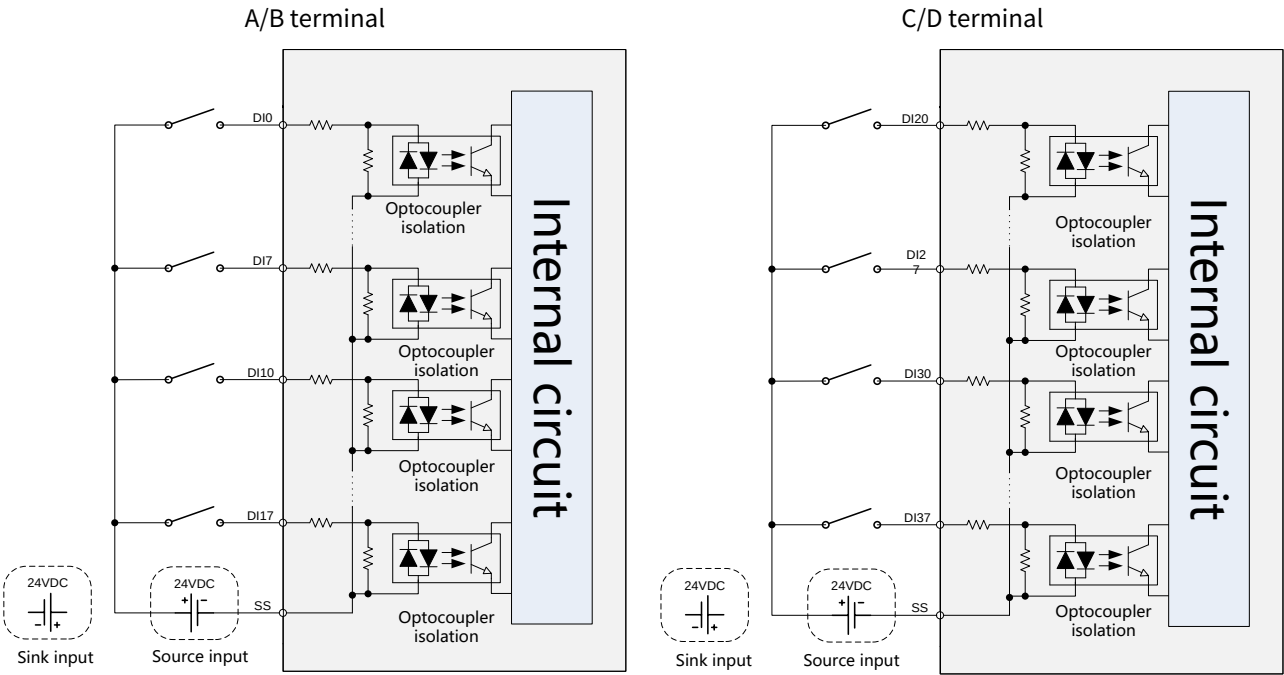
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| User terminal | External wiring I/O terminal                                                      |                                               |                                                                                   |                                      |
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |

### 3.1.2.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DI0         | A0            | B0             | DI10         |
|                                                                                    | DI1         | A1            | B1             | DI11         |
|                                                                                    | DI2         | A2            | B2             | DI12         |
|                                                                                    | DI3         | A3            | B3             | DI13         |
|                                                                                    | DI4         | A4            | B4             | DI14         |
|                                                                                    | DI5         | A5            | B5             | DI15         |
|                                                                                    | DI6         | A6            | B6             | DI16         |
|                                                                                    | DI7         | A7            | B7             | DI17         |
|                                                                                    | SS          | A8            | B8             | SS           |
|                                                                                    | DI20        | C0            | D0             | DI30         |
|                                                                                    | DI21        | C1            | D1             | DI31         |
|                                                                                    | DI22        | C2            | D2             | DI32         |
|                                                                                    | DI23        | C3            | D3             | DI33         |
|                                                                                    | DI24        | C4            | D4             | DI34         |
|                                                                                    | DI25        | C5            | D5             | DI35         |
|                                                                                    | DI26        | C6            | D6             | DI36         |
|                                                                                    | DI27        | C7            | D7             | DI37         |
|                                                                                    | SS          | C8            | D8             | SS           |

■ Terminal wiring



3.1.2.4 Power supply specifications

| Item                                | Specification                 |
|-------------------------------------|-------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)        |
| Fieldbus input power rated current  | 150mA (Typical value at 5VDC) |
| Terminal input power rated voltage  | None                          |
| Terminal input power rated current  | None                          |
| Terminal output power rated voltage | None                          |
| Terminal output power rated current | None                          |
| Hot swapping of module              | Not supported                 |

3.1.2.5 Input specifications

| Item                          | Specification                |
|-------------------------------|------------------------------|
| Input type                    | Digital input                |
| Input mode                    | Source/Sink                  |
| Input channels                | 16                           |
| Input voltage class           | 24VDC±10% (21.6VDC–26.4VDC)  |
| Input current (Typical)       | 7mA (Typical value at 24VDC) |
| ON voltage                    | >15V                         |
| OFF voltage                   | <5V                          |
| Hardware response time ON/OFF | 100µs/100µs                  |
| Software filter time          | Supported                    |

| Item                 | Specification                                                                                                                                                                          |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input resistance     | Reference value is about 3.4kΩ.                                                                                                                                                        |
| Isolation            | Optocoupler                                                                                                                                                                            |
| Input action display | When the input is in driving state, the input indicator is on.                                                                                                                         |
| Input derating       | When each terminal is operating at 55℃, it is derated to 75% (with no more than 12 input points of ON at the same time), or the temperature drops by 10℃ when all input points are ON. |

### 3.1.2.6 Software specifications

| Item                                          | Specification                                                                                                                                                              |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Software input filter time                    | Setting range: 1–65535 (default: 1000); unit: 10μs; 1000 indicates 10ms. Able to set two groups of filter parameter. Every eight channels use a group of filter parameter. |
| Input port exception detection and indication | None                                                                                                                                                                       |
| Input channel logic level configuration       | Not supported                                                                                                                                                              |
| Configuration of independent channel enabling | Not supported                                                                                                                                                              |
| Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                                                                                                         |
| In stop mode                                  | Output will not be refreshed, while input supports refreshing in Safe-operational state.                                                                                   |
| I/O mapping                                   | Supporting the mapping method of bitwise access                                                                                                                            |

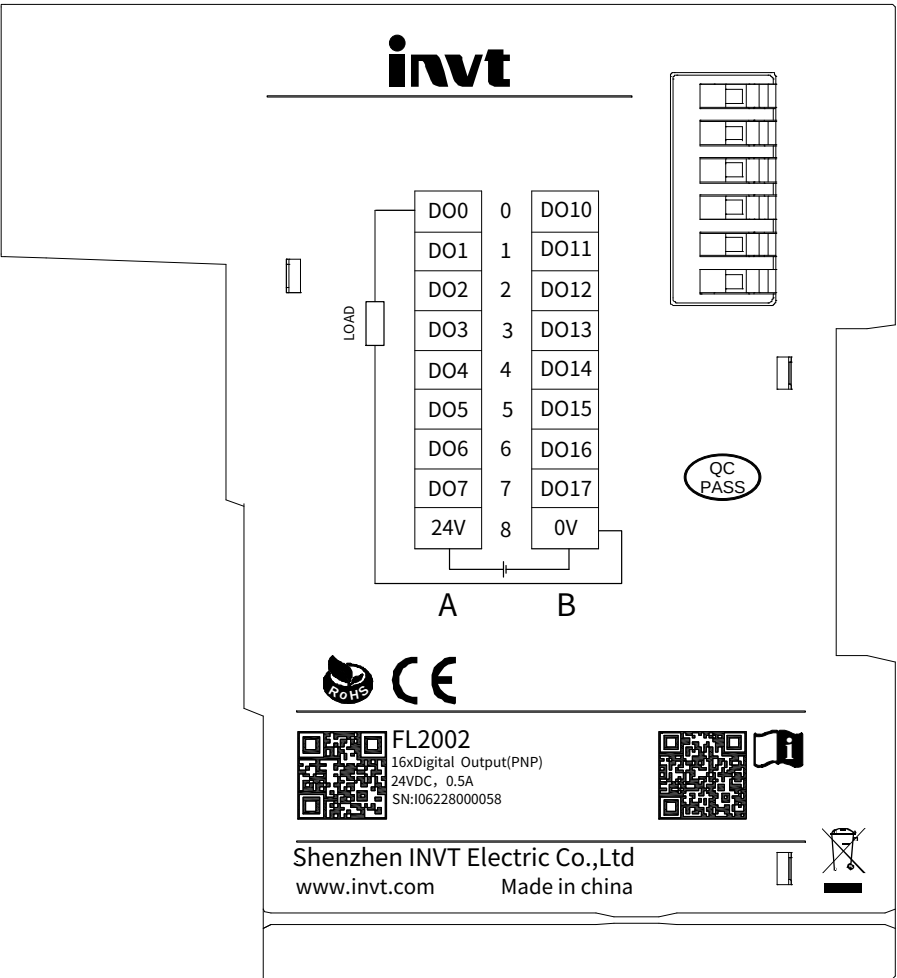
### 3.1.2.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20℃~+55℃                                    |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40℃~+70℃ (RH < 90%, no condensation)        |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.2 Digital output module (source type) (FL200x)

3.2.1 FL2002 (0016DP)

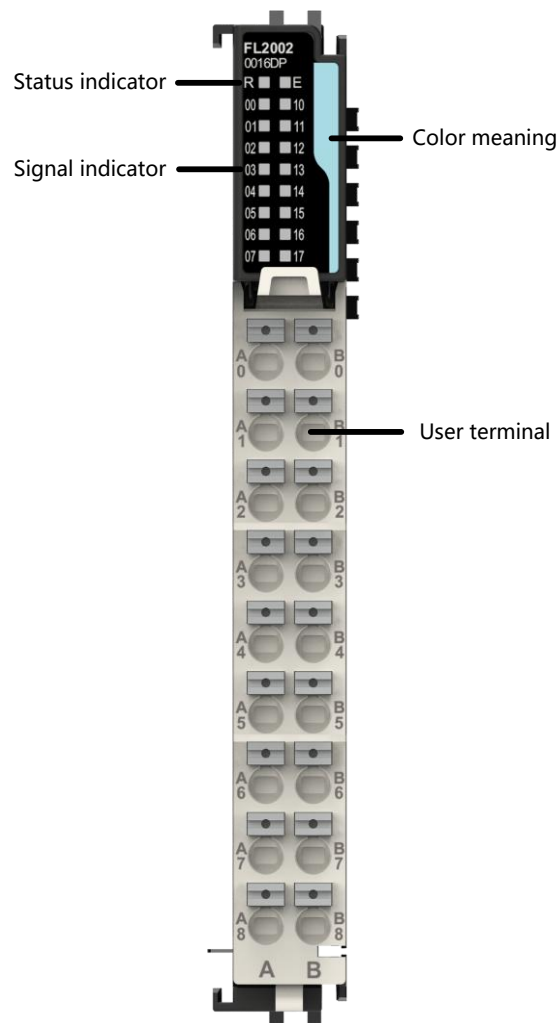
3.2.1.1 Basic information



| Model  | Ordering code | Description                                                                           | Applicable model                     |
|--------|---------------|---------------------------------------------------------------------------------------|--------------------------------------|
| FL2002 | 11016-00006   | Digital output module, with 16 channels of PNP transistor output, 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |



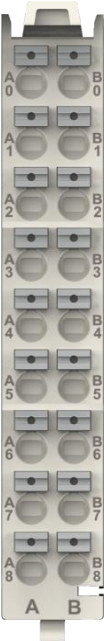
3.2.1.2 Component description



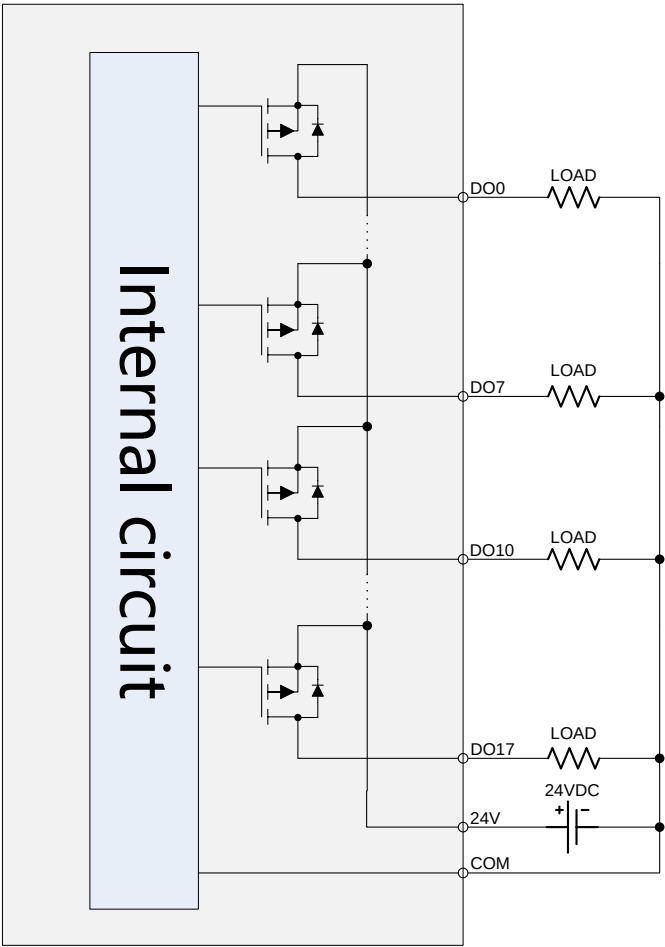
| Name             | Description                                                                         |                                                 |                                                                                       |                                      |
|------------------|-------------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------|
| Status indicator | R: Yellow green                                                                     | Power-on/Run status indicator                   | On: The module is running.                                                            |                                      |
|                  |                                                                                     |                                                 | Slow blinking (500ms): The module is establishing communication.                      |                                      |
|                  |                                                                                     |                                                 | Off: The module is not powered on or it is abnormal.                                  |                                      |
|                  | E: Red                                                                              | Module fault indicator                          | Fast blinking (100ms): The module is offline.                                         |                                      |
|                  |                                                                                     |                                                 | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |                                      |
|                  |                                                                                     |                                                 | Off: The module works normally.                                                       |                                      |
| Signal indicator | 00–07: Green<br>10–17: Green                                                        | Each corresponds to a channel of output signal. | On: Enable output.                                                                    |                                      |
|                  |                                                                                     |                                                 | Off: Disable output.                                                                  |                                      |
| User terminal    | External wiring I/O terminal                                                        |                                                 |                                                                                       |                                      |
| Color meaning    |  | Digital input                                   |    | Digital output (source, sink, relay) |
|                  |  | Analog input (voltage, current, thermocouple)   |    | Analog output                        |

3.2.1.3 Terminal definition and wiring

■ Terminal definition

| Schematic diagram                                                                 | Left signal | Left terminal | Right terminal | Right signal |
|-----------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DO0         | A0            | B0             | DO10         |
|                                                                                   | DO1         | A1            | B1             | DO11         |
|                                                                                   | DO2         | A2            | B2             | DO12         |
|                                                                                   | DO3         | A3            | B3             | DO13         |
|                                                                                   | DO4         | A4            | B4             | DO14         |
|                                                                                   | DO5         | A5            | B5             | DO15         |
|                                                                                   | DO6         | A6            | B6             | DO16         |
|                                                                                   | DO7         | A7            | B7             | DO17         |
|                                                                                   | 24VDC       | A8            | B8             | COM          |

■ Terminal wiring



**3.2.1.4 Power supply specifications**

| Item                                | Specification               |
|-------------------------------------|-----------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)      |
| Fieldbus input power rated current  | 150mA                       |
| Terminal input power rated voltage  | 24VDC (20.4VDC–28.8VDC)     |
| Terminal input power rated current  | 2A (Typical value at 24VDC) |
| Terminal output power rated voltage | None                        |
| Terminal output power rated current | None                        |
| Hot swapping of module              | Not supported               |

**3.2.1.5 Output specifications**

| Item                          | Specification                                                                  |
|-------------------------------|--------------------------------------------------------------------------------|
| Output type                   | Digital output, high-edge output                                               |
| Output mode                   | Source                                                                         |
| Output channel                | 16                                                                             |
| Output voltage class          | 24VDC±10% (21.6VDC–26.4VDC)                                                    |
| Output load (Resistance load) | 0.5A/point, 2A/module                                                          |
| Output load (Inductance load) | 7.2W/point, 12W/module                                                         |
| Output load (Light load)      | 5W/point, 18W/module                                                           |
| Hardware response time ON/OFF | 100μs/100μs                                                                    |
| Leakage current at OFF        | 10μA                                                                           |
| Switch frequency              | 100Hz for resistance load, 0.5Hz for inductance load, and 100ms for light load |
| Isolation                     | Yes                                                                            |
| Output action display         | When the output is in driving state, the output indicator is on.               |
| Input derating                | None                                                                           |
| Protection function           | Short-circuit protection and overcurrent protection                            |

**3.2.1.6 Software specifications**

| Item                                          | Specification                                                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Stop/offline output mode                      | Keeping output, clearing output, or outputting the preset value, which is configured on a point basis |
| Preset value of stop/offline output           | Single-point 0 or 1                                                                                   |
| Output channel exception detection indication | None                                                                                                  |
| Output channel logic level configuration      | Not supported                                                                                         |

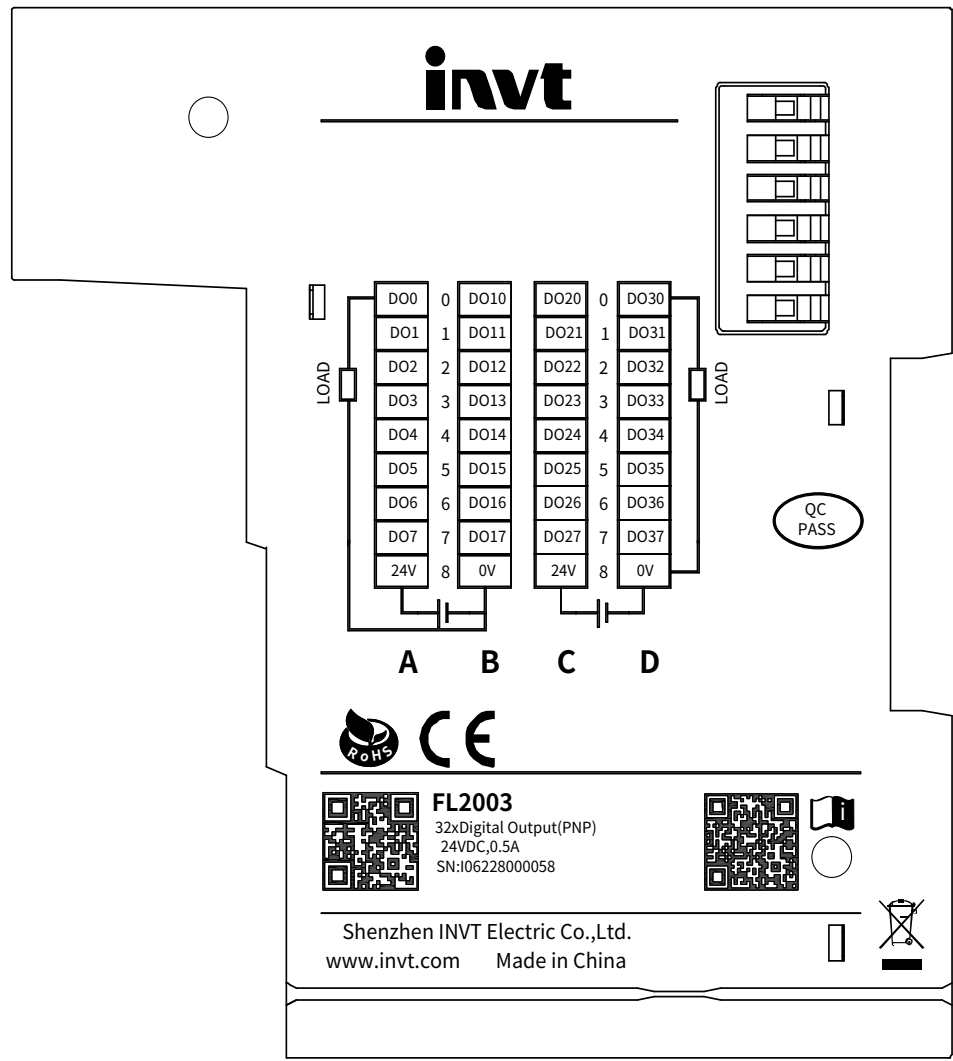
| Item                                          | Specification                                                                                  |
|-----------------------------------------------|------------------------------------------------------------------------------------------------|
| Configuration of independent channel enabling | Not supported                                                                                  |
| Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                             |
| In stop mode                                  | Output according to the stop/offline output mode and preset value, without refreshing any more |
| I/O mapping                                   | Supporting the mapping method of bitwise access                                                |

### 3.2.1.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C—+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C—+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

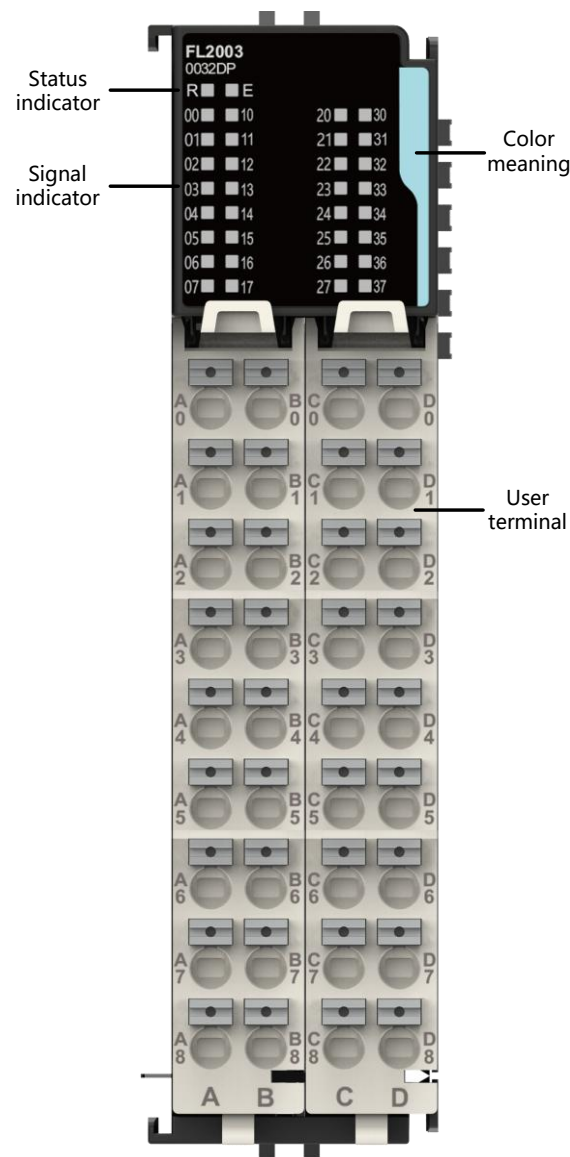
3.2.2 FL2003 (0032DP)

3.2.2.1 Basic information



| Model  | Ordering code | Description                                                                           | Applicable model                     |
|--------|---------------|---------------------------------------------------------------------------------------|--------------------------------------|
| FL2003 | 11016-00013   | Digital output module, with 32 channels of PNP transistor output, 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.2.2.2 Component description

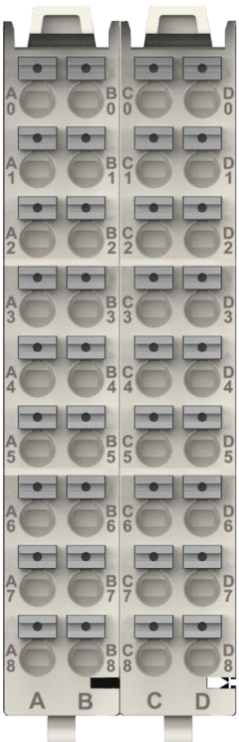


| Name             | Description                                                  |                                                 |                                                                                       |
|------------------|--------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------|
| Status indicator | R: Yellow green                                              | Power-on/Run status indicator                   | On: The module is running.                                                            |
|                  |                                                              |                                                 | Slow blinking (500ms): The module is establishing communication.                      |
|                  |                                                              |                                                 | Off: The module is not powered on or it is abnormal.                                  |
|                  | E: Red                                                       | Module fault indicator                          | Fast blinking (100ms): The module is offline.                                         |
|                  |                                                              |                                                 | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |
|                  |                                                              |                                                 | Off: The module works normally.                                                       |
| Signal indicator | 00–07: Green<br>10–17: Green<br>20–27: Green<br>30–37: Green | Each corresponds to a channel of output signal. | On: Enable output.                                                                    |
|                  |                                                              |                                                 | Off: Disable output.                                                                  |
| User terminal    | External wiring I/O terminal                                 |                                                 |                                                                                       |

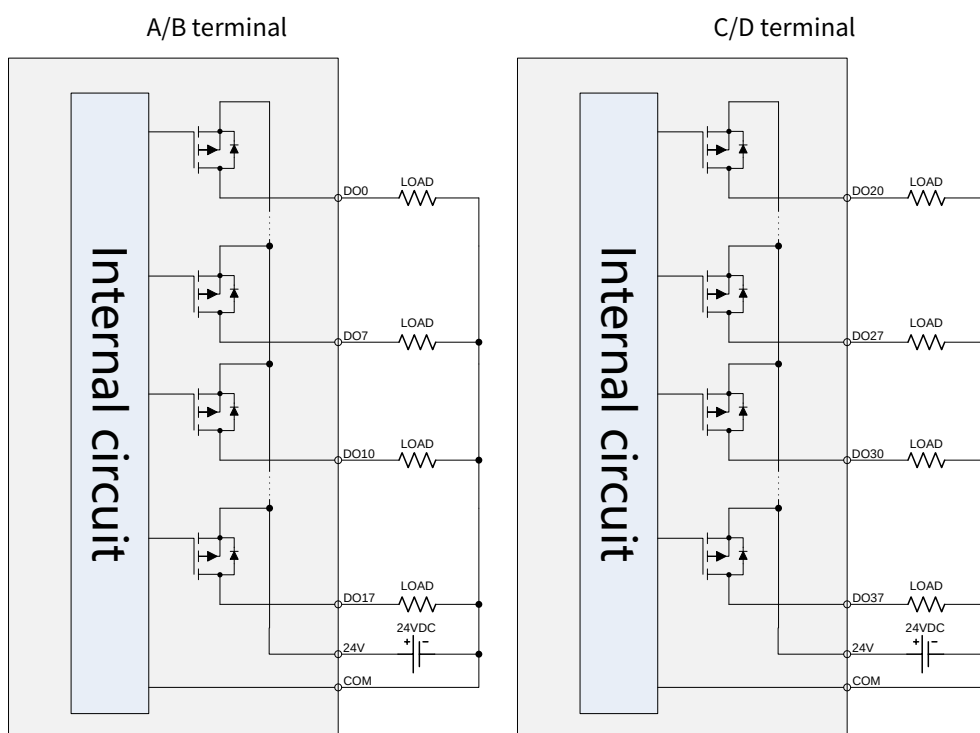
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |

### 3.2.2.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DO0         | A0            | B0             | DO10         |
|                                                                                    | DO1         | A1            | B1             | DO11         |
|                                                                                    | DO2         | A2            | B2             | DO12         |
|                                                                                    | DO3         | A3            | B3             | DO13         |
|                                                                                    | DO4         | A4            | B4             | DO14         |
|                                                                                    | DO5         | A5            | B5             | DO15         |
|                                                                                    | DO6         | A6            | B6             | DO16         |
|                                                                                    | DO7         | A7            | B7             | DO17         |
|                                                                                    | 24VDC       | A8            | B8             | COM          |
|                                                                                    | DO20        | C0            | D0             | DO30         |
|                                                                                    | DO21        | C1            | D1             | DO31         |
|                                                                                    | DO22        | C2            | D2             | DO32         |
|                                                                                    | DO23        | C3            | D3             | DO33         |
|                                                                                    | DO24        | C4            | D4             | DO34         |
|                                                                                    | DO25        | C5            | D5             | DO35         |
|                                                                                    | DO26        | C6            | D6             | DO36         |
|                                                                                    | DO27        | C7            | D7             | DO37         |
|                                                                                    | 24VDC       | C8            | D8             | COM          |

## ■ Terminal wiring



### 3.2.2.4 Power supply specifications

| Item                                | Specification               |
|-------------------------------------|-----------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)      |
| Fieldbus input power rated current  | 150mA                       |
| Terminal input power rated voltage  | 24VDC (20.4VDC–28.8VDC)     |
| Terminal input power rated current  | 2A (Typical value at 24VDC) |
| Terminal output power rated voltage | None                        |
| Terminal output power rated current | None                        |
| Hot swapping of module              | Not supported               |

### 3.2.2.5 Output specifications

| Item                          | Specification                    |
|-------------------------------|----------------------------------|
| Output type                   | Digital output, high-edge output |
| Output mode                   | Source                           |
| Output channel                | 32                               |
| Output voltage class          | 24VDC±10% (21.6VDC–26.4VDC)      |
| Output load (Resistance load) | 0.5A/point, 2A/module            |
| Output load (Inductance load) | 7.2W/point, 12W/module           |



| Item                             | Specification                                                                  |
|----------------------------------|--------------------------------------------------------------------------------|
| Output load (Light load)         | 5W/point, 18W/module                                                           |
| Hardware response time<br>ON/OFF | 100μs/100μs                                                                    |
| Leakage current at OFF           | 10μA                                                                           |
| Switch frequency                 | 100Hz for resistance load, 0.5Hz for inductance load, and 100ms for light load |
| Isolation                        | Yes                                                                            |
| Output action display            | When the output is in driving state, the output indicator is on.               |
| Input derating                   | None                                                                           |
| Protection function              | Short-circuit protection and overcurrent protection                            |

### 3.2.2.6 Software specifications

| Item                                          | Specification                                                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Stop/offline output mode                      | Keeping output, clearing output, or outputting the preset value, which is configured on a point basis |
| Preset value of stop/offline output           | Single-point 0 or 1                                                                                   |
| Output channel exception detection indication | None                                                                                                  |
| Output channel logic level configuration      | Not supported                                                                                         |
| Configuration of independent channel enabling | Not supported                                                                                         |
| Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                                    |
| In stop mode                                  | Output according to the stop/offline output mode and preset value, without refreshing any more        |
| I/O mapping                                   | Supporting the mapping method of bitwise access                                                       |

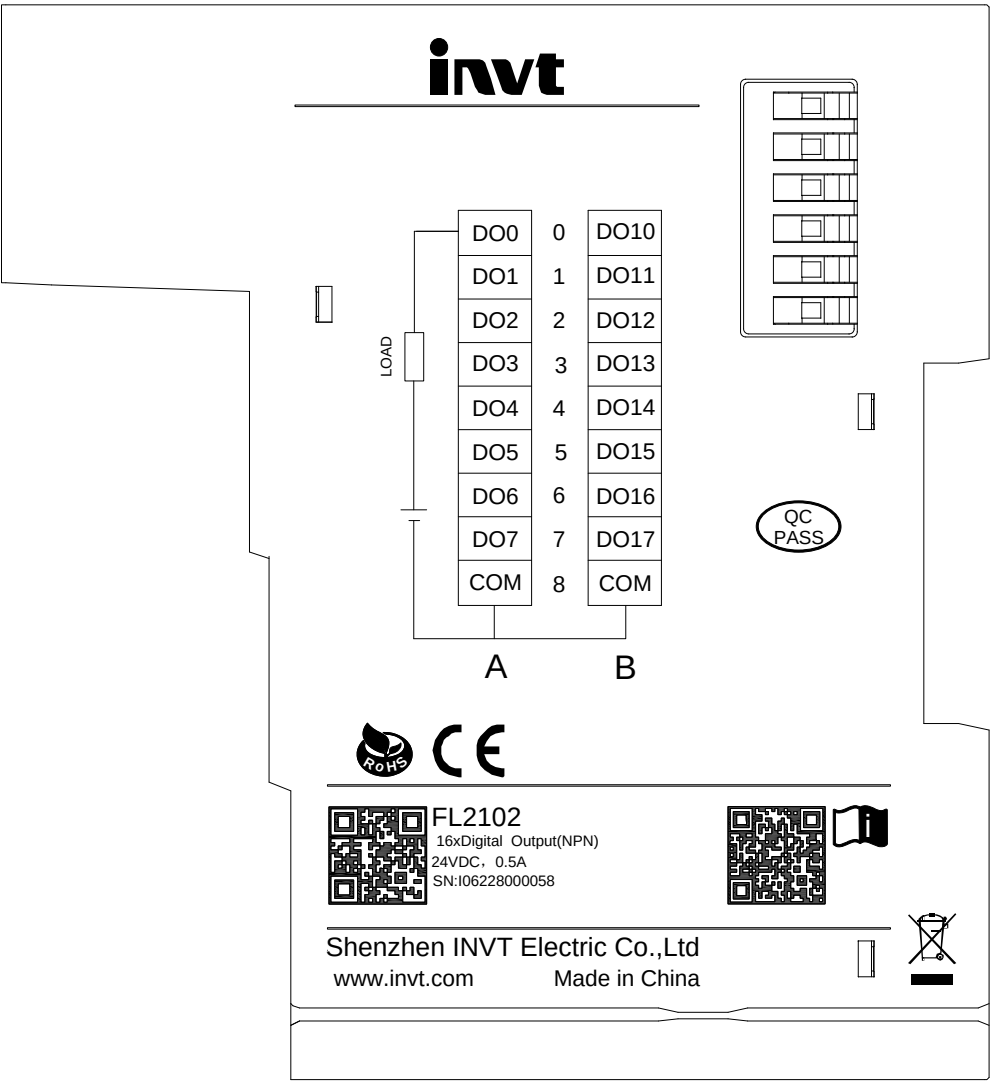
### 3.2.2.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.3 Digital output module (sink type) (FL210x)

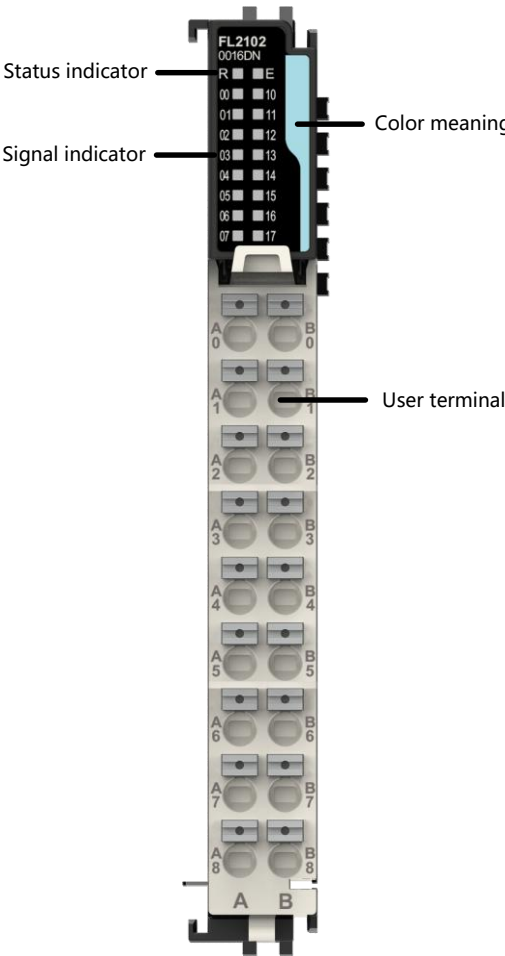
3.3.1 FL2102 (0016DN)

3.3.1.1 Basic information



| Model  | Ordering code | Description                                                                           | Applicable model                     |
|--------|---------------|---------------------------------------------------------------------------------------|--------------------------------------|
| FL2102 | 11016-00003   | Digital output module, with 16 channels of NPN transistor output, 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.3.1.2 Component description



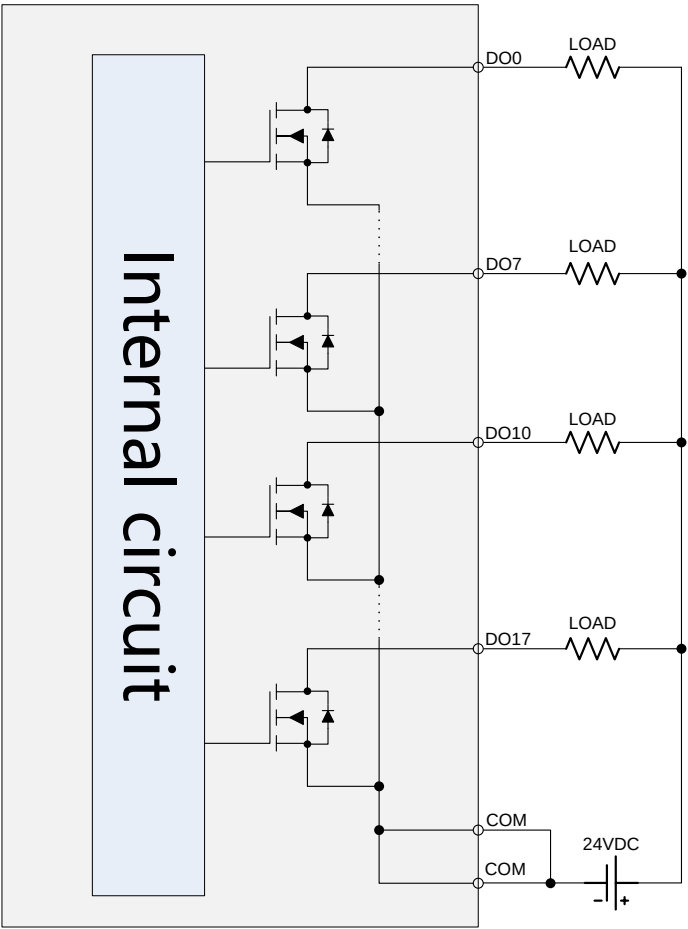
| Name             | Description                                                                         |                                                 |                                                                                            |                                      |
|------------------|-------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------|
| Status indicator | R: Yellow green                                                                     | Power-on/Run status indicator                   | On: The module is running.                                                                 |                                      |
|                  |                                                                                     |                                                 | Slow blinking (500ms): The module is establishing communication.                           |                                      |
|                  |                                                                                     |                                                 | Off: The module is not powered on or it is abnormal.                                       |                                      |
|                  | E: Red                                                                              | Module fault indicator                          | Fast blinking (100ms): The module is offline.                                              |                                      |
|                  |                                                                                     |                                                 | Slow blinking (500ms): Channel overheat/overcurrent alarm or incorrect parameter settings. |                                      |
|                  |                                                                                     |                                                 | Off: The module works normally.                                                            |                                      |
| Signal indicator | 00–07: Green<br>10–17: Green                                                        | Each corresponds to a channel of output signal. | On: Enable output.                                                                         |                                      |
|                  |                                                                                     |                                                 | Off: Disable output.                                                                       |                                      |
| User terminal    | External wiring I/O terminal                                                        |                                                 |                                                                                            |                                      |
| Color meaning    |  | Digital input                                   |         | Digital output (source, sink, relay) |
|                  |  | Analog input (voltage, current, thermocouple)   |         | Analog output                        |

### 3.3.1.3 Terminal definition and wiring

■ Terminal definition

| Schematic diagram | Left signal | Left terminal | Right terminal | Right signal |
|-------------------|-------------|---------------|----------------|--------------|
|                   | DO0         | A0            | B0             | DO10         |
|                   | DO1         | A1            | B1             | DO11         |
|                   | DO2         | A2            | B2             | DO12         |
|                   | DO3         | A3            | B3             | DO13         |
|                   | DO4         | A4            | B4             | DO14         |
|                   | DO5         | A5            | B5             | DO15         |
|                   | DO6         | A6            | B6             | DO16         |
|                   | DO7         | A7            | B7             | DO17         |
|                   | COM         | A8            | B8             | COM          |

■ User terminal wiring



**3.3.1.4 Power supply specifications**

| Item                                | Specification          |
|-------------------------------------|------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC) |
| Fieldbus input power rated current  | 200mA                  |
| Terminal input power rated voltage  | None                   |
| Terminal input power rated current  | None                   |
| Terminal output power rated voltage | None                   |
| Terminal output power rated current | None                   |
| Hot swapping of module              | Not supported          |

**3.3.1.5 Output specifications**

| Item                          | Specification                                                                  |
|-------------------------------|--------------------------------------------------------------------------------|
| Output type                   | Digital output, low-edge output                                                |
| Output mode                   | Sink                                                                           |
| Output channel                | 16                                                                             |
| Output voltage class          | 24VDC±10% (21.6VDC–26.4VDC)                                                    |
| Output load (Resistance load) | 0.5A/point, 4A/module                                                          |
| Output load (Inductance load) | 7.2W/point, 24W/module                                                         |
| Output load (Light load)      | 5W/point, 18W/module                                                           |
| Hardware response time ON/OFF | 100μs/100μs                                                                    |
| Leakage current at OFF        | 10μA                                                                           |
| Switch frequency              | 100Hz for resistance load, 0.5Hz for inductance load, and 100ms for light load |
| Isolation                     | Yes                                                                            |
| Output action display         | When the output is in driving state, the output indicator is on.               |
| Input derating                | None                                                                           |
| Protection function           | Short-circuit protection and overcurrent protection                            |

**3.3.1.6 Software specifications**

| Item                                          | Specification                                                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Stop/offline output mode                      | Keeping output, clearing output, or outputting the preset value, which is configured on a point basis |
| Preset value of stop/offline output           | Single-point 0 or 1                                                                                   |
| Output channel exception detection indication | Overheat/overcurrent detection and protection on a module basis                                       |
| Output channel logic level configuration      | Not supported                                                                                         |

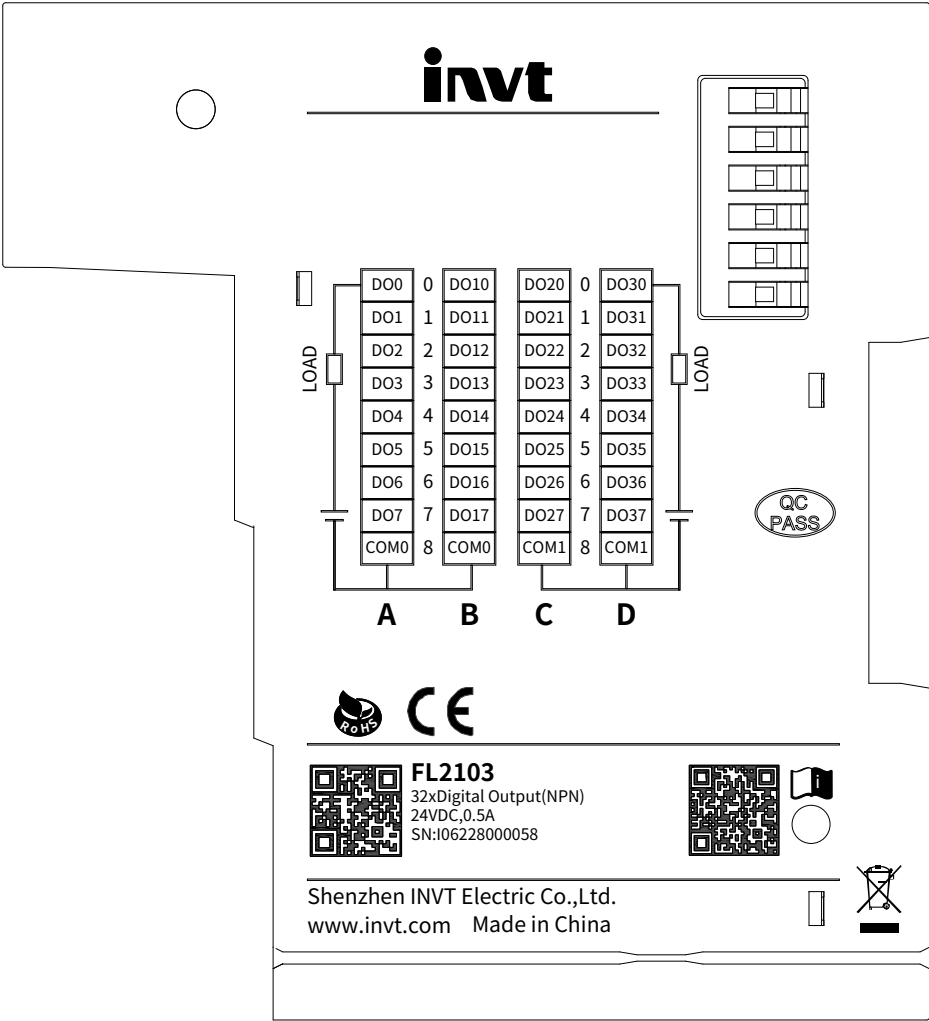
| Item                                          | Specification                                                                                  |
|-----------------------------------------------|------------------------------------------------------------------------------------------------|
| Configuration of independent channel enabling | Not supported                                                                                  |
| Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                             |
| In stop mode                                  | Output according to the stop/offline output mode and preset value, without refreshing any more |
| I/O mapping                                   | Supporting the mapping method of bitwise access                                                |

### 3.3.1.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

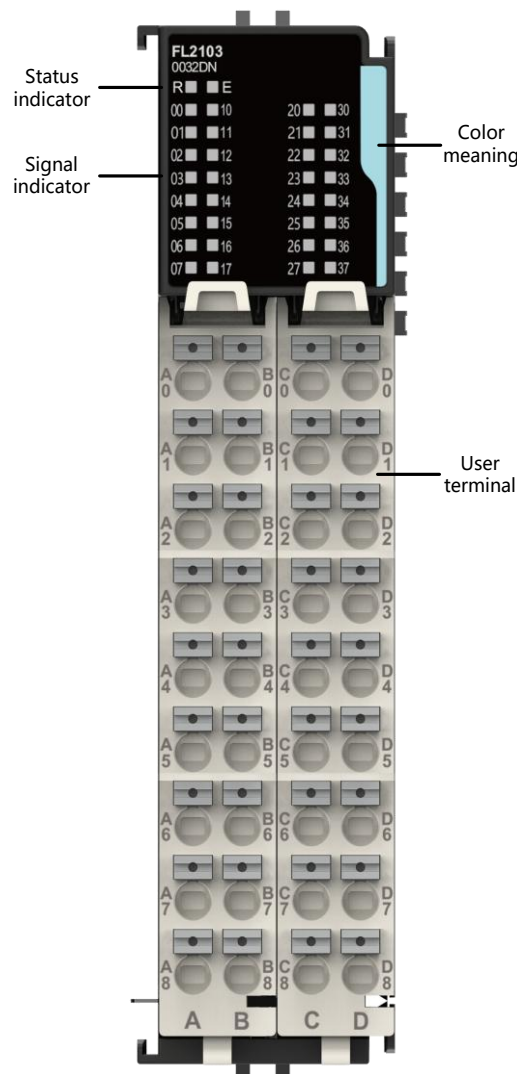
3.3.2 FL2103 (0032DN)

3.3.2.1 Basic information



| Model  | Ordering code | Description                                                                           | Applicable model                     |
|--------|---------------|---------------------------------------------------------------------------------------|--------------------------------------|
| FL2103 | 11016-00017   | Digital output module, with 32 channels of NPN transistor output, 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.3.2.2 Component description



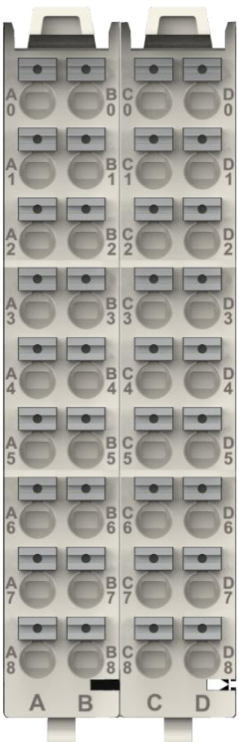
| Name             | Description                                                  |                                                 |                                                                                            |
|------------------|--------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------|
| Status indicator | R: Yellow green                                              | Power-on/Run status indicator                   | On: The module is running.                                                                 |
|                  |                                                              |                                                 | Slow blinking (500ms): The module is establishing communication.                           |
|                  |                                                              |                                                 | Off: The module is not powered on or it is abnormal.                                       |
|                  | E: Red                                                       | Module fault indicator                          | Fast blinking (100ms): The module is offline.                                              |
|                  |                                                              |                                                 | Slow blinking (500ms): Channel overheat/overcurrent alarm or incorrect parameter settings. |
|                  |                                                              |                                                 | Off: The module works normally.                                                            |
| Signal indicator | 00–07: Green<br>10–17: Green<br>20–27: Green<br>30–37: Green | Each corresponds to a channel of output signal. | On: Enable output.                                                                         |
|                  |                                                              |                                                 | Off: Disable output.                                                                       |



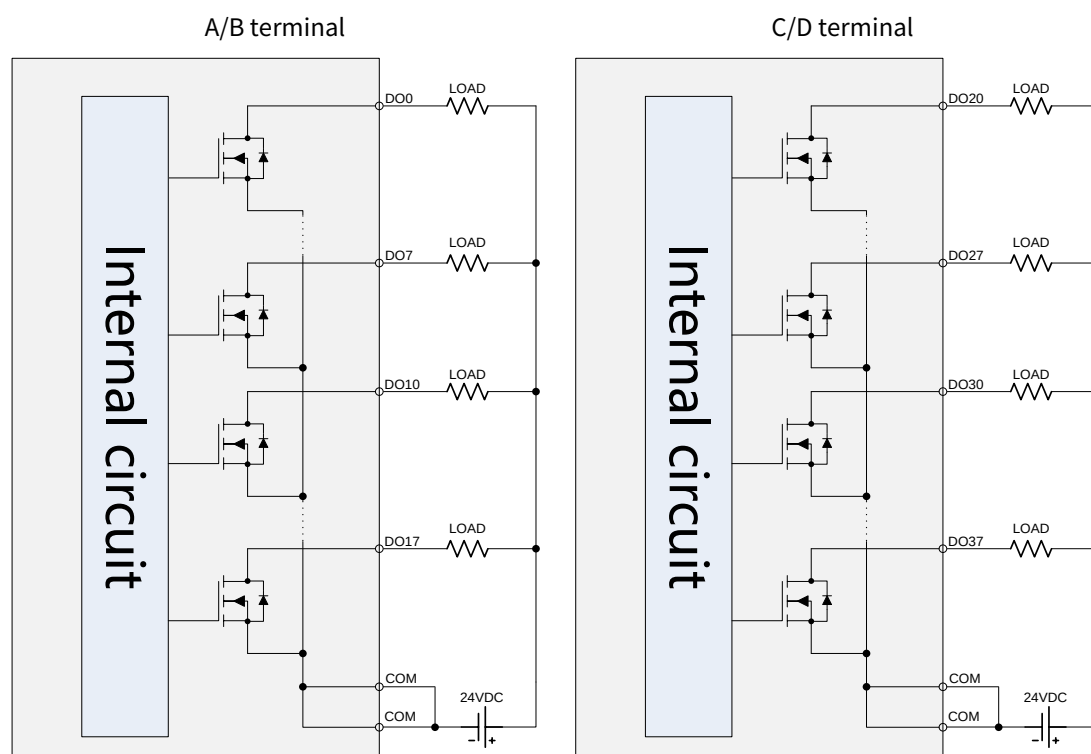
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| User terminal | External wiring I/O terminal                                                      |                                               |                                                                                   |                                      |
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |

### 3.3.2.3 Terminal definition

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DO0         | A0            | B0             | DO10         |
|                                                                                    | DO1         | A1            | B1             | DO11         |
|                                                                                    | DO2         | A2            | B2             | DO12         |
|                                                                                    | DO3         | A3            | B3             | DO13         |
|                                                                                    | DO4         | A4            | B4             | DO14         |
|                                                                                    | DO5         | A5            | B5             | DO15         |
|                                                                                    | DO6         | A6            | B6             | DO16         |
|                                                                                    | DO7         | A7            | B7             | DO17         |
|                                                                                    | COM         | A8            | B8             | COM          |
|                                                                                    | DO20        | C0            | D0             | DO30         |
|                                                                                    | DO21        | C1            | D1             | DO31         |
|                                                                                    | DO22        | C2            | D2             | DO32         |
|                                                                                    | DO23        | C3            | D3             | DO33         |
|                                                                                    | DO24        | C4            | D4             | DO34         |
|                                                                                    | DO25        | C5            | D5             | DO35         |
|                                                                                    | DO26        | C6            | D6             | DO36         |
|                                                                                    | DO27        | C7            | D7             | DO37         |
|                                                                                    | COM         | C8            | D8             | COM          |

## ■ Terminal wiring



### 3.3.2.4 Power supply specifications

| Item                                | Specification          |
|-------------------------------------|------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC) |
| Fieldbus input power rated current  | 300mA                  |
| Terminal input power rated voltage  | None                   |
| Terminal input power rated current  | None                   |
| Terminal output power rated voltage | None                   |
| Terminal output power rated current | None                   |
| Hot swapping of module              | Not supported          |

### 3.3.2.5 Output specifications

| Item                          | Specification                                                                  |
|-------------------------------|--------------------------------------------------------------------------------|
| Output type                   | Digital output, low-edge output                                                |
| Output mode                   | Sink                                                                           |
| Output channel                | 32                                                                             |
| Output voltage class          | 24VDC $\pm$ 10% (21.6VDC–26.4VDC)                                              |
| Output load (Resistance load) | 0.5A/point, 4A/module                                                          |
| Output load (Inductance load) | 7.2W/point, 24W/module                                                         |
| Output load (Light load)      | 5W/point, 18W/module                                                           |
| Hardware response time ON/OFF | 100 $\mu$ s/100 $\mu$ s                                                        |
| Leakage current at OFF        | 10 $\mu$ A                                                                     |
| Switch frequency              | 100Hz for resistance load, 0.5Hz for inductance load, and 100ms for light load |

| Item                  | Specification                                                    |
|-----------------------|------------------------------------------------------------------|
| Isolation             | Yes                                                              |
| Output action display | When the output is in driving state, the output indicator is on. |
| Input derating        | None                                                             |
| Protection function   | Short-circuit protection and overcurrent protection              |

### 3.3.2.6 Software specifications

| Item                                          | Specification                                                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Stop/offline output mode                      | Keeping output, clearing output, or outputting the preset value, which is configured on a point basis |
| Preset value of stop/offline output           | Single-point 0 or 1                                                                                   |
| Output channel exception detection indication | Overheat/overcurrent detection and protection on a module basis                                       |
| Output channel logic level configuration      | Not supported                                                                                         |
| Configuration of independent channel enabling | Not supported                                                                                         |
| Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                                    |
| In stop mode                                  | Output according to the stop/offline output mode and preset value, without refreshing any more        |
| I/O mapping                                   | Supporting the mapping method of bitwise access                                                       |

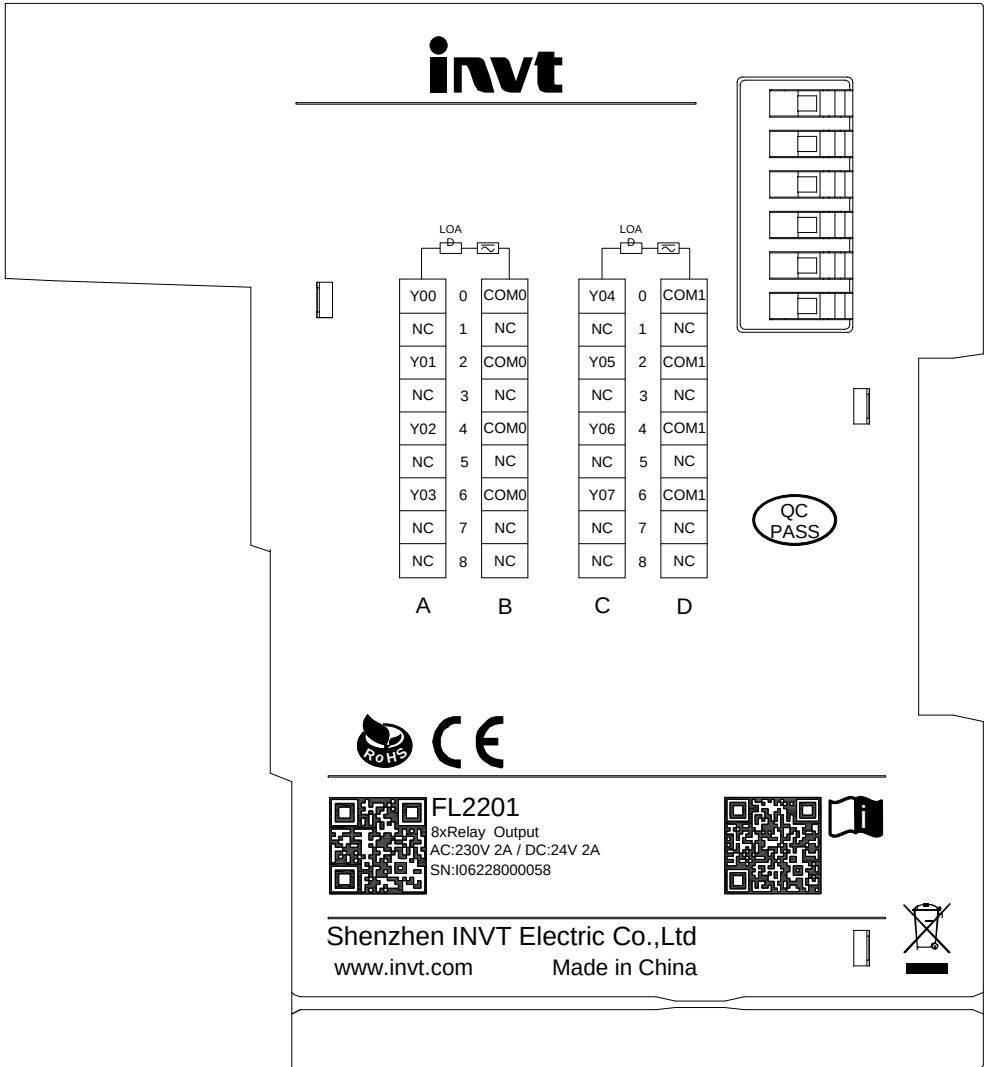
### 3.3.2.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.4 Digital output module (FL2201)

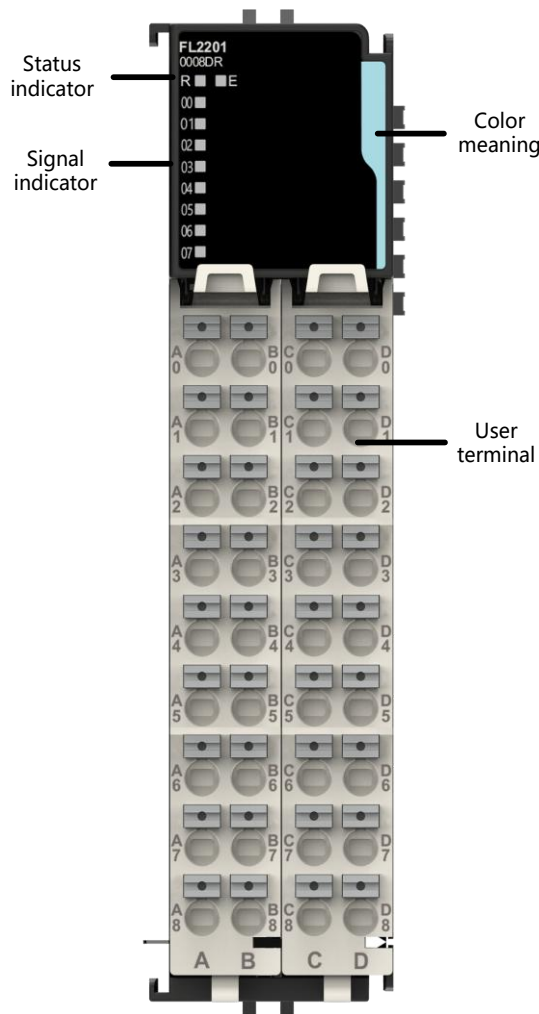
3.4.1 FL2201 (0008DR)

3.4.1.1 Basic information



| Model  | Ordering code | Description                                                                   | Applicable model                     |
|--------|---------------|-------------------------------------------------------------------------------|--------------------------------------|
| FL2201 | 11016-00009   | Digital output module, 8 relay outputs, dry contacts, 3A @ 30VDC/250VAC; RoHS | Applicable to INVT Flex/TS/TM series |

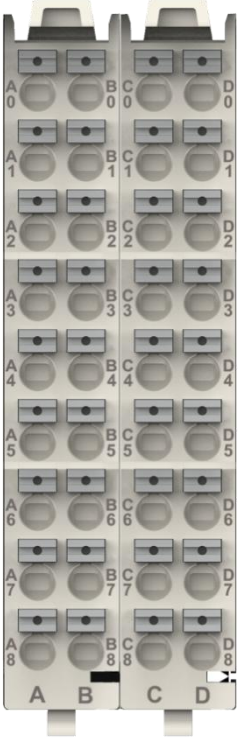
3.4.1.2 Component description



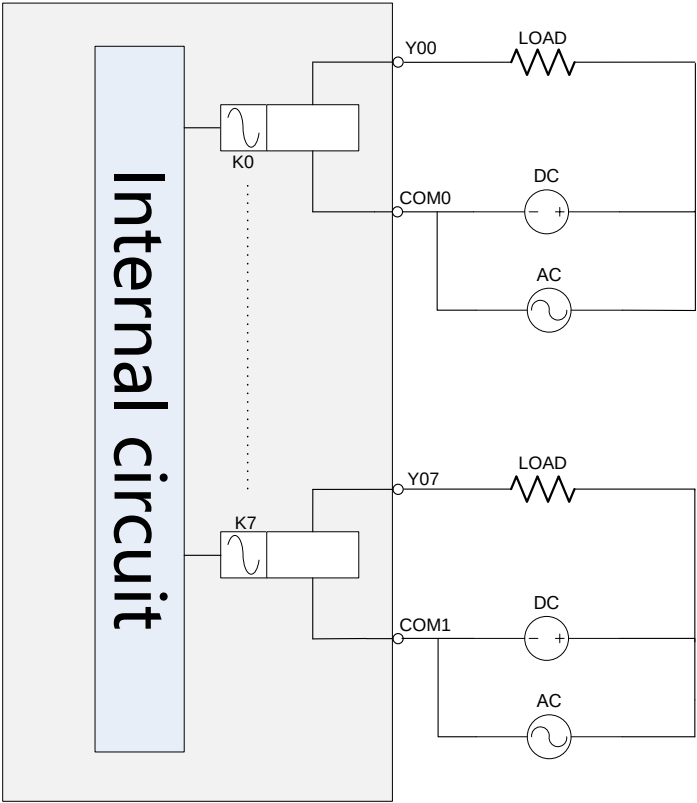
| Name             | Description                                                                         |                                                 |                                                                                     |                                      |
|------------------|-------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|
| Status indicator | R: Yellow green                                                                     | Power-on/Run status indicator                   | On: The module is running.                                                          |                                      |
|                  |                                                                                     |                                                 | Slow blinking (500ms): The module is establishing communication.                    |                                      |
|                  |                                                                                     |                                                 | Off: The module is not powered on or it is abnormal.                                |                                      |
|                  | E: Red                                                                              | Module fault indicator                          | Slow blinking (500ms): Incorrect parameter settings.                                |                                      |
|                  |                                                                                     |                                                 | Fast blinking (100ms): The module is offline.                                       |                                      |
|                  |                                                                                     |                                                 | Off: The module works normally.                                                     |                                      |
| Signal indicator | 00–07: Green                                                                        | Each corresponds to a channel of output signal. | On: Enable output.                                                                  |                                      |
|                  |                                                                                     |                                                 | Off: Disable output.                                                                |                                      |
| User terminal    | External wiring I/O terminal                                                        |                                                 |                                                                                     |                                      |
| Color meaning    |  | Digital input                                   |  | Digital output (source, sink, relay) |
|                  |  | Analog input (voltage, current, thermocouple)   |  | Analog output                        |

3.4.1.3 Terminal definition

■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | Y00         | A0            | B0             | COM0         |
|                                                                                    | -           | A1            | B1             | -            |
|                                                                                    | Y01         | A2            | B2             | COM0         |
|                                                                                    | -           | A3            | B3             | -            |
|                                                                                    | Y02         | A4            | B4             | COM0         |
|                                                                                    | -           | A5            | B5             | -            |
|                                                                                    | Y03         | A6            | B6             | COM0         |
|                                                                                    | -           | A7            | B7             | -            |
|                                                                                    | -           | A8            | B8             | -            |
|                                                                                    | Y04         | C0            | D0             | COM1         |
|                                                                                    | -           | C1            | D1             | -            |
|                                                                                    | Y05         | C2            | D2             | COM1         |
|                                                                                    | -           | C3            | D3             | -            |
|                                                                                    | Y06         | C4            | D4             | COM1         |
|                                                                                    | -           | C5            | D5             | -            |
|                                                                                    | Y07         | C6            | D6             | COM1         |
|                                                                                    | -           | C7            | D7             | -            |
|                                                                                    | -           | C8            | D8             | -            |
|                                                                                    |             |               |                |              |
|                                                                                    |             |               |                |              |
|                                                                                    |             |               |                |              |
|                                                                                    |             |               |                |              |
|                                                                                    |             |               |                |              |
|                                                                                    |             |               |                |              |

■ Terminal wiring



**3.4.1.4 Power supply specifications**

| Item                                | Specification          |
|-------------------------------------|------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC) |
| Fieldbus input power rated current  | 300mA                  |
| Terminal input power rated voltage  | None                   |
| Terminal input power rated current  | None                   |
| Terminal output power rated voltage | None                   |
| Terminal output power rated current | None                   |
| Hot swapping of module              | Not supported          |

**3.4.1.5 Output specifications**

| Item                           | Specification                             |
|--------------------------------|-------------------------------------------|
| Output mode                    | Relay N.O.                                |
| Output channel                 | 8                                         |
| Contact load (Resistance load) | 3A 250VAC/30VDC                           |
| Max. switching voltage         | 250VAC/125VDC (@0.3A)                     |
| Max. switching current         | 3A                                        |
| Contact resistor               | <100mΩ (1A 6VDC)                          |
| Min. load                      | 5VDC 10mA                                 |
| Isolation                      | Strong current isolated from weak current |

**3.4.1.6 Software specifications**

| Item                                          | Specification                                                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Stop/offline output mode                      | Keeping output, clearing output, or outputting the preset value, which is configured on a point basis |
| Preset value of stop/offline output           | Single-point 0 or 1                                                                                   |
| Output channel exception detection indication | Not supported                                                                                         |
| Output channel logic level configuration      | Not supported                                                                                         |
| Configuration of independent channel enabling | Not supported                                                                                         |
| Configuration of diagnosis reporting          | Not supported                                                                                         |
| In stop mode                                  | Output according to the stop/offline output mode and preset value, without refreshing any more        |
| I/O mapping                                   | Supporting the mapping method of bitwise access                                                       |

**3.4.1.7 Environment requirements**

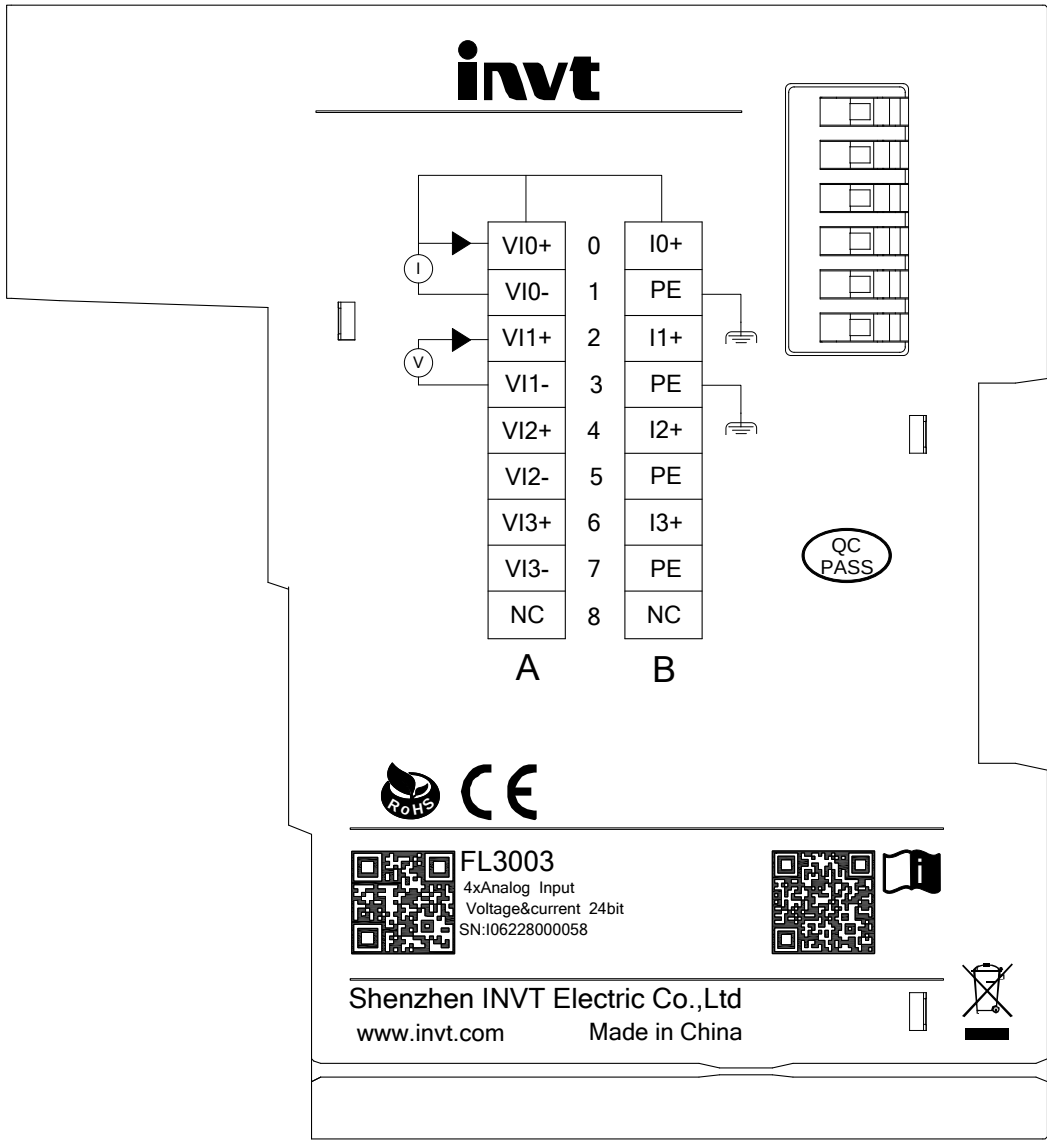
| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |



3.5 Analog input module (FL3xxx)

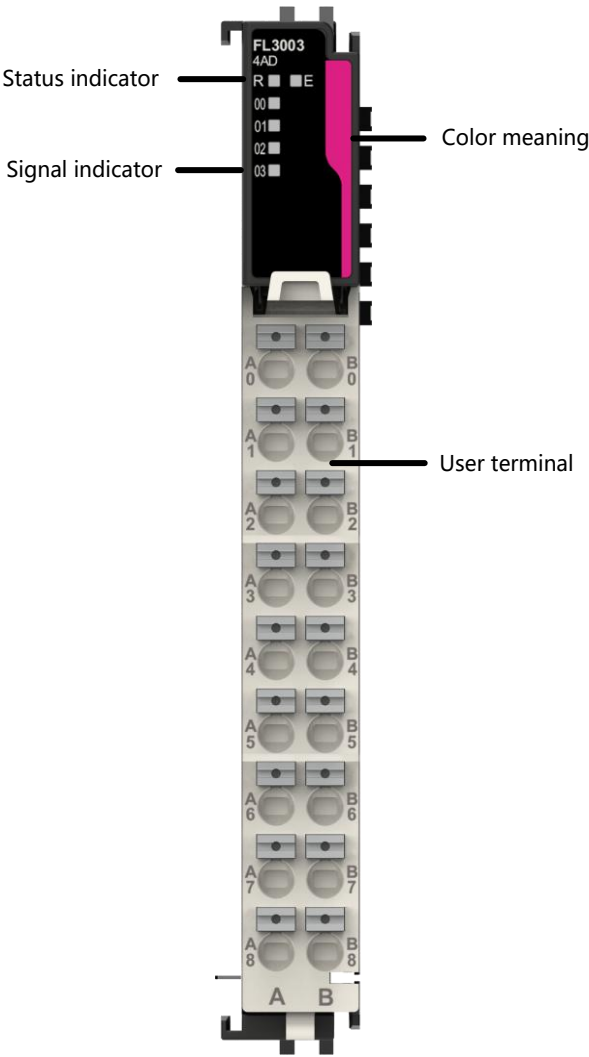
3.5.1 FL3003 (4AD)

3.5.1.1 Basic information



| Model  | Ordering code | Description                                                                                           | Applicable model                     |
|--------|---------------|-------------------------------------------------------------------------------------------------------|--------------------------------------|
| FL3003 | 11016-00011   | Analog input module, 4 channels, 16-bit resolution, room-temperature accuracy of $\pm 0.1\%FS$ ; RoHS | Applicable to INVT Flex/TS/TM series |

3.5.1.2 Component description

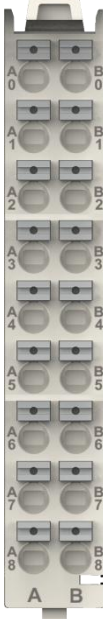


| Name             | Description                  |                               |                                                                                                            |
|------------------|------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------|
| Status indicator | R: Yellow green              | Power-on/Run status indicator | On: The module is running.                                                                                 |
|                  |                              |                               | Slow blinking (500ms): The module is establishing communication.                                           |
|                  |                              |                               | Off: The module is not powered on or it is abnormal.                                                       |
|                  | E: Red                       | Module fault indicator        | Fast blinking (100ms): The module is offline.                                                              |
|                  |                              |                               | Slow blinking (500ms): ADC chip fault or incorrect parameter settings.                                     |
|                  |                              |                               | Off: The module works normally.                                                                            |
| Signal indicator | 00–03: Green                 | Channel status indicator      | On: The channel is enabled.                                                                                |
|                  |                              |                               | Slow blinking (500ms): Over-range or over-limit input signal, or incorrect channel parameter configuration |
|                  |                              |                               | Fast blinking (100ms): Offline at the voltage mode.                                                        |
|                  |                              |                               | Off: The channel is disabled.                                                                              |
| User terminal    | External wiring I/O terminal |                               |                                                                                                            |

| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |

3.5.1.3 Terminal definition

■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | VI0+        | A0            | B0             | I0+          |
|                                                                                    | VI0-        | A1            | B1             | PE           |
|                                                                                    | VI1+        | A2            | B2             | I1+          |
|                                                                                    | VI1-        | A3            | B3             | PE           |
|                                                                                    | VI2+        | A4            | B4             | I2+          |
|                                                                                    | VI2-        | A5            | B5             | PE           |
|                                                                                    | VI3+        | A6            | B6             | I3+          |
|                                                                                    | VI3-        | A7            | B7             | PE           |
|                                                                                    | -           | A8            | B8             | -            |

■ Terminal wiring

Figure 3-1 Voltage input wiring

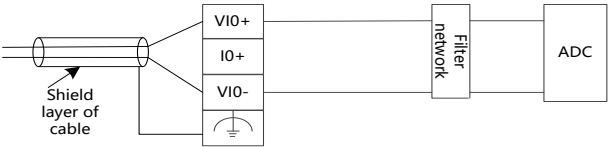
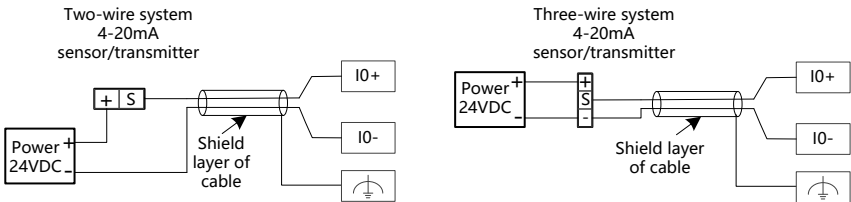
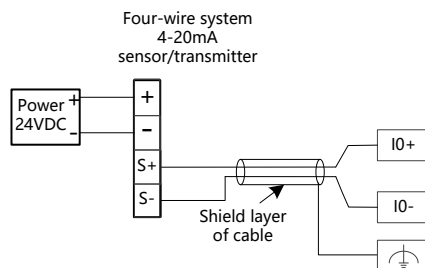


Figure 3-2 Current input wiring





### 3.5.1.4 Power supply specifications

| Item                                | Specification          |
|-------------------------------------|------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC) |
| Fieldbus input power rated current  | 200mA                  |
| Terminal input power rated voltage  | None                   |
| Terminal input power rated current  | None                   |
| Terminal output power rated voltage | None                   |
| Terminal output power rated current | None                   |
| Hot swapping of module              | Not supported          |

### 3.5.1.5 Input specifications

| Item                                               | Specification                     |
|----------------------------------------------------|-----------------------------------|
| Input type                                         | Analog input                      |
| Input mode                                         | Voltage/current                   |
| Input channels                                     | 4                                 |
| Resolution                                         | 16-bit                            |
| Conversion time                                    | 320μs/channel                     |
| Voltage input range                                | 0–5V, 0–10V, -5–+5V, -10–+10V     |
| Voltage input impedance                            | 2.4MΩ                             |
| Voltage input accuracy (25°C)                      | ±0.1%                             |
| Voltage input accuracy (in full temperature range) | ±0.2%                             |
| Voltage input limit                                | ±12V                              |
| Voltage input diagnosis                            | Disconnection detection supported |
| Current input range                                | ±20mA, 0–20mA, 4–20mA             |
| Current input resistance                           | 240Ω                              |
| Current input accuracy (at 25°C)                   | ±0.1%                             |
| Current input accuracy (in full temperature range) | ±0.2%                             |
| Current input limit                                | ±24mA                             |

| Item                    | Specification                                                                                         |
|-------------------------|-------------------------------------------------------------------------------------------------------|
| Current input diagnosis | Not supported                                                                                         |
| Isolation               | No isolation between interface channels; voltage isolated from interface; interface isolated from bus |
| Input action display    | None                                                                                                  |
| Input derating          | None                                                                                                  |

### 3.5.1.6 Software specifications

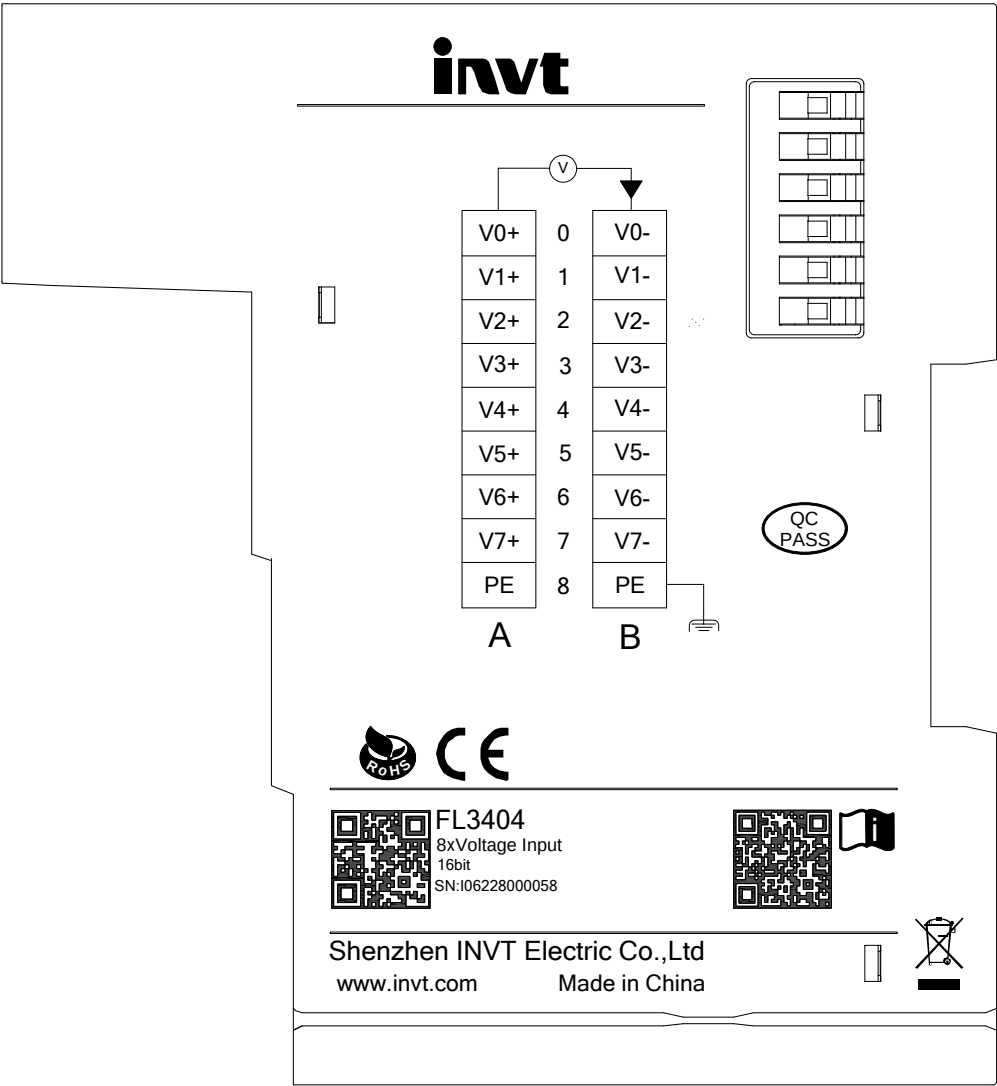
| Item                                           | Specification                                                                                                                  |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Configuration of independent channel enabling  | Supported                                                                                                                      |
| Configuration of diagnosis reporting           | Supported                                                                                                                      |
| Configuration of enabling diagnosis detection  | Voltage-side disconnection, over-range detection, and over-limit detection                                                     |
| Mode switchover configuration                  | 0–5V, 0–10V, ±5V, ±10V, 4–20mA, 0–20mA, ±20mA                                                                                  |
| Filter parameter configuration                 | Software filter time can be set through the host controller, which ranges from 1 to 255, with the sampling period as the unit. |
| Configuration of enabling over-limit detection | Supported                                                                                                                      |
| Configuration of enabling peak holding         | Not supported                                                                                                                  |
| Configuration of conversion digital range      | ±20000                                                                                                                         |
| Sampling time                                  | 4 channels at 1.28ms                                                                                                           |
| Sampling refresh                               | Sampling time based asynchronous refresh, but not bus period based synchronous refresh                                         |
| Stop mode                                      | Present value kept, without refresh                                                                                            |

### 3.5.1.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C–+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C–+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

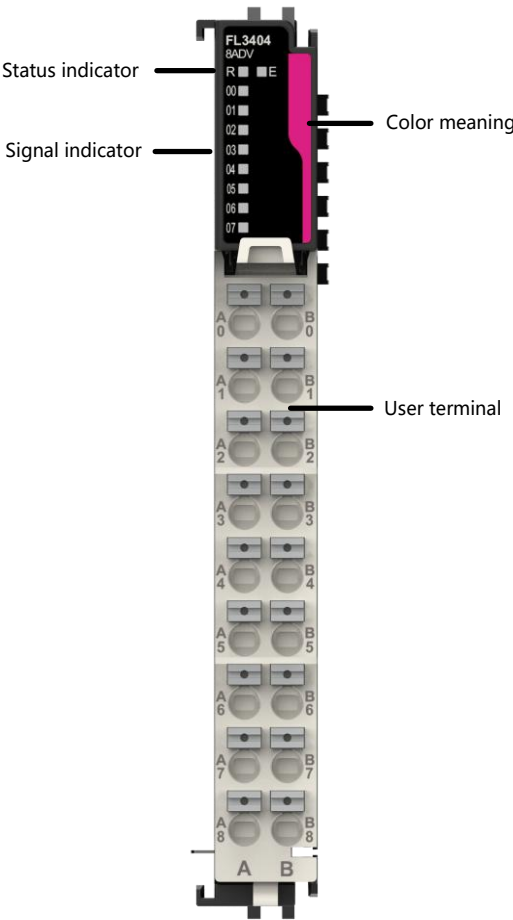
3.5.2 FL3404 (8ADV)

3.5.2.1 Basic information



| Model  | Ordering code | Description                                                                                                            | Applicable model                     |
|--------|---------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| FL3404 | 11016-00026   | Analog input module, 8 channels, voltage signal, 16-bit resolution, room-temperature accuracy of $\pm 0.15\%FS$ ; RoHS | Applicable to INVT Flex/TS/TM series |

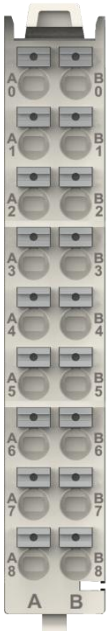
3.5.2.2 Component description



| Name             | Description                                                                         |                                               |                                                                                                            |                                      |
|------------------|-------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Status indicator | R: Yellow green                                                                     | Power-on/Run status indicator                 | On: The module is running.                                                                                 |                                      |
|                  |                                                                                     |                                               | Slow blinking (500ms): The module is establishing communication.                                           |                                      |
|                  |                                                                                     |                                               | Off: The module is not powered on or it is abnormal.                                                       |                                      |
|                  | E: Red                                                                              | Module fault indicator                        | Fast blinking (100ms): The module is offline.                                                              |                                      |
|                  |                                                                                     |                                               | Slow blinking (500ms): ADC chip fault or incorrect parameter settings.                                     |                                      |
|                  |                                                                                     |                                               | Off: The module works normally.                                                                            |                                      |
| Signal indicator | 00–07: Green                                                                        | Channel status indicator                      | On: The channel is enabled.                                                                                |                                      |
|                  |                                                                                     |                                               | Slow blinking (500ms): Over-range or over-limit input signal, or incorrect channel parameter configuration |                                      |
|                  |                                                                                     |                                               | Off: The channel is disabled.                                                                              |                                      |
| User terminal    | External wiring I/O terminal                                                        |                                               |                                                                                                            |                                      |
| Color meaning    |  | Digital input                                 |                         | Digital output (source, sink, relay) |
|                  |  | Analog input (voltage, current, thermocouple) |                         | Analog output                        |

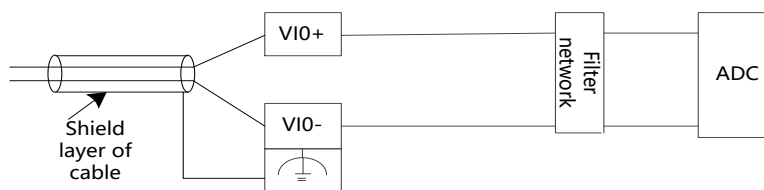
### 3.5.2.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                 | Left signal | Left terminal | Right terminal | Right signal |
|-----------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | V1+         | A0            | B0             | V1-          |
|                                                                                   | V2+         | A1            | B1             | V2-          |
|                                                                                   | V3+         | A2            | B2             | V3-          |
|                                                                                   | V4+         | A3            | B3             | V4-          |
|                                                                                   | V5+         | A4            | B4             | V5-          |
|                                                                                   | V6+         | A5            | B5             | V6-          |
|                                                                                   | V7+         | A6            | B6             | V7-          |
|                                                                                   | PE          | A7            | B7             | PE           |
|                                                                                   | V1+         | A8            | B8             | V1-          |

#### ■ Terminal wiring

Figure 3-3 Voltage input wiring



### 3.5.2.4 Power supply specifications

| Item                                | Specification          |
|-------------------------------------|------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC) |
| Fieldbus input power rated current  | 200mA                  |
| Terminal input power rated voltage  | None                   |
| Terminal input power rated current  | None                   |
| Terminal output power rated voltage | None                   |
| Terminal output power rated current | None                   |
| Hot swapping of module              | Not supported          |



### 3.5.2.5 Input specifications

| Item                                               | Specification                                                                                         |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Input type                                         | Analog input                                                                                          |
| Input mode                                         | Voltage (differential)                                                                                |
| Input channels                                     | 8                                                                                                     |
| Resolution                                         | 16-bit                                                                                                |
| Conversion time                                    | <170μs/channel                                                                                        |
| Voltage input range                                | 0–5V, 0–10V, -5–+5V, -10–+10V                                                                         |
| Voltage input impedance                            | 1MΩ                                                                                                   |
| Voltage input accuracy (25°C)                      | ±0.15%                                                                                                |
| Voltage input accuracy (in full temperature range) | ±0.3%                                                                                                 |
| Voltage input limit                                | ±15V                                                                                                  |
| Voltage input diagnosis                            | Over-limit and over-range detection supported; disconnection detection not supported                  |
| Isolation                                          | No isolation between interface channels; voltage isolated from interface; interface isolated from bus |
| Input action display                               | None                                                                                                  |

### 3.5.2.6 Software specifications

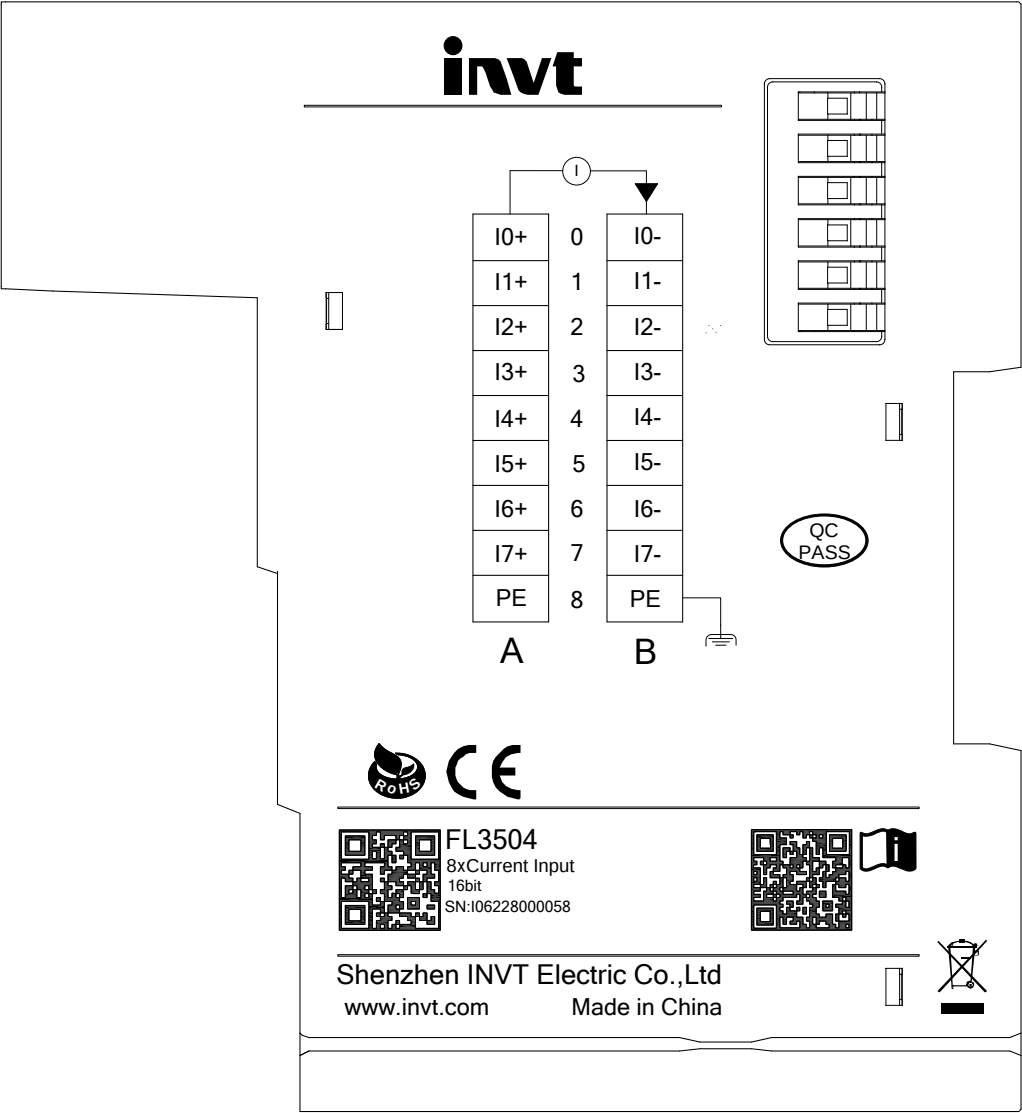
| Item                                           |            | Specification                                                                                                                  |
|------------------------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------|
| Configuration of independent channel enabling  |            | Supported                                                                                                                      |
| Configuration of diagnosis reporting           |            | Supported                                                                                                                      |
| Configuration of enabling diagnosis detection  |            | Over-range detection, and over-limit detection                                                                                 |
| Mode switchover configuration                  |            | 0–5V, 0–10V, ±5V, ±10V                                                                                                         |
| Filter parameter configuration                 |            | Software filter time can be set through the host controller, which ranges from 1 to 255, with the sampling period as the unit. |
| Configuration of enabling over-limit detection |            | Supported                                                                                                                      |
| Configuration of enabling peak holding         |            | Not supported                                                                                                                  |
| Configuration of conversion digital range      | -10–+10VDC | -20000–20000, -32000–32000, -27648–27648                                                                                       |
|                                                | 0–10VDC    | 0–20000, 0–32000, 0–27648                                                                                                      |
|                                                | -5–+5VDC   | -20000–20000, -32000–32000, -27648–27648                                                                                       |
|                                                | 0–5VDC     | 0–20000, 0–32000, 0–27648                                                                                                      |
|                                                | 1–5VDC     | 0–20000, 0–32000, 0–27648                                                                                                      |
| Sampling time                                  |            | <170μs/channel                                                                                                                 |
| Sampling refresh                               |            | Sampling time based asynchronous refresh, but not bus period based synchronous refresh                                         |

**3.5.2.7 Environment requirements**

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

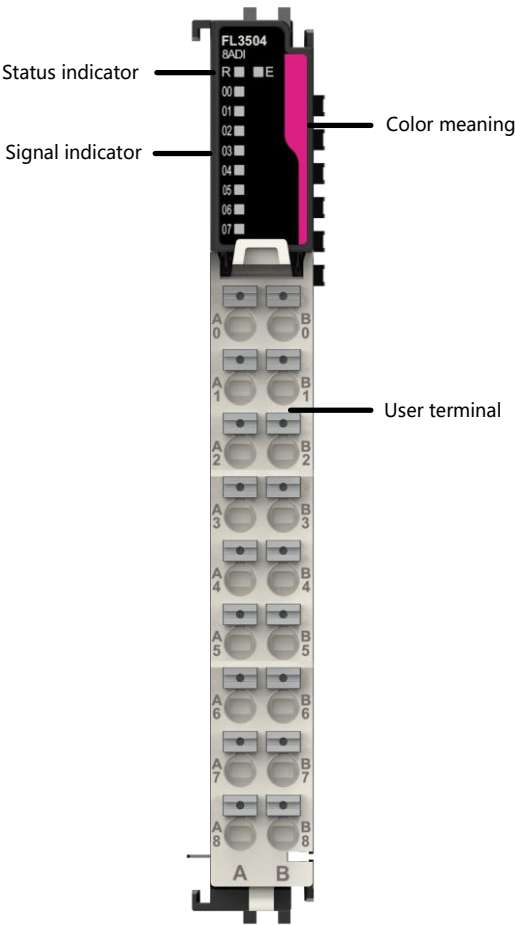
3.5.3 FL3504 (8ADI)

3.5.3.1 Basic information



| Model  | Ordering code | Description                                                                                                            | Applicable model                     |
|--------|---------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| FL3504 | 11016-00027   | Analog input module, 8 channels, current signal, 16-bit resolution, room-temperature accuracy of $\pm 0.15\%FS$ ; RoHS | Applicable to INVT Flex/TS/TM series |

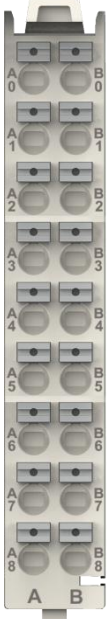
3.5.3.2 Component description



| Name             | Description                                                                         |                                               |                                                                                                            |                                      |
|------------------|-------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Status indicator | R: Yellow green                                                                     | Power-on/Run status indicator                 | On: The module is running.                                                                                 |                                      |
|                  |                                                                                     |                                               | Slow blinking (500ms): The module is establishing communication.                                           |                                      |
|                  |                                                                                     |                                               | Off: The module is not powered on or it is abnormal.                                                       |                                      |
|                  | E: Red                                                                              | Module fault indicator                        | Fast blinking (100ms): The module is offline.                                                              |                                      |
|                  |                                                                                     |                                               | Slow blinking (500ms): ADC chip fault or incorrect parameter settings.                                     |                                      |
|                  |                                                                                     |                                               | Off: The module works normally.                                                                            |                                      |
| Signal indicator | 00–07: Green                                                                        | Channel status indicator                      | On: The channel is enabled.                                                                                |                                      |
|                  |                                                                                     |                                               | Slow blinking (500ms): Over-range or over-limit input signal, or incorrect channel parameter configuration |                                      |
|                  |                                                                                     |                                               | Off: The channel is disabled.                                                                              |                                      |
| User terminal    | External wiring I/O terminal                                                        |                                               |                                                                                                            |                                      |
| Color meaning    |  | Digital input                                 |                         | Digital output (source, sink, relay) |
|                  |  | Analog input (voltage, current, thermocouple) |                         | Analog output                        |

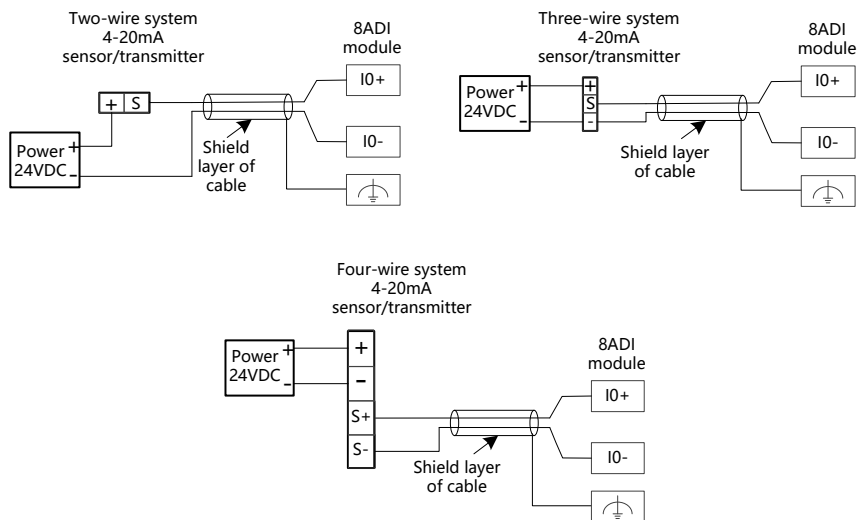
### 3.5.3.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                 | Left signal | Left terminal | Right terminal | Right signal |
|-----------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | I0+         | A0            | B0             | I0-          |
|                                                                                   | I1+         | A1            | B1             | I1-          |
|                                                                                   | I2+         | A2            | B2             | I2-          |
|                                                                                   | I3+         | A3            | B3             | I3-          |
|                                                                                   | I4+         | A4            | B4             | I4-          |
|                                                                                   | I5+         | A5            | B5             | I5-          |
|                                                                                   | I6+         | A6            | B6             | I6-          |
|                                                                                   | I7+         | A7            | B7             | I7-          |
|                                                                                   | PE          | A8            | B8             | PE           |

#### ■ Terminal wiring

Figure 3-4 Current input wiring



**3.5.3.4 Power supply specifications**

| Item                                | Specification          |
|-------------------------------------|------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC) |
| Fieldbus input power rated current  | 200mA                  |
| Terminal input power rated voltage  | None                   |
| Terminal input power rated current  | None                   |
| Terminal output power rated voltage | None                   |
| Terminal output power rated current | None                   |
| Hot swapping of module              | Not supported          |

**3.5.3.5 Input specifications**

| Item                                               | Specification                                                                                         |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Input type                                         | Analog input                                                                                          |
| Input mode                                         | Voltage                                                                                               |
| Input channels                                     | 8                                                                                                     |
| Resolution                                         | 16-bit                                                                                                |
| Conversion time                                    | <170 $\mu$ s/channel                                                                                  |
| Current input range                                | $\pm 20$ mA, 0–20mA, 4–20mA                                                                           |
| Current input resistance                           | 240 $\Omega$                                                                                          |
| Current input accuracy (at 25°C)                   | $\pm 0.15\%$                                                                                          |
| Current input accuracy (in full temperature range) | $\pm 0.3\%$                                                                                           |
| Current input limit                                | $\pm 30$ mA                                                                                           |
| Current input diagnosis                            | Not supported                                                                                         |
| Isolation                                          | No isolation between interface channels; voltage isolated from interface; interface isolated from bus |

**3.5.3.6 Software specifications**

| Item                                          | Specification                                                                                                                  |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Configuration of independent channel enabling | Supported                                                                                                                      |
| Configuration of diagnosis reporting          | Supported                                                                                                                      |
| Configuration of enabling diagnosis detection | Over-range detection, and over-limit detection                                                                                 |
| Mode switchover configuration                 | 4–20mA, 0–20mA, $\pm 20$ mA                                                                                                    |
| Filter parameter configuration                | Software filter time can be set through the host controller, which ranges from 1 to 255, with the sampling period as the unit. |

| Item                                           |             | Specification                                                                          |
|------------------------------------------------|-------------|----------------------------------------------------------------------------------------|
| Configuration of enabling over-limit detection |             | Supported                                                                              |
| Configuration of enabling peak holding         |             | Not supported                                                                          |
| Configuration of conversion digital range      | -20mA~+20mA | -20000~20000, -32000~32000, -27648~27648                                               |
|                                                | 0mA~20mA    | 0~20000, 0~32000, 0~27648                                                              |
|                                                | 4mA~20mA    | 0~20000, 0~32000, 0~27648                                                              |
| Sampling time                                  |             | <170μs/channel                                                                         |
| Sampling refresh                               |             | Sampling time based asynchronous refresh, but not bus period based synchronous refresh |

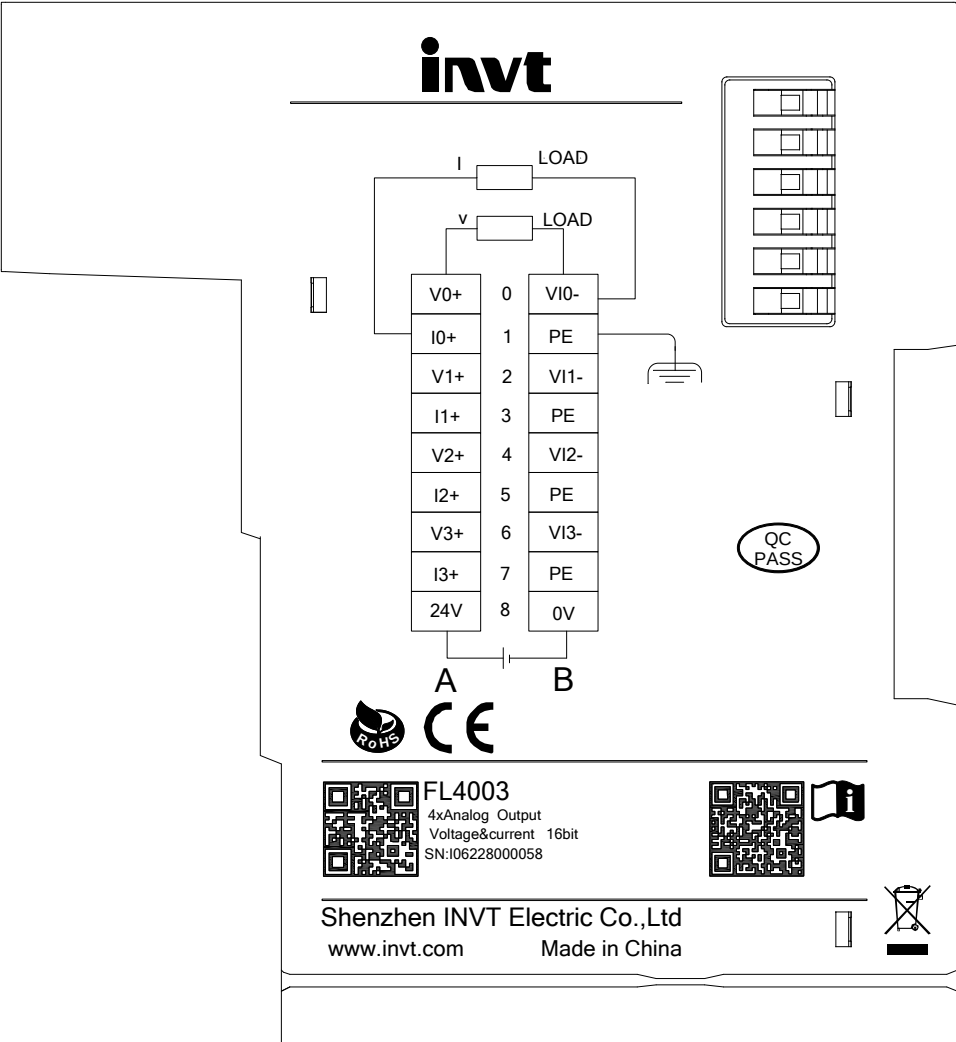
### 3.5.3.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.6 Analog output module (FL4xxx)

3.6.1 FL4003 (4DA)

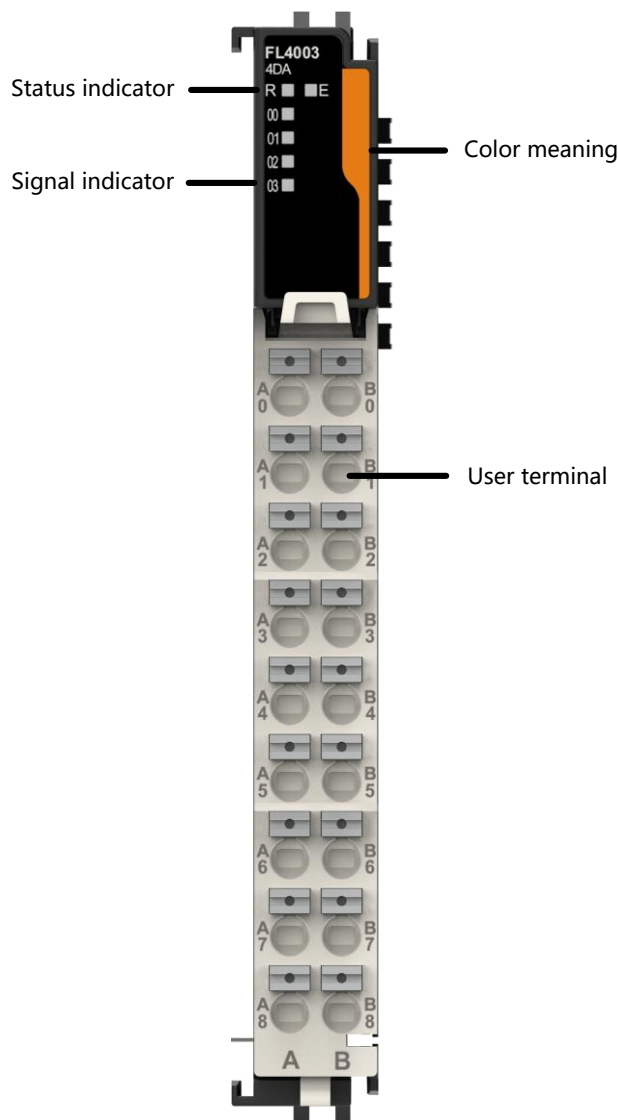
3.6.1.1 Basic information



| Model  | Ordering code | Description                                                                                            | Applicable model                     |
|--------|---------------|--------------------------------------------------------------------------------------------------------|--------------------------------------|
| FL4003 | 11016-00008   | Analog output module, 4 channels, 16-bit resolution, room-temperature accuracy of $\pm 0.1\%$ FS; RoHS | Applicable to INVT Flex/TS/TM series |



3.6.1.2 Component description

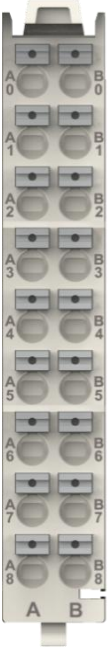


| Name                                          | Description                  |                               |                                                                                      |
|-----------------------------------------------|------------------------------|-------------------------------|--------------------------------------------------------------------------------------|
| Status indicator                              | R: Yellow green              | Power-on/Run status indicator | On: The module is running.                                                           |
|                                               |                              |                               | Slow blinking (500ms): The module is establishing communication.                     |
|                                               |                              |                               | Off: The module is not powered on or it is abnormal.                                 |
|                                               | E: Red                       | Module fault indicator        | Fast blinking (100ms): The module is offline.                                        |
|                                               |                              |                               | Slow blinking (500ms): DAC chip external power exception or parameter setting error. |
|                                               |                              |                               | Off: The module works normally.                                                      |
|                                               | 00–03: Green                 | Channel status indicator      | On: The channel is enabled.                                                          |
|                                               |                              |                               | Slow blinking (500ms): Short circuit or incorrect parameter settings.                |
| Fast blinking (100ms): Current disconnection. |                              |                               |                                                                                      |
| Off: The channel is disabled.                 |                              |                               |                                                                                      |
| User terminal                                 | External wiring I/O terminal |                               |                                                                                      |

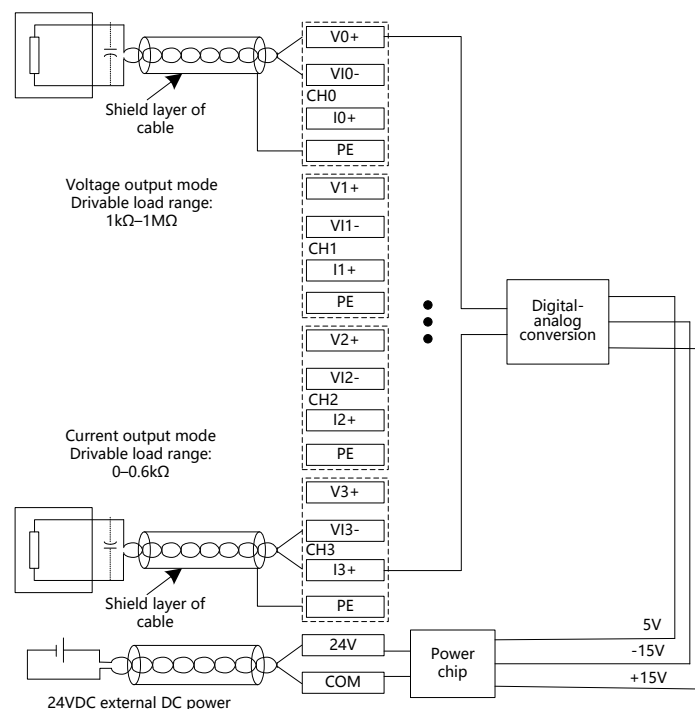
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |

### 3.6.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | V0+         | A0            | B0             | VI0-         |
|                                                                                    | I0+         | A1            | B1             | PE           |
|                                                                                    | V1+         | A2            | B2             | VI1-         |
|                                                                                    | I1+         | A3            | B3             | PE           |
|                                                                                    | V2+         | A4            | B4             | VI2-         |
|                                                                                    | I2+         | A5            | B5             | PE           |
|                                                                                    | V3+         | A6            | B6             | VI3-         |
|                                                                                    | I3+         | A7            | B7             | PE           |
|                                                                                    | 24V         | A8            | B8             | COM          |

#### ■ Terminal wiring



**3.6.1.4 Power supply specifications**

| Item                                | Specification                  |
|-------------------------------------|--------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)         |
| Fieldbus input power rated current  | 150mA                          |
| Terminal input power rated voltage  | 24VDC (20.4VDC–28.8VDC)        |
| Terminal input power rated current  | 100mA (Typical value at 24VDC) |
| Terminal output power rated voltage | None                           |
| Terminal output power rated current | None                           |
| Hot swapping of module              | Not supported                  |

**3.6.1.5 Output specifications**

| Item                                                | Specification                                                                                         |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Output type                                         | Analog output                                                                                         |
| Output mode                                         | Voltage/current                                                                                       |
| Output channel                                      | 4                                                                                                     |
| Resolution                                          | 16-bit                                                                                                |
| Conversion time                                     | 40μs/channel                                                                                          |
| Voltage output range                                | 0–5V, 0–10V, -5–+5V, -10–+10V                                                                         |
| Voltage output load                                 | 1kΩ                                                                                                   |
| Voltage output accuracy (25°C)                      | ±0.1%                                                                                                 |
| Voltage output accuracy (in full temperature range) | ±0.5%                                                                                                 |
| Voltage output diagnosis                            | Short circuit detection and overtemperature protection supported                                      |
| Current output range                                | 0–20mA, 4–20mA                                                                                        |
| Current output load                                 | <600Ω                                                                                                 |
| Current output accuracy (25°C)                      | ±0.1%                                                                                                 |
| Current output accuracy (in full temperature range) | ±0.5%                                                                                                 |
| Current output diagnosis                            | Open circuit detection and overtemperature protection supported                                       |
| Isolation                                           | No isolation between interface channels; voltage isolated from interface; interface isolated from bus |
| Output action display                               | None                                                                                                  |
| Output derating                                     | None                                                                                                  |

**3.6.1.6 Software specifications**

| Item                                          | Specification                                                                                   |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------|
| Configuration of independent channel enabling | Supported                                                                                       |
| Configuration of diagnosis reporting          | Supported                                                                                       |
| Configuration of enabling diagnosis detection | Short circuit detection for voltage, and disconnection detection for current                    |
| Mode switchover configuration                 | 0–5V, 0–10V, $\pm 5V$ , $\pm 10V$ , 4–20mA, 0–20mA                                              |
| Output status configuration after stop        | Clearing, keeping the present output, or outputting the preset value                            |
| Preset value output after stop                | Supported                                                                                       |
| Configuration of conversion digital range     | $\pm 20000$                                                                                     |
| Sampling time                                 | 4 channels at 160 $\mu$ s                                                                       |
| Sampling refresh                              | Sampling time based asynchronous refresh, but not bus period based synchronous refresh          |
| Stop mode                                     | Output according to the fault-caused stop mode or the preset value, without refreshing any more |

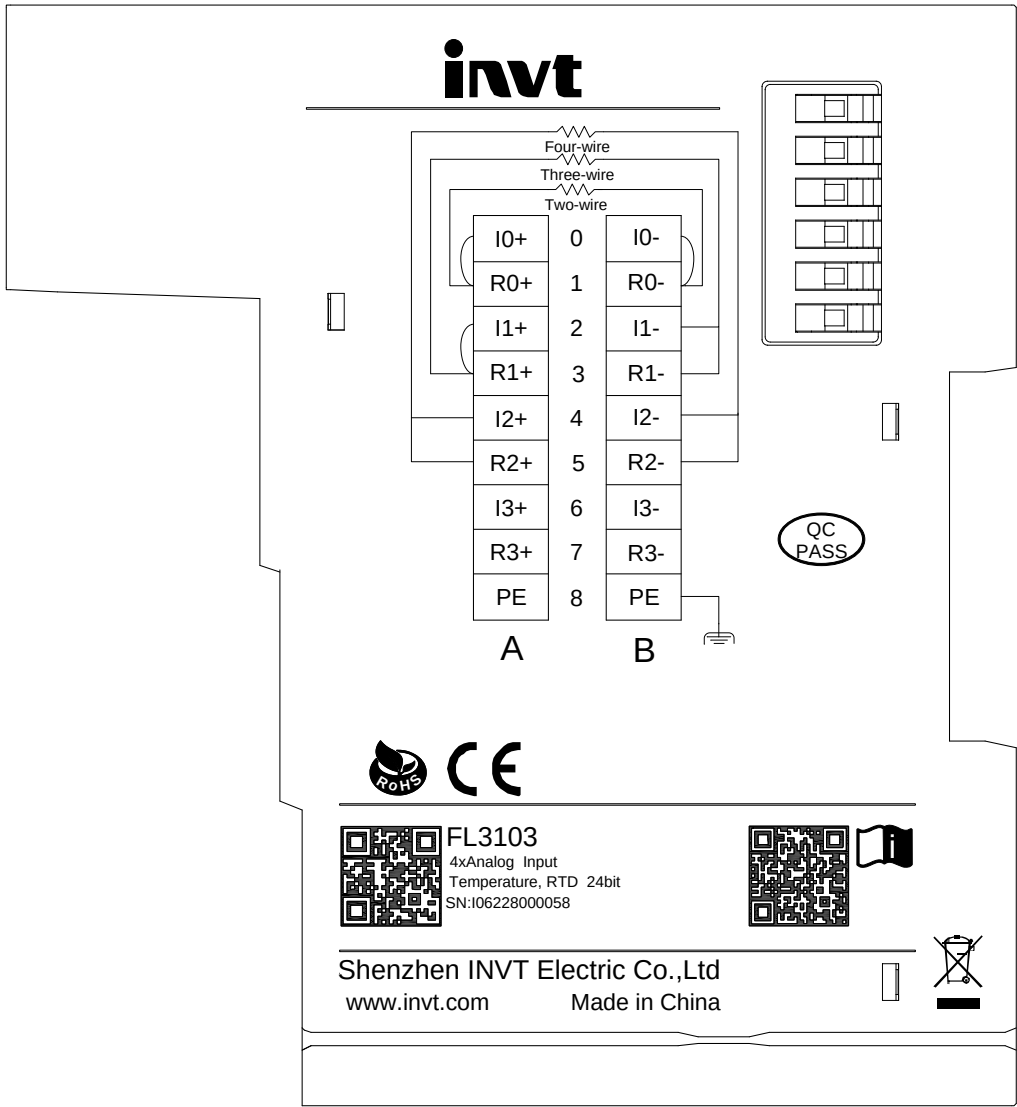
**3.6.1.7 Environment requirements**

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C–+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C–+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.7 Temperature detection module (FL31xx)

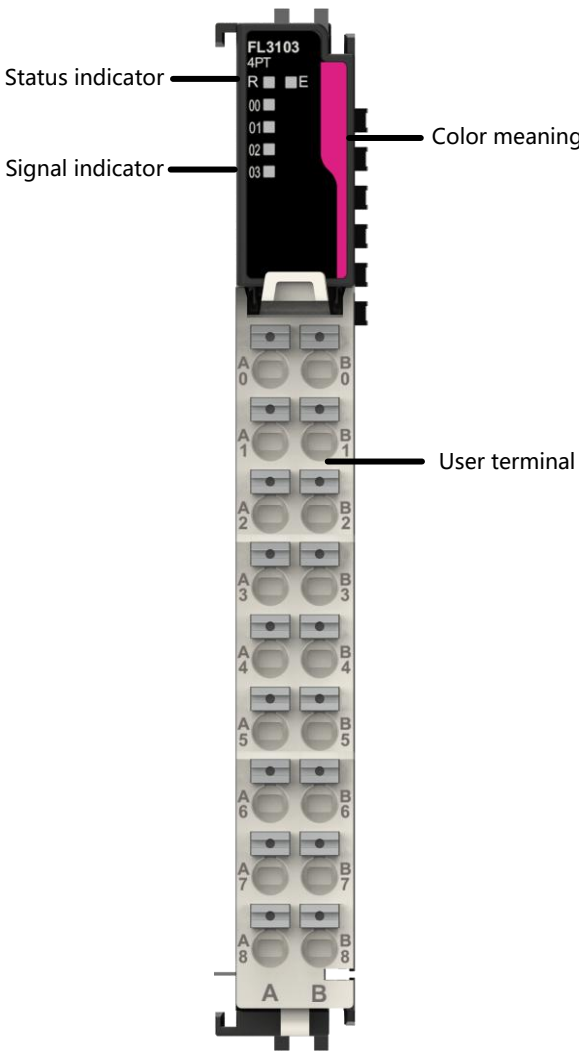
3.7.1 FL3103 (4PT)

3.7.1.1 Basic information



| Model  | Ordering code | Description                                                                    | Applicable model                     |
|--------|---------------|--------------------------------------------------------------------------------|--------------------------------------|
| FL3103 | 11016-00007   | Thermal resistor, 4 channels, 24-bit resolution, sensitivity of 0.1°C/°F; RoHS | Applicable to INVT Flex/TS/TM series |

3.7.1.2 Component description

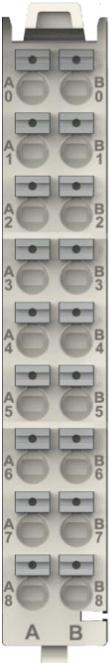


| Name                          | Description                  |                               |                                                                  |
|-------------------------------|------------------------------|-------------------------------|------------------------------------------------------------------|
| Status indicator              | R: Yellow green              | Power-on/Run status indicator | On: The module is running.                                       |
|                               |                              |                               | Slow blinking (500ms): The module is establishing communication. |
|                               |                              |                               | Off: The module is not powered on or it is abnormal.             |
|                               | E: Red                       | Module fault indicator        | Fast blinking (100ms): The module is offline.                    |
|                               |                              |                               | Slow blinking (500ms): Error in temperature detection.           |
|                               |                              |                               | Off: The module works normally.                                  |
|                               | 00–03: Green                 | Channel status indicator      | On: The channel is enabled.                                      |
|                               |                              |                               | Slow blinking (500ms): Input signal out of range or limit.       |
|                               |                              |                               | Fast blinking (100ms): Disconnection.                            |
| Off: The channel is disabled. |                              |                               |                                                                  |
| User terminal                 | External wiring I/O terminal |                               |                                                                  |

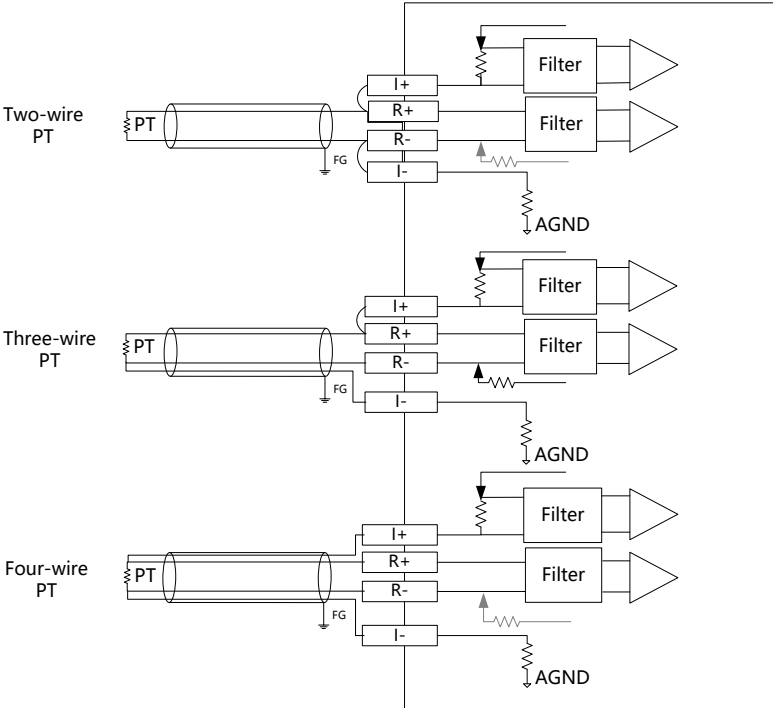
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |

### 3.7.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | I0+         | A0            | B0             | I0-          |
|                                                                                    | R0+         | A1            | B1             | R0-          |
|                                                                                    | I1+         | A2            | B2             | I1-          |
|                                                                                    | R1+         | A3            | B3             | R1-          |
|                                                                                    | I2+         | A4            | B4             | I2-          |
|                                                                                    | R2+         | A5            | B5             | R2-          |
|                                                                                    | I3+         | A6            | B6             | I3-          |
|                                                                                    | R3+         | A7            | B7             | R3-          |
|                                                                                    | PE          | A8            | B8             | PE           |

#### ■ Terminal wiring



**3.7.1.4 Power supply specifications**

| Item                                | Specification          |
|-------------------------------------|------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC) |
| Fieldbus input power rated current  | 250mA                  |
| Terminal input power rated voltage  | None                   |
| Terminal input power rated current  | None                   |
| Terminal output power rated voltage | None                   |
| Terminal output power rated current | None                   |
| Hot swapping of module              | Not supported          |

**3.7.1.5 Input specifications**

| Item                                      | Specification                                                                                                                                                                                                                                                                         |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input channels                            | 4                                                                                                                                                                                                                                                                                     |
| Resolution                                | 24-bit                                                                                                                                                                                                                                                                                |
| Display sensitivity                       | 0.0625°C, 0.0625°F                                                                                                                                                                                                                                                                    |
| Input terminal                            | Four thermal resistor inputs                                                                                                                                                                                                                                                          |
| Sensor type                               | PT100, PT500, PT1000, Cu100                                                                                                                                                                                                                                                           |
| Wiring method                             | Two-wire/Three-wire/Four-wire                                                                                                                                                                                                                                                         |
| Accuracy (at room temperature of 25°C)    | Full scale * $\pm 0.3\%$                                                                                                                                                                                                                                                              |
| Accuracy (in room temperature -20°C–55°C) | Full scale * $\pm 1\%$                                                                                                                                                                                                                                                                |
| Sampling period                           | Channel 1 and channel 2 form a group, while channel 3 and channel 4 form a group. When both channels within a group are enabled and one channel is configured as a three-wire system, the sampling period is 480ms/channel, and in other cases, the sampling period is 240ms/channel. |
| Filter parameter                          | 1–255 (Default: 8)                                                                                                                                                                                                                                                                    |
| Isolation method                          | I/O terminals insulated from the power supply;<br>No insulation between channels                                                                                                                                                                                                      |

**3.7.1.6 Software specifications**

| Item                                          | Specification                                              |
|-----------------------------------------------|------------------------------------------------------------|
| Configuration of diagnosis reporting          | Supported                                                  |
| Configuration of enabling diagnosis detection | Over-limit detection and disconnection detection supported |



| Item                                           | Specification                                                                                                                                                                                                                                                                         |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration of enabling over-limit detection | Supported                                                                                                                                                                                                                                                                             |
| Independent channel configuration              | Supported                                                                                                                                                                                                                                                                             |
| Configuration of enabling temperature offset   | Supported                                                                                                                                                                                                                                                                             |
| Temperature offset setting range               | -204.8~+204.7 temperature unit                                                                                                                                                                                                                                                        |
| Sampling period                                | Channel 1 and channel 2 form a group, while channel 3 and channel 4 form a group. When both channels within a group are enabled and one channel is configured as a three-wire system, the sampling period is 480ms/channel, and in other cases, the sampling period is 240ms/channel. |
| Display mode                                   | Celsius degree (°C), Fahrenheit degree (°F)                                                                                                                                                                                                                                           |
| Sensitivity                                    | 0.0625°C, 0.0625°F                                                                                                                                                                                                                                                                    |
| Sampling refresh                               | Sampling time based asynchronous refresh, but not bus period based synchronous refresh                                                                                                                                                                                                |
| Disconnection or over-limit                    | Output of max. value plus 10°C. Disconnection detection supported.                                                                                                                                                                                                                    |
| System diagnosis                               | Not supported                                                                                                                                                                                                                                                                         |
| Channel diagnosis                              | Upper limit exceeding alarm and lower limit exceeding alarm.                                                                                                                                                                                                                          |
| Software diagnosis                             | Not supported                                                                                                                                                                                                                                                                         |
| Configuration diagnosis                        | Identifying configuration errors, including channel parameter configuration errors.                                                                                                                                                                                                   |

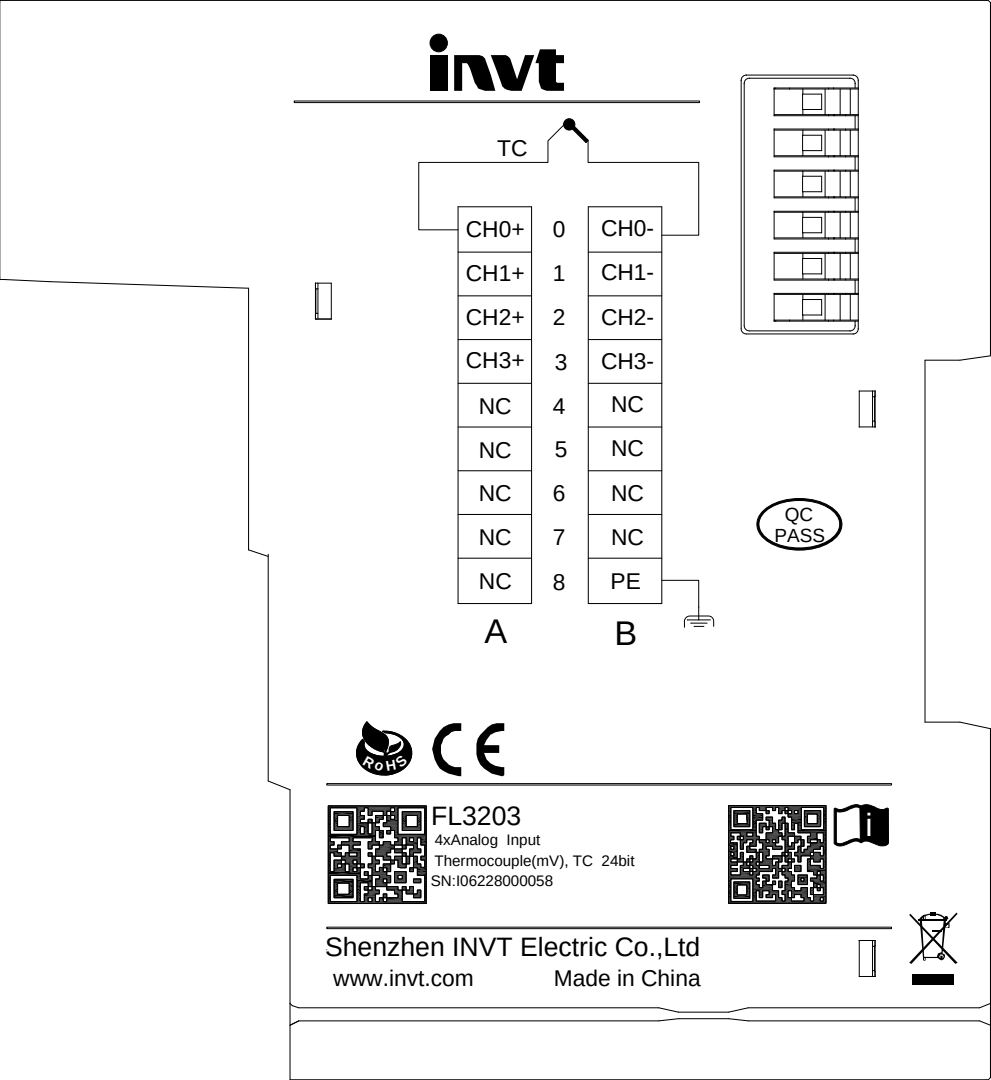
### 3.7.1.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.8 Temperature detection module (FL32xx)

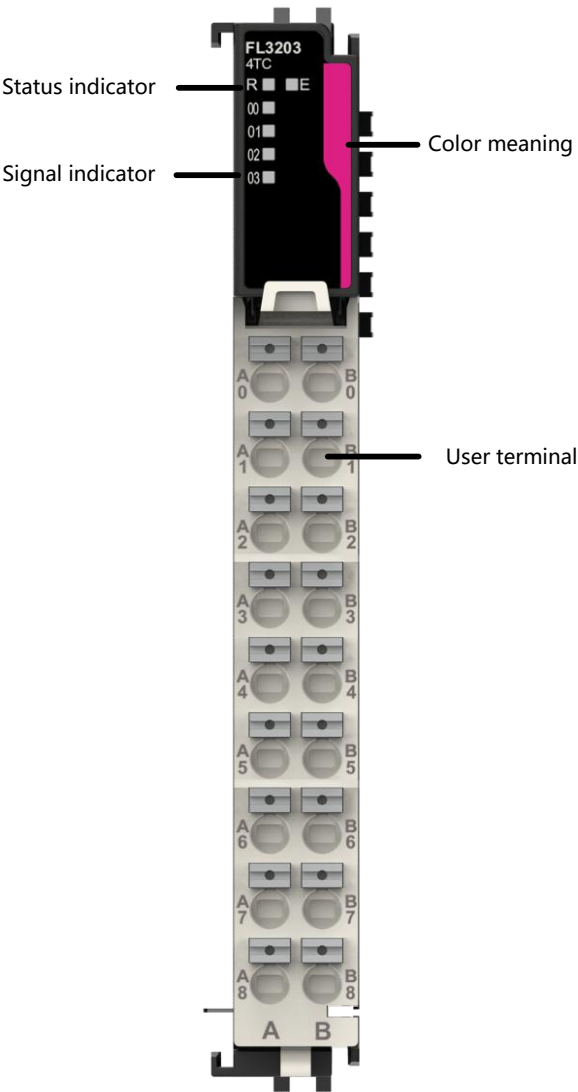
3.8.1 FL3203 (4TC)

3.8.1.1 Basic information



| Model  | Ordering code | Description                                                                | Applicable model                     |
|--------|---------------|----------------------------------------------------------------------------|--------------------------------------|
| FL3203 | 11016-00010   | Thermocouple, 4 channels, 24-bit resolution, sensitivity of 0.1°C/°F; RoHS | Applicable to INVT Flex/TS/TM series |

3.8.1.2 Component description

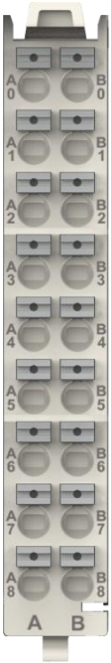


| Name                          | Description                  |                               |                                                                  |
|-------------------------------|------------------------------|-------------------------------|------------------------------------------------------------------|
| Status indicator              | R: Yellow green              | Power-on/Run status indicator | On: The module is running.                                       |
|                               |                              |                               | Slow blinking (500ms): The module is establishing communication. |
|                               |                              |                               | Off: The module is not powered on or it is abnormal.             |
|                               | E: Red                       | Module fault indicator        | Fast blinking (100ms): The module is offline.                    |
|                               |                              |                               | Slow blinking (500ms): Error in temperature detection.           |
|                               |                              |                               | Off: The module works normally.                                  |
|                               | 00–03: Green                 | Channel status indicator      | On: The channel is enabled.                                      |
|                               |                              |                               | Slow blinking (500ms): Input signal out of range or limit.       |
|                               |                              |                               | Fast blinking (100ms): Disconnection.                            |
| Off: The channel is disabled. |                              |                               |                                                                  |
| User terminal                 | External wiring I/O terminal |                               |                                                                  |

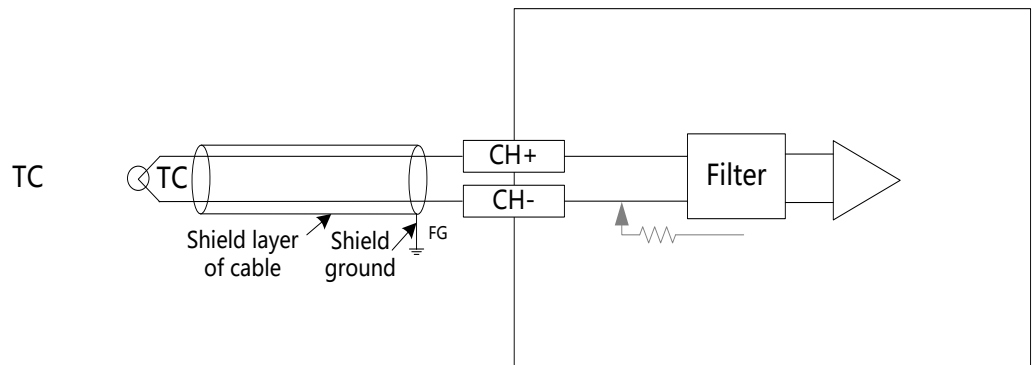
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |

3.8.1.3 Terminal definition and wiring

■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | CH0+        | A0            | B0             | CH0-         |
|                                                                                    | CH1+        | A1            | B1             | CH1-         |
|                                                                                    | CH2+        | A2            | B2             | CH2-         |
|                                                                                    | CH3+        | A3            | B3             | CH3-         |
|                                                                                    | -           | A4            | B4             | -            |
|                                                                                    | -           | A5            | B5             | -            |
|                                                                                    | -           | A6            | B6             | -            |
|                                                                                    | -           | A7            | B7             | -            |
|                                                                                    | -           | A8            | B8             | -            |

■ Terminal wiring



**3.8.1.4 Power supply specifications**

| Item                                | Specification          |
|-------------------------------------|------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC) |
| Fieldbus input power rated current  | 250mA                  |
| Terminal input power rated voltage  | None                   |
| Terminal input power rated current  | None                   |
| Terminal output power rated voltage | None                   |
| Terminal output power rated current | None                   |
| Hot swapping of module              | Not supported          |

**3.8.1.5 Input specifications**

| Item                                      | Specification                                                                    |
|-------------------------------------------|----------------------------------------------------------------------------------|
| Input channels                            | 4                                                                                |
| Resolution                                | 24-bit                                                                           |
| Display sensitivity                       | 0.0625°C, 0.0625°F                                                               |
| Input terminal                            | 4 thermocouple inputs                                                            |
| Thermocouple type                         | B, E, N, J, K, R, S, T                                                           |
| Compensation method                       | Internal cold junction compensation                                              |
| Accuracy (at room temperature of 25°C)    | Full scale * ( $\pm 0.1\%$ ) + Cold junction compensation error                  |
| Accuracy (in room temperature -20°C–55°C) | Full scale * ( $\pm 0.3\%$ ) + Cold junction compensation error                  |
| Isolation                                 | I/O terminals insulated from the power supply;<br>No insulation between channels |
| Input action display                      | None                                                                             |
| Input derating                            | None                                                                             |
| Over-limit and disconnection detection    | Supported                                                                        |

**3.8.1.6 Cold junction compensation**

| Installation direction                  | Cold junction compensation error (-20°C–55°C) |
|-----------------------------------------|-----------------------------------------------|
| Horizontal and upright installation     | $\pm 3^{\circ}\text{C}$                       |
| Non-horizontal but upright installation | $\pm 6^{\circ}\text{C}$                       |

**3.8.1.7 Software specifications**

| Item                                 | Specification |
|--------------------------------------|---------------|
| Configuration of diagnosis reporting | Supported     |

| Item                                           | Specification                                                                          |
|------------------------------------------------|----------------------------------------------------------------------------------------|
| Configuration of enabling diagnosis detection  | Over-limit detection and disconnection detection supported                             |
| Sensor type configuration                      | Supported thermocouple types: B, E, N, J, K, R, S, T                                   |
| Filter parameter                               | 1–255 (Default: 8)                                                                     |
| Overflow and underflow detection               | Not supported                                                                          |
| Configuration of enabling over-limit detection | Supported                                                                              |
| Independent channel configuration              | Supported                                                                              |
| Configuration of enabling temperature offset   | Supported                                                                              |
| Temperature offset setting range               | -204.8–+204.7 temperature unit                                                         |
| Sampling period                                | 360ms/channel                                                                          |
| Display mode                                   | Celsius degree (°C), Fahrenheit degree (°F)                                            |
| Sensitivity                                    | 0.0625°C, 0.0625°F                                                                     |
| Sampling refresh                               | Sampling time based asynchronous refresh, but not bus period based synchronous refresh |
| Disconnection or over-limit                    | Output of max. value plus 10°C.                                                        |
| System diagnosis                               | Not supported                                                                          |
| Channel diagnosis                              | Upper limit exceeding alarm, lower limit exceeding alarm, and disconnection alarm      |
| Software diagnosis                             | Not supported                                                                          |
| Configuration diagnosis                        | Identifying configuration errors, including channel parameter configuration errors.    |

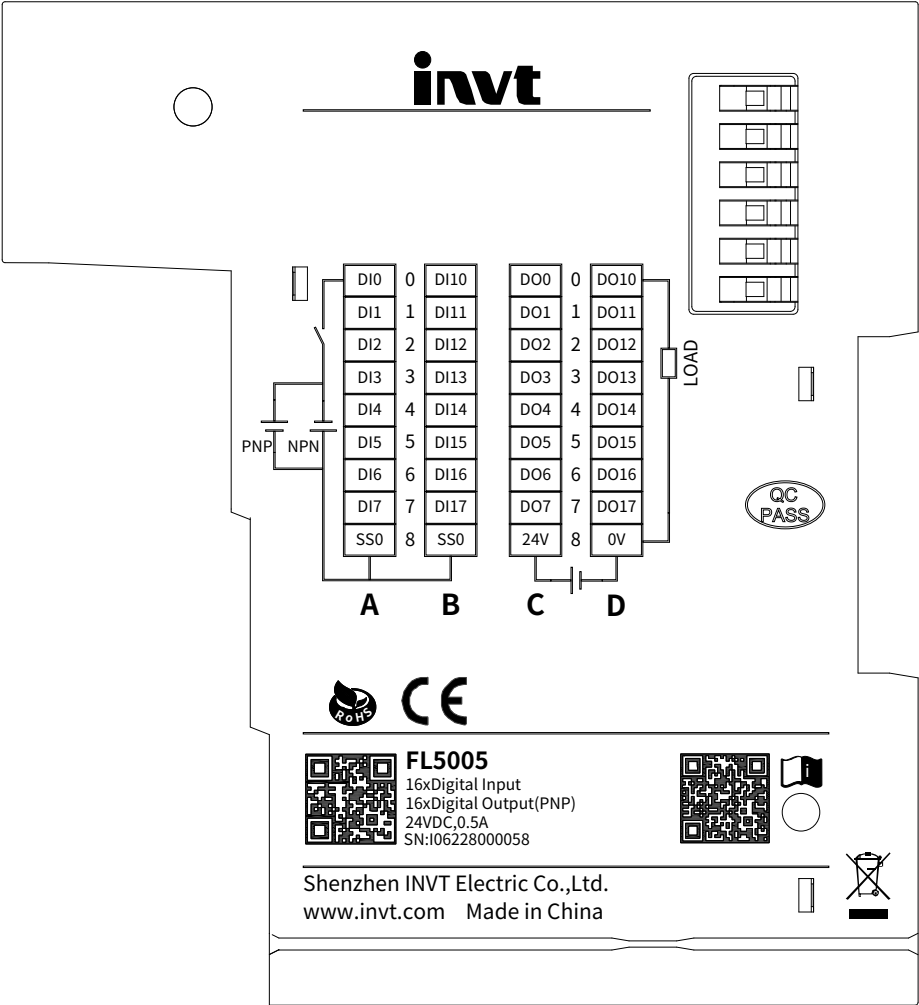
### 3.8.1.8 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C–+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C–+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.9 Hybrid module (FL5xxx)

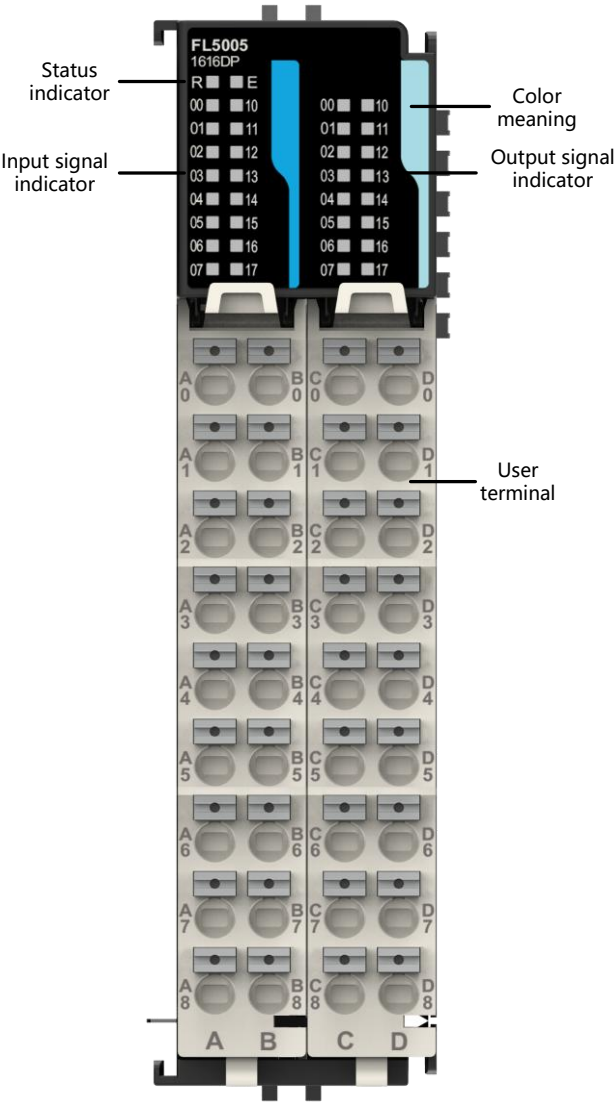
3.9.1 FL5005 (1616DP)

3.9.1.1 Basic information



| Model  | Ordering code | Description                                                                                         | Applicable model                     |
|--------|---------------|-----------------------------------------------------------------------------------------------------|--------------------------------------|
| FL5005 | 11016-00015   | Digital hybrid module, with 16 channels of input + 16 channels of output (PNP), 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.9.1.2 Component description



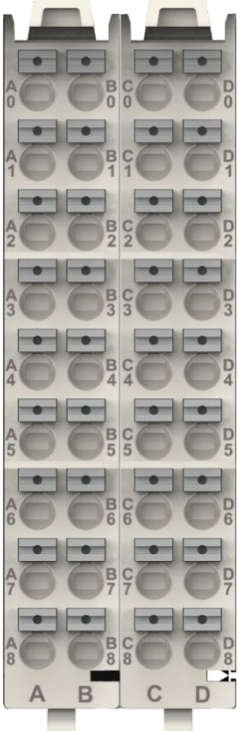
| Name                    |                              | Description                                     |                                                                                       |
|-------------------------|------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------|
| Status indicator        | R: Yellow green              | Power-on/Run status indicator                   | On: The module is running.                                                            |
|                         |                              |                                                 | Slow blinking (500ms): The module is establishing communication.                      |
|                         | E: Red                       | Module fault indicator                          | Off: The module is not powered on or it is abnormal.                                  |
|                         |                              |                                                 | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |
| Input signal indicator  | 00–07: Green<br>10–17: Green | Each corresponds to a channel of input signal.  | Fast blinking (100ms): The module is offline.                                         |
|                         |                              |                                                 | Off: The module works normally.                                                       |
| Output signal indicator | 00–07: Green<br>10–17: Green | Each corresponds to a channel of output signal. | On: The input is valid.                                                               |
|                         |                              |                                                 | Off: The input is invalid.                                                            |
| Output signal indicator | 00–07: Green<br>10–17: Green | Each corresponds to a channel of output signal. | On: Enable output.                                                                    |
|                         |                              |                                                 | Off: Disable output.                                                                  |



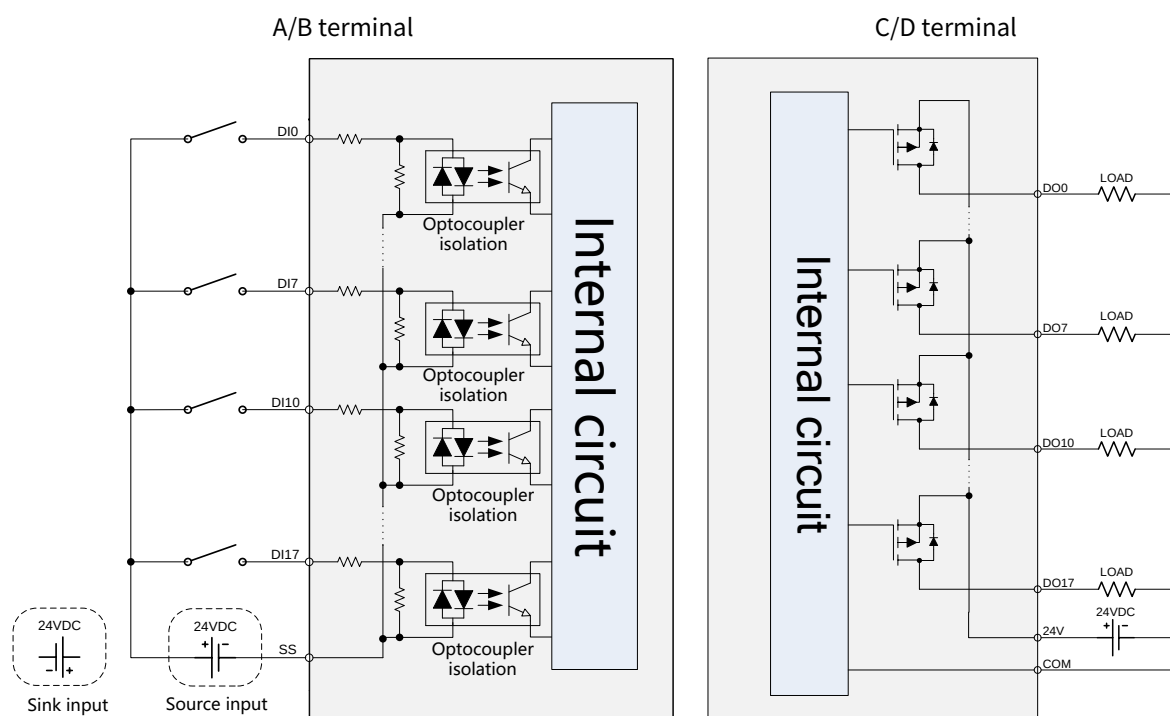
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| User terminal | External wiring I/O terminal                                                      |                                               |                                                                                   |                                      |
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |

### 3.9.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DI0         | A0            | B0             | DI10         |
|                                                                                    | DI1         | A1            | B1             | DI11         |
|                                                                                    | DI2         | A2            | B2             | DI12         |
|                                                                                    | DI3         | A3            | B3             | DI13         |
|                                                                                    | DI4         | A4            | B4             | DI14         |
|                                                                                    | DI5         | A5            | B5             | DI15         |
|                                                                                    | DI6         | A6            | B6             | DI16         |
|                                                                                    | DI7         | A7            | B7             | DI17         |
|                                                                                    | SS          | A8            | B8             | SS           |
|                                                                                    | DO0         | C0            | D0             | DO10         |
|                                                                                    | DO1         | C1            | D1             | DO11         |
|                                                                                    | DO2         | C2            | D2             | DO12         |
|                                                                                    | DO3         | C3            | D3             | DO13         |
|                                                                                    | DO4         | C4            | D4             | DO14         |
|                                                                                    | DO5         | C5            | D5             | DO15         |
|                                                                                    | DO6         | C6            | D6             | DO16         |
|                                                                                    | DO7         | C7            | D7             | DO17         |
|                                                                                    | 24VDC       | C8            | D8             | COM          |

## ■ Terminal wiring



### 3.9.1.4 Power supply specifications

| Item                                | Specification                 |
|-------------------------------------|-------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)        |
| Fieldbus input power rated current  | 150mA (Typical value at 5VDC) |
| Terminal input power rated voltage  | None                          |
| Terminal input power rated current  | None                          |
| Terminal output power rated voltage | None                          |
| Terminal output power rated current | None                          |
| Hot swapping of module              | Not supported                 |

### 3.9.1.5 Input/output specifications

#### ■ Input specifications

| Item                    | Specification                     |
|-------------------------|-----------------------------------|
| Input type              | Digital input                     |
| Input mode              | Source/Sink                       |
| Input channels          | 16                                |
| Input voltage class     | 24VDC $\pm$ 10% (21.6VDC–26.4VDC) |
| Input current (Typical) | 7mA (Typical value at 24VDC)      |
| ON voltage              | >15V                              |

| Item                          | Specification                                                                                                                                                                            |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OFF voltage                   | <5V                                                                                                                                                                                      |
| Hardware response time ON/OFF | 100μs/100μs                                                                                                                                                                              |
| Software filter time          | Supported                                                                                                                                                                                |
| Input resistance              | Reference value is about 3.4kΩ.                                                                                                                                                          |
| Isolation                     | Optocoupler                                                                                                                                                                              |
| Input action display          | When the input is in driving state, the input indicator is on.                                                                                                                           |
| Input derating                | When each terminal is operating at 55°C, it is derated to 75% (with no more than 12 input points of ON at the same time), or the temperature drops by 10°C when all input points are ON. |

### ■ Output specifications

| Item                          | Specification                                                                  |
|-------------------------------|--------------------------------------------------------------------------------|
| Output type                   | Digital output, high-edge output                                               |
| Output mode                   | Source type                                                                    |
| Output channel                | 16                                                                             |
| Output voltage class          | 24VDC±10% (21.6VDC–26.4VDC)                                                    |
| Output load (Resistance load) | 0.5A/point, 2A/module                                                          |
| Output load (Inductance load) | 7.2W/point, 12W/module                                                         |
| Output load (Light load)      | 5W/point, 18W/module                                                           |
| Hardware response time ON/OFF | 100μs/100μs                                                                    |
| Leakage current at OFF        | 10μA                                                                           |
| Switch frequency              | 100Hz for resistance load, 0.5Hz for inductance load, and 100ms for light load |
| Isolation                     | Yes                                                                            |
| Output action display         | When the output is in driving state, the output indicator is on.               |
| Input derating                | None                                                                           |
| Protection function           | Short-circuit protection and overcurrent protection                            |

### 3.9.1.6 Software specifications

| Item                                          | Specification                                                                                                                                                              |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Software input filter time                    | Setting range: 1–65535 (default: 1000); unit: 10μs; 1000 indicates 10ms. Able to set two groups of filter parameter. Every eight channels use a group of filter parameter. |
| Input port exception detection and indication | None                                                                                                                                                                       |
| Input channel logic level configuration       | Not supported                                                                                                                                                              |
| Configuration of independent channel enabling | Not supported                                                                                                                                                              |

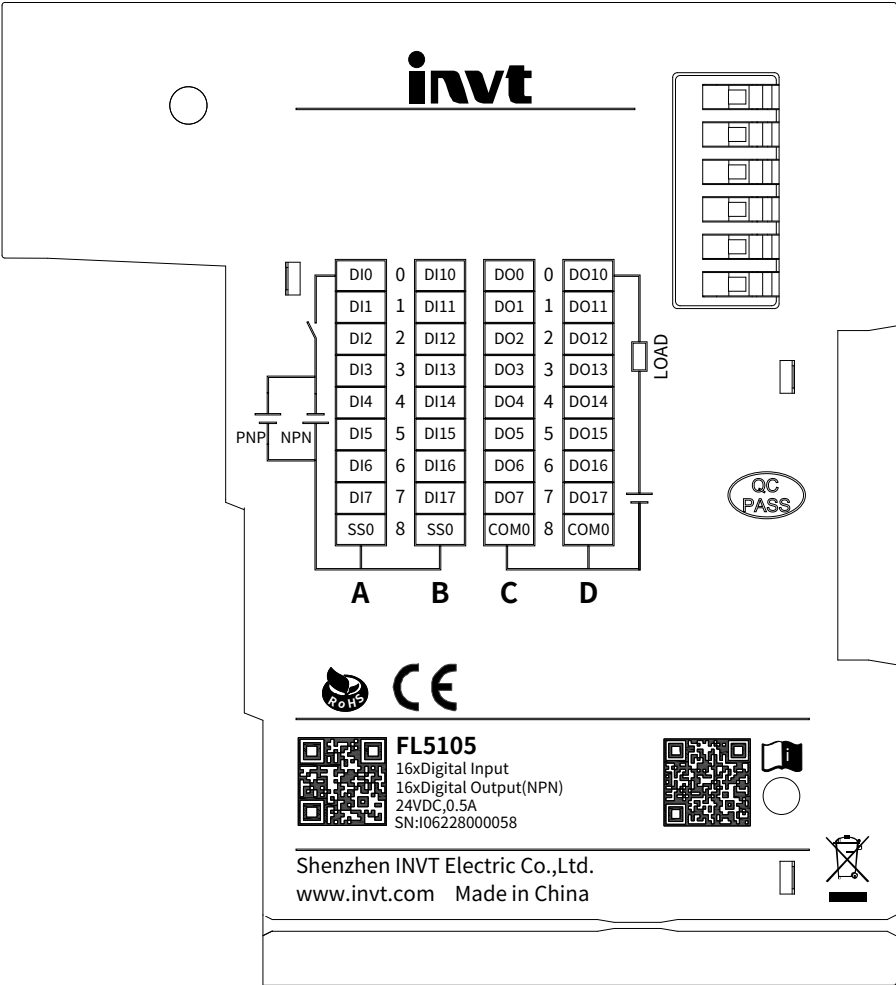
| Item                                 | Specification                                                                            |
|--------------------------------------|------------------------------------------------------------------------------------------|
| Configuration of diagnosis reporting | Diagnosis information will be uploaded by default.                                       |
| In stop mode                         | Output will not be refreshed, while input supports refreshing in Safe-operational state. |
| I/O mapping                          | Supporting the mapping method of bitwise access                                          |

### 3.9.1.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

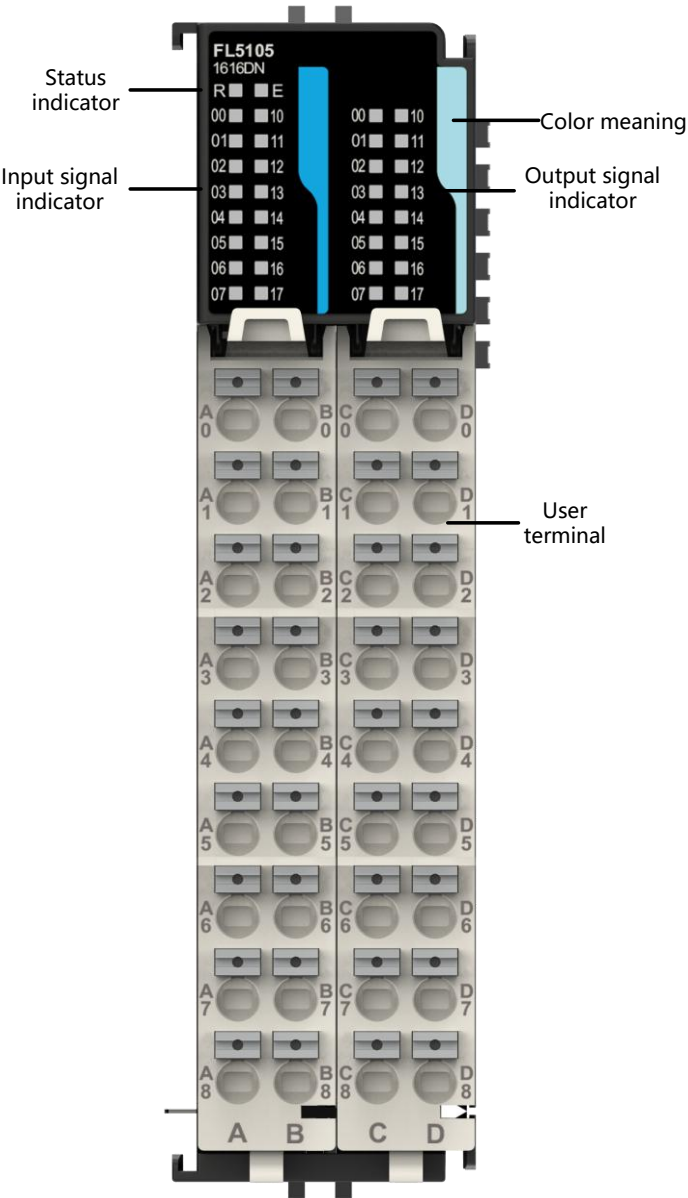
3.9.2 FL5105 (1616DN)

3.9.2.1 Basic information



| Model  | Ordering code | Description                                                                                         | Applicable model                     |
|--------|---------------|-----------------------------------------------------------------------------------------------------|--------------------------------------|
| FL5105 | 11016-00014   | Digital hybrid module, with 16 channels of input + 16 channels of output (NPN), 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.9.2.2 Component description

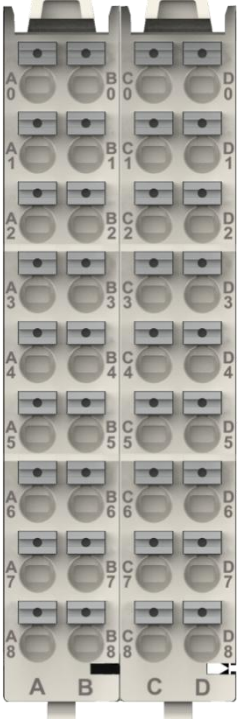


| Name                   | Description                  |                                                |                                                                                            |
|------------------------|------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------|
| Status indicator       | R: Yellow green              | Power-on/Run status indicator                  | On: The module is running.                                                                 |
|                        |                              |                                                | Slow blinking (500ms): The module is establishing communication.                           |
|                        | E: Red                       | Module fault indicator                         | Off: The module is not powered on or it is abnormal.                                       |
|                        |                              |                                                | Slow blinking (500ms): Channel overheat/overcurrent alarm or incorrect parameter settings. |
| Input signal indicator | 00–07: Green<br>10–17: Green | Each corresponds to a channel of input signal. | Fast blinking (100ms): The module is offline.                                              |
|                        |                              |                                                | Off: The module works normally.                                                            |
|                        |                              |                                                | On: The input is valid.                                                                    |
|                        |                              |                                                | Off: The input is invalid.                                                                 |

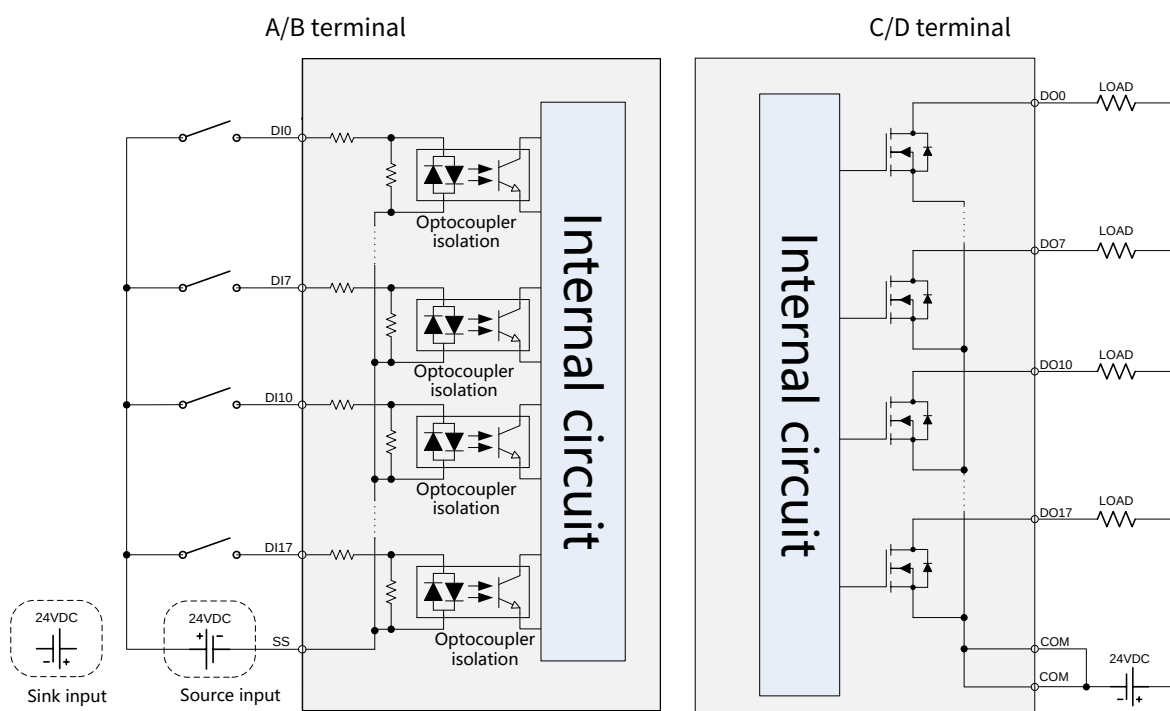
| Name                    | Description                                                                       |                                                 |                                                                                   |                                      |
|-------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| Output signal indicator | 00–07: Green                                                                      | Each corresponds to a channel of output signal. | On: Enable output.                                                                |                                      |
|                         | 10–17: Green                                                                      |                                                 | Off: Disable output.                                                              |                                      |
| User terminal           | External wiring I/O terminal                                                      |                                                 |                                                                                   |                                      |
| Color meaning           |  | Digital input                                   |  | Digital output (source, sink, relay) |
|                         |  | Analog input (voltage, current, thermocouple)   |  | Analog output                        |

### 3.9.2.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DI0         | A0            | B0             | DI10         |
|                                                                                    | DI1         | A1            | B1             | DI11         |
|                                                                                    | DI2         | A2            | B2             | DI12         |
|                                                                                    | DI3         | A3            | B3             | DI13         |
|                                                                                    | DI4         | A4            | B4             | DI14         |
|                                                                                    | DI5         | A5            | B5             | DI15         |
|                                                                                    | DI6         | A6            | B6             | DI16         |
|                                                                                    | DI7         | A7            | B7             | DI17         |
|                                                                                    | SS          | A8            | B8             | SS           |
|                                                                                    | DO0         | C0            | D0             | DO10         |
|                                                                                    | DO1         | C1            | D1             | DO11         |
|                                                                                    | DO2         | C2            | D2             | DO12         |
|                                                                                    | DO3         | C3            | D3             | DO13         |
|                                                                                    | DO4         | C4            | D4             | DO14         |
|                                                                                    | DO5         | C5            | D5             | DO15         |
|                                                                                    | DO6         | C6            | D6             | DO16         |
|                                                                                    | DO7         | C7            | D7             | DO17         |
|                                                                                    | COM         | C8            | D8             | COM          |

## ■ Terminal wiring



### 3.9.2.4 Power supply specifications

| Item                                | Specification                 |
|-------------------------------------|-------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)        |
| Fieldbus input power rated current  | 250mA (Typical value at 5VDC) |
| Terminal input power rated voltage  | None                          |
| Terminal input power rated current  | None                          |
| Terminal output power rated voltage | None                          |
| Terminal output power rated current | None                          |
| Hot swapping of module              | Not supported                 |

### 3.9.2.5 Input/output specifications

#### ■ Input specifications

| Item                    | Specification                |
|-------------------------|------------------------------|
| Input type              | Digital input                |
| Input mode              | Source/Sink                  |
| Input channels          | 16                           |
| Input voltage class     | 24VDC±10% (21.6VDC–26.4VDC)  |
| Input current (Typical) | 7mA (Typical value at 24VDC) |
| ON voltage              | >15V                         |



| Item                          | Specification                                                                                                                                                                            |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OFF voltage                   | <5V                                                                                                                                                                                      |
| Hardware response time ON/OFF | 100μs/100μs                                                                                                                                                                              |
| Software filter time          | Supported                                                                                                                                                                                |
| Input resistance              | Reference value is about 3.4kΩ.                                                                                                                                                          |
| Isolation                     | Optocoupler                                                                                                                                                                              |
| Input action display          | When the input is in driving state, the input indicator is on.                                                                                                                           |
| Input derating                | When each terminal is operating at 55°C, it is derated to 75% (with no more than 12 input points of ON at the same time), or the temperature drops by 10°C when all input points are ON. |

#### ■ Output specifications

| Item                          | Specification                                                                  |
|-------------------------------|--------------------------------------------------------------------------------|
| Output type                   | Digital output, low-edge output                                                |
| Output mode                   | Sink                                                                           |
| Output channel                | 16                                                                             |
| Output voltage class          | 24VDC±10% (21.6VDC–26.4VDC)                                                    |
| Output load (Resistance load) | 0.5A/point, 4A/module                                                          |
| Output load (Inductance load) | 7.2W/point, 24W/module                                                         |
| Output load (Light load)      | 5W/point, 18W/module                                                           |
| Hardware response time ON/OFF | 100μs/100μs                                                                    |
| Leakage current at OFF        | 10μA                                                                           |
| Switch frequency              | 100Hz for resistance load, 0.5Hz for inductance load, and 100ms for light load |
| Isolation                     | Yes                                                                            |
| Output action display         | When the output is in driving state, the output indicator is on.               |
| Input derating                | None                                                                           |

#### 3.9.2.6 Software specifications

| Item                                          | Specification                                                                                                                                                              |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Software input filter time                    | Setting range: 1–65535 (default: 1000); unit: 10μs; 1000 indicates 10ms. Able to set two groups of filter parameter. Every eight channels use a group of filter parameter. |
| Input port exception detection and indication | None                                                                                                                                                                       |
| Input channel logic level configuration       | Not supported                                                                                                                                                              |
| Configuration of independent channel enabling | Not supported                                                                                                                                                              |
| Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                                                                                                         |

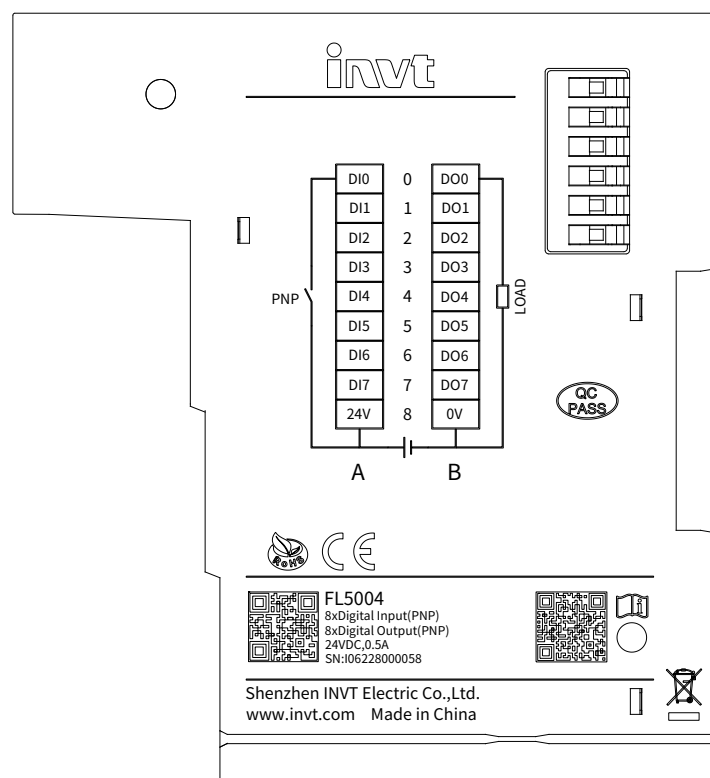
| Item         | Specification                                                                            |
|--------------|------------------------------------------------------------------------------------------|
| In stop mode | Output will not be refreshed, while input supports refreshing in Safe-operational state. |
| I/O mapping  | Supporting the mapping method of bitwise access                                          |

### 3.9.2.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

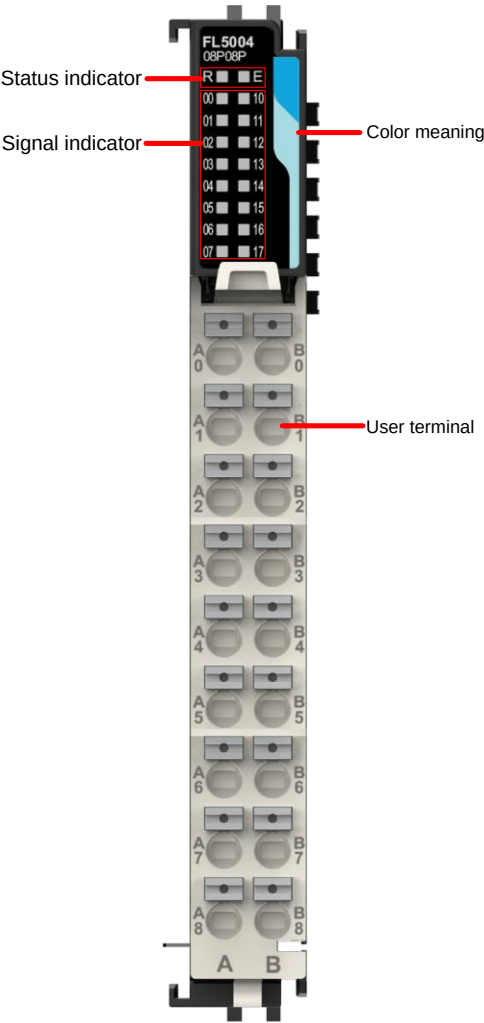
## 3.9.3 FL5004 (08P08P)

### 3.9.3.1 Basic information



| Model  | Ordering code | Description                                                                                       | Applicable model                     |
|--------|---------------|---------------------------------------------------------------------------------------------------|--------------------------------------|
| FL5004 | 11016-00045   | Digital hybrid module, with 8 channels of input + 8 channels of output (PNP), 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.9.3.2 Component description

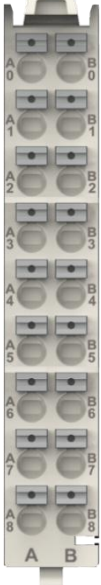


| Name                   | Description     |                                                |                                                                                       |
|------------------------|-----------------|------------------------------------------------|---------------------------------------------------------------------------------------|
| Status indicator       | R: Yellow green | Power-on/Run status indicator                  | On: The module is running.                                                            |
|                        |                 |                                                | Slow blinking (500ms): The module is establishing communication.                      |
|                        |                 |                                                | Off: The module is not powered on or it is abnormal.                                  |
|                        | E: Red          | Module fault indicator                         | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |
|                        |                 |                                                | Fast blinking (100ms): The module is offline.                                         |
| Input signal indicator | 00–07: Green    | Each corresponds to a channel of input signal. | Off: The module works normally.                                                       |
|                        |                 |                                                | On: The input is valid.                                                               |
|                        |                 |                                                | Off: The input is invalid.                                                            |

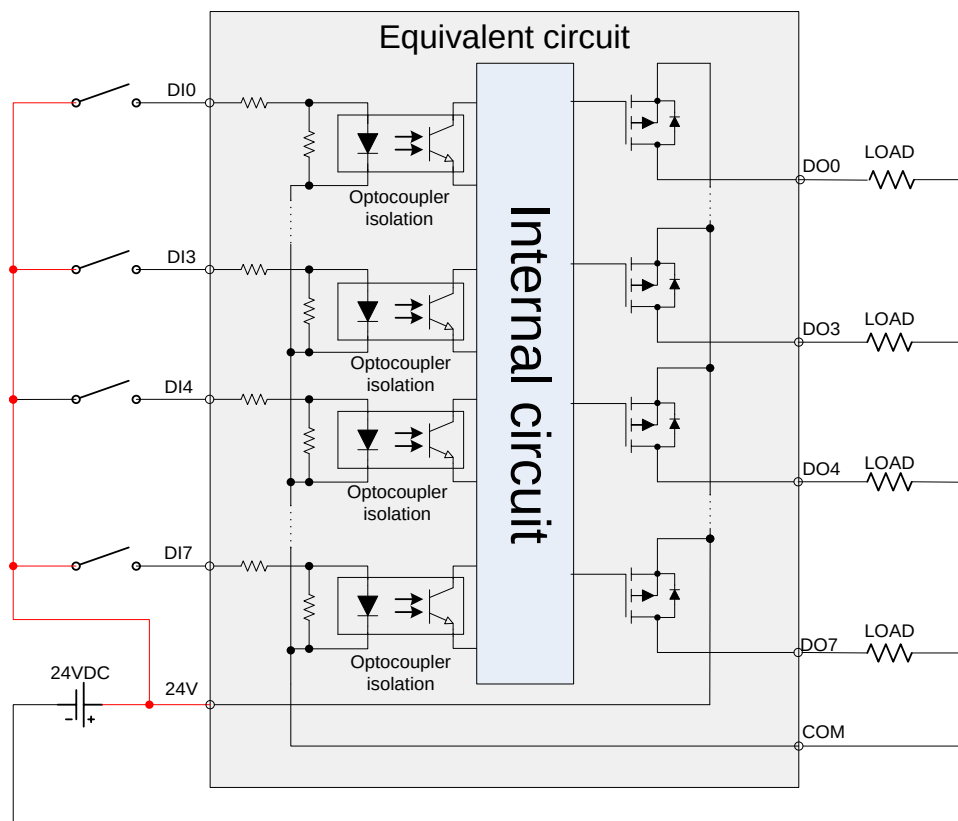
| Name                    | Description                                                                       |                                                 |                                                                                   |                                      |
|-------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| Output signal indicator | 10–17: Green                                                                      | Each corresponds to a channel of output signal. | On: Enable output.                                                                |                                      |
|                         |                                                                                   |                                                 | Off: Disable output.                                                              |                                      |
| User terminal           | External wiring I/O terminal                                                      |                                                 |                                                                                   |                                      |
| Color meaning           |  | Digital input                                   |  | Digital output (source, sink, relay) |
|                         |  | Analog input (voltage, current, thermocouple)   |  | Analog output                        |

### 3.9.3.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DI0         | <b>A0</b>     | <b>B0</b>      | DO0          |
|                                                                                    | DI1         | <b>A1</b>     | <b>B1</b>      | DO1          |
|                                                                                    | DI2         | <b>A2</b>     | <b>B2</b>      | DO2          |
|                                                                                    | DI3         | <b>A3</b>     | <b>B3</b>      | DO3          |
|                                                                                    | DI4         | <b>A4</b>     | <b>B4</b>      | DO4          |
|                                                                                    | DI5         | <b>A5</b>     | <b>B5</b>      | DO5          |
|                                                                                    | DI6         | <b>A6</b>     | <b>B6</b>      | DO6          |
|                                                                                    | DI7         | <b>A7</b>     | <b>B7</b>      | DO7          |
|                                                                                    | 24VDC       | <b>A8</b>     | <b>B8</b>      | COM          |

### ■ Terminal wiring



### 3.9.3.4 Power supply specifications

| Item                                | Specification                 |
|-------------------------------------|-------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)        |
| Fieldbus input power rated current  | 150mA (Typical value at 5VDC) |
| Terminal input power rated voltage  | 24VDC (20.4VDC–28.8VDC)       |
| Terminal input power rated current  | 2A (Typical value at 24VDC)   |
| Terminal output power rated voltage | None                          |
| Terminal output power rated current | None                          |
| Hot swapping of module              | Not supported                 |

### 3.9.3.5 Input/output specifications

#### ■ Input specifications

| Item           | Specification |
|----------------|---------------|
| Input type     | Digital input |
| Input mode     | Source        |
| Input channels | 8             |

| Item                             | Specification                                                                                                                                                                           |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input voltage class              | 24VDC $\pm$ 10% (21.6VDC–26.4VDC)                                                                                                                                                       |
| Input current (Typical)          | 4.6mA (Typical value at 24VDC)                                                                                                                                                          |
| ON voltage                       | >15V                                                                                                                                                                                    |
| OFF voltage                      | <5V                                                                                                                                                                                     |
| Hardware response time<br>ON/OFF | 300 $\mu$ s/300 $\mu$ s                                                                                                                                                                 |
| Software filter time             | Supported                                                                                                                                                                               |
| Input resistance                 | Reference value is about 5.2k $\Omega$ .                                                                                                                                                |
| Isolation                        | Yes                                                                                                                                                                                     |
| Input action display             | When the input is in driving state, the input indicator is on.                                                                                                                          |
| Input derating                   | When each terminal is operating at 55°C, it is derated to 50% (with no more than 4 input points of ON at the same time), or the temperature drops by 10°C when all input points are ON. |

#### ■ Output specifications

| Item                             | Specification                                                                  |
|----------------------------------|--------------------------------------------------------------------------------|
| Output type                      | Digital output, high-edge output                                               |
| Output mode                      | Source                                                                         |
| Output channel                   | 8                                                                              |
| Output voltage class             | 24VDC $\pm$ 10% (21.6VDC–26.4VDC)                                              |
| Output load<br>(Resistance load) | 0.5A/point, 2A/module                                                          |
| Output load<br>(Inductance load) | 7.2W/point, 12W/module                                                         |
| Output load (Light load)         | 5W/point, 9W/module                                                            |
| Hardware response time<br>ON/OFF | 100 $\mu$ s/100 $\mu$ s                                                        |
| Leakage current at OFF           | 10 $\mu$ A                                                                     |
| Switch frequency                 | 100Hz for resistance load, 0.5Hz for inductance load, and 100ms for light load |
| Isolation                        | Yes                                                                            |
| Output action display            | When the output is in driving state, the output indicator is on.               |
| Protection function              | Short-circuit protection and overcurrent protection                            |

#### 3.9.3.6 Software specifications

| Item  |                                               | Specification                                                                                                              |
|-------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Input | Software input filter time                    | Supporting software input filter setting<br>Setting range: 1–65535 (default: 1000); unit: 10 $\mu$ s; 1000 indicates 10ms. |
|       | Input port exception detection and indication | None                                                                                                                       |
|       | Input channel logic level configuration       | Not supported                                                                                                              |
|       | Configuration of independent channel enabling | Not supported                                                                                                              |
|       | Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                                                         |

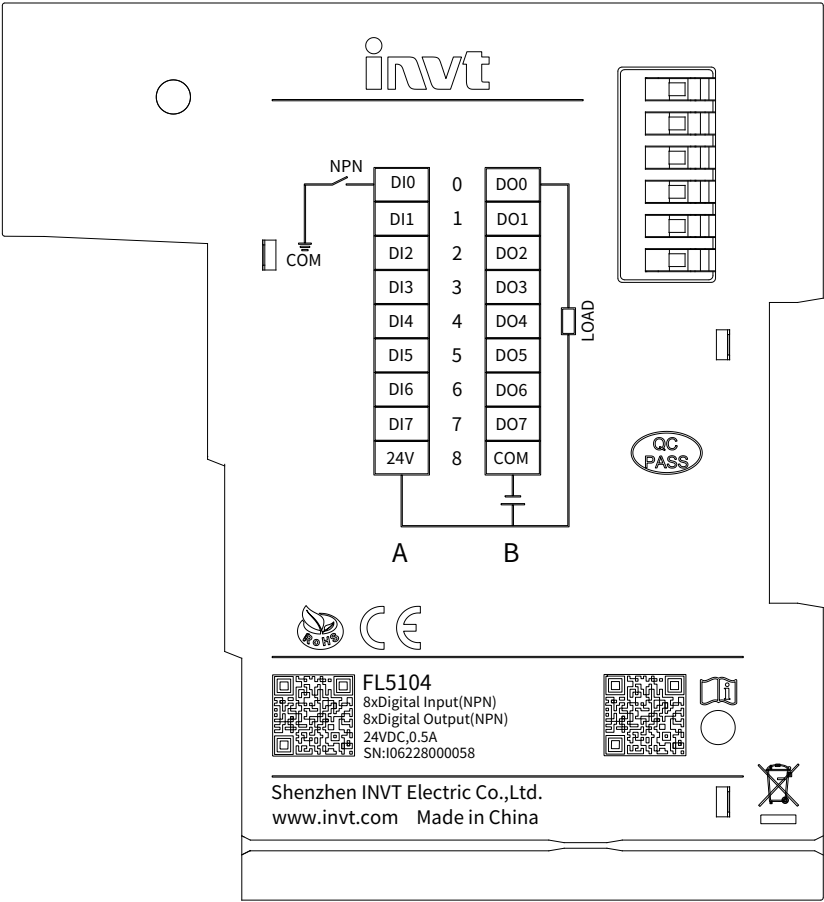
| Item   |                                               | Specification                                                                                         |
|--------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------|
|        | In stop mode                                  | Output will not be refreshed, while input supports refreshing in Safe-operational state.              |
|        | I/O mapping                                   | Supporting the mapping method of bitwise and bitwise access                                           |
| Output | Stop/offline output mode                      | Keeping output, clearing output, or outputting the preset value, which is configured on a point basis |
|        | Preset value of stop/offline output           | Single-point 0 or 1                                                                                   |
|        | Output channel exception detection indication | Overheat/overcurrent detection and protection on a module basis                                       |
|        | Output channel logic level configuration      | Not supported                                                                                         |
|        | Configuration of independent channel enabling | Not supported                                                                                         |
|        | Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                                    |
|        | In stop mode                                  | Output according to the stop/offline output mode and preset value, without refreshing any more        |
|        | I/O mapping                                   | Supporting the mapping method of bitwise and bitwise access.                                          |

### 3.9.3.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.9.4 FL5104 (08N08N)

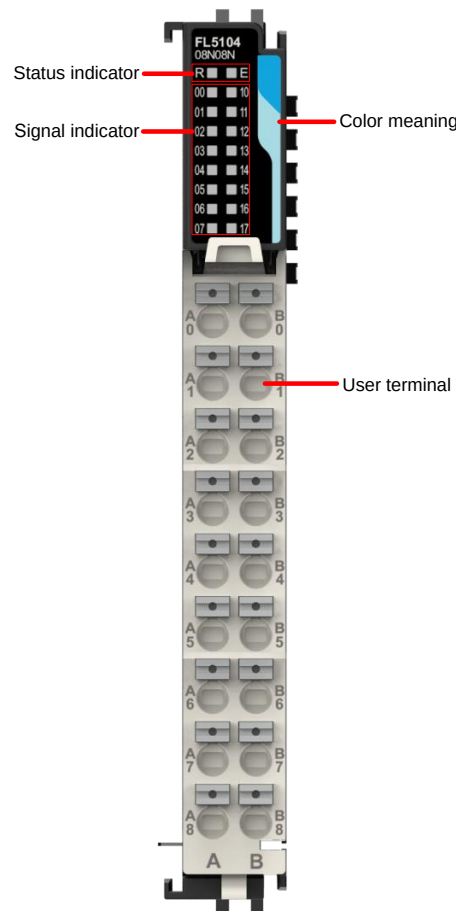
3.9.4.1 Basic information



| Model  | Ordering code | Description                                                                                       | Applicable model                     |
|--------|---------------|---------------------------------------------------------------------------------------------------|--------------------------------------|
| FL5104 | 11016-00044   | Digital hybrid module, with 8 channels of input + 8 channels of output (NPN), 500mA @ 24VDC; RoHS | Applicable to INVT Flex/TS/TM series |



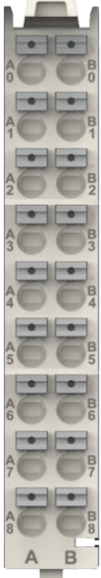
3.9.4.2 Component description



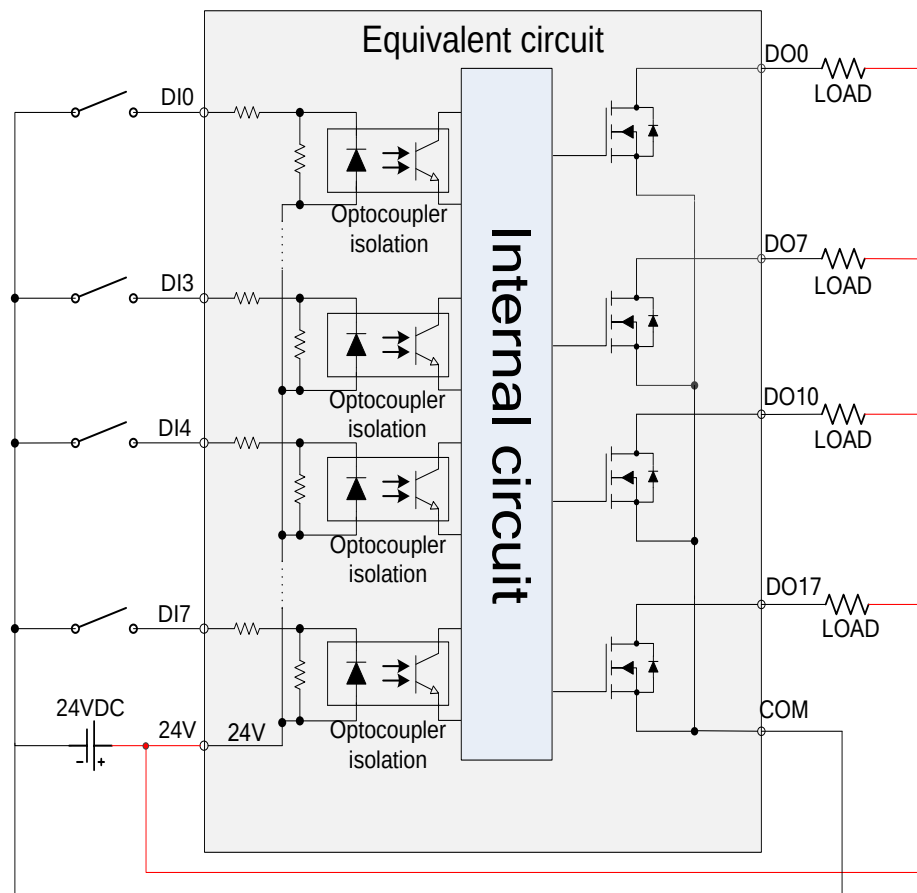
| Name                    | Description                                                                         |                                                 |                                                                                       |                                      |
|-------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------|
| Status indicator        | R: Yellow green                                                                     | Power-on/Run status indicator                   | On: The module is running.                                                            |                                      |
|                         |                                                                                     |                                                 | Slow blinking (500ms): The module is establishing communication.                      |                                      |
|                         |                                                                                     |                                                 | Off: The module is not powered on or it is abnormal.                                  |                                      |
|                         | E: Red                                                                              | Module fault indicator                          | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |                                      |
|                         |                                                                                     |                                                 | Fast blinking (100ms): The module is offline.                                         |                                      |
|                         |                                                                                     |                                                 | Off: The module works normally.                                                       |                                      |
| Input signal indicator  | 00–07: Green                                                                        | Each corresponds to a channel of input signal.  | On: The input is valid.                                                               |                                      |
|                         |                                                                                     |                                                 | Off: The input is invalid.                                                            |                                      |
| Output signal indicator | 10–17: Green                                                                        | Each corresponds to a channel of output signal. | On: Enable output.                                                                    |                                      |
|                         |                                                                                     |                                                 | Off: Disable output.                                                                  |                                      |
| User terminal           | External wiring I/O terminal                                                        |                                                 |                                                                                       |                                      |
| Color meaning           |  | Digital input                                   |    | Digital output (source, sink, relay) |
|                         |  | Analog input (voltage, current, thermocouple)   |    | Analog output                        |

### 3.9.4.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                 | Left signal | Left terminal | Right terminal | Right signal |
|-----------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DI0         | A0            | B0             | DO0          |
|                                                                                   | DI1         | A1            | B1             | DO1          |
|                                                                                   | DI2         | A2            | B2             | DO2          |
|                                                                                   | DI3         | A3            | B3             | DO3          |
|                                                                                   | DI4         | A4            | B4             | DO4          |
|                                                                                   | DI5         | A5            | B5             | DO5          |
|                                                                                   | DI6         | A6            | B6             | DO6          |
|                                                                                   | DI7         | A7            | B7             | DO7          |
|                                                                                   | 24VDC       | A8            | B8             | COM          |

#### ■ Terminal wiring



### 3.9.4.4 Power supply specifications

| Item                                | Specification                  |
|-------------------------------------|--------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)         |
| Fieldbus input power rated current  | 150mA (Typical value at 5VDC)  |
| Terminal input power rated voltage  | 24VDC (20.4VDC–28.8VDC)        |
| Terminal input power rated current  | 100mA (Typical value at 24VDC) |
| Terminal output power rated voltage | None                           |
| Terminal output power rated current | None                           |
| Hot swapping of module              | Not supported                  |

### 3.9.4.5 Input/output specifications

#### ■ Input specifications

| Item                             | Specification                                                                                                                                                                           |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input type                       | Digital input                                                                                                                                                                           |
| Input mode                       | Sink                                                                                                                                                                                    |
| Input channels                   | 8                                                                                                                                                                                       |
| Input voltage class              | 24VDC $\pm$ 10% (21.6VDC–26.4VDC)                                                                                                                                                       |
| Input current (Typical)          | 4.6mA (Typical value at 24VDC)                                                                                                                                                          |
| ON voltage                       | >15V                                                                                                                                                                                    |
| OFF voltage                      | <5V                                                                                                                                                                                     |
| Hardware response time<br>ON/OFF | 300 $\mu$ s/300 $\mu$ s                                                                                                                                                                 |
| Software filter time             | Supported                                                                                                                                                                               |
| Input resistance                 | Reference value is about 5.2k $\Omega$                                                                                                                                                  |
| Isolation                        | Yes                                                                                                                                                                                     |
| Input action display             | When the input is in driving state, the input indicator is on.                                                                                                                          |
| Input derating                   | When each terminal is operating at 55°C, it is derated to 50% (with no more than 4 input points of ON at the same time), or the temperature drops by 10°C when all input points are ON. |

#### ■ Output specifications

| Item                             | Specification                     |
|----------------------------------|-----------------------------------|
| Output type                      | Digital output, low-edge output   |
| Output mode                      | Sink                              |
| Output channel                   | 8                                 |
| Output voltage class             | 24VDC $\pm$ 10% (21.6VDC–26.4VDC) |
| Output load<br>(Resistance load) | 0.5A/point, 2A/module             |
| Output load<br>(Inductance load) | 7.2W/point, 12W/module            |

| Item                             | Specification                                                                                                                                                                                   |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output load (Light load)         | 5W/point, 9W/module                                                                                                                                                                             |
| Hardware response time<br>ON/OFF | 100μs/100us                                                                                                                                                                                     |
| Leakage current at OFF           | 10μA                                                                                                                                                                                            |
| Switch frequency                 | 100Hz for resistance load, 0.5Hz for inductance load, and 100ms for light load                                                                                                                  |
| Isolation                        | Yes                                                                                                                                                                                             |
| Output action display            | When the output is in driving state, the output indicator is on.                                                                                                                                |
| Output derating                  | When each terminal is operating at 55°C, it is derated to 50% (the output current at ON should not exceed 1A at the same time), or the temperature drops by 10°C when all output points are ON. |
| Protection function              | Short-circuit protection and overcurrent protection                                                                                                                                             |

### 3.9.4.6 Software specifications

| Item   |                                               | Specification                                                                                                  |
|--------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Input  | Software input filter time                    | Supporting software filter setting<br>Setting range: 1–65535 (default: 1000); unit: 10μs; 1000 indicates 10ms. |
|        | Input port exception detection and indication | None                                                                                                           |
|        | Input channel logic level configuration       | Not supported                                                                                                  |
|        | Configuration of independent channel enabling | Not supported                                                                                                  |
|        | Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                                             |
|        | In stop mode                                  | Output will not be refreshed, while input supports refreshing in Safe-operational state.                       |
|        | I/O mapping                                   | Supporting the mapping method of bitwise and bitwise access                                                    |
| Output | Stop/offline output mode                      | Keeping output, clearing output, or outputting the preset value, which is configured on a point basis          |
|        | Preset value of stop/offline output           | Single-point 0 or 1                                                                                            |
|        | Output channel exception detection indication | Overheat/overcurrent detection and protection on a module basis                                                |
|        | Output channel logic level configuration      | Not supported                                                                                                  |
|        | Configuration of independent channel enabling | Not supported                                                                                                  |
|        | Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                                             |
|        | In stop mode                                  | Output according to the stop/offline output mode and preset value, without refreshing any more                 |
|        | I/O mapping                                   | Supporting the mapping method of bitwise and bitwise access                                                    |

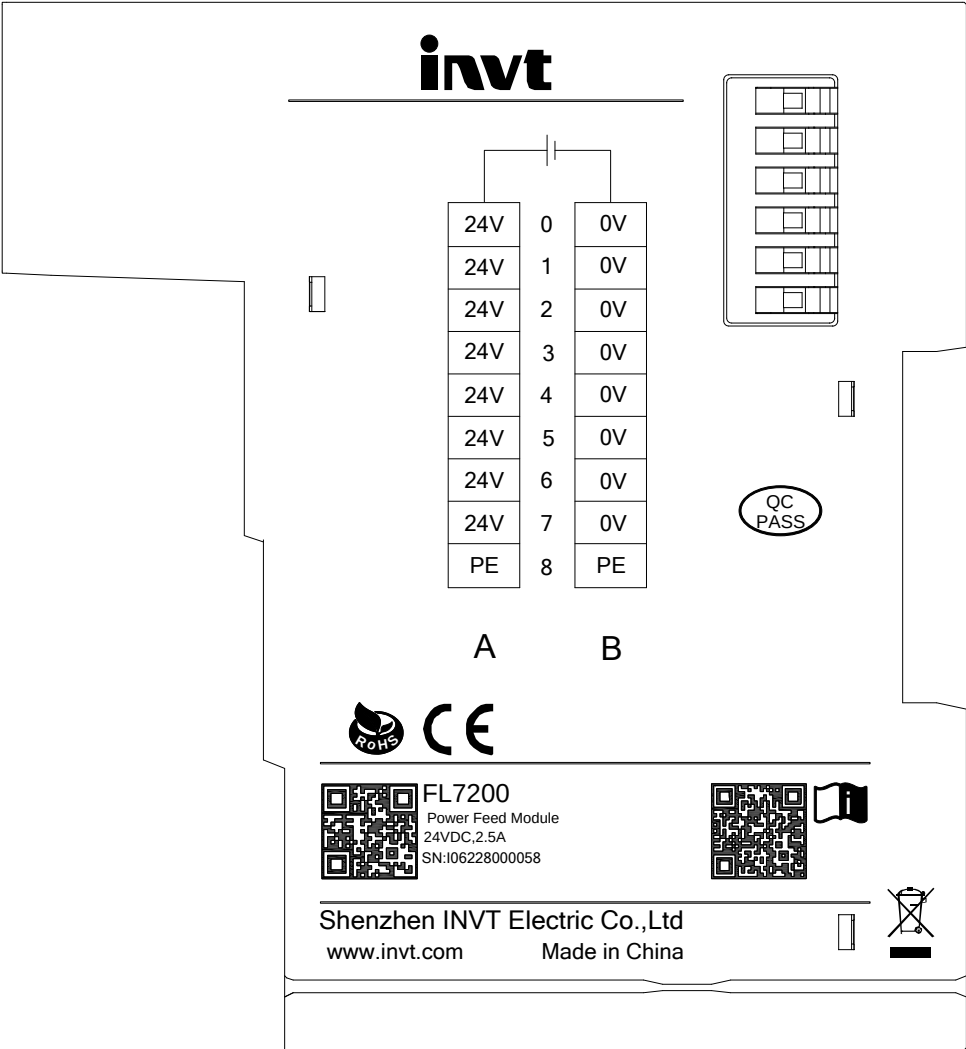
**3.9.4.7 Environment requirements**

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

3.10 Power feed module (FL7200)

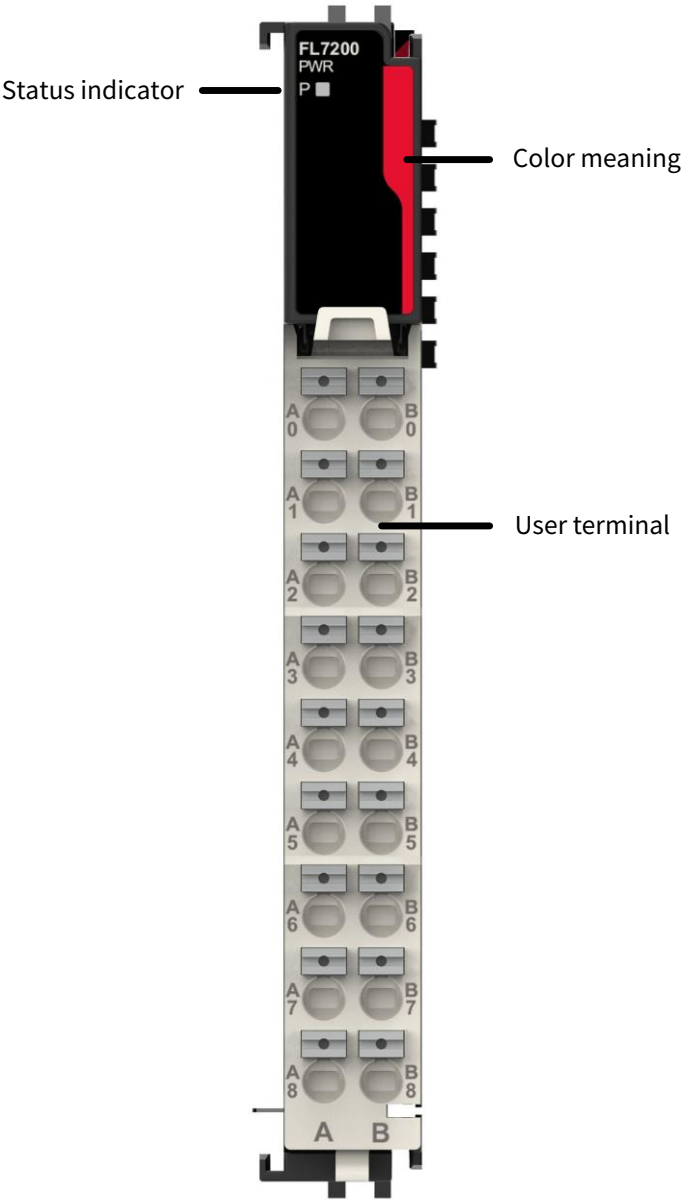
3.10.1 FL7200 (PWR)

3.10.1.1 Basic information



| Model  | Ordering code | Description                                            | Applicable model                     |
|--------|---------------|--------------------------------------------------------|--------------------------------------|
| FL7200 | 11016-00028   | Power feed module, input 24VDC, output 5VDC 2.5A; RoHS | Applicable to INVT Flex/TS/TM series |

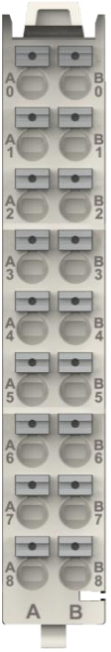
3.10.1.2 Component description



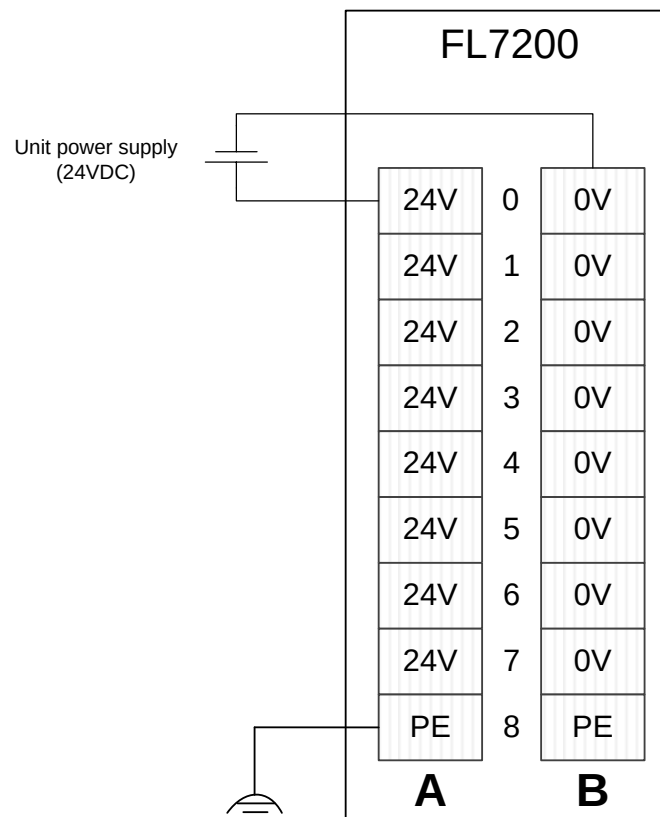
| Name             |                                                                                     | Description                                   |                                                                                     |                                      |  |
|------------------|-------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|--|
| Status indicator |                                                                                     | R: Yellow green                               |                                                                                     |                                      |  |
| User terminal    |                                                                                     | External wiring I/O terminal                  |                                                                                     |                                      |  |
| Color meaning    |  | Digital input                                 |  | Digital output (source, sink, relay) |  |
|                  |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |  |
|                  |  | Power feed                                    |  | Counting and measuring               |  |

### 3.10.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                 | Left signal | Left terminal | Right terminal | Right signal |
|-----------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | 24V         | A0            | B0             | 0V           |
|                                                                                   | 24V         | A1            | B1             | 0V           |
|                                                                                   | 24V         | A2            | B2             | 0V           |
|                                                                                   | 24V         | A3            | B3             | 0V           |
|                                                                                   | 24V         | A4            | B4             | 0V           |
|                                                                                   | 24V         | A5            | B5             | 0V           |
|                                                                                   | 24V         | A6            | B6             | 0V           |
|                                                                                   | 24V         | A7            | B7             | 0V           |
|                                                                                   | PE          | A8            | B8             | PE           |

#### ■ Terminal wiring



\*Terminals with the same designation are internally connected and the maximum terminal current capacity is 4A.



**3.10.1.4 Power supply specifications**

| Item                         | Specification                                  |
|------------------------------|------------------------------------------------|
| External input rated voltage | 24VDC (-15%~+20%)                              |
| External input rated current | 0.8A                                           |
| Output rated voltage         | 5VDC(4.5~5.5VDC)                               |
| Output rated current         | 2.5A (Typical value at room-temperature 25°C)  |
| Output protection            | Short circuit protection and hiccup protection |

**3.10.1.5 Software specifications**

| Item                  | Specification |
|-----------------------|---------------|
| Module addressing     | Not supported |
| Module status reading | Not supported |

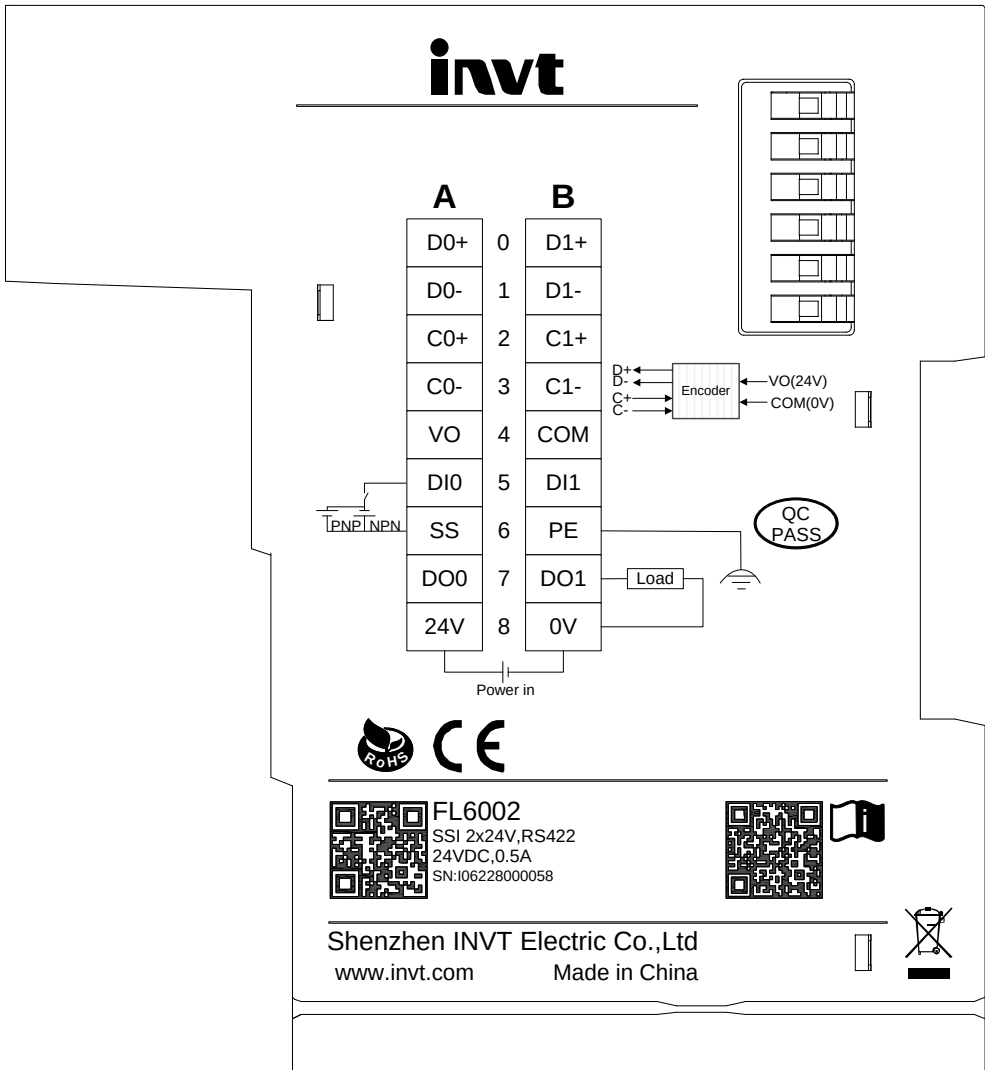
**3.10.1.6 Environment requirements**

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

### 3.11 Counting and measuring module (FL6xxx)

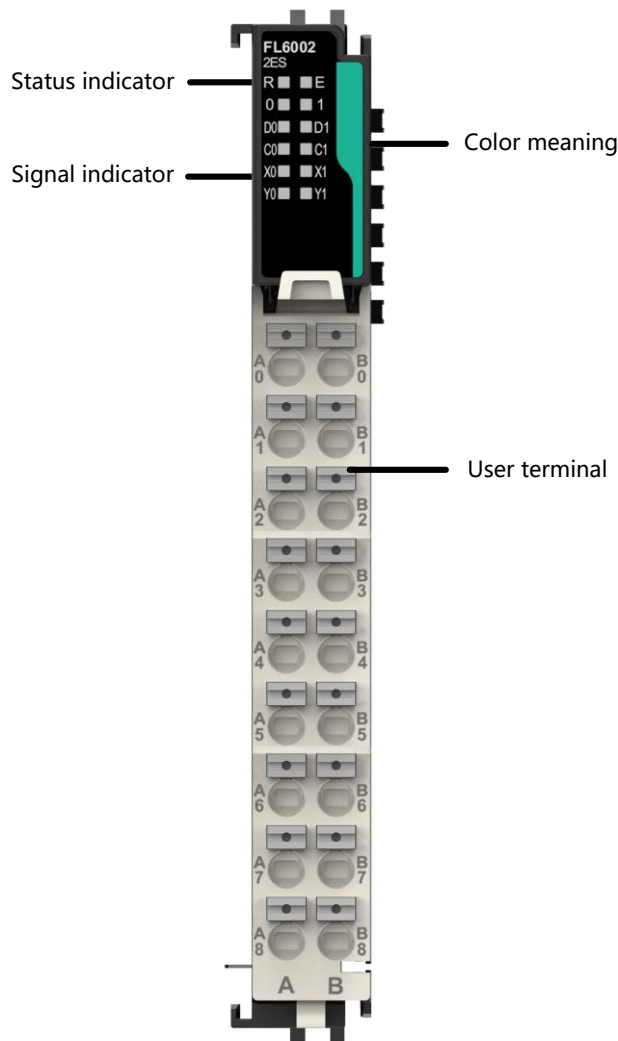
#### 3.11.1 FL6002 (2ES)

##### 3.11.1.1 Basic information



| Model  | Ordering code | Description                                               | Applicable model                     |
|--------|---------------|-----------------------------------------------------------|--------------------------------------|
| FL6002 | 11016-00022   | SSI absolute encoder input, 2 channels, 24VDC, 2MHz; RoHS | Applicable to INVT Flex/TS/TM series |

3.11.1.2 Component description

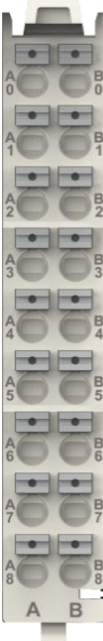


| Name             |                              | Description                             |                                                                                       |
|------------------|------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------|
| Status indicator | R: Yellow green              | Power-on/Run status indicator           | On: The module is running.                                                            |
|                  |                              |                                         | Slow blinking (500ms): The module is establishing communication.                      |
|                  |                              |                                         | Off: The module is not powered on or it is abnormal.                                  |
|                  | E: Red                       | Module fault indicator                  | Fast blinking (100ms): The module is offline.                                         |
|                  |                              |                                         | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |
|                  |                              |                                         | Off: The module works normally.                                                       |
| Signal indicator | D0/C0: Green<br>D1/C1: Green | SSI encoder signal detection Indicator. | On: The differential voltage level difference of data/clock remains positive.         |
|                  |                              |                                         | Off: The differential voltage level difference of data/clock remains negative.        |
|                  | X0/X1: Green                 | Digital input signal indicator          | On: The input signal is valid.                                                        |
|                  |                              |                                         | Off: The input signal is invalid.                                                     |
|                  | Y0/Y1: Green                 | Digital output signal indicator         | On: Enable output.                                                                    |
|                  |                              |                                         | Off: Disable output.                                                                  |

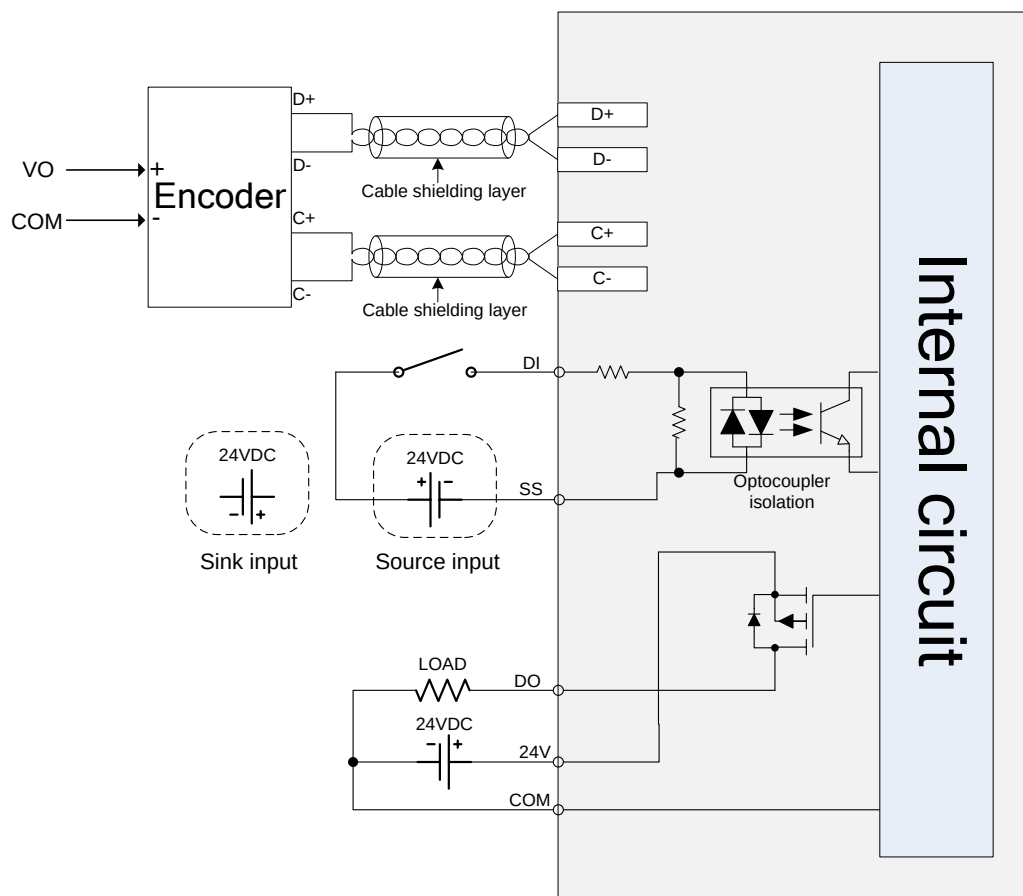
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
| User terminal | External wiring I/O terminal                                                      |                                               |                                                                                   |                                      |
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |
|               |  | Power feed                                    |  | Counting and measuring               |

### 3.11.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | D0+         | A0            | B0             | D1+          |
|                                                                                    | D0-         | A1            | B1             | D1-          |
|                                                                                    | C0+         | A2            | B2             | C1+          |
|                                                                                    | C0-         | A3            | B3             | C1-          |
|                                                                                    | VO          | A4            | B4             | COM          |
|                                                                                    | DI0         | A5            | B5             | DI1          |
|                                                                                    | SS          | A6            | B6             | PE           |
|                                                                                    | DO0         | A7            | B7             | DO1          |
|                                                                                    | 24V         | A8            | B8             | 0V           |

### ■ Terminal wiring



#### 3.11.1.4 Power supply specifications

| Item                                | Specification               |
|-------------------------------------|-----------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)      |
| Fieldbus input power rated current  | 140mA                       |
| Terminal input power rated voltage  | 24VDC (20.4VDC–28.8VDC)     |
| Terminal input power rated current  | 2A (Typical value at 24VDC) |
| Terminal output power rated voltage | None                        |
| Terminal output power rated current | None                        |
| Hot swapping of module              | Not supported               |

#### 3.11.1.5 Input specifications

| Item            | Specification                                        |
|-----------------|------------------------------------------------------|
| Encoder type    | SSI absolute encoder                                 |
| Input mode      | RS422 electrical level standards, differential input |
| Input channel   | 2                                                    |
| Encoder voltage | 24VDC±15%                                            |

| Item                                    | Specification                                   |
|-----------------------------------------|-------------------------------------------------|
| SSI frame length                        | 10–40 (Default: 13)                             |
| SSI clock frequency (Hz)                | 125k, 250k, 500k, 1M, 1.5M, 2M                  |
| Signal type                             | Binary/Gray (default)                           |
| Number of DI channels                   | 2                                               |
| DI detection electrical level           | 24VDC                                           |
| DI type                                 | PNP (source)/NPN (sink)                         |
| DI edge selection                       | Rising edge/Falling edge/Rising or falling edge |
| DI filter time setting                  | (0–65535)*0.1μs                                 |
| DI function                             | Latch, preset, and clear                        |
| Number of DO channels                   | 2                                               |
| DO level                                | 24VDC                                           |
| DO type                                 | PNP (source), rated output current 0.16A        |
| DO function                             | Comparison output                               |
| ON voltage                              | >15V                                            |
| OFF voltage                             | <5V                                             |
| Hardware response time ON/OFF           | 100μs/100μs                                     |
| Input resistance                        | Reference value about 3.4kΩ                     |
| Isolation                               | Optocoupler                                     |
| Measurement variable                    | Frequency/Speed                                 |
| Update time of the measurement function | 20ms/100ms/500ms/1000ms                         |
| Gating function                         | Software gate                                   |

### 3.11.1.6 Software specifications

| Item                                 | Specification                                                                            |
|--------------------------------------|------------------------------------------------------------------------------------------|
| Software input filter time           | Setting range: 0–65535 (default: 1000); unit: indicates 0.1μs.                           |
| Configuration of diagnosis reporting | Diagnosis information will be uploaded by default.                                       |
| In stop mode                         | Output will not be refreshed, while input supports refreshing in Safe-operational state. |

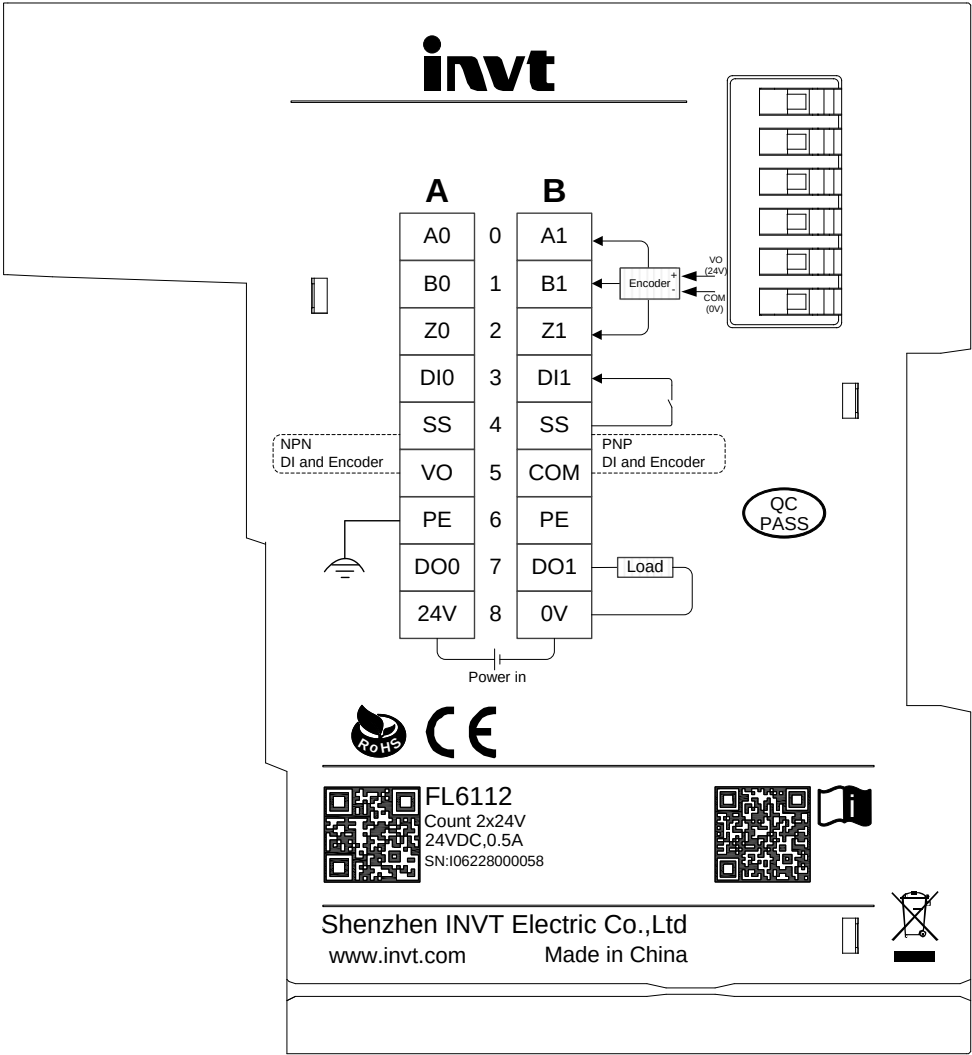
### 3.11.1.7 Environment requirements

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C–+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C–+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |

| Item                        | Specification                     |
|-----------------------------|-----------------------------------|
| EMC anti-interference level | Zone B, compliant with IEC61131-2 |
| Vibration resistance        | Compliant with IEC60068-2-6       |
| Impact resistance           | Compliant with IEC60068-2-27      |

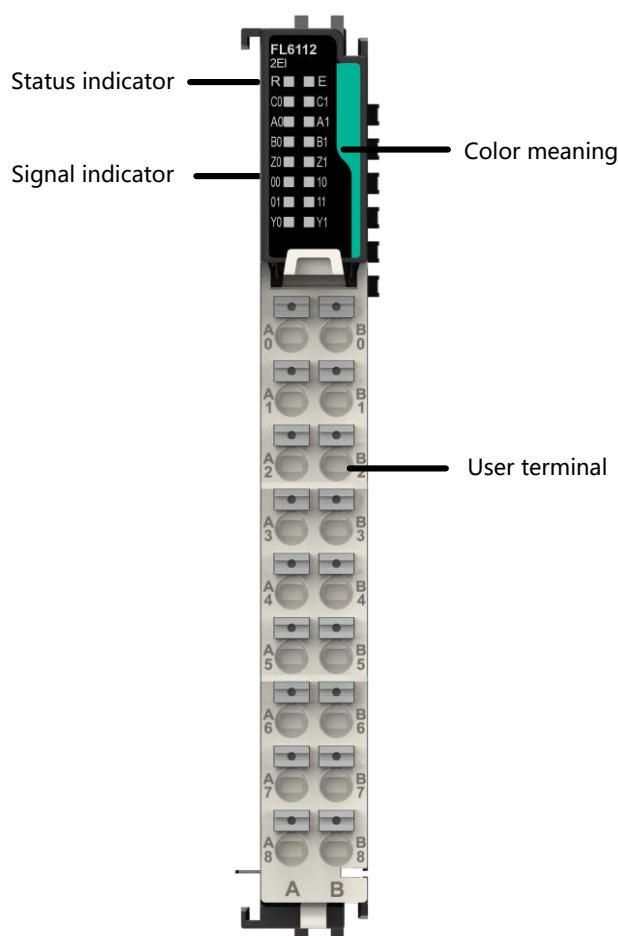
3.11.2 FL6112 (2EI)

3.11.2.1 Basic information



| Model  | Ordering code | Description                                                | Applicable model                     |
|--------|---------------|------------------------------------------------------------|--------------------------------------|
| FL6112 | 11016-00019   | Incremental encoder input, 2 channels, 24VDC, 200kHz; RoHS | Applicable to INVT Flex/TS/TM series |

### 3.11.2.2 Component description



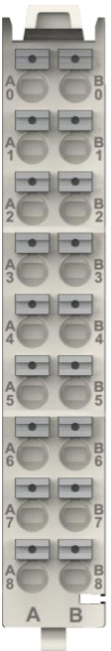
| Name             | Description     |                                          |                                                                                       |
|------------------|-----------------|------------------------------------------|---------------------------------------------------------------------------------------|
| Status indicator | R: Yellow green | Power-on/Run status indicator            | On: The module is running.                                                            |
|                  |                 |                                          | Slow blinking (500ms): The module is establishing communication.                      |
|                  |                 |                                          | Off: The module is not powered on or it is abnormal.                                  |
|                  | E: Red          | Module fault indicator                   | Fast blinking (100ms): The module is offline.                                         |
|                  |                 |                                          | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |
|                  |                 |                                          | Off: The module works normally.                                                       |
| Signal indicator | C0: Green       | Channel 0 enabling status indicator      | On: Encoder channel enabled.                                                          |
|                  | C1: Green       | Channel 1 enabling status indicator      | Off: Encoder channel disabled.                                                        |
|                  | A0/B0/Z0: Green | Encoder channel 0 input signal indicator | On: The input signal is valid.                                                        |
|                  |                 |                                          | Off: The input signal is invalid.                                                     |
|                  | A1/B1/Z1: Green | Encoder channel 1 input signal indicator | On: The input signal is valid.                                                        |
|                  |                 |                                          | Off: The input signal is invalid.                                                     |
|                  | 00/01: Green    | Channel 0 digital input indicator        | On: The input signal is valid.<br>Off: The input signal is invalid.                   |
|                  | 10/11: Green    | Channel 1 digital input indicator        | On: The input signal is valid.<br>Off: The input signal is invalid.                   |



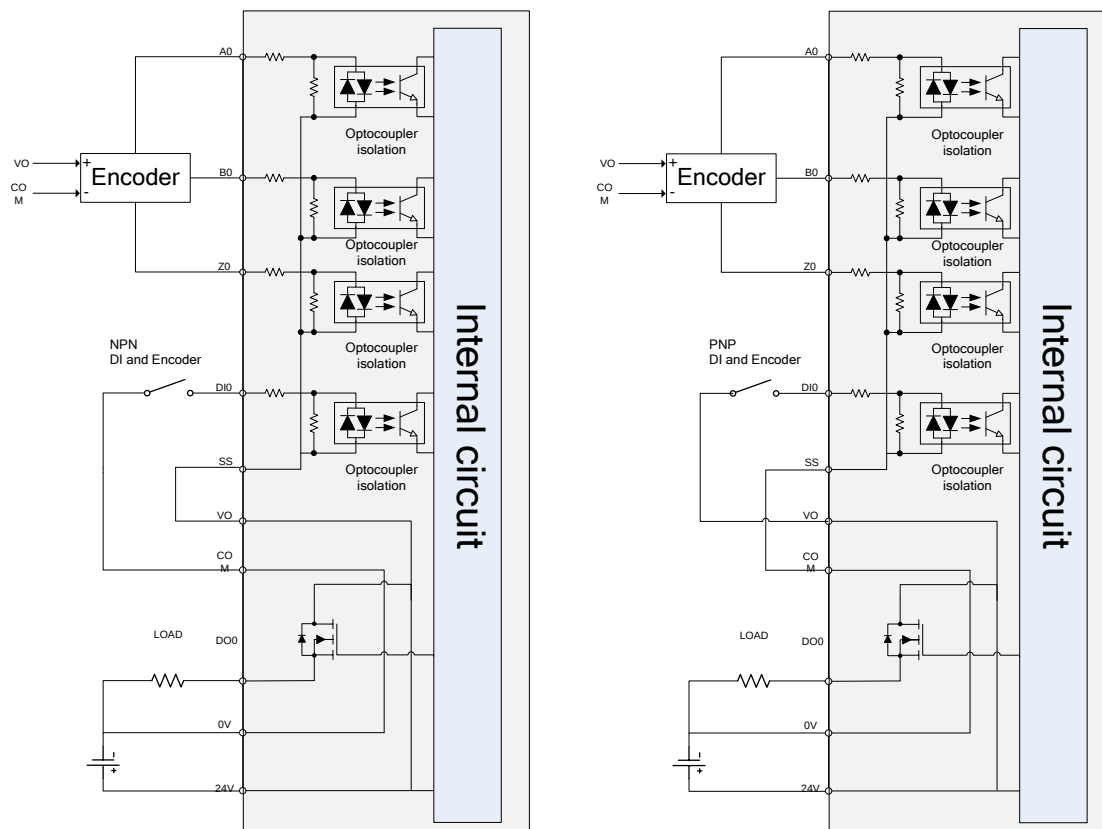
| Name          | Description                                                                       |                                               |                                                                                   |                                      |
|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------|
|               | Y0: Green                                                                         | Channel 0 digital output indicator            | On: Output enabled.<br>Off: Output disabled.                                      |                                      |
|               | Y1: Green                                                                         | Channel 1 digital output indicator            | On: Output enabled.<br>Off: Output disabled.                                      |                                      |
| User terminal | External wiring I/O terminal                                                      |                                               |                                                                                   |                                      |
| Color meaning |  | Digital input                                 |  | Digital output (source, sink, relay) |
|               |  | Analog input (voltage, current, thermocouple) |  | Analog output                        |
|               |  | Power feed                                    |  | Counting and measuring               |

### 3.11.2.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | A0          | A0            | B0             | A1           |
|                                                                                    | B0          | A1            | B1             | B1           |
|                                                                                    | Z0          | A2            | B2             | Z1           |
|                                                                                    | DI0         | A3            | B3             | DI1          |
|                                                                                    | SS          | A4            | B4             | SS           |
|                                                                                    | VO          | A5            | B5             | COM          |
|                                                                                    | PE          | A6            | B6             | PE           |
|                                                                                    | DO0         | A7            | B7             | DO1          |
|                                                                                    | 24V         | A8            | B8             | 0V           |

## ■ Terminal wiring



### 3.11.2.4 Power supply specifications

| Item                                | Specification                 |
|-------------------------------------|-------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)        |
| Fieldbus input power rated current  | 140mA (Typical value at 5VDC) |
| Terminal input power rated voltage  | 24VDC (20.4VDC–28.8VDC)       |
| Terminal input power rated current  | 2A (Typical value at 24VDC)   |
| Terminal output power rated voltage | None                          |
| Terminal output power rated current | None                          |
| Hot swapping of module              | Not supported                 |

### 3.11.2.5 Input specifications

| Item                          | Specification                                                                 |
|-------------------------------|-------------------------------------------------------------------------------|
| Encoder type                  | Incremental encoder                                                           |
| Input channel                 | 2                                                                             |
| Encoder voltage               | 24VDC±15%                                                                     |
| Pulse mode                    | Phase difference pulse/pulse+direction input (supports directionless signals) |
| Counting range                | -2147483648–2147483647                                                        |
| Pulse frequency               | 200kHz                                                                        |
| Frequency multiplication mode | x1/x2/x4                                                                      |
| Resolution                    | 1–65535PPR (number of pulses per revolution)                                  |
| Counter preset                | Default is 0, which means the preset is disabled.                             |

| Item                             | Specification                                    |
|----------------------------------|--------------------------------------------------|
| Z-pulse calibration              | Supported by default when Z signal is connected. |
| Counter filter                   | (0–65535)*0.1μs per channel                      |
| Number of DI channels            | 2                                                |
| DI function                      | Latch                                            |
| DI detection electrical level    | 24VDC                                            |
| DI type                          | PNP (source)/NPN (sink)                          |
| DI edge selection                | Rising edge/Falling edge/Rising or falling edge  |
| DI filter time setting           | (0–65535)*0.1μs                                  |
| Number of DO channels            | 2                                                |
| DO function                      | Comparison output                                |
| DO level                         | 24VDC                                            |
| DO type                          | PNP (source), rated output current 0.16A         |
| DO function                      | Comparison output                                |
| ON voltage                       | >15V                                             |
| OFF voltage                      | <5V                                              |
| Hardware response time<br>ON/OFF | 100μs/100μs                                      |
| Input resistance                 | Reference value about 3.4kΩ                      |
| Isolation                        | Optocoupler                                      |

### 3.11.2.6 Software specifications

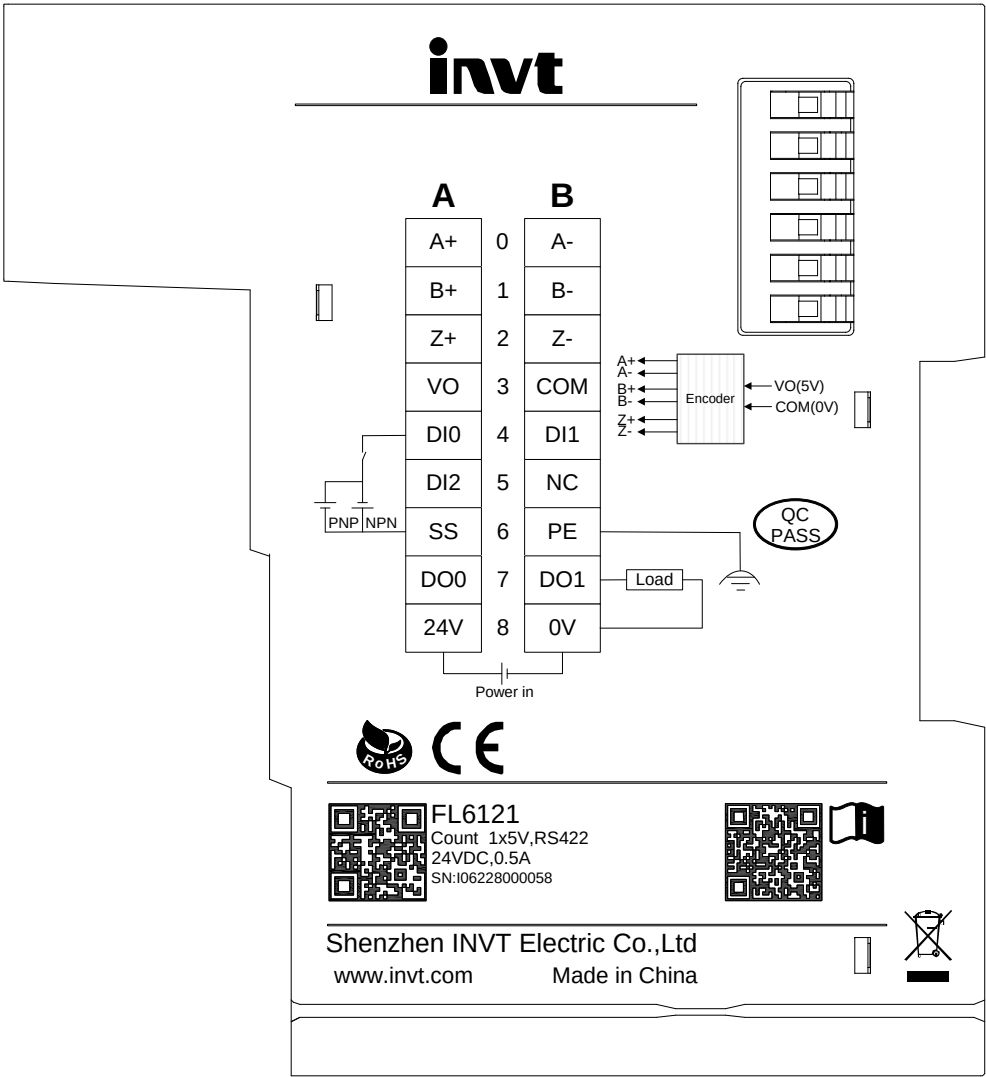
| Item                                       | Specification                                       |
|--------------------------------------------|-----------------------------------------------------|
| Input filter time                          | Setting range: 0–65535 (default: 1000); unit: 0.1μs |
| Measurement variable                       | Frequency/Speed                                     |
| Update time of the<br>measurement function | 20ms/100ms/500ms/1000ms                             |
| Gating function                            | Software gate                                       |

### 3.11.2.7 Environment requirements

| Item                                          | Specification                                |
|-----------------------------------------------|----------------------------------------------|
| Working environment<br>temperature            | -20°C–+55°C                                  |
| Working environment<br>relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                           | -40°C–+70°C (RH < 90%, no condensation)      |
| Air                                           | No corrosive gas                             |
| Altitude                                      | Lower than 3000m                             |
| Pollution degree                              | Below degree 2                               |
| Immunity                                      | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                          | Category II                                  |
| EMC anti-interference<br>level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                          | Compliant with IEC60068-2-6                  |
| Impact resistance                             | Compliant with IEC60068-2-27                 |

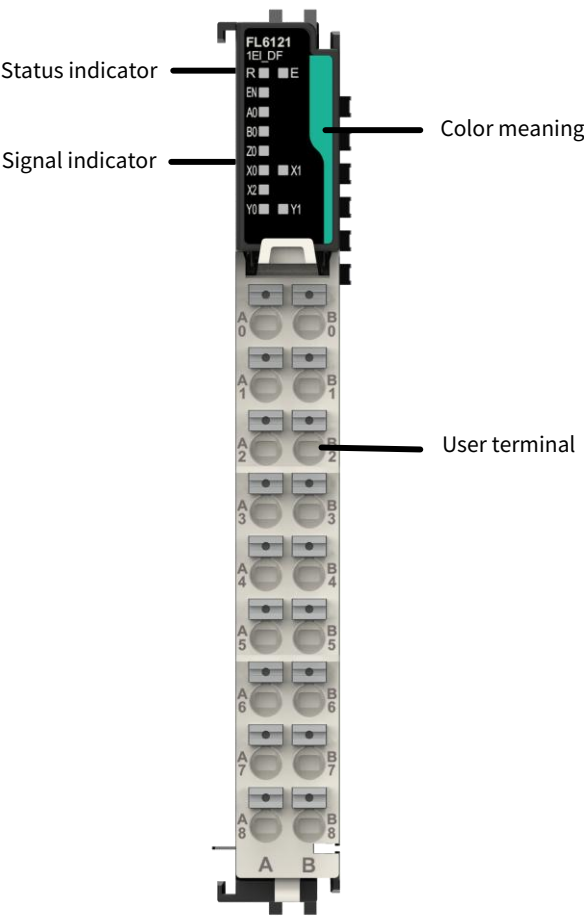
3.11.3 FL6121 (1EI\_DF)

3.11.3.1 Basic information



| Model  | Ordering code | Description                                                         | Applicable model                     |
|--------|---------------|---------------------------------------------------------------------|--------------------------------------|
| FL6121 | 11016-00021   | Incremental encoder differential input, 1 channel, 5VDC, 2MHz; RoHS | Applicable to INVT Flex/TS/TM series |

3.11.3.2 Component description

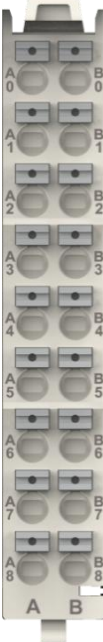


| Name             | Description                                                                         |                                       |                                                                                       |                                      |
|------------------|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------|
| Status indicator | R: Yellow green                                                                     | Power-on/Run status indicator         | On: The module is running.                                                            |                                      |
|                  |                                                                                     |                                       | Slow blinking (500ms): The module is establishing communication.                      |                                      |
|                  |                                                                                     |                                       | Off: The module is not powered on or it is abnormal.                                  |                                      |
|                  | E: Red                                                                              | Module fault indicator                | Fast blinking (100ms): The module is offline.                                         |                                      |
|                  |                                                                                     |                                       | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |                                      |
|                  |                                                                                     |                                       | Off: The module works normally.                                                       |                                      |
|                  | EN: Green                                                                           | Enabling status indicator             | On: Encoder channel enabled.                                                          |                                      |
| Signal indicator | A0/B0/Z0: Green                                                                     | Encode channel input signal indicator | On: The input signal is valid.                                                        |                                      |
|                  |                                                                                     |                                       | Off: The input signal is invalid.                                                     |                                      |
|                  | X0/X1/X2: Green                                                                     | Digital input indicator               | On: The input signal is valid.                                                        |                                      |
|                  |                                                                                     |                                       | Off: The input signal is invalid.                                                     |                                      |
| Y0/Y1: Green     | Digital output indicator                                                            | On: Output enabled.                   |                                                                                       |                                      |
|                  |                                                                                     | Off: Output disabled.                 |                                                                                       |                                      |
| User terminal    | External wiring I/O terminal                                                        |                                       |                                                                                       |                                      |
| Color meaning    |  | Digital input                         |    | Digital output (source, sink, relay) |

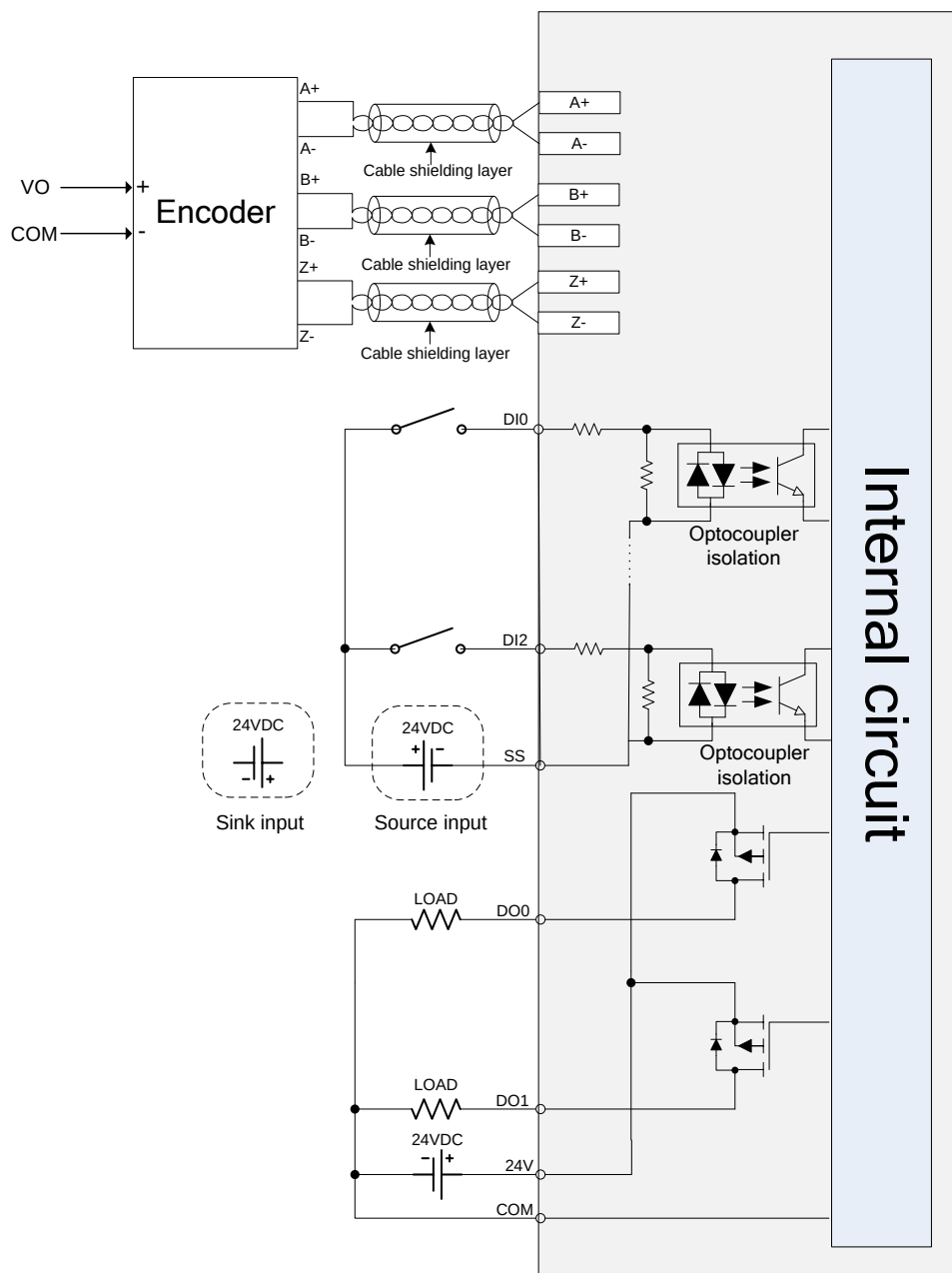
| Name | Description                                                                       |                                               |                                                                                   |                        |
|------|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------|------------------------|
|      |  | Analog input (voltage, current, thermocouple) |  | Analog output          |
|      |  | Power feed                                    |  | Counting and measuring |

### 3.11.3.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | A+          | A0            | B0             | A-           |
|                                                                                    | B+          | A1            | B1             | B-           |
|                                                                                    | Z+          | A2            | B2             | Z-           |
|                                                                                    | VO          | A3            | B3             | COM          |
|                                                                                    | DI0         | A4            | B4             | DI1          |
|                                                                                    | DI2         | A5            | B5             | /            |
|                                                                                    | SS          | A6            | B6             | PE           |
|                                                                                    | DO0         | A7            | B7             | DO1          |
|                                                                                    | 24V         | A8            | B8             | 0V           |

### ■ Terminal wiring



#### 3.11.3.4 Power supply specifications

| Item                                | Specification                 |
|-------------------------------------|-------------------------------|
| Fieldbus input power rated voltage  | 5VDC (4.75VDC–5.25VDC)        |
| Fieldbus input power rated current  | 140mA (Typical value at 5VDC) |
| Terminal input power rated voltage  | 24VDC (20.4VDC–28.8VDC)       |
| Terminal input power rated current  | 2A (Typical value at 24VDC)   |
| Terminal output power rated voltage | None                          |

| Item                                | Specification |
|-------------------------------------|---------------|
| Terminal output power rated current | None          |
| Hot swapping of module              | Not supported |

### 3.11.3.5 Input specifications

| Item                          | Specification                                                                 |
|-------------------------------|-------------------------------------------------------------------------------|
| Encoder type                  | Incremental encoder                                                           |
| Input channel                 | 1                                                                             |
| Encoder voltage               | 5VDC                                                                          |
| Input type                    | RS422 electrical level standards, differential input                          |
| Pulse mode                    | Phase difference pulse/pulse+direction input (supports directionless signals) |
| Counting range                | -2147483648~2147483647                                                        |
| Pulse frequency               | 100Hz~2MkHz                                                                   |
| Frequency multiplication mode | x1/x2/x4                                                                      |
| Resolution                    | 1~65535PPR (number of pulses per revolution)                                  |
| Counter preset                | Default is 0, which means the preset is disabled.                             |
| Z-pulse calibration           | Supported by default when Z signal is connected.                              |
| Counter filter                | (0~65535)*10ns per channel                                                    |
| Number of DI channels         | 3                                                                             |
| DI function                   | Latch, preset, and reset                                                      |
| DI detection electrical level | 24VDC                                                                         |
| DI type                       | PNP (source)/NPN (sink)                                                       |
| DI edge selection             | Rising edge/Falling edge/Rising or falling edge                               |
| DI filter time setting        | (0~65535)*10ns                                                                |
| Hardware reset                | Rising edge reset                                                             |
| Number of DO channels         | 2                                                                             |
| DO function                   | Comparison output                                                             |
| DO level                      | 24VDC                                                                         |
| DO type                       | PNP (source), rated output current 0.16A                                      |
| ON voltage                    | >15V                                                                          |
| OFF voltage                   | <5V                                                                           |
| Hardware response time ON/OFF | 100μs/100μs                                                                   |
| Input resistance              | Reference value about 3.4kΩ                                                   |
| Isolation                     | Optocoupler                                                                   |

### 3.11.3.6 Software specifications

| Item                                    | Specification                                                 |
|-----------------------------------------|---------------------------------------------------------------|
| Input filter time                       | Setting range: 0~65535 (default: 1000); unit: indicates 10ns. |
| Measurement variable                    | Frequency/Speed                                               |
| Update time of the measurement function | 20ms/100ms/500ms/1000ms                                       |
| Gating function                         | Software gate                                                 |



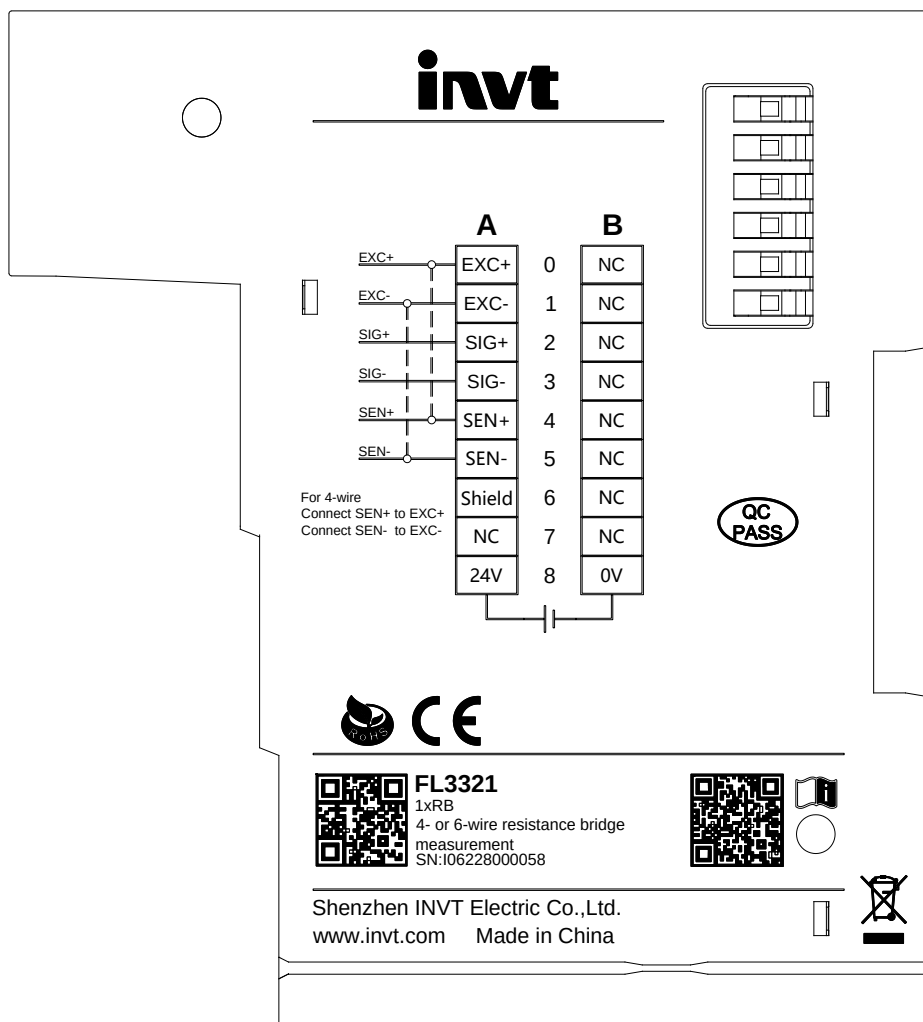
**3.11.3.7 Environment requirements**

| Item                                       | Specification                                |
|--------------------------------------------|----------------------------------------------|
| Working environment temperature            | -20°C~+55°C                                  |
| Working environment relative humidity (RH) | RH < 95%, no condensation                    |
| Storage temperature                        | -40°C~+70°C (RH < 90%, no condensation)      |
| Air                                        | No corrosive gas                             |
| Altitude                                   | Lower than 3000m                             |
| Pollution degree                           | Below degree 2                               |
| Immunity                                   | 2kV power cable, compliant with IEC61000-4-4 |
| Overvoltage category                       | Category II                                  |
| EMC anti-interference level                | Zone B, compliant with IEC61131-2            |
| Vibration resistance                       | Compliant with IEC60068-2-6                  |
| Impact resistance                          | Compliant with IEC60068-2-27                 |

## 3.12 Bridge detection module (FL332x)

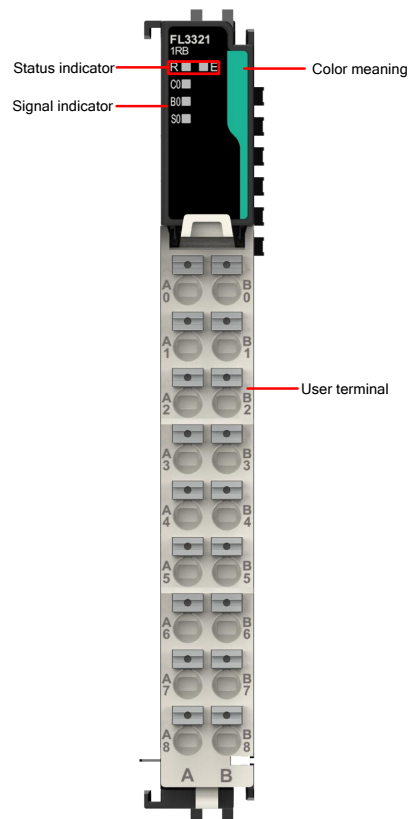
### 3.12.1 FL3321 (1RB)

#### 3.12.1.1 Basic information



| Model  | Ordering code | Description                                                                                  | Applicable model                     |
|--------|---------------|----------------------------------------------------------------------------------------------|--------------------------------------|
| FL3321 | 11016-00030   | Bridge detection module, 4-wire or 6-wire bridge sensor input, 1 channel, 24 Bit, 5VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.12.1.2 Component description



| Name             | Description |                                   |                                                                                                            |
|------------------|-------------|-----------------------------------|------------------------------------------------------------------------------------------------------------|
| Status indicator | R: Green    | Run indicator                     | On: The module is running.                                                                                 |
|                  |             |                                   | Slow blinking (500ms): The module is establishing communication.                                           |
|                  |             |                                   | Off: The module is not powered on or it is abnormal.                                                       |
|                  | E: Red      | Error indicator                   | Slow blinking (500ms): No power connected externally or incorrect parameter settings.                      |
| Signal indicator | C0: Green   | Enabling indicator                | Fast blinking (100ms): The module is offline.                                                              |
|                  |             |                                   | Off: The module works normally.                                                                            |
|                  |             |                                   | On: The channel is enabled.                                                                                |
|                  | B0: Red     | Open-circuit detection indicator  | Slow blinking (500ms): Over-range or over-limit input signal, or incorrect channel parameter configuration |
|                  |             |                                   | Off: The channel is disabled.                                                                              |
|                  | S0: Red     | Short-circuit detection indicator | On: The signal line is disconnected.                                                                       |
|                  |             |                                   | Off: The signal line is operating normally.                                                                |
|                  |             |                                   | On: The excitation power output is short-circuited.                                                        |
|                  |             |                                   | Off: The excitation power output is not short-circuited.                                                   |

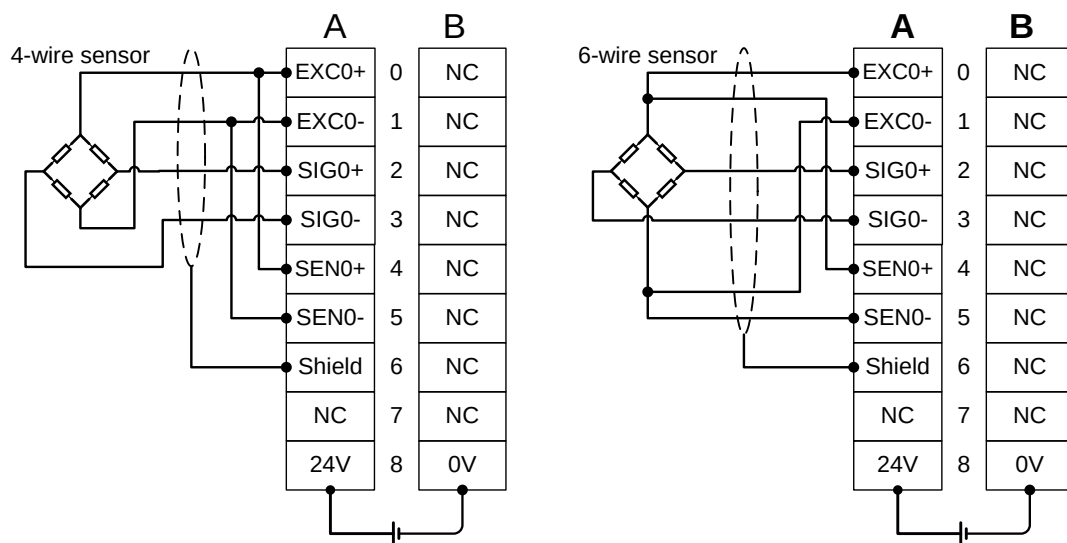
### 3.12.1.3 Terminal definition and wiring

#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | EXC0+       | A0            | B0             | NC           |
|                                                                                    | EXC0-       | A1            | B1             | NC           |
|                                                                                    | SIG0+       | A2            | B2             | NC           |
|                                                                                    | SIG0-       | A3            | B3             | NC           |
|                                                                                    | SEN0+       | A4            | B4             | NC           |
|                                                                                    | SEN0-       | A5            | B5             | NC           |
|                                                                                    | Shield      | A6            | B6             | NC           |
|                                                                                    | NC          | A7            | B7             | NC           |
|                                                                                    | 24V         | A8            | B8             | 0V           |

| Pin | Name   | Description                                                      | Specifications                                                           |
|-----|--------|------------------------------------------------------------------|--------------------------------------------------------------------------|
| A0  | EXC0+  | Positive terminal of the excitation voltage output for Channel 0 | Input form: Differential input<br>Input voltage range: $\pm 30\text{mV}$ |
| A1  | EXC0-  | Negative terminal of the excitation voltage output for Channel 0 |                                                                          |
| A2  | SIG0+  | Positive terminal of the bridge input signal for Channel 0       |                                                                          |
| A3  | SIG0-  | Negative terminal of the bridge input signal for Channel 0       |                                                                          |
| A4  | SEN0+  | Positive terminal of the bridge feedback voltage for Channel 0   |                                                                          |
| A5  | SEN0-  | Negative terminal of the bridge feedback voltage for Channel 0   |                                                                          |
| A6  | Shield | Shielding cable ground of the bridge Channel 0                   |                                                                          |
| A7  | -      | -                                                                | Module power input: 24VDC (20.4VDC–28.8VDC)                              |
| A8  | 24V    | Positive terminal of the external 24V power input                |                                                                          |
| B8  | 0V     | Negative terminal of the external 24V power input                |                                                                          |

## ■ Terminal wiring



### Note:

- Avoid bundling sensor cables together with power cables (high voltage and high current) or other cables that transmit strong interference signals. They should be routed separately and parallel routing should be avoided.
- The sensor and the module should be grounded at equipotential as much as possible.

### 3.12.1.4 Power supply specifications

| Item                               | Specification                                         |
|------------------------------------|-------------------------------------------------------|
| External input rated voltage       | 24VDC (-15%~+20%)                                     |
| External input rated current       | 0.5A                                                  |
| Backplane bus rated output voltage | 5VDC (4.75VDC~5.25VDC)                                |
| Backplane bus current consumption  | 120mA (Typical value)                                 |
| Isolation                          | Yes                                                   |
| Power protection                   | Protection against reverse connection and overcurrent |

### 3.12.1.5 Input/output specifications

| Item                  | Specification                                                               |
|-----------------------|-----------------------------------------------------------------------------|
| Number of channels    | 1                                                                           |
| Input mode            | Differential                                                                |
| Voltage range         | ±30mVDC                                                                     |
| Input sensor type     | 4-wire or 6-wire bridge sensors                                             |
| Loadcell sensitivity  | (1, 2, 4, 6) mV/V                                                           |
| Load resistance range | 40~4010Ω                                                                    |
| Precision             | ±0.01% FS (at 25°C, sampling rate ≥ 80ms, and Loadcell sensitivity > 2mV/V) |

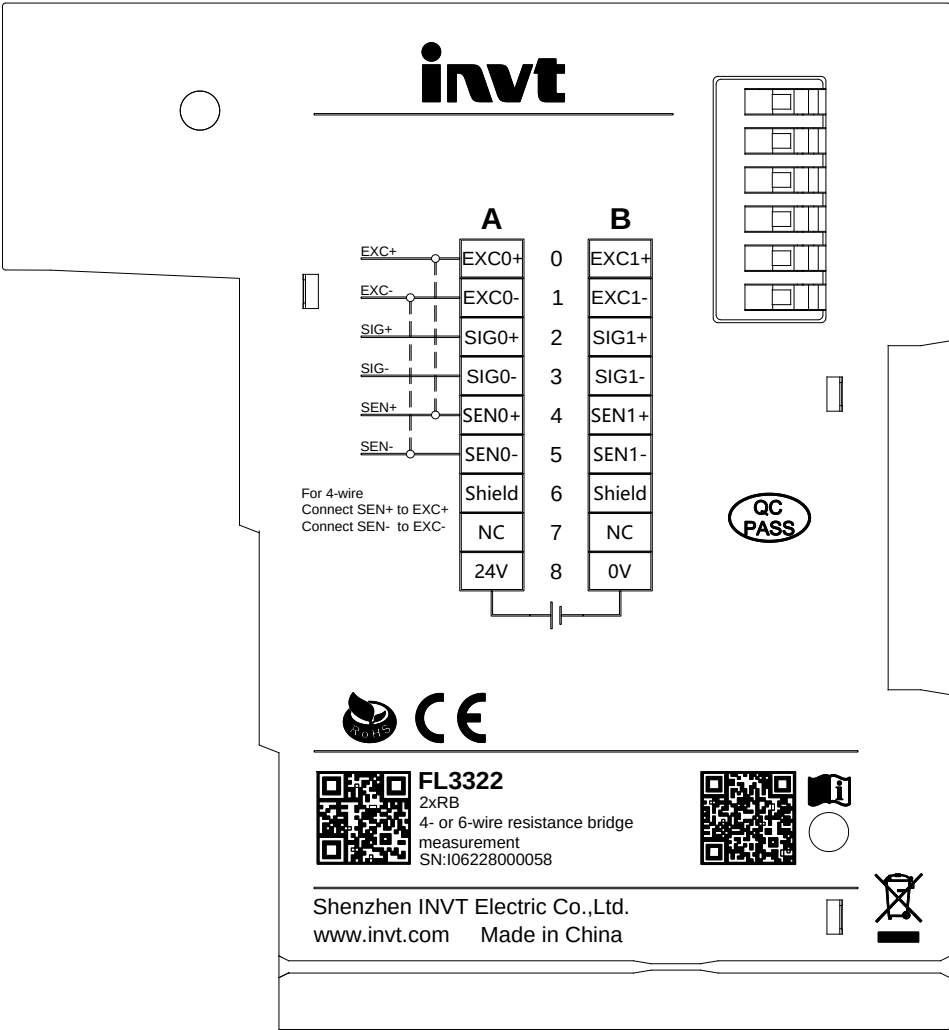
| Item                     | Specification                                                                                                                                                                               |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          | $\pm 0.05\%$ FS (-25°C to +55°C, sampling rate $\geq 80$ ms, and Loadcell sensitivity $> 2$ mV/V)<br>$\pm 1\%$ FS (at 25°C, under interference conditions of the CE certification standard) |
| Maximum excitation power | 5V @ 250mA                                                                                                                                                                                  |
| Open wire detection      | Supported (signal line)                                                                                                                                                                     |
| Over-limit detection     | Supported                                                                                                                                                                                   |
| Over-range detection     | Supported                                                                                                                                                                                   |
| Isolation method         | No isolation between channels                                                                                                                                                               |

### 3.12.1.6 Software specifications

| Item                                          | Specification                                                                            |
|-----------------------------------------------|------------------------------------------------------------------------------------------|
| Conversion time                               | 1ms, 2ms, 5ms, 10ms, 20ms, 40ms, 80ms, 200ms, 400ms                                      |
| Input channel logic level configuration       | Not supported                                                                            |
| Configuration of independent channel enabling | Not supported                                                                            |
| Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                       |
| In stop mode                                  | Output will not be refreshed, while input supports refreshing in Safe-operational state. |
| I/O mapping                                   | Supporting the mapping method of bitwise access                                          |

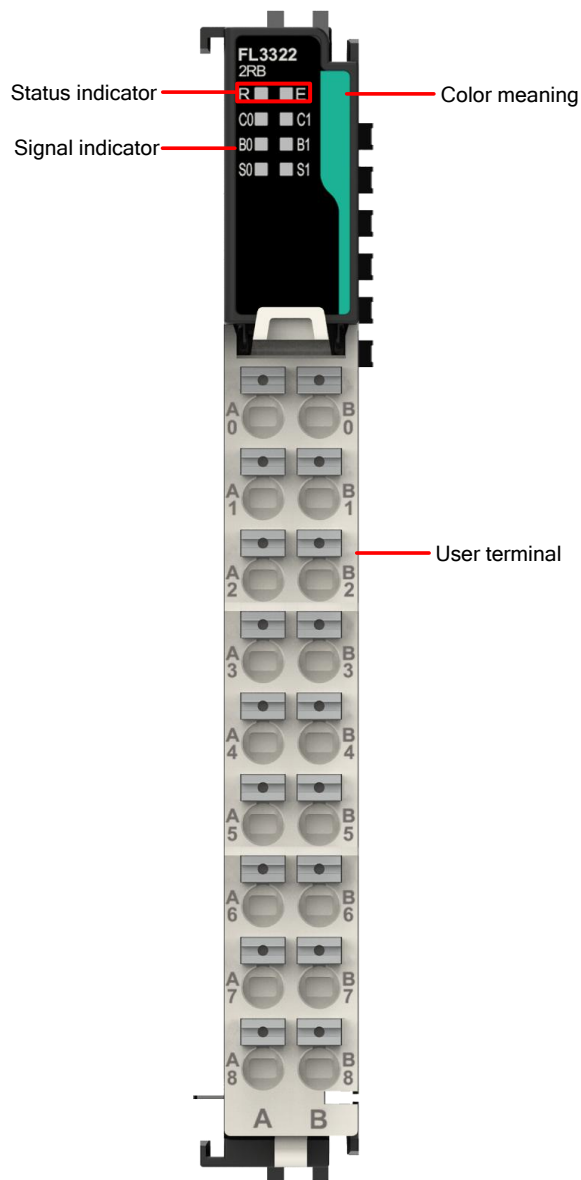
3.12.2 FL3322 (2RB)

3.12.2.1 Basic information



| Model  | Ordering code | Description                                                                                   | Applicable model                     |
|--------|---------------|-----------------------------------------------------------------------------------------------|--------------------------------------|
| FL3322 | 11016-00031   | Bridge detection module, 4-wire or 6-wire bridge sensor input, 2 channels, 24 Bit, 5VDC; RoHS | Applicable to INVT Flex/TS/TM series |

3.12.2.2 Component description



| Name             |              | Description        |                                                                                                            |
|------------------|--------------|--------------------|------------------------------------------------------------------------------------------------------------|
| Status indicator | R: Green     | Run indicator      | On: The module is running.                                                                                 |
|                  |              |                    | Slow blinking (500ms): The module is establishing communication.                                           |
|                  | E: Red       | Error indicator    | Off: The module is not powered on or it is abnormal.                                                       |
|                  |              |                    | Slow blinking (500ms): No power connected externally or incorrect parameter settings.                      |
| Signal indicator | C0/C1: Green | Enabling indicator | Fast blinking (100ms): The module is offline.                                                              |
|                  |              |                    | Off: The module works normally.                                                                            |
|                  |              |                    | On: The channel is enabled.                                                                                |
|                  |              |                    | Slow blinking (500ms): Over-range or over-limit input signal, or incorrect channel parameter configuration |
|                  |              |                    | Off: The channel is disabled.                                                                              |



| Name | Description |                                   |                                                          |
|------|-------------|-----------------------------------|----------------------------------------------------------|
|      | B0/B1: Red  | Open-circuit detection indicator  | On: The signal line is disconnected.                     |
|      |             |                                   | Off: The signal line is operating normally.              |
|      | S0/S1: Red  | Short-circuit detection indicator | On: The excitation power output is short-circuited.      |
|      |             |                                   | Off: The excitation power output is not short-circuited. |

### 3.12.2.3 Terminal definition and wiring

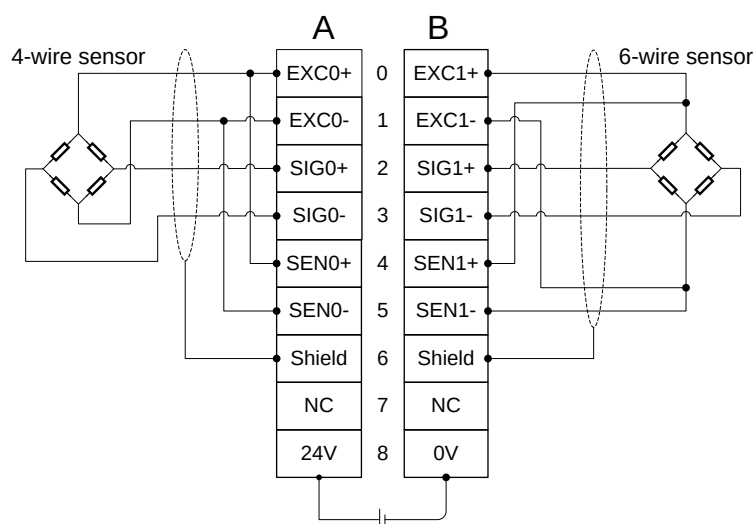
#### ■ Terminal definition

| Schematic diagram                                                                  | Left signal | Left terminal | Right terminal | Right signal |
|------------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | EXC0+       | A0            | B0             | EXC1+        |
|                                                                                    | EXC0-       | A1            | B1             | EXC1-        |
|                                                                                    | SIG0+       | A2            | B2             | SIG1+        |
|                                                                                    | SIG0-       | A3            | B3             | SIG1-        |
|                                                                                    | SEN0+       | A4            | B4             | SEN1+        |
|                                                                                    | SEN0-       | A5            | B5             | SEN1-        |
|                                                                                    | Shield      | A6            | B6             | Shield       |
|                                                                                    | NC          | A7            | B7             | NC           |
|                                                                                    | 24V         | A8            | B8             | 0V           |

| Pin | Name  | Description                                                      | Specifications                                                           |
|-----|-------|------------------------------------------------------------------|--------------------------------------------------------------------------|
| A0  | EXC0+ | Positive terminal of the excitation voltage output for Channel 0 | Input form: Differential input<br>Input voltage range: $\pm 30\text{mV}$ |
| B0  | EXC1+ | Positive terminal of the excitation voltage output for Channel 1 |                                                                          |
| A1  | EXC0- | Negative terminal of the excitation voltage output for Channel 0 |                                                                          |
| B1  | EXC1- | Negative terminal of the excitation voltage output for Channel 1 |                                                                          |
| A2  | SIG0+ | Positive terminal of the bridge input signal for Channel 0       |                                                                          |
| B2  | SIG1+ | Positive terminal of the bridge input signal for Channel 1       |                                                                          |
| A3  | SIG0- | Negative terminal of the bridge input signal for Channel 0       |                                                                          |
| B3  | SIG1- | Negative terminal of the bridge input signal for Channel 1       |                                                                          |
| A4  | SEN0+ | Positive terminal of the bridge feedback voltage for Channel 0   |                                                                          |

| Pin | Name   | Description                                                    | Specifications                              |
|-----|--------|----------------------------------------------------------------|---------------------------------------------|
| B4  | SEN1+  | Positive terminal of the bridge feedback voltage for Channel 1 |                                             |
| A5  | SEN0-  | Negative terminal of the bridge feedback voltage for Channel 0 |                                             |
| B5  | SEN1-  | Negative terminal of the bridge feedback voltage for Channel 1 |                                             |
| A6  | Shield | Shielding cable ground of the bridge Channel 0                 |                                             |
| B6  | Shield | Shielding cable ground of the bridge Channel 1                 |                                             |
| A7  | -      | -                                                              |                                             |
| B7  | -      | -                                                              |                                             |
| A8  | 24V    | Positive terminal of the external 24V power input              | Module power input: 24VDC (20.4VDC–28.8VDC) |
| B8  | 0V     | Negative terminal of the external 24V power input              |                                             |

### ■ Terminal wiring



#### Note:

- Avoid bundling sensor cables together with power cables (high voltage and high current) or other cables that transmit strong interference signals. They should be routed separately and parallel routing should be avoided.
- The sensor and the module should be grounded at equipotential as much as possible.

### 3.12.2.4 Power supply specifications

| Item                               | Specification          |
|------------------------------------|------------------------|
| External input rated voltage       | 24VDC (-15%~+20%)      |
| External input rated current       | 0.5A                   |
| Backplane bus rated output voltage | 5VDC (4.75VDC–5.25VDC) |

| Item                              | Specification                                         |
|-----------------------------------|-------------------------------------------------------|
| Backplane bus current consumption | 120mA (Typical value)                                 |
| Isolation                         | Yes                                                   |
| Power protection                  | Protection against reverse connection and overcurrent |

### 3.12.2.5 Input/output specifications

| Item                     | Specification                                                                                                                                                                                                                                                                                                         |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels       | 2                                                                                                                                                                                                                                                                                                                     |
| Input mode               | Differential                                                                                                                                                                                                                                                                                                          |
| Voltage range            | $\pm 30\text{mVDC}$                                                                                                                                                                                                                                                                                                   |
| Input sensor type        | 4-wire or 6-wire bridge sensors                                                                                                                                                                                                                                                                                       |
| Loadcell sensitivity     | (1, 2, 4, 6) mV/V                                                                                                                                                                                                                                                                                                     |
| Load resistance range    | 40–4010 $\Omega$                                                                                                                                                                                                                                                                                                      |
| Precision                | $\pm 0.01\%$ FS (at 25°C, sampling rate $\geq 80\text{ms}$ , and Loadcell sensitivity $> 2\text{mV/V}$ )<br>$\pm 0.05\%$ FS (-25°C to +55°C, sampling rate $\geq 80\text{ms}$ , and Loadcell sensitivity $> 2\text{mV/V}$ )<br>$\pm 1\%$ FS (at 25°C, under interference conditions of the CE certification standard) |
| Maximum excitation power | 5V @ 250mA                                                                                                                                                                                                                                                                                                            |
| Open wire detection      | Supported (signal line)                                                                                                                                                                                                                                                                                               |
| Over-limit detection     | Supported                                                                                                                                                                                                                                                                                                             |
| Over-range detection     | Supported                                                                                                                                                                                                                                                                                                             |
| Isolation method         | No isolation between channels                                                                                                                                                                                                                                                                                         |

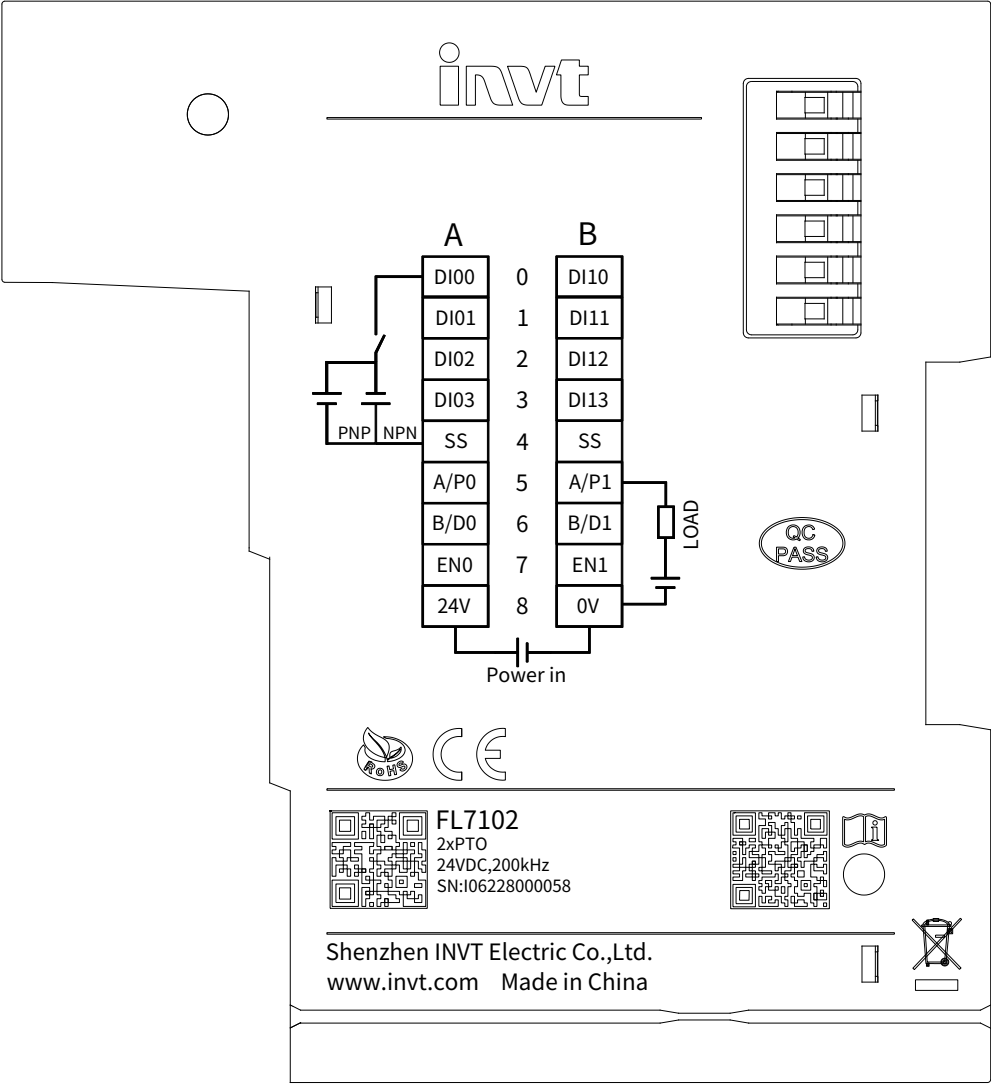
### 3.12.2.6 Software specifications

| Item                                          | Specification                                                                            |
|-----------------------------------------------|------------------------------------------------------------------------------------------|
| Conversion time                               | 1ms, 2ms, 5ms, 10ms, 20ms, 40ms, 80ms, 200ms, 400ms                                      |
| Input channel logic level configuration       | Not supported                                                                            |
| Configuration of independent channel enabling | Not supported                                                                            |
| Configuration of diagnosis reporting          | Diagnosis information will be uploaded by default.                                       |
| In stop mode                                  | Output will not be refreshed, while input supports refreshing in Safe-operational state. |
| I/O mapping                                   | Supporting the mapping method of bitwise access                                          |

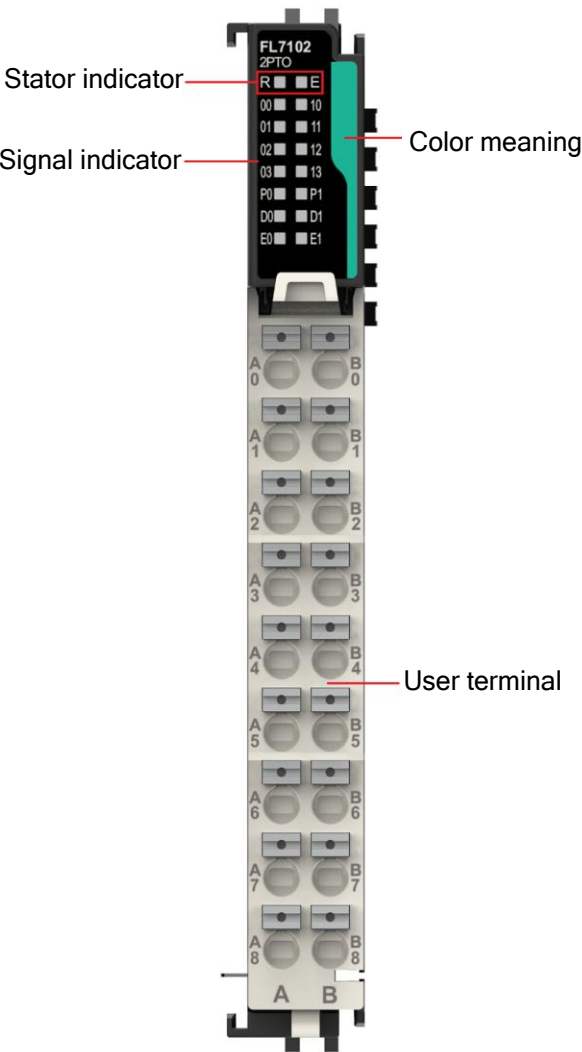
### 3.13 Dual-channel pulse output control module (FL7102)

#### 3.13.1 FL7102 (2PTO)

##### 3.13.1.1 Basic information



3.13.1.2 Component description



| Name                    | Description                  |                               |                                                                                       |
|-------------------------|------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Status indicator        | R: Yellow green              | Power-on/Run status indicator | On: The module is running.                                                            |
|                         |                              |                               | Slow blinking (500ms): The module is establishing communication.                      |
|                         |                              |                               | Off: The module is not powered on or it is abnormal.                                  |
|                         | E: Red                       | Module fault indicator        | Fast blinking (100ms): The module is offline.                                         |
|                         |                              |                               | Slow blinking (500ms): No power connected externally or incorrect parameter settings. |
|                         |                              |                               | Off: The module works normally.                                                       |
| Input signal indicator  | P0/D0/E0/<br>P1/D1/E1: Green | Pulse output indicator        | On: NPN pulse output active                                                           |
|                         |                              |                               | Off: NPN pulse output inactive                                                        |
| Output signal indicator | 00–03: Green<br>10–13: Green | Digital input indicator       | On: Input signal active                                                               |
|                         |                              |                               | Off: Input signal inactive                                                            |
| User terminal           | External wiring I/O terminal |                               |                                                                                       |

### 3.13.1.3 Terminal definition and wiring

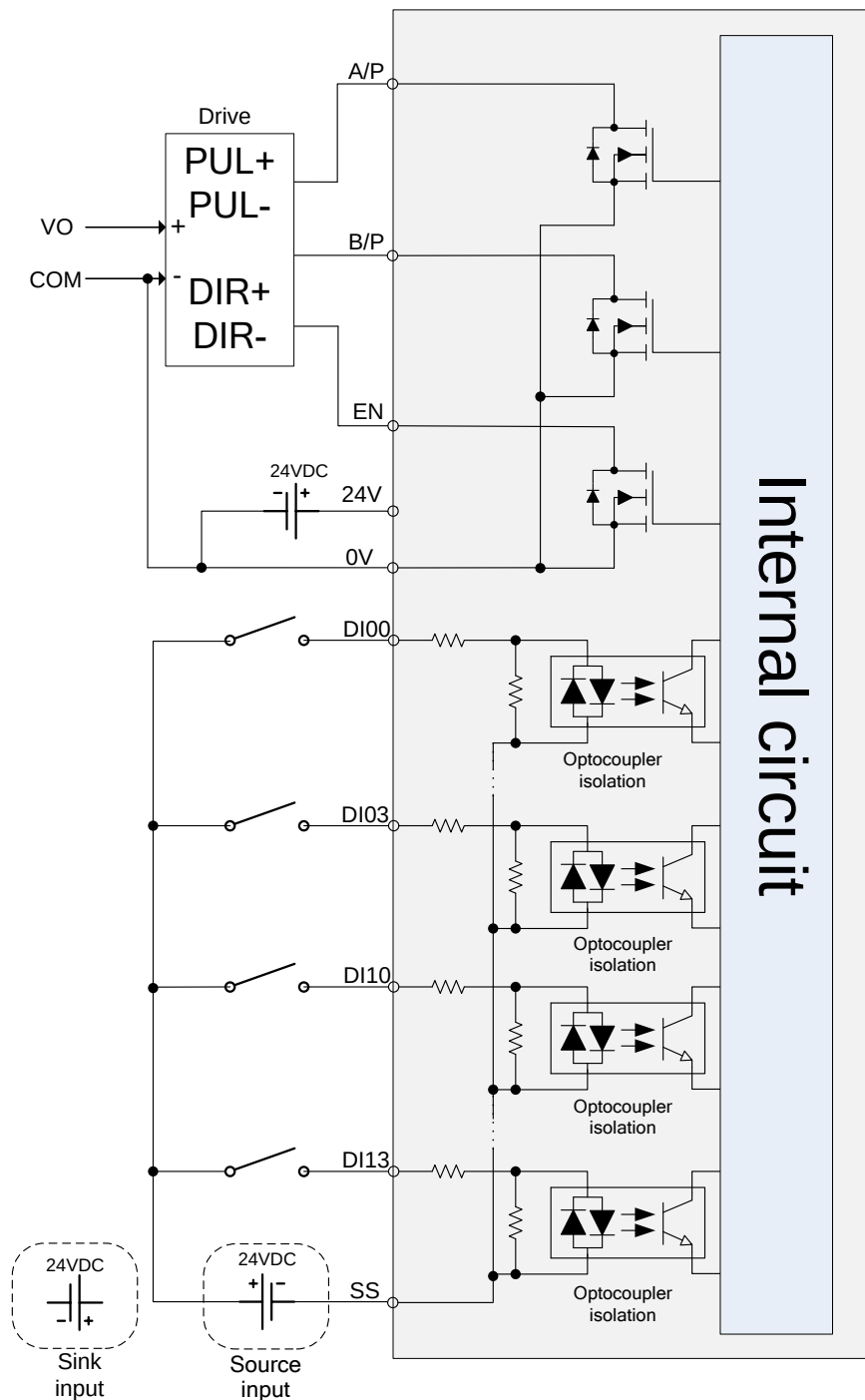
#### ■ Terminal definition

| Schematic diagram                                                                 | Left signal | Left terminal | Right terminal | Right signal |
|-----------------------------------------------------------------------------------|-------------|---------------|----------------|--------------|
|  | DI00        | <b>A0</b>     | <b>B0</b>      | DI10         |
|                                                                                   | DI01        | <b>A1</b>     | <b>B1</b>      | DI11         |
|                                                                                   | DI02        | <b>A2</b>     | <b>B2</b>      | DI12         |
|                                                                                   | DI03        | <b>A3</b>     | <b>B3</b>      | DI13         |
|                                                                                   | SS          | <b>A4</b>     | <b>B4</b>      | SS           |
|                                                                                   | A/P0        | <b>A5</b>     | <b>B5</b>      | A/P1         |
|                                                                                   | B/D0        | <b>A6</b>     | <b>B6</b>      | B/D1         |
|                                                                                   | EN0         | <b>A7</b>     | <b>B7</b>      | EN1          |
|                                                                                   | 24V         | <b>A8</b>     | <b>B8</b>      | 0V           |

| Pin | Name | Description                                       | Terminal function description                                                                                                                                                        |
|-----|------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A0  | DI00 | Positive limit signal input for Channel 0         | Internal impedance: 1.8kΩ<br>Acceptable input voltage: 15–30V<br>Supports sink type input<br>Maximum input frequency: 200kHz                                                         |
| B0  | DI10 | Positive limit signal input for Channel 1         |                                                                                                                                                                                      |
| A1  | DI01 | Negative limit signal input for Channel 0         |                                                                                                                                                                                      |
| B1  | DI11 | Negative limit signal input for Channel 1         |                                                                                                                                                                                      |
| A2  | DI02 | Home signal input for Channel 0                   |                                                                                                                                                                                      |
| B2  | DI12 | Home signal input for Channel 1                   |                                                                                                                                                                                      |
| A3  | DI03 | Emergency stop signal input for Channel 0         |                                                                                                                                                                                      |
| B3  | DI13 | Emergency stop signal input for Channel 1         |                                                                                                                                                                                      |
| A4  | SS   | Common terminal                                   | Input common reference terminal                                                                                                                                                      |
| B4  | SS   | Common terminal                                   |                                                                                                                                                                                      |
| A5  | A/P0 | P-pulse output for Channel 0                      | Single-ended NPN pulse output<br>Output voltage: (12–24 VDC) ±15%<br>Maximum output frequency: 200kHz<br>Peak load current < 1A; continuous current < 0.5A<br>Output impedance: 0.5Ω |
| B5  | A/P1 | P-pulse output for Channel 1                      |                                                                                                                                                                                      |
| A6  | B/D0 | D-pulse output for Channel 0                      |                                                                                                                                                                                      |
| B6  | B/D1 | D-pulse output for Channel 1                      | Enable signal output (Reserved; The interface performance is similar to that of pulse output )                                                                                       |
| A7  | EN0  | Enabling signal output for Channel 0              |                                                                                                                                                                                      |
| B7  | EN1  | Enabling signal output for Channel 1              | Pulse output module power supply input: (12–24 VDC) ±15%                                                                                                                             |
| A8  | 24V  | External 24V power supply input positive terminal |                                                                                                                                                                                      |

| Pin | Name | Description                                       | Terminal function description |
|-----|------|---------------------------------------------------|-------------------------------|
| B8  | 0V   | External 24V power supply input negative terminal |                               |

### ■ Terminal wiring



### 3.13.1.4 Power supply specifications

| Item                               | Specification                 |
|------------------------------------|-------------------------------|
| Fieldbus input power rated voltage | 5VDC (4.75VDC–5.25VDC)        |
| Fieldbus input power rated current | 140mA (Typical value at 5VDC) |

| Item                   | Specification |
|------------------------|---------------|
| Hot swapping of module | Not supported |

### 3.13.1.5 Input/output specifications

| Item                          | Specification                                                    |
|-------------------------------|------------------------------------------------------------------|
| Output type                   | Digital pulse output, low-edge output                            |
| Output mode                   | Sink                                                             |
| Output channel                | Dual channels                                                    |
| Output voltage class          | (12VDC–24VDC) $\pm 15\%$                                         |
| Maximum output frequency      | 200kHz                                                           |
| Output load                   | Single-point peak load current: < 1A; continuous current: < 0.5A |
| Hardware response time ON/OFF | 100 $\mu$ s                                                      |
| Isolation                     | Yes                                                              |
| Output action display         | When the output is in driving state, the output indicator is on. |
| Protection function           | Short-circuit protection and overcurrent protection              |
| DI type                       | Digital input                                                    |
| DI mode                       | Source/Sink                                                      |
| Number of DI channels         | 8                                                                |
| Input voltage class           | 15VDC–30VDC                                                      |
| Maximum input frequency       | 200kHz                                                           |
| Hardware response time ON/OFF | 100 $\mu$ s                                                      |
| Software filter time          | Supported                                                        |
| Input resistance              | Reference value is about 1.8k $\Omega$ .                         |
| Isolation                     | Yes                                                              |
| Input action display          | When the input is in driving state, the input indicator is on.   |

### 3.13.1.6 Software specifications

| Item                                  | Specification                                                              |
|---------------------------------------|----------------------------------------------------------------------------|
| Pulse output mode                     | Supports single-pulse (pulse + direction) and dual-pulse (CW/CCW) modes    |
| Motion mode                           | Supports absolute position mode, relative position mode, and velocity mode |
| Trapezoidal acceleration/deceleration | Supported                                                                  |
| Motion combination                    | Supported                                                                  |
| Homing mode                           | Supports four homing modes (19, 21, 24, 28)                                |
| Software input filter time            | Setting range: 1–65535; unit: 10 $\mu$ s                                   |



## 4 Installation

### 4.1 Preparing

#### 4.1.1 Installation precautions

| Before installation                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <ul style="list-style-type: none"> <li>Make sure all product modules have been powered off before installation.</li> <li>Check the planned overall size and ensure that there is enough space to accommodate the product modules. The module must be installed in a cabinet with each clearance to the surrounding greater than 50mm so that the product hardware has good heat dissipation.</li> </ul>                                                                                                                                                                               |
| During installation                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|    | <ul style="list-style-type: none"> <li>During installing, use the installation tools that meet the requirements, such as screws and gaskets.</li> <li>Prevent metal wire heads, debris, screws, and other objects from falling into the interior of the product. Otherwise, short circuit may occur, or heat dissipation may be degraded.</li> </ul>                                                                                                                                                                                                                                  |
| After installation                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  | <ul style="list-style-type: none"> <li>Ensure that the terminal of the connected communication cable is firmly fastened.</li> <li>Ensure that the rail that hosts the module is reliably fixed.</li> <li>Ensure that the strong-electricity cables are separately routed from the weak-electricity cables, and the cables are routed neatly in the cabinet.</li> <li>After installation, please remove the sticker attached to the module's ventilation holes to ensure smooth heat dissipation.</li> <li>After installation, check the air circulation around the module.</li> </ul> |

#### 4.1.2 Installation environment and site

Check the installation environment and ensure that the environment meets the working conditions of all the components of the product, which include temperature, humidity, dust and corrosion protection requirements.

##### ■ Environment requirements

| Environment | Requirement                                                                         |                                                                                                                                                                                                                                                                               |
|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature |  | <ul style="list-style-type: none"> <li>-20°C–55°C</li> <li>There is no sudden temperature change.</li> <li>When the product is installed in a closed space, such as control cabinet, use a cooling fan or air conditioner for temperature adjustment if necessary.</li> </ul> |
| Humidity    |  | <ul style="list-style-type: none"> <li>RH: 5%–95%, no condensation</li> </ul>                                                                                                                                                                                                 |

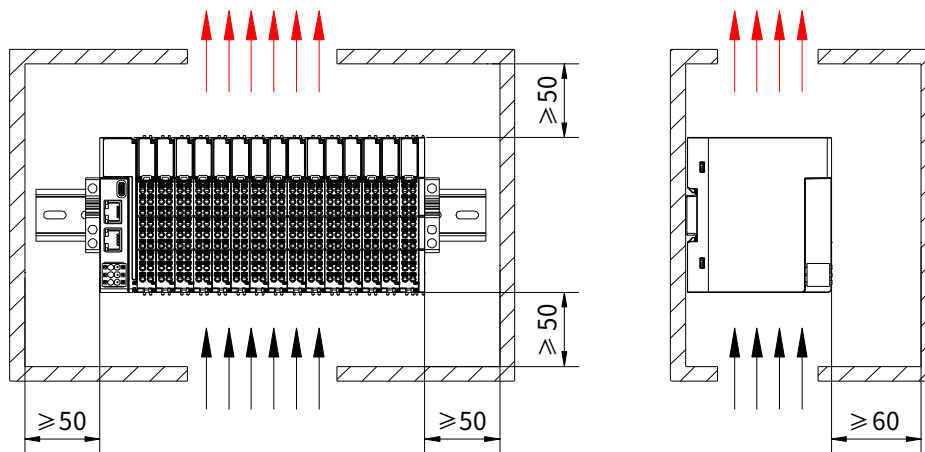
## ■ Site requirement

| Site                               | Requirement                                                                       |                                                                                          |
|------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Indoor,<br>overvoltage<br>class II |  | ● No strong electric field, strong magnetic field, or direct sunlight                    |
|                                    |  | ● No dust, conductive powder such as iron powder, oil mist, salt, or organic solvent     |
|                                    |  | ● No corrosive gas or flammable gas                                                      |
|                                    |  | ● No factors that will cause the machine to directly vibrate or suffer conductive shocks |

### 4.1.3 Installation space

Sufficient space should be reserved between the top and bottom of the module and the housing and other components to facilitate product replacement, ventilation, and heat dissipation.

Figure 4-1 Installation space (unit: mm)



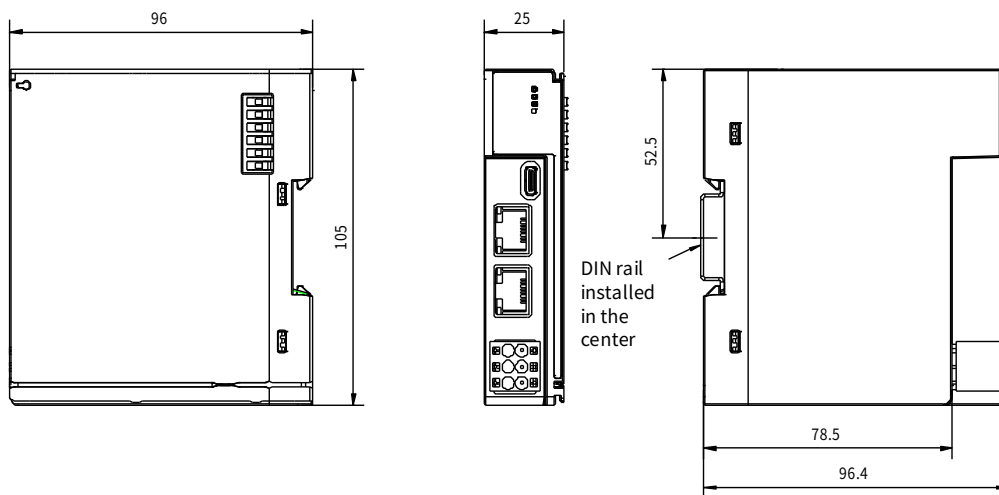
## 4.2 Installation dimensions

### 4.2.1 Communication coupler

#### 4.2.1.1 Module installation dimensions

The dimensions are applicable to FK1100, FK1200, and FK1400.

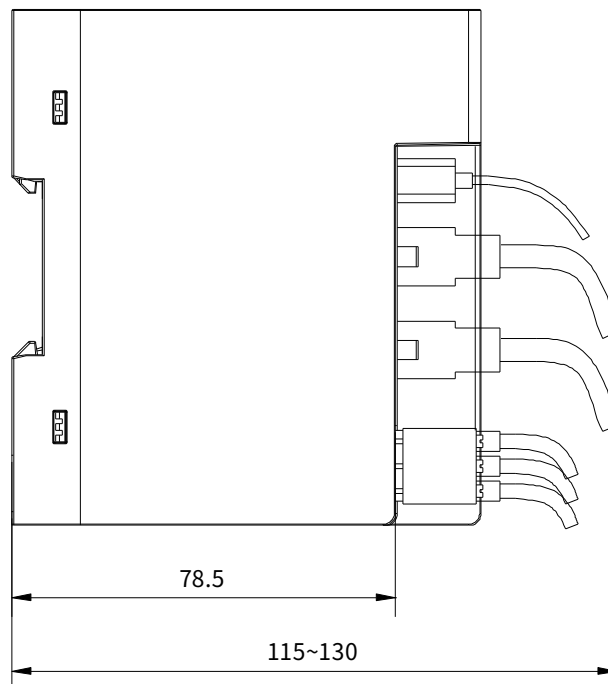
Figure 4-2 Module installation dimensions (unit: mm)



#### 4.2.1.2 Connection cable dimensions

The dimensions are applicable to FK1100, FK1200, and FK1400.

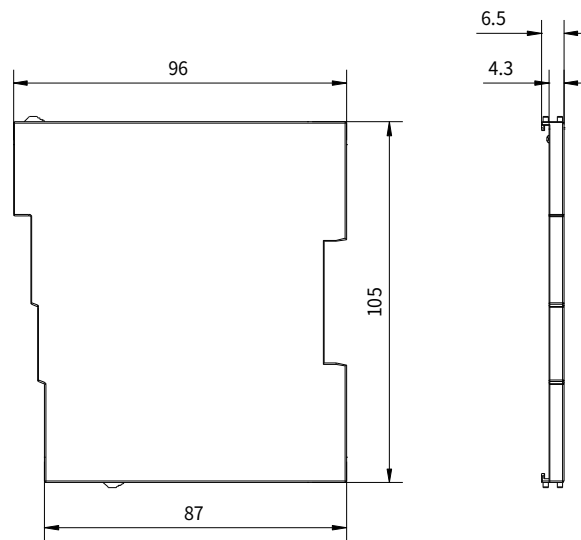
Figure 4-3 Connection cable dimensions (unit: mm)



### 4.2.1.3 End cover dimensions

The dimensions are applicable to FK1100, FK1200, and FK1400.

Figure 4-4 End cover dimensions (unit: mm)

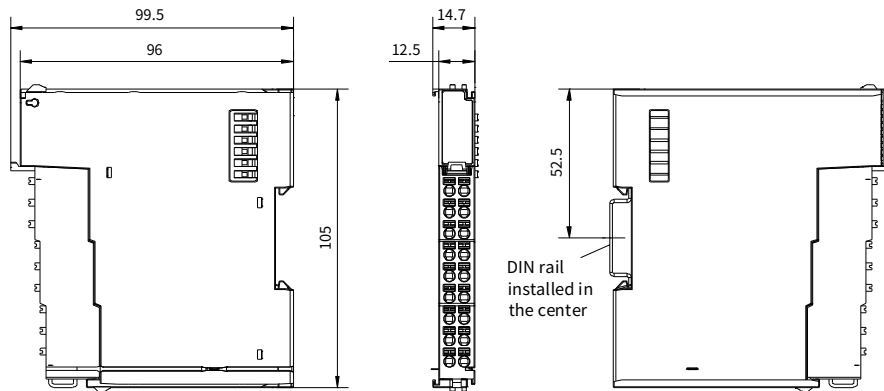


## 4.2.2 I/O module

### 4.2.2.1 Module installation dimensions

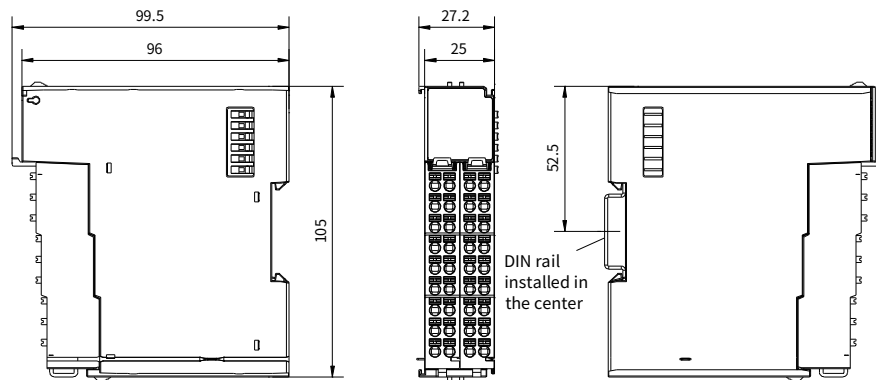
The dimensions are applicable to FL1001, FL2002, FL2102, FL3003, FL3103, FL3203, and FL4003.

Figure 4-5 Module installation dimensions set 1 (unit: mm)



The dimensions are applicable to FL1002, FL2003, FL2103, FL2201, FL5005, and FL5105.

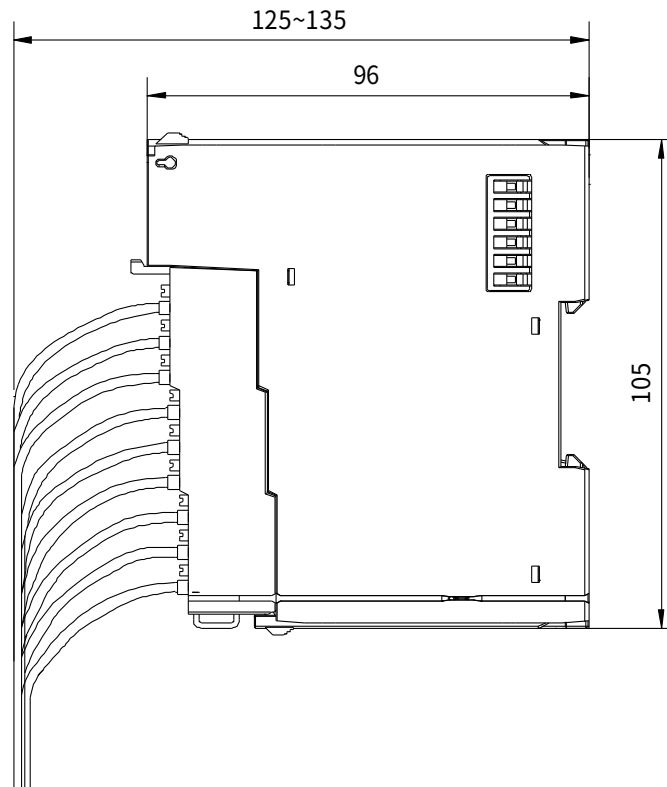
Figure 4-6 Module installation dimensions set 2 (unit: mm)



#### 4.2.2.2 Connection cable dimensions

The dimensions are applicable to all I/O module models.

Figure 4-7 Connection cable dimensions (unit: mm)

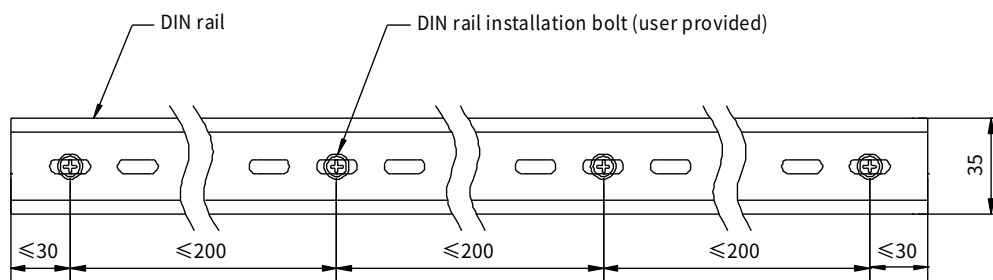


### 4.3 DIN rail model selection

You can refer to the following table to select the applicable DIN rail model.

| Model      | Length x Depth (unit: mm) | Fixing screw |
|------------|---------------------------|--------------|
| TH35-7.5Fe | 35×7.5                    | M4           |
| TH35-7.5A1 | 35×7.5                    | M4           |
| TH35-15Fe  | 35×15                     | M4           |

Figure 4-8 DIN rail installation dimensions (unit: mm)

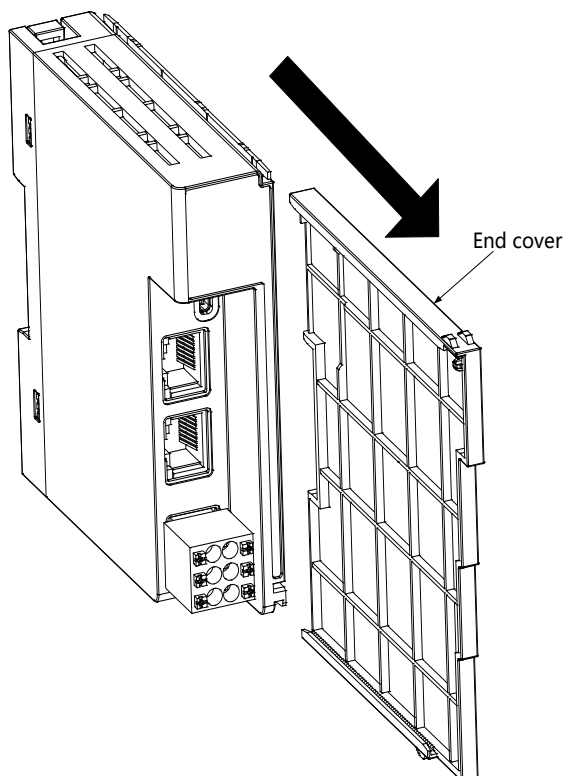


**Note:** To ensure the strength of the DIN rail, install the DIN rail installation bolts (provided by yourself) at the places within 30mm from both ends of the DIN rail, (for details, see Figure 4-8), and ensure that the interval between two adjacent bolts must be within 200mm.

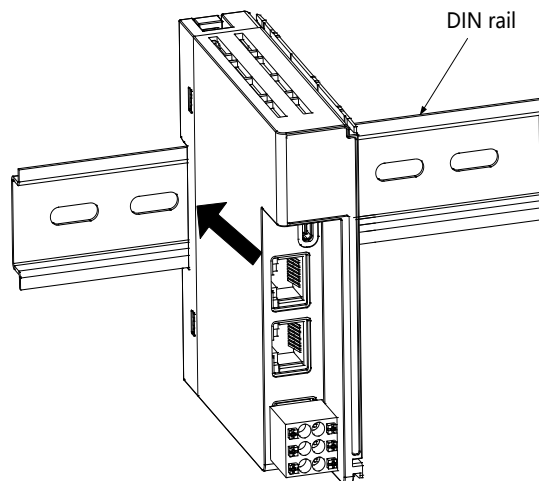
### 4.4 Installation

The installation procedure is as follows:

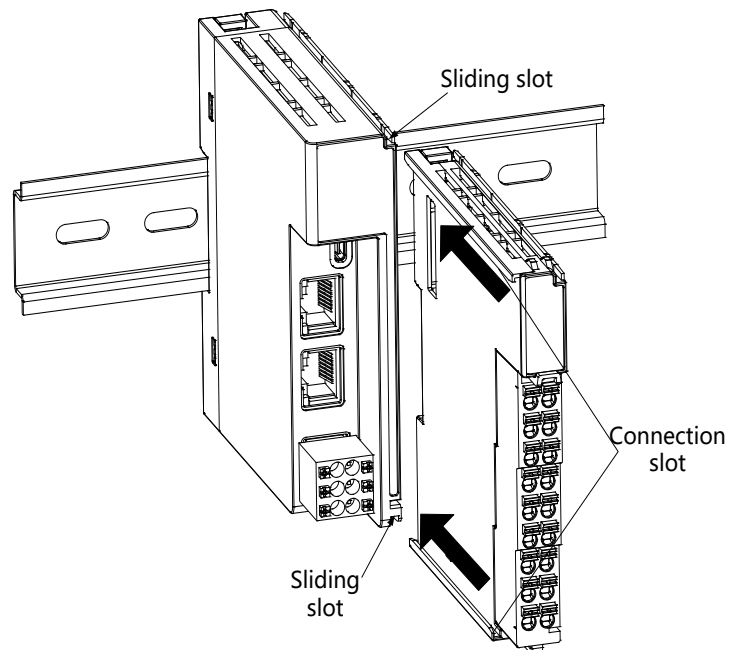
Step 1 Slide the right end cover of the communication coupler forward and remove it.



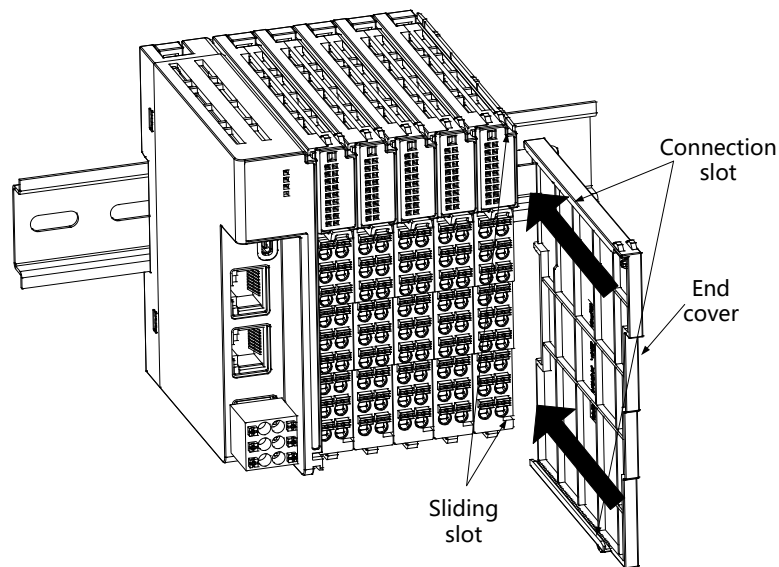
Step 2 Align the communication coupler module with the DIN rail and press inward until the module engages with the DIN rail (there is a noticeable sound of engagement when installed in place).



Step 3 Align the module with the connection rail with the sliding rail of the module fixed on the DIN rail, and push it inward until the module with the connection rail engages with the DIN rail (there is a noticeable sound of engagement when installed in place).

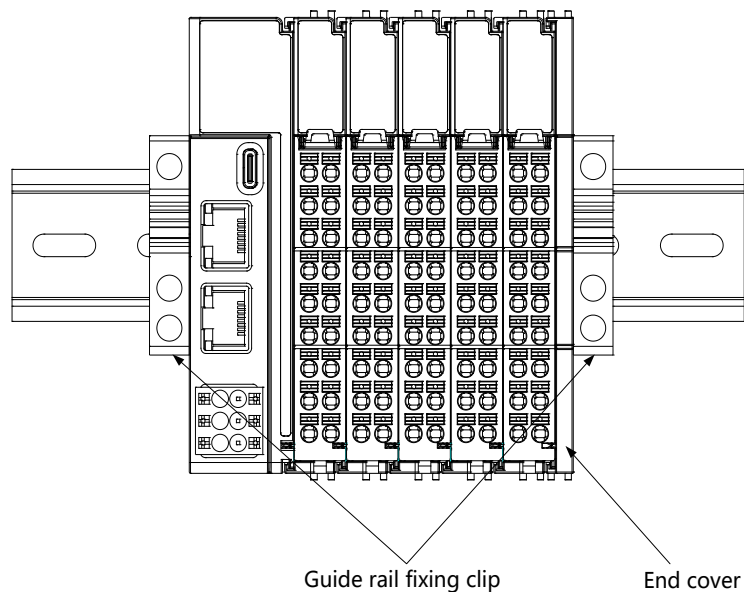


Step 4 Slide the end cover with the connection rail onto the last I/O module.



**Note:** The metal pins on the last I/O module must not be exposed outside.

Step 5 Install a guide rail fixing clip at the head and tail of the module assembly to prevent it from sliding leftward or rightward.



**Note:**

- Before installing the module, remove the end cover before proceeding with the next step. Install the end cover on the rightmost module.
- After the module installation is completed, the rail latch will automatically lock. If the rail latch is not locked with the DIN rail, press the top of the latch towards the rail to ensure proper installation.
- The rail fixing clip is user purchased.



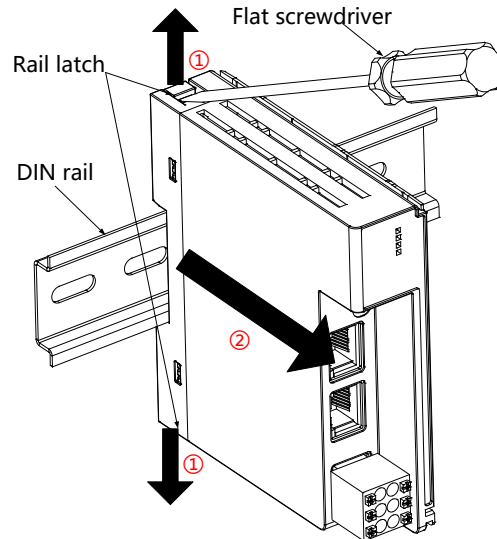
## 4.5 Disassembly

The disassembly procedure is as follows:

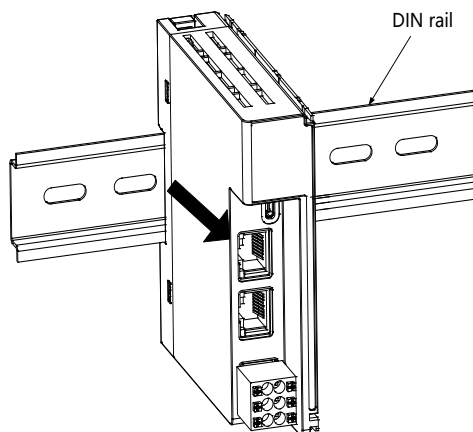
Step 1 Loosen the rail fixing clip to ensure that there is sufficient clearance to pull away the module from the DIN rail.

 **Note:** The rail fixing clip is user purchased.

Step 2 Use a flat screwdriver or other similar tool to pry up the upper and lower rail latches separately.



Step 3 Pull the module out in the direction perpendicular to the DIN rail.



 **Note:** Refer to step 1 in section 4.4 Installation.

## 5 Wiring

### 5.1 Wiring requirements

- Before wiring, ensure that all external power supplies have been cut off.
- After completing the wiring, ensure the module top end cover has been installed properly before powering on or operating the module. Otherwise, electric shock or maloperation can result.
- Before wiring, check the rated voltage and terminal configuration according to product specifications to ensure safe wiring. The connection to a power supply that does not match the ratings or incorrect product wiring may cause serious accidents such as fire and product damage.
- Tighten up screws according to specified torque. If screws are loose, short circuit, fire, or maloperation may result.

 **Note:** If terminal screws are overly tightened, screw or module damage, falling, short circuit, or faults may result.

- Ensure that there are no metal chips or leftover wires or other foreign objects in each module. The foreign objects may cause short circuit, fire, or maloperation.

### 5.2 Grounding requirements

#### ■ Power cable grounding

- ✧ Use correct, independent wiring methods.
- ✧ Connect a cable with the cross-sectional area  $\geq 2\text{mm}^2$  and length  $\leq 30\text{cm}$  for grounding, and ground the power supply module terminal .
- ✧ If the grounding point is close to the product, ensure that the grounding cable is secure.

#### ■ Shielded cable grounding

- ✧ Use shielded cables for analog I/O, RS485, and EtherCAT cables and other cables that transmit sensitive signals.
- ✧ The grounding point should be as close as possible to the module.
- ✧ For the shield part exposed after some of the shield cable is stripped, ground the part and the conductive backplane with an area as large as possible to ensure good contact.

### 5.3 Cable specifications

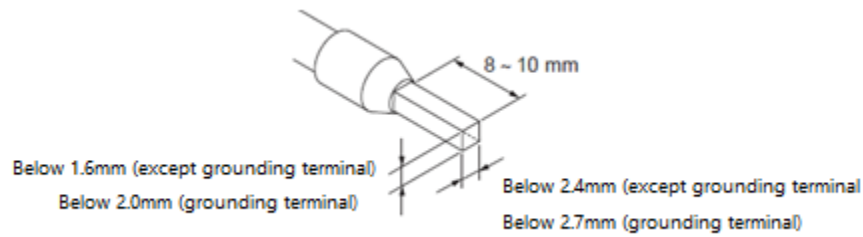
| Cable material    | Cable diameter  |     | Crimping tool                |
|-------------------|-----------------|-----|------------------------------|
|                   | mm <sup>2</sup> | AWG |                              |
| Tubular cable lug | 0.3             | 22  | Use a proper crimping plier. |
|                   | 0.5             | 20  |                              |
|                   | 0.75            | 18  |                              |
|                   | 1.0             | 18  |                              |
|                   | 1.5             | 16  |                              |

 **Note:**

- The cable diameters of the tubular cable lugs in the preceding table are only for reference, which can

be adjusted based on actual situations.

- When using other tubular cable lugs, crimp multiple strands of cable, and the processing size requirements are as follows:



### 5.3.1 Digital output module (Source type)

### 5.3.2 Digital output module (Sink type)

### 5.3.3 Digital output module (Relay)

### 5.3.4 Analog input module

### 5.3.5 Analog output module

### 5.3.6 Temperature detection module (Thermal resistor)

### 5.3.7 Temperature detection module (Thermocouple)

### 5.3.8 Hybrid module

# 6 Communication coupler configuration

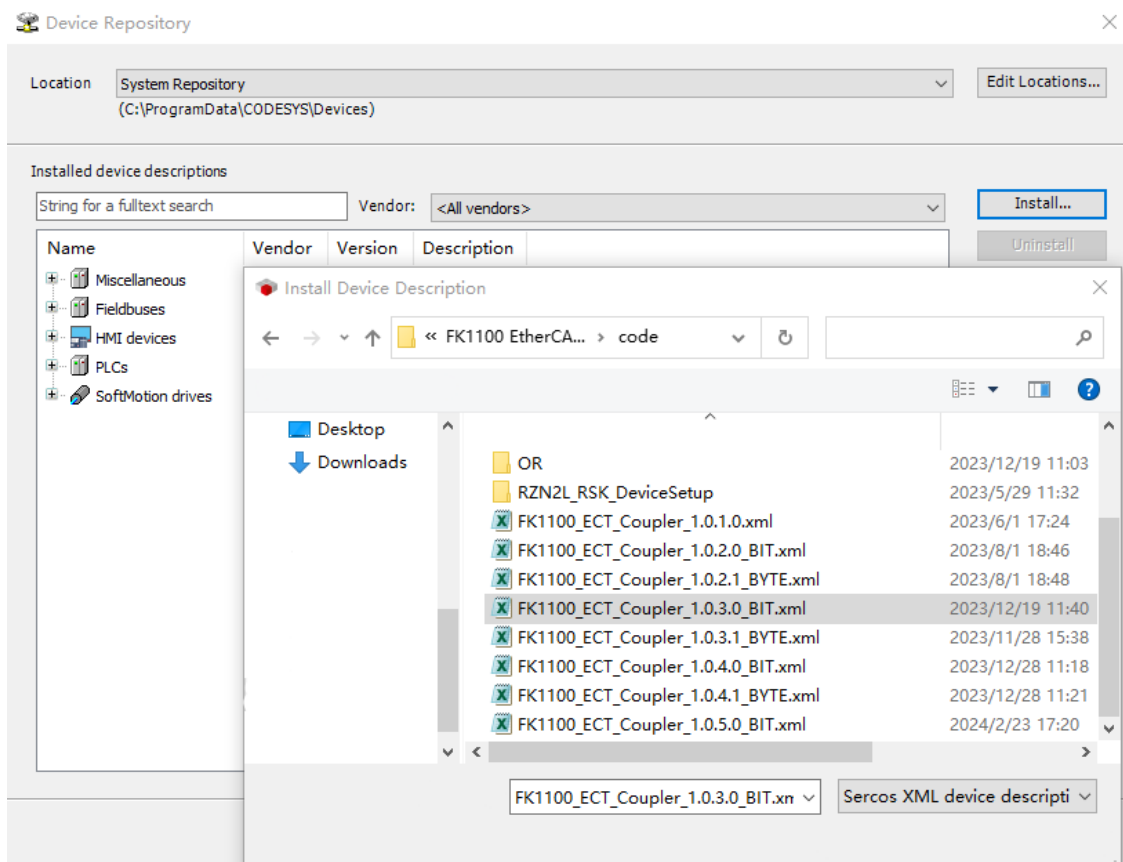
## 6.1 EtherCAT configuration

### 6.1.1 CODESYS configuration

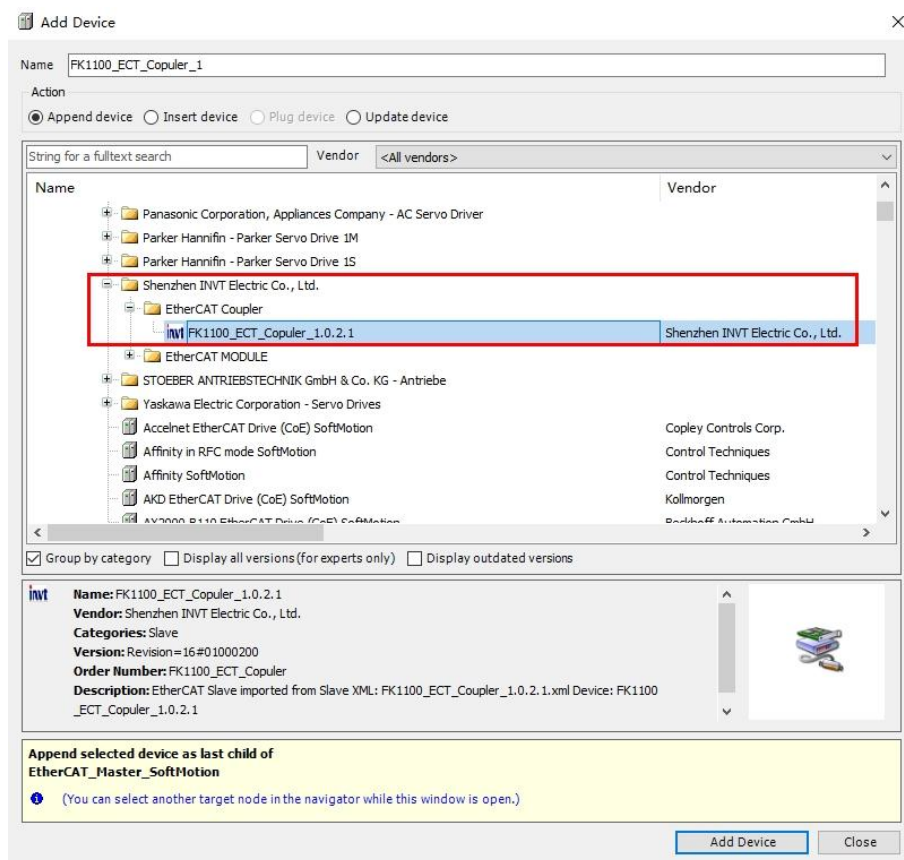
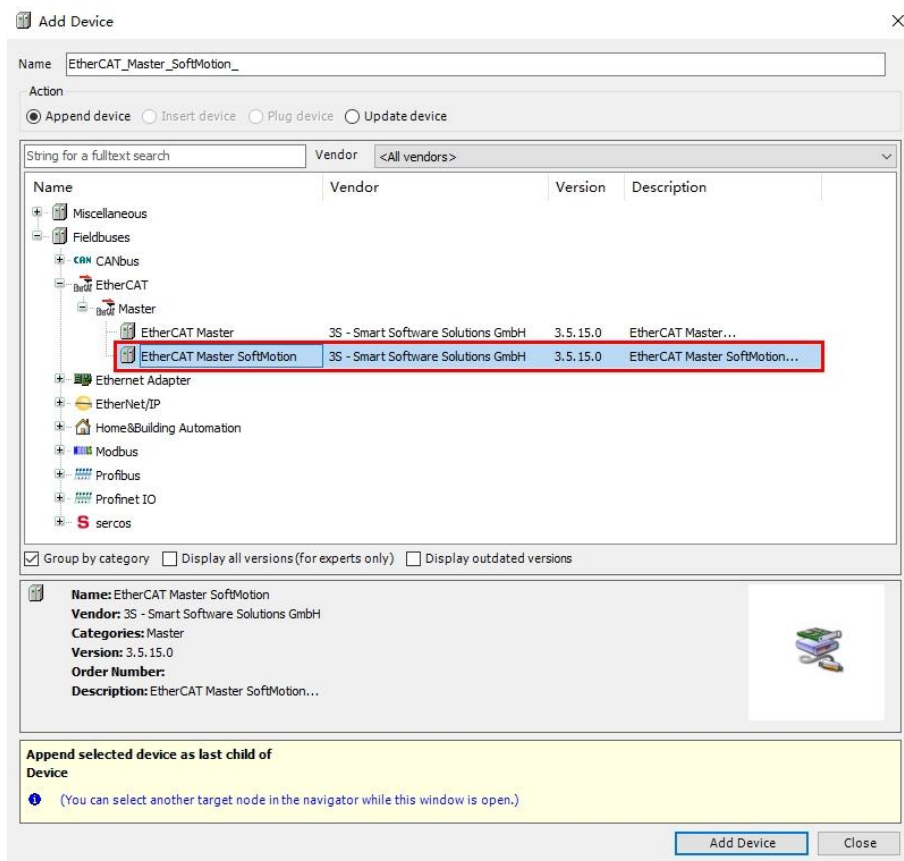
#### 6.1.1.1 EtherCAT communication coupler

##### 1. Device import

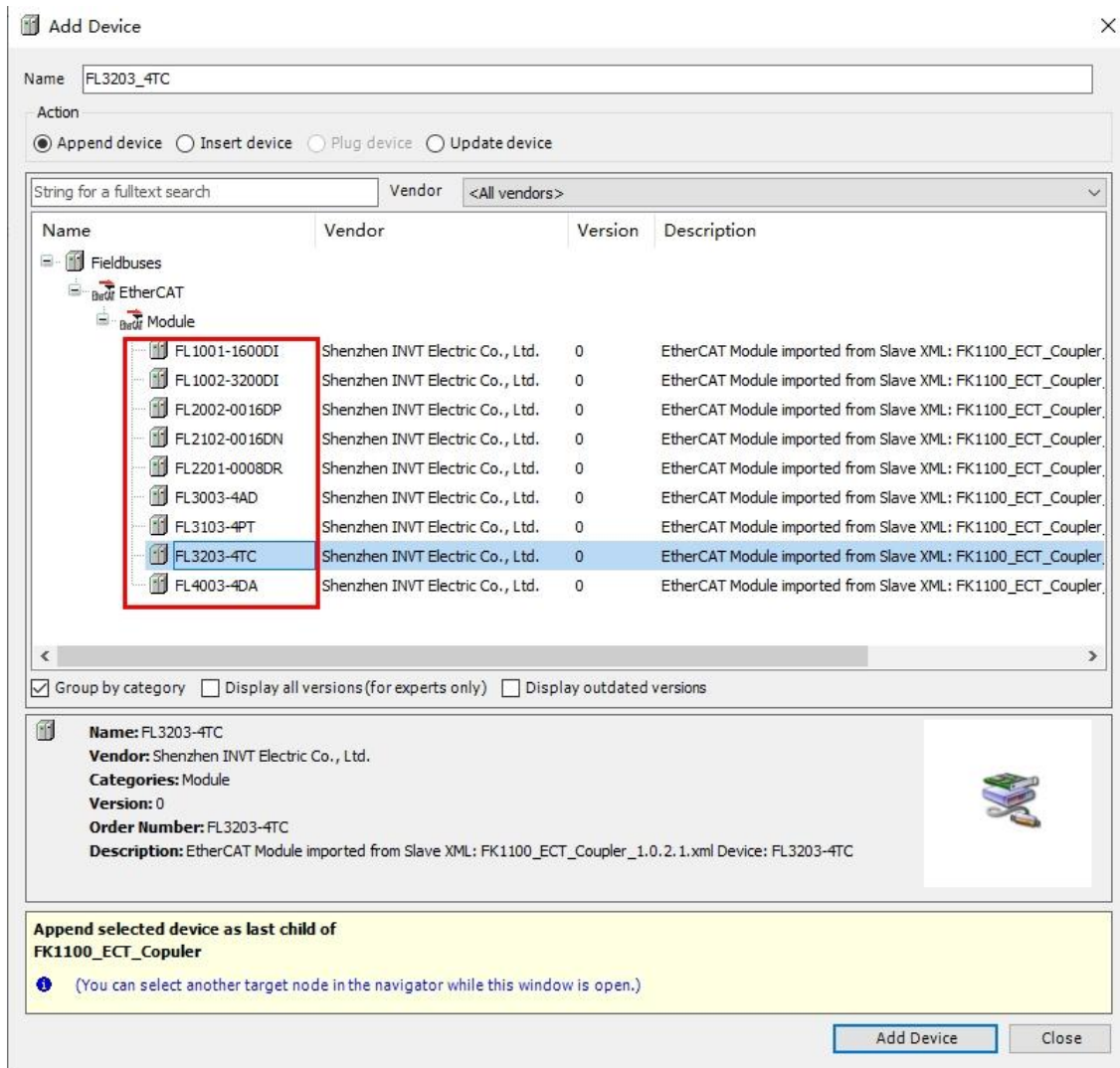
Step 1 Install the device description file named in the format of "FK1100\_ECT\_Coupler\_x.x.x.x.xml".



## Step 2 Create a project, add the master and slave devices.



## Step 3 Add module network configuration based on actual physical configuration (module connection).



Step 4 After completing the module network configuration, set all configuration module parameters. Once compiled, the program can be downloaded and run.

Step 5 (Optional) Enable or disable the module based on actual needs.

## 2. Parameter description

| Parameter                 | Type  | Description                                                                                                                                                                                       |       |                    |      |                     |     |                    |
|---------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------|------|---------------------|-----|--------------------|
| Module Enable             | UDINT | Control bit of expansion module enabling/disabling.<br>Bit that controls the enabling/disabling of the expansion module behind the coupler. Each bit controls the enabling/disabling of a module. |       |                    |      |                     |     |                    |
|                           |       | <table><tr><th>Bit31</th><th>...</th><th>Bit0</th></tr><tr><td>Controls module 32.</td><td>...</td><td>Controls module 1.</td></tr></table>                                                       | Bit31 | ...                | Bit0 | Controls module 32. | ... | Controls module 1. |
|                           |       | Bit31                                                                                                                                                                                             | ...   | Bit0               |      |                     |     |                    |
|                           |       | Controls module 32.                                                                                                                                                                               | ...   | Controls module 1. |      |                     |     |                    |
|                           |       | TRUE: Enable. FALSE: Disable.                                                                                                                                                                     |       |                    |      |                     |     |                    |
| Coupler Info.ActNum       | UINT  | Number of connected expansion modules.                                                                                                                                                            |       |                    |      |                     |     |                    |
| Coupler Info.HW Version   | UINT  | Coupler hardware version number.                                                                                                                                                                  |       |                    |      |                     |     |                    |
| Coupler Info.SW Version   | USINT | Coupler software version number.                                                                                                                                                                  |       |                    |      |                     |     |                    |
| Coupler Info.FPGA Version | USINT | Coupler FPGA software version number.                                                                                                                                                             |       |                    |      |                     |     |                    |

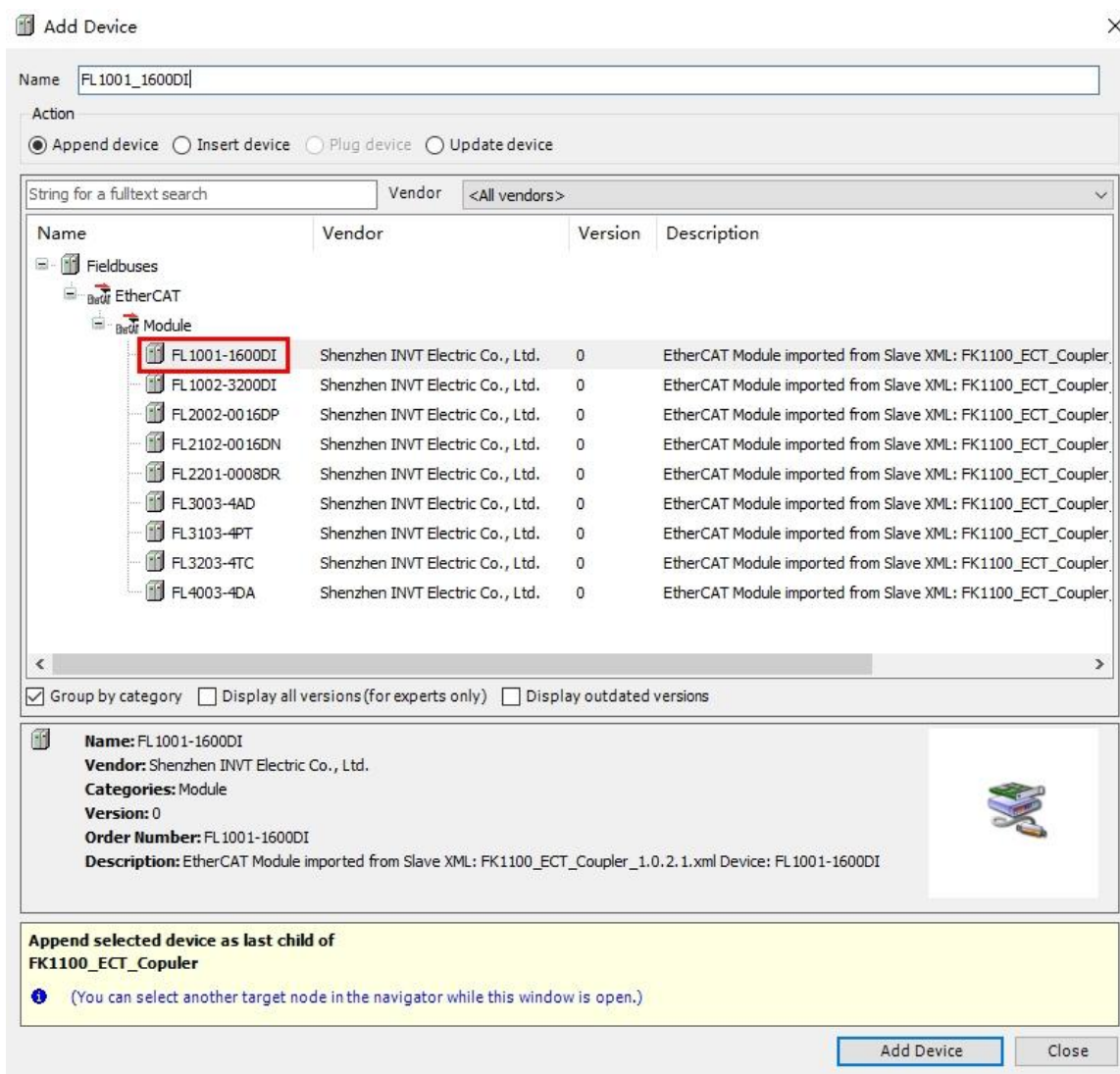
| Parameter                                | Type  | Description                |
|------------------------------------------|-------|----------------------------|
| Detected Module Ident List               | -     | Detection module ID list.  |
| Detected Module Ident List .SubIndex 001 | UDINT | ID of 1st module detected  |
| Detected Module Ident List .SubIndex 002 | UDINT | ID of 2nd module detected  |
| ...                                      | ...   | ...                        |
| Detected Module Ident List .SubIndex 032 | UDINT | ID of 32nd module detected |

### 6.1.1.2 Digital input module

The following takes FL1001 as an example, while FL1002 is set up in a similar way and will not be described in detail here.

#### 1. Device import

Step 1 Add the FL1001-1600DI device.



Step 2 Set the filtering parameters. The digital input module divides every 8 points into a group, and different filtering parameters can be set for each group. Adjust the port filtering mode in the startup parameters according to actual needs, with a unit of 10μs and a default value of 10ms.

| Startup Parameters |                |              |       |            |                          |                          |           |              |
|--------------------|----------------|--------------|-------|------------|--------------------------|--------------------------|-----------|--------------|
| Module I/O Mapping |                |              |       |            |                          |                          |           |              |
| Line               | Index:Subindex | Name         | Value | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line | Comment      |
| 1                  | 16#8001:16#01  | 1600DI Filt0 | 1000  | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 1600DI Filt0 |
| 2                  | 16#8001:16#02  | 1600DI Filt1 | 1000  | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 1600DI Filt1 |



Step 3 Define *ibButton1* and *ibButton2* of the BOOL type in the program.

```

VAR
  ibButton1    : BOOL;
  ibButton2    : BOOL;

END_VAR

```

Step 4 Choose **Module I/O Mapping**, map *ibButton1* and *ibButton2* to the corresponding input points. You just need to use mapped variables in the program.

| Startup Parameters | Find                          | Filter  | Show all |         |      |      |             |
|--------------------|-------------------------------|---------|----------|---------|------|------|-------------|
| Module I/O Mapping |                               |         |          |         |      |      |             |
| Module IEC Objects |                               |         |          |         |      |      |             |
| Information        |                               |         |          |         |      |      |             |
|                    | Variable                      | Mapping | Channel  | Address | Type | Unit | Description |
|                    |                               |         | ErrId    | %IW8    | UINT |      | ErrId       |
|                    |                               |         | I0       | %IX18.0 | BIT  |      | I0          |
|                    | Application.PLC_PRG.ibButton1 |         | I1       | %IX18.1 | BIT  |      | I1          |
|                    | Application.PLC_PRG.ibButton2 |         | I2       | %IX18.2 | BIT  |      | I2          |
|                    |                               |         | I3       | %IX18.3 | BIT  |      | I3          |
|                    |                               |         | I4       | %IX18.4 | BIT  |      | I4          |
|                    |                               |         | I5       | %IX18.5 | BIT  |      | I5          |
|                    |                               |         | I6       | %IX18.6 | BIT  |      | I6          |
|                    |                               |         | I7       | %IX18.7 | BIT  |      | I7          |
|                    |                               |         | I10      | %IX19.0 | BIT  |      | I10         |
|                    |                               |         | I11      | %IX19.1 | BIT  |      | I11         |
|                    |                               |         | I12      | %IX19.2 | BIT  |      | I12         |
|                    |                               |         | I13      | %IX19.3 | BIT  |      | I13         |
|                    |                               |         | I14      | %IX19.4 | BIT  |      | I14         |
|                    |                               |         | I15      | %IX19.5 | BIT  |      | I15         |
|                    |                               |         | I16      | %IX19.6 | BIT  |      | I16         |
|                    |                               |         | I17      | %IX19.7 | BIT  |      | I17         |

## 2. Parameter description

### • FL1001

| Parameter                 | Type | Description                           |
|---------------------------|------|---------------------------------------|
| Filt0                     | UINT | Filter parameters I0–I7. Unit: 10μs   |
| Filt1                     | UINT | Filter parameters I10–I17. Unit: 10μs |
| ErrId                     | UINT | Fault code                            |
| I0                        | BIT  | I0 status feedback                    |
| I1                        | BIT  | I1 status feedback                    |
| ...                       | ...  | ...                                   |
| I17                       | BIT  | I17 status feedback                   |
| Module Info. HW Version   | UINT | Module hardware version number        |
| Module Info. FPGA Version | UINT | Module FPGA software version number   |

### • FL1002

| Parameter | Type | Description                           |
|-----------|------|---------------------------------------|
| Filt0     | UINT | Filter parameters I0–I7. Unit: 10μs   |
| Filt1     | UINT | Filter parameters I10–I17. Unit: 10μs |
| Filt2     | UINT | Filter parameters I20–I27. Unit: 10μs |
| Filt3     | UINT | Filter parameters I30–I37. Unit: 10μs |
| ErrId     | UINT | Fault code                            |
| I0        | BIT  | I0 status feedback                    |
| I1        | BIT  | I1 status feedback                    |
| ...       | ...  | ...                                   |



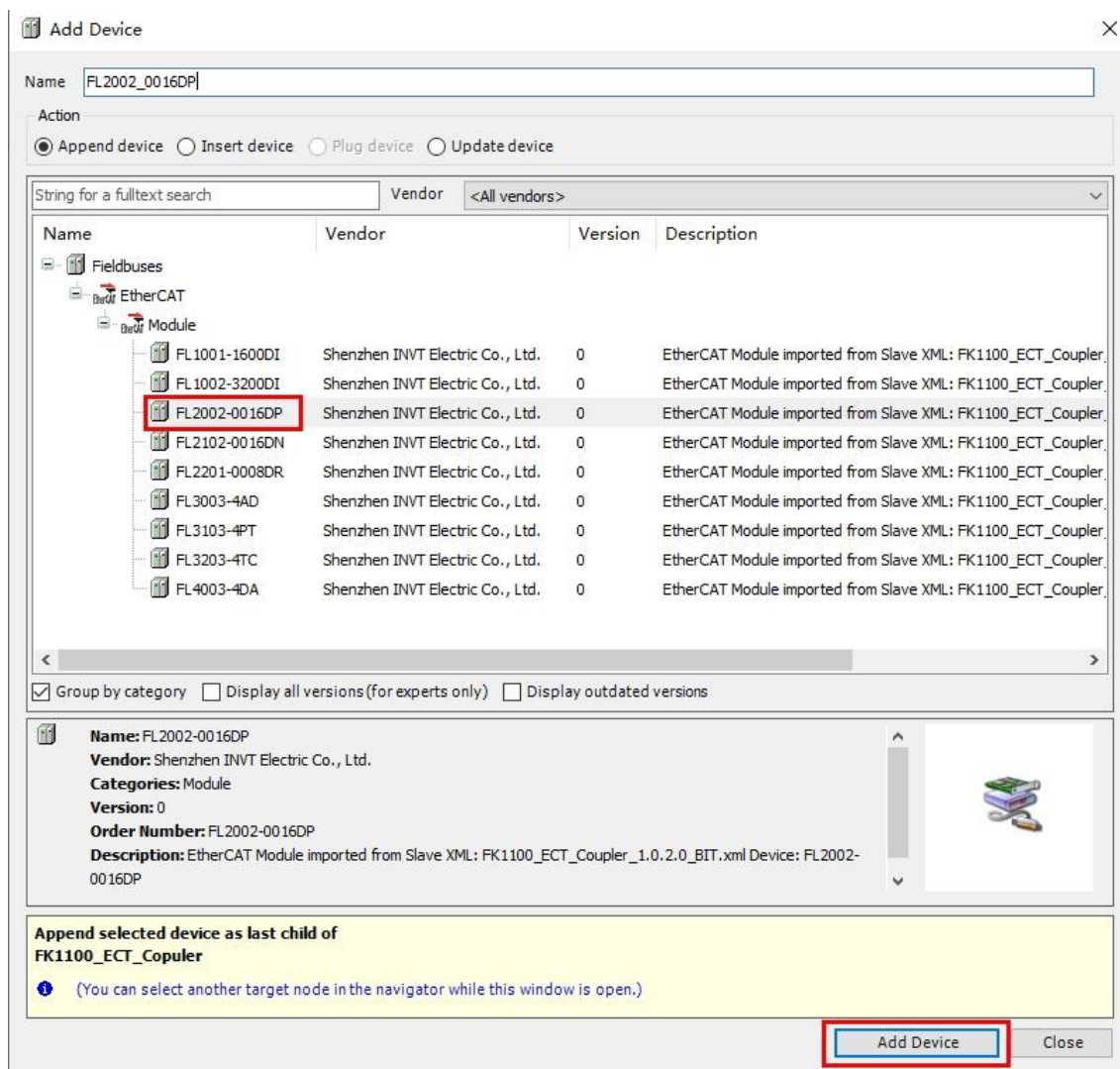
| Parameter                 | Type | Description                         |
|---------------------------|------|-------------------------------------|
| I37                       | BIT  | I37 status feedback                 |
| Module Info. HW Version   | UINT | Module hardware version number      |
| Module Info. FPGA Version | UINT | Module FPGA software version number |

### 6.1.1.3 Digital output module

The following takes FL2002 as an example, while the setting of the rest of the digital output modules is similar and will not be described.

#### 1. Device import

Step 1 Add the FL2002-0016DP device.



Step 2 Set the stop/offline output mode and preset value based on actual needs in the startup parameters.

| Startup Parameters |      |                |                     |       |            |                          |                          |           |
|--------------------|------|----------------|---------------------|-------|------------|--------------------------|--------------------------|-----------|
|                    | Line | Index/Subindex | Name                | Value | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line |
| Module I/O Mapping | 1    | 16#8005:16#01  | 0016DP Stop Mode0   | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         |
| Module IEC Objects | 2    | 16#8005:16#02  | 0016DP Stop Mode1   | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         |
| Information        | 3    | 16#8005:16#03  | 0016DP Stop Output0 | 0     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         |
|                    | 4    | 16#8005:16#04  | 0016DP Stop Output1 | 0     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         |

The digital output module divides every eight channels into a group. The following takes Stop Mode0 configuration as an example. The corresponding output channels are Q0–Q7. The data type of Stop Mode0 is UINT, with every two bits defining an output stop mode. Please refer to the following table for detailed data

description.

| Q7    |       | Q6    |       | Q5    |       | Q4   |      | Q3   |      | Q2   |      | Q1   |      | Q0   |      |
|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|
| bit15 | bit14 | bit13 | bit12 | bit11 | bit10 | bit9 | bit8 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |

The two-digit value of the corresponding output channel represents the output mode as follows:

| Value | Mode                         |
|-------|------------------------------|
| 0b00  | Stop/offline output retained |
| 0b01  | Stop/offline output cleared  |
| 0b10  | Stop/offline output preset   |

For example: Q0 is set to stop/offline output retention; Q1 is set to stop/offline output clearing; Q2–Q7 are all set to stop/offline output preset, then the value of Stop Mode0 is 43684, that is, 2#1010101010100100.

| Q7 |   | Q6 |   | Q5 |   | Q4 |   | Q3 |   | Q2 |   | Q1 |   | Q0 |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | 0 | 1  | 0 | 1  | 0 | 1  | 0 | 1  | 0 | 1  | 0 | 0  | 1 | 0  | 0 |

Step 3 Define BOOL type variables *obCylinder1* and *obCylinder2* in the program.

```
VAR
obCylinder1   : BOOL;
obCylinder2   : BOOL;

END_VAR
```

Step 4 Choose **Module I/O Mapping**, map *obCylinder1* and *obCylinder2* to the corresponding output points. You just need to use mapped variables in the program.

Startup Parameters

Module I/O Mapping

Module IEC Objects

Information

Find

Filter

Show all

+ Add FB for

| Variable                                                                                                            | Mapping                                                                             | Channel | Address                                                                                       | Type | Unit | Description |
|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------|------|------|-------------|
|                                                                                                                     |                                                                                     | Q0      |  %QX58.0 | BIT  |      | Q0          |
|  Application.PLC_PRG.obCylinder1 |  | Q1      | <del>%QX58.1</del>                                                                            | BIT  |      | Q1          |
|  Application.PLC_PRG.obCylinder2 |  | Q2      | <del>%QX58.2</del>                                                                            | BIT  |      | Q2          |
|                                  |                                                                                     | Q3      | %QX58.3                                                                                       | BIT  |      | Q3          |
|                                  |                                                                                     | Q4      | %QX58.4                                                                                       | BIT  |      | Q4          |
|                                  |                                                                                     | Q5      | %QX58.5                                                                                       | BIT  |      | Q5          |
|                                  |                                                                                     | Q6      | %QX58.6                                                                                       | BIT  |      | Q6          |
|                                  |                                                                                     | Q7      | %QX58.7                                                                                       | BIT  |      | Q7          |
|                                  |                                                                                     | Q10     | %QX59.0                                                                                       | BIT  |      | Q10         |
|                                  |                                                                                     | Q11     | %QX59.1                                                                                       | BIT  |      | Q11         |
|                                  |                                                                                     | Q12     | %QX59.2                                                                                       | BIT  |      | Q12         |
|                                  |                                                                                     | Q13     | %QX59.3                                                                                       | BIT  |      | Q13         |
|                                  |                                                                                     | Q14     | %QX59.4                                                                                       | BIT  |      | Q14         |
|                                  |                                                                                     | Q15     | %QX59.5                                                                                       | BIT  |      | Q15         |
|                                  |                                                                                     | Q16     | %QX59.6                                                                                       | BIT  |      | Q16         |
|                                  |                                                                                     | Q17     | %QX59.7                                                                                       | BIT  |      | Q17         |
|                                  |                                                                                     | ErrId   | %IW13                                                                                         | UINT |      | ErrId       |

## 2. Parameter description

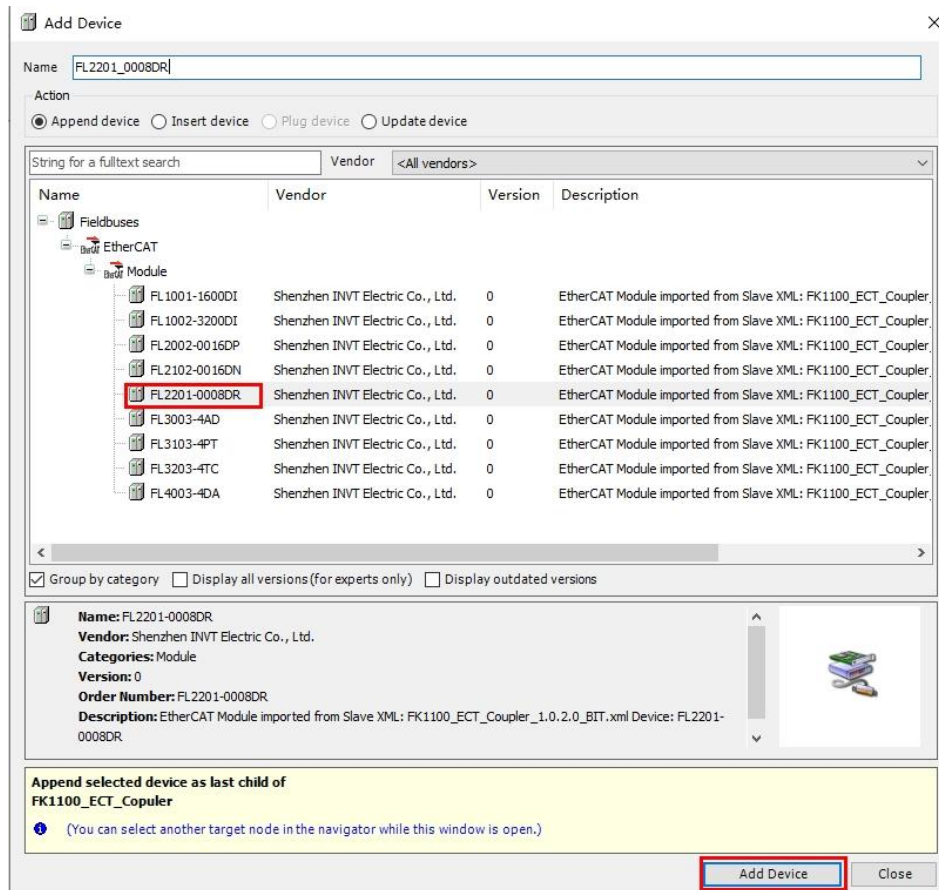
| Parameter                                         | Type | Description                                                                                                                                                                                                                            |       |     |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|---------------------------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|-----|------|------|------|------|--|-------|-------|-----|-----|------|------|------|------|
| Stop Mode0                                        | UINT | Stop/offline output mode:                                                                                                                                                                                                              |       |     |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |      | <table><tr><th colspan="2">Q7</th><th colspan="2">...</th><th colspan="2">Q1</th><th colspan="2">Q0</th></tr><tr><td>Bit15</td><td>Bit14</td><td>...</td><td>...</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr></table> | Q7    |     | ... |      | Q1   |      | Q0   |  | Bit15 | Bit14 | ... | ... | Bit3 | Bit2 | Bit1 | Bit0 |
|                                                   |      | Q7                                                                                                                                                                                                                                     |       | ... |     | Q1   |      | Q0   |      |  |       |       |     |     |      |      |      |      |
|                                                   |      | Bit15                                                                                                                                                                                                                                  | Bit14 | ... | ... | Bit3 | Bit2 | Bit1 | Bit0 |  |       |       |     |     |      |      |      |      |
|                                                   |      | 0b00: Stop/offline output retained                                                                                                                                                                                                     |       |     |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| 0b01: Stop/offline output cleared                 |      |                                                                                                                                                                                                                                        |       |     |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| 0b10: Stop/offline output according to the preset |      |                                                                                                                                                                                                                                        |       |     |     |      |      |      |      |  |       |       |     |     |      |      |      |      |

| Parameter                                         | Type  | Description                                                                                                                                                                                                                               |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|---------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|-----|------|------|------|------|--|-------|-------|-----|-----|------|------|------|------|
| Stop Mode1                                        | UINT  | Stop/offline output mode                                                                                                                                                                                                                  |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |       | <table><tr><td colspan="2">Q17</td><td colspan="2">...</td><td colspan="2">Q11</td><td colspan="2">Q10</td></tr><tr><td>Bit15</td><td>Bit14</td><td>...</td><td>...</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr></table> | Q17   |      | ... |      | Q11  |      | Q10  |  | Bit15 | Bit14 | ... | ... | Bit3 | Bit2 | Bit1 | Bit0 |
|                                                   |       | Q17                                                                                                                                                                                                                                       |       | ...  |     | Q11  |      | Q10  |      |  |       |       |     |     |      |      |      |      |
|                                                   |       | Bit15                                                                                                                                                                                                                                     | Bit14 | ...  | ... | Bit3 | Bit2 | Bit1 | Bit0 |  |       |       |     |     |      |      |      |      |
|                                                   |       | 0b00: Stop/offline output retained                                                                                                                                                                                                        |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| 0b01: Stop/offline output cleared                 |       |                                                                                                                                                                                                                                           |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| 0b10: Stop/offline output according to the preset |       |                                                                                                                                                                                                                                           |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Stop Output0                                      | USINT | Preset value of stop/offline output:                                                                                                                                                                                                      |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |       | <table><tr><td colspan="2">Q7</td><td colspan="2">...</td><td colspan="2">Q1</td><td colspan="2">Q0</td></tr><tr><td colspan="2">Bit7</td><td colspan="2">...</td><td colspan="2">Bit1</td><td colspan="2">Bit0</td></tr></table>         | Q7    |      | ... |      | Q1   |      | Q0   |  | Bit7  |       | ... |     | Bit1 |      | Bit0 |      |
|                                                   |       | Q7                                                                                                                                                                                                                                        |       | ...  |     | Q1   |      | Q0   |      |  |       |       |     |     |      |      |      |      |
| Bit7                                              |       | ...                                                                                                                                                                                                                                       |       | Bit1 |     | Bit0 |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |       |                                                                                                                                                                                                                                           |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Stop Output1                                      | USINT | Preset value of stop/offline output:                                                                                                                                                                                                      |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |       | <table><tr><td colspan="2">Q17</td><td colspan="2">...</td><td colspan="2">Q11</td><td colspan="2">Q10</td></tr><tr><td colspan="2">Bit7</td><td colspan="2">...</td><td colspan="2">Bit1</td><td colspan="2">Bit0</td></tr></table>      | Q17   |      | ... |      | Q11  |      | Q10  |  | Bit7  |       | ... |     | Bit1 |      | Bit0 |      |
|                                                   |       | Q17                                                                                                                                                                                                                                       |       | ...  |     | Q11  |      | Q10  |      |  |       |       |     |     |      |      |      |      |
| Bit7                                              |       | ...                                                                                                                                                                                                                                       |       | Bit1 |     | Bit0 |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |       |                                                                                                                                                                                                                                           |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Q0                                                | BIT   | Q0 output control                                                                                                                                                                                                                         |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Q1                                                | BIT   | Q1 output control                                                                                                                                                                                                                         |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| ...                                               | ...   | ...                                                                                                                                                                                                                                       |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Q17                                               | BIT   | Q17 Output control                                                                                                                                                                                                                        |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| ErrId                                             | UINT  | Fault ID                                                                                                                                                                                                                                  |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Module Info. HW Version                           | UINT  | Module hardware version number                                                                                                                                                                                                            |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Module Info. FPGA Version                         | UINT  | Module FPGA software version number                                                                                                                                                                                                       |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |

#### 6.1.1.4 Digital output module (Relay)

##### 1. Device import

Step 1 Add the FL2201-0008DR device.



Step 2 Set the stop/offline output mode and preset value based on actual needs in the startup parameters.

| Startup Parameters                                                                                                                                                                                                                      |      |                |                    |       |            |                          |                          |           |                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------|--------------------|-------|------------|--------------------------|--------------------------|-----------|--------------------|
| <div> <div> <div>+</div> <div>Add</div> </div> <div> <div>✎</div> <div>Edit</div> </div> <div> <div>✕</div> <div>Delete</div> </div> <div> <div>↕</div> <div>Move Up</div> </div> <div> <div>↕</div> <div>Move Down</div> </div> </div> |      |                |                    |       |            |                          |                          |           |                    |
| Module I/O Mapping                                                                                                                                                                                                                      | Line | Index:Subindex | Name               | Value | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line | Comment            |
| Module IEC Objects                                                                                                                                                                                                                      | 1    | 16#8004:16#01  | 0008DR Stop Mode   | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 0008DR Stop Mode   |
|                                                                                                                                                                                                                                         | 2    | 16#8004:16#02  | 0008DR Stop Output | 0     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 0008DR Stop Output |

**Note:** The setting method in this part is similar to the setting in step 2 in 6.1.1.3 Digital output module, and will not be described.

Step 3 Define BOOL type variables obCylinder1 and obCylinder2 in the program.

```

VAR
obCylinder1    : BOOL;
obCylinder2    : BOOL;

END_VAR

```

Step 4 Choose **Module I/O Mapping**, map *obCylinder1* and *obCylinder2* to the corresponding output points. You just need to use mapped variables in the program.

|                                                                                                      |                                 |         |         |         |      |      |             |
|------------------------------------------------------------------------------------------------------|---------------------------------|---------|---------|---------|------|------|-------------|
| Startup Parameters                                                                                   |                                 |         |         |         |      |      |             |
| Find <input type="text"/> Filter <input type="text"/> Show all <input type="button" value="Add FB"/> |                                 |         |         |         |      |      |             |
| Module I/O Mapping                                                                                   | Variable                        | Mapping | Channel | Address | Type | Unit | Description |
| Module IEC Objects                                                                                   |                                 |         | Q0      | %QX62.0 | BIT  |      | Q0          |
|                                                                                                      | Application.PLC_PRG.obCylinder1 |         | Q1      | %QX62.1 | BIT  |      | Q1          |
|                                                                                                      | Application.PLC_PRG.obCylinder2 |         | Q2      | %QX62.2 | BIT  |      | Q2          |
|                                                                                                      |                                 |         | Q3      | %QX62.3 | BIT  |      | Q3          |
|                                                                                                      |                                 |         | Q4      | %QX62.4 | BIT  |      | Q4          |
|                                                                                                      |                                 |         | Q5      | %QX62.5 | BIT  |      | Q5          |
|                                                                                                      |                                 |         | Q6      | %QX62.6 | BIT  |      | Q6          |
|                                                                                                      |                                 |         | Q7      | %QX62.7 | BIT  |      | Q7          |
|                                                                                                      |                                 |         | ErrId   | %IW15   | UINT |      | ErrId       |
|                                                                                                      |                                 |         |         |         |      |      |             |

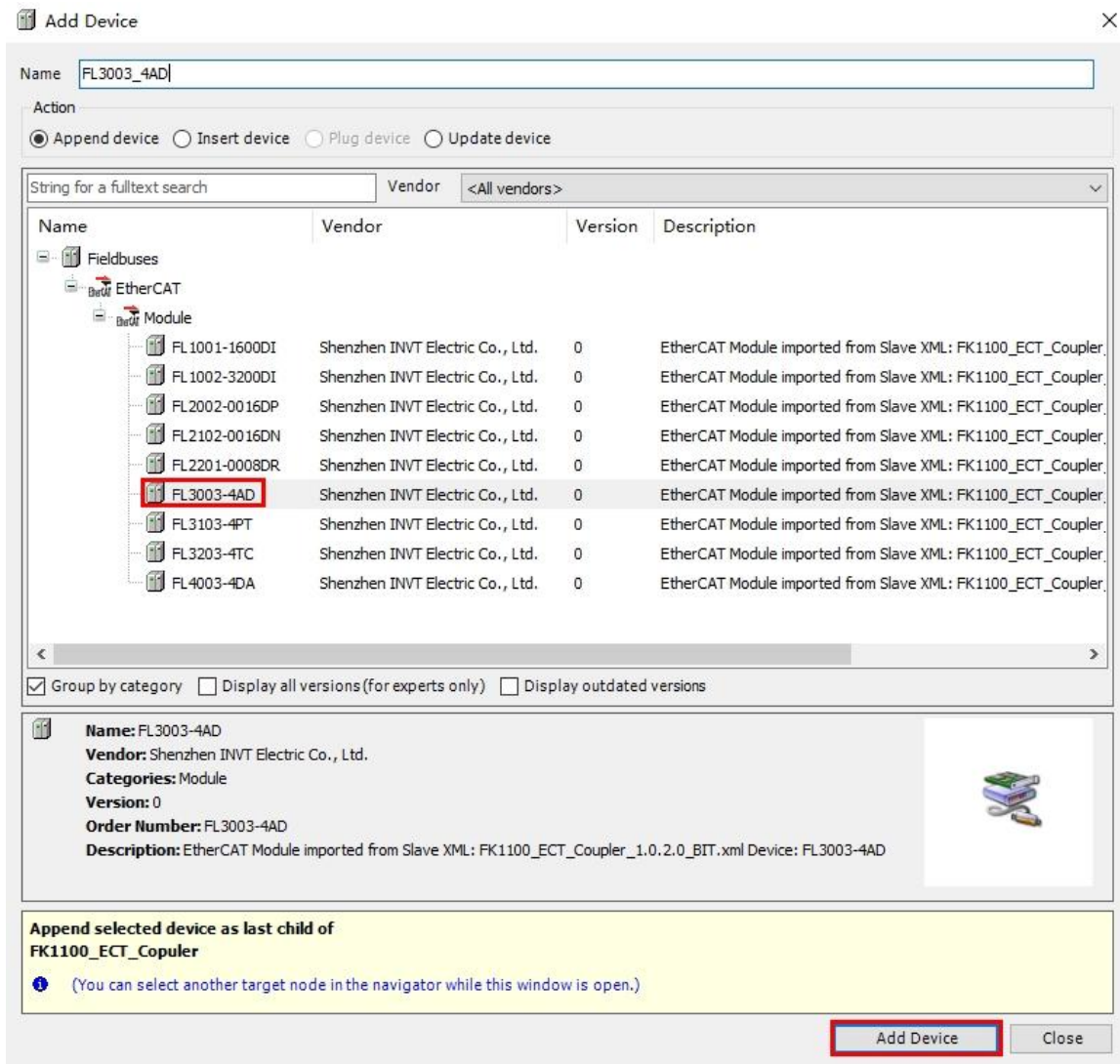
## 2. Parameter description

| Parameter                                         | Type  | Description                                                                                                                                                                                                                            |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|---------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|-----|------|------|------|------|--|-------|-------|-----|-----|------|------|------|------|
| Stop Mode                                         | UINT  | Stop/offline output mode:                                                                                                                                                                                                              |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |       | <table><tr><td colspan="2">Q7</td><td colspan="2">...</td><td colspan="2">Q1</td><td colspan="2">Q0</td></tr><tr><td>Bit15</td><td>Bit14</td><td>...</td><td>...</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr></table> | Q7    |      | ... |      | Q1   |      | Q0   |  | Bit15 | Bit14 | ... | ... | Bit3 | Bit2 | Bit1 | Bit0 |
|                                                   |       | Q7                                                                                                                                                                                                                                     |       | ...  |     | Q1   |      | Q0   |      |  |       |       |     |     |      |      |      |      |
|                                                   |       | Bit15                                                                                                                                                                                                                                  | Bit14 | ...  | ... | Bit3 | Bit2 | Bit1 | Bit0 |  |       |       |     |     |      |      |      |      |
|                                                   |       | 0b00: Stop/offline output retained                                                                                                                                                                                                     |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| 0b01: Stop/offline output cleared                 |       |                                                                                                                                                                                                                                        |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| 0b01: Stop/offline output according to the preset |       |                                                                                                                                                                                                                                        |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Stop Output                                       | USINT | Preset value of stop/offline output:                                                                                                                                                                                                   |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |       | <table><tr><td colspan="2">Q7</td><td colspan="2">...</td><td colspan="2">Q1</td><td colspan="2">Q0</td></tr><tr><td colspan="2">Bit7</td><td colspan="2">...</td><td colspan="2">Bit1</td><td colspan="2">Bit0</td></tr></table>      | Q7    |      | ... |      | Q1   |      | Q0   |  | Bit7  |       | ... |     | Bit1 |      | Bit0 |      |
|                                                   |       | Q7                                                                                                                                                                                                                                     |       | ...  |     | Q1   |      | Q0   |      |  |       |       |     |     |      |      |      |      |
| Bit7                                              |       | ...                                                                                                                                                                                                                                    |       | Bit1 |     | Bit0 |      |      |      |  |       |       |     |     |      |      |      |      |
|                                                   |       |                                                                                                                                                                                                                                        |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Q0                                                | BIT   | Q0 output control                                                                                                                                                                                                                      |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Q1–                                               | BIT   | Q1 output control                                                                                                                                                                                                                      |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| ...                                               | ...   | ...                                                                                                                                                                                                                                    |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| Q7                                                | BIT   | Q7 output control                                                                                                                                                                                                                      |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| ErrId                                             | UINT  | Fault code                                                                                                                                                                                                                             |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| HW Version                                        | UINT  | Module hardware version number                                                                                                                                                                                                         |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |
| FPGA Version                                      | UINT  | Module FPGA software version number                                                                                                                                                                                                    |       |      |     |      |      |      |      |  |       |       |     |     |      |      |      |      |

### 6.1.1.5 Analog input module

#### 1. Device import

Step 1 Add the FL3003-4AD device.



Step 2 Set the channel configuration and channel filter parameters based on actual needs in the startup parameters.

| Startup Parameters                |                |               |       |            |                          |                          |           |               |  |
|-----------------------------------|----------------|---------------|-------|------------|--------------------------|--------------------------|-----------|---------------|--|
| Add Edit Delete Move Up Move Down |                |               |       |            |                          |                          |           |               |  |
| Line                              | Index/Subindex | Name          | Value | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line | Comment       |  |
| 1                                 | 16#8015:16#01  | 4AD AI0 Cfg   | 1     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4AD AI0 Cfg   |  |
| 2                                 | 16#8015:16#02  | 4AD AI1 Cfg   | 1     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4AD AI1 Cfg   |  |
| 3                                 | 16#8015:16#03  | 4AD AI2 Cfg   | 1     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4AD AI2 Cfg   |  |
| 4                                 | 16#8015:16#04  | 4AD AI3 Cfg   | 1     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4AD AI3 Cfg   |  |
| 5                                 | 16#8015:16#05  | 4AD AI0 Filtr | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4AD AI0 Filtr |  |
| 6                                 | 16#8015:16#06  | 4AD AI1 Filtr | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4AD AI1 Filtr |  |
| 7                                 | 16#8015:16#07  | 4AD AI2 Filtr | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4AD AI2 Filtr |  |
| 8                                 | 16#8015:16#08  | 4AD AI3 Filtr | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4AD AI3 Filtr |  |

- AIx Cfg(x=0,1,2,3) is a channel configuration parameter of type USINT. Taking the configuration of channel 0 as an example, the data definitions are detailed in the following table of parameters.



| Bit7                                          | Bit6             | Bit5 | Bit4                             | Bit3                        | Bit2                                  | Bit1                                 | Bit0                     |
|-----------------------------------------------|------------------|------|----------------------------------|-----------------------------|---------------------------------------|--------------------------------------|--------------------------|
| Channel conversion mode (range configuration) |                  |      | Enhanced filter enabling control | Over-range enabling control | Over-range detection enabling control | Open-loop detection enabling control | Channel enabling control |
| 0b000: 0–5V                                   | 0b100: 4–20mA    |      |                                  |                             |                                       |                                      |                          |
| 0b001: 0–10V                                  | 0b101: 0–20mA    |      | 0: Disable                       | 0: Disable                  | 0: Disable                            | 0: Disable                           | 0: Disable               |
| 0b010: -5V–5V                                 | 0b110: Reserved  |      | 1: Enable                        | 1: Enable                   | 1: Enable                             | 1: Enable                            | 1: Enable                |
| 0b011: -10V–+10V                              | 0b111: -20–+20mA |      |                                  |                             |                                       |                                      |                          |

For example: Channel 0 is set to channel enabled, open-circuit detection disabled, over-range detection enabled, over-range enabled, enhanced filtering disabled, and the range is set to 4-20mA. The value should be 141, that is, 2#10001101. Details are as follows:

| Bit7         | Bit6 | Bit5 | Bit4       | Bit3      | Bit2      | Bit1       | Bit0      |
|--------------|------|------|------------|-----------|-----------|------------|-----------|
| 0b100        |      |      | 0          | 1         | 1         | 0          | 1         |
| 0b100:4–20mA |      |      | 0: Disable | 1: Enable | 1: Enable | 0: Disable | 1: Enable |

Range conversion:

| Measurement range | Current (I)/ Voltage (U) | Decimal (D) | Hexadecimal | Range              | Conversion formula               |
|-------------------|--------------------------|-------------|-------------|--------------------|----------------------------------|
| 0–5V              | 8.19175V                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×U/5<br>U = D×5/20000   |
|                   | 5V                       | 20000       | 0x4E20      | Rated range        |                                  |
|                   | 2.5V                     | 10000       | 0x2710      |                    |                                  |
|                   | 0V                       | 0           | 0x0000      |                    |                                  |
|                   | -2.5V                    | -10000      | 0xD8F0      |                    |                                  |
|                   | -5V                      | -20000      | 0xB1E0      |                    |                                  |
|                   | -8.19175V                | -32768      | 0x8000      |                    |                                  |
| 0–10V             | 16.3835V                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×U/10<br>U = D×10/20000 |
|                   | 10V                      | 20000       | 0x4E20      | Rated range        |                                  |
|                   | 5V                       | 10000       | 0x2710      |                    |                                  |
|                   | 0V                       | 0           | 0x0000      |                    |                                  |
|                   | -5V                      | -10000      | 0xD8F0      |                    |                                  |
|                   | -10V                     | -20000      | 0xB1E0      |                    |                                  |
|                   | -16.3835V                | -32768      | 0x8000      |                    |                                  |
| ±5V               | 8.19175V                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×U/5<br>U = D×5/20000   |
|                   | 5V                       | 20000       | 0x4E20      | Rated range        |                                  |
|                   | 2.5V                     | 10000       | 0x2710      |                    |                                  |
|                   | 0V                       | 0           | 0x0000      |                    |                                  |
|                   | -2.5V                    | -10000      | 0xD8F0      |                    |                                  |
|                   | -5V                      | -20000      | 0xB1E0      |                    |                                  |
|                   | -8.19175V                | -32768      | 0x8000      | Beyond lower limit |                                  |
| ±10V              | 16.3835V                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×U/10<br>U = D×10/20000 |
|                   | 10V                      | 20000       | 0x4E20      | Rated range        |                                  |
|                   | 5V                       | 10000       | 0x2710      |                    |                                  |

| Measurement range | Current (I)/ Voltage (U) | Decimal (D) | Hexadecimal | Range              | Conversion formula                     |
|-------------------|--------------------------|-------------|-------------|--------------------|----------------------------------------|
|                   | 0V                       | 0           | 0x0000      |                    |                                        |
|                   | -5V                      | -10000      | 0xD8F0      |                    |                                        |
|                   | -10V                     | -20000      | 0xB1E0      |                    |                                        |
|                   | -16.3835V                | -32768      | 0x8000      | Beyond lower limit |                                        |
| 4–20mA            | 30.2136mA                | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×(I-4)/16<br>I = D×16/20000+4 |
|                   | 20mA                     | 20000       | 0x4E20      | Rated range        |                                        |
|                   | 12mA                     | 10000       | 0x2710      |                    |                                        |
|                   | 4mA                      | 0           | 0x0000      |                    |                                        |
|                   | 0mA                      | -5000       | 0xEC78      | Beyond lower limit |                                        |
|                   | -22.2136mA               | -32768      | 0x8000      |                    |                                        |
| 0–20mA            | 32.767mA                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×I/20<br>I = D×20/20000       |
|                   | 20mA                     | 20000       | 0x4E20      | Rated range        |                                        |
|                   | 10mA                     | 10000       | 0x2710      |                    |                                        |
|                   | 0mA                      | 0           | 0x0000      |                    |                                        |
|                   | -10mA                    | -10000      | 0xD8F0      | Beyond lower limit |                                        |
|                   | -20mA                    | -20000      | 0xB1E0      |                    |                                        |
|                   | -32.767mA                | -32768      | 0x8000      |                    |                                        |
| ±20mA             | 32.767mA                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×I/20<br>I = D×20/20000       |
|                   | 20mA                     | 20000       | 0x4E20      | Rated range        |                                        |
|                   | 10mA                     | 10000       | 0x2710      |                    |                                        |
|                   | 0mA                      | 0           | 0x0000      |                    |                                        |
|                   | - 10mA                   | -10000      | 0xD8F0      |                    |                                        |
|                   | - 20mA                   | -20000      | 0xB1E0      |                    |                                        |
|                   | - 32.767mA               | -32768      | 0x8000      | Beyond lower limit |                                        |

- Alx\_Filt(x=0,1,2,3) is a channel filter parameter of type USINT. The parameter setting range is 1 to 255. Generally, a higher value indicates better suppression of high-frequency interference, but it also leads to greater delay. It should be adjusted according to the actual situation.

Step 3 Define INT type variables iValueAD0 and iValueAD1 in the program.

```

VAR
iValueAD0      : INT;
iValueAD1      : INT;

END_VAR

```

Step 4 Choose **Module I/O Mapping**, map *iValueAD0* and *iValueAD1* to the corresponding input channels. You just need to use mapped variables in the program.

|                    |                               |         |           |         |      |      |             |
|--------------------|-------------------------------|---------|-----------|---------|------|------|-------------|
| Startup Parameters | Find                          | Filter  | Show all  | Add F   |      |      |             |
| Module I/O Mapping | Variable                      | Mapping | Channel   | Address | Type | Unit | Description |
| Module IEC Objects | Application.PLC_PRG.iValueAD0 |         | AI0       | %IW16   | INT  |      | AI0         |
| Information        | Application.PLC_PRG.iValueAD1 |         | AI1       | %IW17   | INT  |      | AI1         |
|                    |                               |         | AI2       | %IW18   | INT  |      | AI2         |
|                    |                               |         | AI3       | %IW19   | INT  |      | AI3         |
|                    |                               |         | AI0_ErrId | %IW20   | UINT |      | AI0_ErrId   |
|                    |                               |         | AI1_ErrId | %IW21   | UINT |      | AI1_ErrId   |
|                    |                               |         | AI2_ErrId | %IW22   | UINT |      | AI2_ErrId   |
|                    |                               |         | AI3_ErrId | %IW23   | UINT |      | AI3_ErrId   |

## 2. Parameter description

| Parameter name | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AI0 Cfg        | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enabling control. (0: Disable. 1: Enable.)<br>Bit1: Open-loop detection enabling control. (0: Disable. 1: Enable.)<br>Bit2: Over-range detection enabling control. (0: Disable. 1: Enable.)<br>Bit3: Over-range enabling control. (0: Disable. 1: Enable.)<br>Bit4: Enhanced filter enabling control. (0: Disable. 1: Enable.)<br>Bit7–Bit5: Channel conversion mode.<br>0b000: Voltage range 0–5V, corresponding to detection value range 0–20000<br>0b001: Voltage range 0–10V, corresponding to detection value range 0–20000<br>0b010: Voltage range -5–5V, corresponding to detection value range -20000–20000<br>0b011: Voltage range -10–10V, corresponding to detection value range -20000–20000<br>0b100: Current range 4–20mA, corresponding to detection value range 0–20000<br>0b101: Current range 0–20mA, corresponding to detection value range 0–20000<br>0b110: Reserved<br>0b111: Current range -20–20mA, corresponding to detection value range -20000–20000 |
| AI1 Cfg        | USINT | Configuration parameter for channel 1. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| AI2 Cfg        | USINT | Configuration parameter for channel 2. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| AI3 Cfg        | USINT | Configuration parameter for channel 3. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| AI0 Filt       | USINT | Filter parameter for channel 0.<br>Range: 1–255. A greater value indicates better filter effect but greater lagging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| AI1 Filt       | USINT | Filter parameter for channel 1. The filter parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

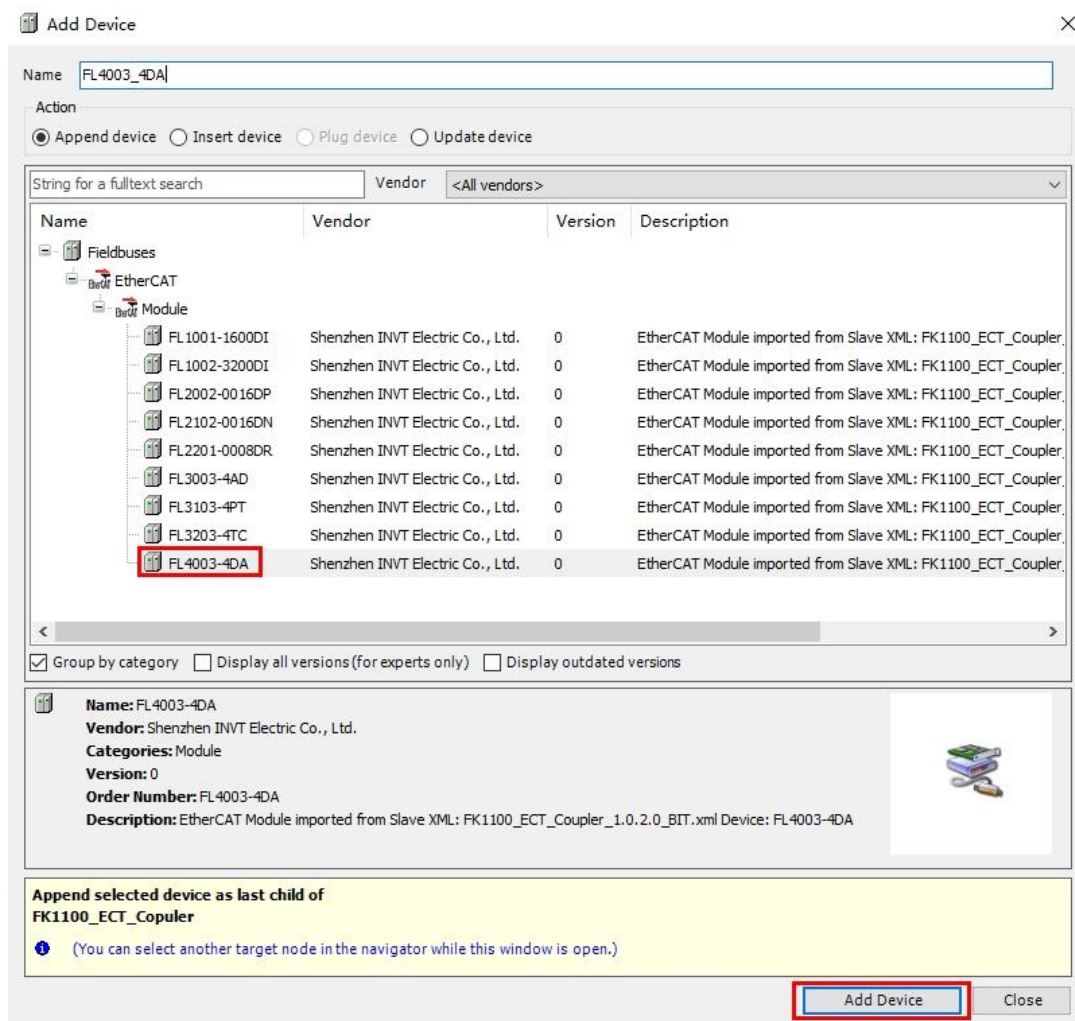


| Parameter name | Type  | Description                                                                                         |
|----------------|-------|-----------------------------------------------------------------------------------------------------|
| AI2 Filt       | USINT | Filter parameter for channel 2. The filter parameter setting is consistent with that for channel 0. |
| AI3 Filt       | USINT | Filter parameter for channel 3. The filter parameter setting is consistent with that for channel 0. |
| AI0            | INT   | Conversion value for channel 0.                                                                     |
| AI1            | INT   | Conversion value for channel 1.                                                                     |
| AI2            | INT   | Conversion value for channel 2.                                                                     |
| AI3            | INT   | Conversion value for channel 3.                                                                     |
| AI0_ErrId      | UINT  | Fault code for channel 0.                                                                           |
| AI1_ErrId      | UINT  | Fault code for channel 1.                                                                           |
| AI2_ErrId      | UINT  | Fault code for channel 2.                                                                           |
| AI3_ErrId      | UINT  | Fault code for channel 3.                                                                           |
| HW Version     | UINT  | Module hardware version number.                                                                     |
| FPGA Version   | UINT  | Module FPGA software version number.                                                                |

### 6.1.1.6 Analog output module

#### 1. Device import

Step 1 Add the FL4003-4DA device.



Step 2 Set the channel configuration and stop/offline output mode preset value parameters based on

actual needs in the startup parameters.

| Startup Parameters |      | Add            | Edit                | Delete | Move Up    | Move Down                |                          |           |                     |  |
|--------------------|------|----------------|---------------------|--------|------------|--------------------------|--------------------------|-----------|---------------------|--|
| Module I/O Mapping | Line | Index/Subindex | Name                | Value  | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line | Comment             |  |
| Module IEC Objects | 1    | 16#8019:16#01  | 4DA AO0 Cfg         | 0      | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4DA AO0 Cfg         |  |
|                    | 2    | 16#8019:16#02  | 4DA AO1 Cfg         | 0      | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4DA AO1 Cfg         |  |
|                    | 3    | 16#8019:16#03  | 4DA AO2 Cfg         | 0      | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4DA AO2 Cfg         |  |
|                    | 4    | 16#8019:16#04  | 4DA AO3 Cfg         | 0      | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4DA AO3 Cfg         |  |
|                    | 5    | 16#8019:16#05  | 4DA AO0 Stop Output | 0      | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4DA AO0 Stop Output |  |
|                    | 6    | 16#8019:16#06  | 4DA AO1 Stop Output | 0      | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4DA AO1 Stop Output |  |
|                    | 7    | 16#8019:16#07  | 4DA AO2 Stop Output | 0      | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4DA AO2 Stop Output |  |
|                    | 8    | 16#8019:16#08  | 4DA AO3 Stop Output | 0      | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4DA AO3 Stop Output |  |

- AOx Cfg(x=0,1,2,3) is a channel configuration parameter of type USINT. Taking the configuration of channel 0 as an example, the data definitions are detailed in the following table of parameters.

| Bit7                    | Bit6 | Bit5            | Bit4     | Bit3                                    | Bit2 | Bit1                                    | Bit0                     |
|-------------------------|------|-----------------|----------|-----------------------------------------|------|-----------------------------------------|--------------------------|
| Channel conversion mode |      |                 | Reserved | Output fault detection enabling control |      | Output fault detection enabling control | Channel enabling control |
| 0b000: 0–5V             |      | 0b100: 4–20mA   | -        | 0b00: Offline output retained           |      | 0: Disable<br>1: Enable                 | 0: Disable<br>1: Enable  |
| 0b001: 0–10V            |      | 0b101: 0–20mA   |          | 0b01: Offline output cleared            |      |                                         |                          |
| 0b010: -5–5V            |      | 0b110: Reserved |          | 0b10: Offline output preset             |      |                                         |                          |
| 0b011: -10–+10V         |      | 0b111: Reserved |          |                                         |      |                                         |                          |

For example: Channel 0 is configured as channel enabled, output fault detection enabled, offline output cleared, and channel conversion mode is set to 4–20mA. The value should be 135, that is, 2#10000111. Details are as follows:

| Bit7         | Bit6 | Bit5 | Bit4 | Bit3                         | Bit2 | Bit1      | Bit0      |
|--------------|------|------|------|------------------------------|------|-----------|-----------|
| 0b100        |      |      | 0    | 0b01                         |      | 1         | 1         |
| 0b100:4–20mA |      |      | -    | 0b01: Offline output cleared |      | 1: Enable | 1: Enable |

Range conversion:

| Output range | Current (I)/Voltage (U) | Decimal (D) | Hexadecimal | Range       | Conversion formula               |
|--------------|-------------------------|-------------|-------------|-------------|----------------------------------|
| 0-5V         | 5V                      | 20000       | 0x4E20      | Rated range | D = 20000×U/5<br>U = D×5/20000   |
|              | 2.5V                    | 10000       | 0x2710      |             |                                  |
|              | 0V                      | 0           | 0x0000      |             |                                  |
| 0-10V        | 10V                     | 20000       | 0x4E20      | Rated range | D = 20000×U/10<br>U = D×10/20000 |
|              | 5V                      | 10000       | 0x2710      |             |                                  |
|              | 0V                      | 0           | 0x0000      |             |                                  |
| ±5V          | 5V                      | 20000       | 0x4E20      | Rated range | D = 20000×U/5<br>U = D×5/20000   |
|              | 2.5V                    | 10000       | 0x2710      |             |                                  |
|              | 0V                      | 0           | 0x0000      |             |                                  |
|              | - 2.5V                  | -10000      | 0xD8F0      |             |                                  |
|              | - 5V                    | -20000      | 0xB1E0      |             |                                  |
| ±10V         | 10V                     | 20000       | 0x4E20      | Rated range | D = 20000×U/10<br>U = D×10/20000 |
|              | 5V                      | 10000       | 0x2710      |             |                                  |
|              | 0V                      | 0           | 0x0000      |             |                                  |
|              | - 5V                    | -10000      | 0xD8F0      |             |                                  |
|              | - 10V                   | -20000      | 0xB1E0      |             |                                  |
| 4-20mA       | 20mA                    | 20000       | 0x4E20      | Rated range | D = 20000×(I-4)/16               |

| Output range | Current (I)/<br>Voltage (U) | Decimal (D) | Hexadecimal | Range       | Conversion formula                                                                      |
|--------------|-----------------------------|-------------|-------------|-------------|-----------------------------------------------------------------------------------------|
| 0-20mA       | 12mA                        | 10000       | 0x2710      | Rated range | $I = D \times 16 / 20000 + 4$<br>$D = 20000 \times I / 20$<br>$I = D \times 20 / 20000$ |
|              | 4mA                         | 0           | 0x0000      |             |                                                                                         |
|              | 20mA                        | 20000       | 0x4E20      |             |                                                                                         |
|              | 10mA                        | 10000       | 0x2710      |             |                                                                                         |
|              | 0mA                         | 0           | 0x0000      |             |                                                                                         |

- Alx\_Stop Output (x=0,1,2,3) is used for stop/offline output mode control, which can be set as described in 6.1.1.3 Digital output module.

Step 3 Define INT type variables *iValueDA0* and *iValueDA1* in the program.

```

VAR
iValueDA0      : INT;
iValueDA1      : INT;

END_VAR

```

Step 4 Choose **Module I/O Mapping**, map *iValueDA0* and *iValueDA1* to the corresponding output channels. You just need to use mapped variables in the program.

| Startup Parameters | Find                          | Filter  | Show all  |         |      |      |             |
|--------------------|-------------------------------|---------|-----------|---------|------|------|-------------|
| Module I/O Mapping | Variable                      | Mapping | Channel   | Address | Type | Unit | Description |
| Module IEC Objects | Application.PLC_PRG.iValueDA0 |         | AO0       | %QW32   | INT  |      | AO0         |
| Information        | Application.PLC_PRG.iValueDA1 |         | AO1       | %QW33   | INT  |      | AO1         |
|                    |                               |         | AO2       | %QW34   | INT  |      | AO2         |
|                    |                               |         | AO3       | %QW35   | INT  |      | AO3         |
|                    |                               |         | AO0_ErrId | %IW48   | UINT |      | AO0_ErrId   |
|                    |                               |         | AO1_ErrId | %IW49   | UINT |      | AO1_ErrId   |
|                    |                               |         | AO2_ErrId | %IW50   | UINT |      | AO2_ErrId   |
|                    |                               |         | AO3_ErrId | %IW51   | UINT |      | AO3_ErrId   |

## 2. Parameter description

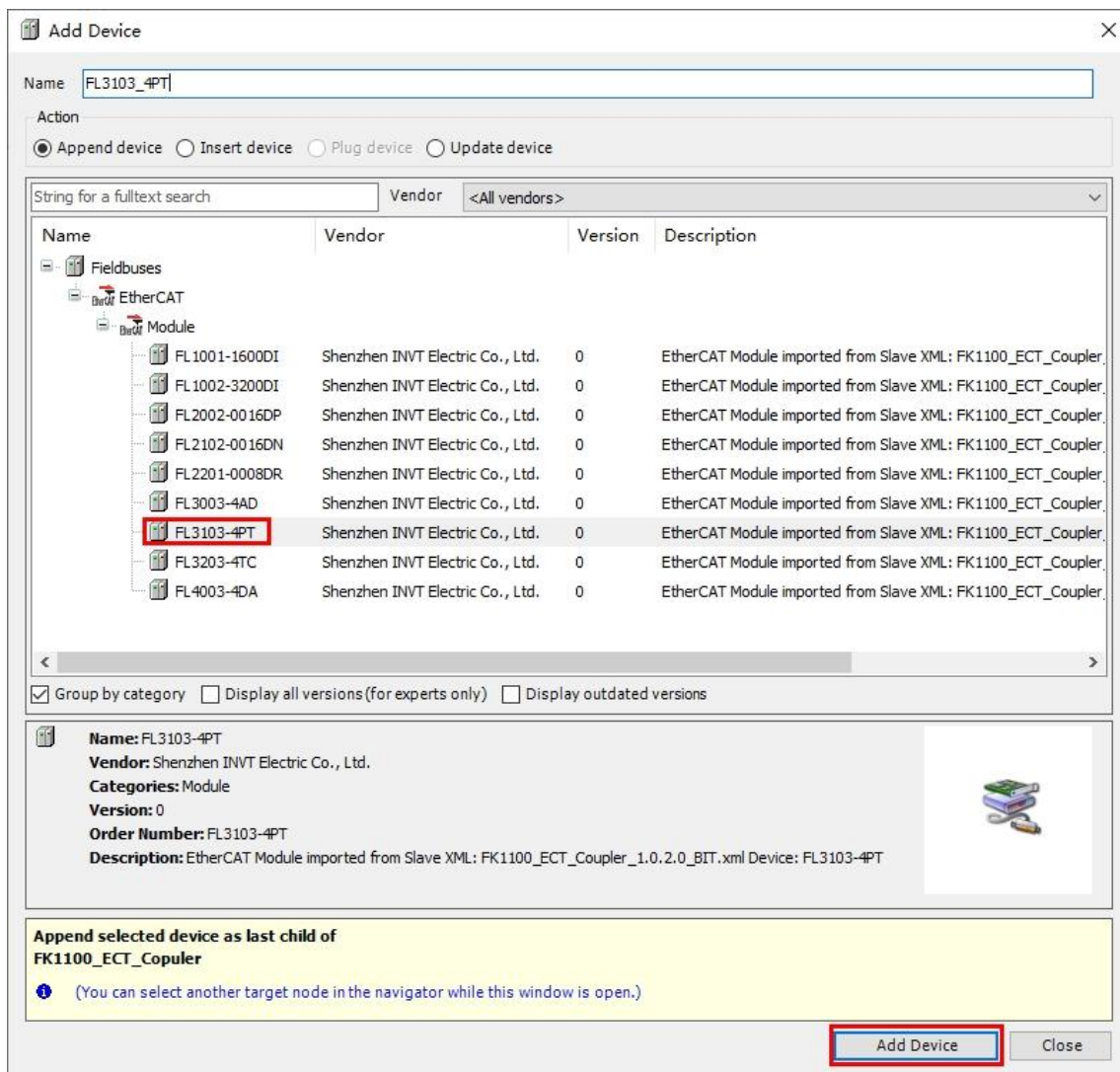
| Parameter name | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AO0 Cfg        | USINT | <p>Configuration parameter for channel 0.</p> <p>Bit0: Channel enabling control. (0: Disable. 1: Enable.)</p> <p>Bit1: Output fault detection enabling control. (0: Disable. 1: Enable.)</p> <p>Bit3–Bit2: Offline output mode.</p> <p>0b00: Offline output retained</p> <p>0b01: Offline output cleared</p> <p>0b10: Offline output preset</p> <p>Bit4: Reserved</p> <p>Bit7–Bit5: Channel conversion mode.</p> <p>0b000: Voltage range 0–5V, corresponding to detection value range 0–20000</p> <p>0b001: Voltage range 0–10V, corresponding to detection value range 0–20000</p> <p>0b010: Voltage range -5–5V, corresponding to detection value range -20000–20000</p> <p>0b011: Voltage range -10–10V, corresponding to detection value</p> |

| Parameter name  | Type  | Description                                                                                                                                                                                                            |
|-----------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 |       | range -20000–20000<br>0b100: Current range 4–20mA, corresponding to detection value range 0–20000<br>0b101: Current range 0–20mA, corresponding to detection value range 0–20000<br>0b110: Reserved<br>0b111: Reserved |
| AO1 Cfg         | USINT | Configuration parameter for channel 1. The parameter setting is consistent with that for channel 0.                                                                                                                    |
| AO2 Cfg         | USINT | Configuration parameter for channel 2. The parameter setting is consistent with that for channel 0.                                                                                                                    |
| AO3 Cfg         | USINT | Configuration parameter for channel 3. The parameter setting is consistent with that for channel 0.                                                                                                                    |
| AO0 Stop Output | INT   | Preset value of stop/offline output for channel 0.                                                                                                                                                                     |
| AO1 Stop Output | INT   | Preset value of stop/offline output for channel 1.                                                                                                                                                                     |
| AO2 Stop Output | INT   | Preset value of stop/offline output for channel 2.                                                                                                                                                                     |
| AO3 Stop Output | INT   | Preset value of stop/offline output for channel 3.                                                                                                                                                                     |
| AO0             | INT   | Output control value for channel 0.                                                                                                                                                                                    |
| AO1             | INT   | Output control value for channel 1.                                                                                                                                                                                    |
| AO2             | INT   | Output control value for channel 2.                                                                                                                                                                                    |
| AO3             | INT   | Output control value for channel 3.                                                                                                                                                                                    |
| AO0_ErrId       | UINT  | Fault code for channel 0.                                                                                                                                                                                              |
| AO1_ErrId       | UINT  | Fault code for channel 1.                                                                                                                                                                                              |
| AO2_ErrId       | UINT  | Fault code for channel 2.                                                                                                                                                                                              |
| AO3_ErrId       | UINT  | Fault code for channel 3.                                                                                                                                                                                              |
| HW Version      | UINT  | Module hardware version number.                                                                                                                                                                                        |
| FPGA Version    | UINT  | Module FPGA software version number.                                                                                                                                                                                   |

### 6.1.1.7 Temperature detection module (Thermal resistor)

#### 1. Device import

Step 1 Add the FL3103-4PT device.



Step 2 Set the channel configuration, channel filter parameters, and temperature offset values based on actual needs in the startup parameters.

| Startup Parameters                |                |                  |       |            |                          |                          |           |                  |
|-----------------------------------|----------------|------------------|-------|------------|--------------------------|--------------------------|-----------|------------------|
| Add Edit Delete Move Up Move Down |                |                  |       |            |                          |                          |           |                  |
| Line                              | Index/Subindex | Name             | Value | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line | Comment          |
| 1                                 | 16#8029:16#01  | 4PT Temp0 Cfg    | 128   | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp0 Cfg    |
| 2                                 | 16#8029:16#02  | 4PT Temp1 Cfg    | 128   | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp1 Cfg    |
| 3                                 | 16#8029:16#03  | 4PT Temp2 Cfg    | 128   | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp2 Cfg    |
| 4                                 | 16#8029:16#04  | 4PT Temp3 Cfg    | 128   | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp3 Cfg    |
| 5                                 | 16#8029:16#05  | 4PT Temp0 Filtr  | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp0 Filtr  |
| 6                                 | 16#8029:16#06  | 4PT Temp1 Filtr  | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp1 Filtr  |
| 7                                 | 16#8029:16#07  | 4PT Temp2 Filtr  | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp2 Filtr  |
| 8                                 | 16#8029:16#08  | 4PT Temp3 Filtr  | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp3 Filtr  |
| 9                                 | 16#8029:16#09  | 4PT Temp0 Offset | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp0 Offset |
| 10                                | 16#8029:16#0A  | 4PT Temp1 Offset | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp1 Offset |
| 11                                | 16#8029:16#0B  | 4PT Temp2 Offset | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp2 Offset |
| 12                                | 16#8029:16#0C  | 4PT Temp3 Offset | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp3 Offset |
| 13                                | 16#8029:16#0D  | 4PT Temp0 Up     | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp0 Up     |
| 14                                | 16#8029:16#0E  | 4PT Temp1 Up     | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp1 Up     |
| 15                                | 16#8029:16#0F  | 4PT Temp2 Up     | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp2 Up     |
| 16                                | 16#8029:16#10  | 4PT Temp3 Up     | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp3 Up     |
| 17                                | 16#8029:16#11  | 4PT Temp0 Low    | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp0 Low    |
| 18                                | 16#8029:16#12  | 4PT Temp1 Low    | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp1 Low    |
| 19                                | 16#8029:16#13  | 4PT Temp2 Low    | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp2 Low    |
| 20                                | 16#8029:16#14  | 4PT Temp3 Low    | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4PT Temp3 Low    |

 **Note:** The temperature upper limit and lower limit are reserved parameters, and therefore they do not need to be set.

- Tempx Cfg(x=0,1,2,3) is a channel configuration parameter of type USINT. Taking the configuration of channel 0 as an example, the data definitions are detailed in the following table of parameters.

| Bit7                                     | Bit6          | Bit5          | Bit4                | Bit3                      | Bit2                    | Bit1                                        | Bit0                           |
|------------------------------------------|---------------|---------------|---------------------|---------------------------|-------------------------|---------------------------------------------|--------------------------------|
| Channel conversion mode<br>(sensor type) |               |               | Temperature<br>unit | Thermistor<br>wire system |                         | Over-range<br>detection enabling<br>control | Channel<br>enabling<br>control |
| 000: Reserved                            | 100: PT1000   | 001: PT100    | 0: °C<br>1: °F      | 00: Two-wire<br>system    | 0: Disable<br>1: Enable | 0: Disable<br>1: Enable                     | 0: Disable<br>1: Enable        |
| 010: PT500                               | 101: Reserved | 110: Reserved |                     | 01: Three-wire<br>system  |                         |                                             |                                |
| 011: Reserved                            | 111: CU100    |               |                     | 10: Four-wire<br>system   |                         |                                             |                                |
|                                          |               |               |                     | 11: Reserved              |                         |                                             |                                |

For example: Channel 0 is configured as channel enabled, over-range detection enabled, using 3-wire system, temperature unit selected as Celsius (°C), sensor selected as PT1000. Temp0 Cfg should be 135, that is, 2#10000111. Details are as follows:

| Bit7 | Bit6        | Bit5 | Bit4  | Bit3                  | Bit2 | Bit1      | Bit0      |
|------|-------------|------|-------|-----------------------|------|-----------|-----------|
| 100  |             |      | 0     | 01                    |      | 1         | 1         |
|      | 100: PT1000 |      | 0: °C | 01: Three-wire system |      | 1: Enable | 1: Enable |

- Tempx Filt(x=0,1,2,3) is the channel filter parameter of type USINT, with the setting range of 1–255. Generally, a higher value indicates better suppression of high-frequency interference, but it also leads to greater delay. It should be adjusted according to the actual situation.
- Tempx Offset(x=0,1,2,3) is a temperature offset parameter of type USINT. The value is magnified by 10 times (for example, the setting 999 represents 99.9), measured value = actual value + offset value.

Step 3 Define REAL type variables rValuePT0 and rValuePT1 in the program.

```

VAR
rValuePT0      : REAL;
rValuePT1      : REAL;

END_VAR

```

Step 4 Choose **Module I/O Mapping**, map the variables rValuePT0 and rValuePT1 to the corresponding input channels in the Module I/O mapping, and use the mapped variables in the program.

| Startup Parameters | Find                          | Filter  | Show all    | Add FB for |      |      |             |
|--------------------|-------------------------------|---------|-------------|------------|------|------|-------------|
| Module I/O Mapping | Variable                      | Mapping | Channel     | Address    | Type | Unit | Description |
|                    | Application.PLC_PRG.rValuePT0 |         | Temp0       | %ID12      | REAL |      | Temp0       |
|                    | Application.PLC_PRG.rValuePT1 |         | Temp1       | %ID13      | REAL |      | Temp1       |
|                    |                               |         | Temp2       | %ID14      | REAL |      | Temp2       |
|                    |                               |         | Temp3       | %ID15      | REAL |      | Temp3       |
|                    |                               |         | Temp0_ErrId | %IW32      | UINT |      | Temp0_ErrId |
|                    |                               |         | Temp1_ErrId | %IW33      | UINT |      | Temp1_ErrId |
|                    |                               |         | Temp2_ErrId | %IW34      | UINT |      | Temp2_ErrId |
|                    |                               |         | Temp3_ErrId | %IW35      | UINT |      | Temp3_ErrId |

## 2. Parameter description



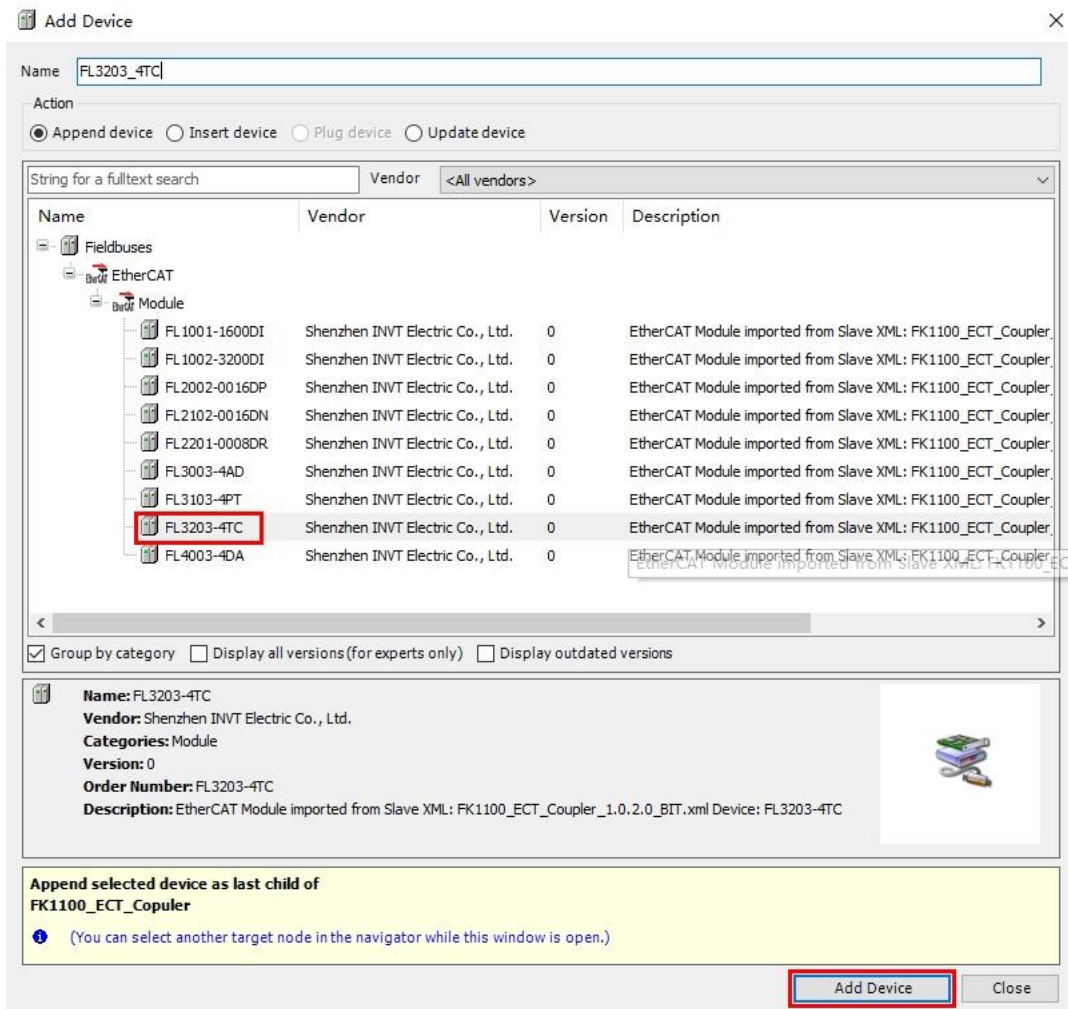
| Parameter name | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temp0 Cfg      | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enabling control. (0: Disable. 1: Enable.)<br>Bit1: Over-range detection enabling control. (0: Disable. 1: Enable.)<br>Bit3–bit2: Thermal resistor wire system. (0b00: Two-wire system. 0b01: Three-wire system. 0b10: Four-wire)<br>Bit4: Temperature unit. (0: °C. 1: °F.)<br>Bit7–Bit5: Channel conversion mode.<br>0b000: Reserved<br>0b001: PT100<br>0b010: PT500<br>0b011: Reserved<br>0b100: PT1000<br>0b101: Reserved<br>0b110: Reserved<br>0b111: CU100 |
| Temp1 Cfg      | USINT | Configuration parameter for channel 1. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Temp2 Cfg      | USINT | Configuration parameter for channel 2. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Temp3 Cfg      | USINT | Configuration parameter for channel 3. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Temp0 Filt     | USINT | Filter parameter for channel 0. Range: 1–255. A greater value indicates better filter effect but greater lagging.                                                                                                                                                                                                                                                                                                                                                                                                        |
| Temp1 Filt     | USINT | Filter parameter for channel 1. The filter parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Temp2 Filt     | USINT | Filter parameter for channel 2. The filter parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Temp3 Filt     | USINT | Filter parameter for channel 3. The filter parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Temp0 Offset   | INT   | Temperature offset value for channel 0.<br>The value has been amplified by 10 times, with 999 representing 99.9. Detection value = Actually measured value + Offset value                                                                                                                                                                                                                                                                                                                                                |
| Temp1 Offset   | INT   | Temperature offset value for channel 1. The temperature offset value is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                              |
| Temp2 Offset   | INT   | Temperature offset value for channel 2. The temperature offset value is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                              |
| Temp3 Offset   | INT   | Temperature offset value for channel 3. The temperature offset value is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                              |
| Temp0 Up       | INT   | Temperature upper limit for channel 0. Reserved. The sensor provided limit value is used.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Temp1 Up       | INT   | Temperature upper limit for channel 1. Reserved. The sensor provided limit value is used.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Temp2 Up       | INT   | Temperature upper limit for channel 2. Reserved. The sensor provided limit value is used.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Temp3 Up       | INT   | Temperature upper limit for channel 3. Reserved. The sensor provided limit value is used.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Temp0 Low      | INT   | Temperature lower limit for channel 0. Reserved. The sensor provided limit value is used.                                                                                                                                                                                                                                                                                                                                                                                                                                |

| Parameter name | Type | Description                                                                               |
|----------------|------|-------------------------------------------------------------------------------------------|
| Temp1 Low      | INT  | Temperature lower limit for channel 1. Reserved. The sensor provided limit value is used. |
| Temp2 Low      | INT  | Temperature lower limit for channel 2. Reserved. The sensor provided limit value is used. |
| Temp3 Low      | INT  | Temperature lower limit for channel 3. Reserved. The sensor provided limit value is used. |
| Temp0          | REAL | Conversion value for channel 0.                                                           |
| Temp1          | REAL | Conversion value for channel 1.                                                           |
| Temp2          | REAL | Conversion value for channel 2.                                                           |
| Temp3          | REAL | Conversion value for channel 3.                                                           |
| Temp0_ErrId    | UINT | Fault code for channel 0.                                                                 |
| Temp1_ErrId    | UINT | Fault code for channel 1.                                                                 |
| Temp2_ErrId    | UINT | Fault code for channel 2.                                                                 |
| Temp3_ErrId    | UINT | Fault code for channel 3.                                                                 |
| HW Version     | UINT | Module hardware version number.                                                           |
| FPGA Version   | UINT | Module FPGA software version number.                                                      |

### 6.1.1.8 Temperature detection module (Thermocouple)

#### 1. Programming instance

Step 1 Add the FL3203-4TC device.





Step 2 Set the channel configuration, channel filter parameters, and temperature offset values based on actual needs in the startup parameters.

| Startup Parameters                             |      |                |                  |       |            |                          |                          |           |                  |
|------------------------------------------------|------|----------------|------------------|-------|------------|--------------------------|--------------------------|-----------|------------------|
| <div> Add Edit Delete Move Up Move Down </div> |      |                |                  |       |            |                          |                          |           |                  |
| Module I/O Mapping                             | Line | Index/Subindex | Name             | Value | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line | Comment          |
| Module IEC Objects                             | 1    | 16#802D:16#01  | 4TC Temp0 Cfg    | 96    | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp0 Cfg    |
|                                                | 2    | 16#802D:16#02  | 4TC Temp1 Cfg    | 96    | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp1 Cfg    |
|                                                | 3    | 16#802D:16#03  | 4TC Temp2 Cfg    | 96    | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp2 Cfg    |
|                                                | 4    | 16#802D:16#04  | 4TC Temp3 Cfg    | 96    | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp3 Cfg    |
|                                                | 5    | 16#802D:16#05  | 4TC Temp0 Filt   | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp0 Filt   |
|                                                | 6    | 16#802D:16#06  | 4TC Temp1 Filt   | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp1 Filt   |
|                                                | 7    | 16#802D:16#07  | 4TC Temp2 Filt   | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp2 Filt   |
|                                                | 8    | 16#802D:16#08  | 4TC Temp3 Filt   | 8     | 8          | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp3 Filt   |
|                                                | 9    | 16#802D:16#09  | 4TC Temp0 Offset | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp0 Offset |
|                                                | 10   | 16#802D:16#0A  | 4TC Temp1 Offset | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp1 Offset |
|                                                | 11   | 16#802D:16#0B  | 4TC Temp2 Offset | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp2 Offset |
|                                                | 12   | 16#802D:16#0C  | 4TC Temp3 Offset | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp3 Offset |
|                                                | 13   | 16#802D:16#0D  | 4TC Temp0 Up     | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp0 Up     |
|                                                | 14   | 16#802D:16#0E  | 4TC Temp1 Up     | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp1 Up     |
|                                                | 15   | 16#802D:16#0F  | 4TC Temp2 Up     | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp2 Up     |
| Information                                    | 16   | 16#802D:16#10  | 4TC Temp3 Up     | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp3 Up     |
|                                                | 17   | 16#802D:16#11  | 4TC Temp0 Low    | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp0 Low    |
|                                                | 18   | 16#802D:16#12  | 4TC Temp1 Low    | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp1 Low    |
|                                                | 19   | 16#802D:16#13  | 4TC Temp2 Low    | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp2 Low    |
|                                                | 20   | 16#802D:16#14  | 4TC Temp3 Low    | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 4TC Temp3 Low    |

**Note:** The temperature upper limit and lower limit are reserved parameters, and therefore they do not need to be set.

- Tempx Cfg(x=0,1,2,3) is a channel configuration parameter of type USINT. Taking the configuration of channel 0 as an example, the data definitions are detailed in the following table of parameters.

| Bit7                                  | Bit6                              | Bit5 | Bit4             | Bit3     | Bit2 | Bit1                                  | Bit0                     |
|---------------------------------------|-----------------------------------|------|------------------|----------|------|---------------------------------------|--------------------------|
| Channel conversion mode (sensor type) |                                   |      | Temperature unit | Reserved |      | Over-range detection enabling control | Channel enabling control |
| 0b00:<br>Thermocouple of type B.      | 0b100:<br>Thermocouple of type N. |      | 0: °C<br>1: °F   | -        |      | 0: Disable<br>1: Enable               | 0: Disable<br>1: Enable  |
| 0b001:<br>Thermocouple of type E.     | 0b101:<br>Thermocouple of type R. |      |                  |          |      |                                       |                          |
| 0b010:<br>Thermocouple of type J.     | 0b110:<br>Thermocouple of type S. |      |                  |          |      |                                       |                          |
| 0b011:<br>Thermocouple of type K.     | 0b111:<br>Thermocouple of type T. |      |                  |          |      |                                       |                          |

For example: Channel 0 is configured as channel enabled, over-range detection enabled, temperature unit selected as Celsius (°C), and sensor selected as J-type thermocouple. Temp0 Cfg should be 67, that is, 2#01000011. Details are as follows:

| Bit7                           | Bit6 | Bit5 | Bit4  | Bit3     | Bit2 | Bit1      | Bit0      |
|--------------------------------|------|------|-------|----------|------|-----------|-----------|
| 0b010                          |      |      | 0     | 0b00     |      | 1         | 1         |
| 0b010: Thermocouple of type J. |      |      | 0: °C | Reserved |      | 1: Enable | 1: Enable |

- Tempx Filt(x=0,1,2,3) is a channel filter parameter of type USINT, with the setting range of 1–255. Generally, a higher value indicates better suppression of high-frequency interference, but it also leads to greater delay. It should be adjusted according to the actual situation.
- Tempx Offset(x=0,1,2,3) is a temperature offset parameter of type USINT. The value is magnified by 10

times (for example, the setting 999 represents 99.9), measured value = actual value + offset value.

Step 3 Define REAL type variables rValueTC0 and rValueTC1 in the program.

```
VAR
rValueTC0      : REAL;
rValueTC1      : REAL;

END_VAR
```

Step 4 Map the variables rValueTC0 and rValueTC1 to the corresponding input channels in the Module I/O mapping, and use the mapped variables in the program.

| Variable                  | Mapping | Channel     | Address | Type | Unit | Description |
|---------------------------|---------|-------------|---------|------|------|-------------|
| Application.POU.rValueTC0 |         | Temp0       | %ID17   | REAL |      | Temp0       |
| Application.POU.rValueTC1 |         | Temp1       | %ID18   | REAL |      | Temp1       |
|                           |         | Temp2       | %ID19   | REAL |      | Temp2       |
|                           |         | Temp3       | %ID20   | REAL |      | Temp3       |
|                           |         | Temp0_ErrId | %IW42   | UINT |      | Temp0_ErrId |
|                           |         | Temp1_ErrId | %IW43   | UINT |      | Temp1_ErrId |
|                           |         | Temp2_ErrId | %IW44   | UINT |      | Temp2_ErrId |
|                           |         | Temp3_ErrId | %IW45   | UINT |      | Temp3_ErrId |

## 2. Parameter description

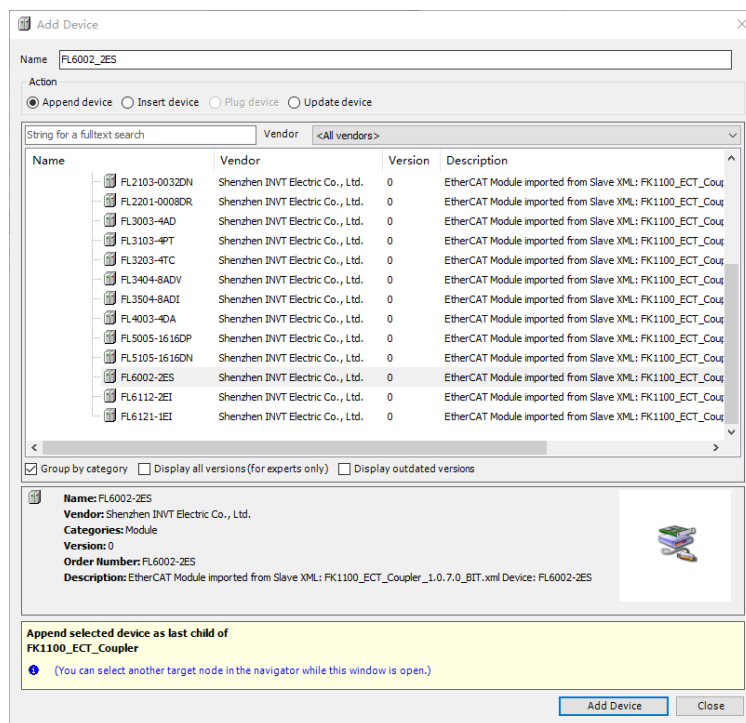
| Parameter name | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temp0 Cfg      | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enabling control. (0: Disable. 1: Enable.)<br>Bit1: Over-range detection enabling control. (0: Disable. 1: Enable.)<br>Bit3–Bit2: Reserved<br>Bit4: Temperature unit. (0: °C. 1: °F.)<br>Bit7–Bit5: Channel conversion mode.<br>0b000: Thermocouple of type B.<br>0b001: Thermocouple of type E.<br>0b010: Thermocouple of type J.<br>0b011: Thermocouple of type K.<br>0b100: Thermocouple of type N.<br>0b101: Thermocouple of type R.<br>0b110: Thermocouple of type S.<br>0b111: Thermocouple of type T. |
| Temp1 Cfg      | USINT | Configuration parameter for channel 1. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Temp2 Cfg      | USINT | Configuration parameter for channel 2. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Temp3 Cfg      | USINT | Configuration parameter for channel 3. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Temp0 Filt     | USINT | Filter parameter for channel 0.<br>Range: 1–255. A greater value indicates better filter effect but greater lagging.                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Temp1 Filt     | USINT | Filter parameter for channel 1. The filter parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Temp2 Filt     | USINT | Filter parameter for channel 2. The filter parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Parameter name | Type  | Description                                                                                                                                                                 |
|----------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temp3 Filt     | USINT | Filter parameter for channel 3. The filter parameter setting is consistent with that for channel 0.                                                                         |
| Temp0 Offset   | INT   | Temperature offset value for channel 0. (The value has been amplified by 10 times, with 999 representing 99.9.)<br>Detection value = Actually measured value + Offset value |
| Temp1 Offset   | INT   | Same as the temperature offset value for channel 0.                                                                                                                         |
| Temp2 Offset   | INT   | Same as the temperature offset value for channel 1.                                                                                                                         |
| Temp3 Offset   | INT   | Same as the temperature offset value for channel 2.                                                                                                                         |
| Temp0 Up       | INT   | Temperature upper limit for channel 0. Reserved. The sensor provided limit value is used.                                                                                   |
| Temp1 Up       | INT   | Temperature upper limit for channel 1. Reserved. The sensor provided limit value is used.                                                                                   |
| Temp2 Up       | INT   | Temperature upper limit for channel 2. Reserved. The sensor provided limit value is used.                                                                                   |
| Temp3 Up       | INT   | Temperature upper limit for channel 3. Reserved. The sensor provided limit value is used.                                                                                   |
| Temp0 Low      | INT   | Temperature lower limit for channel 0. Reserved. The sensor provided limit value is used.                                                                                   |
| Temp1 Low      | INT   | Temperature lower limit for channel 1. Reserved. The sensor provided limit value is used.                                                                                   |
| Temp2 Low      | INT   | Temperature lower limit for channel 2. Reserved. The sensor provided limit value is used.                                                                                   |
| Temp3 Low      | INT   | Temperature lower limit for channel 3. Reserved. The sensor provided limit value is used.                                                                                   |
| Temp0          | REAL  | Conversion value for channel 0.                                                                                                                                             |
| Temp1          | REAL  | Conversion value for channel 1.                                                                                                                                             |
| Temp2          | REAL  | Conversion value for channel 2.                                                                                                                                             |
| Temp3          | REAL  | Conversion value for channel 3.                                                                                                                                             |
| Temp0_ErrId    | UINT  | Fault code for channel 0.                                                                                                                                                   |
| Temp1_ErrId    | UINT  | Fault code for channel 1.                                                                                                                                                   |
| Temp2_ErrId    | UINT  | Fault code for channel 2.                                                                                                                                                   |
| Temp3_ErrId    | UINT  | Fault code for channel 3.                                                                                                                                                   |
| HW Version     | UINT  | Module hardware version number                                                                                                                                              |
| FPGA Version   | UINT  | Module FPGA software version number                                                                                                                                         |

#### 6.1.1.9 Counting and measurement module (FL6002)

## 1. Programming instance

Step 1 Add the FL6002-2ES device.



Step 2 In the startup parameters, set the counter DI filter time (unit: 0.1μs), SSI communication frame length, the number of least significant bits and number of most significant bits in the SSI communication position value, SSI communication configuration, and counter configuration according to actual needs.

| Startup Parameters | Line | Index:Subindex | Name                | Value | Bit Length |
|--------------------|------|----------------|---------------------|-------|------------|
| Module I/O Mapping | 1    | 16#8035:16#01  | ZES DI0 Filt        | 5     | 16         |
| Module IEC Objects | 2    | 16#8035:16#02  | ZES DI1 Filt        | 5     | 16         |
| Information        | 3    | 16#8035:16#03  | ZES Cnt0 SSI Length | 13    | 8          |
|                    | 4    | 16#8035:16#04  | ZES Cnt1 SSI Length | 13    | 8          |
|                    | 5    | 16#8035:16#05  | ZES Cnt0 SSI LSB    | 0     | 8          |
|                    | 6    | 16#8035:16#06  | ZES Cnt1 SSI LSB    | 0     | 8          |
|                    | 7    | 16#8035:16#07  | ZES Cnt0 SSI MSB    | 12    | 8          |
|                    | 8    | 16#8035:16#08  | ZES Cnt1 SSI MSB    | 12    | 8          |
|                    | 9    | 16#8035:16#09  | ZES Cnt0 SSI Cfg    | 0     | 8          |
|                    | 10   | 16#8035:16#0A  | ZES Cnt1 SSI Cfg    | 0     | 8          |
|                    | 11   | 16#8035:16#0B  | ZES Cnt0 Cfg        | 0     | 16         |
|                    | 12   | 16#8035:16#0C  | ZES Cnt1 Cfg        | 0     | 16         |

- **Dlx Filt (x=0,1)** is the filter parameter for the external DI channel, with a unit of 0.1μs and a default value of 5. If it is set to 10, it means that only signals that remain stable and do not jump within 1μs are sampled.
- **Cntx SSI Length (x=0,1)** is the encoder SSI communication frame length, with a setting range of 10–40 and a default value of 13. If a 23-bit multi-turn encoder is used, indicating that the position value has 23 bits, this parameter should be set to 23.
- **Cntx SSI LSB (x=0,1)** is the number of least significant bits in the SSI communication frame position value, with a default value of 0. If a 23-bit multi-turn encoder is used, indicating that the position value has 23 bits, this parameter should be set to 0.

- Cntx SSI MSB (x=0,1) is the number of most significant bits in the SSI communication frame position value, with a default value of 12. If a 23-bit multi-turn encoder is used, indicating that the position value has 23 bits, this parameter should be set to 22.

 **Note:** See the corresponding encoder's manual to set the SSI Length/SSI LSB/SSI MSB parameters based on the actual situation.

- Cntx SSI Cfg (x=0,1) is a counter SSI communication configuration parameter of type USINT. The data definitions are detailed in the following parameter description table.

| Bit       | Name                                                | Parameter description                                                                                                                          |
|-----------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit2–Bit0 | SSI clock frequency                                 | 2#000: 125kHz (Default)<br>2#001: 250kHz<br>2#010: 500kHz<br>2#011: 1MHz<br>2#100: 1.5MHz<br>2#101: 2MHz<br>2#110: Reserved<br>2#111: Reserved |
| Bit3      | SSI data format                                     | 2#0: Binary (Default)<br>2#1: Gray code                                                                                                        |
| Bit7–bit4 | Position reading interval time in SSI communication | Unit: 100μs. Default: 0<br>For example, 2#0001 (decimal 1) indicates 100μs; 2#1001 (decimal 9) indicates 900μs.                                |

- If the counter SSI clock frequency is set to 500kHz, SSI data format is Gray code, and the position reading interval time is 500μs, Cntx SSI Cfg(x=0,1) should be set to 90, that is, 2#01011010. For details, see the following table.

| Bit7        | Bit6 | Bit5 | Bit4 | Bit3      | Bit2   | Bit1 | Bit0 |
|-------------|------|------|------|-----------|--------|------|------|
| 2#0101      |      |      |      | 2#1       | 2#010  |      |      |
| Unit: 100μs |      |      |      | Gray code | 500kHz |      |      |

- Cntx Cfg (x=0,1) is a counter configuration parameter of type USINT. The data definitions are detailed in the following parameter description table.

| Bit        | Name                                     | Parameter description                                                                                                                                                                          |
|------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit1–bit0  | Frequency measurement period             | 2#00: 20ms (Default)<br>2#01: 100ms<br>2#10: 500ms<br>2#11: 1000ms                                                                                                                             |
| Bit3–bit2  | DI edge latch enabling                   | 2#00: Disable (Default)<br>2#01: Rising edge<br>2#10: Falling edge<br>2#11: Dual edges                                                                                                         |
| Bit5–bit4  | Comparison consistent pulse output width | 2#00: 1ms (Default)<br>2#01: 2ms<br>2#10: 4ms<br>2#11: 8ms                                                                                                                                     |
| Bit7–bit6  | Output mode for comparison               | 2#00: Consistent output for comparison (Default)<br>2#01: Output between [Count lower limit, Comparison value]<br>2#10: Output between [Comparison value, Count upper limit]<br>2#11: Reserved |
| Bit15–bit8 | Reserved                                 | -                                                                                                                                                                                              |

If the counter is configured with a frequency measurement period of 100 ms, with DI rising edge latch enabled, a period of 8ms for consistent output for comparison, and DO output mode for comparison set to generate consistent output within the range [Comparison value, Counter upper limit], then Cntx Cfg (x=0,1) should be set to 53, that is, 2#000000000110101. See the following table for details.

| Bit15–Bit8 | Bit7                         | Bit6 | Bit5 | Bit4 | Bit3        | Bit2 | Bit1  | Bit0 |
|------------|------------------------------|------|------|------|-------------|------|-------|------|
| 2#00000000 | 2#00                         |      | 2#11 |      | 2#01        |      | 2#01  |      |
| Reserved   | Comparison consistent output |      | 8ms  |      | Rising edge |      | 100ms |      |

Step 3 After configuring the preceding startup parameters and downloading the program, control the counter on the Module I/O mapping interface.

| Variable                                                                                        | Mapping | Channel       | Address | Type  | Unit | Description   |
|-------------------------------------------------------------------------------------------------|---------|---------------|---------|-------|------|---------------|
|  Cnt0_Ctrl     |         | Cnt0_Ctrl     | %QB68   | USINT |      | Cnt0_Ctrl     |
|  Cnt1_Ctrl     |         | Cnt1_Ctrl     | %QB69   | USINT |      | Cnt1_Ctrl     |
|  Cnt0_CmpVal   |         | Cnt0_CmpVal   | %QD18   | DINT  |      | Cnt0_CmpVal   |
|  Cnt1_CmpVal   |         | Cnt1_CmpVal   | %QD19   | DINT  |      | Cnt1_CmpVal   |
|  Cnt0_Status   |         | Cnt0_Status   | %IB120  | USINT |      | Cnt0_Status   |
|  Cnt1_Status   |         | Cnt1_Status   | %IB121  | USINT |      | Cnt1_Status   |
|  Cnt0_Val      |         | Cnt0_Val      | %ID31   | DINT  |      | Cnt0_Val      |
|  Cnt1_Val      |         | Cnt1_Val      | %ID32   | DINT  |      | Cnt1_Val      |
|  Cnt0_LatchVal |         | Cnt0_LatchVal | %ID33   | DINT  |      | Cnt0_LatchVal |
|  Cnt1_LatchVal |         | Cnt1_LatchVal | %ID34   | DINT  |      | Cnt1_LatchVal |
|  Cnt0_Freq     |         | Cnt0_Freq     | %ID35   | UDINT |      | Cnt0_Freq     |
|  Cnt1_Freq     |         | Cnt1_Freq     | %ID36   | UDINT |      | Cnt1_Freq     |
|  Cnt0_Velocity |         | Cnt0_Velocity | %ID37   | REAL  |      | Cnt0_Velocity |
|  Cnt1_Velocity |         | Cnt1_Velocity | %ID38   | REAL  |      | Cnt1_Velocity |
|  Cnt0_ErrId    |         | Cnt0_ErrId    | %IW78   | UINT  |      | Cnt0_ErrId    |
|  Cnt1_ErrId    |         | Cnt1_ErrId    | %IW79   | UINT  |      | Cnt1_ErrId    |

- Cntx\_Ctrl(x=0,1) is a counter control parameter. See the following table for detailed parameter description.

| Bit       | Name               | Parameter description       |
|-----------|--------------------|-----------------------------|
| Bit0      | Enable counting    | 2#0: Disable<br>2#1: Enable |
| Bit1      | Reserved           | -                           |
| Bit2      | Reserved           | -                           |
| Bit3      | Reserved           | -                           |
| Bit4      | Counter comparison | 2#0: Disable<br>2#1: Enable |
| Bit7–bit5 | Reserved           | -                           |

- Cntx\_CmpVal(x=0,1) is a counter comparison value of type DINT.

If Cnt0\_CmpVal is set to 1000000 and you want to enable the counter for comparison, set Cnt0\_Ctrl to 17, that is, 2#00010001. The details are as follows.

| Bit7–Bit5 | Bit4     | Bit3                         | Bit2     | Bit1     | Bit0     |
|-----------|----------|------------------------------|----------|----------|----------|
| 2#000     | 2#1      | 2#0                          | 2#0      | 2#0      | 2#1      |
| Reserved  | Power on | Effective at the rising edge | Reserved | Reserved | Power on |

- Cntx\_Val (x=0,1) is a counter comparison value of type DINT.

According to the previously mentioned Cntx Cfg (x=0,1) configuration value of 53 (enabling DO consistent output for comparison, with the pulse output of 8ms), when the count value Cntx\_Val (x=0,1) is 1,000,000, the DO will output pulse lasting 8ms.

 **Note:** DI0/DI1 are the counter latch inputs, and the corresponding latch values are Cntx\_LatchVal (x=0,1).

## 2. Parameter description

| Parameter name      | Type  | Description                                                                                                                                                                                                                                                                                                                                             |
|---------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2ES DI0 Filt        | UINT  | DI0 filter time. Unit: 0.1μs.                                                                                                                                                                                                                                                                                                                           |
| 2ES DI1 Filt        | UINT  | DI1 filter time. Unit: 0.1μs.                                                                                                                                                                                                                                                                                                                           |
| 2ES Cnt0 SSI Length | USINT | Cnt0 SSI communication frame length.                                                                                                                                                                                                                                                                                                                    |
| 2ES Cnt1 SSI Length | USINT | Cnt1 SSI communication frame length.                                                                                                                                                                                                                                                                                                                    |
| 2ES Cnt0 SSI LSB    | USINT | Cnt0 SSI position value least significant bit count.                                                                                                                                                                                                                                                                                                    |
| 2ES Cnt1 SSI LSB    | USINT | Cnt1 SSI position value least significant bit count.                                                                                                                                                                                                                                                                                                    |
| 2ES Cnt0 SSI MSB    | USINT | Cnt0 SSI position value most significant bit count.                                                                                                                                                                                                                                                                                                     |
| 2ES Cnt1 SSI MSB    | USINT | Cnt1 SSI position value most significant bit count.                                                                                                                                                                                                                                                                                                     |
| 2ES Cnt0 SSI Cfg    | USINT | Cnt0 SSI configuration parameter.<br>[2:0] SSI clock frequency<br>2#000: 125kHz;<br>2#001: 250kHz;<br>2#010: 500kHz;<br>2#011: 1MHz;<br>2#100: 1.5MHz;<br>2#101: 2MHz;<br>2#110: Reserved;<br>2#111: Reserved;<br>[3] Data format. 0: Binary   1: Gray code<br>[7:4] Position reading interval time (Unit: 100μs)                                       |
| 2ES Cnt1 SSI Cfg    | USINT | Cnt1 SSI configuration parameter.<br>[2:0] SSI clock frequency<br>2#000: 125kHz;<br>2#001: 250kHz;<br>2#010: 500kHz;<br>2#011: 1MHz;<br>2#100: 1.5MHz;<br>2#101: 2MHz;<br>2#110: Reserved;<br>2#111: Reserved;<br>[3] Data format. 0: Binary   1: Gray code<br>[7:4] Position reading interval time (Unit: 100μs)                                       |
| 2ES Cnt0 Cfg        | UINT  | Cnt0 count configuration parameter.<br>[1:0] Frequency measurement period<br>2#00: 20ms;<br>2#01: 100ms;<br>2#10: 500ms;<br>2#11: 1000ms;<br>[3:2] L0 edge latch count value enabling<br>2#00: Disable;<br>2#01: Rising edge;<br>2#10: Falling edge;<br>2#11: Dual edges;<br>[5:4] Comparison consistent output pulse width<br>2#00: 1ms;<br>2#01: 2ms; |

| Parameter name | Type | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                |      | 2#10:4ms;<br>2#11:8ms;<br>[7:6] Output mode for comparison<br>2#00: Comparison consistent output;<br>2#01: Output between [Count lower limit, Comparison value);<br>2#10: Output between (Comparison value, Count upper limit];<br>2#11: Reserved (Comparison consistent output);<br>[15:8] Reserved                                                                                                                                                                                                                                                                                                                                                      |
| 2ES Cnt1 Cfg   | UINT | Cnt1 count configuration parameter.<br>[1:0] Frequency measurement period<br>2#00:20ms;<br>2#01:100ms;<br>2#10:500ms;<br>2#11:1000ms;<br>[3:2] L0 edge latch count value enabling<br>2#00: Disable;<br>2#01: Rising edge;<br>2#10: Falling edge;<br>2#11: Dual edges;<br>[5:4] Comparison consistent output pulse width<br>2#00:1ms;<br>2#01:2ms;<br>2#10:4ms;<br>2#11:8ms;<br>[7:6] Output mode for comparison<br>2#00: Comparison consistent output;<br>2#01: Output between [Count lower limit, Comparison value);<br>2#10: Output between (Comparison value, Count upper limit];<br>2#11: Reserved (Comparison consistent output);<br>[15:8] Reserved |
| Cnt0_Ctrl      | USNT | Control parameter for counter 0.<br>Bit0: Enable counting, valid at high levels;<br>Bit1: Reserved;<br>Bit2: Reserved;<br>Bit3: Reserved;<br>Bit4: Enable count comparison function, valid at high levels (Provided that the counting is enabled.)<br>Bit7–Bit5: Reserved.                                                                                                                                                                                                                                                                                                                                                                                |
| Cnt1_Ctrl      | USNT | Control parameter for counter 1.<br>Bit0: Enable counting, valid at high levels;<br>Bit1: Reserved;<br>Bit2: Reserved;<br>Bit3: Reserved;<br>Bit4: Enable count comparison function, valid at high levels (Provided that the counting is enabled.)                                                                                                                                                                                                                                                                                                                                                                                                        |

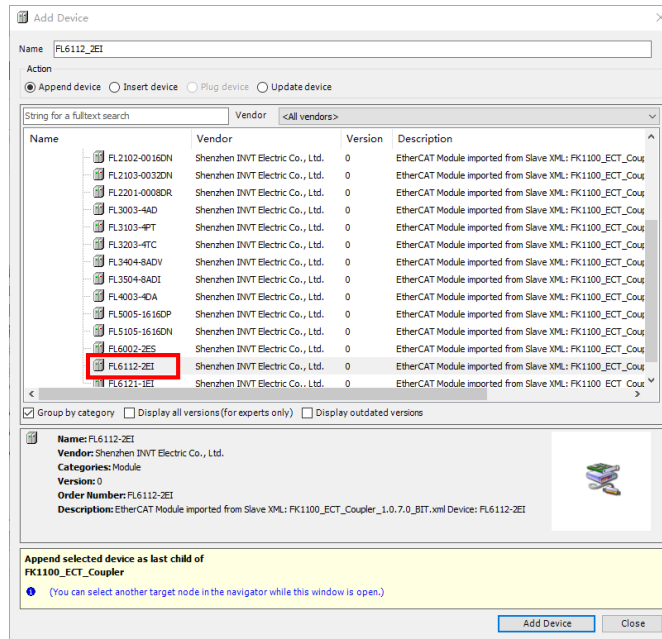


| Parameter name | Type  | Description                                                                                                                                                                                                                                     |
|----------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                |       | Bit7–Bit5: Reserved.                                                                                                                                                                                                                            |
| Cnt0_CmpVal    | DINT  | Counter 0 comparison value                                                                                                                                                                                                                      |
| Cnt1_CmpVal    | DINT  | Counter 1 comparison value                                                                                                                                                                                                                      |
| Cnt0_Status    | USINT | Counter 0 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Reserved<br>Bit3: Reserved<br>Bit4: DI latch completion flag<br>Bit5: Reserved<br>Bit6: Status when the data line is idle<br>Bit7: Reserved |
| Cnt0_Status    | USINT | Counter 1 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Reserved<br>Bit3: Reserved<br>Bit4: DI latch completion flag<br>Bit5: Reserved<br>Bit6: Status when the data line is idle<br>Bit7: Reserved |
| Cnt0_Val       | DINT  | Count value of counter 0                                                                                                                                                                                                                        |
| Cnt1_Val       | DINT  | Count value of counter 1                                                                                                                                                                                                                        |
| Cnt0_LatchVal  | DINT  | Latched value of counter 0                                                                                                                                                                                                                      |
| Cnt1_LatchVal  | DINT  | Latched value of counter 1                                                                                                                                                                                                                      |
| Cnt0_Freq      | UDINT | Counter 0 frequency                                                                                                                                                                                                                             |
| Cnt1_Freq      | UDINT | Counter 1 frequency                                                                                                                                                                                                                             |
| Cnt0_Velocity  | REAL  | Counter 0 speed (Valid for single-turn encoder)                                                                                                                                                                                                 |
| Cnt1_Velocity  | REAL  | Counter 1 speed (Valid for single-turn encoder)                                                                                                                                                                                                 |
| Cnt0_ErrId     | UINT  | Counter 0 error code                                                                                                                                                                                                                            |
| Cnt1_ErrId     | UINT  | Counter 1 error code                                                                                                                                                                                                                            |

### 6.1.1.10 Counting and measurement module (FL6112)

#### 1. Programming instance

##### Step 1 Add the FL6112\_2EI device.



##### Step 2 Choose **Startup Parameters**, set the counter, filtering mode, encoder resolution, and counter preset values based on the actual needs, with a filter unit of 0.1μs.

| Startup Parameters                                                                                           |                |                    |       |            |                          |                          |           |                    |
|--------------------------------------------------------------------------------------------------------------|----------------|--------------------|-------|------------|--------------------------|--------------------------|-----------|--------------------|
| <span>+</span> Add <span>✎</span> Edit <span>✕</span> Delete <span>↕</span> Move Up <span>↕</span> Move Down |                |                    |       |            |                          |                          |           |                    |
| Line                                                                                                         | Index/Subindex | Name               | Value | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line | Comment            |
| 1                                                                                                            | 16#8031:16#01  | 2EI Cnt0 Cfg       | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 2EI Cnt0 Cfg       |
| 2                                                                                                            | 16#8031:16#02  | 2EI Cnt1 Cfg       | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 2EI Cnt1 Cfg       |
| 3                                                                                                            | 16#8031:16#03  | 2EI Cnt0 Filt      | 5     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 2EI Cnt0 Filt      |
| 4                                                                                                            | 16#8031:16#04  | 2EI Cnt1 Filt      | 5     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 2EI Cnt1 Filt      |
| 5                                                                                                            | 16#8031:16#05  | 2EI Cnt0 Ratio     | 10000 | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 2EI Cnt0 Ratio     |
| 6                                                                                                            | 16#8031:16#06  | 2EI Cnt1 Ratio     | 10000 | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 2EI Cnt1 Ratio     |
| 7                                                                                                            | 16#8031:16#07  | 2EI Cnt0 PresetVal | 0     | 32         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 2EI Cnt0 PresetVal |
| 8                                                                                                            | 16#8031:16#08  | 2EI Cnt1 PresetVal | 0     | 32         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 2EI Cnt1 PresetVal |

Cntx Cfg(x=0,1) is the counter configuration parameter of type UINT. Taking the counter 0 configuration as an example, the data definition can be found in the parameter description.

| Bit         | Name                                     | Description                                                                                                                                                                    |
|-------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit1–bit0   | Channel mode                             | 00: A/B phase quadruple frequency; 01: A/B phase double frequency<br>10: A/B phase rated frequency; 11: Pulse+direction                                                        |
| Bit3–bit2   | Frequency measurement period             | 00: 20ms; 01: 100ms; 10: 500ms; 11: 1000ms                                                                                                                                     |
| Bit5–bit4   | Edge latch enabling                      | 00: Disabled; 01: Rise edge; 10: Fall edge; 11: Two edges                                                                                                                      |
| Bit7–bit6   | Reserved                                 | Reserved                                                                                                                                                                       |
| Bit9–bit8   | Comparison consistent pulse output width | 00: 1ms; 01: 2ms; 10: 4ms; 11: 8ms                                                                                                                                             |
| Bit11–bit10 | DO comparison output mode                | 00: Comparison consistent output<br>01: Output between [lower limit of count, comparison value]<br>10: Output between [comparison value, upper limit of count]<br>11: Reserved |
| Bit15–bit12 | Reserved                                 | Reserved                                                                                                                                                                       |

Assuming that counter 0 is configured as A/B phase quadruple frequency, the frequency measurement period is 100ms, DI0 rising edge latch is enabled, and comparison mode is set to produce a consistent output of 8ms, then Cnt0 Cfg should be configured as 788, which is 2#0000001100010100, as detailed below.

| Bit15–bit12 | Bit11                        | Bit10 | Bit9 | Bit8 | Bit7     | Bit6 | Bit5        | Bit4 | Bit3  | Bit2 | Bit1                          | Bit0 |
|-------------|------------------------------|-------|------|------|----------|------|-------------|------|-------|------|-------------------------------|------|
| 0000        | 00                           |       | 11   |      | 00       |      | 01          |      | 01    |      | 00                            |      |
| Reserved    | Comparison consistent output |       | 8ms  |      | Reserved |      | Rising edge |      | 100ms |      | A/B phase quadruple frequency |      |

Cntx Filt(x=0,1) is the filter parameter of A/B/Z/DI port with a unit of 0.1μs. If it is set to 10, it means that only signals that remain stable and do not jump within 1μs are sampled.

Cntx Ratio(x=0,1) is the encoder resolution (number of pulses fed back from one revolution, which is the pulse increment between two Z pulses). Assuming the resolution labeled on the encoder is 2500P/R, the Cnt0 Ratio should be set to 10000 since the Cnt0 Cfg is configured as A/B phase quadruple.

Cntx PresetVal(x=0,1) is the counter preset value of type DINT.

**Step 3** After configuring the above startup parameters and downloading the program, control the counter on the Module I/O mapping interface.

| Startup Parameters | Find          | Filter  | Show all |         |       |      |               |
|--------------------|---------------|---------|----------|---------|-------|------|---------------|
| Module I/O Mapping | Variable      | Mapping | Channel  | Address | Type  | Unit | Description   |
| Module IEC Objects | Cnt0_Ctrl     |         |          | %QB52   | USINT |      | Cnt0_Ctrl     |
| Information        | Cnt1_Ctrl     |         |          | %QB53   | USINT |      | Cnt1_Ctrl     |
|                    | Cnt0_CmpVal   |         |          | %QD14   | DINT  |      | Cnt0_CmpVal   |
|                    | Cnt1_CmpVal   |         |          | %QD15   | DINT  |      | Cnt1_CmpVal   |
|                    | Cnt0_Status   |         |          | %IB28   | USINT |      | Cnt0_Status   |
|                    | Cnt1_Status   |         |          | %IB29   | USINT |      | Cnt1_Status   |
|                    | Cnt0_Val      |         |          | %ID8    | DINT  |      | Cnt0_Val      |
|                    | Cnt1_Val      |         |          | %ID9    | DINT  |      | Cnt1_Val      |
|                    | Cnt0_LatchVal |         |          | %ID10   | DINT  |      | Cnt0_LatchVal |
|                    | Cnt1_LatchVal |         |          | %ID11   | DINT  |      | Cnt1_LatchVal |
|                    | Cnt0_Freq     |         |          | %ID12   | UDINT |      | Cnt0_Freq     |
|                    | Cnt1_Freq     |         |          | %ID13   | UDINT |      | Cnt1_Freq     |
|                    | Cnt0_Velocity |         |          | %ID14   | REAL  |      | Cnt0_Velocity |
|                    | Cnt1_Velocity |         |          | %ID15   | REAL  |      | Cnt1_Velocity |
|                    | Cnt0_ErrId    |         |          | %IW32   | UINT  |      | Cnt0_ErrId    |
|                    | Cnt1_ErrId    |         |          | %IW33   | UINT  |      | Cnt1_ErrId    |

Cntx\_Ctrl(x=0,1) is the counter control parameter. Taking the counter 0 as an example, the data definition can be found in the parameter description.

| Bit       | Name                       | Description                  |
|-----------|----------------------------|------------------------------|
| Bit0      | Enable counting            | 0: Disable 1: Enable         |
| Bit1      | Clear count value          | Effective at the rising edge |
| Bit2      | Write counter preset value | Effective at the rising edge |
| Bit3      | Clear count overflow flag  | Effective at the rising edge |
| Bit4      | Counter comparison         | 0: Disable 1: Enable         |
| Bit7–bit5 | Reserved                   | Reserved                     |

Cntx\_CmpVal(x=0,1) is the counter comparison value of type DINT.

Assuming that Cnt0\_CmpVal is set to 1000000 and you want to enable the counter for comparison, set Cnt0\_Ctrl to 17, which is 2#00010001. The details are as follows.

| Bit7-bit5 | Bit4      | Bit3                         | Bit2                         | Bit1                         | Bit0      |
|-----------|-----------|------------------------------|------------------------------|------------------------------|-----------|
| 000       | 1         | 0                            | 0                            | 0                            | 1         |
| Reserved  | 1: Enable | Effective at the rising edge | Effective at the rising edge | Effective at the rising edge | 1: Enable |

According to the configuration value 788 of Cnt0 Cfg mentioned above (enabling DO comparison consistent output and output pulse 8ms), when the count value Cnt0\_Val is equal to 1000000, DO0 will output 8ms.

To clear the current count value of counter 0, set Cnt0\_Ctrl to 2, which is 2#00000010. The details are as follows.

| Bit7-bit5 | Bit4       | Bit3                         | Bit2                         | Bit1                         | Bit0       |
|-----------|------------|------------------------------|------------------------------|------------------------------|------------|
| 000       | 0          | 0                            | 0                            | 1                            | 0          |
| Reserved  | 0: Disable | Effective at the rising edge | Effective at the rising edge | Effective at the rising edge | 0: Disable |

At this point, the bit1 of Cnt0\_Ctrl changes from 0 to 1. The FL6112\_2EI module monitors the rising edge of this bit and clears the count value of counter 0, which means Cnt0\_Val is cleared.

## 2. Parameter description

| Parameter name | Type | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2EI Cnt0 Cfg   | UINT | <p>Configuration parameter for counter 0:</p> <p>Bit1–Bit0: Channel mode configuration</p> <p>0b00: A/B phase quadruple frequency;</p> <p>0b01: A/B phase double frequency;</p> <p>0b10: A/B phase rated frequency;</p> <p>0b11: Pulse+direction (high level, positive);</p> <p>Bit3–Bit2: Frequency measurement period</p> <p>0b00: 20ms;</p> <p>0b01: 100ms;</p> <p>0b10: 500ms;</p> <p>0b11: 1000ms;</p> <p>Bit5–Bit4: Edge latch count value enabling</p> <p>0b00: Disable;</p> <p>0b01: Rising edge;</p> <p>0b10: Falling edge;</p> <p>0b11: Dual edges;</p> <p>Bit7–Bit6: Reserved</p> <p>Bit9–Bit8: Comparison consistent output pulse width</p> <p>0b00: 1ms;</p> <p>0b01: 2ms;</p> <p>0b10: 4ms;</p> <p>0b11: 8ms;</p> <p>Bit11–Bit10: DO comparison output mode</p> <p>0b00: Comparison consistent output;</p> <p>0b01: Output between [lower limit of count, comparison value];</p> <p>0b10: Output between [comparison value, upper limit of count];</p> |

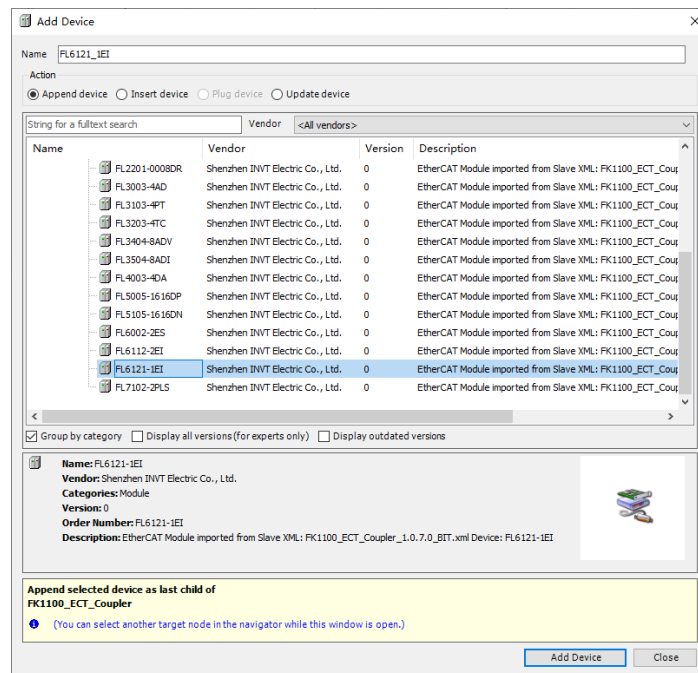
| Parameter name     | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |       | 0b11: Reserved (Comparison consistent output)<br>Bit15–Bit12: Reserved                                                                                                                                                                                                                                                                                                                            |
| 2EI Cnt0 Cfg       | UINT  | Configuration parameter for counter 1. The parameter configuration is consistent with counter 0.                                                                                                                                                                                                                                                                                                  |
| 2EI Cnt0 Filt      | UINT  | Filtering parameter for counter 0 A/B/Z/DI port.<br>Application scope 1–65535 (Unit: 0.1μs)                                                                                                                                                                                                                                                                                                       |
| 2EI Cnt1 Filt      | UINT  | Filtering parameter for counter 1 A/B/Z/DI port.<br>Application scope 1–65535 (Unit: 0.1μs)                                                                                                                                                                                                                                                                                                       |
| 2EI Cnt0 Ratio     | UINT  | Encoder resolution for counter 0 (number of pulses fed back from one revolution, the pulse increment between two Z pulses).                                                                                                                                                                                                                                                                       |
| 2EI Cnt1 Ratio     | UINT  | Encoder resolution for counter 1 (number of pulses fed back from one revolution, the pulse increment between two Z pulses).                                                                                                                                                                                                                                                                       |
| 2EI Cnt0 PresetVal | DINT  | Counter 0 preset value.                                                                                                                                                                                                                                                                                                                                                                           |
| 2EI Cnt1 PresetVal | DINT  | Counter 1 preset value.                                                                                                                                                                                                                                                                                                                                                                           |
| Cnt0_Ctrl          | USINT | Control parameter for counter 0.<br>Bit0: Enable counting, valid at high levels;<br>Bit1: Clear counting, valid at the rising edge;<br>Bit2: Write counter preset value, valid at the rising edge;<br>Bit3: Clear count overflow flag, valid at the rising edge;<br>Bit4: Enable count comparison function, valid at high levels (Provided that the counting is enabled.)<br>Bit7–Bit5: Reserved. |
| Cnt1_Ctrl          | USINT | Control parameter for counter 1. The parameter configuration is consistent with counter 0.                                                                                                                                                                                                                                                                                                        |
| Cnt0_CmpVal        | DINT  | Counter 0 comparison value.                                                                                                                                                                                                                                                                                                                                                                       |
| Cnt1_CmpVal        | DINT  | Counter 1 comparison value.                                                                                                                                                                                                                                                                                                                                                                       |
| Cnt0_Status        | USINT | Counter 0 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Overflow flag bit<br>Bit3: Underflow flag bit<br>Bit4: DI0 latch completion flag<br>Bit7–Bit5: Reserved                                                                                                                                                                                       |
| Cnt1_Status        | USINT | Counter 1 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Overflow flag bit<br>Bit3: Underflow flag bit<br>Bit4: DI1 latch completion flag<br>Bit7–Bit5: Reserved                                                                                                                                                                                       |
| Cnt0_Val           | DINT  | Count value of counter 0                                                                                                                                                                                                                                                                                                                                                                          |
| Cnt1_Val           | DINT  | Count value of counter 1                                                                                                                                                                                                                                                                                                                                                                          |
| Cnt0_LatchVal      | DINT  | Latched value of counter 0                                                                                                                                                                                                                                                                                                                                                                        |
| Cnt1_LatchVal      | DINT  | Latched value of counter 1                                                                                                                                                                                                                                                                                                                                                                        |
| Cnt0_Freq          | UDINT | Counter 0 frequency                                                                                                                                                                                                                                                                                                                                                                               |
| Cnt1_Freq          | UDINT | Counter 1 frequency                                                                                                                                                                                                                                                                                                                                                                               |

| Parameter name | Type | Description          |
|----------------|------|----------------------|
| Cnt0_Velocity  | REAL | Counter 0 speed      |
| Cnt1_Velocity  | REAL | Counter 1 speed      |
| Cnt0_Errld     | UINT | Counter 0 error code |
| Cnt1_Errld     | UINT | Counter 1 error code |

### 6.1.1.11 Counting and measurement module (FL6121)

#### 1. Programming instance

Step 1 Add the FL6121-1EI device.



Step 2 Choose **Startup Parameters**, set the counter, filtering mode, encoder resolution, and counter preset values based on the actual needs, with a filter unit of 10ns.

| Startup Parameters |      |                |                   |       |            |                          |                          |           |                   |
|--------------------|------|----------------|-------------------|-------|------------|--------------------------|--------------------------|-----------|-------------------|
|                    | Line | Index:Subindex | Name              | Value | Bit Length | Abort on Error           | Jump to Line on Error    | Next Line | Comment           |
| Module I/O Mapping | 1    | 16#8030:16#01  | 1EI Cnt Cfg       | 0     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 1EI Cnt Cfg       |
| Module IEC Objects | 2    | 16#8030:16#02  | 1EI Cnt Filt      | 5     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 1EI Cnt Filt      |
|                    | 3    | 16#8030:16#03  | 1EI DI Filt       | 5     | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 1EI DI Filt       |
| Information        | 4    | 16#8030:16#04  | 1EI Cnt Ratio     | 10000 | 16         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 1EI Cnt Ratio     |
|                    | 5    | 16#8030:16#05  | 1EI Cnt PresetVal | 0     | 32         | <input type="checkbox"/> | <input type="checkbox"/> | 0         | 1EI Cnt PresetVal |

- Cnt Cfg is a counter configuration parameter, with data type of UINT. Refer to the parameter description table for data definition.

| Bit       | Name                         | Parameter description                                                                                                                           |
|-----------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit1–bit0 | Channel mode configuration   | 2#00: A/B phase quadruple frequency (Default)<br>2#01: A/B phase double frequency<br>2#10: A/B phase rated frequency<br>2#11: Pulse + direction |
| Bit3–bit2 | Frequency measurement period | 2#00:20ms (Default)<br>2#01:100ms<br>2#10:500ms<br>2#11:1000ms                                                                                  |

| Bit         | Name                                     | Parameter description                                                                                                                                                                          |
|-------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit5–bit4   | DI0 edge latch enabling                  | 2#00: Disable (Default)<br>2#01: Rising edge<br>2#10: Falling edge<br>2#11: Dual edges                                                                                                         |
| Bit7–bit6   | DI1 edge latch enabling                  | 2#00: Disable (Default)<br>2#01: Rising edge<br>2#10: Falling edge<br>2#11: Dual edges                                                                                                         |
| Bit9–bit8   | Comparison consistent pulse output width | 2#00:1ms (Default)<br>2#01:2ms<br>2#10:4ms<br>2#11:8ms                                                                                                                                         |
| Bit11–bit10 | DO0 comparison output mode               | 2#00: Consistent output for comparison (Default)<br>2#01: Output between [Count lower limit, Comparison value]<br>2#10: Output between [Comparison value, Count upper limit]<br>2#11: Reserved |
| Bit13–bit12 | DO1 comparison output mode               | 2#00: Consistent output for comparison (Default)<br>2#01: Output between [Count lower limit, Comparison value]<br>2#10: Output between [Comparison value, Count upper limit]<br>2#11: Reserved |
| Bit15–bit14 | Reserved                                 | -                                                                                                                                                                                              |

Assuming that counter is configured as A/B phase quadruple frequency, the frequency measurement period is 100ms, DI0 rising edge latch and DI1 falling edge latch are enabled, comparison consistent pulse output width is 8ms, DO0 comparison output mode is comparison consistent output, DO1 comparison output mode is output between [comparison value, upper limit of count], then Cnt Cfg should be configured as 9108, which is 2#0010001110010100, as detailed below.

| Bit15–Bit14 | Bit13                                                   | Bit12 | Bit11                        | Bit10 | Bit9 | Bit8 | Bit7 | Bit6      | Bit5 | Bit4        | Bit3 | Bit2  | Bit1 | Bit0                          |
|-------------|---------------------------------------------------------|-------|------------------------------|-------|------|------|------|-----------|------|-------------|------|-------|------|-------------------------------|
| 2#00        | 2#10                                                    |       | 2#00                         |       |      | 2#11 |      | 2#10      |      | 2#01        |      | 2#01  |      | 2#00                          |
| Reserved    | Output between [comparison value, upper limit of count] |       | Comparison consistent output |       |      | 8ms  |      | fall edge |      | Rising edge |      | 100ms |      | A/B phase quadruple frequency |

- Cnt Filt is the filtering parameter for A/B/Z ports, in units of 10ns, with a default value of 5. If it is set to 100, it means that only signals that remain stable and do not jump within 1μs are sampled.
- DI Filt is the filtering parameter for DI0/ DI1/ DI2 ports, in units of 10ns, with a default value of 5. If it is set to 100, it means that only signals that remain stable and do not jump within 1μs are sampled.
- Cnt Ratio is the encoder resolution (number of pulses fed back from one turn, namely the pulse increment between two Z pulses), with a default value of 10000. Assuming the resolution labeled on the encoder is 2500P/R, the Cnt Ratio should be set to 10000 since the Cnt Cfg is configured as A/B phase quadruple.
- Cnt PresetVal is the counter preset value, with a default value of 0 and a parameter type of DINT.

Step 3 After configuring the above startup parameters and downloading the program, control the counter on the Module I/O mapping interface.

|                    |                                   |         |               |         |          |      |                               |  |
|--------------------|-----------------------------------|---------|---------------|---------|----------|------|-------------------------------|--|
| Startup Parameters | Find                              |         | Filter        |         | Show all |      | <div><div></div></div> Add FB |  |
| Module I/O Mapping | Variable                          | Mapping | Channel       | Address | Type     | Unit | Description                   |  |
| Module IEC Objects | <div><div></div><div></div></div> |         | Cnt_Ctrl      | %QW22   | UINT     |      | Cnt_Ctrl                      |  |
|                    | <div><div></div><div></div></div> |         | Cnt_Cmp0Val   | %QD12   | DINT     |      | Cnt_Cmp0Val                   |  |
| Information        | <div><div></div><div></div></div> |         | Cnt_Cmp1Val   | %QD13   | DINT     |      | Cnt_Cmp1Val                   |  |
|                    | <div><div></div><div></div></div> |         | Cnt_Status    | %IW2    | UINT     |      | Cnt_Status                    |  |
|                    | <div><div></div><div></div></div> |         | Cnt_Val       | %ID2    | DINT     |      | Cnt_Val                       |  |
|                    | <div><div></div><div></div></div> |         | Cnt_Latch0Val | %ID3    | DINT     |      | Cnt_Latch0Val                 |  |
|                    | <div><div></div><div></div></div> |         | Cnt_Latch1Val | %ID4    | DINT     |      | Cnt_Latch1Val                 |  |
|                    | <div><div></div><div></div></div> |         | Cnt_Freq      | %ID5    | UDINT    |      | Cnt_Freq                      |  |
|                    | <div><div></div><div></div></div> |         | Cnt_Velocity  | %ID6    | REAL     |      | Cnt_Velocity                  |  |
|                    | <div><div></div><div></div></div> |         | Cnt_ErrId     | %IW14   | UINT     |      | Cnt_ErrId                     |  |

- Cnt\_Ctrl is the counter control parameter. Refer to the parameter description table for data definition.

| Bit       | Name                        | Parameter description        |
|-----------|-----------------------------|------------------------------|
| Bit0      | Enable counting             | 2#0: Disable<br>2#1: Enable  |
| Bit1      | Clear counting              | Effective at the rising edge |
| Bit2      | Write counter preset value  | Effective at the rising edge |
| Bit3      | Clear counter overflow flag | Effective at the rising edge |
| Bit4      | Counter comparison          | 2#0: Disable<br>2#1: Enable  |
| Bit7-bit5 | Reserved                    | -                            |

- Cnt\_CmpxVal (x=0,1) is the counter comparison value of type DINT.

Assuming that Cnt\_Cmp0Val is set to 1000000, if you need to enable the counter for comparison, set Cnt\_Ctrl to 17, which is 2#00010001. The details are as follows.

| Bit7-Bit5 | Bit4     | Bit3                         | Bit2                         | Bit1                         | Bit0     |
|-----------|----------|------------------------------|------------------------------|------------------------------|----------|
| 2#000     | 2#1      | 2#0                          | 2#0                          | 2#0                          | 2#1      |
| Reserved  | Power on | Effective at the rising edge | Effective at the rising edge | Effective at the rising edge | Power on |

- Cnt\_Val is the counter counting value of type DINT.

According to the configuration value 9108 of Cnt Cfg mentioned above (enabling DO0 comparison consistent output and output pulse 8ms), when the count value Cnt\_Val is equal to 1000000, DO0 will output 8ms.

If you want to clear the current count value of the counter, you need to set Cnt\_Ctrl to 2, which is 2#00000010, as detailed below.

| Bit7-Bit5 | Bit4    | Bit3                         | Bit2                         | Bit1                         | Bit0    |
|-----------|---------|------------------------------|------------------------------|------------------------------|---------|
| 2#000     | 2#0     | 2#0                          | 2#0                          | 2#1                          | 2#0     |
| Reserved  | Disable | Effective at the rising edge | Effective at the rising edge | Effective at the rising edge | Disable |

At this point, bit1 of Cnt\_Ctrl changes from 0 to 1. The FL6121\_1EI module detects the rising edge of this bit, and the counter value is cleared to zero, that is, Cnt\_Val is cleared to zero.

**Note:**

- DI0/DI1 serves as the counter latch input, with corresponding latch values of Cnt\_Latch0Val/Cnt\_Latch1Val.



- In Cnt\_Ctrl, the function of bit1 is to clear the count value. When clearing the count value, the overflow flag of the counter will also be cleared. The function of bit3 in Cnt\_Ctrl is to clear the overflow flag, and at the same time as clearing the overflow flag, the count value will not be cleared.
- DI2 is the counter reset input and it is valid at the rising edge. After the FL6121\_1EI module detects a rising edge on DI2, it will reset the count value Cnt\_Val to the preset value Cnt\_PresetVal, clear the overflow flag of the counter, and reset the latch values Cnt\_Latch0Val/Cnt\_Latch1Val to 0.

## 2. Parameter description

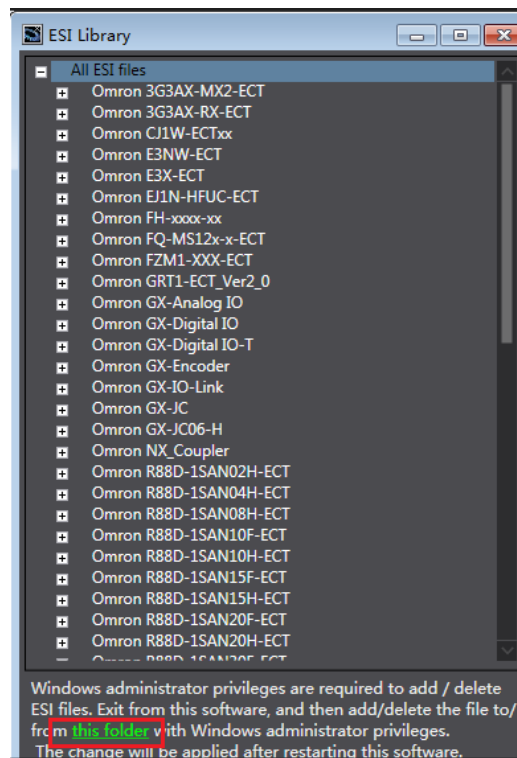
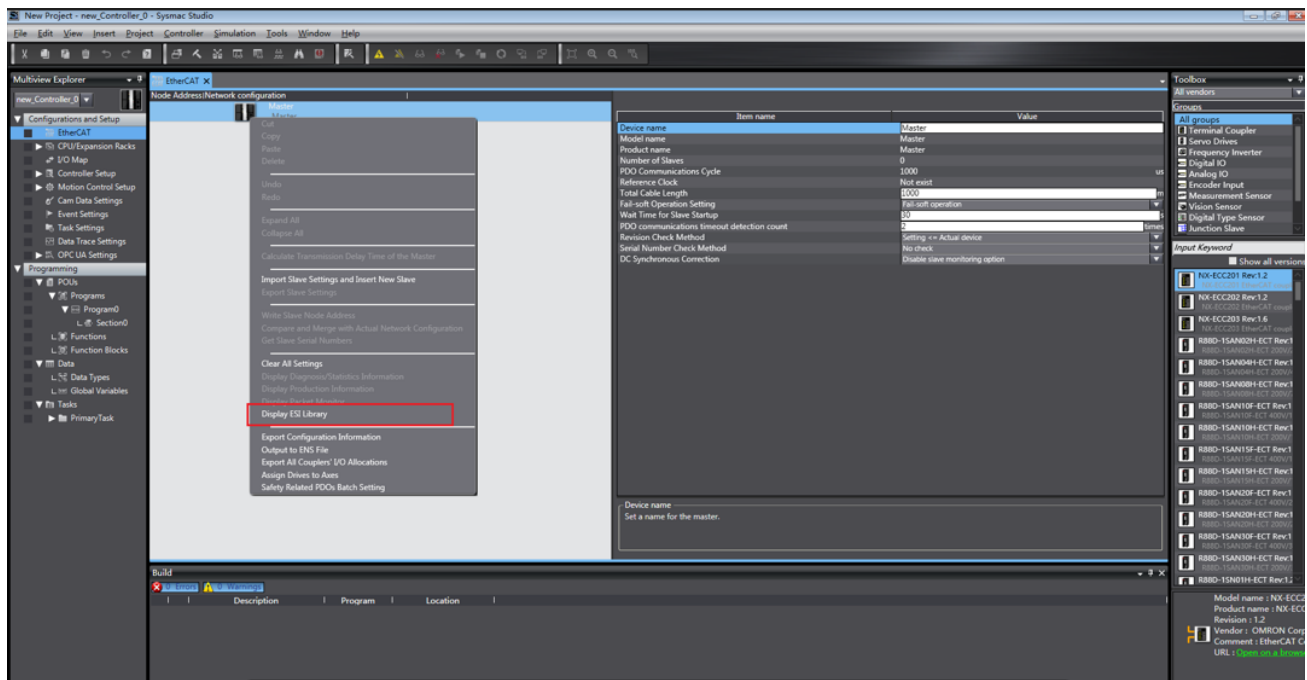
| Parameter name | Type | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1EI Cnt Cfg    | UINT | <p>Configuration parameter for counter 0:</p> <p>Bit1–Bit0: Channel mode configuration</p> <p>0b00: A/B phase quadruple frequency;</p> <p>0b01: A/B phase double frequency;</p> <p>0b10: A/B phase rated frequency;</p> <p>0b11: Pulse+direction (high level, positive);</p> <p>Bit3–Bit2: Frequency measurement period</p> <p>0b00: 20ms;</p> <p>0b01: 100ms;</p> <p>0b10: 500ms;</p> <p>0b11: 1000ms;</p> <p>Bit5–Bit4: DI0 edge latch count value enabling</p> <p>0b00: Disable;</p> <p>0b01: Rising edge;</p> <p>0b10: Falling edge;</p> <p>0b11: Dual edges;</p> <p>Bit7–Bit6: DI1 edge latch count value enabling</p> <p>0b00: Disable;</p> <p>0b01: Rising edge;</p> <p>0b10: Falling edge;</p> <p>0b11: Dual edges;</p> <p>Bit9–Bit8: Comparison consistent output pulse width</p> <p>0b00: 1ms;</p> <p>0b01: 2ms;</p> <p>0b10: 4ms;</p> <p>0b11: 8ms;</p> <p>Bit11–Bit10: DO0 comparison output mode</p> <p>0b00: Comparison consistent output;</p> <p>0b01: Output between [lower limit of count, comparison value];</p> <p>0b10: Output between [comparison value, upper limit of count];</p> <p>0b11: Reserved (Comparison consistent output)</p> <p>Bit13–Bit12: DO1 comparison output mode</p> <p>0b00: Comparison consistent output;</p> <p>0b01: Output between [lower limit of count, comparison value];</p> <p>0b10: Output between [comparison value, upper limit of count];</p> <p>0b11: Reserved (Comparison consistent output)</p> <p>Bit15–Bit14: Reserved</p> |

| Parameter name    | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1EI Cnt Filt      | UINT  | Filtering parameter for counter A/B/Z port. Application scope 1–65535 (Unit: 10ns)                                                                                                                                                                                                                                                                                                                |
| 1EI DI Filt       | UINT  | Filtering parameter for counter DI port. Application scope 1–65535 (Unit: 10ns)                                                                                                                                                                                                                                                                                                                   |
| 1EI Cnt Ratio     | UINT  | Encoder resolution (number of pulses fed back from one revolution, the pulse increment between two Z pulses).                                                                                                                                                                                                                                                                                     |
| 1EI Cnt PresetVal | DINT  | Counter preset value                                                                                                                                                                                                                                                                                                                                                                              |
| Cnt_Ctrl          | UINT  | Control parameter for counter 0.<br>Bit0: Enable counting, valid at high levels;<br>Bit1: Clear counting, valid at the rising edge;<br>Bit2: Write counter preset value, valid at the rising edge;<br>Bit3: Clear count overflow flag, valid at the rising edge;<br>Bit4: Enable count comparison function, valid at high levels (Provided that the counting is enabled.)<br>Bit7–Bit5: Reserved. |
| Cnt_Cmp0Val       | DINT  | Counter comparison value 0                                                                                                                                                                                                                                                                                                                                                                        |
| Cnt_Cmp1Val       | DINT  | Counter comparison value 1                                                                                                                                                                                                                                                                                                                                                                        |
| Cnt_Status        | UINT  | Counter 0 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Overflow flag bit<br>Bit3: Underflow flag bit<br>Bit4: DI0 latch completion flag<br>Bit5: DI1 latch completion flag<br>Bit7–Bit6: Reserved                                                                                                                                                    |
| Cnt_Val           | DINT  | Count value of counter                                                                                                                                                                                                                                                                                                                                                                            |
| Cnt_Latch0Val     | DINT  | Latched value 0 of counter                                                                                                                                                                                                                                                                                                                                                                        |
| Cnt_Latch1Val     | DINT  | Latched value 1 of counter                                                                                                                                                                                                                                                                                                                                                                        |
| Cnt_Freq          | UDINT | Counter frequency                                                                                                                                                                                                                                                                                                                                                                                 |
| Cnt_Velocity      | REAL  | Counter speed                                                                                                                                                                                                                                                                                                                                                                                     |
| Cnt_ErrId         | UINT  | Counter error code                                                                                                                                                                                                                                                                                                                                                                                |

## 6.1.2 Sysmac Studio configuration description

### 6.1.2.1 Installing the device descriptor file

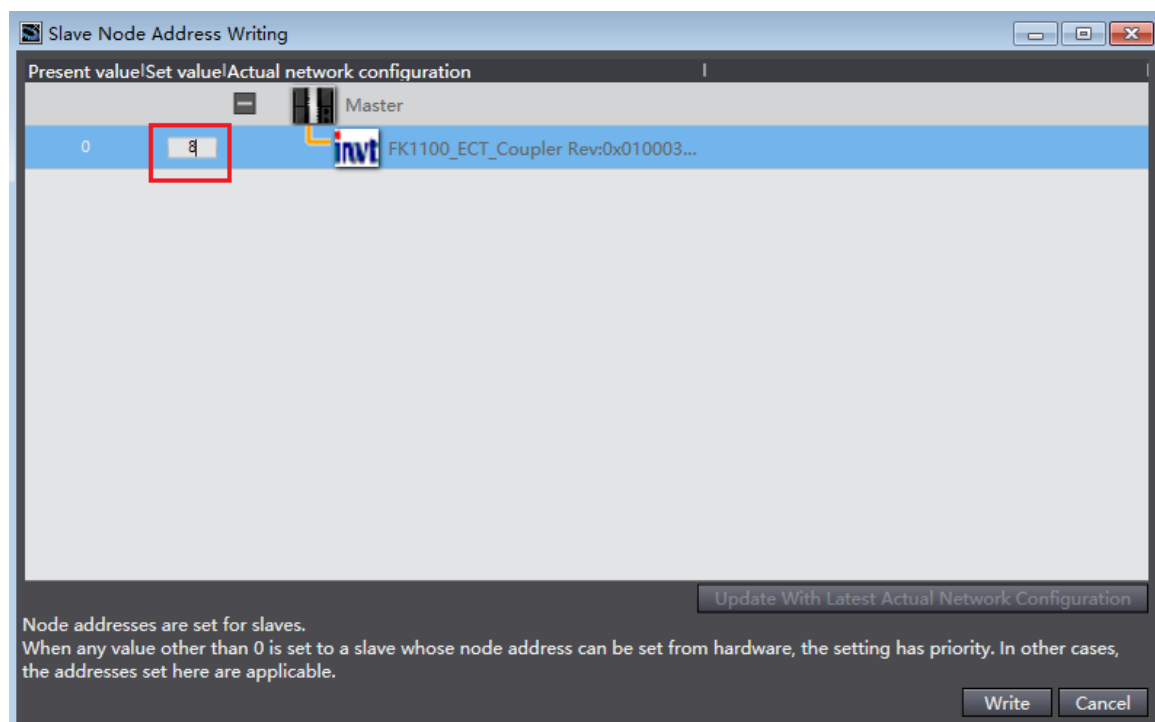
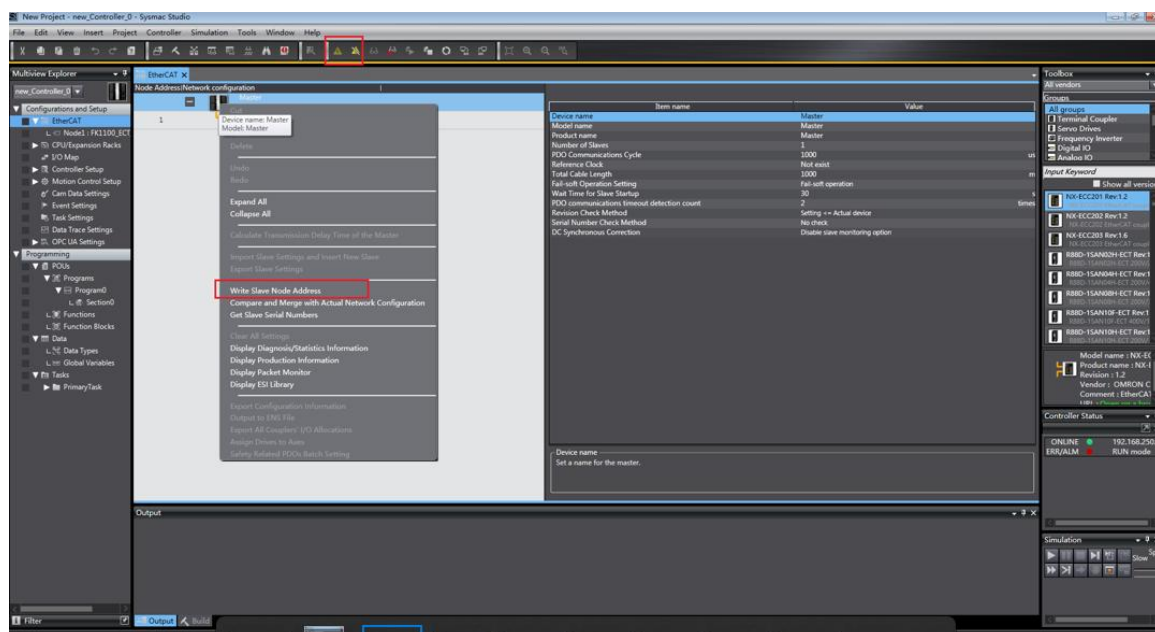
Double-click **EtherCAT**, right-click **Master device** on the pop-up interface, choose **Display ESI library**, click **this folder** on the pop-up ESI library interface to open the ESI library folder, put the device description file **FK1100\_ECT\_Coupler\_x.x.x.x.xml** into the folder, and restart the Sysmac Studio software.



### 6.1.2.2 Setting the slave node address

When the coupler module is used for the first time, you need to configure the slave node address.

After the device is connected, click the online button, right-click the main device, choose **Write to Slave Node Address**, modify the setting on the pop-up **Sub-device node address writing in progress** interface (the setting ranges from 1 to 192 and cannot be repeated), and click **Write**. After successful writing, the FK1100\_ECT\_Coupler coupler module will take effect after power off and restart.

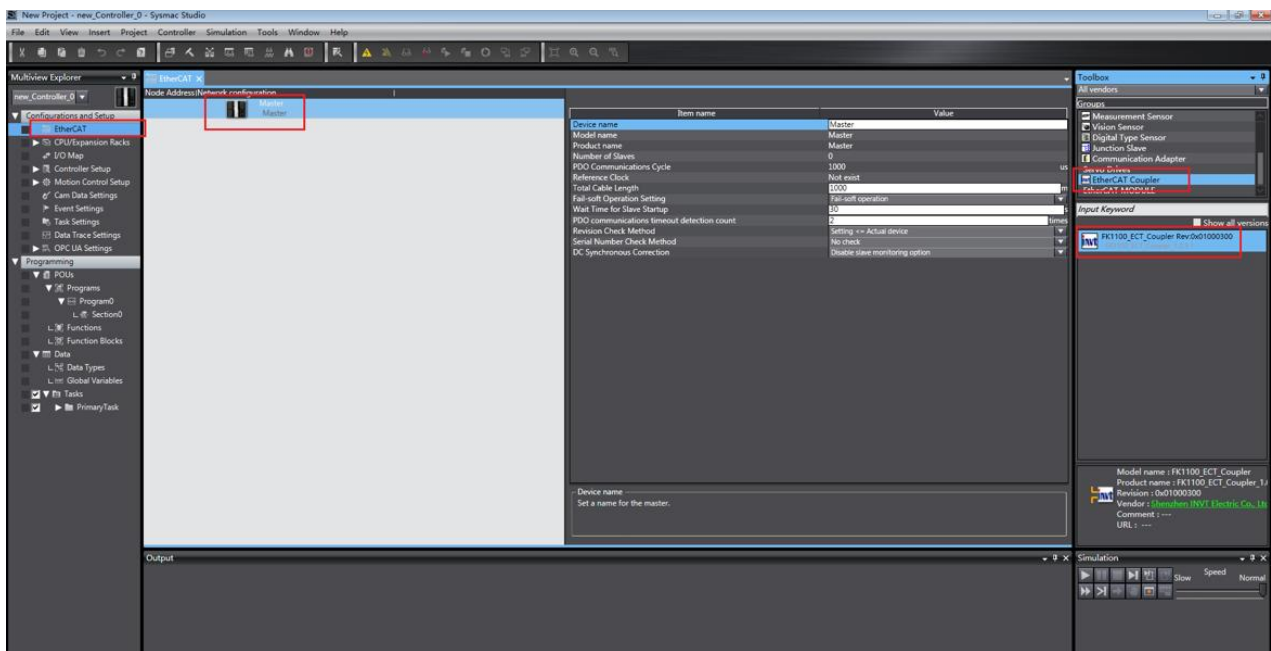


### 6.1.2.3 Performing network configuration

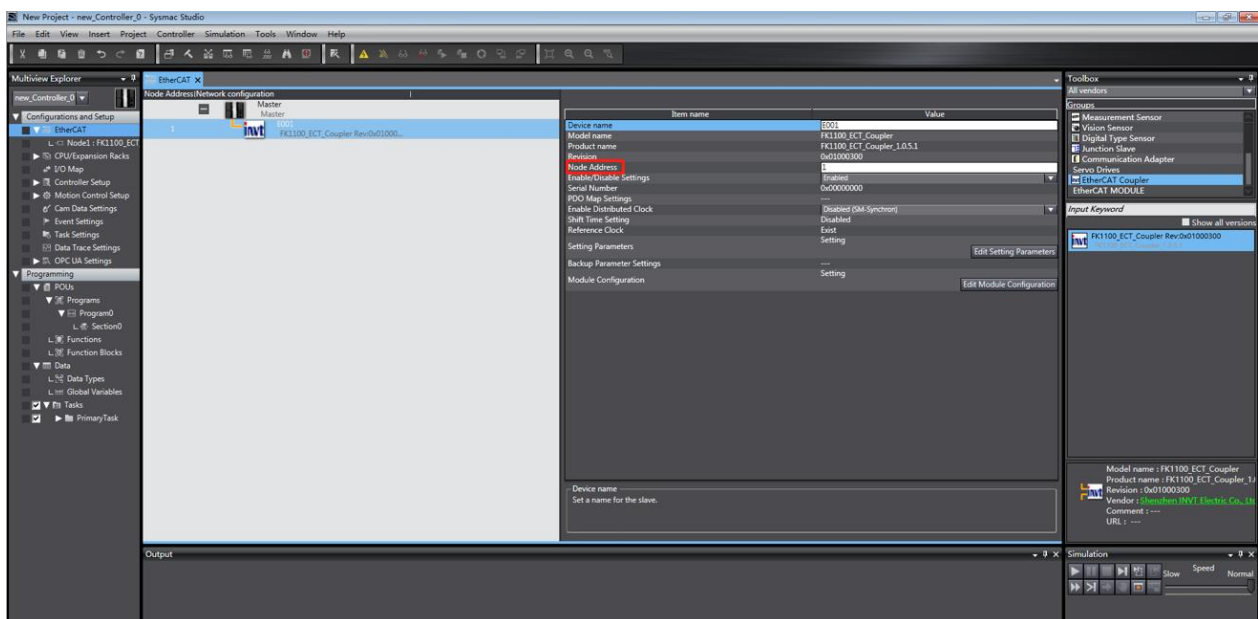
#### ■ Manual configuration

1. Add FK1100 ECT Couper Slave.

In offline state, double-click **EtherCAT > Master**, find the EtherCAT coupler with the INVT label in the toolbar on the right, double-click **FK1100\_ECT\_Coupler** to add the coupler slave.

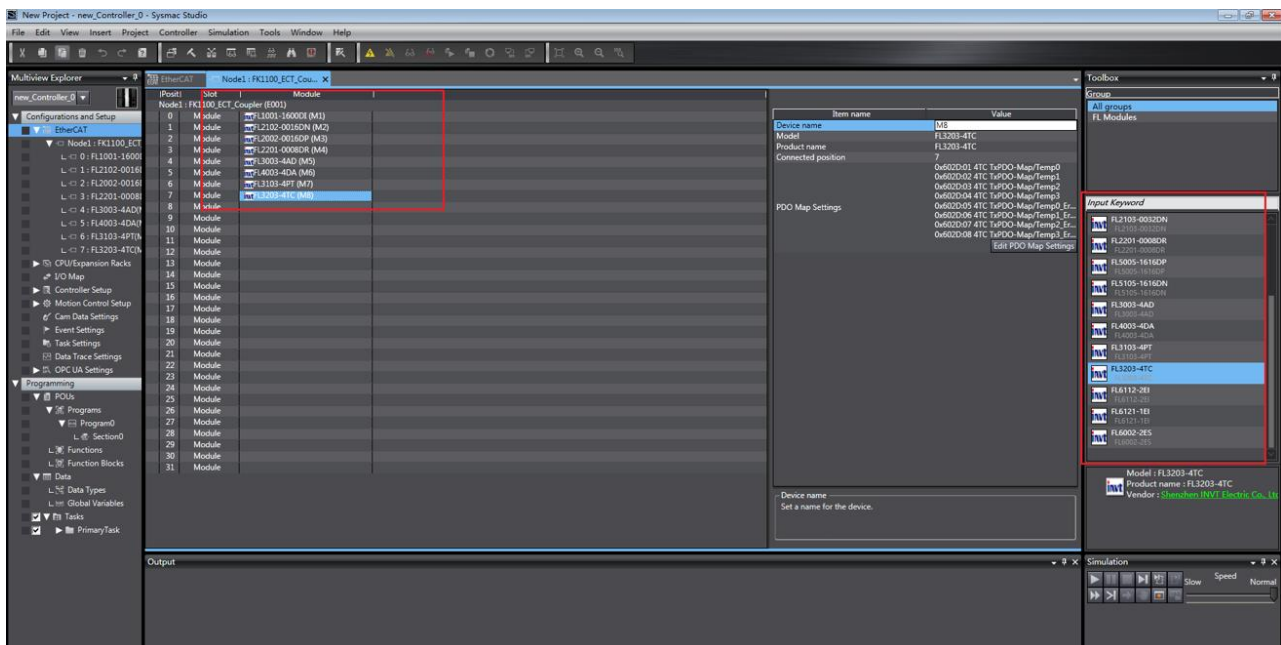
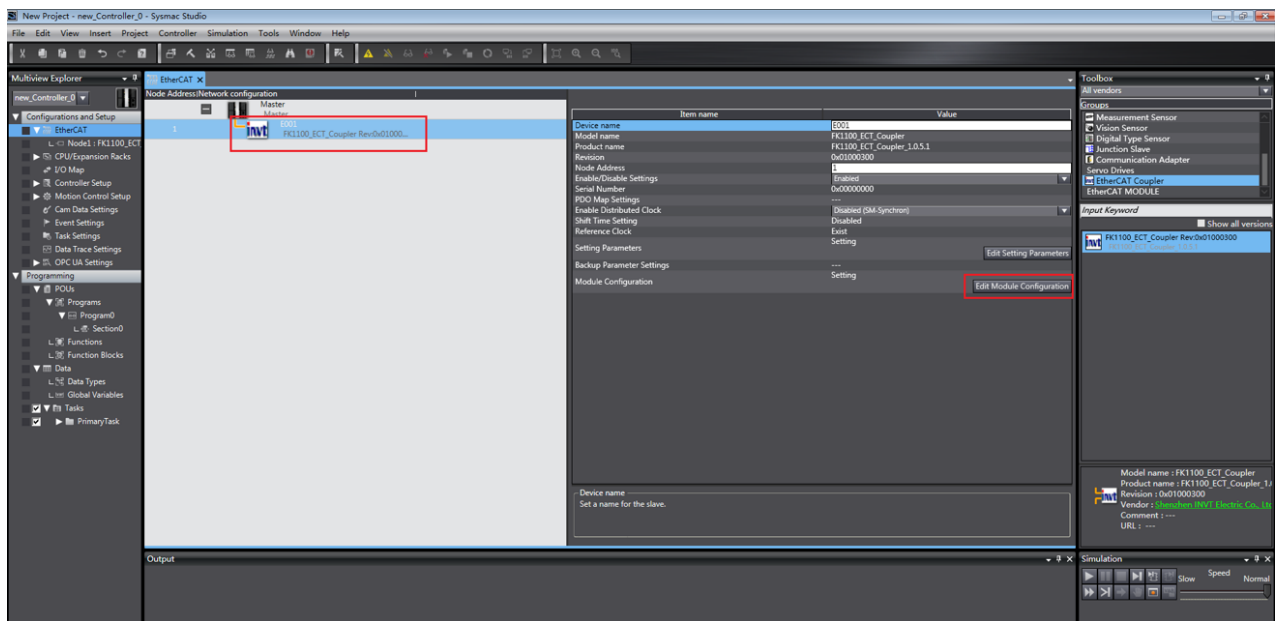


**Note:** The address of the sub-node here needs to be consistent with the one configured in 6.1.2.2 Setting the slave node address.

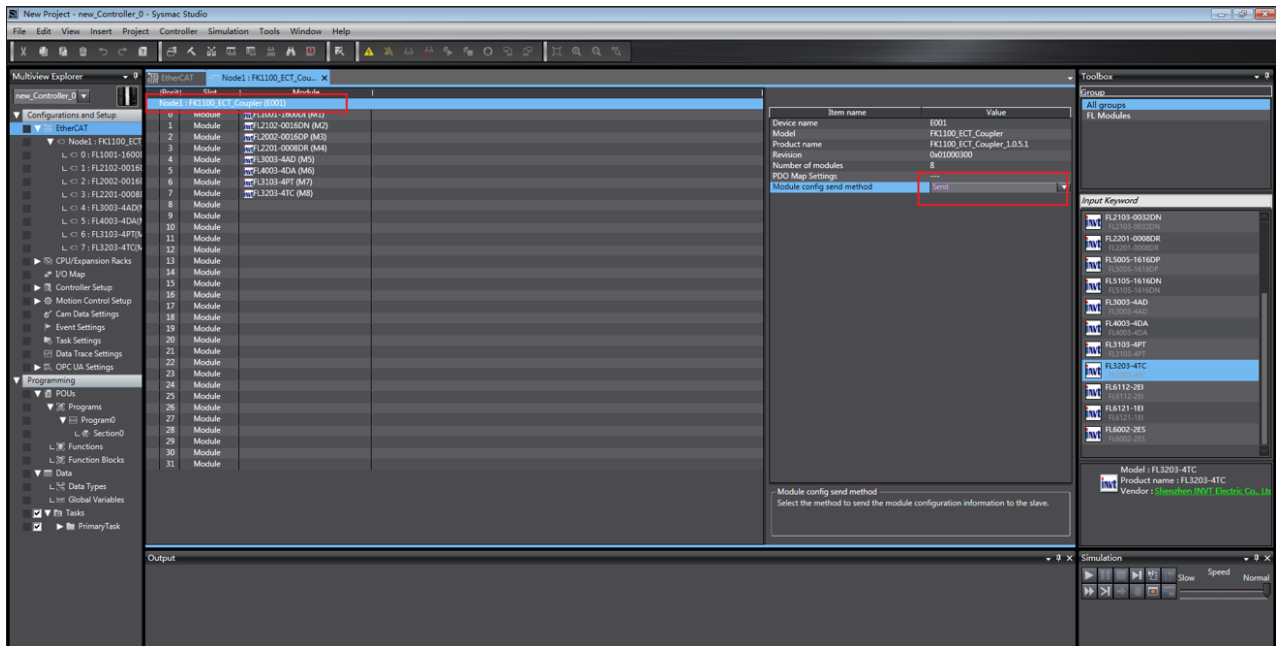


2. Add the expansion module.

Click **FK1100\_ECT\_Coupler** that has been added, then click **Edit Module Configuration** in the configuration box on the right. Based on the actual physical connection of the modules, add the modules from the toolbar to the slots.



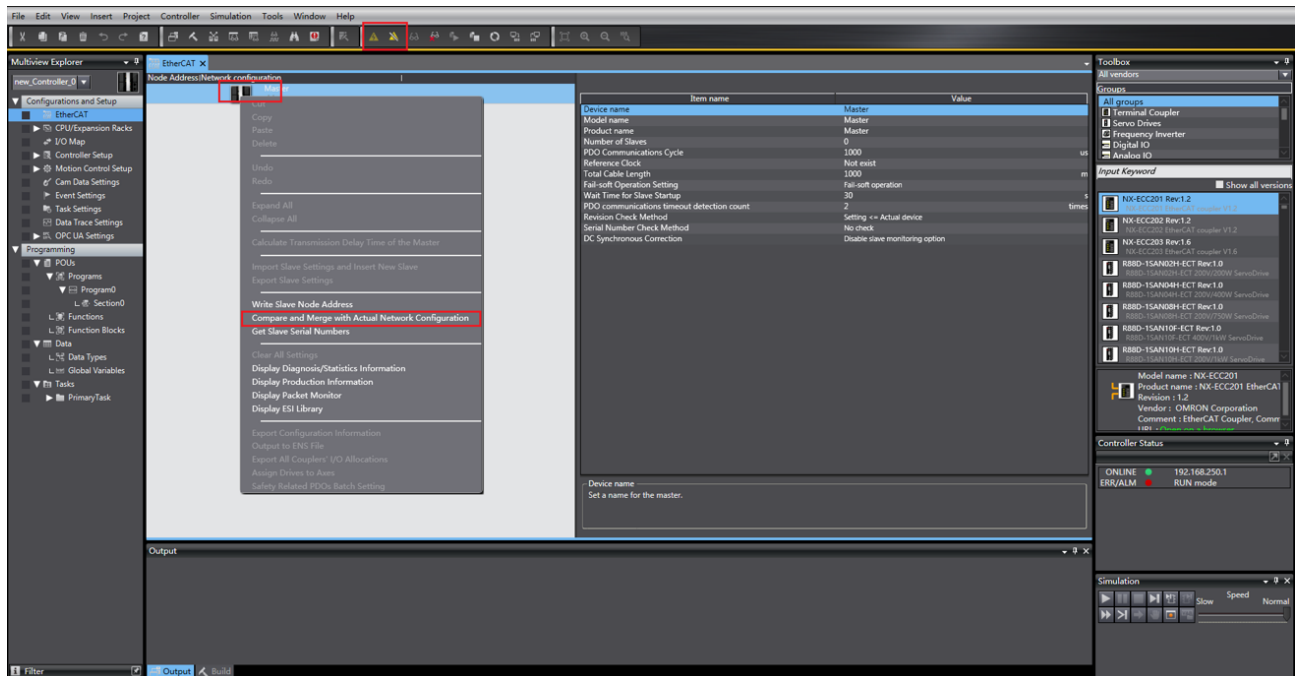
**Note:** On this interface (node configuration interface), click **Node: FK1100\_ECT\_Coupler**, and change **Module config send method** to **Send** on the right configuration interface. If the network configuration is not modified, it will not be sent to the slave node, and thus the slave node cannot receive the network configuration, resulting in a configuration mismatch error. In addition, EtherCAT communication will also fail to enter the OP state.



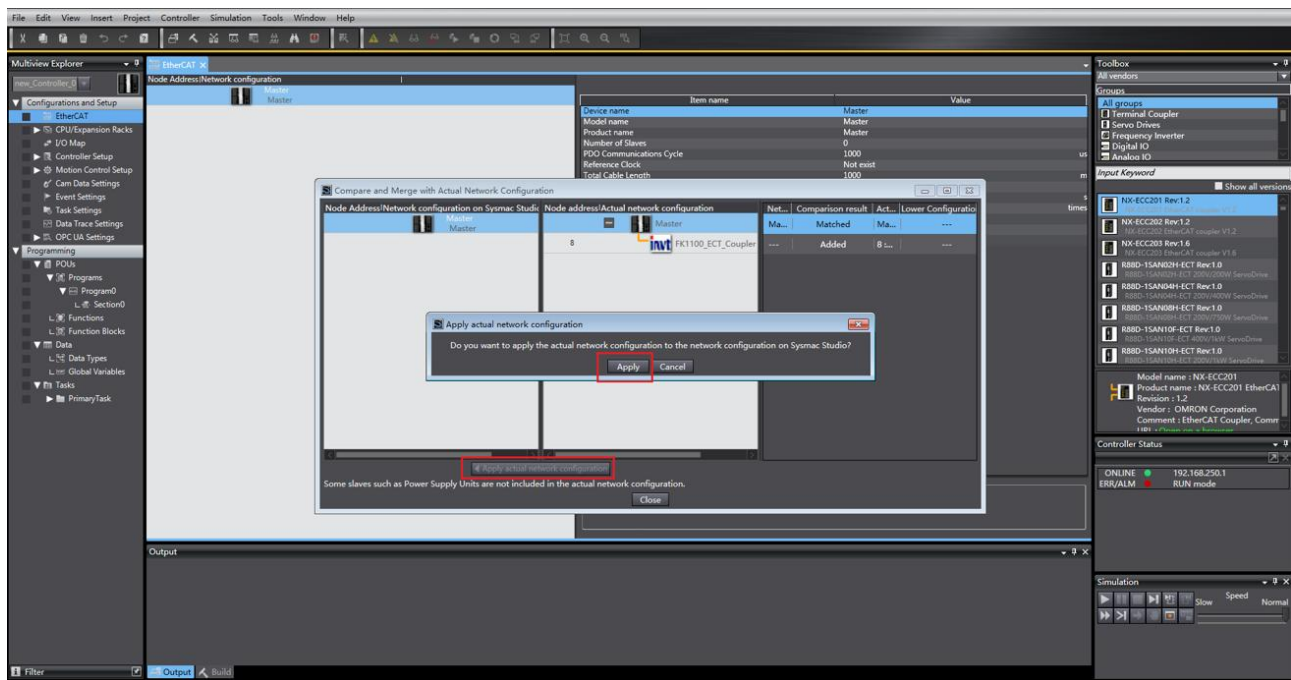
**Note:** The physical configuration must be consistent with the network configuration. If the configuration is inconsistent, EtherCAT communication cannot enter the OP state.

### Automatic scanning

Click the online button, right-click **Master**, choose **Compare and Merge with Actual Network Configuration**, and click **Apply actual network configuration** on the pop-up **Compare and Merge with Actual Network Configuration** interface.





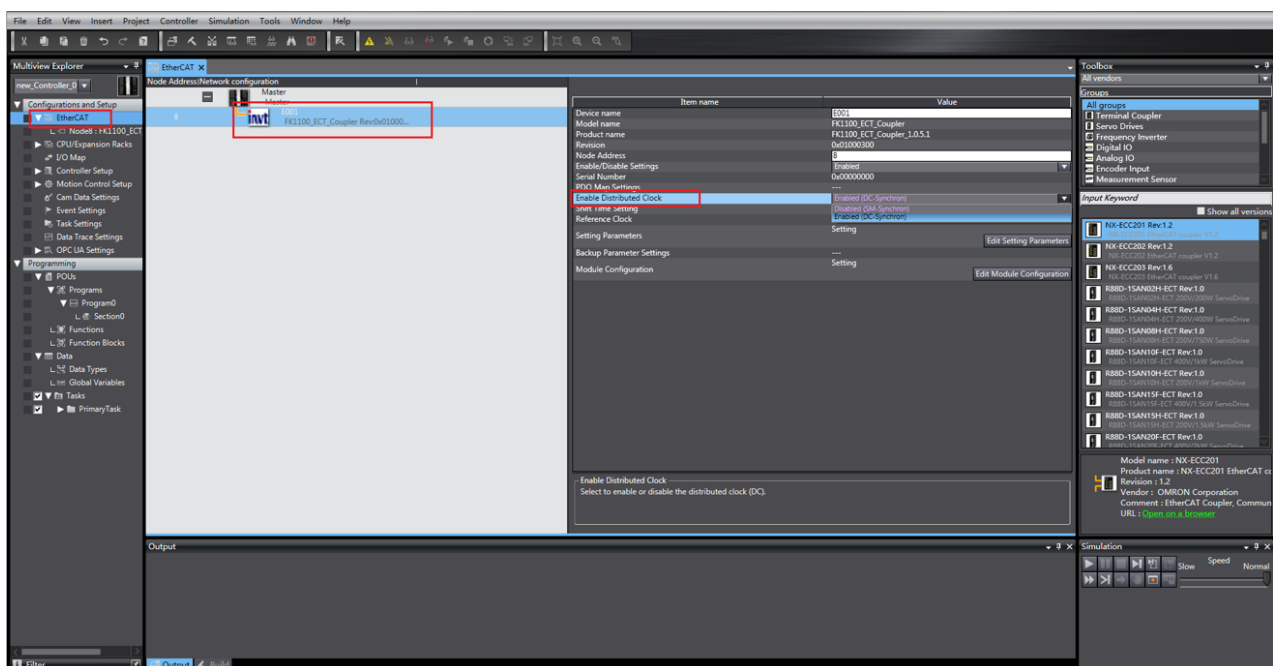


#### Note:

- For offline state, on the node configuration interface, click **Node: FK1100\_ECT\_Coupler**, and change **Module config send method** to **Send** on the right configuration interface. If the network configuration is not modified, it will not be sent to the slave node, and thus the slave node cannot receive the network configuration, resulting in a configuration mismatch error. In addition, EtherCAT communication will also fail to enter the OP state.
- After the automatic scanning, it is recommended to check whether the network configuration and physical configuration added by the scan match, and adjustments can be made manually.

### 6.1.2.4 EtherCAT communication parameter configuration

- Synchronous mode: Double-click **EtherCAT**, click **FK1100\_ECT\_Coupler** on the pop-up interface, and set **Enable Distributed Clock** on the right side.





## 2. Synchronization period: /

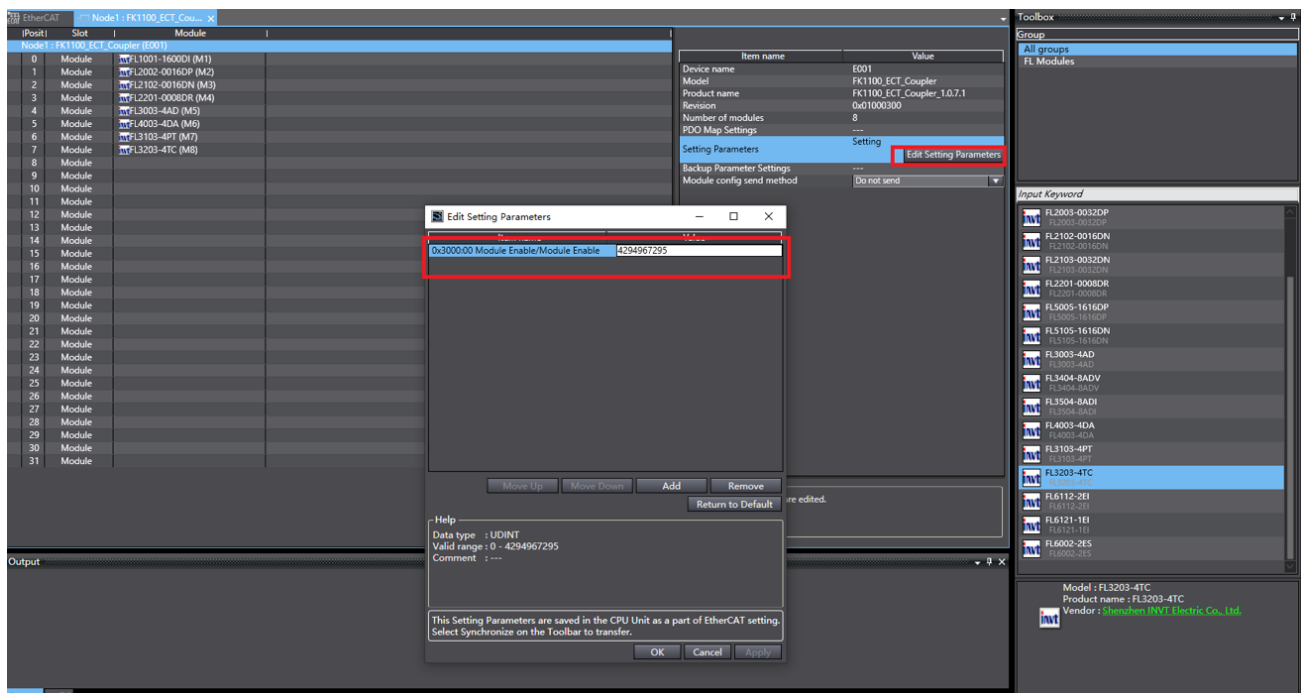
## 6.1.2.5 Module configuration parameter

Testing revealed that some versions of Omron support visual configuration of initialization parameters, while others do not. The testing results on Omron's Sysmac Studio V1.52 are as follows; other versions may vary depending on specific conditions.

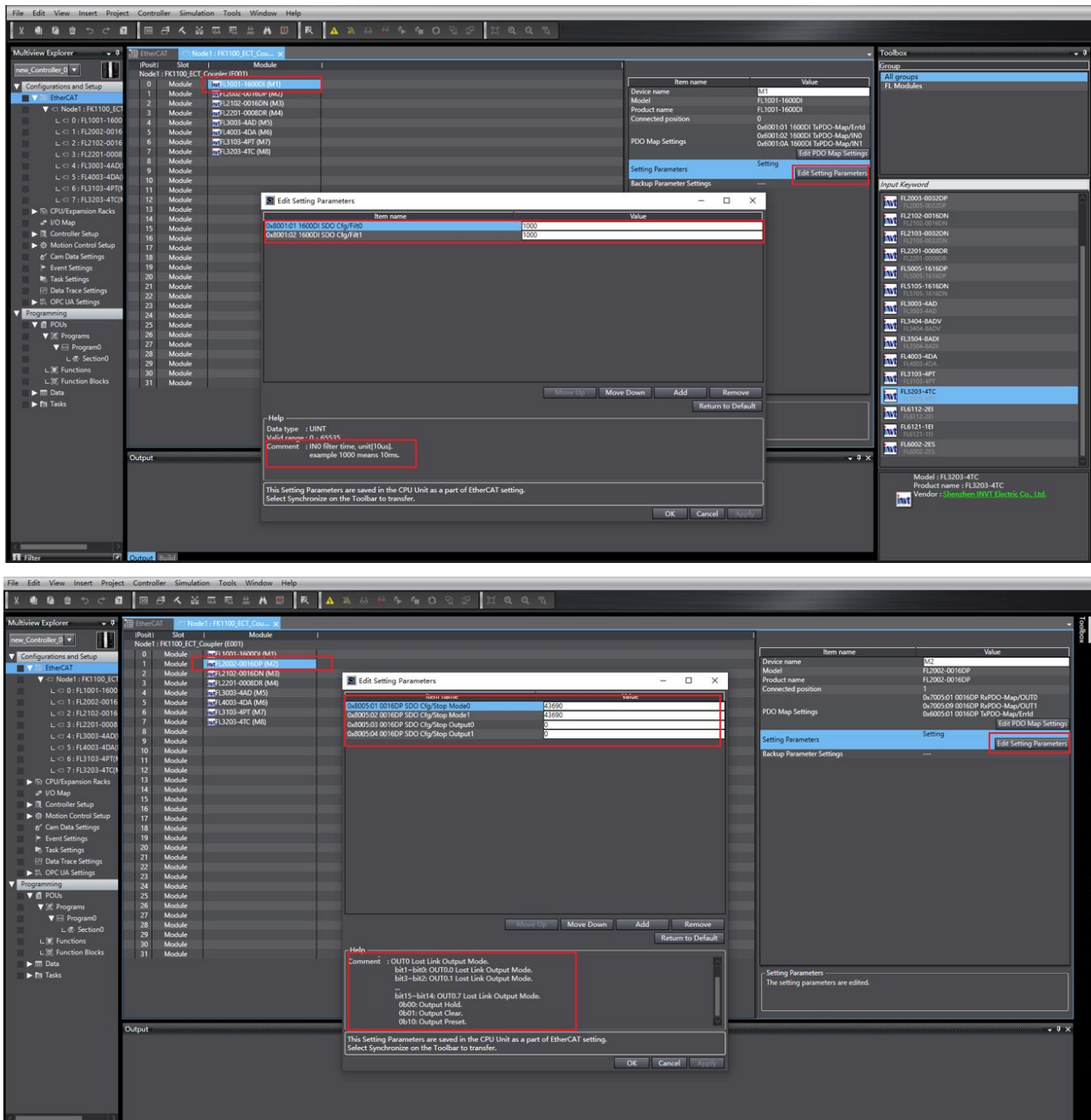
| Omron host controller | Model  | PLC version       | Support visual configuration |
|-----------------------|--------|-------------------|------------------------------|
| NJ501                 | 1300   | V1.40 and later   | Supported                    |
|                       | 1400   | V1.21             | Not supported                |
|                       | 1500   | V1.20 and earlier | Not supported                |
| NX701                 | 1600   | V1.21 and earlier | Not supported                |
|                       | 1700   |                   |                              |
| NX1P2                 | 9024DT | V1.40 and later   | Supported                    |
|                       | 1040DT | V1.21             | Not supported                |
|                       | 1140DT | V1.20 and earlier | Not supported                |

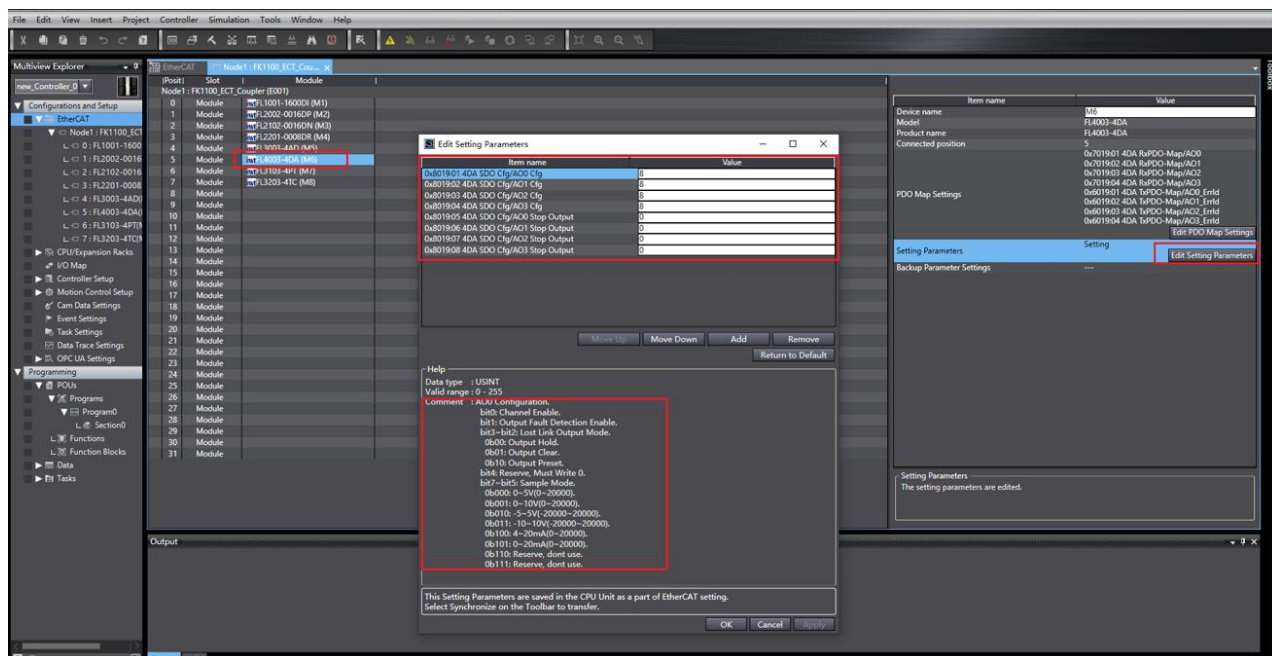
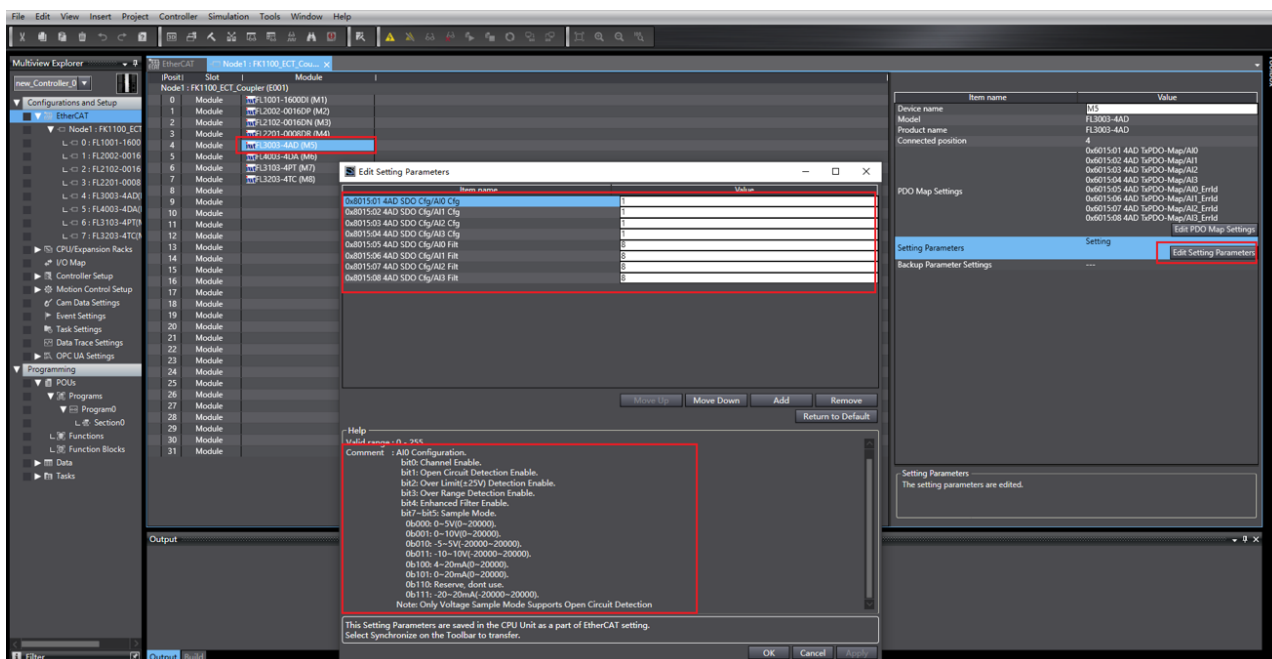
### Visual modification of initialization parameters

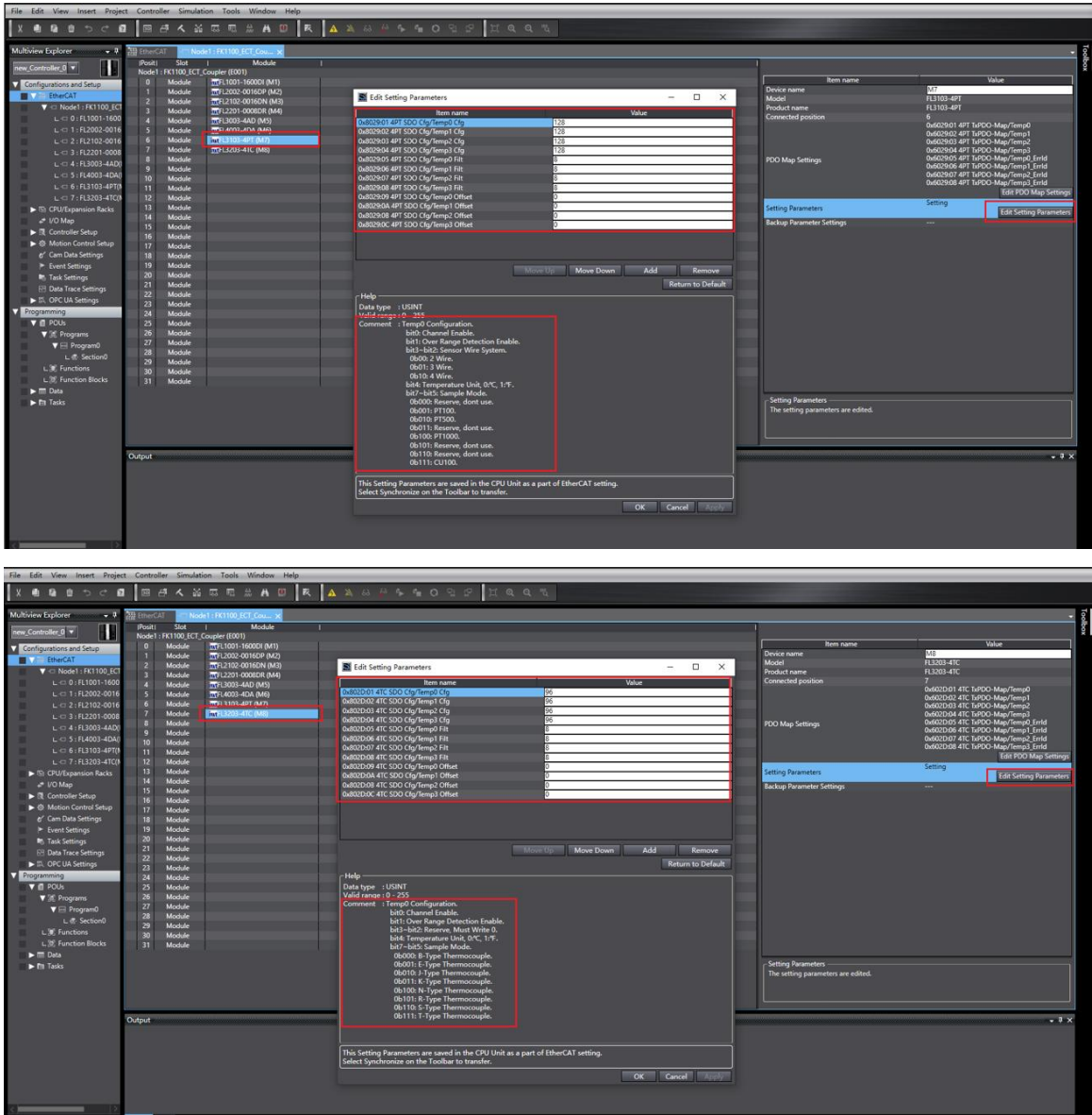
Double-click **Node 1: FK1100\_ECT\_Coupler**, click **Edit Setting Parameters** on the right side, and modify the coupler configuration parameter **Module Enable** on the pop-up **Edit Setting Parameters** interface. For the specific meanings of the parameters, refer to 6.1.2.7 Object dictionary description.



The visual configuration of other digital, analog, and temperature sampling modules can be seen in the following figures. For details of the parameters, refer to the parameter remarks in the figures and 6.1.2.7 Object dictionary description.

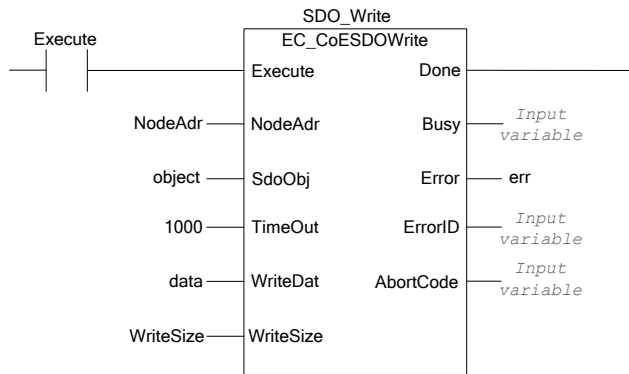






■ Modify initialization parameters of the SDO function block

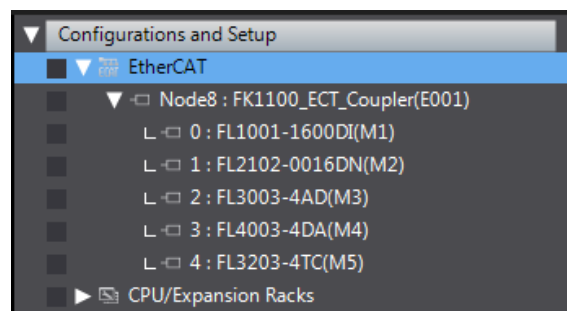
Configuration parameters are all SDO parameters. Omron does not support a PLC version that visually configures initialization parameters. Configuring SDO parameters requires the use of the EC\_CoESDOWrite function block.



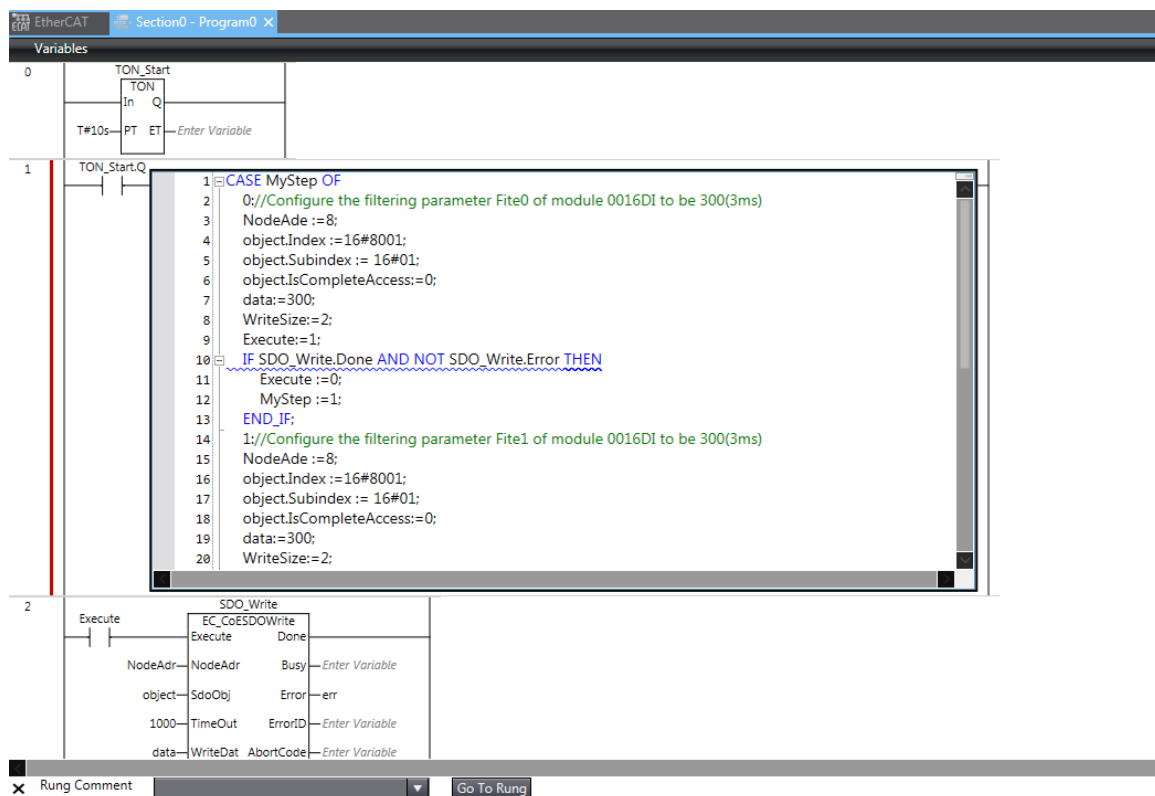
| Name    | Description                                                                   |
|---------|-------------------------------------------------------------------------------|
| Execute | Rising edge active, and the rising edge enables the SDO Write function block. |

| Name      | Description                                                                                                                                             |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| NodeAdr   | Node address                                                                                                                                            |
| SdoObj    | Object dictionary SDO parameter<br>SdoObj.Index: Index<br>SdoObj.Subindex: Subindex<br>SdoObj.IsCompleteAccess: Indicates whether to access all indexes |
| TimeOut   | Timeout time                                                                                                                                            |
| WriteDat  | Data written                                                                                                                                            |
| WriteSize | Written data size, unit: byte                                                                                                                           |

Each module configuration parameter index can be calculated by referring to 9.3 Expansion module object dictionary allocation and 6.1.2.7 Object dictionary description, each subindex can also be calculated by referring to 6.1.2.7 Object dictionary description, and the same configuration can be set up in the Invtmatic Studio to view the index and subindex of each configuration parameter in the software.



Configuration example for FK1100\_ECT\_Coupler + FL1001-1600DI + FL2102-0016DN + FL3003-4AD + FL4003-4DA + FL3201-4TC is as follows:



The delay before starting to write the SDO should be adjusted according to the actual situation; here, only a simple example is provided.

```
CASE myStep OF
  0://Set the 1600DI module filter parameter Filt0 to 300 (3ms).
    NodeAdr := 8;
    object.Index := 16#8001;
    object.Subindex := 16#01;
    object.IsCompleteAccess := 0;
    data := 300;
    WriteSize := 2;
    Execute := 1;
    IF SDO_Write.Done AND NOT SDO_Write.Error THEN
      Execute := 0;
      myStep := 1;
    END_IF;
  1://Set the 1600DI module filter parameter Filt1 to 300 (3ms).
    NodeAdr := 8;
    object.Index := 16#8001;
    object.Subindex := 16#02;
    object.IsCompleteAccess := 0;
    data := 300;
    WriteSize := 2;
    Execute := 1;
    IF SDO_Write.Done AND NOT SDO_Write.Error THEN
      Execute := 0;
      myStep := 2;
    END_IF;
  2://Set the 4AD module channel 0 configuration parameter AI0 Cfg.
    NodeAdr := 8;
    object.Index := 16#8115;
    object.Subindex := 16#01;
    object.IsCompleteAccess := 0;
    data := 16#01; //0-5V channel enable
    WriteSize := 1;
    Execute := 1;
    IF SDO_Write.Done AND NOT SDO_Write.Error THEN
      Execute := 0;
      myStep := 3;
    END_IF;
  3://Set the 4AD module channel 1 configuration parameter AI1 Cfg.
    NodeAdr := 8;
    object.Index := 16#8115;
    object.Subindex := 16#02;
    object.IsCompleteAccess := 0;
    data := 16#21; //0-10V channel enable
    WriteSize := 1;
    Execute := 1;
    IF SDO_Write.Done AND NOT SDO_Write.Error THEN
      Execute := 0;
      myStep := 4;
    END_IF;
  4://Set the 4AD module channel 2 configuration parameter AI2 Cfg.
    NodeAdr := 8;
```

```
    object.Index := 16#8115;
    object.Subindex := 16#03;
    object.IsCompleteAccess := 0;
    data := 16#81; //4-20mA channel enable
    WriteSize := 1;
    Execute := 1;
    IF SDO_Write.Done AND NOT SDO_Write.Error THEN
        Execute := 0;
        myStep := 5;
    END_IF;
5://Set 4DA module channel 0 configuration parameter AO0 Cfg.
    NodeAdr := 8;
    object.Index := 16#8199;
    object.Subindex := 16#01;
    object.IsCompleteAccess := 0;
    data := 16#1; //0-5 channel enable
    WriteSize := 1;
    Execute := 1;
    IF SDO_Write.Done AND NOT SDO_Write.Error THEN
        Execute := 0;
        myStep := 6;
    END_IF;
6://Set 4DA module channel 1 configuration parameters AO1 Cfg.
    NodeAdr := 8;
    object.Index := 16#8199;
    object.Subindex := 16#02;
    object.IsCompleteAccess := 0;
    data := 16#21; //0-10 channel enable
    WriteSize := 1;
    Execute := 1;
    IF SDO_Write.Done AND NOT SDO_Write.Error THEN
        Execute := 0;
        myStep := 7;
    END_IF;
7://Set 4DA module channel 2 configuration parameter AO2 Cfg.
    NodeAdr := 8;
    object.Index := 16#8199;
    object.Subindex := 16#03;
    object.IsCompleteAccess := 0;
    data := 16#81; //4-20mA channel enable
    WriteSize := 1;
    Execute := 1;
    IF SDO_Write.Done AND NOT SDO_Write.Error THEN
        Execute := 0;
        myStep := 8;
    END_IF;
8://Set 4TC module channel 0 configuration parameter Temp0 Cfg.
    NodeAdr := 8;
    object.Index := 16#822D;
    object.Subindex := 16#01;
    object.IsCompleteAccess := 0;
```

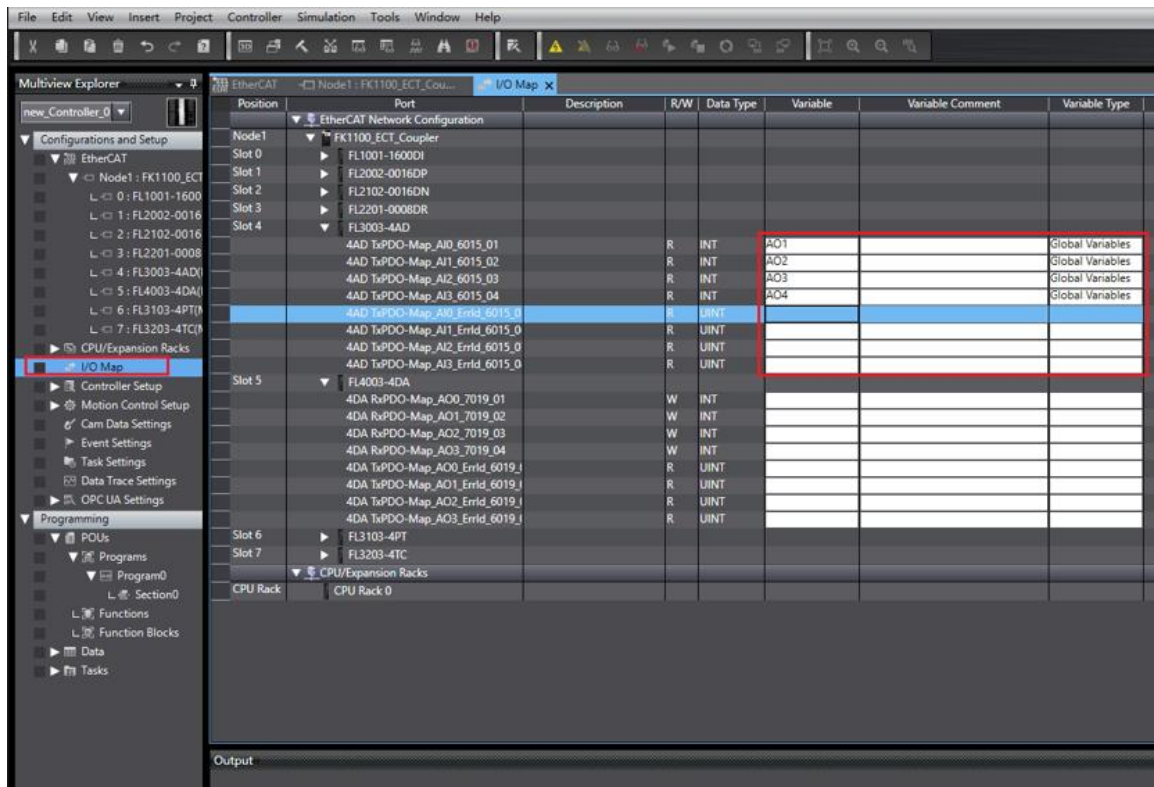


```

data := 16#61; // K-type thermocouple channel enable
WriteSize := 1;
Execute := 1;
IF SDO_Write.Done AND NOT SDO_Write.Error THEN
    Execute := 0;
    myStep := 9;
END_IF;
9:
    //do something
;
END_CASE;

```

### 6.1.2.6 Module process data



### 6.1.2.7 Object dictionary description

#### ■ FK1100\_ECT\_Coupler

| Name                        | Index--Subindex | Parameter     | Type  | Description                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------|-----------------|---------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration parameter SDO | 0x3000:00       | Module Enable | UDINT | <p>Enabling/disabling control bits for the expansion modules behind the coupler, with each bit controlling the enabling/disabling of a module.</p> <ul style="list-style-type: none"> <li>• bit0 controls the 1st module.</li> <li>• bit1 controls the 2nd module.</li> <li>• ...</li> <li>• bit31 controls the 32nd module.</li> </ul> <p>TRUE: Enable<br/>FALSE: Disable</p> |
| Control                     | -               | -             | -     | -                                                                                                                                                                                                                                                                                                                                                                              |



| Name                           | Index--Subindex | Parameter                  | Type  | Description                            |
|--------------------------------|-----------------|----------------------------|-------|----------------------------------------|
| parameter<br>RxPDO             |                 |                            |       |                                        |
| Feedback<br>parameter<br>TxPDO | -               | -                          | -     | -                                      |
| Status<br>parameter SDO        | 0x3080          | Coupler Info               | -     | Coupler information.                   |
|                                | Subindex 0x01   | ActNum                     | UINT  | Number of connected expansion modules. |
|                                | Subindex 0x02   | HW Version                 | UINT  | Coupler hardware version number.       |
|                                | Subindex 0x03   | SW Version                 | USINT | Coupler software version number.       |
|                                | Subindex 0x04   | FPGA Version               | USINT | Coupler FPGA software version number.  |
|                                | 0xF050          | Detected Module Ident List | -     | Detection module ID list.              |
|                                | Subindex 0x01   | SubIndex 001               | UDINT | ID of 1st module detected.             |
|                                | Subindex 0x02   | SubIndex 002               | UDINT | ID of 2nd module detected.             |
|                                | ...             | ...                        | ...   | ...                                    |
|                                | Subindex 0x20   | SubIndex 032               | UDINT | ID of 32nd module detected.            |

#### ■ FL1001-1600DI

| Name                           | Index--Subindex | Parameter      | Type | Description                                   |
|--------------------------------|-----------------|----------------|------|-----------------------------------------------|
| Configuration<br>parameter SDO | 0x8001+0x80*n   | 1600DI SDO Cfg | -    | 1600DI module filter configuration parameter. |
|                                | Subindex 0x01   | Filt0          | UINT | I0–I7 filter parameter. Unit: 10μs            |
|                                | Subindex 0x02   | Filt1          | UINT | I10–I17 filter parameter. Unit: 10μs          |
| Control<br>parameter<br>RxPDO  | -               | -              | -    | -                                             |
| Feedback<br>parameter<br>TxPDO | 0x6001+0x80*n   | 1600DI TxPDO   | -    | 1600DI module status feedback parameter.      |
|                                | Subindex 0x01   | ErrId          | UINT | Fault code.                                   |
|                                | Subindex 0x02   | I0             | BIT  | I0 status feedback.                           |
|                                | Subindex 0x03   | I1             | BIT  | I1 status feedback.                           |
|                                | ...             | ...            | ...  | ...                                           |
|                                | Subindex 0x11   | I17            | BIT  | I17 status feedback.                          |
| Status<br>parameter SDO        | 0x8078+0x80*n   | Module Info    | -    | Module information.                           |
|                                | Subindex 0x01   | HW Version     | UINT | Module hardware version number.               |
|                                | Subindex 0x02   | FPGA Version   | UINT | Module FPGA software version number.          |

 **Note:** n represents the slot where the expansion module is located,  $n \in [0, 31]$

#### ■ FL1002-3200DI

| Name                           | Index--Subindex | Parameter      | Type | Description                                   |
|--------------------------------|-----------------|----------------|------|-----------------------------------------------|
| Configuration<br>parameter SDO | 0x8002+0x80*n   | 3200DI SDO Cfg | -    | 3200DI module filter configuration parameter. |
|                                | Subindex 0x01   | Filt0          | UINT | I0–I7 filter parameter. Unit: 10μs            |

| Name                     | Index--Subindex | Parameter    | Type | Description                              |
|--------------------------|-----------------|--------------|------|------------------------------------------|
|                          | Subindex 0x02   | Filt1        | UINT | I10–I17 filter parameter. Unit: 10μs     |
|                          | Subindex 0x03   | Filt2        | UINT | I20–I27 filter parameter. Unit: 10μs     |
|                          | Subindex 0x04   | Filt3        | UINT | I30–I37 filter parameter. Unit: 10μs     |
| Control parameter RxPDO  | -               | -            | -    | -                                        |
| Feedback parameter TxPDO | 0x6002+0x80*n   | 3200DI TxPDO | -    | 3200DI module status feedback parameter. |
|                          | Subindex 0x01   | ErrId        | UINT | Fault code.                              |
|                          | Subindex 0x02   | I0           | BIT  | I0 status feedback.                      |
|                          | Subindex 0x03   | I1           | BIT  | I1 status feedback.                      |
|                          | ...             | ...          | ...  | ...                                      |
|                          | Subindex 0x21   | I37          | BIT  | I37 status feedback.                     |
| Status parameter SDO     | 0x8078+0x80*n   | Module Info  | -    | Module information.                      |
|                          | Subindex 0x01   | HW Version   | UINT | Module hardware version number.          |
|                          | Subindex 0x02   | FPGA Version | UINT | Module FPGA software version number.     |

 **Note:** n represents the slot where the expansion module is located, n∈[0,31]

#### ■ FL2002(0016DP) & FL2102(0016DN)

| Name                        | Index--Subindex | Parameter      | Type  | Description                                                                                                                                                               |
|-----------------------------|-----------------|----------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration parameter SDO | 0x8005+ 0x80*n  | 0016D* SDO Cfg | -     | 0016DP/DN module stop/offline configuration parameter.                                                                                                                    |
|                             | Subindex 0x01   | Stop Mode0     | UINT  | Stop/offline output mode                                                                                                                                                  |
|                             |                 |                |       | Q0 bit1: bit0                                                                                                                                                             |
|                             |                 |                |       | Q1 bit3: bit2                                                                                                                                                             |
|                             |                 |                |       | ...                                                                                                                                                                       |
|                             |                 |                |       | Q7 bit15: bit14                                                                                                                                                           |
|                             | Subindex 0x02   | Stop Mode1     | UINT  | <ul style="list-style-type: none"> <li>0b00: Stop/offline output retained</li> <li>0b01: Stop/offline output cleared</li> <li>0b10: Stop/offline output preset</li> </ul> |
|                             |                 |                |       | Stop/offline output mode.                                                                                                                                                 |
|                             |                 |                |       | Q10 bit1: bit0                                                                                                                                                            |
|                             |                 |                |       | Q11 bit3: bit2                                                                                                                                                            |
|                             |                 |                |       | ...                                                                                                                                                                       |
|                             |                 |                |       | Q17 bit15: bit14                                                                                                                                                          |
|                             | Subindex 0x03   | Stop Output0   | USINT | <ul style="list-style-type: none"> <li>0b00: Stop/offline output retained</li> <li>0b01: Stop/offline output cleared</li> <li>0b10: Stop/offline output preset</li> </ul> |
|                             |                 |                |       | Preset value of stop/offline output. <ul style="list-style-type: none"> <li>Bit0: Q0 stop/offline output preset</li> <li>Bit1: Q1 stop/offline output</li> </ul>          |

| Name                                                                                                                                                                   | Index--Subindex | Parameter    | Type  | Description                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                        |                 |              |       | preset <ul style="list-style-type: none"> <li>...</li> <li>Bit7: Q7 stop/offline output preset</li> </ul>                                                                                                                            |
|                                                                                                                                                                        | Subindex 0x04   | Stop Output1 | USINT | Preset value of stop/offline output. <ul style="list-style-type: none"> <li>Bit0: Q10 stop/offline output preset</li> <li>Bit1: Q11 stop/offline output preset</li> <li>...</li> <li>Bit7: Q17 stop/offline output preset</li> </ul> |
| Control parameter RxPDO                                                                                                                                                | 0x7005+0x80*n   | 0016D* RxPDO | -     | 0016DP/DN module output control value.                                                                                                                                                                                               |
|                                                                                                                                                                        | Subindex 0x01   | Q0           | BIT   | Q0 output control.                                                                                                                                                                                                                   |
|                                                                                                                                                                        | Subindex 0x02   | Q1           | BIT   | Q1 output control.                                                                                                                                                                                                                   |
|                                                                                                                                                                        | ...             | ...          | ...   | ...                                                                                                                                                                                                                                  |
|                                                                                                                                                                        | Subindex 0x10   | Q17          | BIT   | Q17 Output control.                                                                                                                                                                                                                  |
| Feedback parameter TxPDO                                                                                                                                               | 0x6005+0x80*n   | 0016D* TxPDO | -     | 0016 DP/DN module status feedback parameter.                                                                                                                                                                                         |
|                                                                                                                                                                        | Subindex 0x01   | ErrId        | UINT  | Fault code.                                                                                                                                                                                                                          |
| Status parameter SDO                                                                                                                                                   | 0x8078+0x80*n   | Module Info  | -     | Module information.                                                                                                                                                                                                                  |
|                                                                                                                                                                        | Subindex 0x01   | HW Version   | UINT  | Module hardware version number.                                                                                                                                                                                                      |
|                                                                                                                                                                        | Subindex 0x02   | FPGA Version | UINT  | Module FPGA software version number.                                                                                                                                                                                                 |
|  <b>Note:</b> n represents the slot where the expansion module is located, n∈[0,31] |                 |              |       |                                                                                                                                                                                                                                      |

#### ■ FL2003(0032DP) & FL2103(0032DN)

| Name                        | Index--Subindex | Parameter      | Type | Description                                                                                                                                                               |
|-----------------------------|-----------------|----------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration parameter SDO | 0x8006+ 0x80*n  | 0032D* SDO Cfg | -    | 0032DP/DN module stop/offline configuration parameter.                                                                                                                    |
|                             | Subindex 0x01   | Stop Mode0     | UINT | Stop/offline output mode.                                                                                                                                                 |
|                             |                 |                |      | Q0 bit1: bit0                                                                                                                                                             |
|                             |                 |                |      | Q1 bit3: bit2                                                                                                                                                             |
|                             |                 |                |      | ...                                                                                                                                                                       |
|                             |                 |                |      | Q7 bit15: bit14                                                                                                                                                           |
|                             |                 |                |      | <ul style="list-style-type: none"> <li>0b00: Stop/offline output retained</li> <li>0b01: Stop/offline output cleared</li> <li>0b10: Stop/offline output preset</li> </ul> |
|                             | Subindex 0x02   | Stop Mode1     | UINT | Stop/offline output mode.                                                                                                                                                 |
|                             |                 |                |      | Q10 bit1: bit0                                                                                                                                                            |
|                             |                 |                |      | Q11 bit3: bit2                                                                                                                                                            |
|                             |                 |                |      | ...                                                                                                                                                                       |
|                             |                 |                |      | Q17 bit15: bit14                                                                                                                                                          |
|                             |                 |                |      | <ul style="list-style-type: none"> <li>0b00: Stop/offline output</li> </ul>                                                                                               |

| Name | Index--Subindex | Parameter    | Type  | Description                                                                                                                                                     |              |       |                                                                                                                                                                             |              |       |
|------|-----------------|--------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------|
|      |                 |              |       | retained<br>● 0b01: Stop/offline output cleared<br>● 0b10: Stop/offline output preset                                                                           |              |       |                                                                                                                                                                             |              |       |
|      | Subindex 0x03   | Stop Mode2   | UINT  | Stop/offline output mode.                                                                                                                                       |              |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | Q20                                                                                                                                                             | bit1: bit0   |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | Q21                                                                                                                                                             | bit3: bit2   |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | ...                                                                                                                                                             | ...          |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | Q27                                                                                                                                                             | bit15: bit14 |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | ● 0b00: Stop/offline output retained<br>● 0b01: Stop/offline output cleared<br>● 0b10: Stop/offline output preset                                               |              |       |                                                                                                                                                                             |              |       |
|      | Subindex 0x04   | Stop Mode3   | UINT  | Stop/offline output mode.                                                                                                                                       |              |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | Q30                                                                                                                                                             | bit1: bit0   |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | Q31                                                                                                                                                             | bit3: bit2   |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | ...                                                                                                                                                             | ...          |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | Q37                                                                                                                                                             | bit15: bit14 |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | ● 0b00: Stop/offline output retained<br>● 0b01: Stop/offline output cleared<br>● 0b10: Stop/offline output preset                                               |              |       |                                                                                                                                                                             |              |       |
|      | Subindex 0x05   | Stop Output0 | USINT | Stop/offline output preset.<br>● Bit0: Q0 stop/offline output preset<br>● Bit1: Q1 stop/offline output preset<br>● ...<br>● Bit7: Q7 stop/offline output preset |              |       |                                                                                                                                                                             |              |       |
|      |                 |              |       | Subindex 0x06                                                                                                                                                   | Stop Output1 | USINT | Preset value of stop/offline output.<br>● Bit0: Q10 stop/offline output preset<br>● Bit1: Q11 stop/offline output preset<br>● ...<br>● Bit7: Q17 stop/offline output preset |              |       |
|      |                 |              |       |                                                                                                                                                                 |              |       | Subindex 0x07                                                                                                                                                               | Stop Output2 | USINT |

| Name                     | Index--Subindex | Parameter    | Type  | Description                                                                                                                                                                                                                            |
|--------------------------|-----------------|--------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          | Subindex 0x08   | Stop Output3 | USINT | Stop/offline output preset.<br><ul style="list-style-type: none"> <li>• Bit0: Q30 stop/offline output preset</li> <li>• Bit1: Q31 stop/offline output preset</li> <li>• ...</li> <li>• Bit7: Q37 stop/offline output preset</li> </ul> |
| Control parameter RxPDO  | 0x7006+0x80*n   | 0032D* RxPDO | -     | 0032DP/DN module output control value.                                                                                                                                                                                                 |
|                          | Subindex 0x01   | Q0           | BIT   | Q0 output control.                                                                                                                                                                                                                     |
|                          | Subindex 0x02   | Q1           | BIT   | Q1 output control.                                                                                                                                                                                                                     |
|                          | ...             | ...          | ...   | ...                                                                                                                                                                                                                                    |
|                          | Subindex 0x20   | Q17          | BIT   | Q37 output control.                                                                                                                                                                                                                    |
| Feedback parameter TxPDO | 0x6006+0x80*n   | 0032D* TxPDO | -     | 0032DP/DN module status feedback parameter.                                                                                                                                                                                            |
|                          | Subindex 0x01   | ErrId        | UINT  | Fault code.                                                                                                                                                                                                                            |
| Status parameter SDO     | 0x8078+0x80*n   | Module Info  | -     | Module information.                                                                                                                                                                                                                    |
|                          | Subindex 0x01   | HW Version   | UINT  | Module hardware version number.                                                                                                                                                                                                        |
|                          | Subindex 0x02   | FPGA Version | UINT  | Module FPGA software version number.                                                                                                                                                                                                   |

 **Note:** n represents the slot where the expansion module is located, n∈[0,31]

#### ■ FL2201-0008DR

| Name                                                                                                                                                                        | Index--Subindex | Parameter      | Type                                  | Description                                         |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|---------------------------------------|-----------------------------------------------------|--------------|
| Configuration parameter SDO                                                                                                                                                 | 0x8004+0x80*n   | 0008DR SDO Cfg | -                                     | 0008DR module stop/offline configuration parameter. |              |
|                                                                                                                                                                             | Subindex 0x01   | Stop Mode      | UINT                                  | Stop/offline output mode.                           |              |
|                                                                                                                                                                             |                 |                |                                       | Q0                                                  | bit1: bit0   |
|                                                                                                                                                                             |                 |                |                                       | Q1                                                  | bit3: bit2   |
|                                                                                                                                                                             |                 |                |                                       | ...                                                 | ...          |
|                                                                                                                                                                             |                 |                |                                       | Q7                                                  | bit15: bit14 |
| <ul style="list-style-type: none"><li>● 0b00: Stop/offline output retained</li><li>● 0b01: Stop/offline output cleared</li><li>● 0b10: Stop/offline output preset</li></ul> |                 |                |                                       |                                                     |              |
| Subindex 0x02                                                                                                                                                               | Stop Output     | USINT          | Preset value of stop/offline output.  |                                                     |              |
|                                                                                                                                                                             |                 |                | ● Bit0: Q0 stop/offline output preset |                                                     |              |
|                                                                                                                                                                             |                 |                | ● Bit1: Q1 stop/offline output preset |                                                     |              |
|                                                                                                                                                                             |                 |                | ● ...                                 |                                                     |              |
|                                                                                                                                                                             |                 |                | ● Bit7: Q7 stop/offline output preset |                                                     |              |
| Control parameter RxPDO                                                                                                                                                     | 0x7004+0x80*n   | 0008DR RxPDO   | -                                     | 0008DR module output control value.                 |              |
|                                                                                                                                                                             | Subindex 0x01   | Q0             | BIT                                   | Q0 output control.                                  |              |

| Name                     | Index--Subindex | Parameter    | Type | Description                              |
|--------------------------|-----------------|--------------|------|------------------------------------------|
|                          | Subindex 0x02   | Q1           | BIT  | Q1 output control.                       |
|                          | ...             | ...          | ...  | ...                                      |
|                          | Subindex 0x08   | Q7           | BIT  | Q7 output control.                       |
| Feedback parameter TxPDO | 0x6004+0x80*n   | 0008DR TxPDO | -    | 0008DR module status feedback parameter. |
|                          | Subindex 0x01   | ErrId        | UINT | Fault code.                              |
| Status parameter SDO     | 0x8078+0x80*n   | Module Info  | -    | Module information.                      |
|                          | Subindex 0x01   | HW Version   | UINT | Module hardware version number.          |
|                          | Subindex 0x02   | FPGA Version | UINT | Module FPGA software version number.     |

 **Note:** n represents the slot where the expansion module is located,  $n \in [0, 31]$

#### ■ FL3003-4AD

| Name                        | Index--Subindex | Parameter   | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------|-----------------|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration parameter SDO | 0x8015+0x80*n   | 4AD SDO Cfg | -     | 4AD module configuration parameter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                             | Subindex 0x01   | AI0 Cfg     | USINT | <p>Configuration parameter for channel 0.</p> <ul style="list-style-type: none"> <li>bit0: Channel enabling control. (0: Disable. 1: Enable.)</li> <li>bit1: Open-loop detection enabling control. (0: Disable. 1: Enable.)</li> <li>bit2: Over-limit detection enabling control. (0: Disable. 1: Enable.)</li> <li>bit3: Over-range enabling control. (0: Disable. 1: Enable.)</li> <li>bit4: Enhanced filter enabling control. (0: Disable. 1: Enable.)</li> <li>bit7-bit5: Channel conversion mode. <ul style="list-style-type: none"> <li>✧ 0b000: voltage 0–5V<br/>Corresponding code value: 0–20000</li> <li>✧ 0b001: voltage 0–10V<br/>Corresponding code value: 0–20000</li> <li>✧ 0b010: voltage -5–5V<br/>Corresponding code value: 20000–20000</li> <li>✧ 0b011: voltage -10–10V<br/>Corresponding code value: 20000–20000</li> <li>✧ 0b100: current 4–20mA<br/>Corresponding code value: 0–20000</li> <li>✧ 0b101: current 0–20mA<br/>Corresponding code value: 0–</li> </ul> </li> </ul> |

| Name                                                                                                                                                                          | Index--Subindex | Parameter    | Type  | Description                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|-------|----------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                               |                 |              |       | 20000<br>✧ 0b110: reserved<br>✧ 0b111: current -20–20mA<br>Corresponding code value:<br>20000–20000                  |
|                                                                                                                                                                               | Subindex 0x02   | AI1 Cfg      | USINT | Same as the configuration parameter for channel 0.                                                                   |
|                                                                                                                                                                               | Subindex 0x03   | AI2 Cfg      | USINT | Same as the configuration parameter for channel 0.                                                                   |
|                                                                                                                                                                               | Subindex 0x04   | AI3 Cfg      | USINT | Same as the configuration parameters for channel 0.                                                                  |
|                                                                                                                                                                               | Subindex 0x05   | AI0 Filt     | USINT | Filter parameter for channel 0.<br>Range: 1–255. A greater value indicates better filter effect but greater lagging. |
|                                                                                                                                                                               | Subindex 0x06   | AI1 Filt     | USINT | Same as the filter parameter for channel 0.                                                                          |
|                                                                                                                                                                               | Subindex 0x07   | AI2 Filt     | USINT | Same as the filter parameter for channel 0.                                                                          |
|                                                                                                                                                                               | Subindex 0x08   | AI3 Filt     | USINT | Same as the filter parameter for channel 0.                                                                          |
| Control parameter RxPDO                                                                                                                                                       | -               | -            | -     | -                                                                                                                    |
| Feedback parameter TxPDO                                                                                                                                                      | 0x6015+0x80*n   | 4AD TxPDO    | -     | 4AD module status feedback parameter.                                                                                |
|                                                                                                                                                                               | Subindex 0x01   | AI0          | INT   | Conversion value for channel 0.                                                                                      |
|                                                                                                                                                                               | Subindex 0x02   | AI1          | INT   | Conversion value for channel 1.                                                                                      |
|                                                                                                                                                                               | Subindex 0x03   | AI2          | INT   | Conversion value for channel 2.                                                                                      |
|                                                                                                                                                                               | Subindex 0x04   | AI3          | INT   | Conversion value for channel 3.                                                                                      |
|                                                                                                                                                                               | Subindex 0x05   | AI0_ErrId    | UINT  | Fault code for channel 0.                                                                                            |
|                                                                                                                                                                               | Subindex 0x06   | AI1_ErrId    | UINT  | Fault code for channel 1.                                                                                            |
|                                                                                                                                                                               | Subindex 0x07   | AI2_ErrId    | UINT  | Fault code for channel 2.                                                                                            |
| Status parameter SDO                                                                                                                                                          | 0x8078+0x80*n   | Module Info  | -     | Module information.                                                                                                  |
|                                                                                                                                                                               | Subindex 0x01   | HW Version   | UINT  | Module hardware version number.                                                                                      |
|                                                                                                                                                                               | Subindex 0x02   | FPGA Version | UINT  | Module FPGA software version number.                                                                                 |
|  <b>Note:</b> n represents the slot where the expansion module is located, $n \in [0, 31]$ |                 |              |       |                                                                                                                      |

#### ■ FL4003-4DA

| Name                        | Index--Subindex | Parameter   | Type  | Description                                                                                             |
|-----------------------------|-----------------|-------------|-------|---------------------------------------------------------------------------------------------------------|
| Configuration parameter SDO | 0x8019+0x80*n   | 4DA SDO Cfg | -     | 4DA module configuration parameter.                                                                     |
|                             | Subindex 0x01   | AO0 Cfg     | USINT | Configuration parameter for channel 0.<br>● bit0: Channel enabling control.<br>(0: Disable. 1: Enable.) |

| Name                    | Index--Subindex | Parameter       | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------|-----------------|-----------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |                 |                 |       | <ul style="list-style-type: none"> <li>bit1: Output fault detection enabling control. (0: Disable. 1: Enable.)</li> <li>bit3–bit2: Offline output mode <ul style="list-style-type: none"> <li>✧ 0b00: Offline output retained</li> <li>✧ 0b01: Offline output cleared</li> <li>✧ 0b10: Offline output preset</li> </ul> </li> <li>bit4: Reserved</li> <li>bit7–bit5: Channel conversion mode. <ul style="list-style-type: none"> <li>✧ 0b000: voltage 0–5V<br/>Corresponding code value: 0–20000</li> <li>✧ 0b001: voltage 0–10V<br/>Corresponding code value: 0–20000</li> <li>✧ 0b010: voltage -5–+5V<br/>Corresponding code value: 20000–20000</li> <li>✧ 0b011: voltage -10–+10V<br/>Corresponding code value: 20000–20000</li> <li>✧ 0b100: current 4–20mA<br/>Corresponding code value: 0–20000</li> <li>✧ 0b101: current 0–20mA<br/>Corresponding code value: 0–20000</li> <li>✧ 0b110: Reserved</li> <li>✧ 0b111: Reserved</li> </ul> </li> </ul> |
|                         | Subindex 0x02   | AO1 Cfg         | USINT | Same as the configuration parameter for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                         | Subindex 0x03   | AO2 Cfg         | USINT | Same as the configuration parameter for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                         | Subindex 0x04   | AO3 Cfg         | USINT | Same as the configuration parameter for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                         | Subindex 0x05   | AO0 Stop Output | INT   | Preset value of stop/offline output for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                         | Subindex 0x06   | AO1 Stop Output | INT   | Preset value of stop/offline output for channel 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                         | Subindex 0x07   | AO2 Stop Output | INT   | Preset value of stop/offline output for channel 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                         | Subindex 0x08   | AO3 Stop Output | INT   | Preset value of stop/offline output for channel 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Control parameter RxPDO | 0x7019+0x80*n   | 4DA RxPDO       | -     | 4DA module output control value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                         | Subindex 0x01   | AO0             | INT   | Output control value for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                         | Subindex 0x02   | AO1             | INT   | Output control value for channel 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                         | Subindex 0x03   | AO2             | INT   | Output control value for channel 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                         | Subindex 0x04   | AO3             | INT   | Output control value for channel 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



| Name                                                                                                                                                                 | Index--Subindex | Parameter    | Type | Description                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|------|---------------------------------------|
| Feedback parameter TxPDO                                                                                                                                             | 0x6019+0x80*n   | 4DA TxPDO    | -    | 4DA module status feedback parameter. |
|                                                                                                                                                                      | Subindex 0x01   | AO0_ErrId    | UINT | Fault code for channel 0.             |
|                                                                                                                                                                      | Subindex 0x02   | AO1_ErrId    | UINT | Fault code for channel 1.             |
|                                                                                                                                                                      | Subindex 0x03   | AO2_ErrId    | UINT | Fault code for channel 2.             |
|                                                                                                                                                                      | Subindex 0x04   | AO3_ErrId    | UINT | Fault code for channel 3.             |
| Status parameter SDO                                                                                                                                                 | 0x8078+0x80*n   | Module Info  | -    | Module information.                   |
|                                                                                                                                                                      | Subindex 0x01   | HW Version   | UINT | Module hardware version number.       |
|                                                                                                                                                                      | Subindex 0x02   | FPGA Version | UINT | Module FPGA software version number.  |
|  <b>Note:</b> n represents the slot where the expansion module is located, n∈[0,31] |                 |              |      |                                       |

#### ■ FL3101-4PT

| Name                        | Index--Subindex | Parameter   | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------|-----------------|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration parameter SDO | 0x8029+0x80*n   | 4PT SDO Cfg | -     | 4PT module configuration parameter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                             | Subindex 0x01   | Temp0 Cfg   | USINT | Configuration parameter for channel 0. <ul style="list-style-type: none"> <li>bit0: Channel enabling control. (0: Disable. 1: Enable.)</li> <li>bit1: Over-range detection enabling control. (0: Disable. 1: Enable.)</li> <li>bit3-bit2: Thermistor wire system               <ul style="list-style-type: none"> <li>0b00: Two-wire system</li> <li>0b01: Three-wire system</li> <li>0b10: Four-wire system</li> </ul> </li> <li>bit4: Temperature unit               <ul style="list-style-type: none"> <li>0: °C</li> <li>1: °F</li> </ul> </li> <li>bit7-bit5: Channel conversion mode.               <ul style="list-style-type: none"> <li>0b000: Reserved</li> <li>0b001: PT100</li> <li>0b010: PT500</li> <li>0b011: Reserved</li> <li>0b100: PT1000</li> <li>0b101: Reserved</li> <li>0b110: Reserved</li> <li>0b111: CU100</li> </ul> </li> </ul> |
|                             | Subindex 0x02   | Temp1 Cfg   | USINT | Same as the configuration parameter for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                             | Subindex 0x03   | Temp2 Cfg   | USINT | Same as the configuration parameter for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                             | Subindex 0x04   | Temp3 Cfg   | USINT | Same as the configuration parameter for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                             | Subindex 0x05   | Temp0 Filt  | USINT | Filter parameter for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                             |                 |             |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| Name                    | Index--Subindex | Parameter    | Type  | Description                                                                                                                                              |
|-------------------------|-----------------|--------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |                 |              |       | Range: 1–255. A greater value indicates a more effective filtering effect, though this consequently leads to an increased delay.                         |
|                         | Subindex 0x06   | Temp1 Filt   | USINT | Same as the filter parameter for channel 0.                                                                                                              |
|                         | Subindex 0x07   | Temp2 Filt   | USINT | Same as the filter parameter for channel 0.                                                                                                              |
|                         | Subindex 0x08   | Temp3 Filt   | USINT | Same as the filter parameter for channel 0.                                                                                                              |
|                         | Subindex 0x09   | Temp0 Offset | INT   | Temperature offset value for channel 0.<br>Amplified by a factor of ten, 999 represents 99.9.<br>Detected value = Actually measured value + Offset value |
|                         | Subindex 0xA    | Temp1 Offset | INT   | Same as the temperature offset value for channel 0.                                                                                                      |
|                         | Subindex 0xB    | Temp2 Offset | INT   | Same as the temperature offset value for channel 1.                                                                                                      |
|                         | Subindex 0xC    | Temp3 Offset | INT   | Same as the temperature offset value for channel 2.                                                                                                      |
|                         | Subindex 0xD    | Temp0 Up     | INT   | Channel 0 temperature upper limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|                         | Subindex 0xE    | Temp1 Up     | INT   | Channel 1 temperature upper limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|                         | Subindex 0xF    | Temp2 Up     | INT   | Channel 2 temperature upper limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|                         | Subindex 0x10   | Temp3 Up     | INT   | Channel 3 temperature upper limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|                         | Subindex 0x11   | Temp0 Low    | INT   | Channel 0 temperature lower limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|                         | Subindex 0x12   | Temp1 Low    | INT   | Channel 1 temperature lower limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|                         | Subindex 0x13   | Temp2 Low    | INT   | Channel 2 temperature lower limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|                         | Subindex 0x14   | Temp3 Low    | INT   | Channel 3 temperature lower limit, reserved.<br>Use sensor inherent limitations.                                                                         |
| Control parameter RxPDO | -               | -            | -     | -                                                                                                                                                        |

| Name                                                                                                                                                                       | Index--Subindex | Parameter    | Type   | Description                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|--------|---------------------------------------|
| Feedback parameter TxPDO                                                                                                                                                   | 0x6029+0x80*n   | 4PT TxPDO    | -      | 4PT module status feedback parameter. |
|                                                                                                                                                                            | Subindex 0x01   | Temp0        | REAL32 | Conversion value for channel 0.       |
|                                                                                                                                                                            | Subindex 0x02   | Temp1        | REAL32 | Conversion value for channel 1.       |
|                                                                                                                                                                            | Subindex 0x03   | Temp2        | REAL32 | Conversion value for channel 2.       |
|                                                                                                                                                                            | Subindex 0x04   | Temp3        | REAL32 | Conversion value for channel 3.       |
|                                                                                                                                                                            | Subindex 0x05   | Temp0_ErrId  | UINT   | Fault code for channel 0.             |
|                                                                                                                                                                            | Subindex 0x06   | Temp1_ErrId  | UINT   | Fault code for channel 1.             |
|                                                                                                                                                                            | Subindex 0x07   | Temp2_ErrId  | UINT   | Fault code for channel 2.             |
|                                                                                                                                                                            | Subindex 0x08   | Temp3_ErrId  | UINT   | Fault code for channel 3.             |
| Status parameter SDO                                                                                                                                                       | 0x8078+0x80*n   | Module Info  | -      | Module information.                   |
|                                                                                                                                                                            | Subindex 0x01   | HW Version   | UINT   | Module hardware version number.       |
|                                                                                                                                                                            | Subindex 0x02   | FPGA Version | UINT   | Module FPGA software version number.  |
|  <b>Note:</b> n represents the slot where the expansion module is located, $n \in [0,31]$ |                 |              |        |                                       |

#### ■ FL3203-4TC

| Name                        | Index--Subindex | Parameter   | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------|-----------------|-------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration parameter SDO | 0x802D+0x80*n   | 4TC SDO Cfg | -     | 4TC module configuration parameter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                             | Subindex 0x01   | Temp0 Cfg   | USINT | Configuration parameter for channel 0. <ul style="list-style-type: none"> <li>● bit0: Channel enabling control. (0: Disable. 1: Enable.)</li> <li>● bit1: Over-range detection enabling control. (0: Disable. 1: Enable.)</li> <li>● bit3-bit2: Reserved</li> <li>● bit4: Temperature unit               <ul style="list-style-type: none"> <li>✧ 0: °C</li> <li>✧ 1: °F</li> </ul> </li> <li>● bit7-bit5: Channel conversion mode.               <ul style="list-style-type: none"> <li>✧ 0b000: Thermocouple of type B.</li> <li>✧ 0b001: Thermocouple of type E.</li> <li>✧ 0b010: Thermocouple of type J.</li> <li>✧ 0b011: Thermocouple of type K.</li> <li>✧ 0b100: Thermocouple of type N.</li> <li>✧ 0b101: Thermocouple of type R.</li> <li>✧ 0b110: Thermocouple of type S.</li> <li>✧ 0b111: Thermocouple of type</li> </ul> </li> </ul> |

| Name | Index--Subindex | Parameter    | Type  | Description                                                                                                                                              |
|------|-----------------|--------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |                 |              |       | T.                                                                                                                                                       |
|      | Subindex 0x02   | Temp1 Cfg    | USINT | Same as the configuration parameter for channel 0.                                                                                                       |
|      | Subindex 0x03   | Temp2 Cfg    | USINT | Same as the configuration parameter for channel 0.                                                                                                       |
|      | Subindex 0x04   | Temp3 Cfg    | USINT | Same as the configuration parameter for channel 0.                                                                                                       |
|      | Subindex 0x05   | Temp0 Filt   | USINT | Filter parameter for channel 0.<br>Range: 1–255. A greater value indicates better filter effect but greater lagging.                                     |
|      | Subindex 0x06   | Temp1 Filt   | USINT | Same as the filter parameter for channel 0.                                                                                                              |
|      | Subindex 0x07   | Temp2 Filt   | USINT | Same as the filter parameter for channel 0.                                                                                                              |
|      | Subindex 0x08   | Temp3 Filt   | USINT | Same as the filter parameter for channel 0.                                                                                                              |
|      | Subindex 0x09   | Temp0 Offset | INT   | Temperature offset value for channel 0.<br>Amplified by a factor of ten, 999 represents 99.9.<br>Detected value = Actually measured value + Offset value |
|      | Subindex 0xA    | Temp1 Offset | INT   | Same as the temperature offset value for channel 0.                                                                                                      |
|      | Subindex 0xB    | Temp2 Offset | INT   | Same as the temperature offset value for channel 1.                                                                                                      |
|      | Subindex 0xC    | Temp3 Offset | INT   | Same as the temperature offset value for channel 2.                                                                                                      |
|      | Subindex 0xD    | Temp0 Up     | INT   | Channel 0 temperature upper limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|      | Subindex 0xE    | Temp1 Up     | INT   | Channel 1 temperature upper limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|      | Subindex 0xF    | Temp2 Up     | INT   | Channel 2 temperature upper limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|      | Subindex 0x10   | Temp3 Up     | INT   | Channel 3 temperature upper limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|      | Subindex 0x11   | Temp0 Low    | INT   | Channel 0 temperature lower limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|      | Subindex 0x12   | Temp1 Low    | INT   | Channel 1 temperature lower limit, reserved.<br>Use sensor inherent limitations.                                                                         |
|      | Subindex 0x13   | Temp2 Low    | INT   | Channel 2 temperature lower limit, reserved.                                                                                                             |

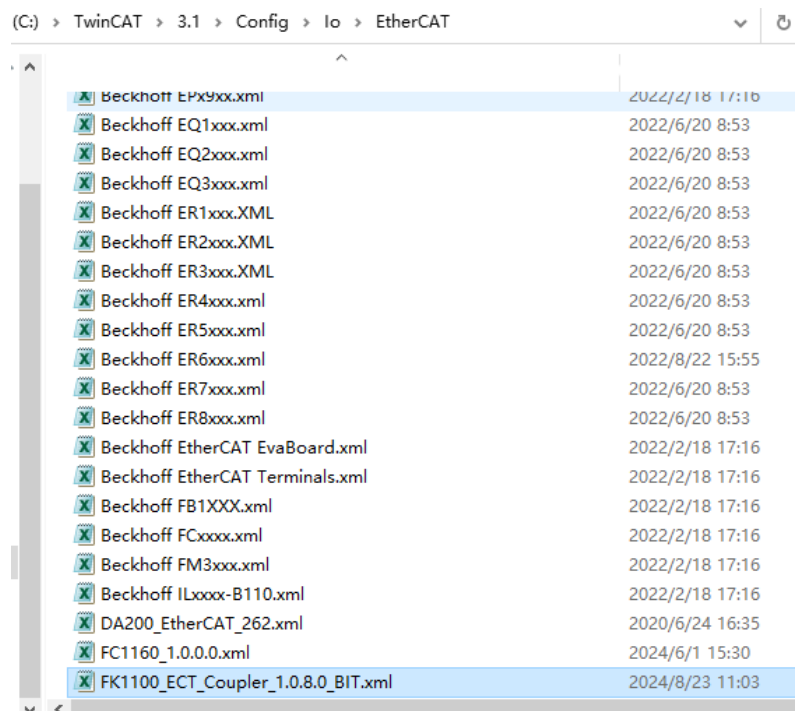
| Name                     | Index--Subindex | Parameter    | Type   | Description                                  |
|--------------------------|-----------------|--------------|--------|----------------------------------------------|
|                          |                 |              |        | Use sensor inherent limitations.             |
|                          | Subindex 0x14   | Temp3 Low    | INT    | Channel 3 temperature lower limit, reserved. |
|                          |                 |              |        | Use sensor inherent limitations.             |
| Control parameter RxPDO  | -               | -            | -      | -                                            |
| Feedback parameter TxPDO | 0x602D+0x80*n   | 4TC TxPDO    | -      | 4TC module status feedback parameter.        |
|                          | Subindex 0x01   | Temp0        | REAL32 | Conversion value for channel 0.              |
|                          | Subindex 0x02   | Temp1        | REAL32 | Conversion value for channel 1.              |
|                          | Subindex 0x03   | Temp2        | REAL32 | Conversion value for channel 2.              |
|                          | Subindex 0x04   | Temp3        | REAL32 | Conversion value for channel 3.              |
|                          | Subindex 0x05   | Temp0_ErrId  | UINT   | Fault code for channel 0.                    |
|                          | Subindex 0x06   | Temp1_ErrId  | UINT   | Fault code for channel 1.                    |
|                          | Subindex 0x07   | Temp2_ErrId  | UINT   | Fault code for channel 2.                    |
|                          | Subindex 0x08   | Temp3_ErrId  | UINT   | Fault code for channel 3.                    |
| Status parameter SDO     | 0x8078+0x80*n   | Module Info  | -      | Module information.                          |
|                          | Subindex 0x01   | HW Version   | UINT   | Module hardware version number.              |
|                          | Subindex 0x02   | FPGA Version | UINT   | Module FPGA software version number.         |

 **Note:** n represents the slot where the expansion module is located,  $n \in [0,31]$

## 6.1.3 TwinCAT3 configuration description

### 6.1.3.1 Installing the device description file

Copy the device description file named like FK1100\_ECT\_Coupler\_x.x.x.x.xml to the directory **C:\TwinCAT\3.1\Config\Io\EtherCAT**, and restart the TwinCAT software.

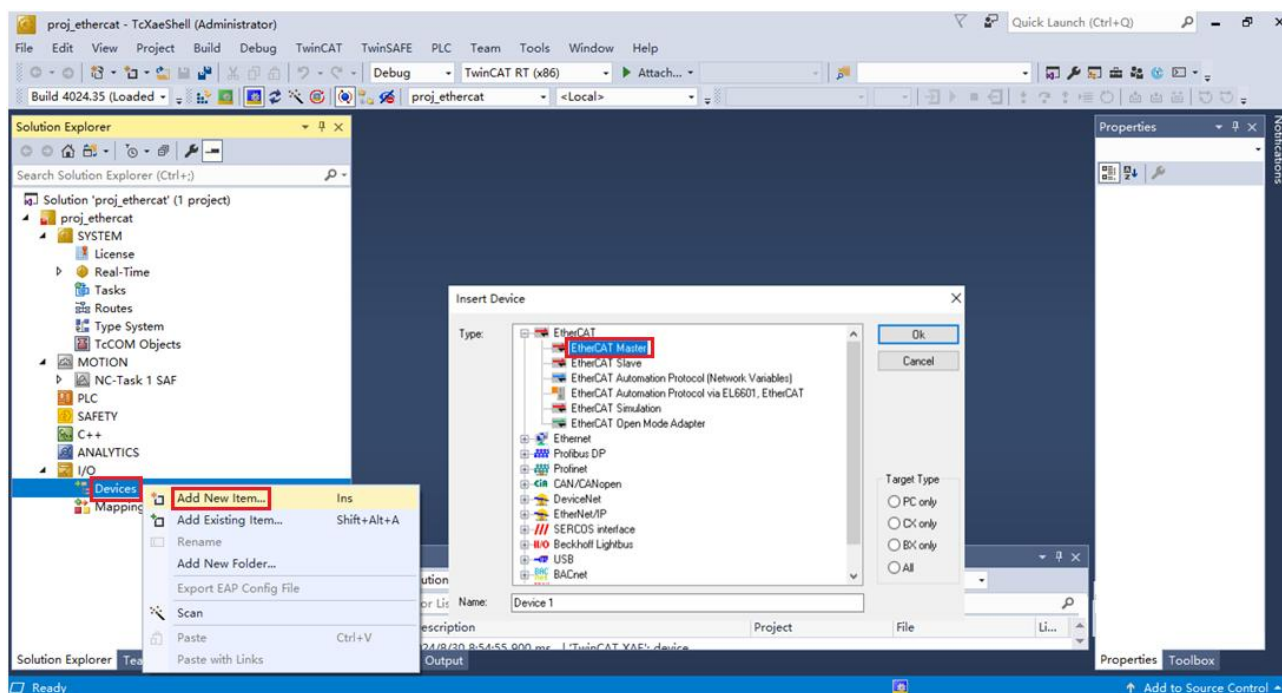


### 6.1.3.2 Performing network configuration

#### ■ Manual configuration

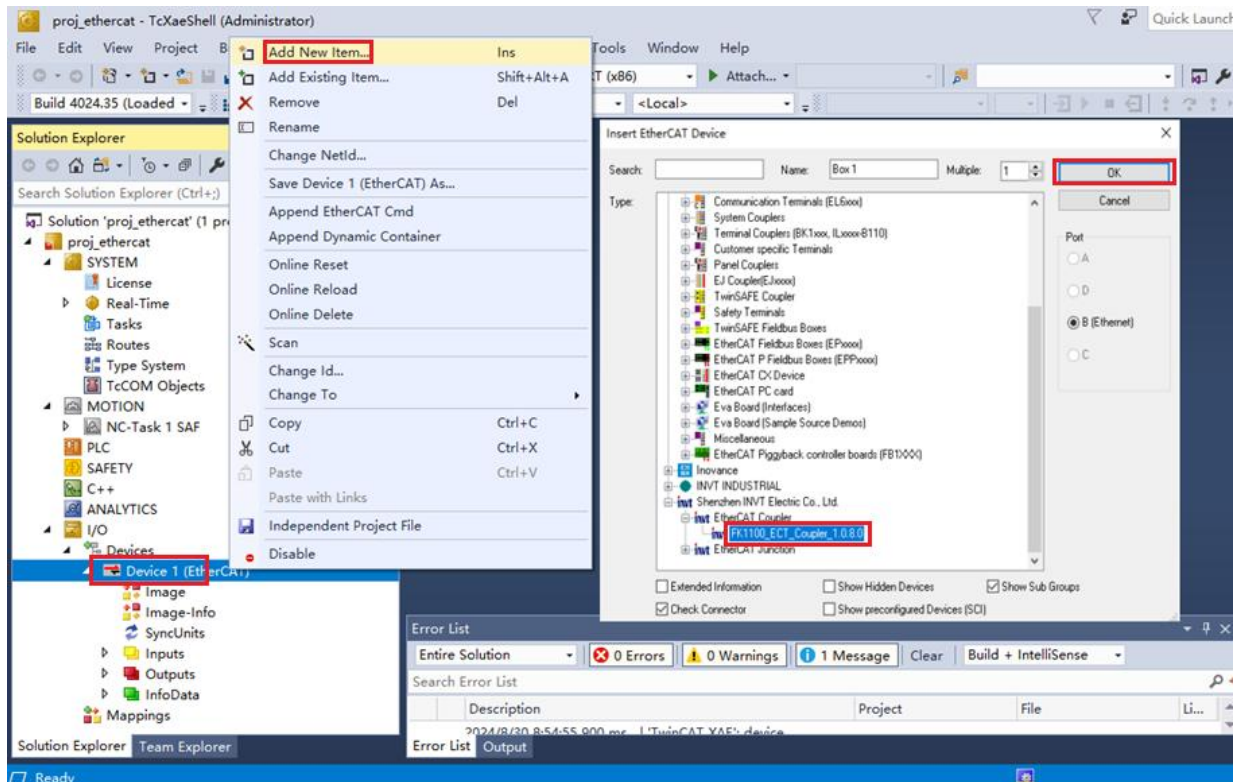
Step 1 Add EtherCAT Master.

Right-click **Devices** under **I/O**, choose **Add New Item**, choose **EtherCAT Master** on the pop-up **Insert Device** interface, and select the correct network port on the pop-up **Device Found At** interface.



### Step 2 Add FK1100\_ECT\_Coupler Slave.

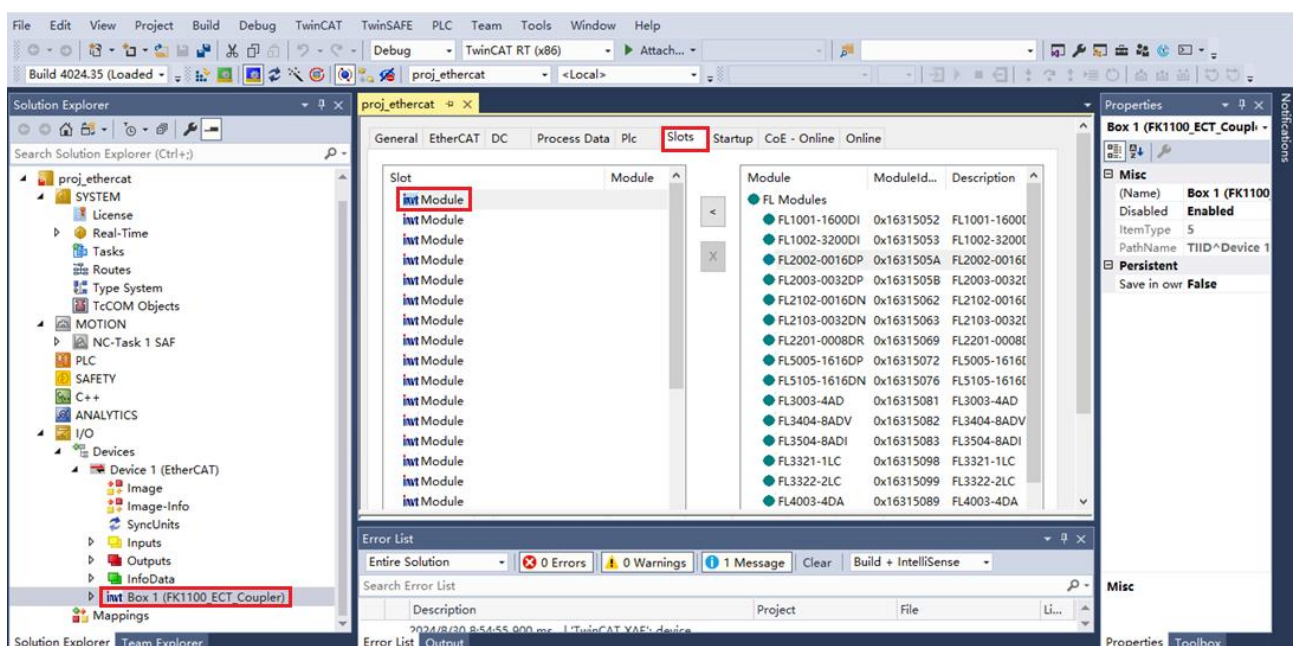
Right click **Device 1(EtherCAT)** under **Devices**, choose **Add New Item**, find FK1100\_ECT\_Coupler on the pop-up **Insert EtherCAT Device** interface, and click **OK** to add an EtherCAT slave.



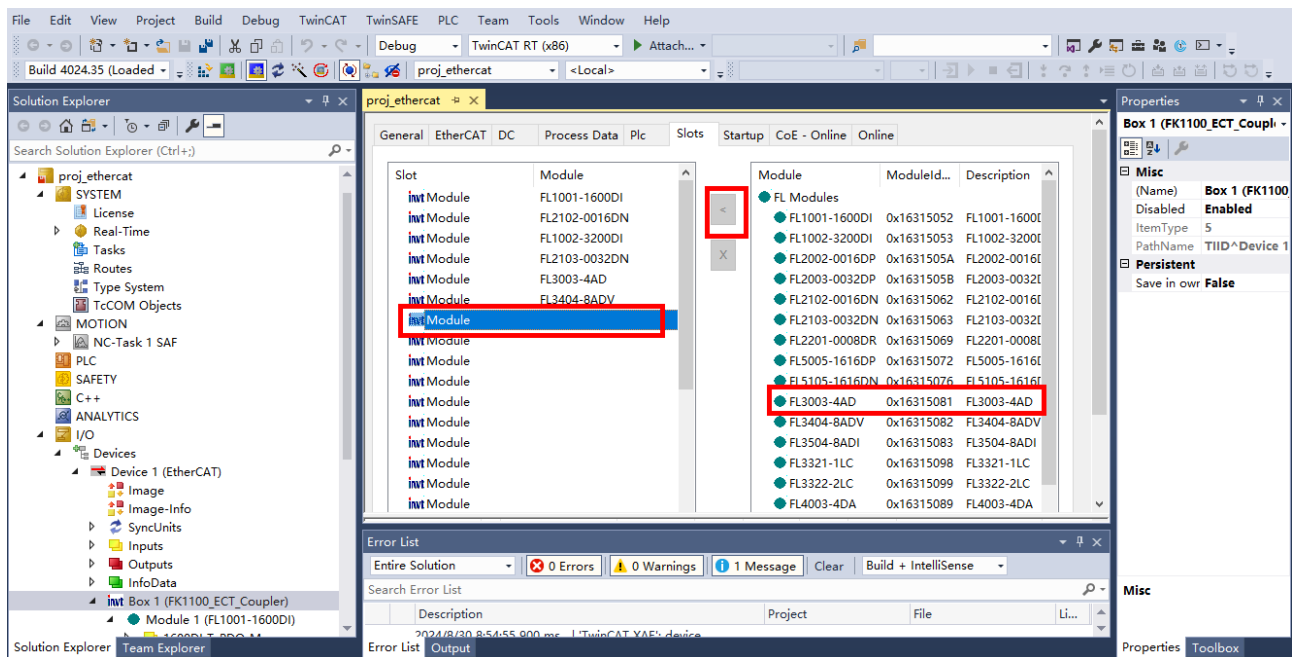
### Step 3 Add the expansion module.

Double click **FK1100\_ECT\_Coupler** and click the **Slots** tab. Based on the physical configuration (actual physical connection sequence), correctly add the modules on the right to the slots on the left.

**Note:** The physical configuration must be consistent with the network configuration. If the configuration is inconsistent, EtherCAT communication cannot enter the OP state.

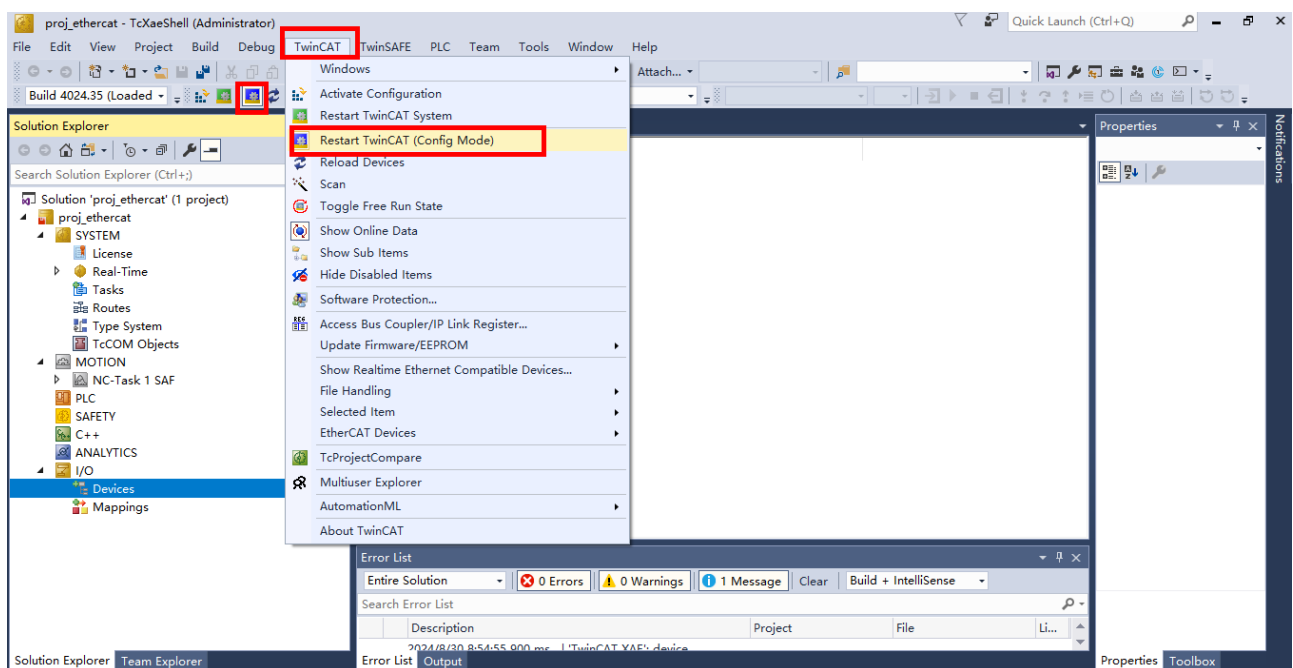






## Automatic scanning

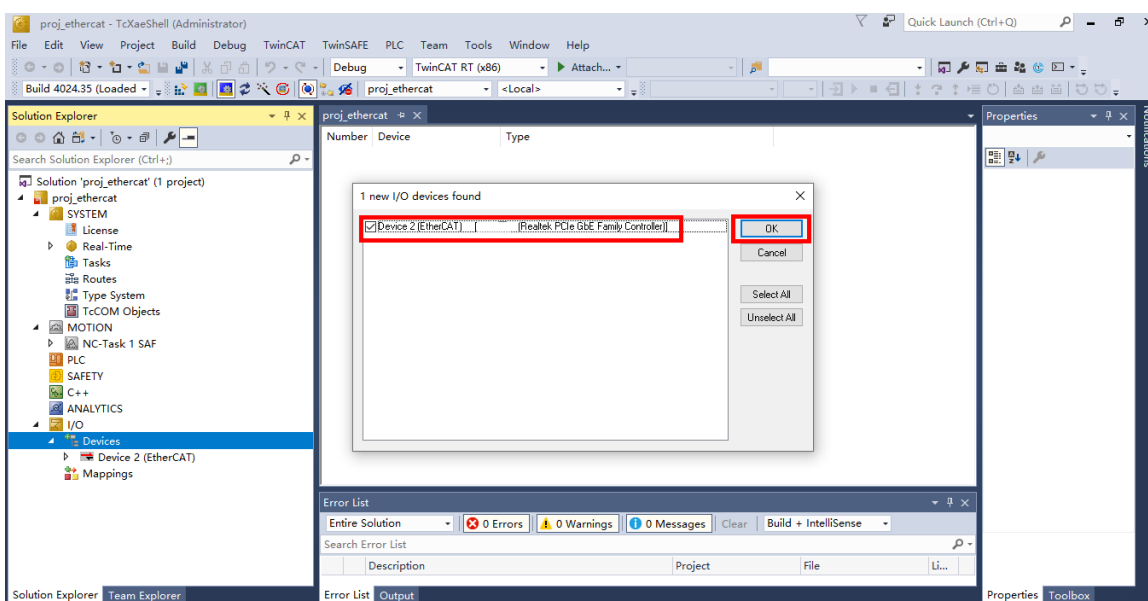
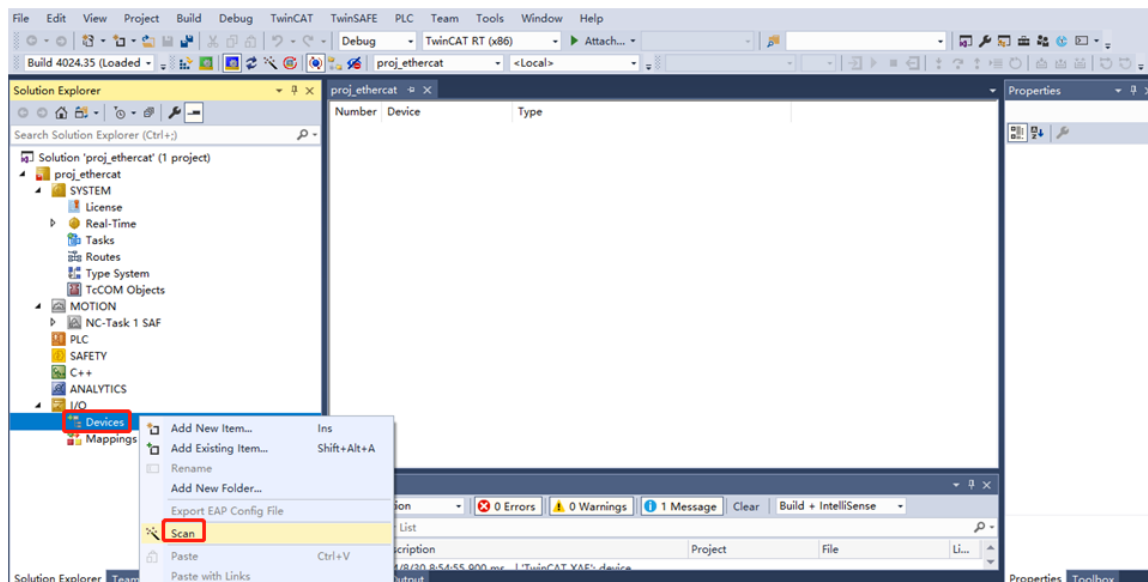
Step 1 Establish a reliable physical connection for Computer > PLC > FK1100\_ECT\_Coupler, and switch the PLC to configuration mode.





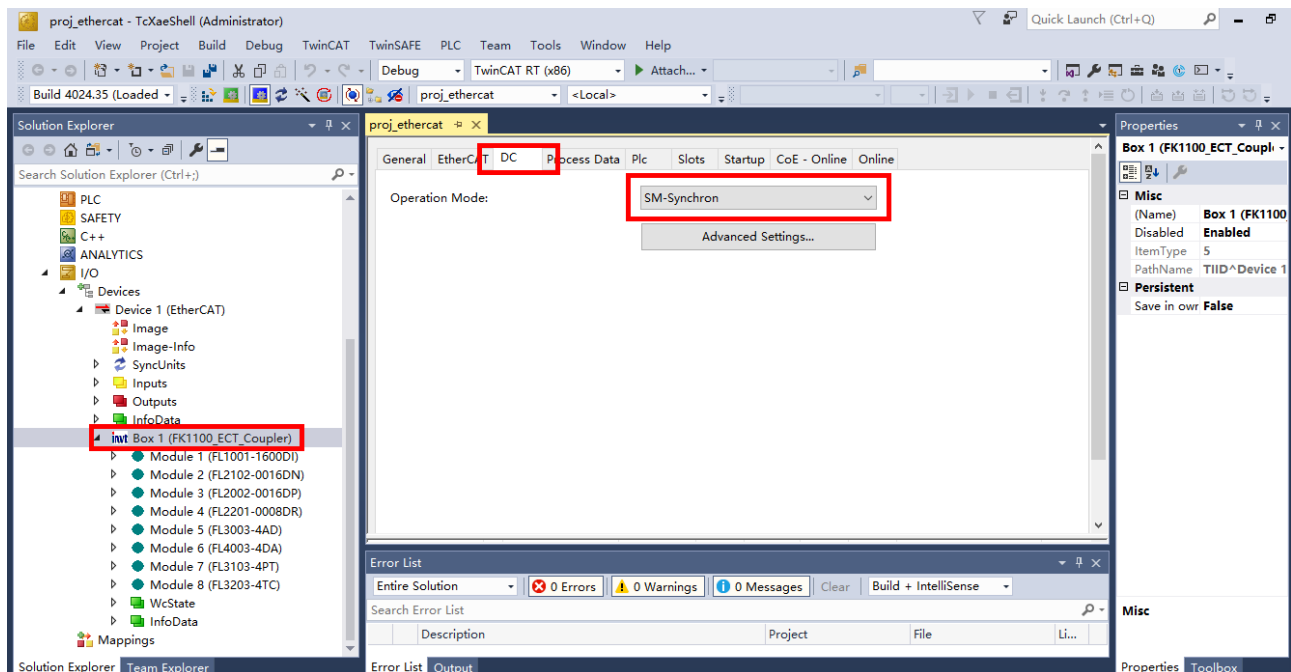
Step 2 Right-click **Devices** under **I/O**, choose **Scan**, and click **OK** in the pop-up dialog box to wait for the scan results. Select the devices scanned as needed, click **OK**, and click **Yes** in the pop-up **Scan for boxes** dialog box to wait for the scan results.

 **Note:** It is recommended to check whether the network configuration and physical configuration added in automatic scan match, and adjustments can be made manually.

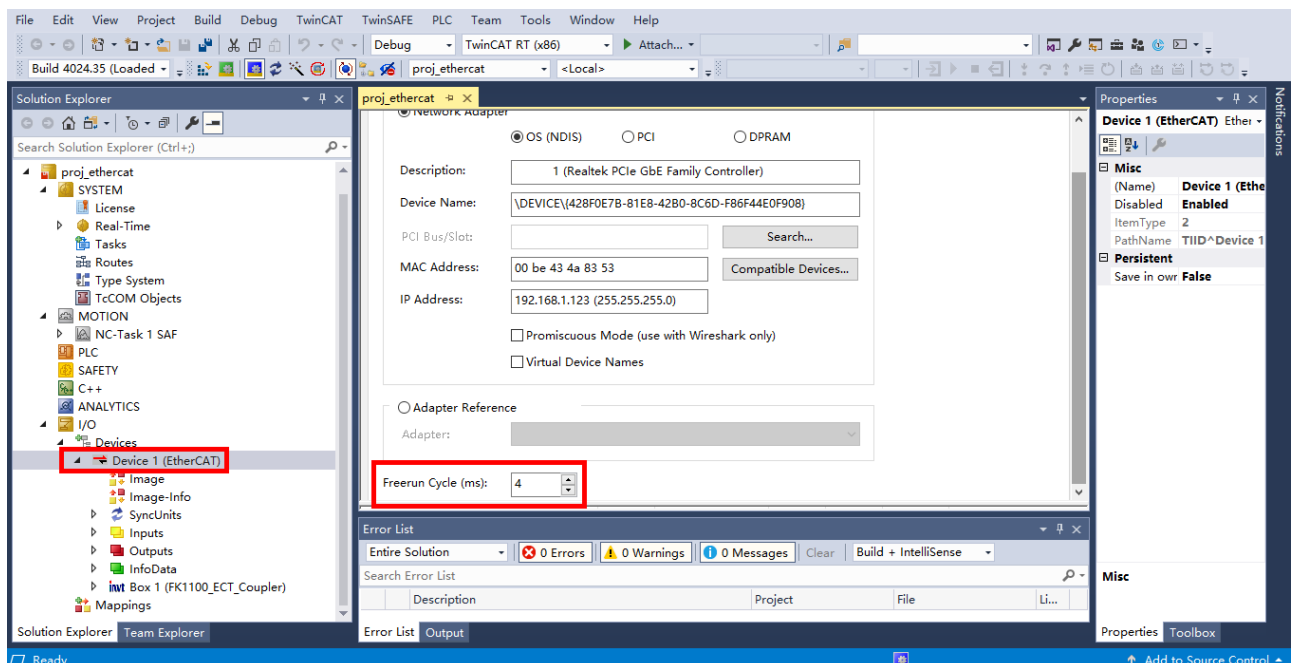


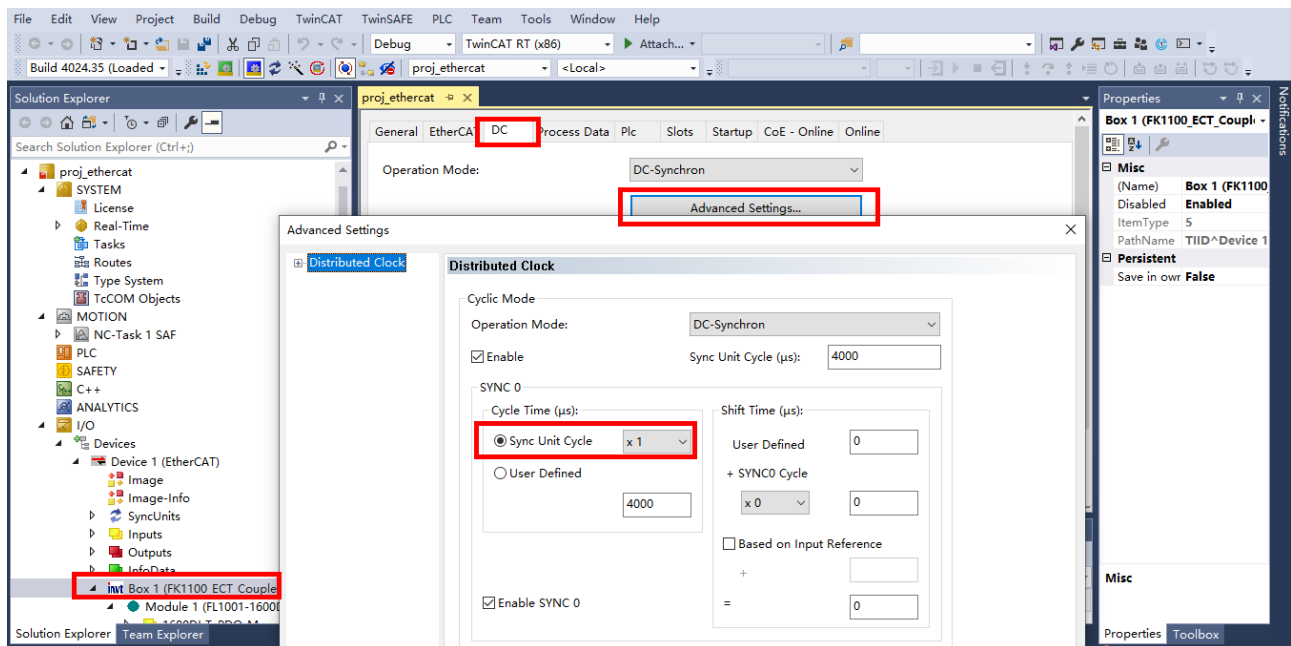
### 6.1.3.3 EtherCAT communication parameter configuration

1. Synchronous mode: Double click **FK1100\_ECT\_Coupler** and click the **DC** tab, and set **Operation Mode**.



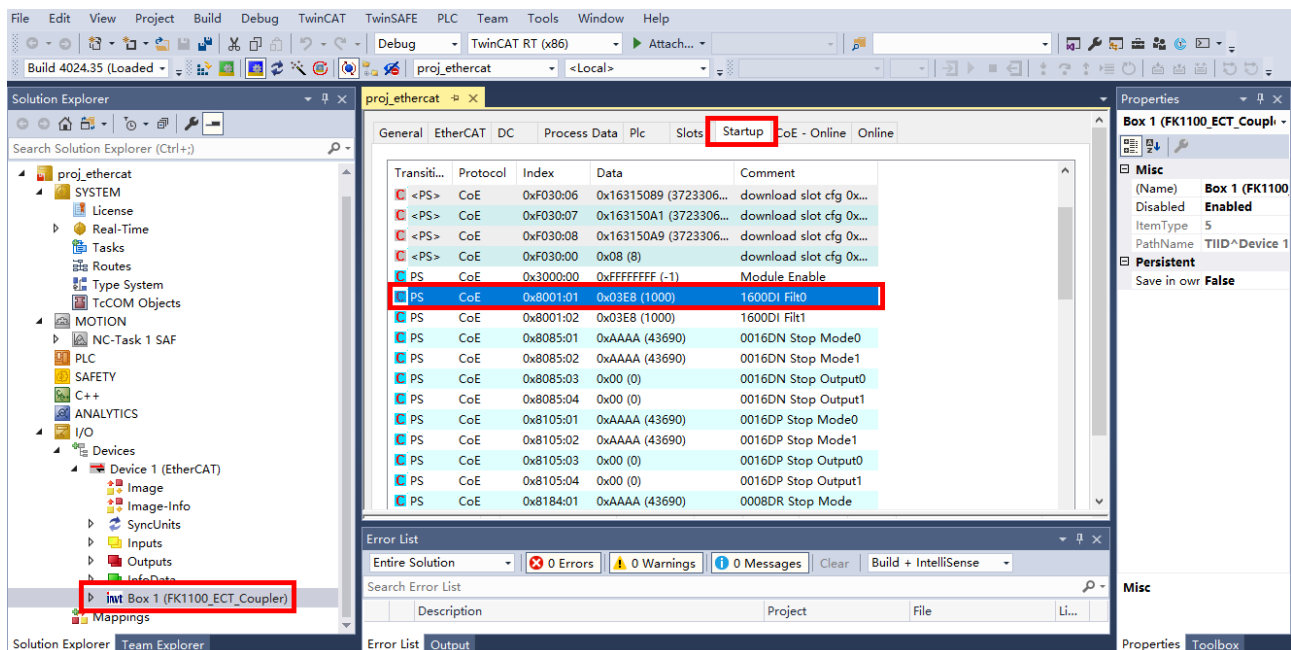
2. Synchronization period:
  - A. Double-click **I/O > Devices > EtherCAT**, click the **Adapter** tab, and set **Freerun Cycle(ms)** (recommended to adjust).
  - B. Double-click **FK1100\_ECT\_Coupler**, click the **DC** tab, click **Advanced Settings**, in the **SYNC 0** area, set **Sync Unit Cycle** (not recommended to adjust).



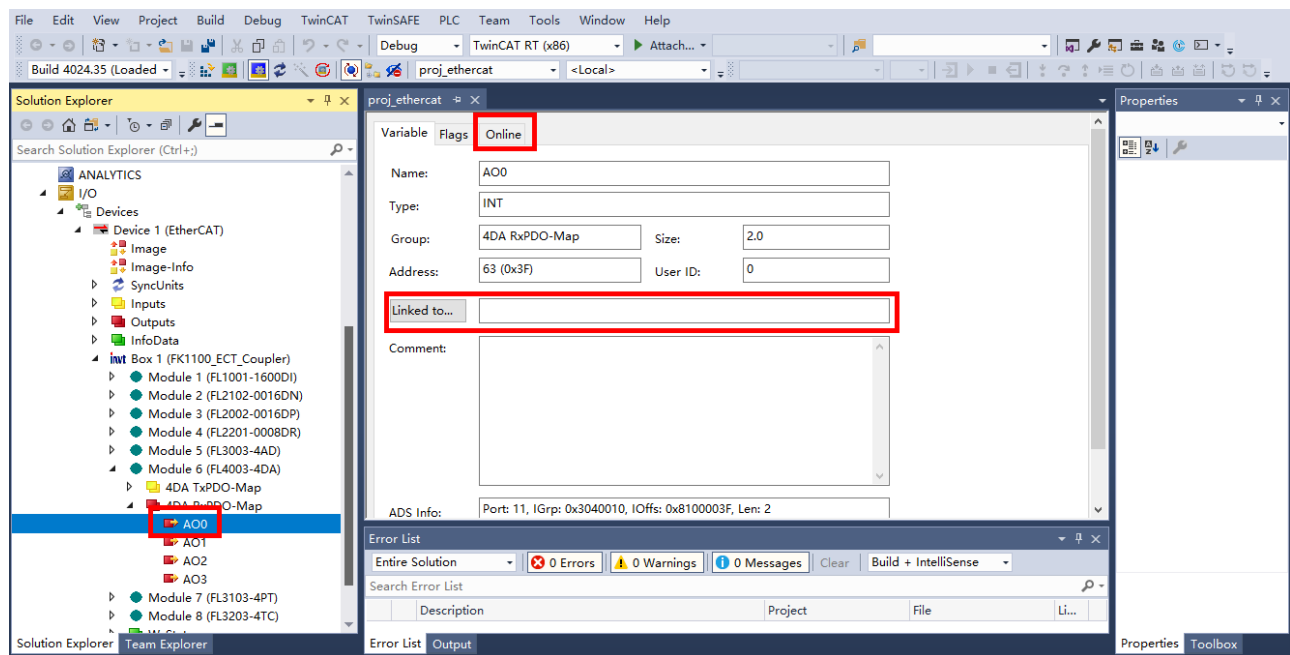


#### 6.1.3.4 Module configuration parameter

On the **FK1100\_ECT\_Coupler** > **Startup** interface, the **Startup** parameters are all SDO data, which are the initialization configuration parameters of each module. They are sent to the slave node during the transition from Pre-OP to Safe-OP in EtherCAT communication. Refer to 6.1.2.7 Object dictionary description for parameter details.



### 6.1.3.5 Module process data



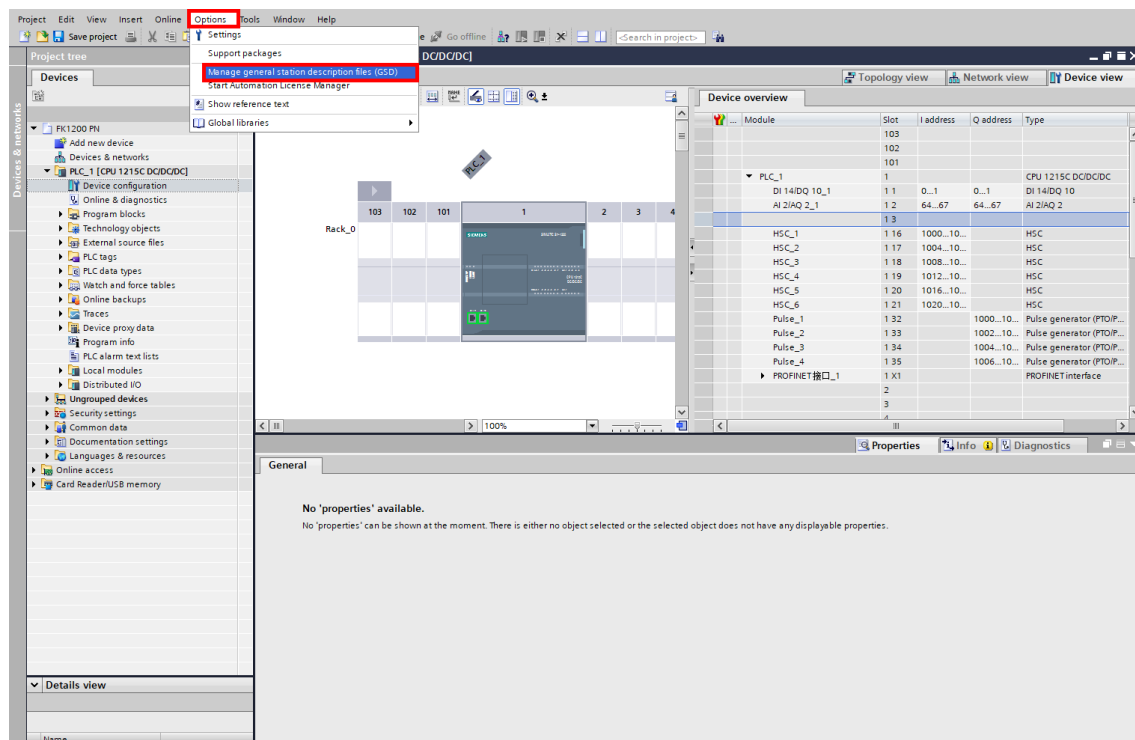
## 6.2 PROFINET configuration description

### 6.2.1 TIA Portal configuration description

#### 6.2.1.1 PROFINET communication coupler—FK1200

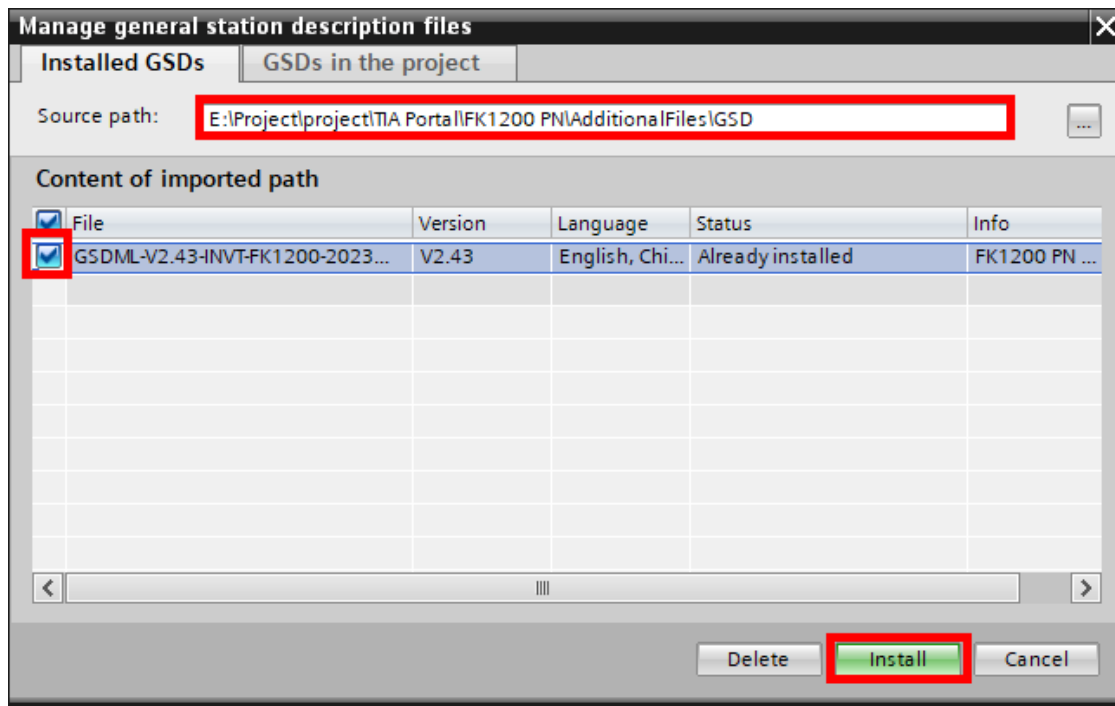
1. Install the device description file named in the format of GSDML-V2.43-INVT-FK1200-xxxxxxx.xml.

Step 1 Choose **Options > Manage general station description files (GSD)** from the menu bar.



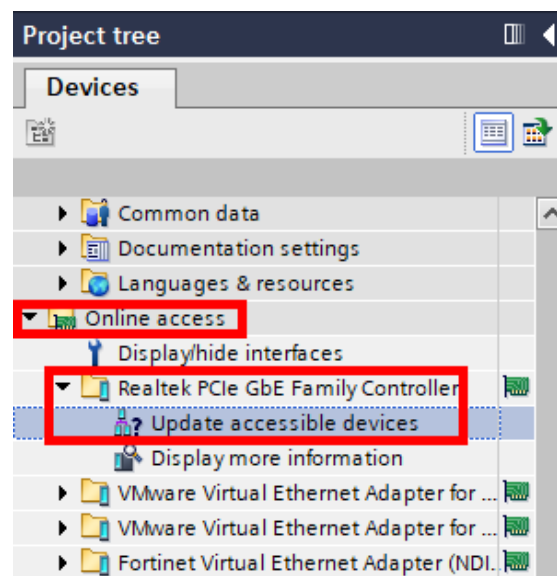
Step 2 In the **Manage general station description files** window that appears, set **Source path** to the GSD

file saving path, select the GSD file to be installed, and then click **Install**.



2. Set the PN device name and IP address.

Step 1 Complete the actual physical connection. Under **Project tree**, choose **Devices > Online access > Realtek PCIe GbE Family Controller > Update accessible devices**.



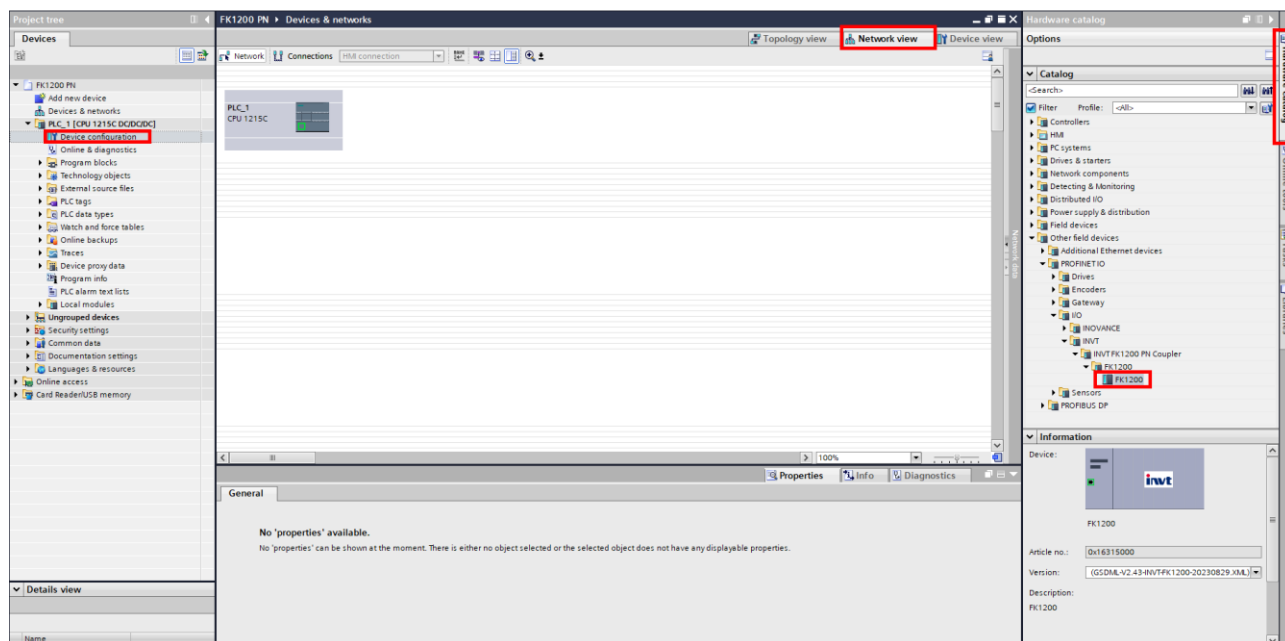
- Step 2 Choose the refreshed PN coupler device (you can confirm the device according to the MAC address). Choose **Online & diagnostics** under **fk1200**, choose **Functions > Assign IP address**, set **IP address** and **Subnet mask**, and click **Assign IP address**. After the IP address assignment, choose **Assign PROFINET device name**, set **PROFINET device name**, and click **Assign name**.

The first screenshot shows the 'Project tree' on the left with 'Online & diagnostics' selected under the 'fk1200' device. The 'Functions' menu is open, and 'Assign IP address' is highlighted. The main window displays the 'Assign IP address to the device' dialog. The MAC address is '00-BE-43-4A-83-55'. The IP address is set to '192.168.1.128' and the Subnet mask is '255.255.255.0'. The 'Assign IP address' button is highlighted.

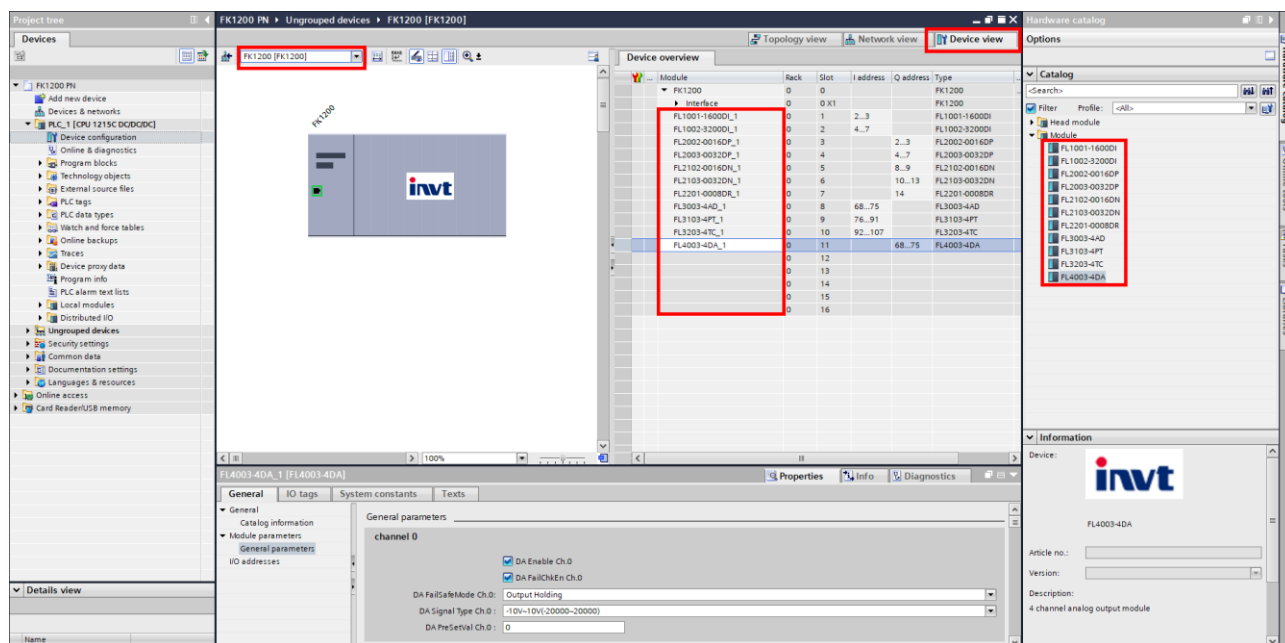
The second screenshot shows the 'Assign PROFINET device name' dialog. The 'Configured PROFINET device' section shows the 'PROFINET device name' as 'fk1200\_001' and the 'Device type' as 'FK1200\_PN\_Coupler'. The 'Device filter' section has three checkboxes: 'Only show devices of the same type', 'Only show devices with bad parameter settings', and 'Only show devices without names'. The 'Accessible devices in the network' table is empty. The 'Assign name' button is highlighted.

### 3. Network configuration

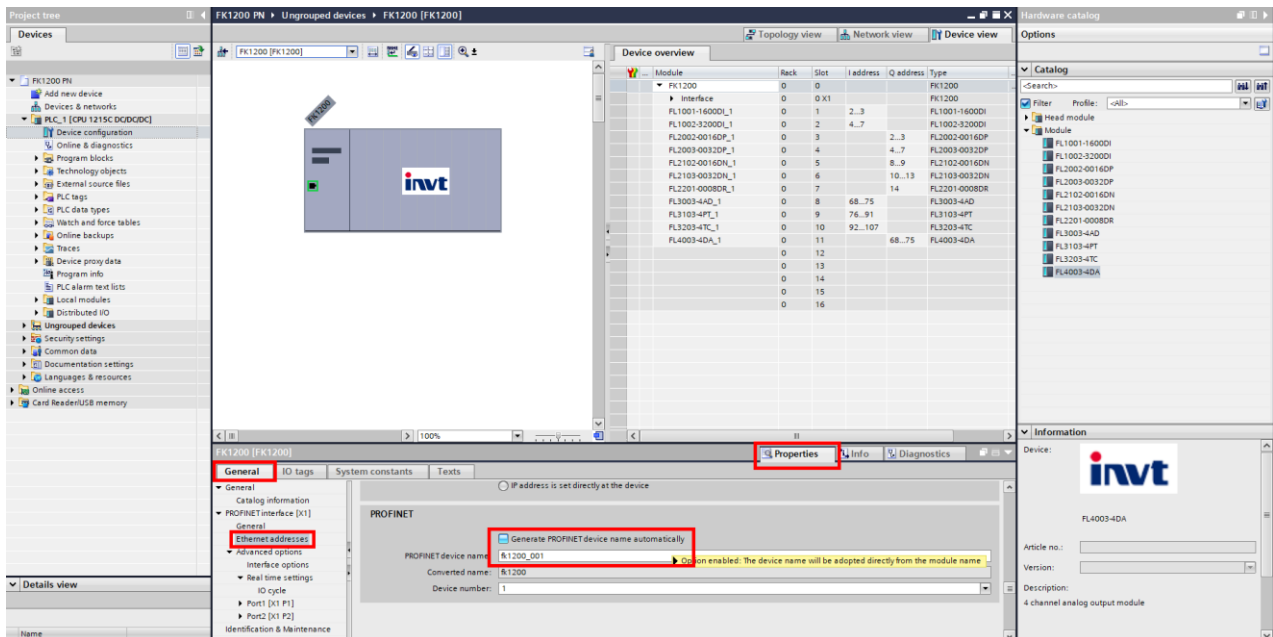
Step 1 Choose **PLC\_1** > **Device configuration** on the left, click **Network view** on the main interface, click **Hardware catalog** on the right, choose **Other field devices** > **PROFINET IO** > **I/O** > **INVT** > **FK1200** > **FK1200**.



Step 2 Choose **PLC\_1 > Device configuration** on the left, click **Device view** on the main interface, choose the FK1200 devices, and add modules to the slots according to actual physical configuration on the right.



Step 3 On the **Device view** interface, double click **FK1200**. Under the lower part of interface, choose **Properties > General > PROFINET interface [X1] > Ethernet addresses**, deselect **Generate PROFINET device automatically**, and set **PROFINET device name** to the current device name.

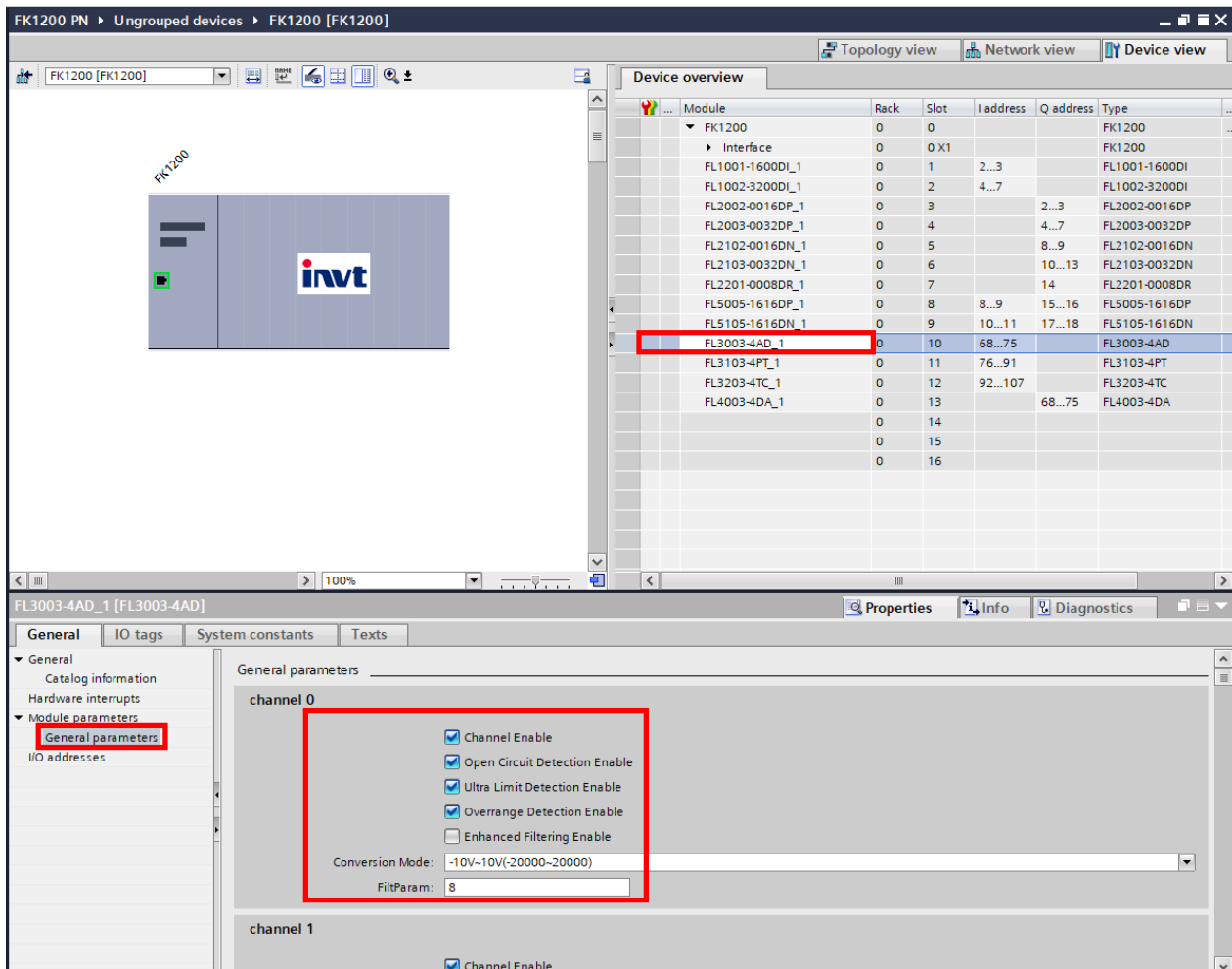


**Note:** In PROFINET communication, devices are identified through device names. Therefore, the set device names must match the actual device names of modules, and each device name must be unique.

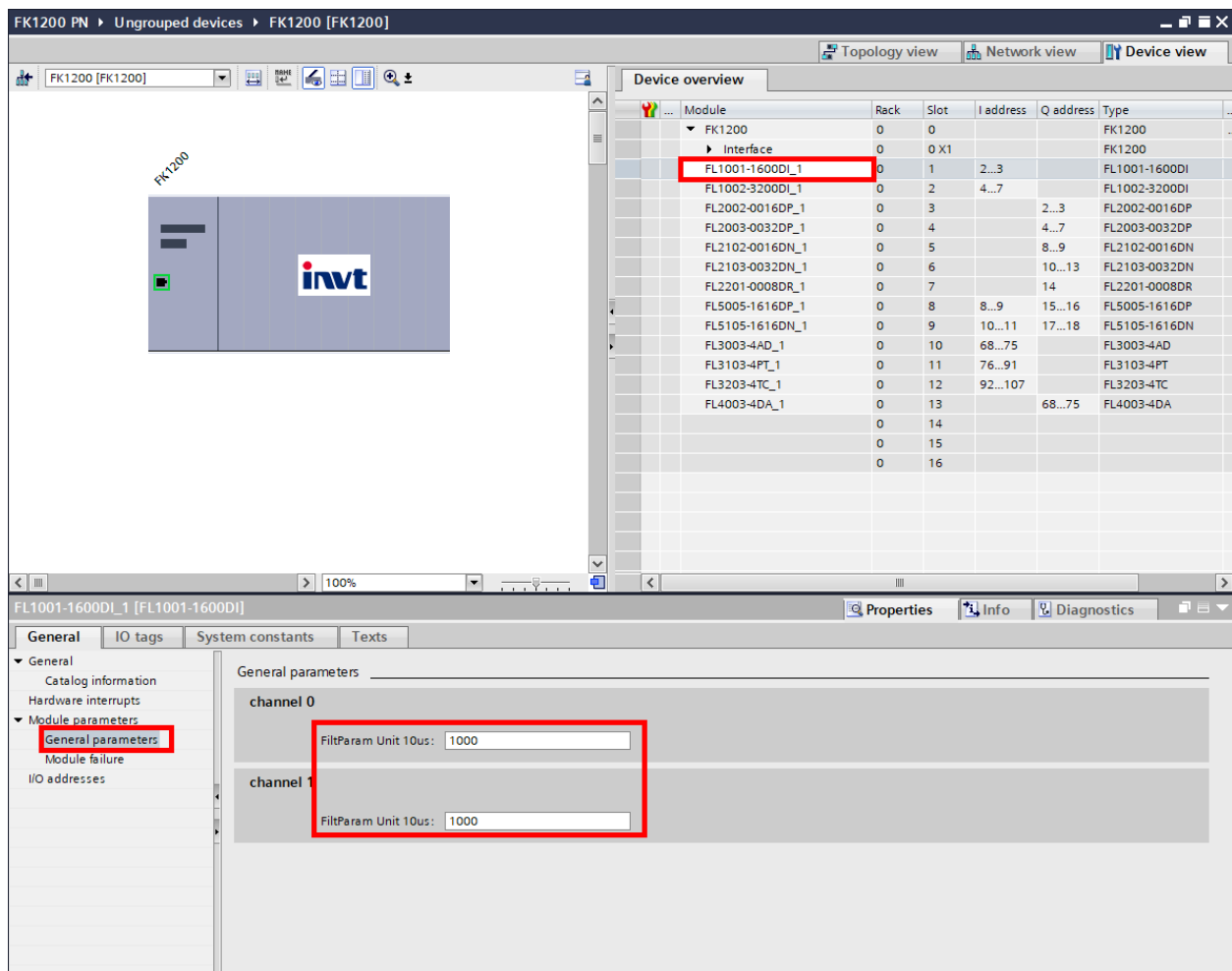


## Step 4 Set module parameters.

Example 1: On the **Device view** interface, double click **FL3003-4AD** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



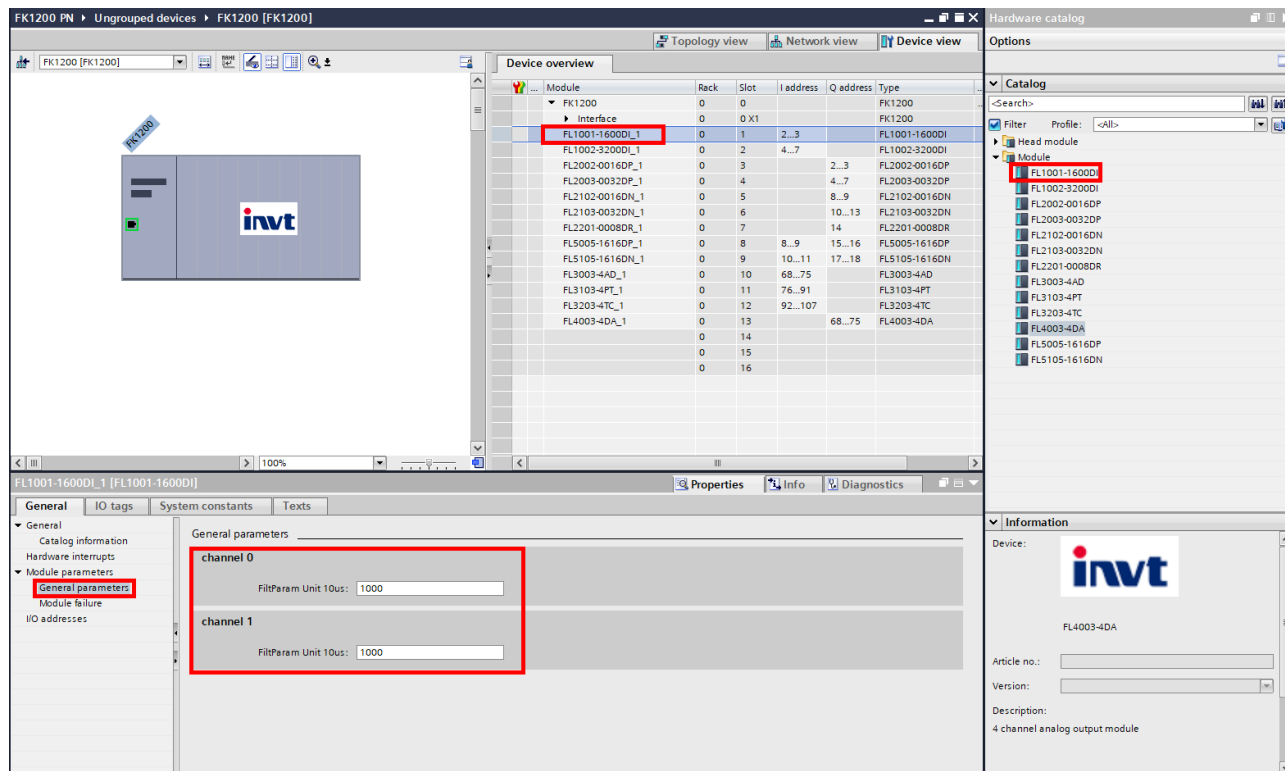
Example 2: On the **Device view** interface, double click **FL1001-1600DI** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



Step 5 After completing the network configuration, set all configuration module parameters. Once compiled, the program can be downloaded and run.

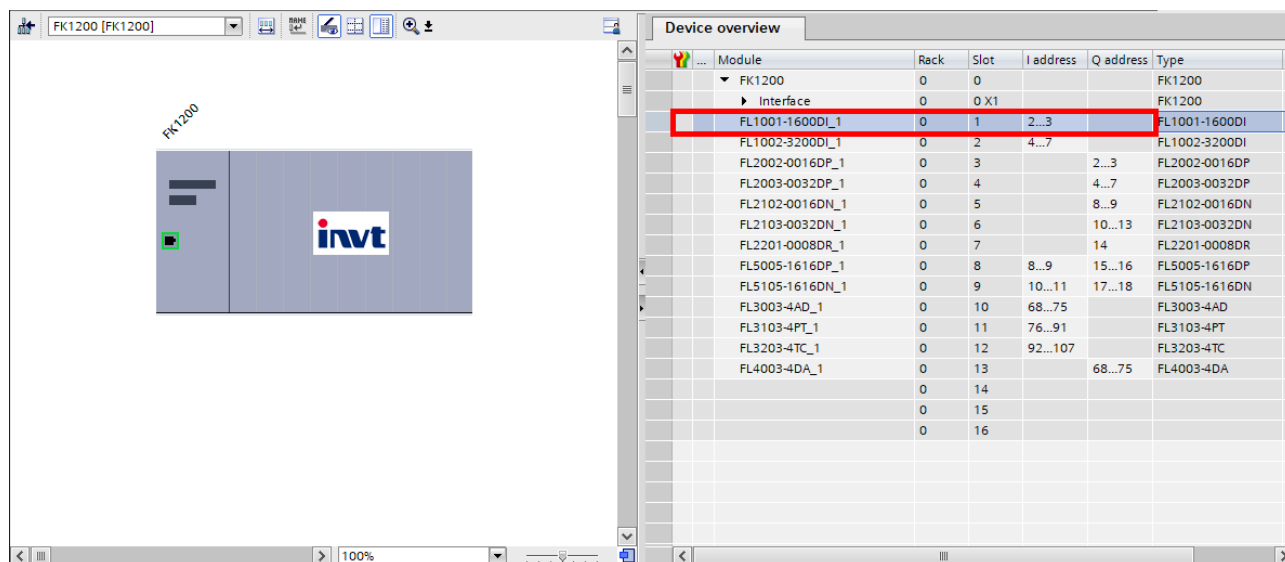
### 6.2.1.2 Digital input module—FL1001 (1600D)

Step 1 On the **Device view** interface, add **FL1001-1600DI**, double click **FL1001-1600DI** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



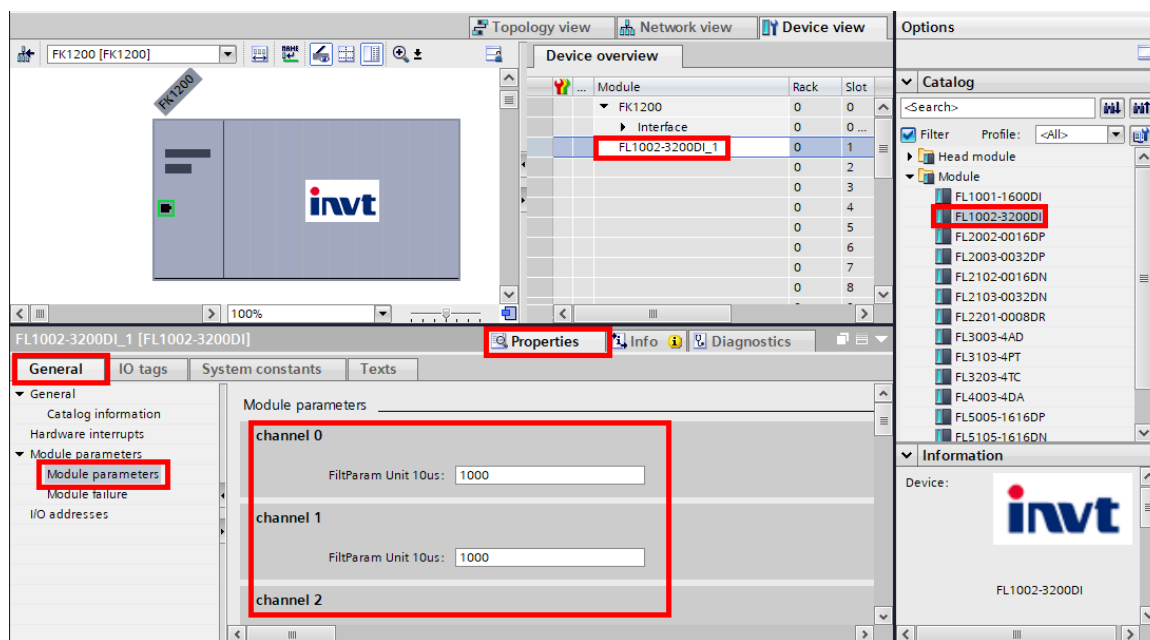
**Note:** For filtering parameter setting, the digital input module divides every 8 points into a group, and different filtering parameters can be set for each group. Adjust the port filtering mode in the startup parameters according to actual needs, with a unit of 10μs and a default value of 10ms.

Step 2 Obtain sampling values through I addresses.



### 6.2.1.3 Digital input module—FL1002 (3200D)

Step 1 On the **Device view** interface, add **FL1002-3200DI**, double click **FL1002-3200DI** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



**Note:** For filtering parameter setting, the digital input module divides every 8 points into a group, and different filtering parameters can be set for each group. Adjust the port filtering mode in the startup parameters according to actual needs, with a unit of 10μs and a default value of 10ms.

Step 2 Obtain sampling values through I addresses.

| Device overview |                 |      |      |           |           |               |             |
|-----------------|-----------------|------|------|-----------|-----------|---------------|-------------|
|                 | Module          | Rack | Slot | I address | Q address | Type          | Article no. |
|                 | FK1200          | 0    | 0    |           |           | FK1200        | 0x16315000  |
|                 | Interface       | 0    | 0 X1 |           |           | FK1200        |             |
|                 | FL1002-3200DI_1 | 0    | 1    | 2...5     |           | FL1002-3200DI |             |
|                 |                 | 0    | 2    |           |           |               |             |
|                 |                 | 0    | 3    |           |           |               |             |
|                 |                 | 0    | 4    |           |           |               |             |
|                 |                 | 0    | 5    |           |           |               |             |
|                 |                 | 0    | 6    |           |           |               |             |
|                 |                 | 0    | 7    |           |           |               |             |
|                 |                 | 0    | 8    |           |           |               |             |

### 6.2.1.4 Digital output module (source type)—FL2002 (0016DP)

Step 1 On the **Device view** interface, add **FL2002-0016DP**, double click **FL2002-0016DP** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

The screenshot shows the INVT software interface with the 'Device view' tab selected. The 'Device overview' table lists the following modules:

| Module          | Rack | Slot | I address | Q address | Type          |
|-----------------|------|------|-----------|-----------|---------------|
| FK1200          | 0    | 0    |           |           | FK1200        |
| Interface       | 0    | 0 X1 |           |           | FK1200        |
| FL1001-1600DI_1 | 0    | 1    | 2...3     |           | FL1001-1600DI |
| FL1002-3200DI_1 | 0    | 2    | 4...7     |           | FL1002-3200DI |
| FL2002-0016DP_1 | 0    | 3    |           | 2...3     | FL2002-0016DP |
| FL2003-0032DP_1 | 0    | 4    |           | 4...7     | FL2003-0032DP |
| FL2102-0016DN_1 | 0    | 5    |           | 8...9     | FL2102-0016DN |
| FL2103-0032DN_1 | 0    | 6    |           | 10...13   | FL2103-0032DN |
| FL2201-0008DR_1 | 0    | 7    |           | 14        | FL2201-0008DR |
| FL5005-1616DP_1 | 0    | 8    | 8...9     | 15...16   | FL5005-1616DP |
| FL5105-1616DN_1 | 0    | 9    | 10...11   | 17...18   | FL5105-1616DN |
| FL3003-4AD_1    | 0    | 10   | 68...75   |           | FL3003-4AD    |
| FL3103-4PT_1    | 0    | 11   | 76...91   |           | FL3103-4PT    |
| FL3203-4TC_1    | 0    | 12   | 92...107  |           | FL3203-4TC    |
| FL4003-4DA_1    | 0    | 13   |           | 68...75   | FL4003-4DA    |
|                 | 0    | 14   |           |           |               |
|                 | 0    | 15   |           |           |               |
|                 | 0    | 16   |           |           |               |

The 'Properties' window for 'FL2002-0016DP\_1' is open, showing the 'General' tab. The 'Module parameters' section is expanded, and the 'LostLink Output Mode' settings are visible:

- LostLink Output Mode Out0 : Output Holding
- LostLink Output Mode Out1 : Output Holding
- LostLink Output Mode Out2 : Output Holding
- LostLink Output Mode Out3 : Output Holding
- LostLink Output Mode Out4 : Output Holding
- LostLink Output Mode Out5 : Output Holding
- LostLink Output Mode Out6 : Output Holding
- LostLink Output Mode Out7 : Output Holding

Below these, there are checkboxes for 'LostLink Output PreSetVal' for each output channel (Out0 to Out4).

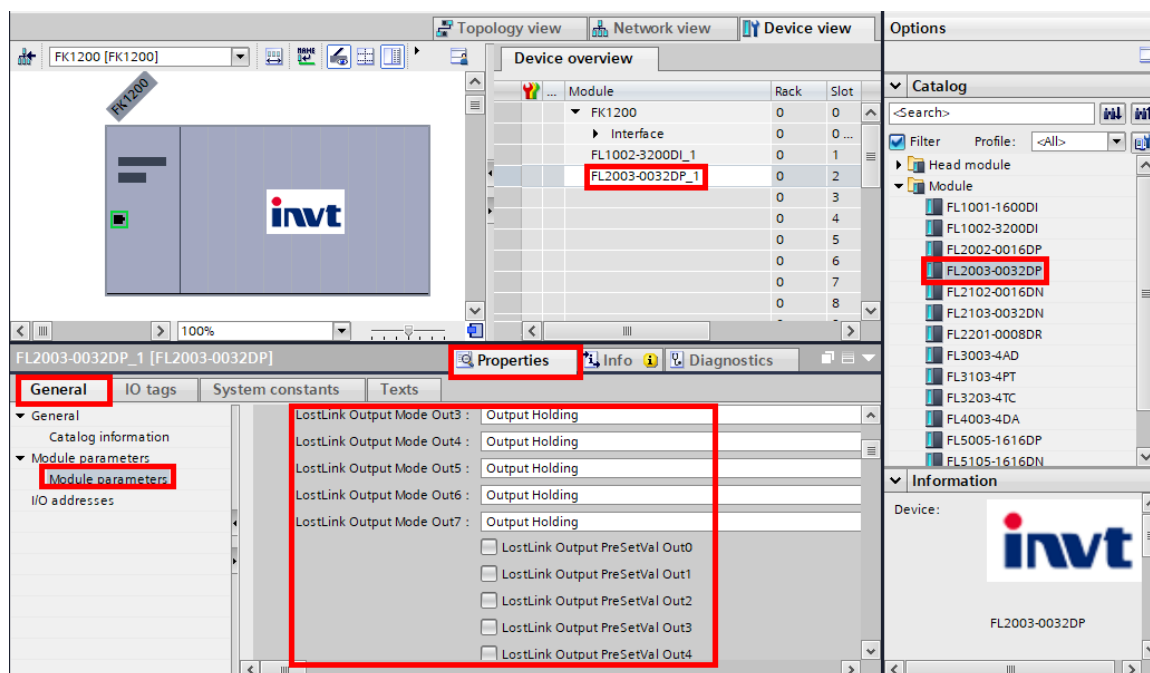
Step 2 Control output through Q addresses.

The screenshot shows the 'Device overview' table with the following modules:

| Module          | Rack | Slot | I address | Q address | Type          |
|-----------------|------|------|-----------|-----------|---------------|
| FK1200          | 0    | 0    |           |           | FK1200        |
| Interface       | 0    | 0 X1 |           |           | FK1200        |
| FL1001-1600DI_1 | 0    | 1    | 2...3     |           | FL1001-1600DI |
| FL1002-3200DI_1 | 0    | 2    | 4...7     |           | FL1002-3200DI |
| FL2002-0016DP_1 | 0    | 3    |           | 2...3     | FL2002-0016DP |
| FL2003-0032DP_1 | 0    | 4    |           | 4...7     | FL2003-0032DP |
| FL2102-0016DN_1 | 0    | 5    |           | 8...9     | FL2102-0016DN |
| FL2103-0032DN_1 | 0    | 6    |           | 10...13   | FL2103-0032DN |
| FL2201-0008DR_1 | 0    | 7    |           | 14        | FL2201-0008DR |
| FL5005-1616DP_1 | 0    | 8    | 8...9     | 15...16   | FL5005-1616DP |
| FL5105-1616DN_1 | 0    | 9    | 10...11   | 17...18   | FL5105-1616DN |
| FL3003-4AD_1    | 0    | 10   | 68...75   |           | FL3003-4AD    |
| FL3103-4PT_1    | 0    | 11   | 76...91   |           | FL3103-4PT    |
| FL3203-4TC_1    | 0    | 12   | 92...107  |           | FL3203-4TC    |
| FL4003-4DA_1    | 0    | 13   |           | 68...75   | FL4003-4DA    |
|                 | 0    | 14   |           |           |               |
|                 | 0    | 15   |           |           |               |
|                 | 0    | 16   |           |           |               |

### 6.2.1.5 Digital output module (source type)—FL2003 (0032DP)

Step 1 On the **Device view** interface, add **FL2003-0032DP**, double click **FL2003-0032DP** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



Step 2 Control output through Q addresses.

| Device overview |                 |      |      |           |           |               |             |
|-----------------|-----------------|------|------|-----------|-----------|---------------|-------------|
|                 | Module          | Rack | Slot | I address | Q address | Type          | Article no. |
| Device view     | FK1200          | 0    | 0    |           |           | FK1200        | 0x16315000  |
|                 | Interface       | 0    | 0 X1 |           |           | FK1200        |             |
|                 | FL1002-3200DI_1 | 0    | 1    | 2...5     |           | FL1002-3200DI |             |
|                 | FL2003-0032DP_1 | 0    | 2    |           | 2...5     | FL2003-0032DP |             |
|                 |                 | 0    | 3    |           |           |               |             |
|                 |                 | 0    | 4    |           |           |               |             |
|                 |                 | 0    | 5    |           |           |               |             |
|                 |                 | 0    | 6    |           |           |               |             |
|                 |                 | 0    | 7    |           |           |               |             |
|                 |                 | 0    | 8    |           |           |               |             |

### 6.2.1.6 Digital output module (sink type)—FL2102 (0016DN)

Step 1 On the **Device view** interface, add **FL2102-0016DN**, double click **FL2102-0016DN** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

The screenshot shows the INVT software interface with the 'Device view' tab selected. The 'Device overview' table lists modules, and the 'General parameters' section shows output modes.

| Module          | Rack | Slot | I address | Q address | Type          |
|-----------------|------|------|-----------|-----------|---------------|
| FK1200          | 0    | 0    |           |           | FK1200        |
| Interface       | 0    | 0    | X1        |           | FK1200        |
| FL1001-1600DI_1 | 0    | 1    | 2...3     |           | FL1001-1600DI |
| FL1002-3200DI_1 | 0    | 2    | 4...7     |           | FL1002-3200DI |
| FL2002-0016DP_1 | 0    | 3    |           | 2...3     | FL2002-0016DP |
| FL2003-0032DP_1 | 0    | 4    |           | 4...7     | FL2003-0032DP |
| FL2102-0016DN_1 | 0    | 5    |           | 8...9     | FL2102-0016DN |
| FL2103-0032DN_1 | 0    | 6    |           | 10...13   | FL2103-0032DN |
| FL2201-0008DR_1 | 0    | 7    |           | 14        | FL2201-0008DR |
| FL5005-1616DP_1 | 0    | 8    | 8...9     | 15...16   | FL5005-1616DP |
| FL5105-1616DN_1 | 0    | 9    | 10...11   | 17...18   | FL5105-1616DN |
| FL3003-4AD_1    | 0    | 10   | 68...75   |           | FL3003-4AD    |
| FL3103-4PT_1    | 0    | 11   | 76...91   |           | FL3103-4PT    |
| FL3203-4TC_1    | 0    | 12   | 92...107  |           | FL3203-4TC    |
| FL4003-4DA_1    | 0    | 13   |           | 68...75   | FL4003-4DA    |
|                 | 0    | 14   |           |           |               |
|                 | 0    | 15   |           |           |               |
|                 | 0    | 16   |           |           |               |

The 'General parameters' section shows the following output modes:

- LostLink Output Mode Out0 : Output Holding
- LostLink Output Mode Out1 : Output Holding
- LostLink Output Mode Out2 : Output Holding
- LostLink Output Mode Out3 : Output Holding
- LostLink Output Mode Out4 : Output Holding
- LostLink Output Mode Out5 : Output Holding
- LostLink Output Mode Out6 : Output Holding
- LostLink Output Mode Out7 : Output Holding

Below the output modes, there are checkboxes for 'LostLink Output PreSetVal' for each output mode (Out0 to Out4).

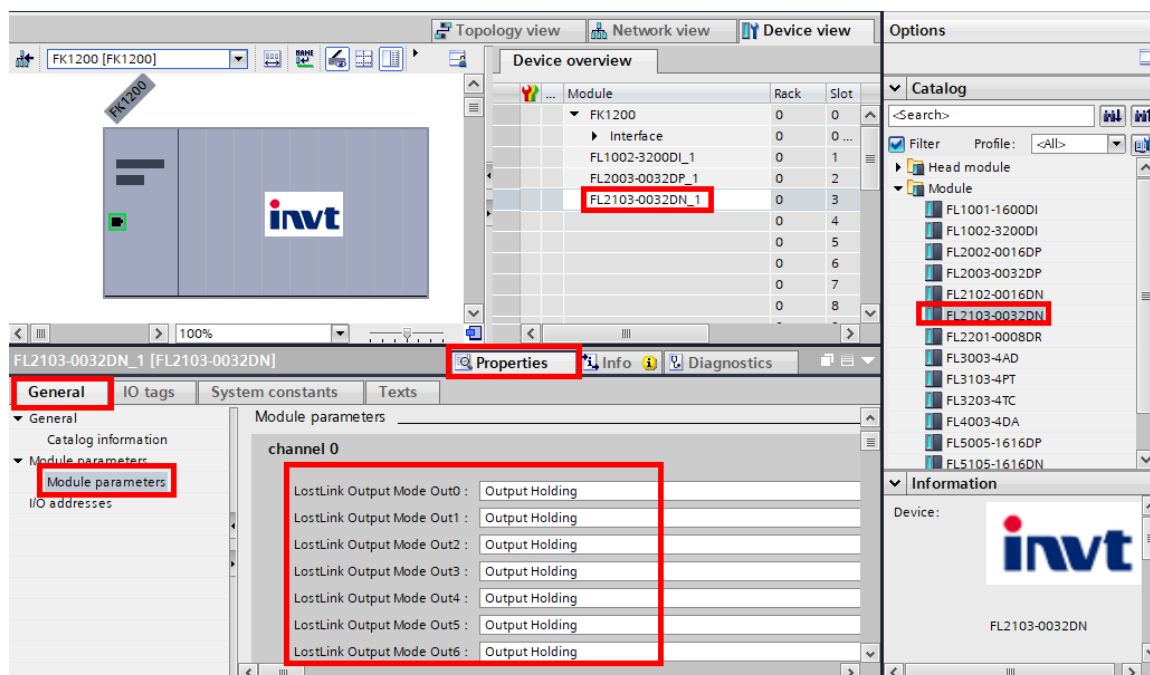
Step 2 Control output through Q addresses.

The screenshot shows the INVT software interface with the 'Device view' tab selected. The 'Device overview' table lists modules, and the 'General parameters' section shows output modes.

| Module          | Rack | Slot | I address | Q address | Type          |
|-----------------|------|------|-----------|-----------|---------------|
| FK1200          | 0    | 0    |           |           | FK1200        |
| Interface       | 0    | 0    | X1        |           | FK1200        |
| FL1001-1600DI_1 | 0    | 1    | 2...3     |           | FL1001-1600DI |
| FL1002-3200DI_1 | 0    | 2    | 4...7     |           | FL1002-3200DI |
| FL2002-0016DP_1 | 0    | 3    |           | 2...3     | FL2002-0016DP |
| FL2003-0032DP_1 | 0    | 4    |           | 4...7     | FL2003-0032DP |
| FL2102-0016DN_1 | 0    | 5    |           | 8...9     | FL2102-0016DN |
| FL2103-0032DN_1 | 0    | 6    |           | 10...13   | FL2103-0032DN |
| FL2201-0008DR_1 | 0    | 7    |           | 14        | FL2201-0008DR |
| FL5005-1616DP_1 | 0    | 8    | 8...9     | 15...16   | FL5005-1616DP |
| FL5105-1616DN_1 | 0    | 9    | 10...11   | 17...18   | FL5105-1616DN |
| FL3003-4AD_1    | 0    | 10   | 68...75   |           | FL3003-4AD    |
| FL3103-4PT_1    | 0    | 11   | 76...91   |           | FL3103-4PT    |
| FL3203-4TC_1    | 0    | 12   | 92...107  |           | FL3203-4TC    |
| FL4003-4DA_1    | 0    | 13   |           | 68...75   | FL4003-4DA    |
|                 | 0    | 14   |           |           |               |
|                 | 0    | 15   |           |           |               |
|                 | 0    | 16   |           |           |               |

### 6.2.1.7 Digital output module (sink type)—FL2103 (0032DN)

Step 1 On the **Device view** interface, add **FL2103-0032DN**, double click **FL2103-0032DN** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



Step 2 Control output through Q addresses.

| Device overview |      |      |           |           |               |             |  |
|-----------------|------|------|-----------|-----------|---------------|-------------|--|
| Module          | Rack | Slot | I address | Q address | Type          | Article no. |  |
| FK1200          | 0    | 0    |           |           | FK1200        | 0x16315000  |  |
| Interface       | 0    | 0 X1 |           |           | FK1200        |             |  |
| FL1002-3200DI_1 | 0    | 1    | 2...5     |           | FL1002-3200DI |             |  |
| FL2003-0032DP_1 | 0    | 2    |           | 2...5     | FL2003-0032DP |             |  |
| FL2103-0032DN_1 | 0    | 3    |           | 6...9     | FL2103-0032DN |             |  |
|                 | 0    | 4    |           |           |               |             |  |
|                 | 0    | 5    |           |           |               |             |  |
|                 | 0    | 6    |           |           |               |             |  |
|                 | 0    | 7    |           |           |               |             |  |
|                 | 0    | 8    |           |           |               |             |  |



### 6.2.1.8 Digital output module (relay)—FL2201 (0008DR)

Step 1 On the **Device view** interface, add **FL2201-0008DR**, double click **FL2201-0008DR** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

The screenshot displays the INVT software interface for configuring the FL2201-0008DR module. The top panel shows the 'Device overview' table with the module highlighted. The bottom panel shows the 'General parameters' for channel 0, where output modes are set to 'Output Holding'.

| Module                 | Rack     | Slot     | I address | Q address | Type                 |
|------------------------|----------|----------|-----------|-----------|----------------------|
| FK1200                 | 0        | 0        |           |           | FK1200               |
| Interface              | 0        | 0 X1     |           |           | FK1200               |
| FL1001-1600DI_1        | 0        | 1        | 2...3     |           | FL1001-1600DI        |
| FL1002-3200DI_1        | 0        | 2        | 4...7     |           | FL1002-3200DI        |
| FL2002-0016DP_1        | 0        | 3        |           | 2...3     | FL2002-0016DP        |
| FL2003-0032DP_1        | 0        | 4        |           | 4...7     | FL2003-0032DP        |
| FL2102-0016DN_1        | 0        | 5        |           | 8...9     | FL2102-0016DN        |
| FL2103-0032DN_1        | 0        | 6        |           | 10...13   | FL2103-0032DN        |
| <b>FL2201-0008DR_1</b> | <b>0</b> | <b>7</b> |           | <b>14</b> | <b>FL2201-0008DR</b> |
| FL5005-1616DP_1        | 0        | 8        | 8...9     | 15...16   | FL5005-1616DP        |
| FL5105-1616DN_1        | 0        | 9        | 10...11   | 17...18   | FL5105-1616DN        |
| FL3003-4AD_1           | 0        | 10       | 68...75   |           | FL3003-4AD           |
| FL3103-4PT_1           | 0        | 11       | 76...91   |           | FL3103-4PT           |
| FL3203-4TC_1           | 0        | 12       | 92...107  |           | FL3203-4TC           |
| FL4003-4DA_1           | 0        | 13       |           | 68...75   | FL4003-4DA           |
|                        | 0        | 14       |           |           |                      |
|                        | 0        | 15       |           |           |                      |
|                        | 0        | 16       |           |           |                      |

The bottom panel shows the 'General parameters' for channel 0, where output modes are set to 'Output Holding'.

| Parameter                      | Value                    |
|--------------------------------|--------------------------|
| LostLink Output Mode Out0 :    | Output Holding           |
| LostLink Output Mode Out1 :    | Output Holding           |
| LostLink Output Mode Out2 :    | Output Holding           |
| LostLink Output Mode Out3 :    | Output Holding           |
| LostLink Output Mode Out4 :    | Output Holding           |
| LostLink Output Mode Out5 :    | Output Holding           |
| LostLink Output Mode Out6 :    | Output Holding           |
| LostLink Output Mode Out7 :    | Output Holding           |
| LostLink Output PreSetVal Out0 | <input type="checkbox"/> |
| LostLink Output PreSetVal Out1 | <input type="checkbox"/> |

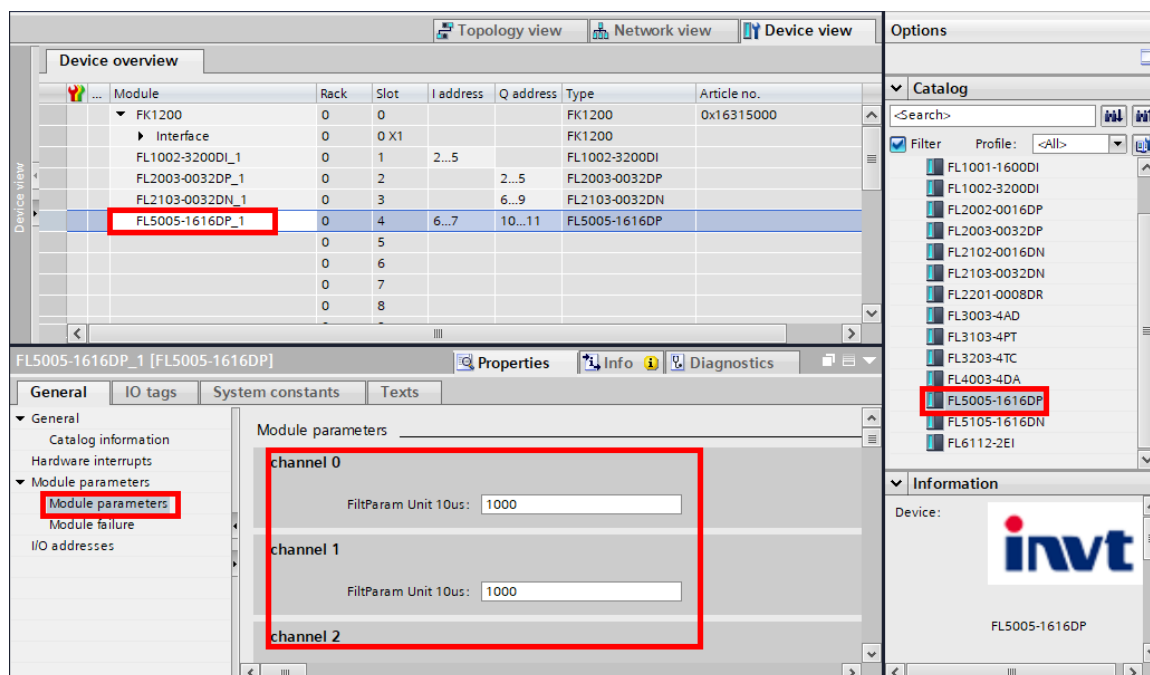
Step 2 Control output through Q addresses.

The screenshot displays the INVT software interface for configuring the FL2201-0008DR module. The top panel shows the 'Device overview' table with the module highlighted. The table shows the module's Q address range.

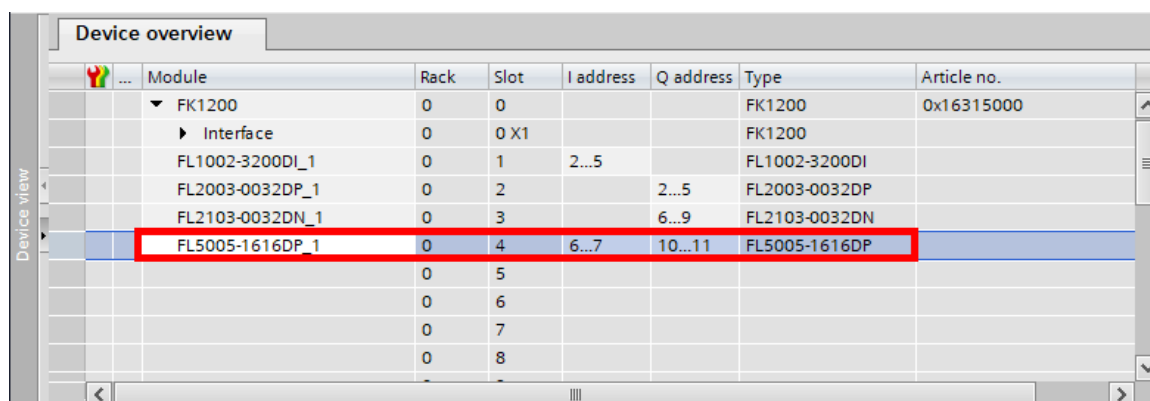
| Module                 | Rack     | Slot     | I address | Q address | Type                 |
|------------------------|----------|----------|-----------|-----------|----------------------|
| FK1200                 | 0        | 0        |           |           | FK1200               |
| Interface              | 0        | 0 X1     |           |           | FK1200               |
| FL1001-1600DI_1        | 0        | 1        | 2...3     |           | FL1001-1600DI        |
| FL1002-3200DI_1        | 0        | 2        | 4...7     |           | FL1002-3200DI        |
| FL2002-0016DP_1        | 0        | 3        |           | 2...3     | FL2002-0016DP        |
| FL2003-0032DP_1        | 0        | 4        |           | 4...7     | FL2003-0032DP        |
| FL2102-0016DN_1        | 0        | 5        |           | 8...9     | FL2102-0016DN        |
| FL2103-0032DN_1        | 0        | 6        |           | 10...13   | FL2103-0032DN        |
| <b>FL2201-0008DR_1</b> | <b>0</b> | <b>7</b> |           | <b>14</b> | <b>FL2201-0008DR</b> |
| FL5005-1616DP_1        | 0        | 8        | 8...9     | 15...16   | FL5005-1616DP        |
| FL5105-1616DN_1        | 0        | 9        | 10...11   | 17...18   | FL5105-1616DN        |
| FL3003-4AD_1           | 0        | 10       | 68...75   |           | FL3003-4AD           |
| FL3103-4PT_1           | 0        | 11       | 76...91   |           | FL3103-4PT           |
| FL3203-4TC_1           | 0        | 12       | 92...107  |           | FL3203-4TC           |
| FL4003-4DA_1           | 0        | 13       |           | 68...75   | FL4003-4DA           |
|                        | 0        | 14       |           |           |                      |
|                        | 0        | 15       |           |           |                      |
|                        | 0        | 16       |           |           |                      |

### 6.2.1.9 Digital hybrid module—FL5005 (1616DP),FL5004(08P08P)

Step 1 On the **Device view** interface, add **FL5005-1616DP**, double click **FL5005-1616DP** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

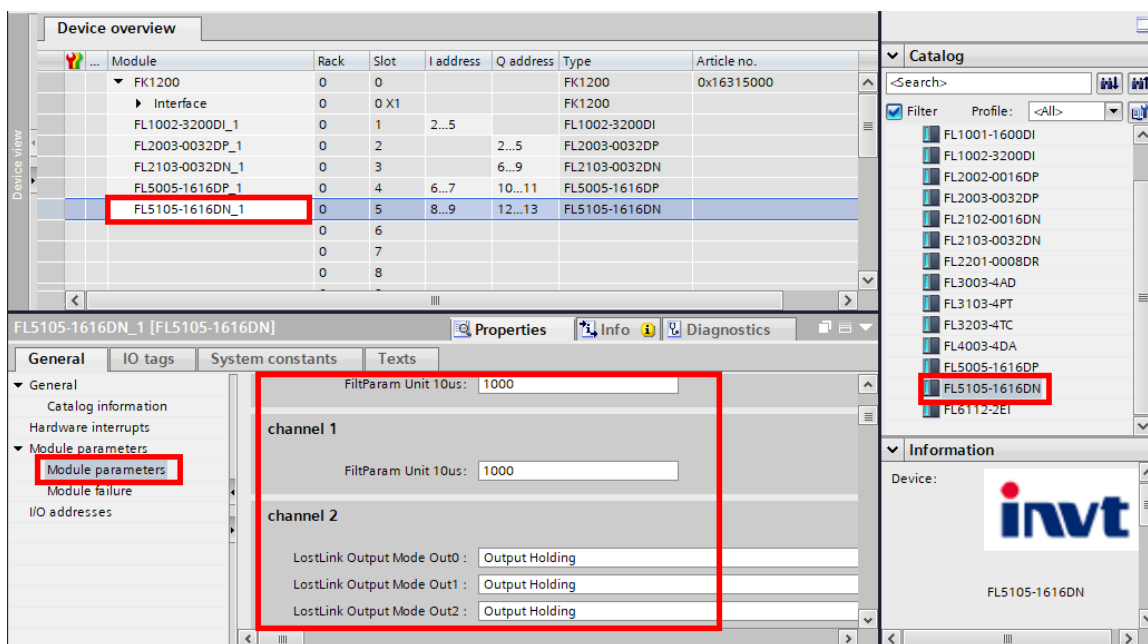


Step 2 Obtain sampling values through I addresses and control output through Q addresses.

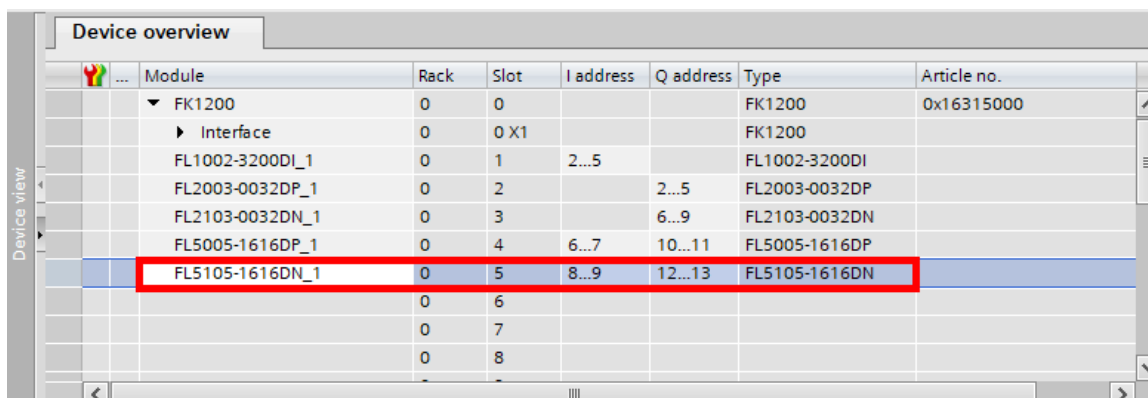


### 6.2.1.10 Digital hybrid module—FL5105 (1616DN), FL5104(08N08N)

Step 1 On the **Device view** interface, add **FL5105-1616DN**, double click **FL5105-1616DN** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

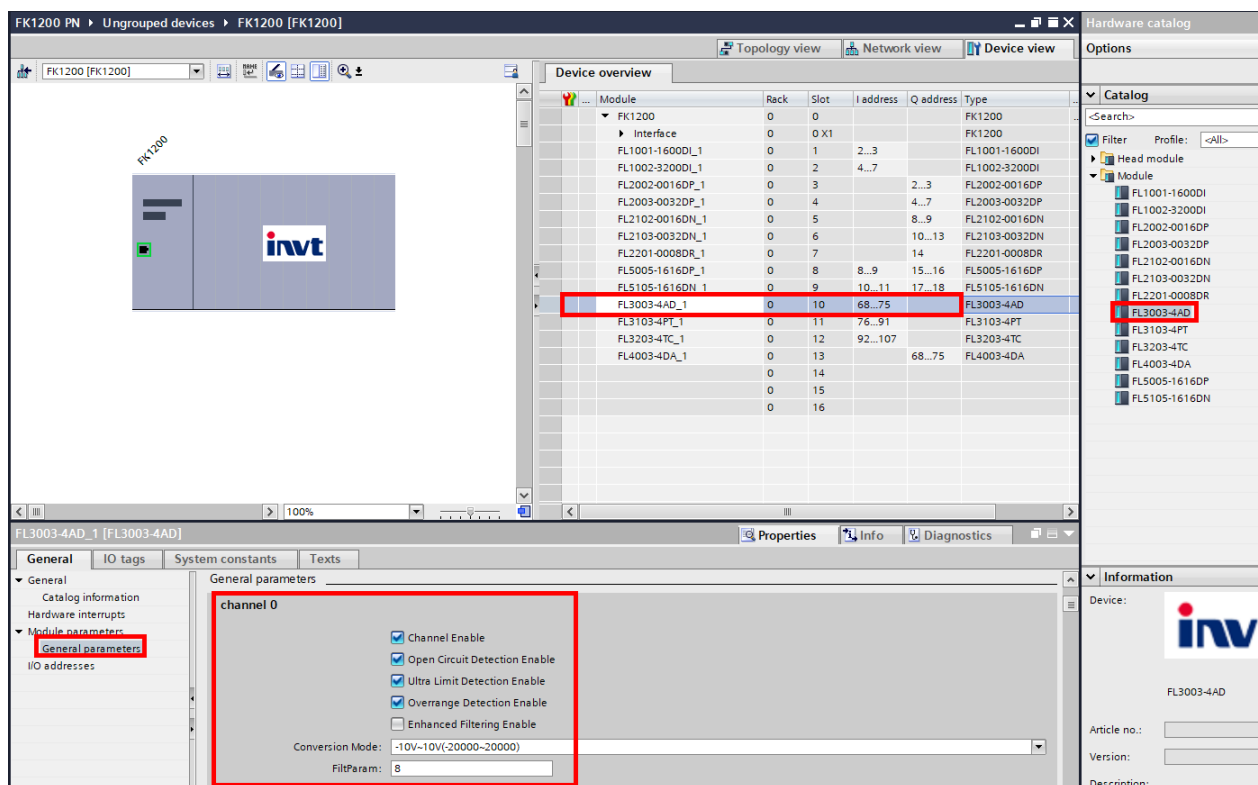


Step 2 Obtain sampling values through I addresses and control output through Q addresses.

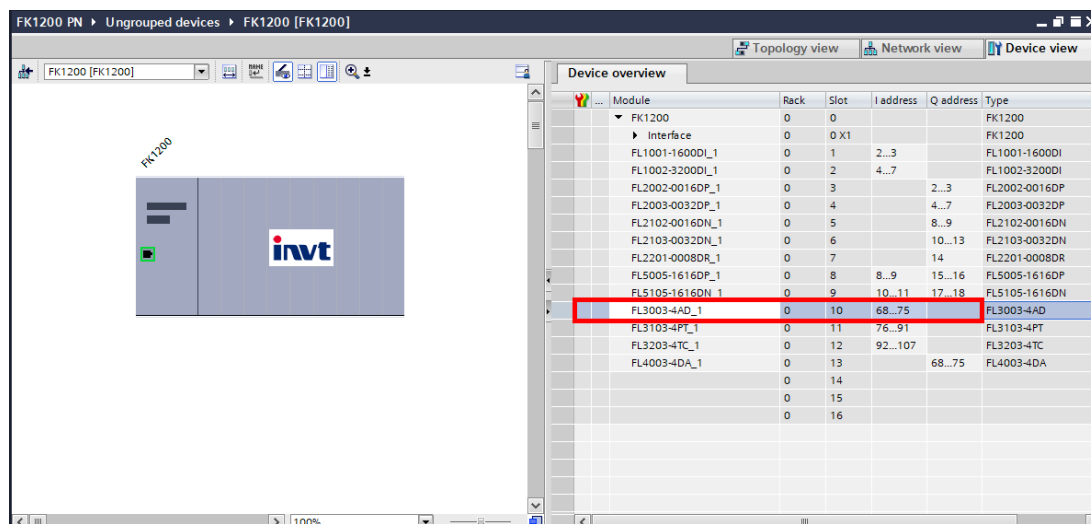


### 6.2.1.11 Analog input module—FL3003 (4AD)

Step 1 On the **Device view** interface, add **FL3003-4AD**, double click **FL3003-4AD** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

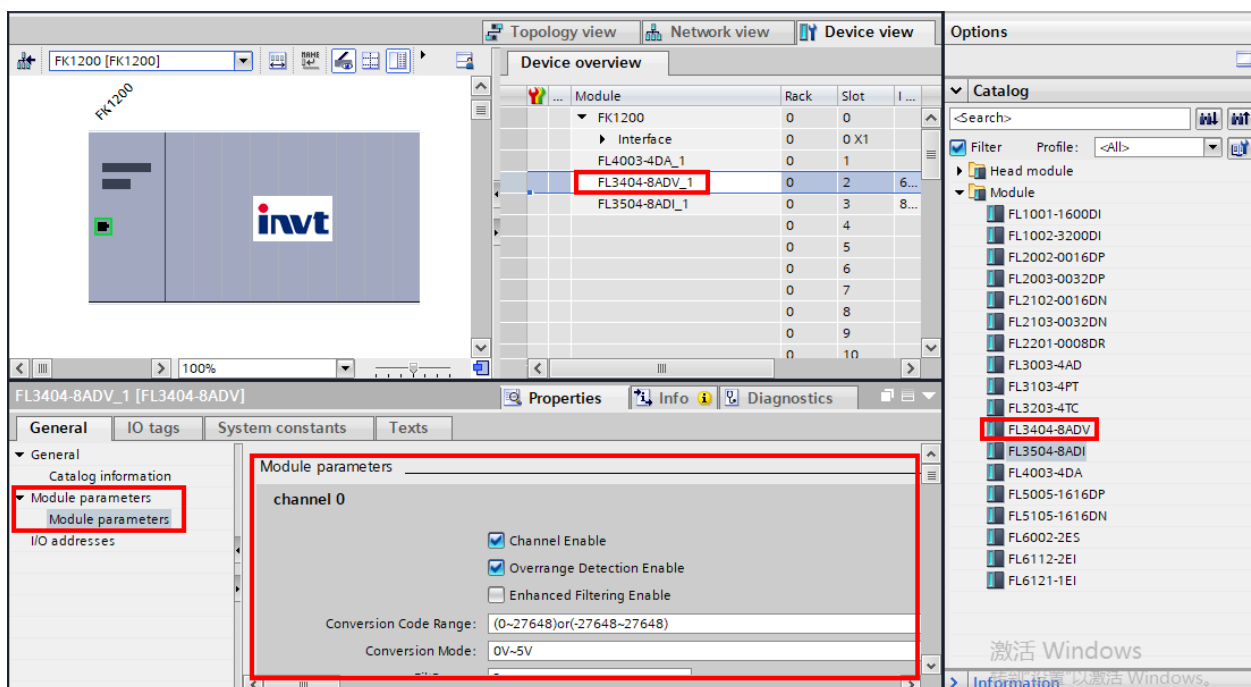


Step 2 Obtain sampling values through I addresses.

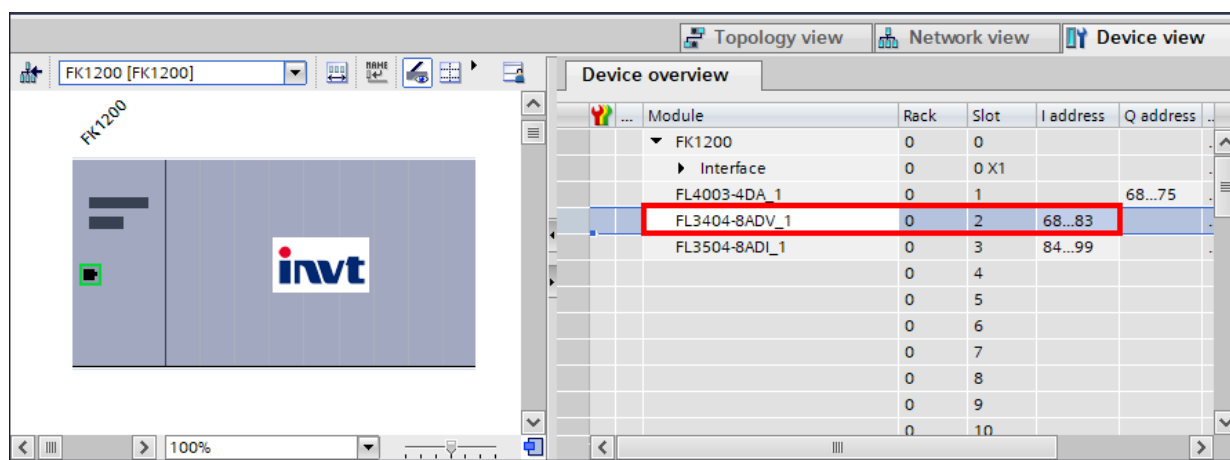


### 6.2.1.12 Analog input module—FL3404(8ADV)

Step 1 In the **Device view** interface, add **FL3404-8ADV**, double click **FL3404-8ADV** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

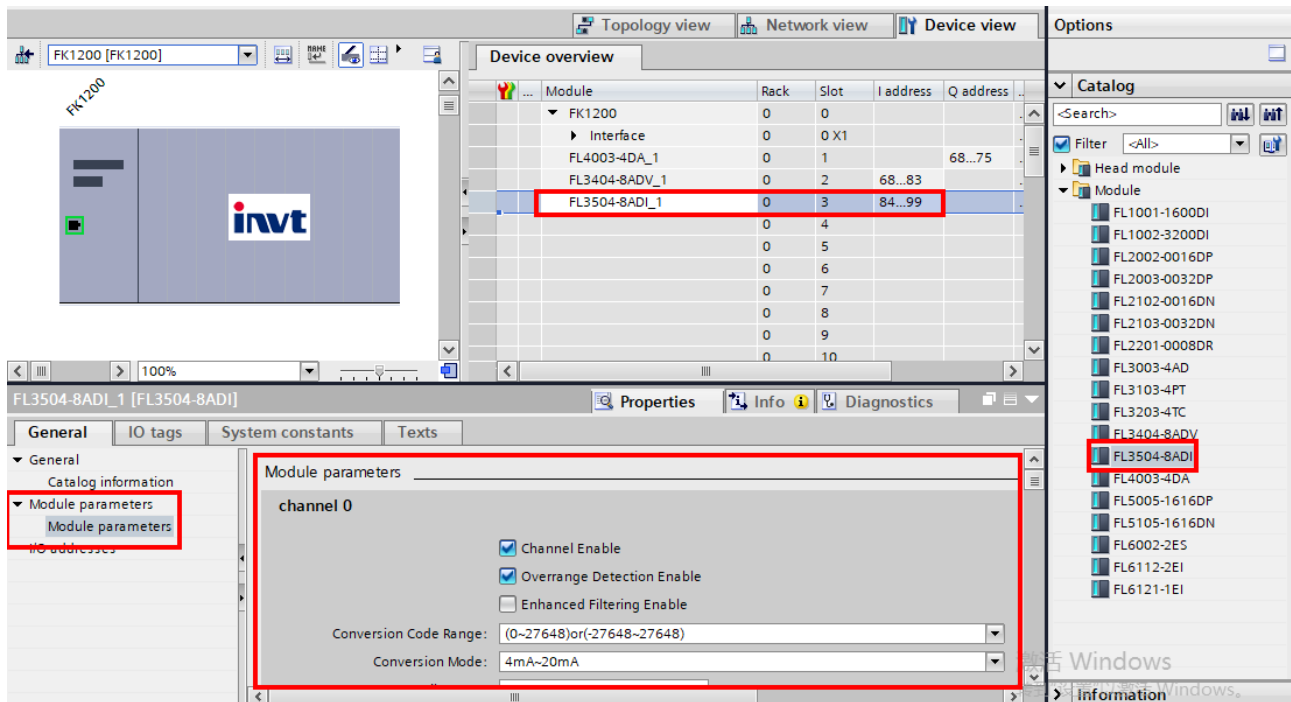


Step 2 Obtain sampling values through I addresses.

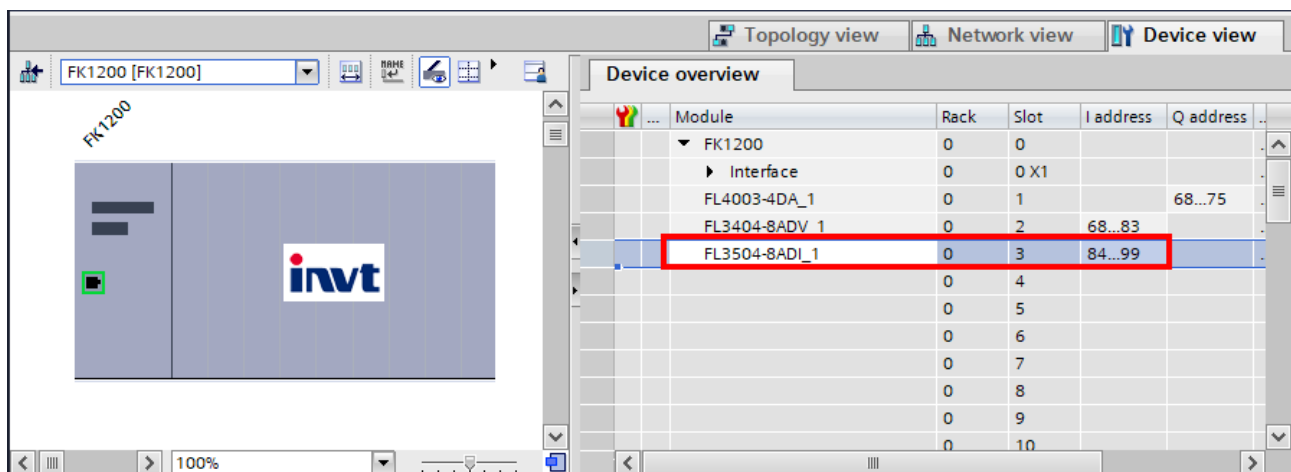


### 6.2.1.13 Analog input module—FL3504(8ADI)

Step 1 In the **Device view** interface, add **FL3504-8ADI**, double click **FL3504-8ADI** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

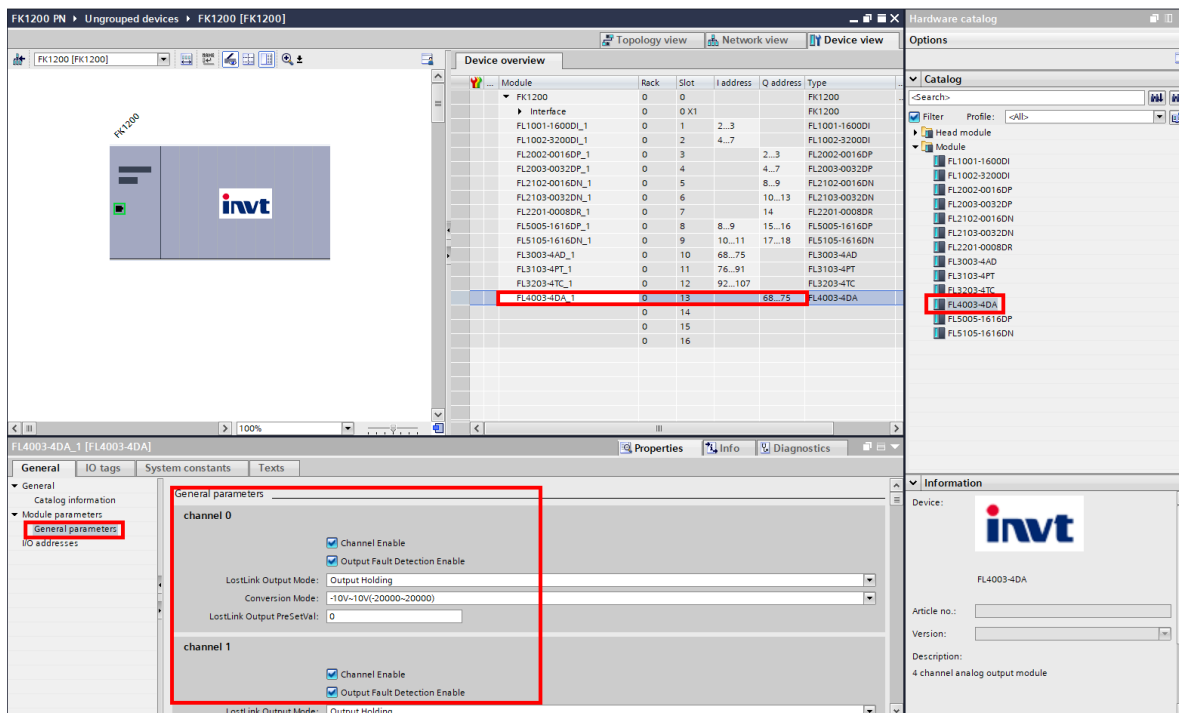


Step 2 Obtain sampling values through I addresses.

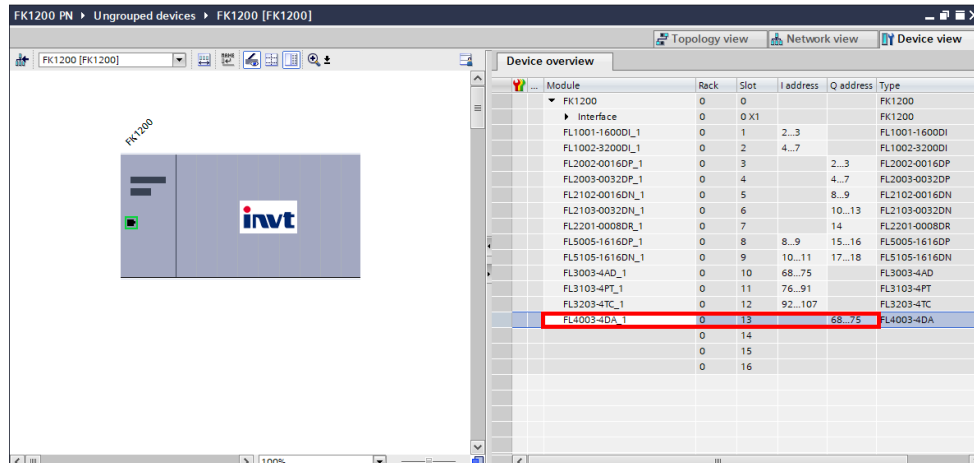


### 6.2.1.14 Analog output module—FL4003 (4DA)

Step 1 On the **Device view** interface, add **FL4003-4DA**, double click **FL4003-4DA** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

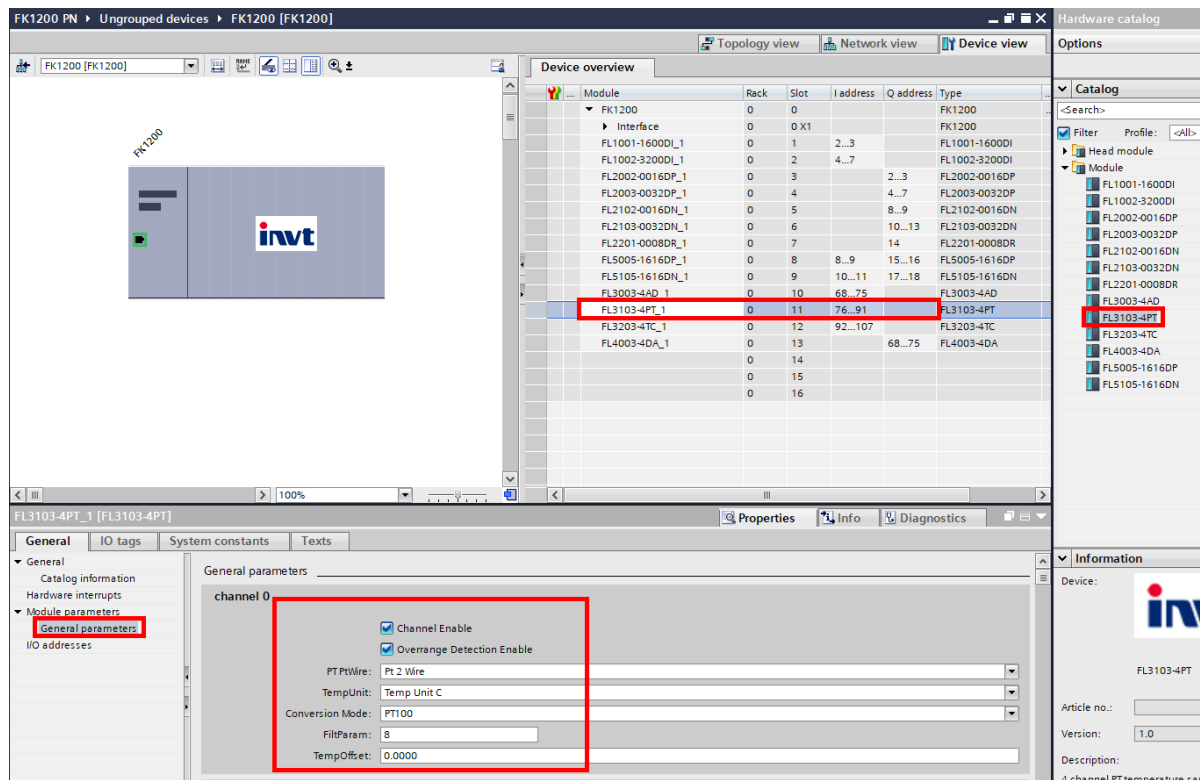


Step 2 Control output through Q addresses.

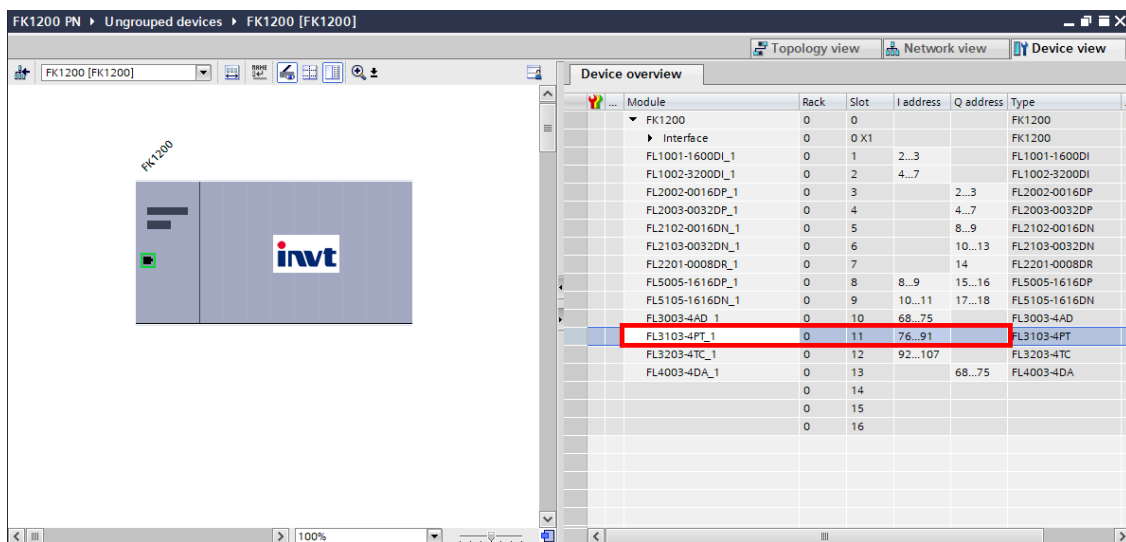


### 6.2.1.15 Temperature detection module (thermistor)—FL3103 (4PT)

Step 1 On the **Device view** interface, add **FL3103-4PT**, double click **FL3103-4PT** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



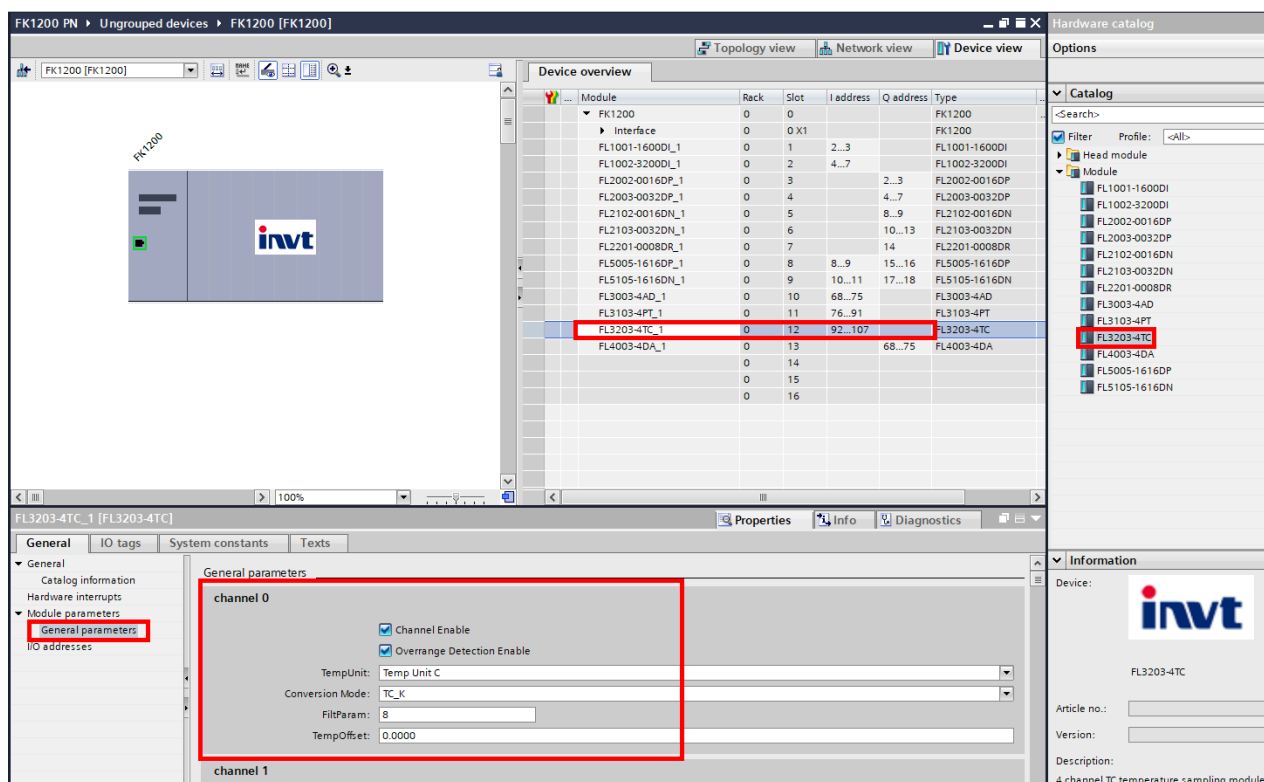
Step 2 Obtain sampling values through I addresses.



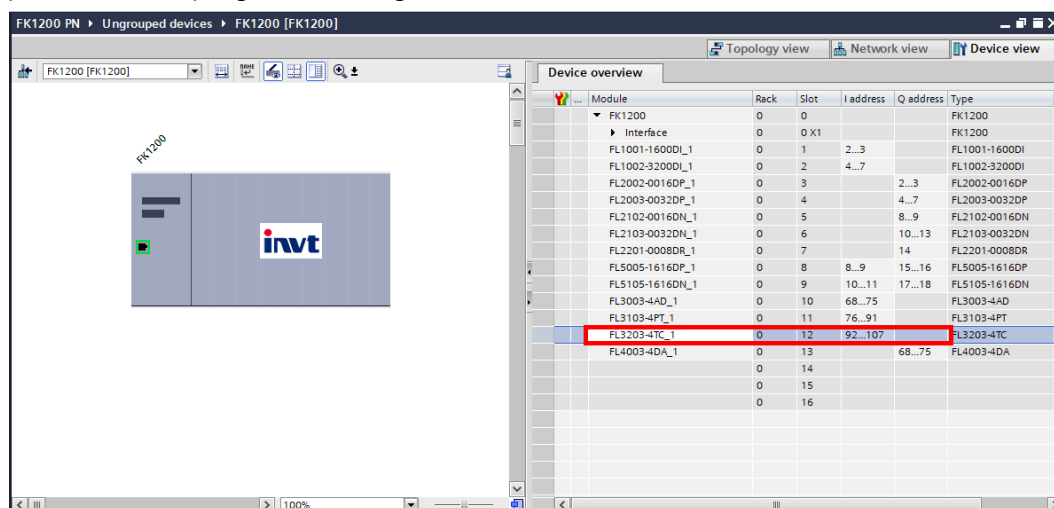


### 6.2.1.16 Temperature detection module (thermistor)—FL3203 (4TC)

Step 1 On the **Device view** interface, add **FL3203-4TC**, double click **FL3203-4TC** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.

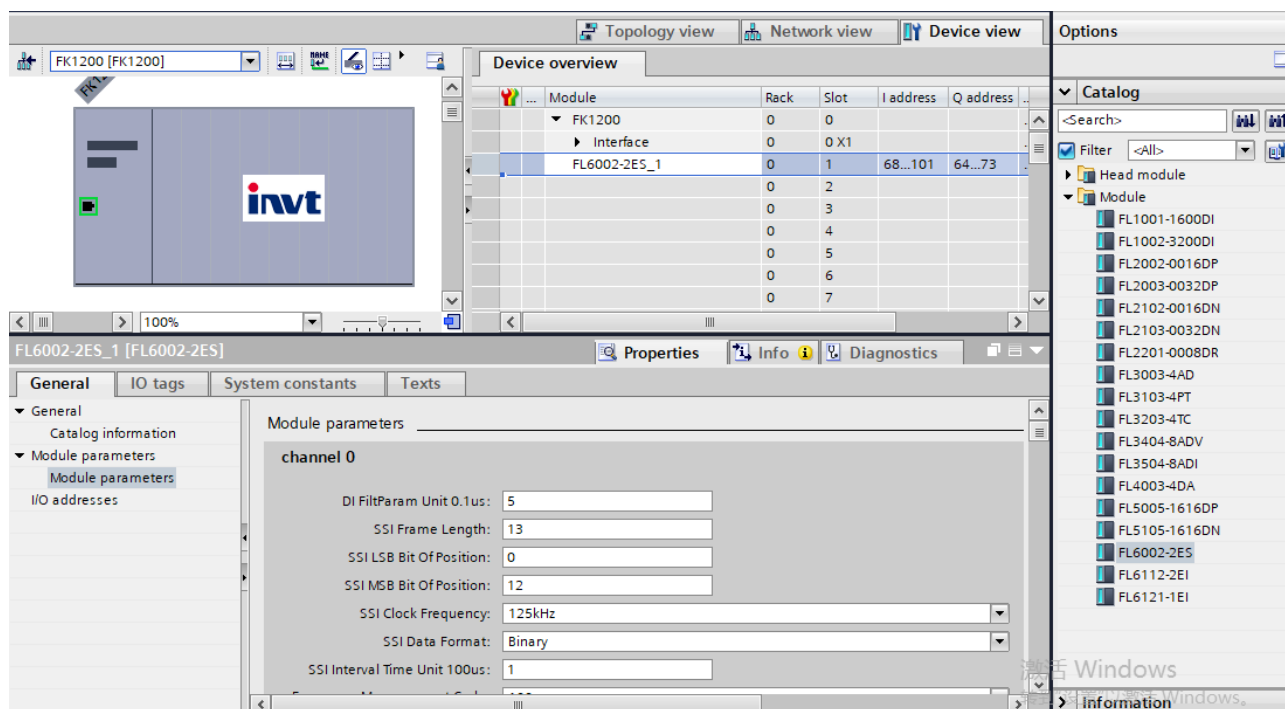


Step 2 Obtain sampling values through I addresses.

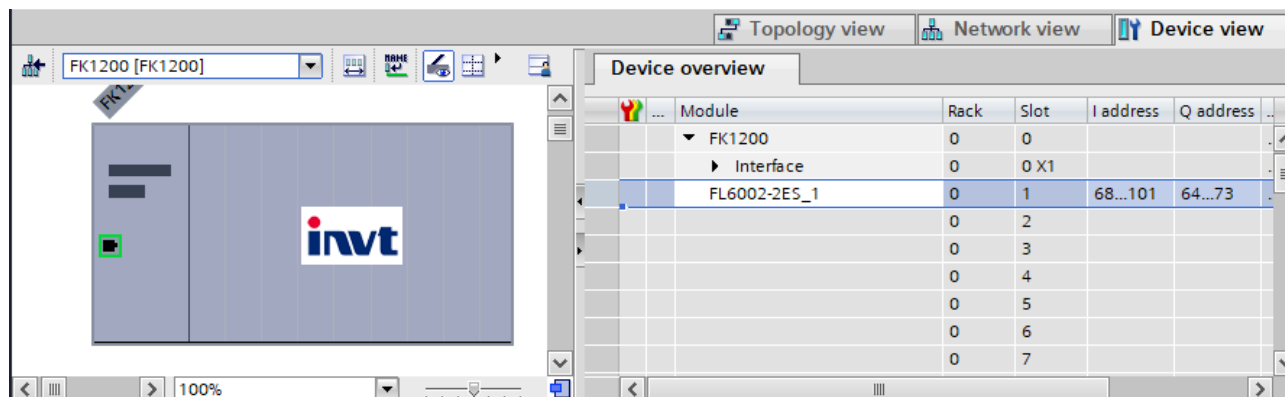


### 6.2.1.17 Counting and measurement module—FL6002-2ES

Step 1 In the **Device view** interface, add **FL6002-2ES**, double click **FL6002-2ES** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



Step 2 Obtain sampling values through I addresses and control the module through Q addresses.



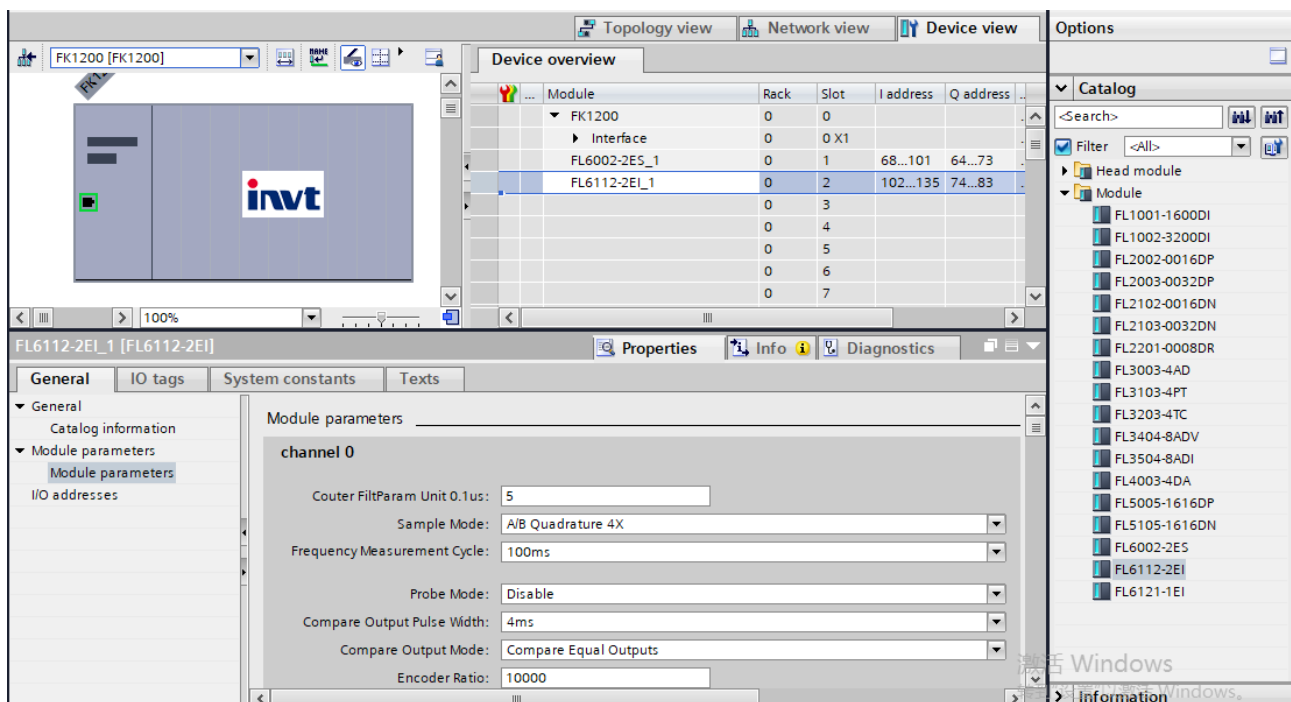
The meaning of I and Q addresses is as follows:

| Address | Parameter name | Type | Description                                                                                                                                                                                                                                                                |
|---------|----------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| %QB64   | Cnt0_Ctrl      | USNT | Control parameter for counter 0.<br>Bit0: Enable counting, valid at high levels;<br>Bit1: Reserved;<br>Bit2: Reserved;<br>Bit3: Reserved;<br>Bit4: Enable count comparison function, valid at high levels (Provided that the counting is enabled.)<br>Bit7–Bit5: Reserved. |
| %QB65   | Cnt1_Ctrl      | USNT | Control parameter for counter 1.<br>Bit0: Enable counting, valid at high levels;<br>Bit1: Reserved;                                                                                                                                                                        |

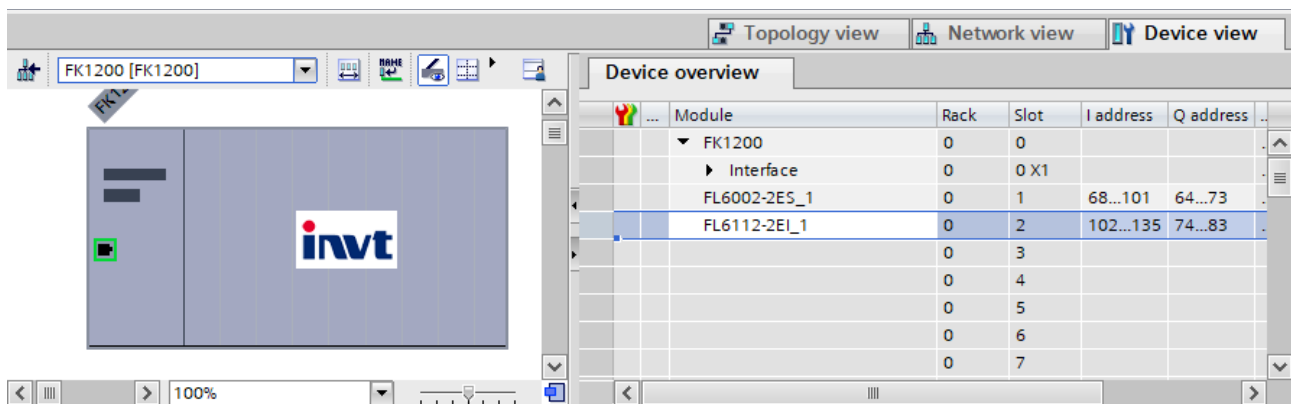
| Address | Parameter name | Type  | Description                                                                                                                                                                                                                                     |
|---------|----------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |                |       | Bit2: Reserved;<br>Bit3: Reserved;<br>Bit4: Enable count comparison function, valid at high levels (Provided that the counting is enabled.)<br>Bit7–Bit5: Reserved.                                                                             |
| %QD66   | Cnt0_CmpVal    | DINT  | Counter 0 comparison value                                                                                                                                                                                                                      |
| %QD70   | Cnt1_CmpVal    | DINT  | Counter 1 comparison value                                                                                                                                                                                                                      |
| %IB68   | Cnt0_Status    | USINT | Counter 0 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Reserved<br>Bit3: Reserved<br>Bit4: DI latch completion flag<br>Bit5: Reserved<br>Bit6: Status when the data line is idle<br>Bit7: Reserved |
| %IB69   | Cnt1_Status    | USINT | Counter 1 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Reserved<br>Bit3: Reserved<br>Bit4: DI latch completion flag<br>Bit5: Reserved<br>Bit6: Status when the data line is idle<br>Bit7: Reserved |
| %ID70   | Cnt0_Val       | DINT  | Count value of counter 0                                                                                                                                                                                                                        |
| %ID74   | Cnt1_Val       | DINT  | Count value of counter 1                                                                                                                                                                                                                        |
| %ID78   | Cnt0_LatchVal  | DINT  | Latched value of counter 0                                                                                                                                                                                                                      |
| %ID82   | Cnt1_LatchVal  | DINT  | Latched value of counter 1                                                                                                                                                                                                                      |
| %ID86   | Cnt0_Freq      | UDINT | Counter 0 frequency                                                                                                                                                                                                                             |
| %ID90   | Cnt1_Freq      | UDINT | Counter 1 frequency                                                                                                                                                                                                                             |
| %ID94   | Cnt0_Velocity  | REAL  | Counter 0 speed (Valid for single-turn encoder)                                                                                                                                                                                                 |
| %ID98   | Cnt1_Velocity  | REAL  | Counter 1 speed (Valid for single-turn encoder)                                                                                                                                                                                                 |

### 6.2.1.18 Counting and measurement module—FL6112-2EI

Step 1 In the **Device view** interface, add **FL6112-2EI**, double click **FL6112-2EI** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



Step 2 Obtain sampling values through I addresses and control the module through Q addresses.



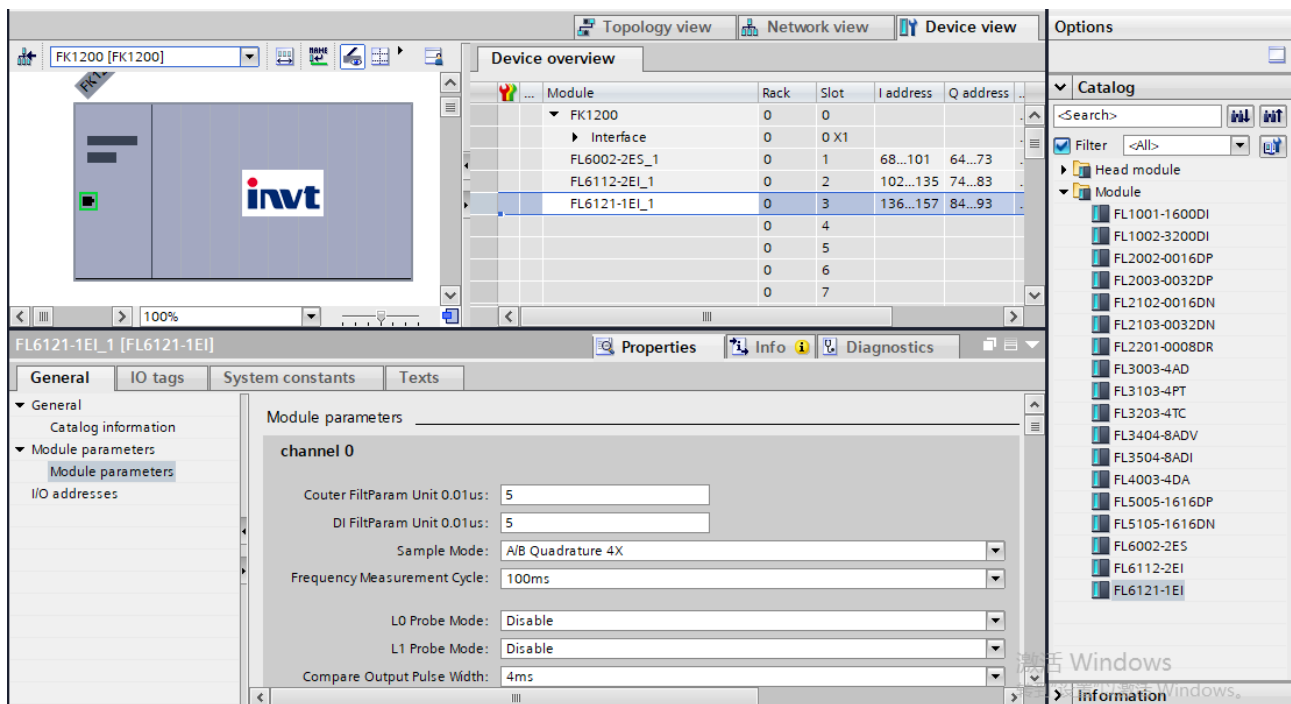
The meaning of I and Q addresses is as follows:

| Address | Parameter name | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                       |
|---------|----------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| %QB74   | Cnt0_Ctrl      | USINT | Control parameter for counter 0.<br>Bit0: Enable counting, valid at high levels;<br>Bit1: Clear counting, valid at the rising edge;<br>Bit2: Write counter preset value, valid at the rising edge;<br>Bit3: Clear count overflow flag, valid at the rising edge;<br>Bit4: Enable count comparison function, valid at high levels (Provided that the counting is enabled.)<br>Bit7–Bit5: Reserved. |
| %QB75   | Cnt1_Ctrl      | USINT | Control parameter for counter 1. The                                                                                                                                                                                                                                                                                                                                                              |

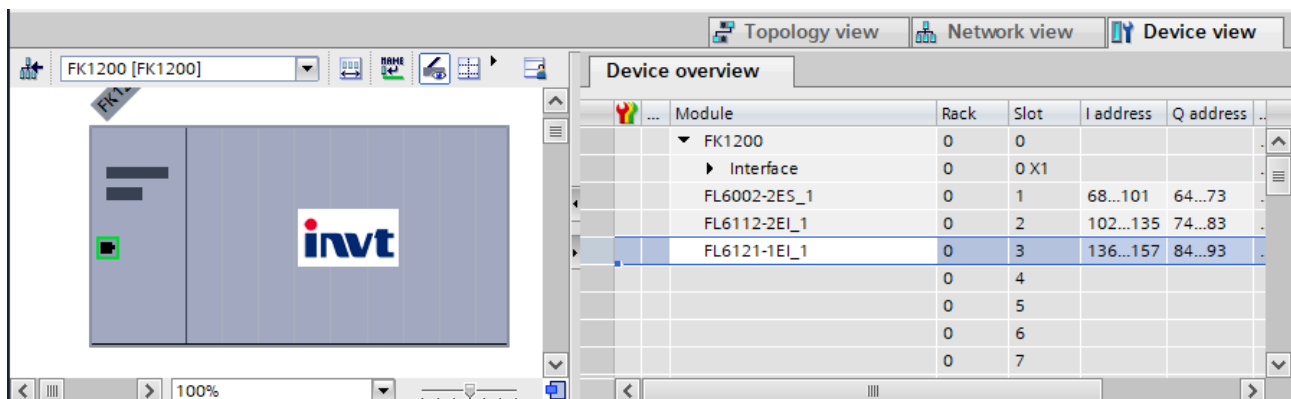
| Address | Parameter name | Type  | Description                                                                                                                                                                                                 |
|---------|----------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |                |       | parameter configuration is consistent with counter 0.                                                                                                                                                       |
| %QD76   | Cnt0_CmpVal    | DINT  | Counter 0 comparison value.                                                                                                                                                                                 |
| %QD80   | Cnt1_CmpVal    | DINT  | Counter 1 comparison value.                                                                                                                                                                                 |
| %IB102  | Cnt0_Status    | USINT | Counter 0 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Overflow flag bit<br>Bit3: Underflow flag bit<br>Bit4: DI0 latch completion flag<br>Bit7–Bit5: Reserved |
| %IB103  | Cnt1_Status    | USINT | Counter 1 count state feedback<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Overflow flag bit<br>Bit3: Underflow flag bit<br>Bit4: DI1 latch completion flag<br>Bit7–Bit5: Reserved |
| %ID104  | Cnt0_Val       | DINT  | Count value of counter 0                                                                                                                                                                                    |
| %ID108  | Cnt1_Val       | DINT  | Count value of counter 1                                                                                                                                                                                    |
| %ID112  | Cnt0_LatchVal  | DINT  | Latched value of counter 0                                                                                                                                                                                  |
| %ID116  | Cnt1_LatchVal  | DINT  | Latched value of counter 1                                                                                                                                                                                  |
| %ID120  | Cnt0_Freq      | UDINT | Counter 0 frequency                                                                                                                                                                                         |
| %ID124  | Cnt1_Freq      | UDINT | Counter 1 frequency                                                                                                                                                                                         |
| %ID128  | Cnt0_Velocity  | REAL  | Counter 0 speed                                                                                                                                                                                             |
| %ID132  | Cnt1_Velocity  | REAL  | Counter 1 speed                                                                                                                                                                                             |

### 6.2.1.19 Counting and measurement module—FL6121-1EI

Step 1 In the **Device view** interface, add **FL6121-1EI**, double click **FL6121-1EI** under **Module**, choose **Properties > General > Module parameters**, and then set module initialization parameters.



Step 2 Obtain sampling values through I addresses and control the module through Q addresses.



The meaning of I and Q addresses is as follows:

| Address | Parameter name | Type | Description                                                                                                                                                                                                                                                                                                                                                                             |
|---------|----------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| %QW84   | Cnt_Ctrl       | UINT | Counter control parameter.<br>Bit0: Enable counting, valid at high levels<br>Bit1: Clear counting, valid at the rising edge<br>Bit2: Write counter preset value, valid at the rising edge<br>Bit3: Clear count overflow flag, valid at the rising edge<br>Bit4: Enable count comparison function, valid at high levels (Provided that the counting is enabled.)<br>Bit15–Bit5: Reserved |
| %QD86   | Cnt_Cmp0Val    | DINT | Counter comparison value 0.                                                                                                                                                                                                                                                                                                                                                             |

| Address | Parameter name | Type  | Description                                                                                                                                                                                                                                    |
|---------|----------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| %QD90   | Cnt_Cmp1Val    | DINT  | Counter comparison value 1.                                                                                                                                                                                                                    |
| %IW136  | Cnt_Status     | UINT  | Counter count state feedback.<br>Bit0: Forward run flag bit<br>Bit1: Reverse run flag bit<br>Bit2: Overflow flag bit<br>Bit3: Underflow flag bit<br>Bit4: DI0 latch completion flag<br>Bit5: DI1 latch completion flag<br>Bit15–Bit6: Reserved |
| %ID138  | Cnt_Val        | DINT  | Count value of counter                                                                                                                                                                                                                         |
| %ID142  | Cnt_Latch0Val  | DINT  | Latched value 0 of counter                                                                                                                                                                                                                     |
| %ID146  | Cnt_Latch1Val  | DINT  | Latched value 1 of counter                                                                                                                                                                                                                     |
| %ID150  | Cnt_Freq       | UDINT | Counter frequency                                                                                                                                                                                                                              |
| %ID154  | Cnt_Velocity   | REAL  | Counter speed                                                                                                                                                                                                                                  |

## 6.3 EtherNet/IP configuration description

### 6.3.1 EDS use description

The FK1300 EIP coupler EDS files come in two forms: one is a generic EDS file, and the other is a specialized EDS file generated by the Ttools-IO host controller software based on the configuration.

#### 6.3.1.1 Module parameter

- FK1300 coupling

| Parameter | Type | Description              | Data type       |
|-----------|------|--------------------------|-----------------|
| hwVersion | UINT | Coupler hardware version | Input Data(T→O) |
| swVersion | UINT | Coupler software version |                 |

- Digital input module

| Parameter                 | Type  | Description                          | Data type      |
|---------------------------|-------|--------------------------------------|----------------|
| 1600DI-Filt0/3200DI-Filt0 | UINT  | I0–I7 filter parameter. Unit: 10μs   | Config Param   |
| 1600DI-Filt0/3200DI-Filt1 | UINT  | I10–I17 filter parameter. Unit: 10μs |                |
| 3200DI-Filt2              | UINT  | I20–I27 filter parameter. Unit: 10μs |                |
| 3200DI-Filt3              | UINT  | I30–I37 filter parameter. Unit: 10μs |                |
| 1600DI-ErrId/3200DI-ErrId | UINT  | Fault code                           | Diagnosis Data |
| 1600DI-IN0/3200DI-IN0     | USINT | I0–I7 status feedback                | Input (T→O)    |
| 1600DI-IN0/3200DI-IN1     | USINT | I10–I17 status feedback              |                |
| 3200DI-IN2                | USINT | I20–I27 status feedback              |                |
| 3200DI-IN3                | USINT | I30–I37 status feedback              |                |

- Digital output module

| Parameter                                      | Type | Description                                        | Data type    |
|------------------------------------------------|------|----------------------------------------------------|--------------|
| (0016DP/N)-Stop_Mode0<br>(0032DP/N)-Stop_Mode0 | UINT | Stop/offline output mode:<br>Q7    ...    Q1    Q0 | Config Param |

| Parameter                                          | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                           | Data type                           |       |      |      |      |      |      |      |      |       |       |     |      |      |      |      |      |
|----------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------|------|------|------|------|------|------|------|-------|-------|-----|------|------|------|------|------|
|                                                    |       | <table><tr><td>bit15</td><td>bit14</td><td>...</td><td>...</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr></table><br>0b00: Stop/offline output retained<br>0b01: Stop/offline output cleared<br>0b10: Stop/offline output preset                                                                                                                                                                       | bit15                               | bit14 | ...  | ...  | bit3 | bit2 | bit1 | bit0 |      |       |       |     |      |      |      |      |      |
| bit15                                              | bit14 | ...                                                                                                                                                                                                                                                                                                                                                                                                                   | ...                                 | bit3  | bit2 | bit1 | bit0 |      |      |      |      |       |       |     |      |      |      |      |      |
| (0016DP/N)-Stop_Mode1<br>(0032DP/N)-Stop_Mode1     | UINT  | Stop/offline output mode<br><table><tr><td colspan="2">Q17</td><td colspan="2">...</td><td colspan="2">Q11</td><td colspan="2">Q10</td></tr></table> <table><tr><td>bit15</td><td>bit14</td><td>...</td><td>...</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr></table><br>0b00: Stop/offline output retained<br>0b01: Stop/offline output cleared<br>0b10: Stop/offline output according to the preset | Q17                                 |       | ...  |      | Q11  |      | Q10  |      |      | bit15 | bit14 | ... | ...  | bit3 | bit2 | bit1 | bit0 |
| Q17                                                |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | Q11   |      | Q10  |      |      |      |      |      |       |       |     |      |      |      |      |      |
| bit15                                              | bit14 | ...                                                                                                                                                                                                                                                                                                                                                                                                                   | ...                                 | bit3  | bit2 | bit1 | bit0 |      |      |      |      |       |       |     |      |      |      |      |      |
| (0032DP/N)-Stop_Mode2                              | UINT  | Stop/offline output mode<br><table><tr><td colspan="2">Q27</td><td colspan="2">...</td><td colspan="2">Q21</td><td colspan="2">Q20</td></tr></table> <table><tr><td>bit15</td><td>bit14</td><td>...</td><td>...</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr></table><br>0b00: Stop/offline output retained<br>0b01: Stop/offline output cleared<br>0b10: Stop/offline output according to the preset | Q27                                 |       | ...  |      | Q21  |      | Q20  |      |      | bit15 | bit14 | ... | ...  | bit3 | bit2 | bit1 | bit0 |
| Q27                                                |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | Q21   |      | Q20  |      |      |      |      |      |       |       |     |      |      |      |      |      |
| bit15                                              | bit14 | ...                                                                                                                                                                                                                                                                                                                                                                                                                   | ...                                 | bit3  | bit2 | bit1 | bit0 |      |      |      |      |       |       |     |      |      |      |      |      |
| (0032DP/N)-Stop_Mode3                              | UINT  | Stop/offline output mode<br><table><tr><td colspan="2">Q37</td><td colspan="2">...</td><td colspan="2">Q31</td><td colspan="2">Q30</td></tr></table> <table><tr><td>bit15</td><td>bit14</td><td>...</td><td>...</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr></table><br>0b00: Stop/offline output retained<br>0b01: Stop/offline output cleared<br>0b10: Stop/offline output preset                  | Q37                                 |       | ...  |      | Q31  |      | Q30  |      |      | bit15 | bit14 | ... | ...  | bit3 | bit2 | bit1 | bit0 |
| Q37                                                |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | Q31   |      | Q30  |      |      |      |      |      |       |       |     |      |      |      |      |      |
| bit15                                              | bit14 | ...                                                                                                                                                                                                                                                                                                                                                                                                                   | ...                                 | bit3  | bit2 | bit1 | bit0 |      |      |      |      |       |       |     |      |      |      |      |      |
| (0016DP/N)-Stop Output0<br>(0032DP/N)-Stop Output0 | USINT | Stop/offline output preset<br><table><tr><td colspan="2">Q7</td><td colspan="2">...</td><td colspan="2">Q1</td><td colspan="2">Q0</td></tr></table> <table><tr><td colspan="2">bit7</td><td colspan="2">...</td><td colspan="2">bit1</td><td colspan="2">bit0</td></tr></table>                                                                                                                                       | Q7                                  |       | ...  |      | Q1   |      | Q0   |      | bit7 |       | ...   |     | bit1 |      | bit0 |      |      |
| Q7                                                 |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | Q1    |      | Q0   |      |      |      |      |      |       |       |     |      |      |      |      |      |
| bit7                                               |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | bit1  |      | bit0 |      |      |      |      |      |       |       |     |      |      |      |      |      |
| (0016DP/N)-Stop Output1<br>(0032DP/N)-Stop Output1 | USINT | Stop/offline output preset<br><table><tr><td colspan="2">Q17</td><td colspan="2">...</td><td colspan="2">Q11</td><td colspan="2">Q10</td></tr></table> <table><tr><td colspan="2">bit7</td><td colspan="2">...</td><td colspan="2">bit1</td><td colspan="2">bit0</td></tr></table>                                                                                                                                    | Q17                                 |       | ...  |      | Q11  |      | Q10  |      | bit7 |       | ...   |     | bit1 |      | bit0 |      |      |
| Q17                                                |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | Q11   |      | Q10  |      |      |      |      |      |       |       |     |      |      |      |      |      |
| bit7                                               |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | bit1  |      | bit0 |      |      |      |      |      |       |       |     |      |      |      |      |      |
| (0032DP/N)-Stop Output2                            | USINT | Stop/offline output preset<br><table><tr><td colspan="2">Q27</td><td colspan="2">...</td><td colspan="2">Q21</td><td colspan="2">Q20</td></tr></table> <table><tr><td colspan="2">bit7</td><td colspan="2">...</td><td colspan="2">bit1</td><td colspan="2">bit0</td></tr></table>                                                                                                                                    | Q27                                 |       | ...  |      | Q21  |      | Q20  |      | bit7 |       | ...   |     | bit1 |      | bit0 |      |      |
| Q27                                                |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | Q21   |      | Q20  |      |      |      |      |      |       |       |     |      |      |      |      |      |
| bit7                                               |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | bit1  |      | bit0 |      |      |      |      |      |       |       |     |      |      |      |      |      |
| (0032DP/N)-Stop Output3                            | USINT | Stop/offline output preset<br><table><tr><td colspan="2">Q37</td><td colspan="2">...</td><td colspan="2">Q31</td><td colspan="2">Q30</td></tr></table> <table><tr><td colspan="2">bit7</td><td colspan="2">...</td><td colspan="2">bit1</td><td colspan="2">bit0</td></tr></table>                                                                                                                                    | Q37                                 |       | ...  |      | Q31  |      | Q30  |      | bit7 |       | ...   |     | bit1 |      | bit0 |      |      |
| Q37                                                |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | Q31   |      | Q30  |      |      |      |      |      |       |       |     |      |      |      |      |      |
| bit7                                               |       | ...                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     | bit1  |      | bit0 |      |      |      |      |      |       |       |     |      |      |      |      |      |
| (0016DP/N)-OUT0<br>(0032DP/N)-OUT0                 | USINT | Q0–Q7 output control                                                                                                                                                                                                                                                                                                                                                                                                  | Output<br>(O → T)                   |       |      |      |      |      |      |      |      |       |       |     |      |      |      |      |      |
| (0016DP/N)-OUT1<br>(0032DP/N)-OUT1                 | USINT | Q10–Q17 output control                                                                                                                                                                                                                                                                                                                                                                                                |                                     |       |      |      |      |      |      |      |      |       |       |     |      |      |      |      |      |
| (0032DP/N)-OUT2                                    | USINT | Q20–Q27 output control                                                                                                                                                                                                                                                                                                                                                                                                |                                     |       |      |      |      |      |      |      |      |       |       |     |      |      |      |      |      |
| (0032DP/N)-OUT3                                    | USINT | Q30–Q37 output control                                                                                                                                                                                                                                                                                                                                                                                                |                                     |       |      |      |      |      |      |      |      |       |       |     |      |      |      |      |      |
| Satisfy Parameter                                  | USINT | Empty parameter, used for alignment and padding for modules with fewer than 16 points                                                                                                                                                                                                                                                                                                                                 |                                     |       |      |      |      |      |      |      |      |       |       |     |      |      |      |      |      |
| (0016DP/N)-ErrID/<br>(0032DP/N)-ErrID              | UINT  | Fault code                                                                                                                                                                                                                                                                                                                                                                                                            | Diagnosis<br>Data<br>(Input(T → O)) |       |      |      |      |      |      |      |      |       |       |     |      |      |      |      |      |

The digital output module divides every eight channels into a group. Taking configuration



0016DP-Stop\_Mode0 as an example, the corresponding output channels are Q0–Q7. The data type of 0016DP-Stop\_Mode0 is UINT. The data definition is detailed in the following parameter description table.

| Q7    |       | Q6    |       | Q5    |       | Q4   |      | Q3   |      | Q2   |      | Q1   |      | Q0   |      |
|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|
| bit15 | bit14 | bit13 | bit12 | bit11 | bit10 | bit9 | bit8 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |

The output modes represented by bit1 and bit0 values are as follows:

| Value | Mode                         |
|-------|------------------------------|
| 0b00  | Stop/offline output retained |
| 0b01  | Stop/offline output cleared  |
| 0b10  | Stop/offline output preset   |

If Q0–Q7 are all configured as output retained, then the value of 0016DP-Stop\_Mode0 is 0, that is, 2#0000000000000000.

| Q7 |   | Q6 |   | Q5 |   | Q4 |   | Q3 |   | Q2 |   | Q1 |   | Q0 |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 0  | 0 | 0  | 0 | 0  | 0 | 0  | 0 | 0  | 0 | 0  | 0 | 0  | 0 | 0  | 0 |

● Analog input module-FL3003 (4AD)

| Parameter name | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Data type    |
|----------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 4AD-AI0_Cfg    | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enabling control. (0: Disable. 1: Enable.)<br>Bit1: Open-loop detection enabling control. (0: Disable. 1: Enable.)<br>Bit2: Over-range detection enabling control. (0: Disable. 1: Enable.)<br>Bit3: Over-range enabling control. (0: Disable. 1: Enable.)<br>Bit4: Enhanced filter enabling control. (0: Disable. 1: Enable.)<br>Bit7–bit5: Channel conversion mode.<br>0b000: Voltage range 0–5V, corresponding to detection value range 0–20000<br>0b001: Voltage range 0–10V, corresponding to detection value range 0–20000<br>0b010: Voltage range -5–5V, corresponding to detection value range -20000–20000<br>0b011: Voltage range -10–10V, corresponding to detection value range -20000–20000<br>0b100: Current range 4–20mA, corresponding to detection value range 0–20000<br>0b101: Current range 0–20mA, corresponding to detection value range 0–20000<br>0b110: Reserved<br>0b111: Current range -20–20mA, corresponding to detection value range -20000–20000 | Config Param |
| 4AD-AI1_Cfg    | USINT | Configuration parameter for channel 1. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |
| 4AD-AI2_Cfg    | USINT | Configuration parameter for channel 2. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |

| Parameter name | Type  | Description                                                                                                          | Data type                        |
|----------------|-------|----------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 4AD-AI3_Cfg    | USINT | Configuration parameter for channel 3. The parameter setting is consistent with that for channel 0.                  |                                  |
| 4AD-AI0_Filt   | USINT | Filter parameter for channel 0.<br>Range: 1–255. A greater value indicates better filter effect but greater lagging. |                                  |
| 4AD-AI1_Filt   | USINT | Filter parameter for channel 1. The filter parameter setting is consistent with that for channel 0.                  |                                  |
| 4AD-AI2_Filt   | USINT | Filter parameter for channel 2. The filter parameter setting is consistent with that for channel 0.                  |                                  |
| 4AD-AI3_Filt   | USINT | Filter parameter for channel 3. The filter parameter setting is consistent with that for channel 0.                  |                                  |
| 4AD-AI0        | DINT  | Conversion value for channel 0.                                                                                      | Input(T→O)                       |
| 4AD-AI1        | DINT  | Conversion value for channel 1.                                                                                      |                                  |
| 4AD-AI2        | DINT  | Conversion value for channel 2.                                                                                      |                                  |
| 4AD-AI3        | DINT  | Conversion value for channel 3.                                                                                      |                                  |
| 4AD-AI0_ErrId  | UINT  | Fault code for channel 0.                                                                                            | Diagnosis Data<br>(Input(T → O)) |
| 4AD-AI1_ErrId  | UINT  | Fault code for channel 1.                                                                                            |                                  |
| 4AD-AI2_ErrId  | UINT  | Fault code for channel 2.                                                                                            |                                  |
| 4AD-AI3_ErrId  | UINT  | Fault code for channel 3.                                                                                            |                                  |

Taking channel 0 as an example, the parameter type is USINT. See the following table for detailed definition of 4AD-AI0\_Cfg.

| Bit7                                                                      | Bit6                                                                      | Bit5 | Bit4                                   | Bit3                              | Bit2                                           | Bit1                                          | Bit0                           |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------|------|----------------------------------------|-----------------------------------|------------------------------------------------|-----------------------------------------------|--------------------------------|
| Channel conversion mode<br>(range configuration)                          |                                                                           |      | Enhanced<br>filter enabling<br>control | Over-range<br>enabling<br>control | Over-range<br>detection<br>enabling<br>control | Open-loop<br>detection<br>enabling<br>control | Channel<br>enabling<br>control |
| 0b000: 0–5V<br>0b001: 0–10V<br>0b010: -5V–<br>+5V<br>0b011: -10V–<br>+10V | 0b100: 4–20mA<br>0b101: 0–20mA<br>0b110: Reserved<br>0b111: -20–<br>+20mA |      | 0: Disable<br>1: Enable                | 0: Disable<br>1: Enable           | 0: Disable<br>1: Enable                        | 0: Disable<br>1: Enable                       | 0: Disable<br>1: Enable        |

Channel 0 is set to channel enabled, open-circuit detection disabled, over-range detection enabled, over-range enabled, enhanced filtering disabled, and the range is set to 4–20mA. The value should be 141, that is, 2#10001101. Details are as follows:

| Bit7         | Bit6 | Bit5 | Bit4       | Bit3      | Bit2      | Bit1       | Bit0      |
|--------------|------|------|------------|-----------|-----------|------------|-----------|
| 0b100        |      |      | 0          | 1         | 1         | 0          | 1         |
| 0b100:4–20mA |      |      | 0: Disable | 1: Enable | 1: Enable | 0: Disable | 1: Enable |

Range conversion:

| Measurement<br>range | Current (I)/<br>Voltage (U) | Decimal (D) | Hexadecimal | Range                 | Conversion<br>formula          |
|----------------------|-----------------------------|-------------|-------------|-----------------------|--------------------------------|
| 0–5V                 | 8.19175V                    | 32767       | 0x7FFF      | Beyond upper<br>limit | D = 20000×U/5<br>U = D×5/20000 |
|                      | 5V                          | 20000       | 0x4E20      | Rated range           |                                |

| Measurement range | Current (I)/ Voltage (U) | Decimal (D) | Hexadecimal | Range              | Conversion formula                        |
|-------------------|--------------------------|-------------|-------------|--------------------|-------------------------------------------|
|                   | 2.5V                     | 10000       | 0x2710      | Beyond lower limit |                                           |
|                   | 0V                       | 0           | 0x0000      |                    |                                           |
|                   | -2.5V                    | -10000      | 0xD8F0      |                    |                                           |
|                   | -5V                      | -20000      | 0xB1E0      |                    |                                           |
|                   | -8.19175V                | -32768      | 0x8000      |                    |                                           |
| 0–10V             | 16.3835V                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×U/10<br>U = D×10/20000          |
|                   | 10V                      | 20000       | 0x4E20      | Rated range        |                                           |
|                   | 5V                       | 10000       | 0x2710      |                    |                                           |
|                   | 0V                       | 0           | 0x0000      |                    |                                           |
|                   | -5V                      | -10000      | 0xD8F0      | Beyond lower limit |                                           |
|                   | -10V                     | -20000      | 0xB1E0      |                    |                                           |
|                   | -16.3835V                | -32768      | 0x8000      |                    |                                           |
| ±5V               | 8.19175V                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×U/5<br>U = D×5/20000            |
|                   | 5V                       | 20000       | 0x4E20      | Rated range        |                                           |
|                   | 2.5V                     | 10000       | 0x2710      |                    |                                           |
|                   | 0V                       | 0           | 0x0000      |                    |                                           |
|                   | -2.5V                    | -10000      | 0xD8F0      |                    |                                           |
|                   | -5V                      | -20000      | 0xB1E0      |                    |                                           |
|                   | -8.19175V                | -32768      | 0x8000      | Beyond lower limit |                                           |
| ±10V              | 16.3835V                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×U/10<br>U = D×10/20000          |
|                   | 10V                      | 20000       | 0x4E20      | Rated range        |                                           |
|                   | 5V                       | 10000       | 0x2710      |                    |                                           |
|                   | 0V                       | 0           | 0x0000      |                    |                                           |
|                   | -5V                      | -10000      | 0xD8F0      |                    |                                           |
|                   | -10V                     | -20000      | 0xB1E0      |                    |                                           |
|                   | -16.3835V                | -32768      | 0x8000      | Beyond lower limit |                                           |
| 4–20mA            | 30.2136mA                | 32767       | 0x7FFF      | Beyond upper limit | D =<br>20000×(I-4)/16<br>I = D×16/20000+4 |
|                   | 20mA                     | 20000       | 0x4E20      | Rated range        |                                           |
|                   | 12mA                     | 10000       | 0x2710      |                    |                                           |
|                   | 4mA                      | 0           | 0x0000      |                    |                                           |
|                   | 0mA                      | -5000       | 0xEC78      | Beyond lower limit |                                           |
|                   | -22.2136mA               | -32768      | 0x8000      |                    |                                           |
| 0–20mA            | 32.767mA                 | 32767       | 0x7FFF      | Beyond upper limit | D = 20000×I/20<br>I = D×20/20000          |
|                   | 20mA                     | 20000       | 0x4E20      | Rated range        |                                           |
|                   | 10mA                     | 10000       | 0x2710      |                    |                                           |
|                   | 0mA                      | 0           | 0x0000      |                    |                                           |
|                   | -10mA                    | -10000      | 0xD8F0      |                    |                                           |
|                   | -20mA                    | -20000      | 0xB1E0      |                    |                                           |
|                   | -32.767mA                | -32768      | 0x8000      |                    |                                           |
| ±20mA             | 32.767mA                 | 32767       | 0x7FFF      | Beyond upper       | D = 20000×I/20                            |

| Measurement range | Current (I)/ Voltage (U) | Decimal (D) | Hexadecimal | Range              | Conversion formula |
|-------------------|--------------------------|-------------|-------------|--------------------|--------------------|
|                   |                          |             |             | limit              | I = D×20/20000     |
|                   | 20mA                     | 20000       | 0x4E20      | Rated range        |                    |
|                   | 10mA                     | 10000       | 0x2710      |                    |                    |
|                   | 0mA                      | 0           | 0x0000      |                    |                    |
|                   | - 10mA                   | -10000      | 0xD8F0      |                    |                    |
|                   | - 20mA                   | -20000      | 0xB1E0      |                    |                    |
|                   | - 32.767mA               | -32768      | 0x8000      | Beyond lower limit |                    |

● Analog output module-FL4003 (4DA)

| Parameter name      | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Data type    |
|---------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 4DA-AO0_Cfg         | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enabling control. (0: Disable. 1: Enable.)<br>Bit1: Output fault detection enabling control. (0: Disable. 1: Enable.)<br>Bit3–bit2: Offline output mode.<br>0b00: Offline output retained<br>0b01: Offline output cleared<br>0b10: Offline output preset<br>Bit4: Reserved<br>Bit7–bit5: Channel conversion mode.<br>0b000: Voltage range 0–5V, corresponding to detection value range 0–20000<br>0b001: Voltage range 0–10V, corresponding to detection value range 0–20000<br>0b010: Voltage range -5–+5V, corresponding to detection value range -20000–20000<br>0b011: Voltage range -10–+10V, corresponding to detection value range -20000–20000<br>0b100: Current range 4–20mA, corresponding to detection value range 0–20000<br>0b101: Current range 0–20mA, corresponding to detection value range 0–20000<br>0b110: Reserved<br>0b111: Reserved | Config Param |
| 4DA-AO1_Cfg         | USINT | Configuration parameter for channel 1. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |
| 4DA-AO2_Cfg         | USINT | Configuration parameter for channel 2. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |
| 4DA-AO3_Cfg         | USINT | Configuration parameter for channel 3. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |
| 4DA-AO0_Stop_Output | INT   | Preset value of stop/offline output for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |
| 4DA-AO1_Stop_Output | INT   | Preset value of stop/offline output for channel 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |
| 4DA-AO2_Stop_Output | INT   | Preset value of stop/offline output for channel 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |

| Parameter name      | Type | Description                                        | Data type                        |
|---------------------|------|----------------------------------------------------|----------------------------------|
| 4DA-AO3_Stop_Output | INT  | Preset value of stop/offline output for channel 3. |                                  |
| 4DA-AO0             | DINT | Output control value for channel 0.                | Output(O → T)                    |
| 4DA-AO1             | DINT | Output control value for channel 1.                |                                  |
| 4DA-AO2             | DINT | Output control value for channel 2.                |                                  |
| 4DA-AO3             | DINT | Output control value for channel 3.                |                                  |
| 4DA-AO0_ErrId       | UINT | Fault code for channel 0.                          | Diagnosis Data<br>(Input(T → O)) |
| 4DA-AO1_ErrId       | UINT | Fault code for channel 1.                          |                                  |
| 4DA-AO2_ErrId       | UINT | Fault code for channel 2.                          |                                  |
| 4DA-AO3_ErrId       | UINT | Fault code for channel 3.                          |                                  |

● Temperature detection module-FL3103 (4PT)

| Parameter name | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Data type    |
|----------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 4PT-Temp0_Cfg  | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enabling control. (0: Disable. 1: Enable.)<br>Bit1: Over-range detection enabling control. (0: Disable. 1: Enable.)<br>Bit3–bit2 Thermistor wire system configuration (0b00: Two-wire system; 0b01: Three-wire system; 0b10: Four-wire system)<br>Bit4: Temperature unit. (0: °C. 1: °F.)<br>Bit7–bit5: Channel conversion mode.<br>0b000: Reserved<br>0b001: PT100<br>0b010: PT500<br>0b011: Reserved<br>0b100: PT1000<br>0b101: Reserved<br>0b110: Reserved<br>0b111: CU100 | Config Param |
| 4PT-Temp1_Cfg  | USINT | Configuration parameter for channel 1. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
| 4PT-Temp2_Cfg  | USINT | Configuration parameter for channel 2. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
| 4PT-Temp3_Cfg  | USINT | Configuration parameter for channel 3. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
| 4PT-Temp0_Filt | USINT | Filter parameter for channel 0. Range: 1–255. A greater value indicates better filter effect but greater lagging.                                                                                                                                                                                                                                                                                                                                                                                                                     |              |
| 4PT-Temp1_Filt | USINT | Filter parameter for channel 1. The filter parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
| 4PT-Temp2_Filt | USINT | Filter parameter for channel 2. The filter parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |

| Parameter name   | Type  | Description                                                                                                                                                            | Data type                        |
|------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 4PT-Temp3_Filt   | USINT | Filter parameter for channel 3. The filter parameter setting is consistent with that for channel 0.                                                                    |                                  |
| 4PT-Temp0_Offset | DINT  | Temperature offset value for channel 0. The value has been amplified by 10 times, with 999 representing 99.9. Detection value = Actually measured value + Offset value |                                  |
| 4PT-Temp1_Offset | DINT  | Temperature offset value for channel 1. The temperature offset value is consistent with that for channel 0.                                                            |                                  |
| 4PT-Temp2_Offset | DINT  | Temperature offset value for channel 2. The temperature offset value is consistent with that for channel 0.                                                            |                                  |
| 4PT-Temp3_Offset | DINT  | Temperature offset value for channel 3. The temperature offset value is consistent with that for channel 0.                                                            |                                  |
| 4PT-Temp0        | REAL  | Conversion value for channel 0.                                                                                                                                        | Input(T→O)                       |
| 4PT-Temp1        | REAL  | Conversion value for channel 1.                                                                                                                                        |                                  |
| 4PT-Temp2        | REAL  | Conversion value for channel 2.                                                                                                                                        |                                  |
| 4PT-Temp3        | REAL  | Conversion value for channel 3.                                                                                                                                        |                                  |
| 4PT-Temp0_ErrId  | UINT  | Fault code for channel 0.                                                                                                                                              | Diagnosis Data<br>(Input(T → O)) |
| 4PT-Temp1_ErrId  | UINT  | Fault code for channel 1.                                                                                                                                              |                                  |
| 4PT-Temp2_ErrId  | UINT  | Fault code for channel 2.                                                                                                                                              |                                  |
| 4PT-Temp3_ErrId  | UINT  | Fault code for channel 3.                                                                                                                                              |                                  |

● Temperature detection module-FL3203 (4TC)

| Parameter name | Type  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Data type    |
|----------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 4TC-Temp0_Cfg  | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enabling control. (0: Disable. 1: Enable.)<br>Bit1: Over-range detection enabling control. (0: Disable. 1: Enable.)<br>Bit3–bit2: Reserved<br>Bit4: Temperature unit. (0: °C. 1: °F.)<br>Bit7–bit5: Channel conversion mode.<br>0b000: Thermocouple of type B.<br>0b001: Thermocouple of type E.<br>0b010: Thermocouple of type J.<br>0b011: Thermocouple of type K.<br>0b100: Thermocouple of type N.<br>0b101: Thermocouple of type R.<br>0b110: Thermocouple of type S.<br>0b111: Thermocouple of type T. | Config Param |
| 4TC-Temp1_Cfg  | USINT | Configuration parameter for channel 1. The parameter setting is consistent with that for channel 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |              |
| 4TC-Temp2_Cfg  | USINT | Configuration parameter for channel 2. The parameter setting is consistent with that for                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |

| Parameter name   | Type  | Description                                                                                                                                                                 | Data type                        |
|------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
|                  |       | channel 0.                                                                                                                                                                  |                                  |
| 4TC-Temp3_Cfg    | USINT | Configuration parameter for channel 3. The parameter setting is consistent with that for channel 0.                                                                         |                                  |
| 4TC-Temp0_Filt   | USINT | Filter parameter for channel 0. Range: 1–255. A greater value indicates better filter effect but greater lagging.                                                           |                                  |
| 4TC-Temp1_Filt   | USINT | Filter parameter for channel 1. The filter parameter setting is consistent with that for channel 0.                                                                         |                                  |
| 4TC-Temp2_Filt   | USINT | Filter parameter for channel 2. The filter parameter setting is consistent with that for channel 0.                                                                         |                                  |
| 4TC-Temp3_Filt   | USINT | Filter parameter for channel 3. The filter parameter setting is consistent with that for channel 0.                                                                         |                                  |
| 4TC-Temp0_Offset | DINT  | Temperature offset value for channel 0. (The value has been amplified by 10 times, with 999 representing 99.9.)<br>Detection value = Actually measured value + Offset value |                                  |
| 4TC-Temp1_Offset | DINT  | Same as the temperature offset value for channel 0.                                                                                                                         |                                  |
| 4TC-Temp2_Offset | DINT  | Same as the temperature offset value for channel 1.                                                                                                                         |                                  |
| 4TC-Temp3_Offset | DINT  | Same as the temperature offset value for channel 2.                                                                                                                         |                                  |
| 4TC-Temp0        | REAL  | Conversion value for channel 0.                                                                                                                                             | Input (T→O)                      |
| 4TC-Temp1        | REAL  | Conversion value for channel 1.                                                                                                                                             |                                  |
| 4TC-Temp2        | REAL  | Conversion value for channel 2.                                                                                                                                             |                                  |
| 4TC-Temp3        | REAL  | Conversion value for channel 3.                                                                                                                                             |                                  |
| 4TC-Temp0_ErrId  | UINT  | Fault code for channel 0.                                                                                                                                                   | Diagnosis Data<br>(Input(T → O)) |
| 4TC-Temp1_ErrId  | UINT  | Fault code for channel 1.                                                                                                                                                   |                                  |
| 4TC-Temp2_ErrId  | UINT  | Fault code for channel 2.                                                                                                                                                   |                                  |
| 4TC-Temp3_ErrId  | UINT  | Fault code for channel 3.                                                                                                                                                   |                                  |

- Incremental encoder input detection module-FL6112(2EI)

| Parameter    | Type | Description                                                                                                                                                                                                                                                                                                                                                                                                                                               | Data type    |
|--------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 2EI_Cnt0_Cfg | UINT | Bit[1:0] Channel mode configuration <ul style="list-style-type: none"> <li>● 0b00: A/B phase quadrature mode x4</li> <li>● 0b01: A/B phase quadrature mode x2</li> <li>● 0b10: A/B phase quadrature mode x1</li> <li>● 0b11: Pulse + Direction (high level forward)</li> </ul> Bit[3:2] Frequency measurement period <ul style="list-style-type: none"> <li>● 0b00: 20ms</li> <li>● 0b01: 100ms</li> <li>● 0b10: 500ms</li> <li>● 0b11: 1000ms</li> </ul> | Config Param |

| Parameter    | Type | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Data type |
|--------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|              |      | Bit[5:4] Edge latch count value enabling <ul style="list-style-type: none"> <li>0b00: Disable</li> <li>0b01: Rising edge</li> <li>0b10: Falling edge</li> <li>0b11: Dual edge</li> </ul> Bit[7:6] Reserved           Bit[9:8] Consistent output pulse width for comparison <ul style="list-style-type: none"> <li>0b00: 1ms</li> <li>0b01: 2ms</li> <li>0b10: 4ms</li> <li>0b11: 8ms</li> </ul> Bit [11:10] DO comparison output mode <ul style="list-style-type: none"> <li>0b00: Consistent output for comparison</li> <li>0b01: Output between [Lower count limit, Comparison value)</li> <li>0b10: Output between [Comparison value, Upper count limit]</li> <li>0b11: Reserved (Consistent output for comparison)</li> </ul> Bit[15:12] Reserved                                                                                                                                                                                                                                                                                                                                                            |           |
| 2EI_Cnt1_Cfg | UINT | Bit[1:0] Channel mode configuration <ul style="list-style-type: none"> <li>0b00: A/B phase quadrature mode x4</li> <li>0b01: A/B phase quadrature mode x2</li> <li>0b10: A/B phase quadrature mode x1</li> <li>0b11: Pulse + Direction (high level forward)</li> </ul> Bit[3:2] Frequency measurement period <ul style="list-style-type: none"> <li>0b00: 20ms</li> <li>0b01: 100ms</li> <li>0b10: 500ms</li> <li>0b11: 1000ms</li> </ul> Bit[5:4] Edge latch count value enabling <ul style="list-style-type: none"> <li>0b00: Disable</li> <li>0b01: Rising edge</li> <li>0b10: Falling edge</li> <li>0b11: Dual edge</li> </ul> Bit[7:6] Reserved           Bit[9:8] Consistent output pulse width for comparison <ul style="list-style-type: none"> <li>0b00: 1ms</li> <li>0b01: 2ms</li> <li>0b10: 4ms</li> <li>0b11: 8ms</li> </ul> Bit [11:10] DO comparison output mode <ul style="list-style-type: none"> <li>0b00: Consistent output for comparison</li> <li>0b01: Output between [Lower count limit, Comparison value)</li> <li>0b10: Output between [Comparison value, Upper count limit]</li> </ul> |           |



| Parameter          | Type  | Description                                                                                                                                                                                                                                                                                                     | Data type                        |
|--------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
|                    |       | <ul style="list-style-type: none"> <li>0b11: Reserved (Consistent output for comparison)</li> </ul> Bit[15:12] Reserved                                                                                                                                                                                         |                                  |
| 2EI_Cnt0_Filt      | UINT  | Cnt A/B/Z/L/R Port filter parameter. Unit: 0.1μs                                                                                                                                                                                                                                                                |                                  |
| 2EI_Cnt1_Filt      | UINT  | Cnt A/B/Z/L/R Port filter parameter. Unit: 0.1μs                                                                                                                                                                                                                                                                |                                  |
| 2EI_Cnt0_Ratio     | UINT  | Encoder resolution, number of pulses per revolution, pulse increment between two Z pulses                                                                                                                                                                                                                       |                                  |
| 2EI_Cnt1_Ratio     | UINT  | Encoder resolution, number of pulses per revolution, pulse increment between two Z pulses                                                                                                                                                                                                                       |                                  |
| 2EI_Cnt0_PresetVal | DINT  | Counter preset value                                                                                                                                                                                                                                                                                            |                                  |
| 2EI_Cnt1_PresetVal | DINT  | Counter preset value                                                                                                                                                                                                                                                                                            |                                  |
| 2EI_Cnt0_Status    | USINT | Counter status feedback<br>Bit[0] Forward rotation flag<br>Bit[1] Reverse rotation flag<br>Bit[2] Overflow flag<br>Bit[3] Underflow flag<br>Bit[4] L0 latch completion flag<br>Bit[7:5] Reserved                                                                                                                | Input (T→O)                      |
| 2EI_Cnt1_Status    | USINT | Counter status feedback<br>Bit[0] Forward rotation flag<br>Bit[1] Reverse rotation flag<br>Bit[2] Overflow flag<br>Bit[3] Underflow flag<br>Bit[4] L0 latch completion flag<br>Bit[7:5] Reserved                                                                                                                |                                  |
| 2EI_Cnt0_Val       | DINT  | Count value feedback                                                                                                                                                                                                                                                                                            |                                  |
| 2EI_Cnt1_Val       | DINT  | Count value feedback                                                                                                                                                                                                                                                                                            |                                  |
| 2EI_Cnt0_Freq      | DINT  | Count frequency feedback Hz                                                                                                                                                                                                                                                                                     |                                  |
| 2EI_Cnt1_Freq      | DINT  | Count frequency feedback Hz                                                                                                                                                                                                                                                                                     |                                  |
| 2EI_Cnt0_LatchVal  | DINT  | Count latch value feedback                                                                                                                                                                                                                                                                                      |                                  |
| 2EI_Cnt1_LatchVal  | DINT  | Count latch value feedback                                                                                                                                                                                                                                                                                      |                                  |
| 2EI_Cnt0_Velocity  | DINT  | Running speed feedback r/min                                                                                                                                                                                                                                                                                    |                                  |
| 2EI_Cnt1_Velocity  | DINT  | Running speed feedback r/min                                                                                                                                                                                                                                                                                    |                                  |
| 2EI_Cnt0_ErrId     | UINT  | Fault code                                                                                                                                                                                                                                                                                                      | Diagnosis Data<br>(Input(T → O)) |
| 2EI_Cnt1_ErrId     | UINT  | Fault code                                                                                                                                                                                                                                                                                                      |                                  |
| 2EI_Cnt0_Ctrl      | USINT | Bit[0] Counter enabling, high active<br>Bit[1] Counter reset, rising edge active<br>Bit[2] Counter preset value writing, rising edge active<br>Bit[3] Counter overflow flag clear, rising edge active<br>Bit[4] Counter compare function enabling, high active (Counter enabling required)<br>bit[7:5] Reserved | Output (O → T)                   |
| 2EI_Cnt1_Ctrl      | USINT | Bit[0] Counter enabling, high active<br>Bit[1] Counter clearing, rising edge active<br>Bit[2] Counter preset value writing, rising edge active                                                                                                                                                                  |                                  |

| Parameter       | Type | Description                                                                                                                                                          | Data type |
|-----------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                 |      | Bit[3] Counter overflow flag clearing, rising edge active<br>Bit[4] Counter compare function enabling, high active (Counter enabling required)<br>Bit [7:5] Reserved |           |
| 2EI_Cnt0_CmpVal | DINT | Counter comparison value                                                                                                                                             |           |
| 2EI_Cnt1_CmpVal | DINT | Counter comparison value                                                                                                                                             |           |

### 6.3.1.2 Universal EDS file

**FK1300\_universal\_V1.0.eds:** This is a universal EDS file that is used regardless of how the module configuration changes or which master node it is compatible with. The current version in use is V1.0.

EDS has declared 6 connections:

1. Exclusive Owner
2. Input Only
3. Listen Only
4. Exclusive Owner Diagnosis Interface
5. Input Only Diagnosis Interface
6. Listen Only Diagnosis Interface

 **Note:** Generally, connections 1, 2, and 3 are used based on the situation; connections 4, 5, and 6 are for diagnostics (not recommended for use).

#### ■ Input(T→O) size and output(O→T) size settings

When configuring, it is necessary to set the sizes of the connected input (T→O) and output (O→T). The bytes occupied by each I/O module are listed as follows.

Table 6-1 Number of bytes occupied I/O modules

| No. | Module        | Input(T→O): bytes | Output(O→T): bytes |
|-----|---------------|-------------------|--------------------|
| 0   | FK1300        | 4                 | 0                  |
| 1   | FL1001_1600DI | 2                 | 0                  |
| 2   | FL1002_3200DI | 4                 | 0                  |
| 3   | FL2002_0016DP | 0                 | 2                  |
| 4   | FL2003_0032DP | 0                 | 4                  |
| 5   | FL2102_0016DN | 0                 | 2                  |
| 6   | FL2103_0032DN | 0                 | 4                  |
| 7   | FL2201_0008DR | 0                 | 2                  |
| 8   | FL3003_4AD    | 8                 | 0                  |
| 9   | FL3103_4PT    | 16                | 0                  |
| 10  | FL3203_4TC    | 16                | 0                  |
| 11  | FL4003_4DA    | 0                 | 8                  |
| 12  | FL5005_1616DP | 2                 | 2                  |
| 13  | FL5105_1616DN | 2                 | 2                  |
| 14  | FL6112_2EI    | 34                | 10                 |

For example, combination of FK1300 + FL1001\_1600DI + FL3103\_4PT + FL2201\_0008DR

After checking the table:

FK1300: 4 bytes Input(T→O), Parameter name: hwVersion, swVersion

FL1001\_1600DI: 2bytes Input(T→O), Parameter name: 1600DI-IN0, 1600DI-IN1

FL3103\_4PT: 16bytes Input(T→O), Parameter name: 4PT-Temp0 – 4PT-Temp4

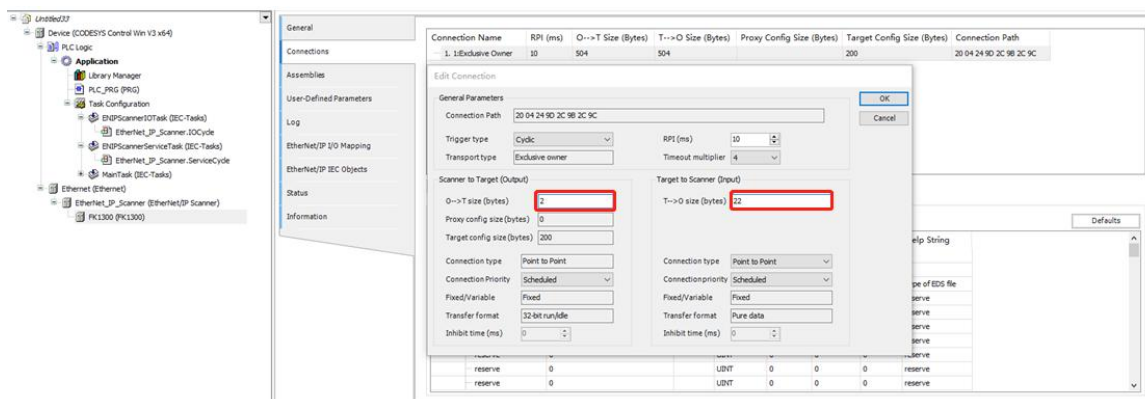
FL2201\_0008DR: 2bytes Output(O→T), Parameter name: 0008DR-OUT0, Satisfy Parameter (empty parameter)

| T→O byte | T→O parameter name                  |
|----------|-------------------------------------|
| 0        | hwVersion                           |
| 1        |                                     |
| 2        |                                     |
| 3        | swVersion                           |
| 4        |                                     |
| 5        | 1600DI-IN0                          |
| 6        | 1600DI-IN1                          |
| 7        | 4PT-Temp0                           |
| 8        |                                     |
| 9        |                                     |
| 10       | 4PT-Temp1                           |
| 11       |                                     |
| 12       |                                     |
| 13       | 4PT-Temp2                           |
| 14       |                                     |
| 15       |                                     |
| 16       | 4PT-Temp3                           |
| 17       |                                     |
| 18       |                                     |
| 19       | 4PT-Temp3                           |
| 20       |                                     |
| 21       |                                     |
| O→T byte | O→T parameter name                  |
| 0        | 0008DR-OUT0                         |
| 1        | Satisfy Parameter (Empty parameter) |

Input(T→O) length:  $4+2+16+0=22$

Output(O→T) length:  $0+0+2=2$

The configuration is as follows if in Codesys:



**Note:**

- The length of the data in the input and output process must be set correctly; otherwise a connection

cannot be established.

- When calculating the length of input data, please note that the FK1300 coupler occupies 4 bytes of data.

#### ■ Config Param configuration parameter description

The current ConfigParam field includes the configuration for 14 supported I/O modules, with uniform settings for the same modules within the configuration, with a total length of 206 bytes. The specific offsets are as follows:

| Module        | Configuration parameter name | Offset | Default value | Configurable |
|---------------|------------------------------|--------|---------------|--------------|
| FK1300        | EDS type                     | 0      | 1             | No           |
|               |                              | 1      |               |              |
|               | SLOT 1-8 Module Enable Bit   | 2      | 255           | Yes          |
|               | SLOT 9-16 Module Enable Bit  | 3      | 255           | Yes          |
|               | SLOT 17-24 Module Enable Bit | 4      | 255           | Yes          |
|               | SLOT 25-32 Module Enable Bit | 5      | 255           | Yes          |
| FL1001-1600DI | slot1_FlexIO(FL1001)         | 6      | 372330578     | No           |
|               |                              | 7      |               |              |
|               |                              | 8      |               |              |
|               |                              | 9      |               |              |
|               | slot1_1600DI_Filt0           | 10     | 1000          | Yes          |
|               |                              | 11     |               |              |
|               | slot1_1600DI_Filt1           | 12     | 1000          | Yes          |
|               |                              | 13     |               |              |
| FL1002-3200DI | slot2_FlexIO(FL1002)         | 14     | 372330579     | No           |
|               |                              | 15     |               |              |
|               |                              | 16     |               |              |
|               |                              | 17     |               |              |
|               | slot2_3200DI_Filt0           | 18     | 1000          | Yes          |
|               |                              | 19     |               |              |
|               | slot2_3200DI_Filt1           | 20     | 1000          | Yes          |
|               |                              | 21     |               |              |
|               | slot2_3200DI_Filt2           | 22     | 1000          | Yes          |
|               |                              | 23     |               |              |
|               | slot2_3200DI_Filt3           | 24     | 1000          | Yes          |
|               |                              | 25     |               |              |
| FL2002-0016DP | slot3_FlexIO(FL2002)         | 26     | 372330586     | No           |
|               |                              | 27     |               |              |
|               |                              | 28     |               |              |
|               |                              | 29     |               |              |
|               | slot3_0016DP_Stop_Mode0      | 30     | 0             | Yes          |
|               |                              | 31     |               |              |
|               | slot3_0016DP_Stop_Mode1      | 32     | 0             | Yes          |
|               |                              | 33     |               |              |
|               | slot3_0016DP_Stop_Output0    | 34     | 0             | Yes          |
|               | slot3_0016DP_Stop_Output1    | 35     | 0             | Yes          |
| FL2003-0032DP | slot4_FlexIO(FL2003)         | 36     | 372330587     | No           |
|               |                              | 37     |               |              |
|               |                              | 38     |               |              |

| Module        | Configuration parameter name | Offset | Default value | Configurable |
|---------------|------------------------------|--------|---------------|--------------|
|               | slot4_0032DP_Stop_Mode0      | 39     | 0             | Yes          |
|               |                              | 40     |               |              |
|               |                              | 41     |               |              |
|               | slot4_0032DP_Stop_Mode1      | 42     | 0             | Yes          |
|               |                              | 43     |               |              |
|               | slot4_0032DP_Stop_Mode2      | 44     | 0             | Yes          |
|               |                              | 45     |               |              |
|               | slot4_0032DP_Stop_Mode3      | 46     | 0             | Yes          |
|               |                              | 47     |               |              |
|               | slot4_0032DP_Stop_Output0    | 48     | 0             | Yes          |
| FL2102-0016DN | slot5_FlexIO(FL2102)         | 52     | 372330594     | No           |
|               |                              | 53     |               |              |
|               |                              | 54     |               |              |
|               |                              | 55     |               |              |
|               | slot5_0016DN_Stop_Mode0      | 56     | 0             | Yes          |
|               |                              | 57     |               |              |
|               | slot5_0016DN_Stop_Mode1      | 58     | 0             | Yes          |
|               |                              | 59     |               |              |
| FL2103-0032DN | slot6_FlexIO(FL2103)         | 60     | 0             | Yes          |
|               |                              | 61     | 0             | Yes          |
|               |                              | 62     | 372330595     | No           |
|               |                              | 63     |               |              |
|               |                              | 64     |               |              |
|               |                              | 65     |               |              |
|               | slot6_0032DN_Stop_Mode0      | 66     | 0             | Yes          |
|               |                              | 67     |               |              |
|               | slot6_0032DN_Stop_Mode1      | 68     | 0             | Yes          |
|               |                              | 69     |               |              |
|               | slot6_0032DN_Stop_Mode2      | 70     | 0             | Yes          |
|               |                              | 71     |               |              |
| FL2201-0008DR | slot6_0032DN_Stop_Mode3      | 72     | 0             | Yes          |
|               |                              | 73     |               |              |
|               | slot6_0032DN_Stop_Output0    | 74     | 0             | Yes          |
|               | slot6_0032DN_Stop_Output1    | 75     | 0             | Yes          |
|               | slot6_0032DN_Stop_Output2    | 76     | 0             | Yes          |
|               | slot6_0032DN_Stop_Output3    | 77     | 0             | Yes          |
|               | slot7_FlexIO(FL2201)         | 78     | 372330601     | No           |
|               |                              | 79     |               |              |
|               |                              | 80     |               |              |
|               |                              | 81     |               |              |
|               | slot7_0008DR_Stop_Mode       | 82     | 0             | Yes          |
|               |                              | 83     |               |              |
|               | slot7_0008DR_Stop_Output     | 84     | 0             | Yes          |
| FL3003-4AD    | slot8_FlexIO(FL3003)         | 85     | 372330625     | No           |
|               |                              | 86     |               |              |

| Module     | Configuration parameter name | Offset | Default value | Configurable |
|------------|------------------------------|--------|---------------|--------------|
|            |                              | 87     |               |              |
|            |                              | 88     |               |              |
|            | slot8_4AD_AI0_Cfg            | 89     | 97            | Yes          |
|            | slot8_4AD_AI1_Cfg            | 90     | 97            | Yes          |
|            | slot8_4AD_AI2_Cfg            | 91     | 97            | Yes          |
|            | slot8_4AD_AI3_Cfg            | 92     | 97            | Yes          |
|            | slot8_4AD_AI0_Filt           | 93     | 8             | Yes          |
|            | slot8_4AD_AI1_Filt           | 94     | 8             | Yes          |
|            | slot8_4AD_AI2_Filt           | 95     | 8             | Yes          |
|            | slot8_4AD_AI3_Filt           | 96     | 8             | Yes          |
| FL3103-4PT | slot9_FlexIO(FL3103)         | 97     | 372330657     | No           |
|            |                              | 98     |               |              |
|            |                              | 99     |               |              |
|            |                              | 100    |               |              |
|            | slot9_4PT_Temp0_Cfg          | 101    | 129           | Yes          |
|            | slot9_4PT_Temp1_Cfg          | 102    | 129           | Yes          |
|            | slot9_4PT_Temp2_Cfg          | 103    | 129           | Yes          |
|            | slot9_4PT_Temp3_Cfg          | 104    | 129           | Yes          |
|            | slot9_4PT_Temp0_Filt         | 105    | 8             | Yes          |
|            | slot9_4PT_Temp1_Filt         | 106    | 8             | Yes          |
|            | slot9_4PT_Temp2_Filt         | 107    | 8             | Yes          |
|            | slot9_4PT_Temp3_Filt         | 108    | 8             | Yes          |
|            | slot9_4PT_Temp0_Offset       | 109    | 0             | Yes          |
|            |                              | 110    |               |              |
|            | slot9_4PT_Temp1_Offset       | 111    | 0             | Yes          |
|            |                              | 112    |               |              |
|            | slot9_4PT_Temp2_Offset       | 113    | 0             | Yes          |
|            |                              | 114    |               |              |
|            | slot9_4PT_Temp3_Offset       | 115    | 0             | Yes          |
|            |                              | 116    |               |              |
| FL3203-4TC | slot10_FlexIO(FL3203)        | 117    | 372330665     | No           |
|            |                              | 118    |               |              |
|            |                              | 119    |               |              |
|            |                              | 120    |               |              |
|            | slot10_4TC_Temp0_Cfg         | 121    | 129           | Yes          |
|            | slot10_4TC_Temp1_Cfg         | 122    | 129           | Yes          |
|            | slot10_4TC_Temp2_Cfg         | 123    | 129           | Yes          |
|            | slot10_4TC_Temp3_Cfg         | 124    | 129           | Yes          |
|            | slot10_4TC_Temp0_Filt        | 125    | 8             | Yes          |
|            | slot10_4TC_Temp1_Filt        | 126    | 8             | Yes          |
|            | slot10_4TC_Temp2_Filt        | 127    | 8             | Yes          |
|            | slot10_4TC_Temp3_Filt        | 128    | 8             | Yes          |
|            | slot10_4TC_Temp0_Offset      | 129    | 0             | Yes          |
|            |                              | 130    |               |              |
|            | slot10_4TC_Temp1_Offset      | 131    | 0             | Yes          |
|            |                              | 132    |               |              |
|            | slot10_4TC_Temp2_Offset      | 133    | 0             | Yes          |
|            |                              | 134    |               |              |

| Module        | Configuration parameter name | Offset | Default value | Configurable |
|---------------|------------------------------|--------|---------------|--------------|
|               | slot10_4TC_Temp3_Offset      | 135    | 0             | Yes          |
|               |                              | 136    |               |              |
| FL4003-4DA    | slot11_FlexIO(FL4003)        | 137    | 372330633     | No           |
|               |                              | 138    |               |              |
|               |                              | 139    |               |              |
|               |                              | 140    |               |              |
|               | slot11_4DA_AO0_Cfg           | 141    | 97            | Yes          |
|               | slot11_4DA_AO1_Cfg           | 142    | 97            | Yes          |
|               | slot11_4DA_AO2_Cfg           | 143    | 97            | Yes          |
|               | slot11_4DA_AO3_Cfg           | 144    | 97            | Yes          |
|               | slot11_4DA_AO0_Stop_Output   | 145    | 0             | Yes          |
|               |                              | 146    |               |              |
|               | slot11_4DA_AO1_Stop_Output   | 147    | 0             | Yes          |
|               |                              | 148    |               |              |
|               | slot11_4DA_AO2_Stop_Output   | 149    | 0             | Yes          |
|               |                              | 150    |               |              |
|               | slot11_4DA_AO3_Stop_Output   | 151    | 0             | Yes          |
|               |                              | 152    |               |              |
| FL5005-1616DP | slot12_FlexIO(FL5005)        | 153    | 372330610     | No           |
|               |                              | 154    |               |              |
|               |                              | 155    |               |              |
|               |                              | 156    |               |              |
|               | slot12_1616DP_Filt0          | 157    | 1000          | Yes          |
|               |                              | 158    |               |              |
|               | slot12_1616DP_Filt1          | 159    | 1000          | Yes          |
|               |                              | 160    |               |              |
|               | slot12_1616DP_Stop_Mode0     | 161    | 0             | Yes          |
|               |                              | 162    |               |              |
|               | slot12_1616DP_Stop_Mode1     | 163    | 0             | Yes          |
|               |                              | 164    |               |              |
|               | slot12_1616DP_Stop_Output0   | 165    | 0             | Yes          |
|               | slot12_1616DP_Stop_Output1   | 166    | 0             | Yes          |
| FL5105-1616DN | slot13_FlexIO(FL5105)        | 167    | 372330614     | No           |
|               |                              | 168    |               |              |
|               |                              | 169    |               |              |
|               |                              | 170    |               |              |
|               | slot13_1616DN_Filt0          | 171    | 1000          | Yes          |
|               |                              | 172    |               |              |
|               | slot13_1616DN_Filt1          | 173    | 1000          | Yes          |
|               |                              | 174    |               |              |
|               | slot13_1616DN_Stop_Mode0     | 175    | 0             | Yes          |
|               |                              | 176    |               |              |
|               | slot13_1616DN_Stop_Mode1     | 177    | 0             | Yes          |
|               |                              | 178    |               |              |
|               | slot13_1616DN_Stop_Output0   | 179    | 0             | Yes          |
|               | slot13_1616DN_Stop_Output1   | 180    | 0             | Yes          |
| FL6112_2EI    | slot14_FlexIO(FL6112)        | 181    | 372330673     | No           |
|               |                              | 182    |               |              |

| Module | Configuration parameter name | Offset | Default value | Configurable |
|--------|------------------------------|--------|---------------|--------------|
|        |                              | 183    |               |              |
|        |                              | 184    |               |              |
|        | slot14_2EI_Cnt0_Cfg          | 185    | 772           | Yes          |
|        |                              | 186    |               |              |
|        | slot14_2EI_Cnt1_Cfg          | 187    | 772           | Yes          |
|        |                              | 188    |               |              |
|        | slot14_2EI_Cnt0_Filt         | 189    | 5             | Yes          |
|        |                              | 190    |               |              |
|        | slot14_2EI_Cnt1_Filt         | 191    | 5             | Yes          |
|        |                              | 192    |               |              |
|        | slot14_2EI_Cnt0_Ratio        | 193    | 10000         | Yes          |
|        |                              | 194    |               |              |
|        | slot14_2EI_Cnt1_Ratio        | 195    | 10000         | Yes          |
|        |                              | 196    |               |              |
|        | slot14_2EI_Cnt0_PresetVal    | 197    | 0             | Yes          |
|        |                              | 198    |               |              |
|        |                              | 199    |               |              |
|        |                              | 200    |               |              |
|        | slot14_2EI_Cnt1_PresetVal    | 201    | 0             | Yes          |
|        |                              | 202    |               |              |
|        |                              | 203    |               |              |
|        |                              | 204    |               |              |
| FK1300 | Satisfy Parameter            | 205    | 0             | No           |

For specific module configuration instructions, see 6.3.1.1 Module parameter.

FK1300 configurable parameter descriptions are listed in the following table.

| Parameter                     | Type  | Description                                                                                                                                                                                       |      |                    |      |                     |     |                    |
|-------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------|------|---------------------|-----|--------------------|
| SLOT 1-8 Module Enable        | USINT | Control bit of expansion module enabling/disabling. Bit that controlling the enabling/disabling of the expansion module behind the coupler. Each bit controls the enabling/disabling of a module. |      |                    |      |                     |     |                    |
|                               |       | <table><tr><th>Bit7</th><th>...</th><th>Bit0</th></tr><tr><td>Controls module 8.</td><td>...</td><td>Controls module 1.</td></tr></table>                                                         | Bit7 | ...                | Bit0 | Controls module 8.  | ... | Controls module 1. |
|                               |       | Bit7                                                                                                                                                                                              | ...  | Bit0               |      |                     |     |                    |
|                               |       | Controls module 8.                                                                                                                                                                                | ...  | Controls module 1. |      |                     |     |                    |
| TRUE: Enable. FALSE: Disable. |       |                                                                                                                                                                                                   |      |                    |      |                     |     |                    |
|                               |       |                                                                                                                                                                                                   |      |                    |      |                     |     |                    |
| SLOT 9-16 Module Enable       | USINT | Control bit of expansion module enabling/disabling. Bit that controlling the enabling/disabling of the expansion module behind the coupler. Each bit controls the enabling/disabling of a module. |      |                    |      |                     |     |                    |
|                               |       | <table><tr><th>Bit7</th><th>...</th><th>Bit0</th></tr><tr><td>Controls module 16.</td><td>...</td><td>Controls module 9.</td></tr></table>                                                        | Bit7 | ...                | Bit0 | Controls module 16. | ... | Controls module 9. |
|                               |       | Bit7                                                                                                                                                                                              | ...  | Bit0               |      |                     |     |                    |
|                               |       | Controls module 16.                                                                                                                                                                               | ...  | Controls module 9. |      |                     |     |                    |
| TRUE: Enable. FALSE: Disable. |       |                                                                                                                                                                                                   |      |                    |      |                     |     |                    |
|                               |       |                                                                                                                                                                                                   |      |                    |      |                     |     |                    |
| SLOT 17-24 Module Enable      | USINT | Control bit of expansion module enabling/disabling. Bit that controlling the enabling/disabling of the expansion module behind the coupler. Each bit controls the enabling/disabling of a module. |      |                    |      |                     |     |                    |



| Parameter                | Type  | Description                                                                                                                                                                                       |     |                     |
|--------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------|
|                          |       | Bit7                                                                                                                                                                                              | ... | Bit0                |
| SLOT 25-32 Module Enable | USINT | Controls module 24.                                                                                                                                                                               | ... | Controls module 17. |
|                          |       | TRUE: Enable. FALSE: Disable.                                                                                                                                                                     |     |                     |
|                          |       | Control bit of expansion module enabling/disabling. Bit that controlling the enabling/disabling of the expansion module behind the coupler. Each bit controls the enabling/disabling of a module. |     |                     |
|                          |       | Bit7                                                                                                                                                                                              | ... | Bit0                |
|                          |       | Controls module 32.                                                                                                                                                                               | ... | Controls module 25. |
|                          |       | TRUE: Enable. FALSE: Disable.                                                                                                                                                                     |     |                     |

### 6.3.1.3 Specialized EDS file

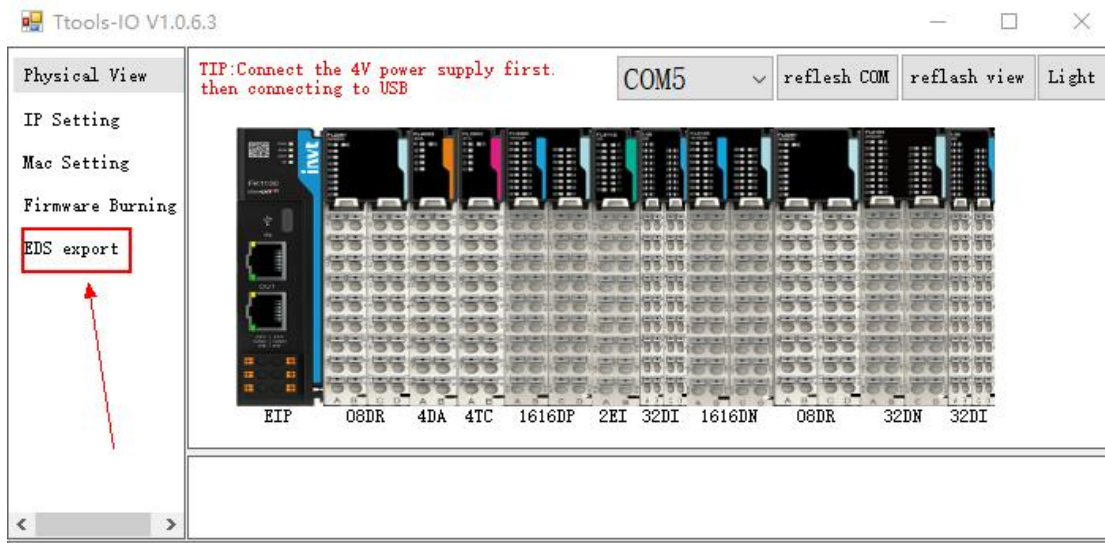
Based on the actual configuration, the corresponding EDS file is generated using a tool, and there is no need to set input(T→O) size/output(O→T) size again during master node configuration.

#### ■ Instructions for generating a specialized EDS file

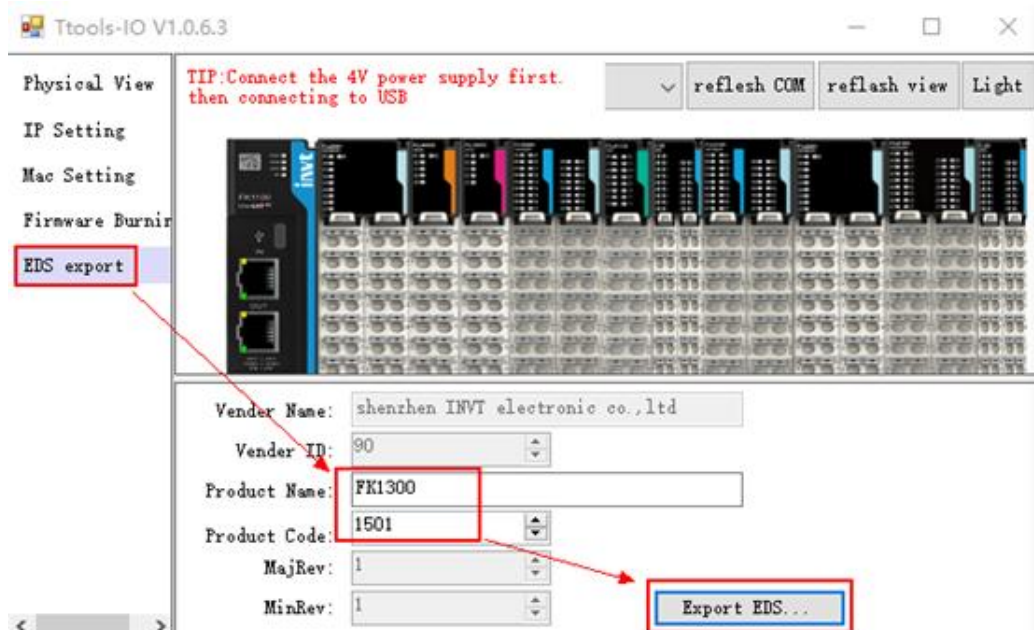
- Tool software: **Ttools-IO.exe**, use version V1.0.6.2 or later.
  - USB cable: Type-C
1. After the coupler is powered on, connect the Type-C cable to the computer, and then run the Ttools-IO software. See the following figure.



- Click **refresh COM** and **refresh view**. See the following figure.



- Click the buttons shown in the following figure for EDS file generation.



**Note:** Distinguish non-configured EDS files by modifying the product code.

Two files are generated:

- **FK1300.eds**: Specialized EDS file.
- **FK1300\_IO.excel**: IO mapping table for easy querying of parameter offset addresses.

Description of a parameter name in the document: Slot name + Module name + Parameter name; you can know the slot and module type according to the name.

For example:

- **slot1\_1600DI\_IN0**: slot1 is the first slot counted from the coupler end, the module is 1600DI, and the parameter is IN0.
- **slot10\_4TC\_Temp0**: slot10 is the tenth slot counted from the coupler end, the module is 4TC, and the parameter is Temp0.

IO mapping table description:

|    | A             | B                | C        | D |
|----|---------------|------------------|----------|---|
| 1  | Module        | Param            | Byte no. |   |
| 2  | FL1001-1600DI | slot1_1600DI_IN0 | 0        |   |
| 3  |               | slot1_1600DI_IN1 | 1        |   |
| 4  |               | slot2_3200DI_IN0 | 2        |   |
| 5  | FL1002-3200DI | slot2_3200DI_IN1 | 3        |   |
| 6  |               | slot2_3200DI_IN2 | 4        |   |
| 7  |               | slot2_3200DI_IN3 | 5        |   |
| 8  | FL5105-1616DN | slot3_1616DN_IN0 | 6        |   |
| 9  |               | slot3_1616DN_IN1 | 7        |   |
| 10 | FL5005-1616DP | slot4_1616DP_IN0 | 8        |   |
| 11 |               | slot4_1616DP_IN1 | 9        |   |
| 12 |               |                  | 10       |   |
| 13 |               | slot10_4TC_Temp0 | 11       |   |
| 14 |               |                  | 12       |   |
| 15 |               |                  | 13       |   |
| 16 |               |                  | 14       |   |
| 17 |               | slot10_4TC_Temp1 | 15       |   |
| 18 |               |                  | 16       |   |
| 19 |               |                  | 17       |   |
| 20 | FL3203-4TC    |                  | 18       |   |
| 21 |               |                  | 19       |   |
| 22 |               | slot10_4TC_Temp2 | 20       |   |
| 23 |               |                  | 21       |   |
| 24 |               |                  | 22       |   |
| 25 |               |                  | 23       |   |
| 26 |               | slot10_4TC_Temp3 | 24       |   |
| 27 |               |                  | 25       |   |
| 28 |               |                  | 26       |   |
| 29 |               | slot11_4PT_Temp0 | 27       |   |
| 30 |               |                  | 28       |   |

According to the byte sequence number, you can know the offset address and the number of bytes occupied.

There are a total of three tables as follows:

- Input: Input process data
- Output: Output process data
- Config: Configuration data

#### ■ Parameter description

See 6.3.1.1 Module parameter for the specific module configuration description.

#### 6.3.1.4 Object information

The object information can be obtained/configured through UCMM using the Get Attribute Single (0x0E) and Set Attribute Single (0x10) services. Common object information is listed in the following table.

| Data object         | Class | Instance | Attribute | Service | Remarks                                                                                                              |
|---------------------|-------|----------|-----------|---------|----------------------------------------------------------------------------------------------------------------------|
| Coupler information | 0x04  | 0x68     | 0x03      | 0x0E    | Bytes 0–1: Number of Act<br>num modules<br>Bytes 2–3: Hw version<br>Bytes 4–5: Sw version<br>Bytes 6–7: Fpga version |

| Data object                | Class | Instance | Attribute | Service    | Remarks                                                                                                                                                                                                                                      |
|----------------------------|-------|----------|-----------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Module configuration       | 0x04  | 0x69     | 0x03      | 0x0E       | Bytes 0–31: Slot 1–32 module type<br>Module does not exist: 0x00<br>FL1001-1600DI: 0x12<br>FL2002-0016DP: 0x1A<br>FL2102-0016DN: 0x22<br>FL2201-0008DR: 0x29<br>FL3003-4AD: 0x41<br>FL4003-4DA: 0x49<br>FL3103-4PT: 0x61<br>FL3203-4TC: 0x69 |
| Slot 1 module info         | 0x04  | 0x70     | 0x03      | 0x0E       | Bytes 0–1: Hw version<br>Bytes 2–3: FPGA version                                                                                                                                                                                             |
| ...                        | 0x04  | ...      | 0x03      | 0x0E       |                                                                                                                                                                                                                                              |
| Slot 32 module info        | 0x04  | 0x8F     | 0x03      | 0x0E       |                                                                                                                                                                                                                                              |
| IP configuration method    | 0xF5  | 0x01     | 0x03      | 0x0E, 0x10 | CIP standard object                                                                                                                                                                                                                          |
| IP interface configuration | 0xF5  | 0x01     | 0x05      | 0x0E, 0x10 | CIP standard object                                                                                                                                                                                                                          |
| IP address                 | 0x04  | 0x92     | 0x03      | 0x0E, 0x10 | -                                                                                                                                                                                                                                            |
| Subnet mask                | 0x04  | 0x93     | 0x03      | 0x0E, 0x10 | -                                                                                                                                                                                                                                            |
| Gateway                    | 0x04  | 0x94     | 0x03      | 0x0E, 0x10 | -                                                                                                                                                                                                                                            |

## 6.3.2 KV STUDIO configuration description

### 6.3.2.1 Preparation

- PLC: KV-8000
- Computer: Pre-installed KV STUDIO software
- network cable, power supply, coupler, module

The list is as follows:

| Type         | Model          | Qty | Slot |
|--------------|----------------|-----|------|
| PLC          | KV-8000        | 1   | -    |
| Coupler      | FK1300         | 1   | 0    |
| IO module    | FL1001(1600D)  | 1   | 1    |
|              | FL2002(0016DP) | 1   | 2    |
|              | FL1002(3200D)  | 1   | 3    |
|              | FL2002(0016DP) | 1   | 4    |
| Bottom cover | Bottom cover   | 1   | 5    |

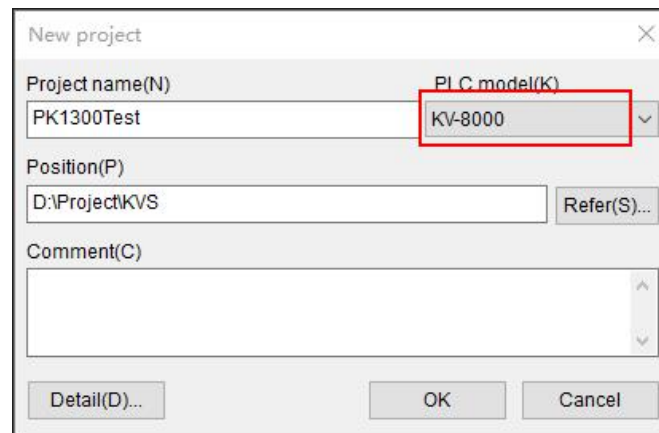
Device configuration file (choose one from two options; this example uses a universal EDS file)

- Universal EDS file: **FK1300\_universal\_V1.0.eds**
- Specialized EDS file: **FK1300.eds** that is generated using the Ttools-IO software.

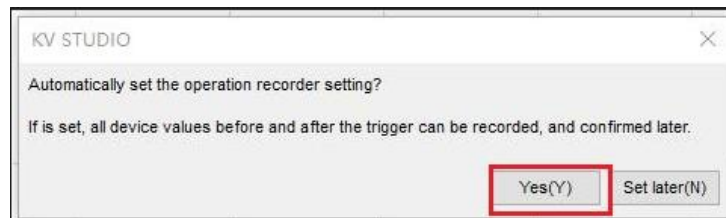
For hardware configuration and connection, see the requirements and operations described in chapters 4 Installation and 5 Wiring.

### 6.3.2.2 Project establishing

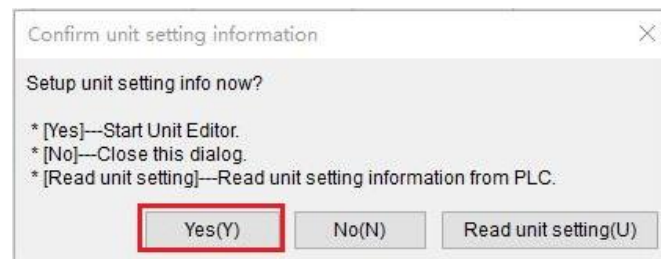
Step 1 Open KV STUDIO software, choose **File > New Project**, enter information such as **Project name** and **PLC model**, and click **OK** on the pop-up interface.



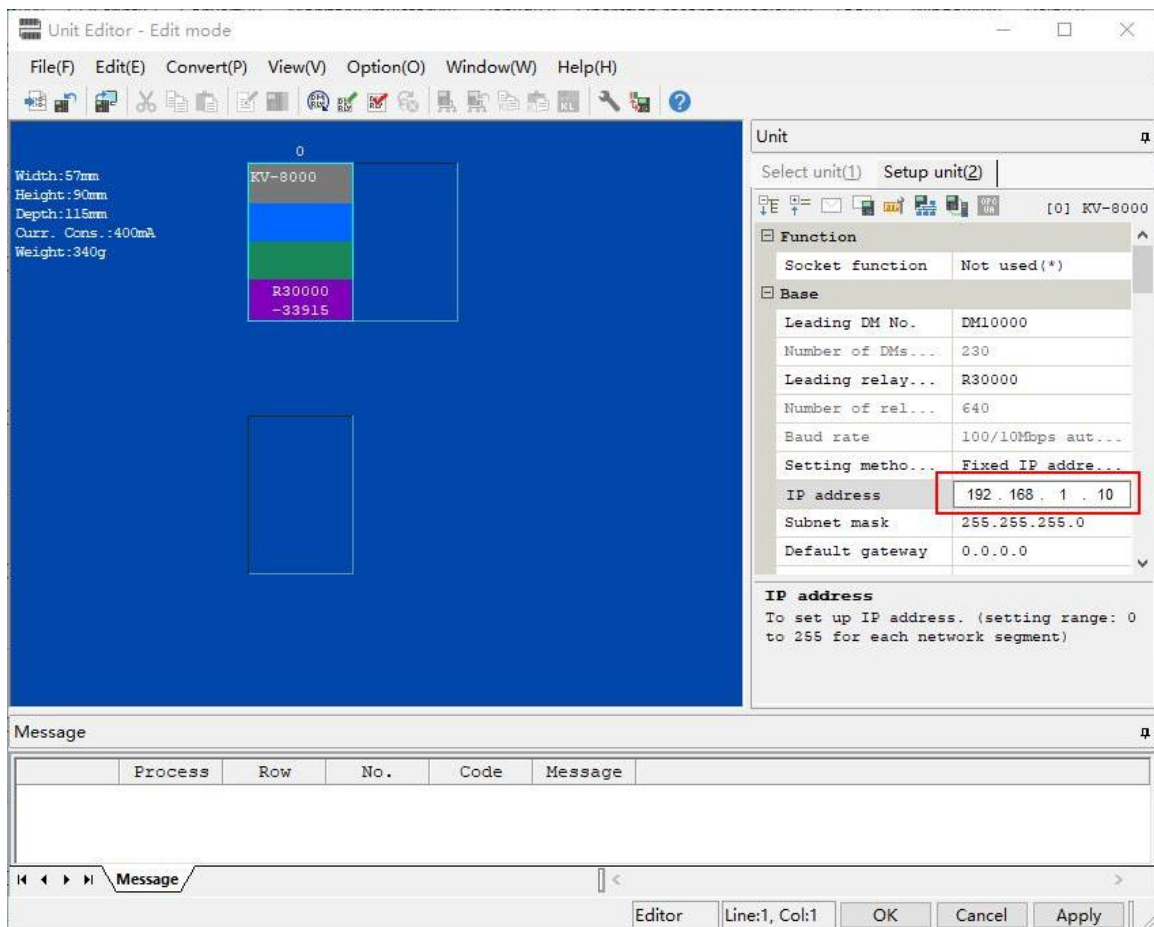
Step 2 Click **Yes**.



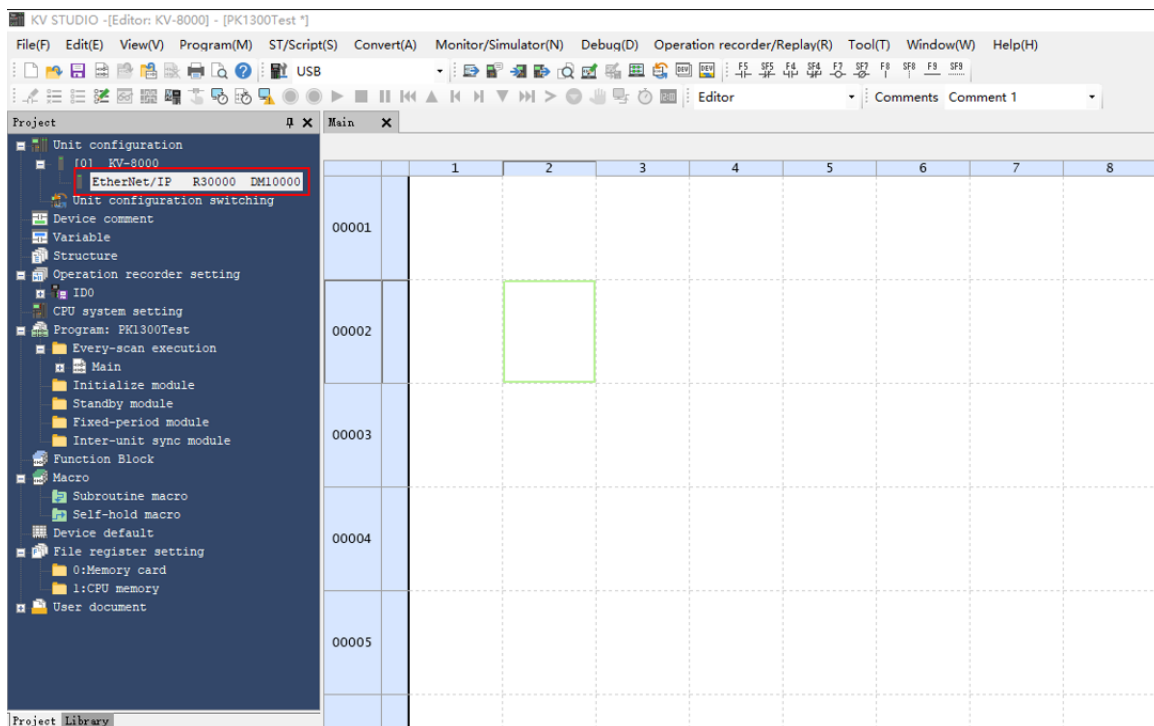
Step 3 Click **Yes**.



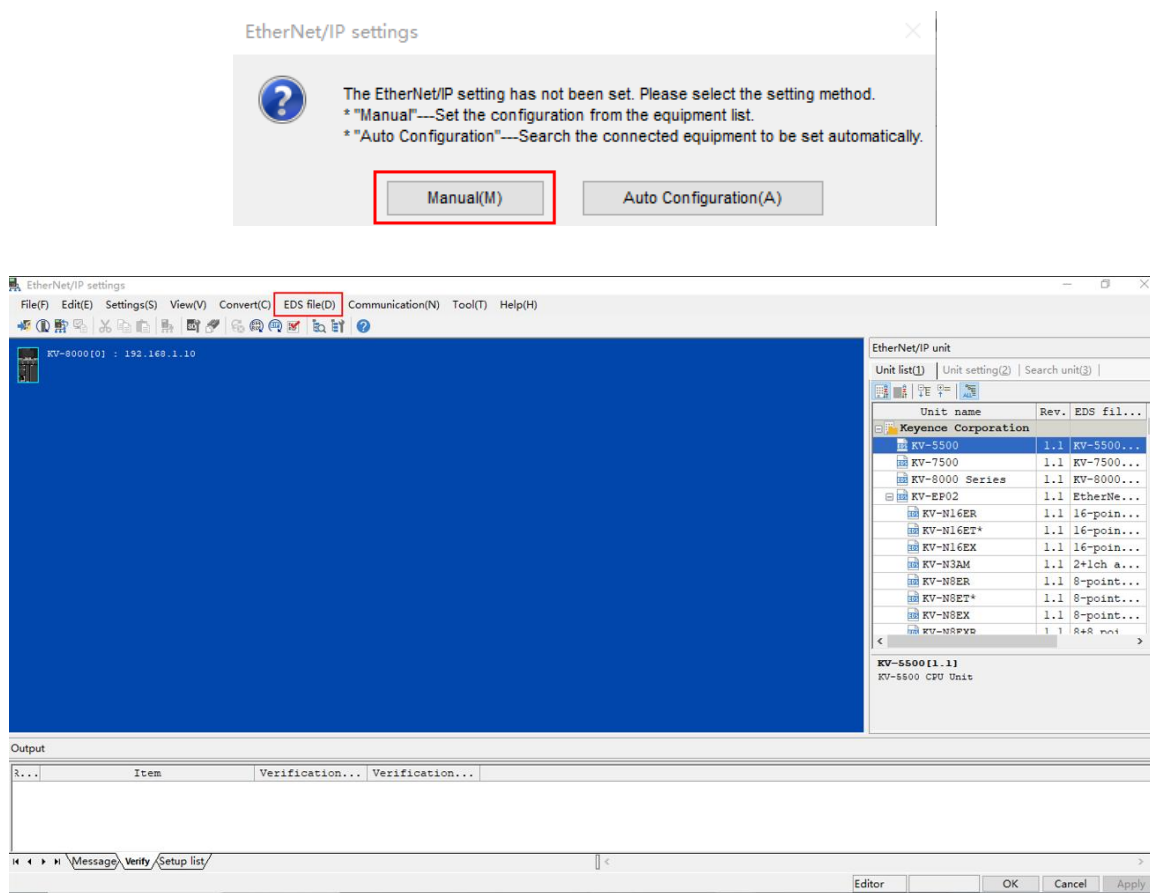
Step 4 Set the IP address of KV-8000. Ensure it is in the same network segment as PK1300.



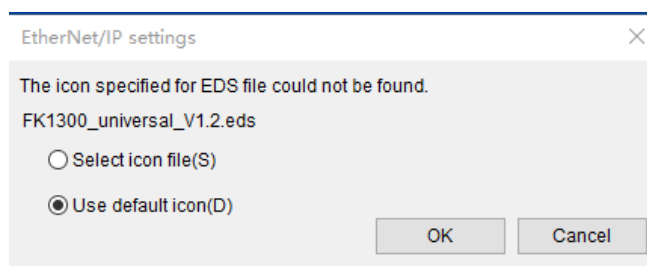
Step 5 Double-click the unit in the red box to configure the network.



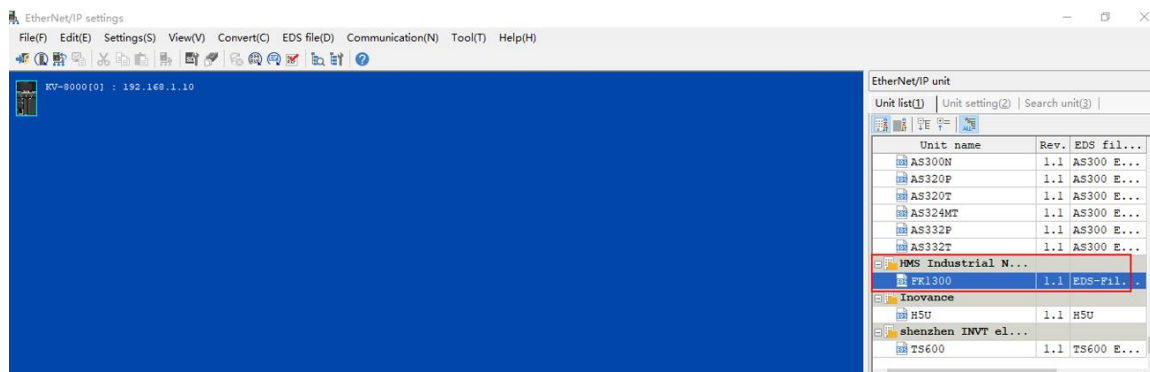
Step 6 Click **Manual**, enter the **EtherNet/IP settings** interface, and click **EDS file** to add an EDS file.



Step 7 Select **FK1300\_universal\_V1.0.eds** and then click **OK**.

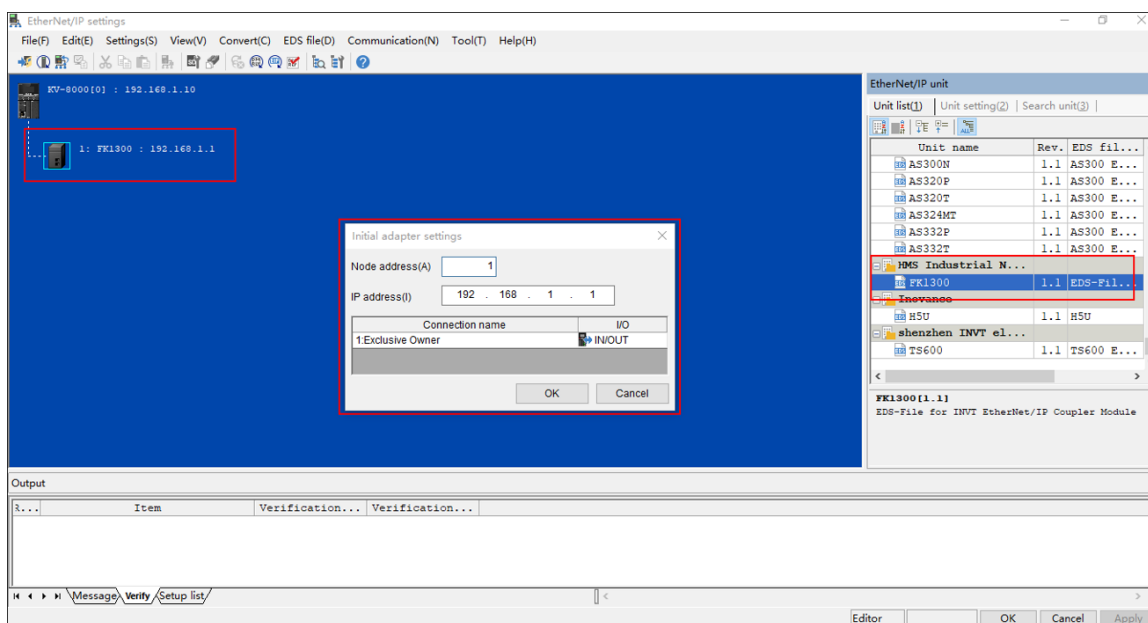


After successful addition, the interface shown in the following figure appears.

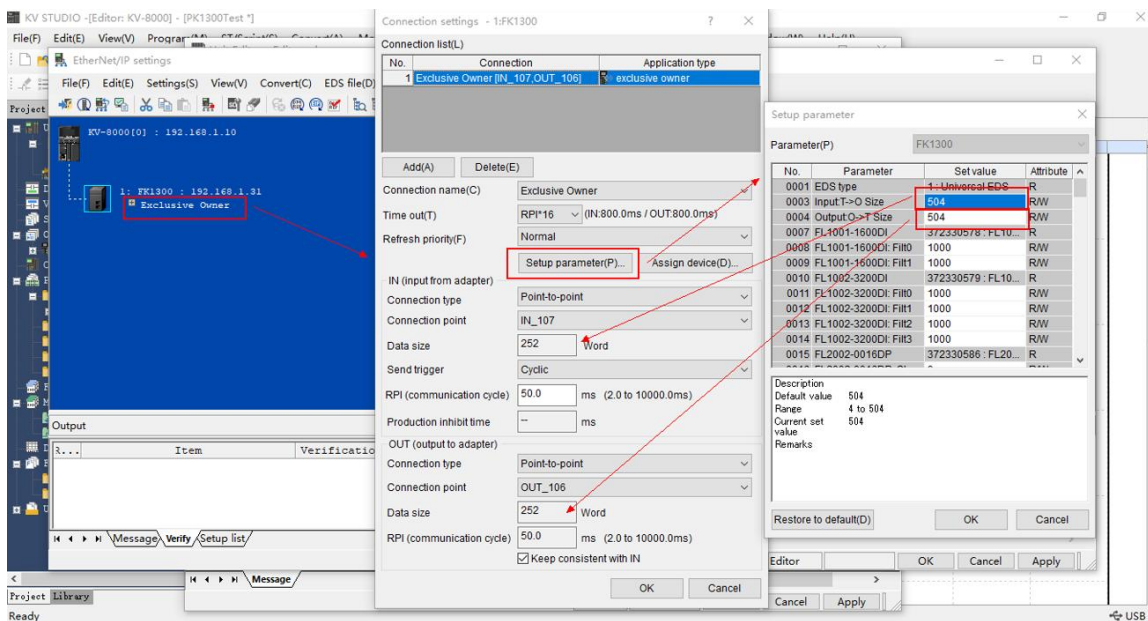




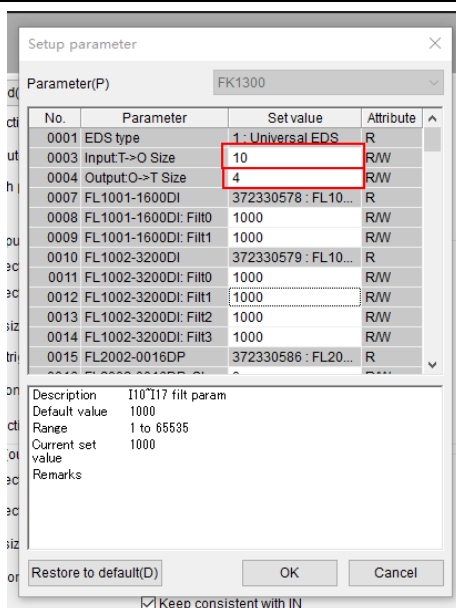
Step 8 Double click **FK1300**, change the corresponding IP to the actual IP of the coupler, and add the device to the configuration.



Step 9 After adding the module, click **Exclusive Owner** to enter the module settings window, click **Setup parameter**, and set the correct T→O and O→T sizes.





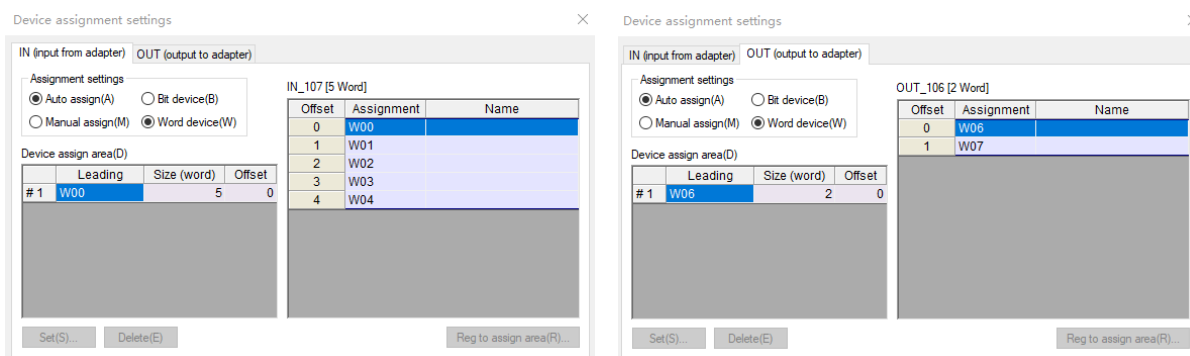


Assign soft elements by referring to Table 6-1 based on the actual IO module configuration.

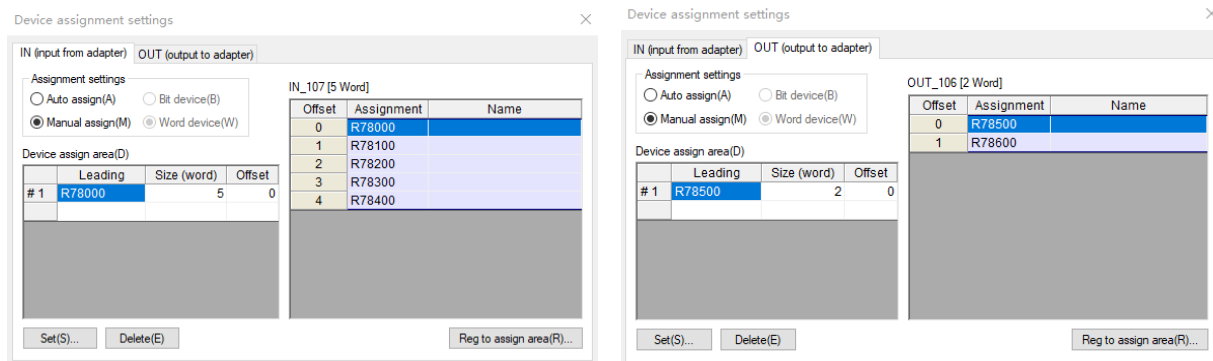
| Type      | Model          | Slot | T→O size (Bytes) | O→T size (Bytes) | Automatic soft element assignment (word access) | Manual assignment (bit access)  |
|-----------|----------------|------|------------------|------------------|-------------------------------------------------|---------------------------------|
| IO module | FK1300         | 0    | 4                | 0                | W00, W01                                        | -                               |
|           | FL1001(1600D)  | 1    | 2                | 0                | W02                                             | R78000–R78015                   |
|           | FL2002(0016DP) | 2    | 0                | 2                | W06                                             | R78400–R78415                   |
|           | FL1002(3200D)  | 3    | 4                | 0                | W03, W04                                        | R78100–R78115,<br>R78200–R78215 |
|           | FL2002(0016DP) | 4    | 0                | 2                | W07                                             | R78500–R78515                   |

Step 10 Soft element assignment: choose manual or automatic. See the preceding table for corresponding module parameters.

Automatic assignment:



Manual assignment: Use the unit of R.

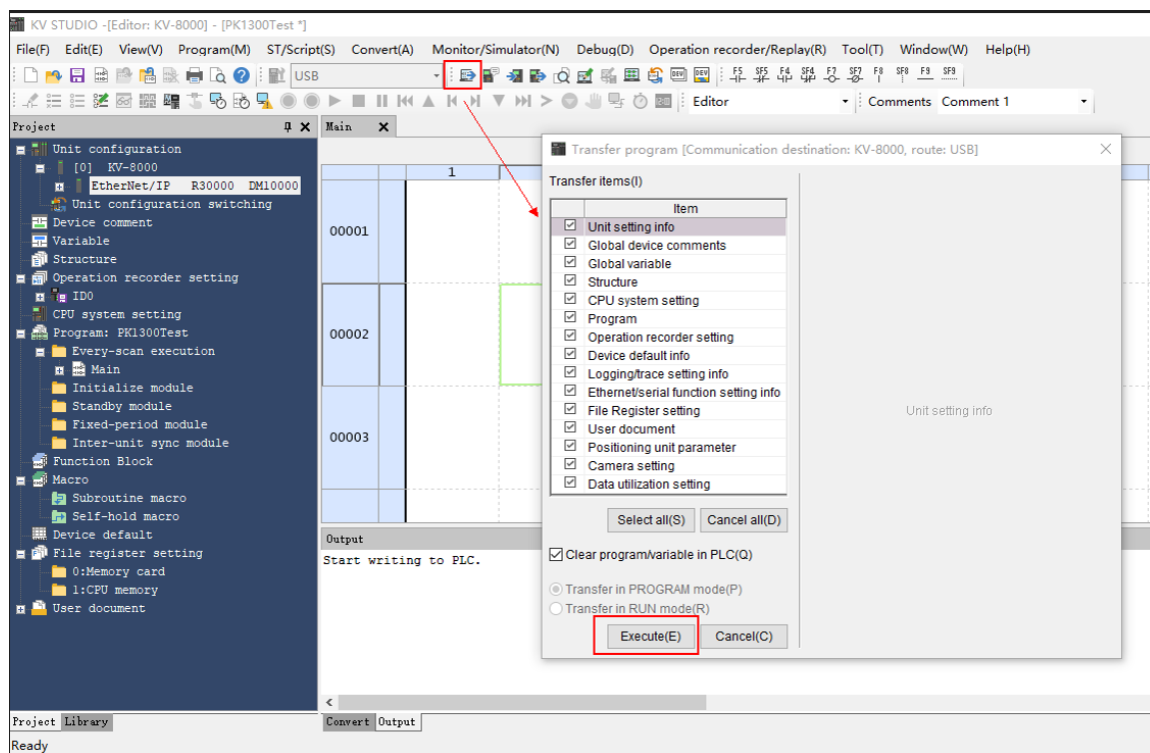


Step 11 Set RPI.

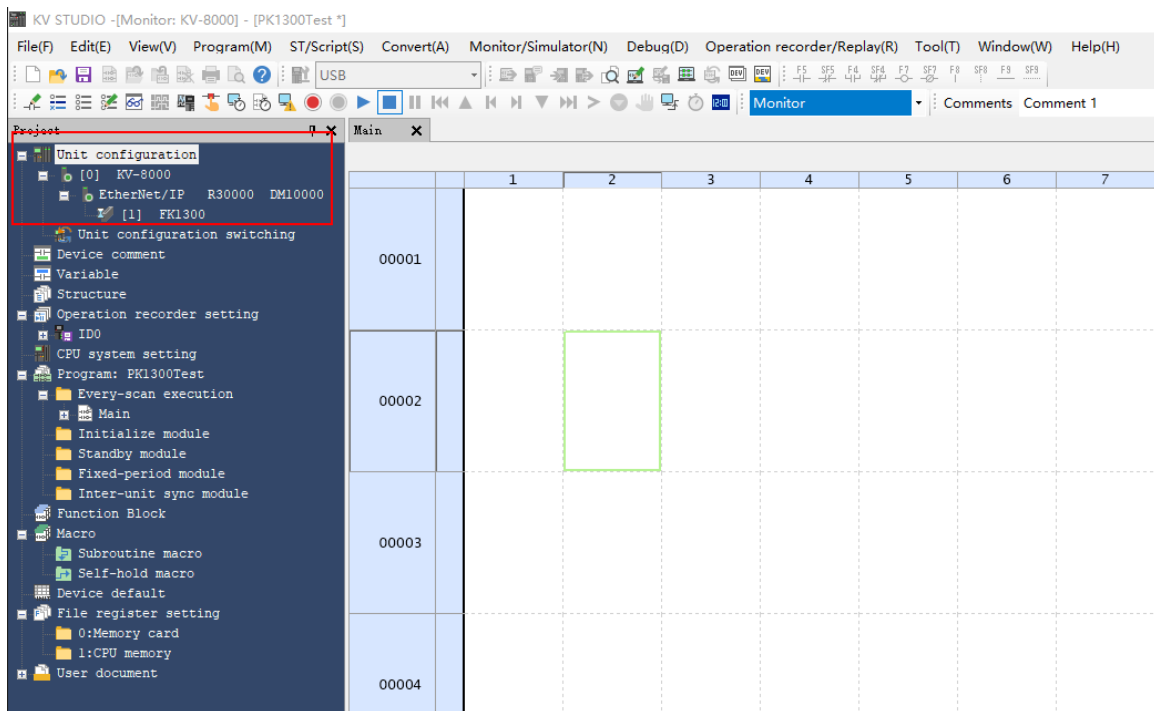
Step 12 After setting is completed, click **OK** to enter the download verification.

### 6.3.2.3 Configuration download and verification

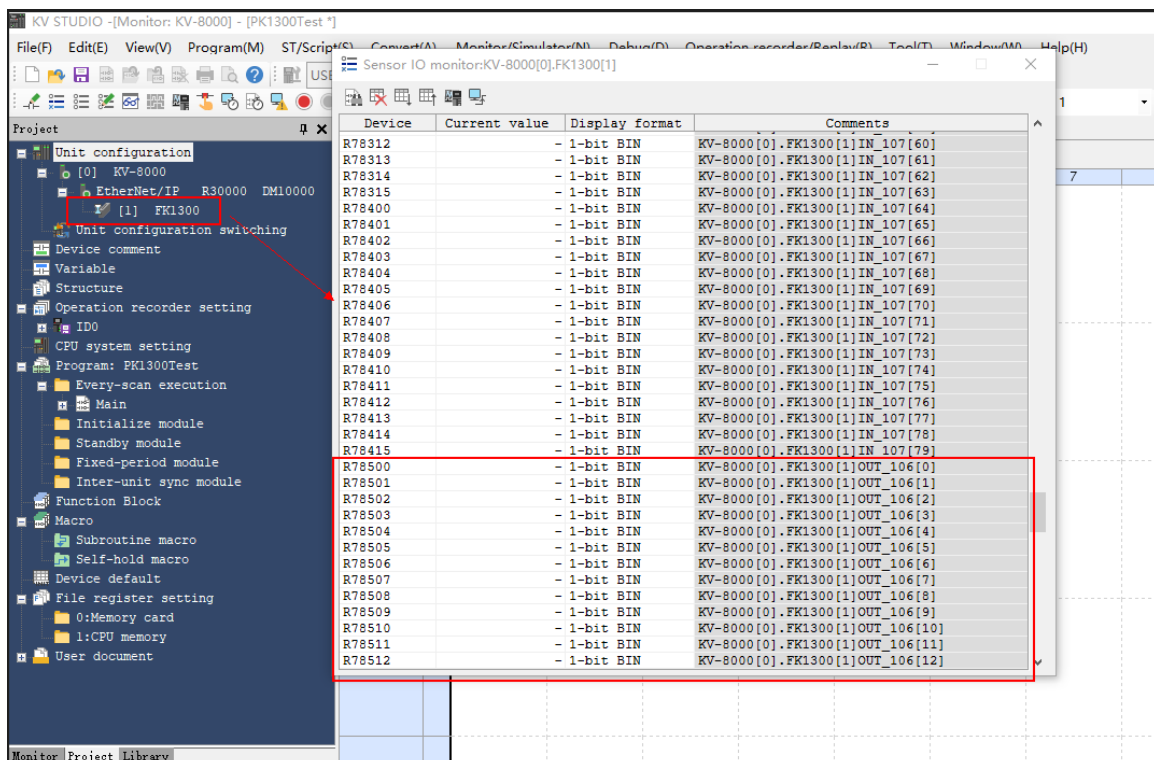
Choose **Monitor/Simulator (N) > PLC Transfer > Monitor Mode (C)**, and click **Execute** to download to the PLC.



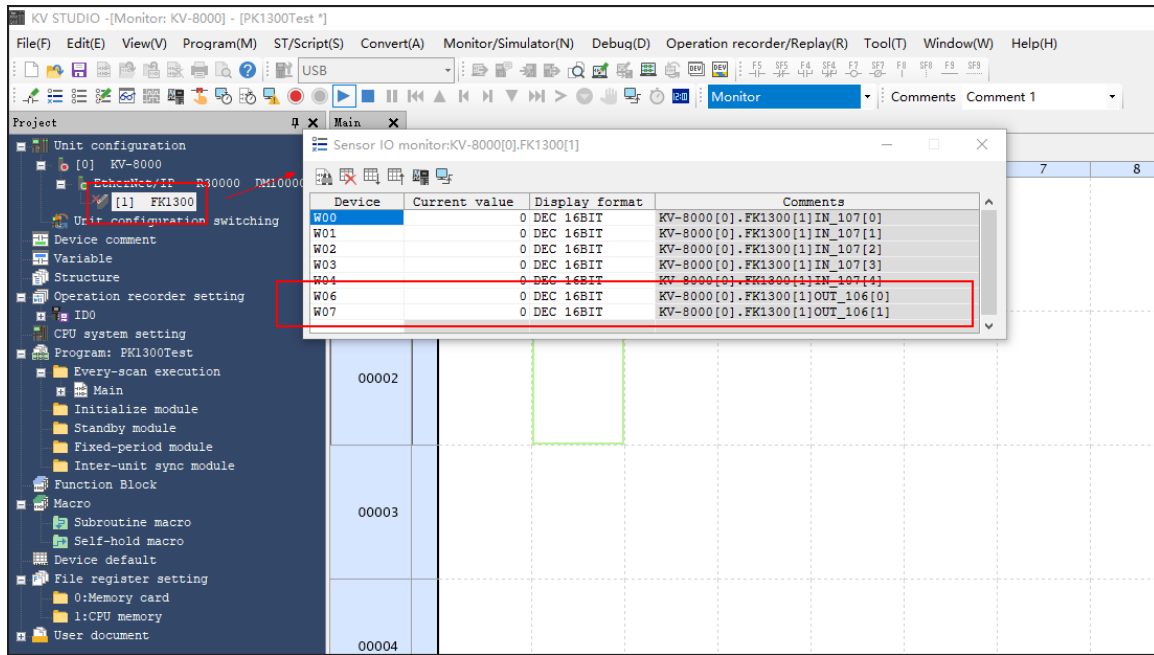
At this time, the PK1300 indicator lights PWR and MS\_R are steady on in green.



Manual soft element configuration:



Automatic soft element configuration:



### 6.3.3 RSLogix5000 configuration description

#### 6.3.3.1 Preparation

- PLC: Rockwell 1769-L36ERMS LOGIX5370 SAFETY
- Computer: Preinstalled with STUDIO 5000 software
- network cable, power supply, coupler, module

The list is as follows:

| Type         | Model                                     | Qty | Slot |
|--------------|-------------------------------------------|-----|------|
| PLC          | Rockwell<br>1769-L36ERMS LOGIX5370 SAFETY | 1   | -    |
| Coupler      | FK1300                                    | 1   | 0    |
| IO module    | FL1001(1600D)                             | 1   | 1    |
|              | FL2002(0016DP)                            | 1   | 2    |
|              | FL1002(3200D)                             | 1   | 3    |
|              | FL2002(0016DP)                            | 1   | 4    |
| Bottom cover | Bottom cover                              | 1   | 5    |

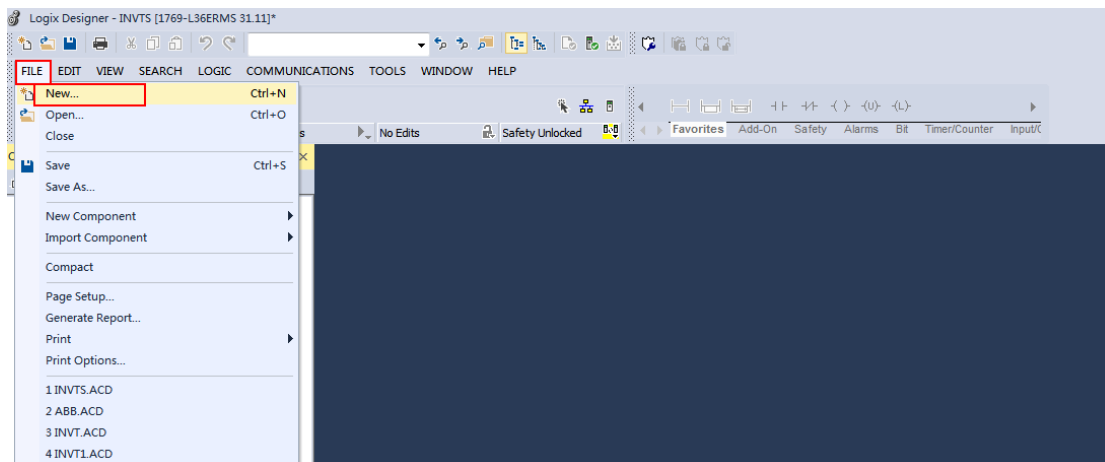
Device configuration file (choose one from two options; this example uses a universal EDS file)

- Universal EDS file: **FK1300\_universal\_V1.0.eds**
- Specialized EDS file: **FK1300.eds** that is generated using the Ttools-IO software.

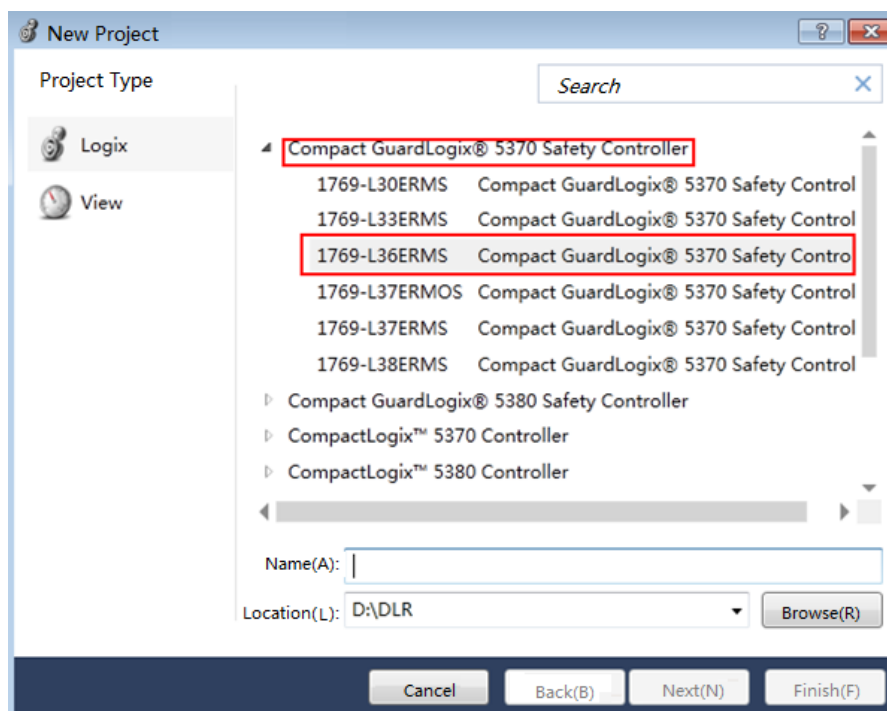
For hardware configuration and connection, see the requirements and operations described in chapters 4 Installation and 5 Wiring.

### 6.3.3.2 Project establishing

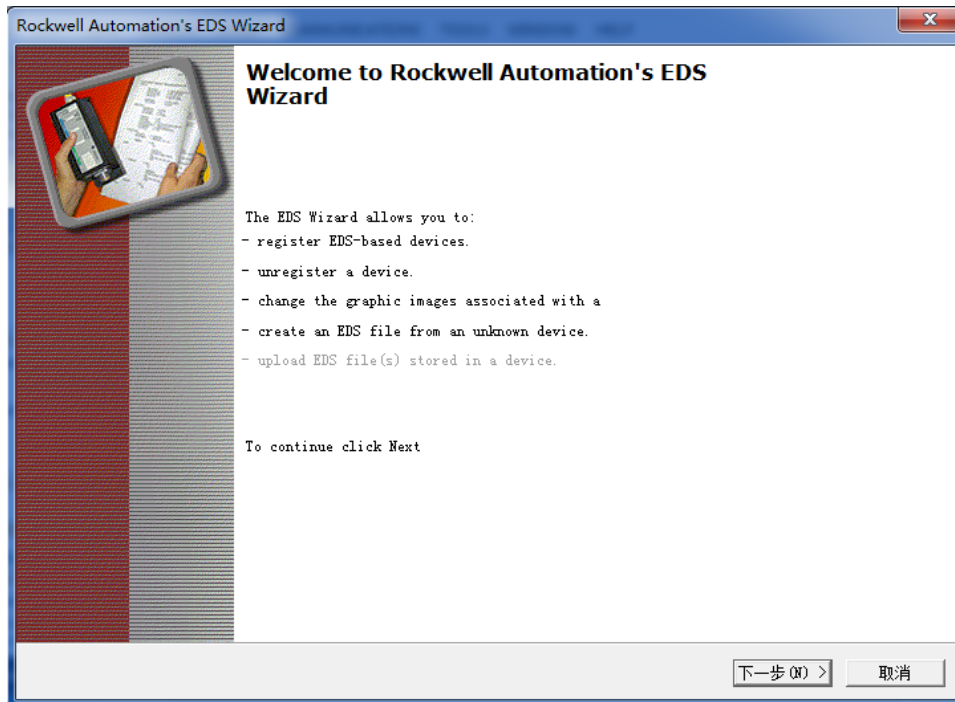
Step 1 Use a printer cable or Ethernet cable to connect the computer and the PLC, open Studio5000 software, right-click the **File** option, and then click **New**.



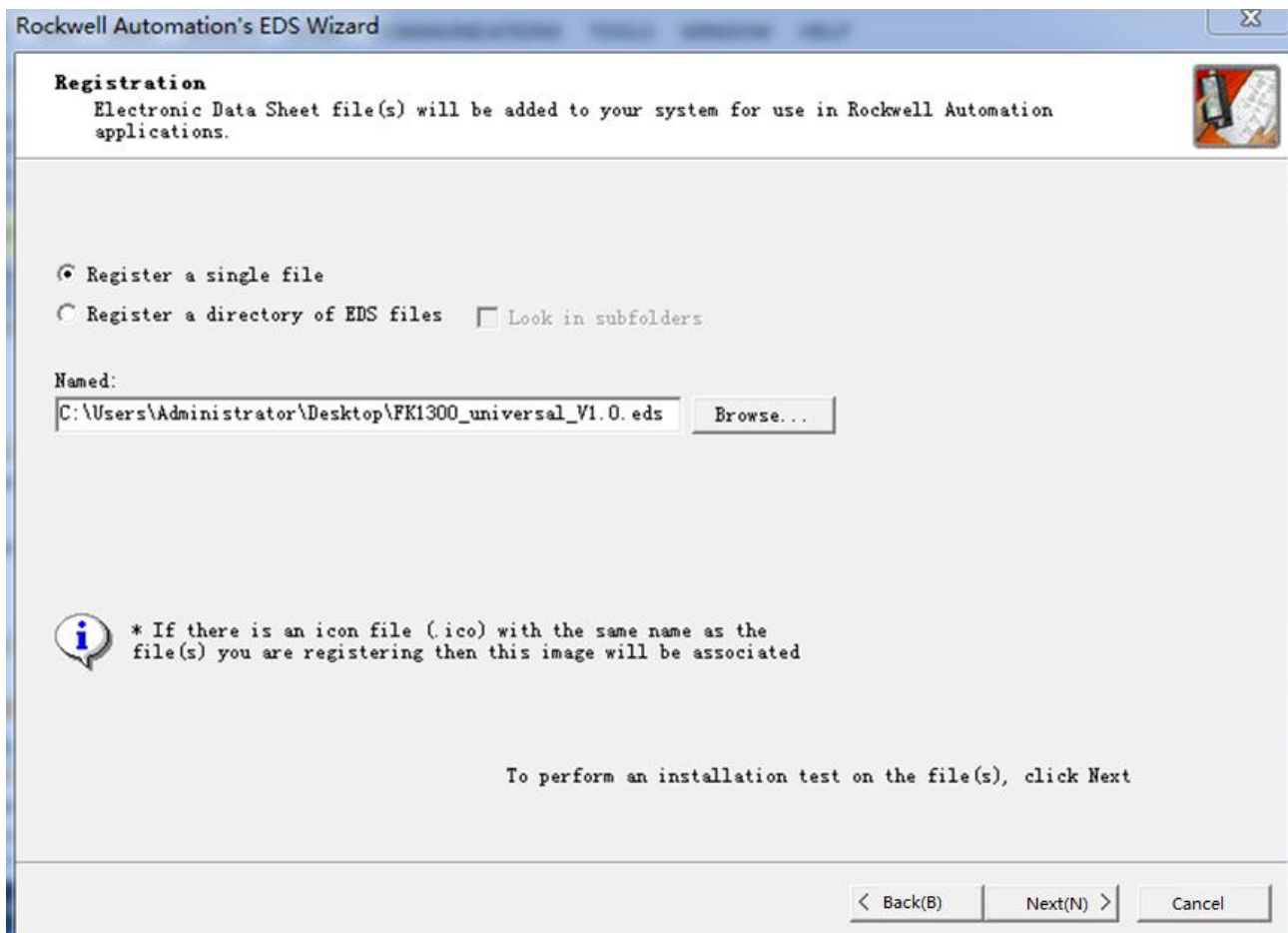
Step 2 Select the correct PLC model, fill in the project name, and click **Next**.



Step 3 Add the EDS file. Click **TOOLS > EDS Hardware Installation Tool**. The following interface appears.

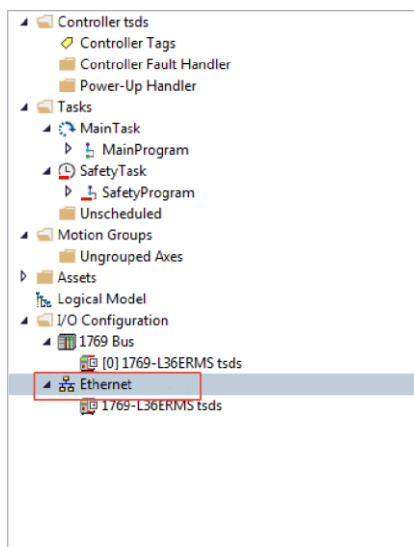


Step 4 Click **Next** to proceed to the next page, choose **Register an EDS file(s)**, then click **Next** again to enter the interface shown below. Choose the path of the EDS file we want to install.

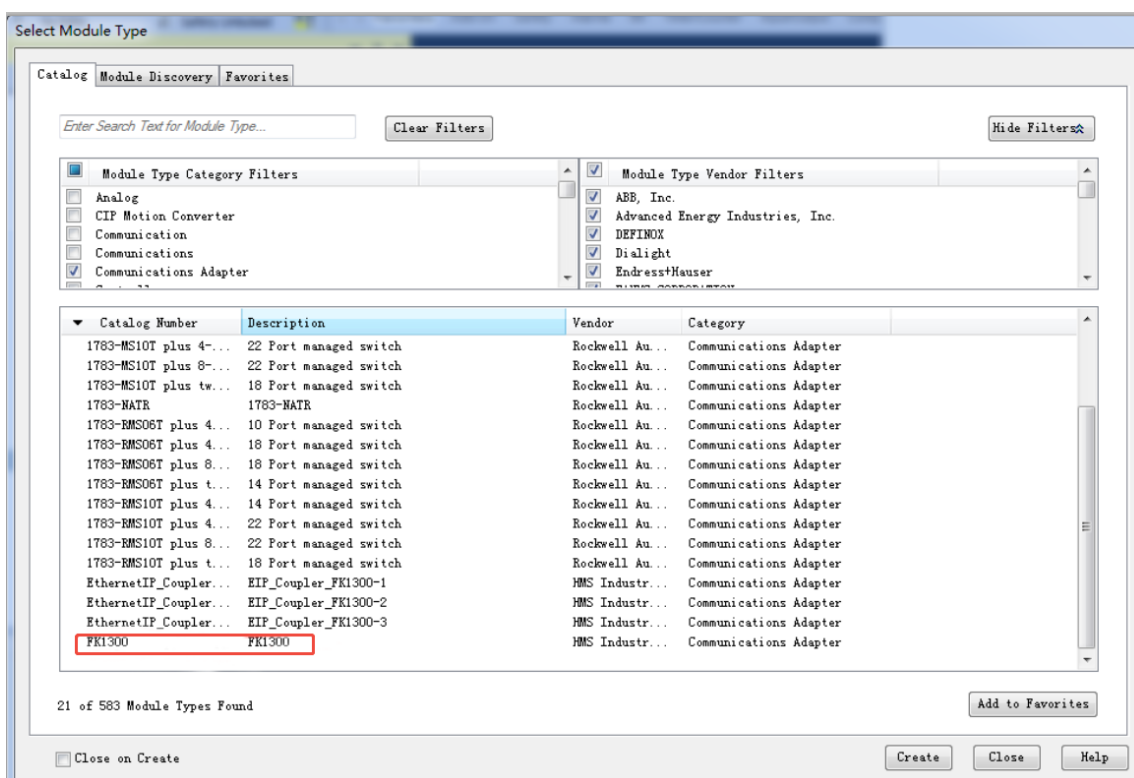


Step 5 Keep clicking **Next** until **OK**.

Step 6 Right-click **Ethernet** and choose **New Module**.



Step 7 Double click **FK1300** to add the device to the configuration.



Step 8 Set FK1300 name and IP address, and then click **Change**.

The 'New Module' dialog box is shown with the 'General' tab selected. The 'Type' is 'FK1300 FK1300', 'Vendor' is 'HMS Industrial Networks AB', and 'Parent' is 'Local'. The 'Name' field contains 'test'. The 'Description' field is empty. The 'Ethernet Address' section has 'IP Address' selected with the value '192.168.1.31'. The 'Module Definition' section shows 'Revision: 1.001', 'Electronic Keying: Compatible Module', and 'Connections: Exclusive Owner'. A 'Change ...' button is highlighted with a red box. The status at the bottom is 'Creating'.

Step 9 Modify the input(T→O) size and output(O→T) size.

The 'Module Definition\*' dialog box is shown with the 'Connections' tab selected. The 'Revision' is '1' and '001'. The 'Electronic Keying' is 'Compatible Module'. The 'Connections' table shows the following data:

| Name            | Input   | Size |      |
|-----------------|---------|------|------|
| Exclusive Owner | Input:  | 10   | SINT |
|                 | Output: | 4    |      |

The 'Input' size is highlighted with a red box. The 'OK' button is highlighted with a blue box.

Assign soft elements by referring to Table 6-1 based on the actual IO module configuration.

| Type      | Model          | Slot | T→O size (Bytes) | O→T size (Bytes) |
|-----------|----------------|------|------------------|------------------|
| IO module | FK1300         | 0    | 4                | 0                |
|           | FL1001(1600D)  | 1    | 2                | 0                |
|           | FL2002(0016DP) | 2    | 0                | 2                |
|           | FL1002(3200D)  | 3    | 4                | 0                |



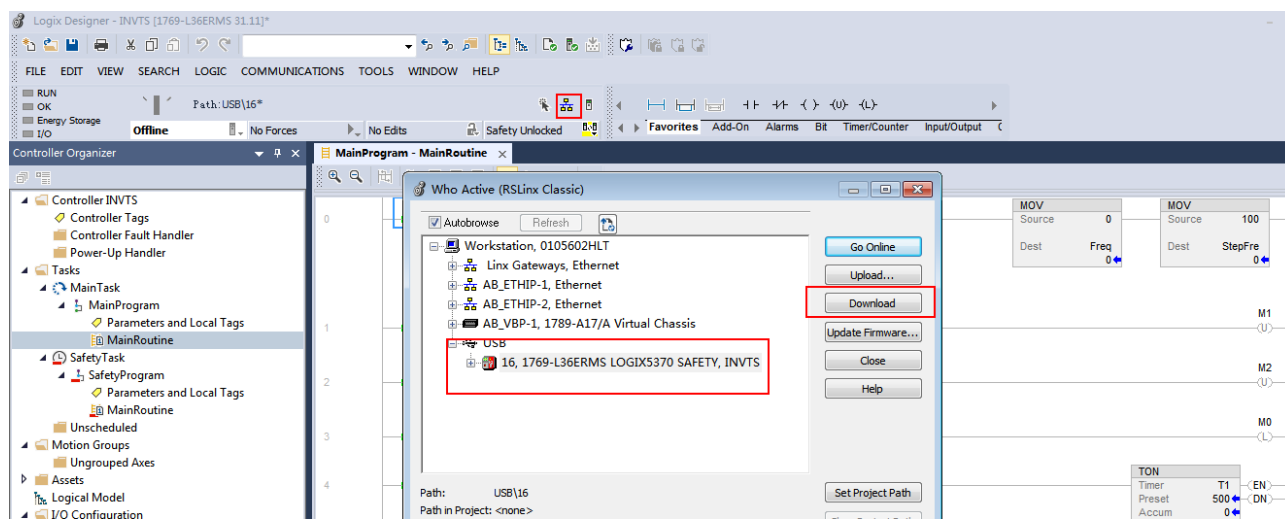
| Type | Model          | Slot | T→O size (Bytes) | O→T size (Bytes) |
|------|----------------|------|------------------|------------------|
|      | FL2002(0016DP) | 4    | 0                | 2                |

- Input(T→O) Size: 10
- Output(O→T) Size: 4

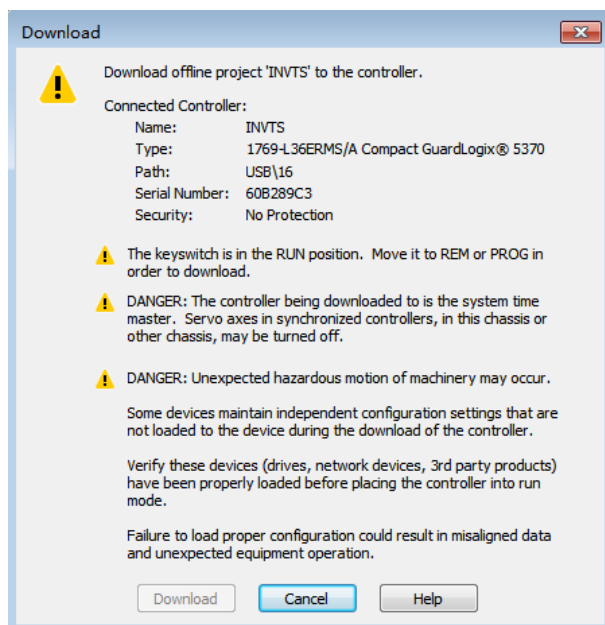
Step 10 Click **OK** > **Yes** > **OK** > **Close**.

### 6.3.3.3 Download

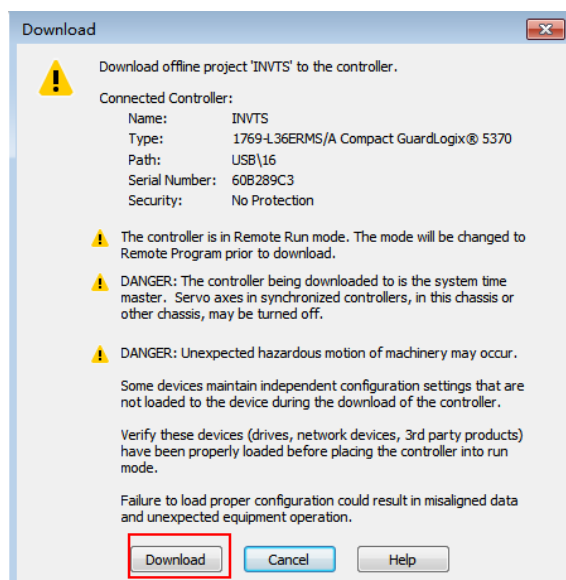
Select the bus symbol (as shown in the red box in the middle of the following figure) to enter the WHO Active interface, select the controller you are using, and click **Download**.



If the following interface appears, set the gear of the PLC controller to REM or PROG mode.



Then click Download again to complete the download successfully.



At this time, the PK1300 indicator lights PWR and MS\_R are steady on in green.

To view the data: choose **Menu > LOGIC > Monitor Tags**.

| Controller Tags - tsds(controller) |       |            |               |                       |          |             |                          |  |  |
|------------------------------------|-------|------------|---------------|-----------------------|----------|-------------|--------------------------|--|--|
| Name                               | Value | Force Mask | Style         | Data Type             | Class    | Description | Constant                 |  |  |
| test:C                             |       | {...}      | {...}         | _005A:FK1300_A4B97... | Standard |             | <input type="checkbox"/> |  |  |
| test:C.Data                        |       | {...}      | {...} Decimal | SINT[206]             | Standard |             |                          |  |  |
| test:I                             |       | {...}      | {...}         | _005A:FK1300_C81BC... | Standard |             | <input type="checkbox"/> |  |  |
| test:I.ConnectionFaulted           |       | 0          | Decimal       | BOOL                  | Standard |             |                          |  |  |
| test:I.Data                        |       | {...}      | {...} Decimal | SINT[6]               | Standard |             |                          |  |  |
| test:I.Data[0]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:I.Data[1]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:I.Data[2]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:I.Data[3]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:I.Data[4]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:I.Data[5]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:O                             |       | {...}      | {...}         | _005A:FK1300_AAB94... | Standard |             | <input type="checkbox"/> |  |  |
| test:O.Data                        |       | {...}      | {...} Decimal | SINT[4]               | Standard |             |                          |  |  |
| test:O.Data[0]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:O.Data[1]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:O.Data[2]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |
| test:O.Data[3]                     |       | 0          | Decimal       | SINT                  | Standard |             |                          |  |  |

- Test: When FK1300 is loaded, enter **Name**.
- test:C: Configuration information
- test:I: Input process data
- test:O: Output process data

## 6.3.4 CODESYS configuration description

### 6.3.4.1 Preparation

Hardware environment:

- One computer pre-installed with CODESYS V3.5 software
- Network cable and power module model should be configured according to the actual situation.

The list is as follows:

| Type | Model                                         | Slot |
|------|-----------------------------------------------|------|
| PLC  | CODESYS Control WIN V3 – x64 SysTray software | -    |

| Type         | Model         | Slot |
|--------------|---------------|------|
| Coupler      | FK1300        | 0    |
| I/O module   | FL1002-3200DI | 1    |
|              | FL2103-0032DN | 2    |
|              | FL3203-4TC    | 3    |
|              | FL3003-4AD    | 4    |
|              | FL4003-4DA    | 5    |
|              | FL6112_2EI    | 6    |
|              | FL1001-1600DI | 7    |
|              | FL5005-1616DP | 8    |
|              | FL5105-1616DN | 9    |
|              | FL2201-0008DR | 10   |
|              | FL3103-4PT    | 11   |
|              | FL2003-0032DP | 12   |
|              | FL2002-0016DP | 13   |
| Bottom cover | Bottom cover  | 15   |

Device configuration file (Choose one from the two)

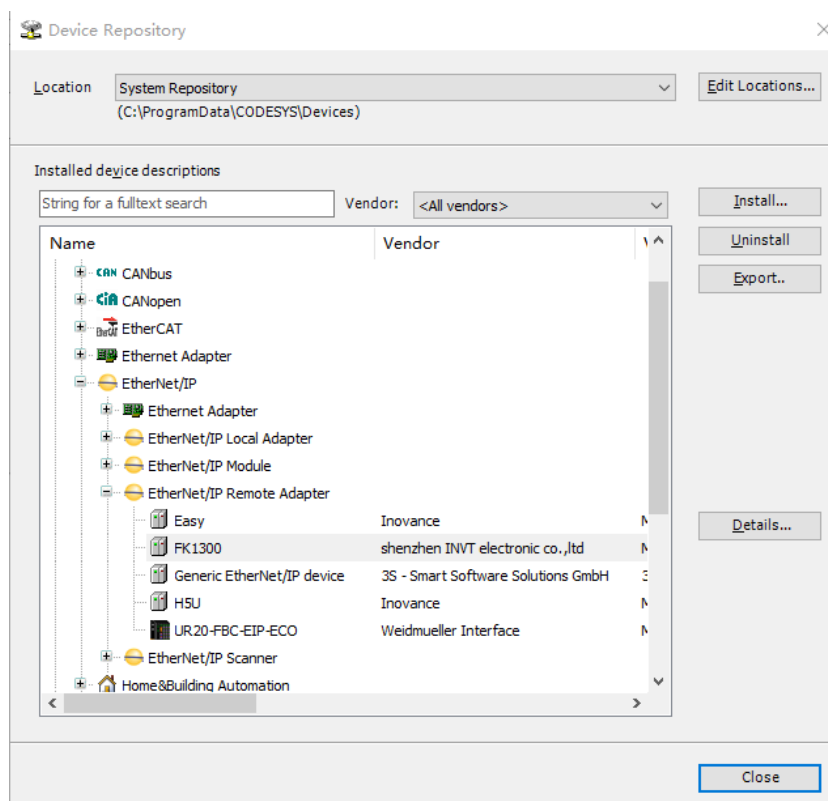
- Universal EDS file: **FK1300\_universal\_V1.0.eds**
- Specialized EDS file: **FK1300.eds** that is generated using the Ttools-IO software.

For hardware configuration and connection, see the requirements and operations described in chapters 4 Installation and 5 Wiring.

### 6.3.4.2 EDS file installing

Install the EDS device descriptor file (**FK1300\_universal\_V1.0.eds**).

Open the CODESYS software, choose **Tools > Device Repository**, click **Install**, and select **FK1300\_universal\_V1.0.eds** to install. See the following figure.



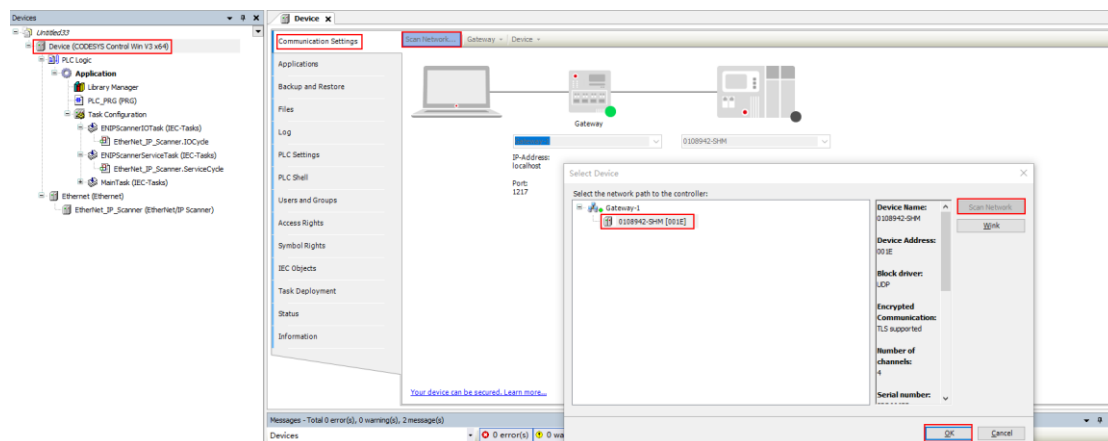
### 6.3.4.3 Project establishing

1. Click **File** and choose **New Project**.
2. Add **Ethernet**.

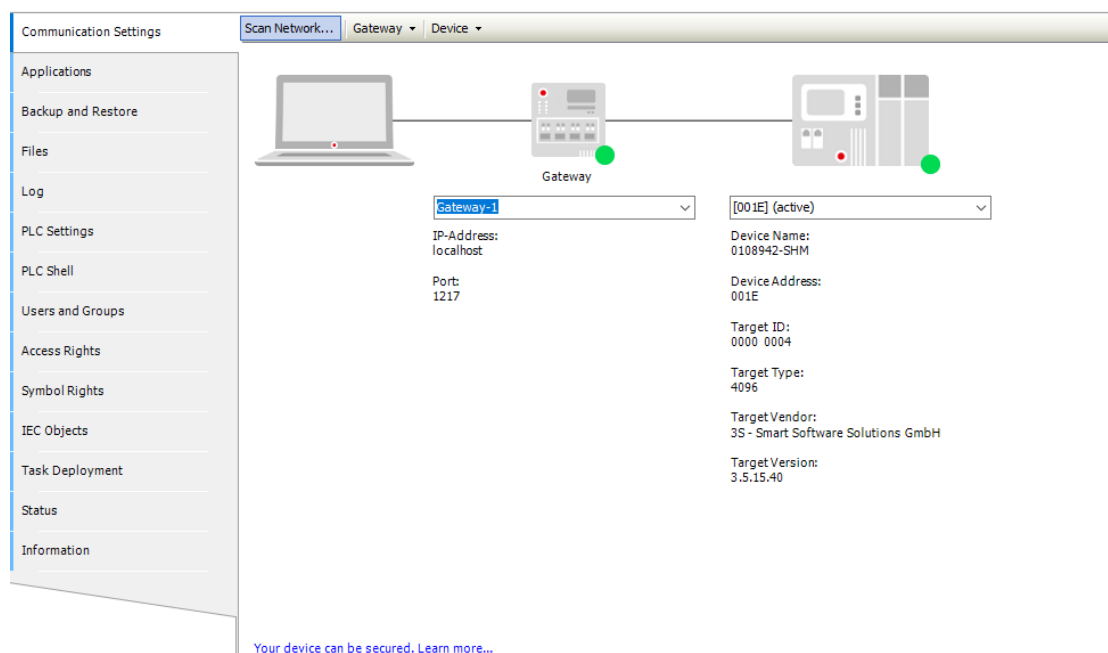
Step 1 Start the PLC: **CODESYS Control Win V3 - x64 SysTray**.

Step 2 Double click **Device (CODESYS Control Win V3 x64)** in the left navigation tree, and then click **Scan Network**.

Step 3 Select the device, click **Scan Network**, and select the network path.

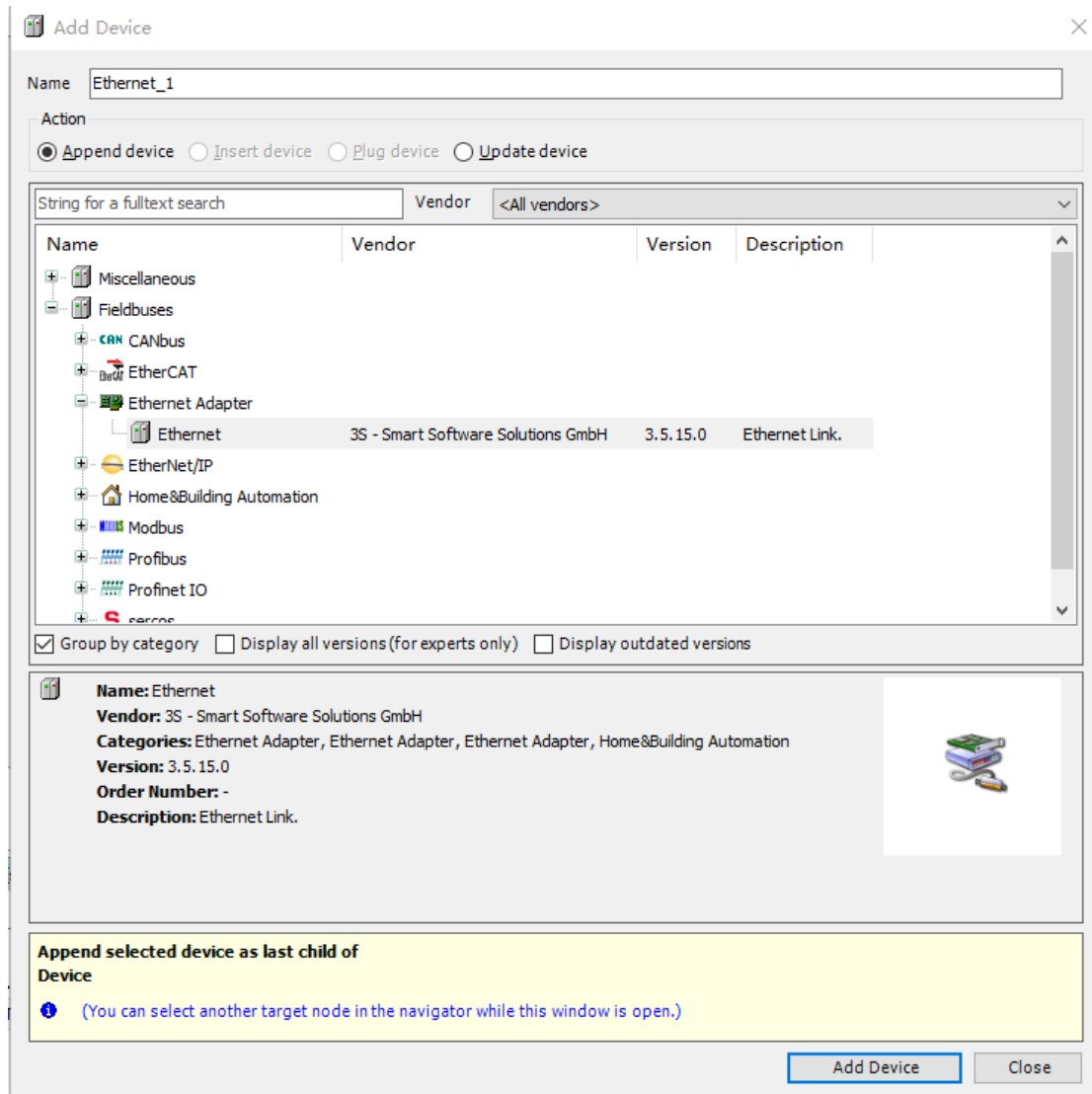


Step 4 Click **OK** to enter the interface as shown in the following figure. The network is in activated state.



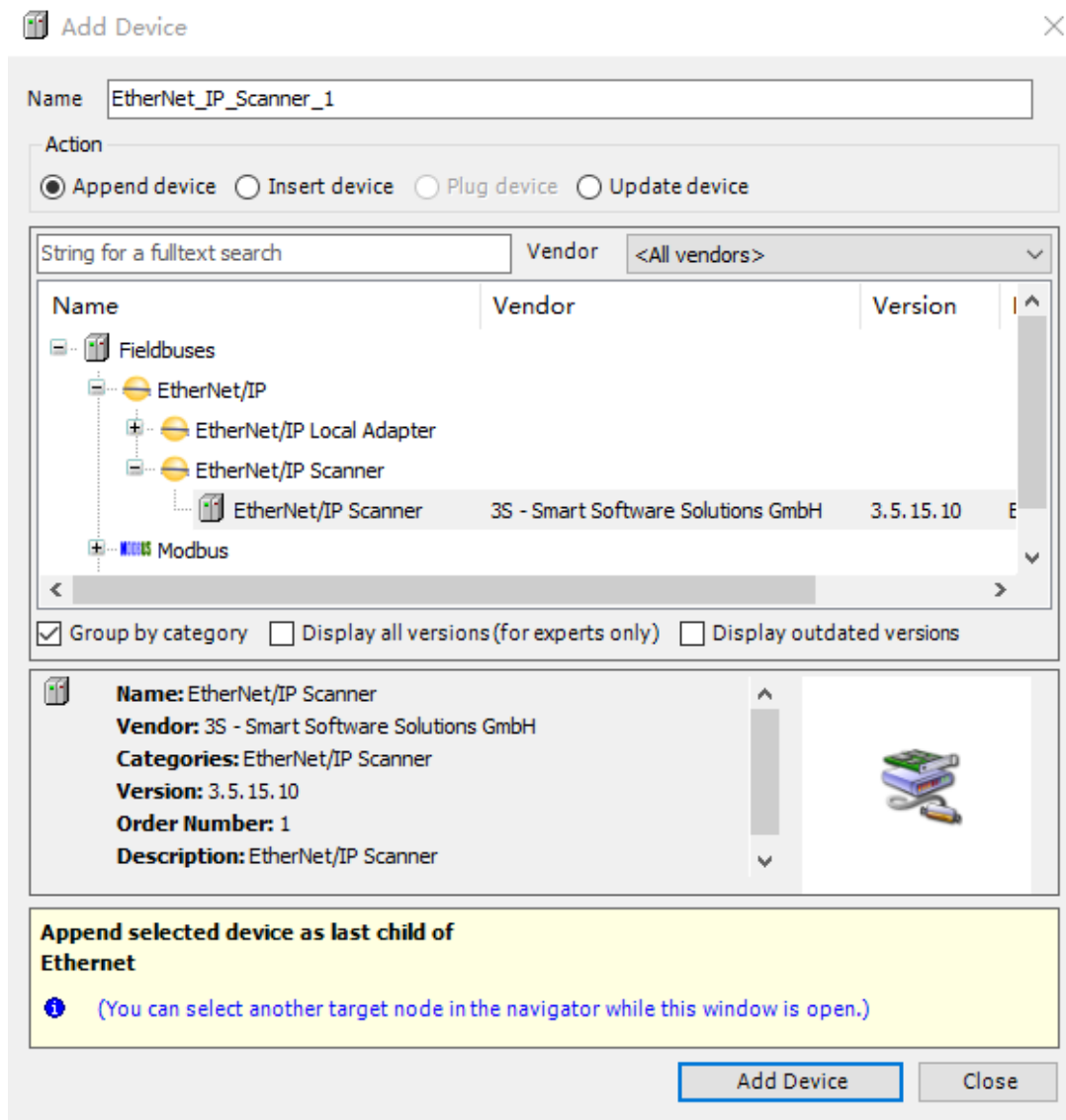
Step 5 Choose **Device (CODESYS Control Win V3 x64)** from the left navigation tree, right-click and choose **Add Device**.

Step 6 Choose **EthernetIP > Ethernet Adapter > Ethernet**. See the following figure.

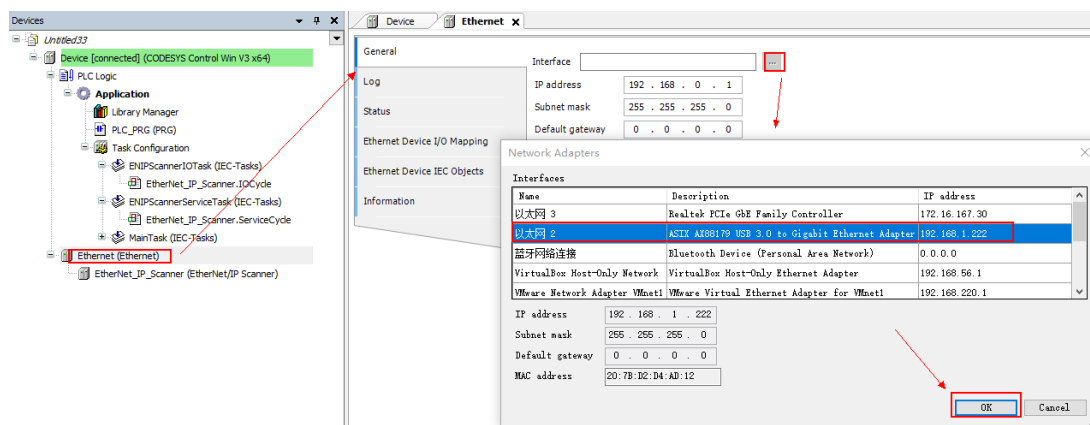


Step 7 Choose **Ethernet (Ethernet)** from the navigation tree on the left, right-click and choose **Add Device**.

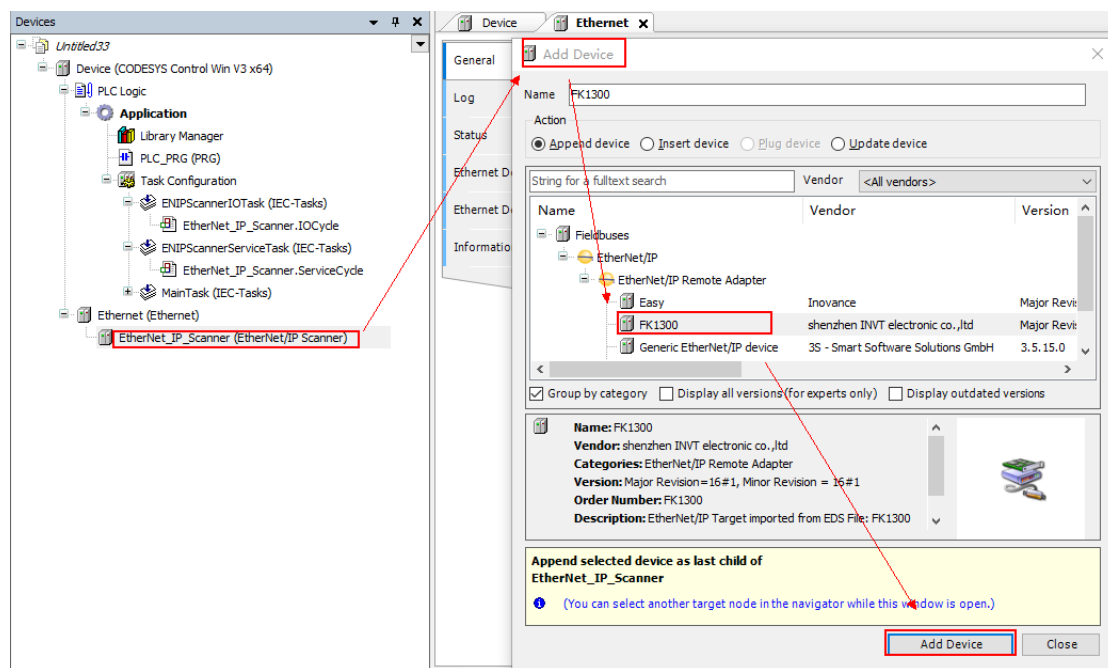
Step 8 Choose **EtherNetIP > EtherNet/IP Scanner > EtherNet/IP Scanner**. See the following figure.



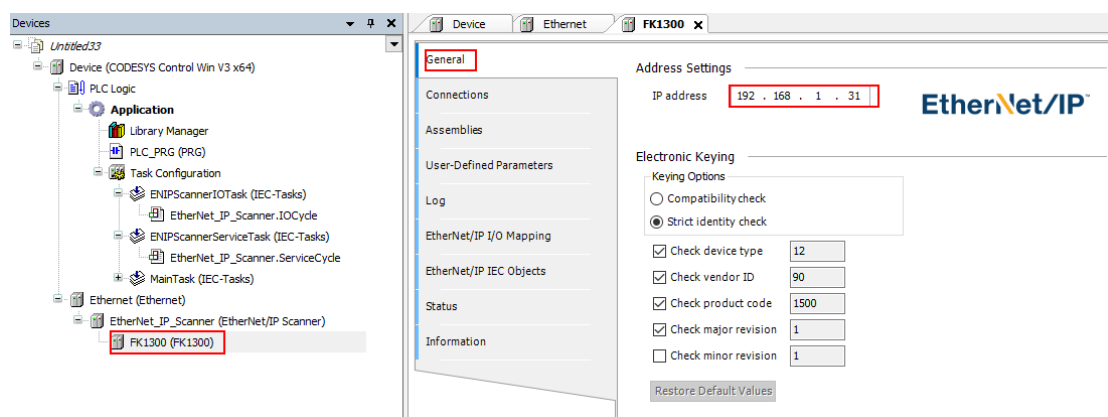
Step 9 Configure **EthernetIP**. Double-click **Ethernet (Ethernet)** in the left navigation tree to open the configuration window. On the **General** tab, click the right side of **Interface** and select the network adapter, as shown in the following figure.



Step 10 Add a device. Right-click **EtherNet\_IP\_Scanner** and choose **Add Device**. See the following figure.

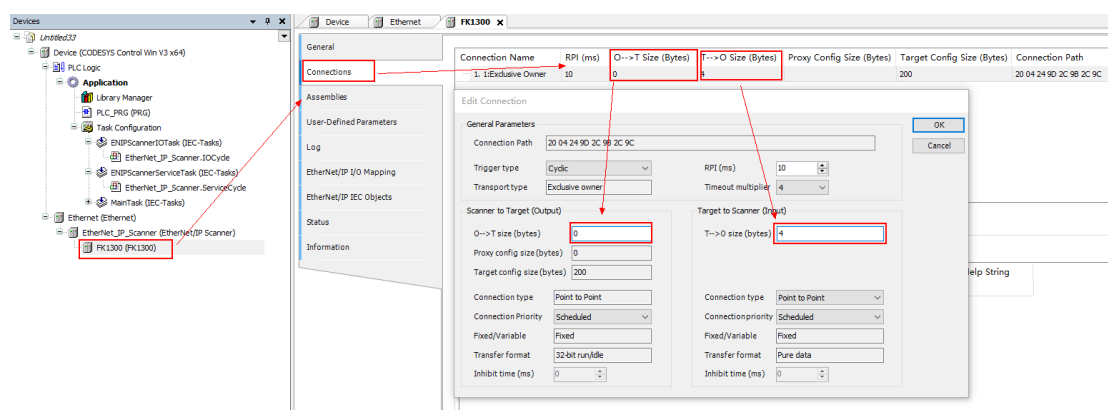


Step 11 After adding the device, configure the device communication parameters, setting the actual IP of the coupler. Ensure that the coupler and the Ethernet IP master are on the same network segment.



Step 12 Set device connection parameters.

Double click the device **FK1300**, open the device configuration window, and switch to the **Connection** page. See the following figure.



See Table 6-1 for the O→T size (bytes) and T→O size (bytes).

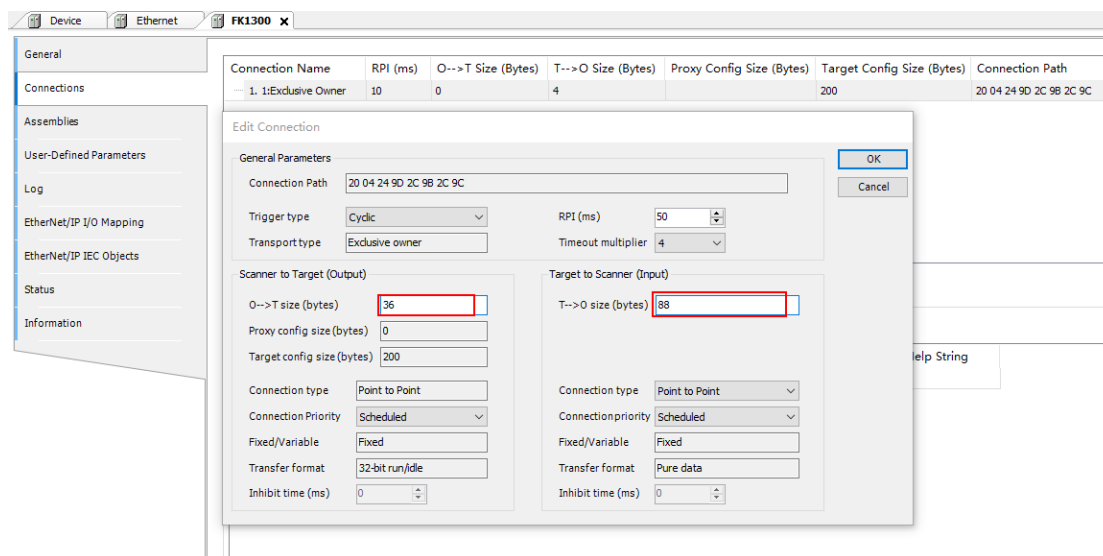
According to the actual IO module configuration, check the table.

| Type      | Model         | Slot | T→O size (Bytes) | O→T size (Bytes) |
|-----------|---------------|------|------------------|------------------|
| IO module | FK1300        | 0    | 4                | 0                |
|           | FL1002-3200DI | 1    | 4                | 0                |
|           | FL2103-0032DN | 2    | 0                | 4                |
|           | FL3203-4TC    | 3    | 16               | 0                |
|           | FL3003-4AD    | 4    | 8                | 0                |
|           | FL4003-4DA    | 5    | 0                | 8                |
|           | FL6112_2EI    | 6    | 34               | 10               |
|           | FL1001-1600DI | 7    | 2                | 0                |
|           | FL5005-1616DP | 8    | 2                | 2                |
|           | FL5105-1616DN | 9    | 2                | 2                |
|           | FL2201-0008DR | 10   | 0                | 2                |
|           | FL3103-4PT    | 11   | 16               | 0                |
|           | FL2003-0032DP | 12   | 0                | 4                |
|           | FL2002-0016DP | 13   | 0                | 2                |
|           | FL2102-0016DN | 14   | 0                | 2                |
| Summary   |               |      | 88               | 36               |

Calculate based on the preceding table: O→T size (bytes): 36

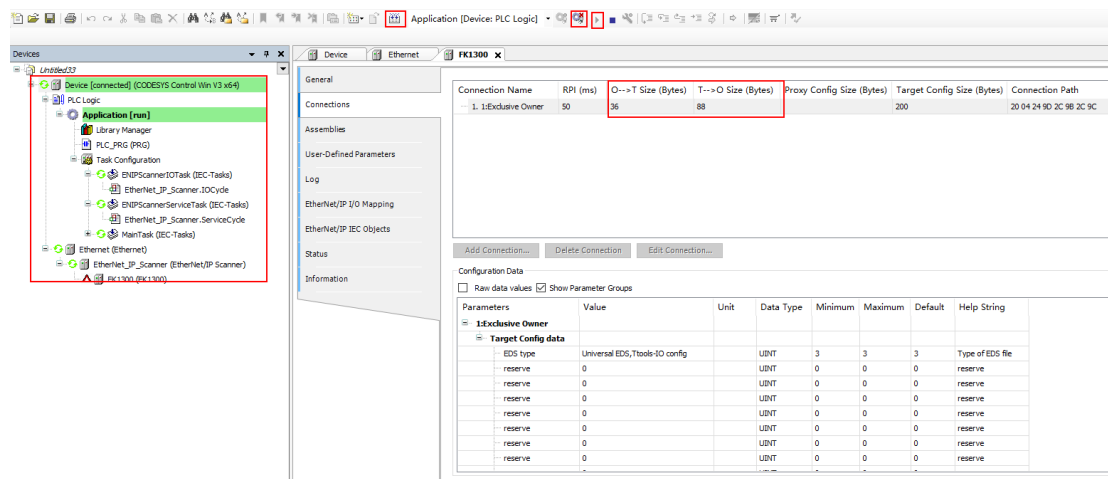
T→O size (Bytes): 88

The following figure shows the corresponding positions.





Step 13 Click **OK**. Then click the compile, download, and run buttons. See the following figure.



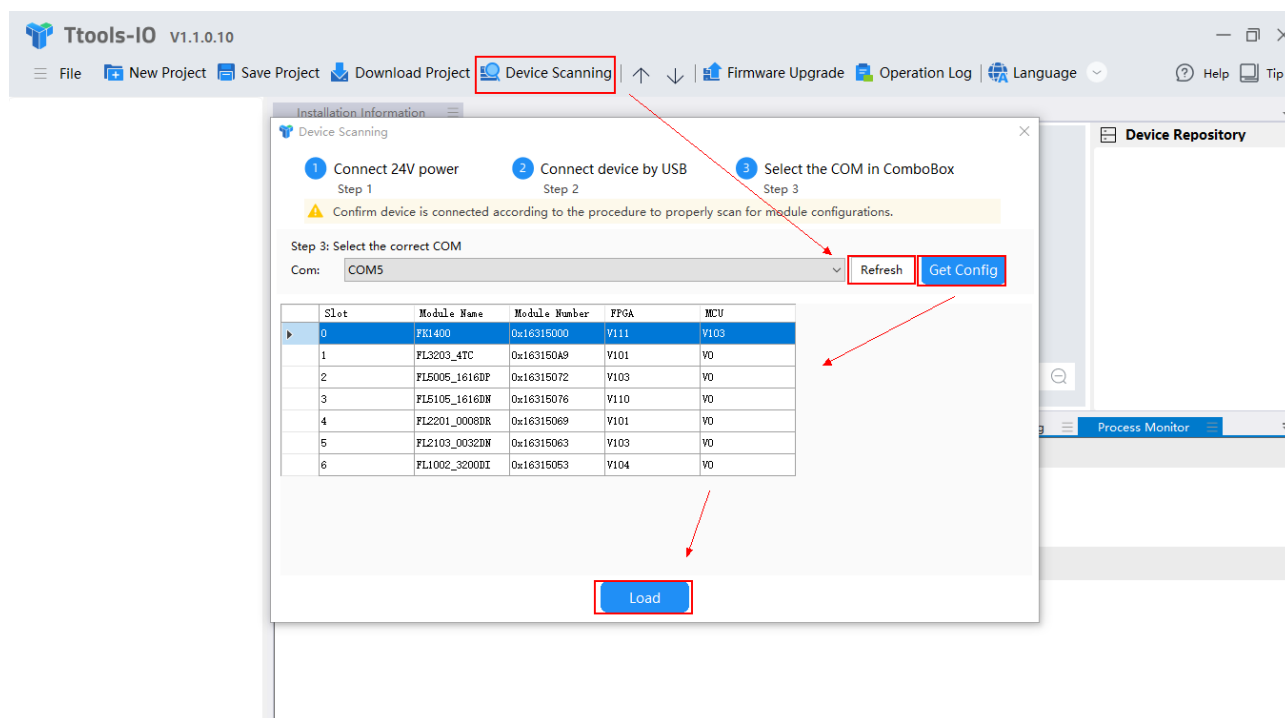
Step 14 Configuration is completed and the PLC program can be written and verified in practice.

## 6.4 ModbusTCP configuration

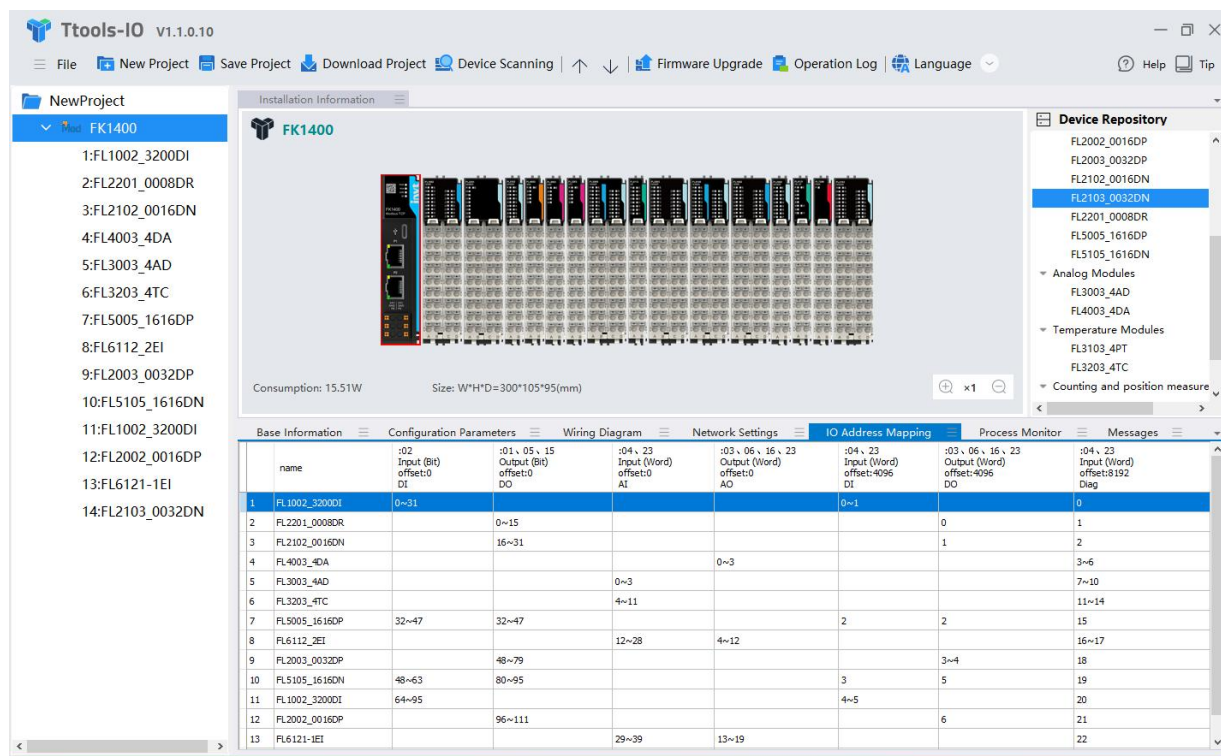
### 6.4.1 Ttools-IO upper computer configuration example

Use Ttools-IO to configure the FK1400. Note that the power must be turned on before connecting the type-C cable to the computer.

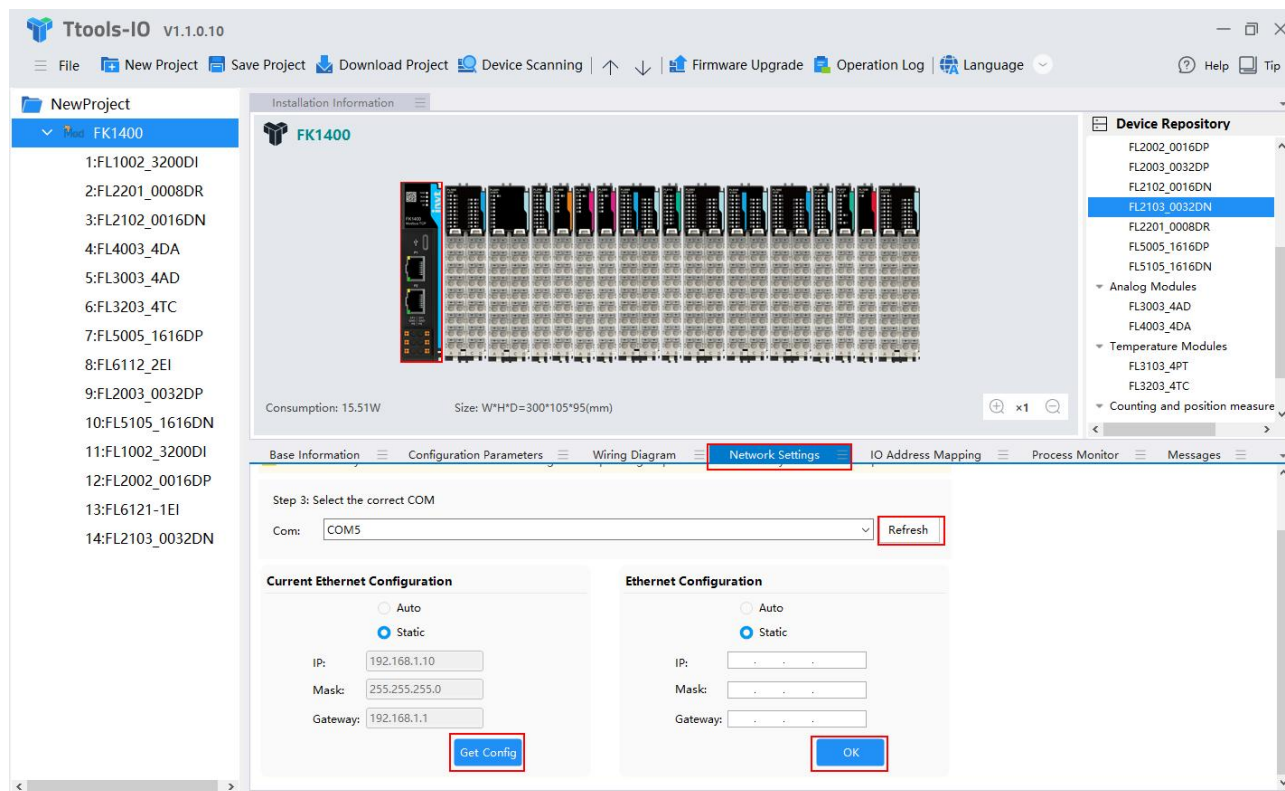
- Configuration reading



Click **Device Scanning** > **Refresh** to select the serial port corresponding to the device. Click **Get Config** to load the version information and slots of each module in the configuration. Then click **Load** to proceed to the next page.



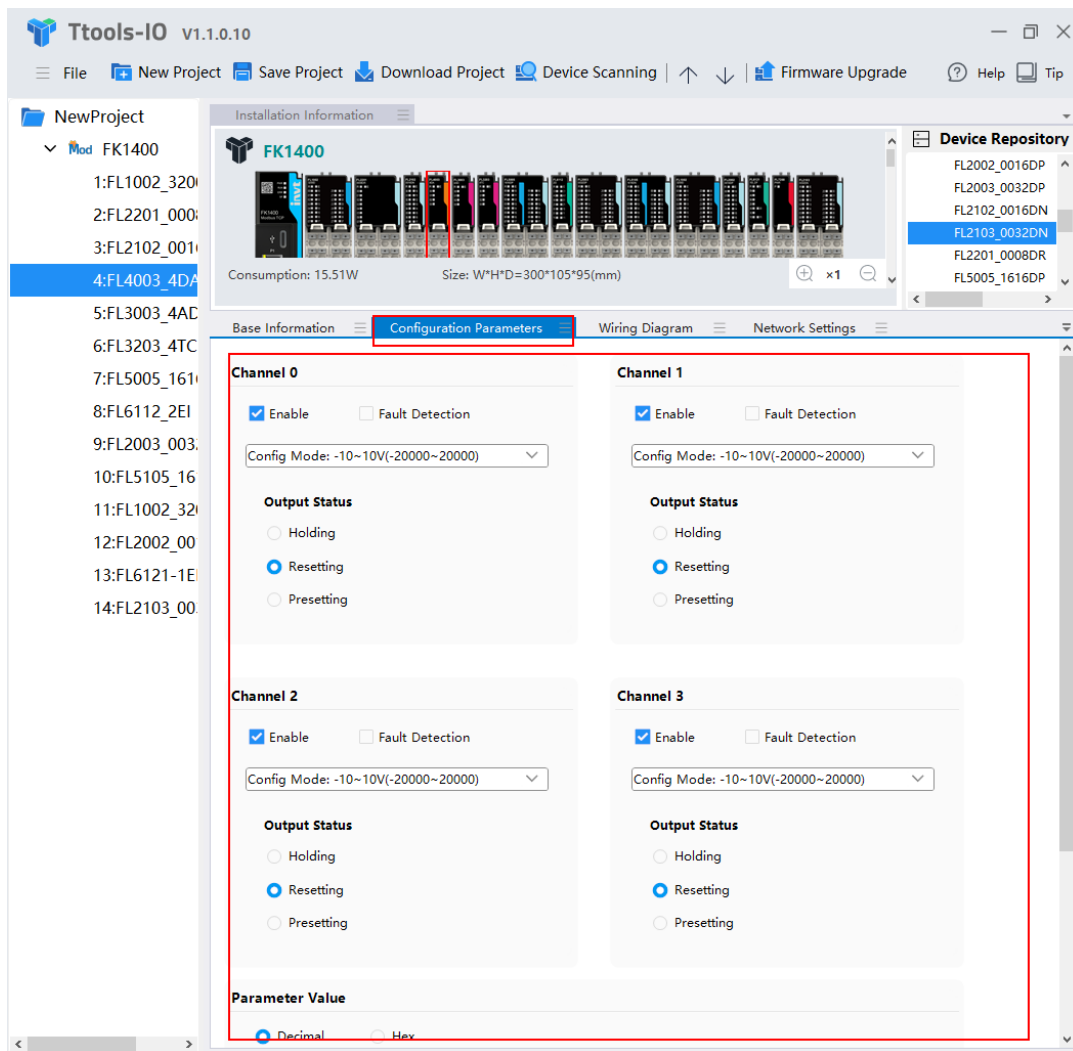
### ● IP configuration



Read: Click the **Get Config** button to load the device configuration information such as IP address, subnet mask, etc.

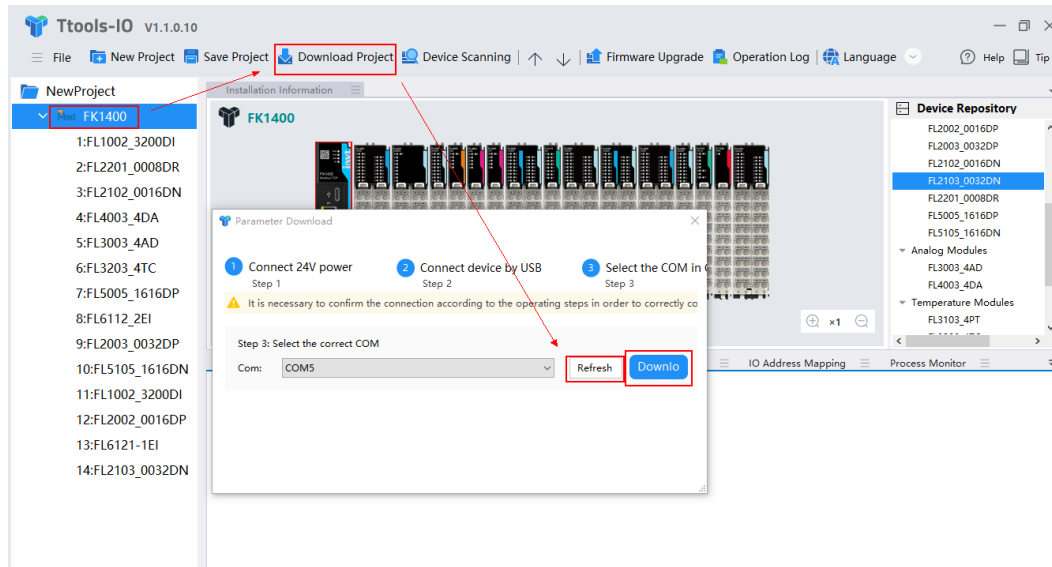
Modify: After entering the IP address, subnet mask, and gateway, click **OK**. The settings will take effect after the device is powered on again.

- Module parameter configuration



By clicking on each slot module in the configuration information column on the left, you can enter the **Configuration Parameters** interface to set parameters for each channel. After making the necessary modifications, use the **Download Project** function to download the settings to the coupler, which will then save the configuration information.

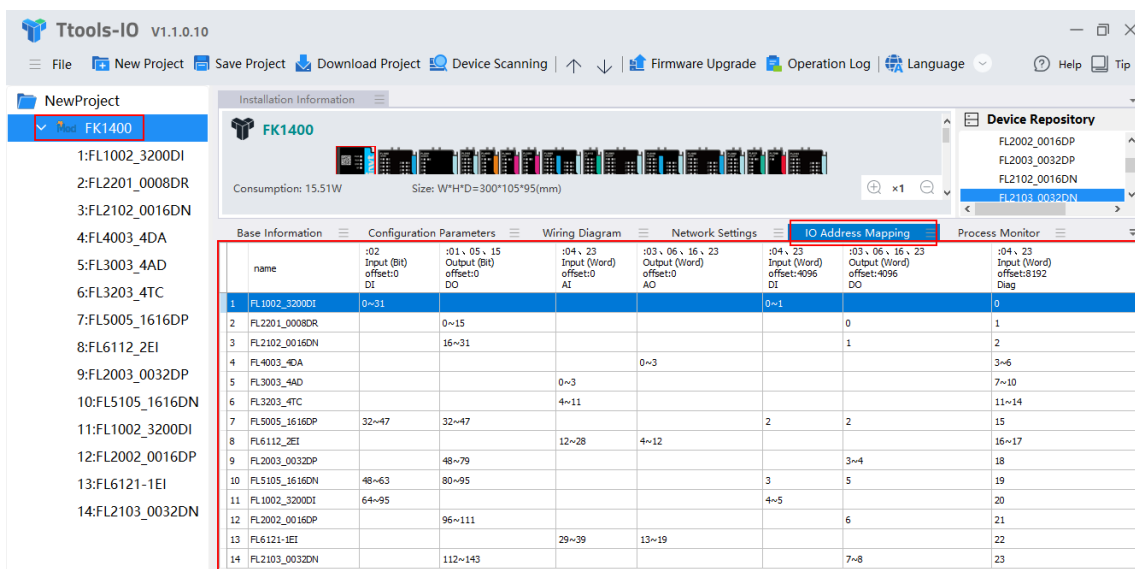
- Configuration writing



When all modules have been configured, click in the order shown in the above diagram to write the configuration settings and module configurations to the coupler.

If the configuration information does not match the actual configuration, the SF indicator on the coupler will illuminate to indicate a configuration mismatch. Please carefully verify that the configuration information on the left side of the diagram above matches the actual configuration.

- Address mapping table



**Note:** The Address mapping table requires reference to Appendix A for operation.

## 6.4.2 Module configuration application example

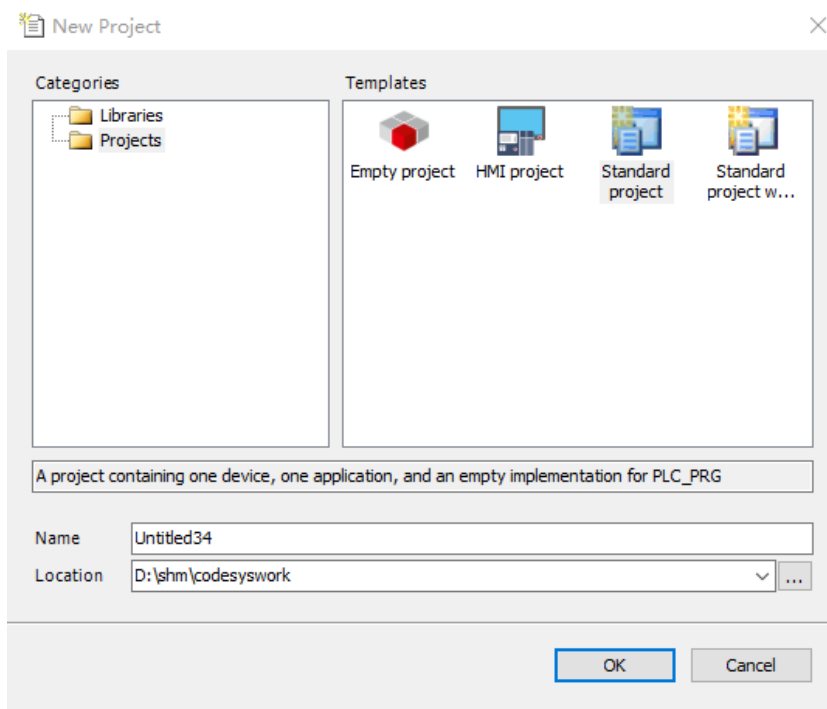
### 6.4.2.1 Codesys configuration example

- Environment

Perform the configuration operation according to the Ttools-IO setup. Power on the coupler and connect the network cable to the computer. Ensure that the IP address of the coupler and the IP address of the computer are in the same subnet. The computer should be pre-installed with the software "CODESYS V3.5, CODESYS Control Win V3 - x64 SysTray".

- Creating a new project

Log in to CODESYS, click **File > New Project**, enter a name, and click **OK**, as shown in the figure below.

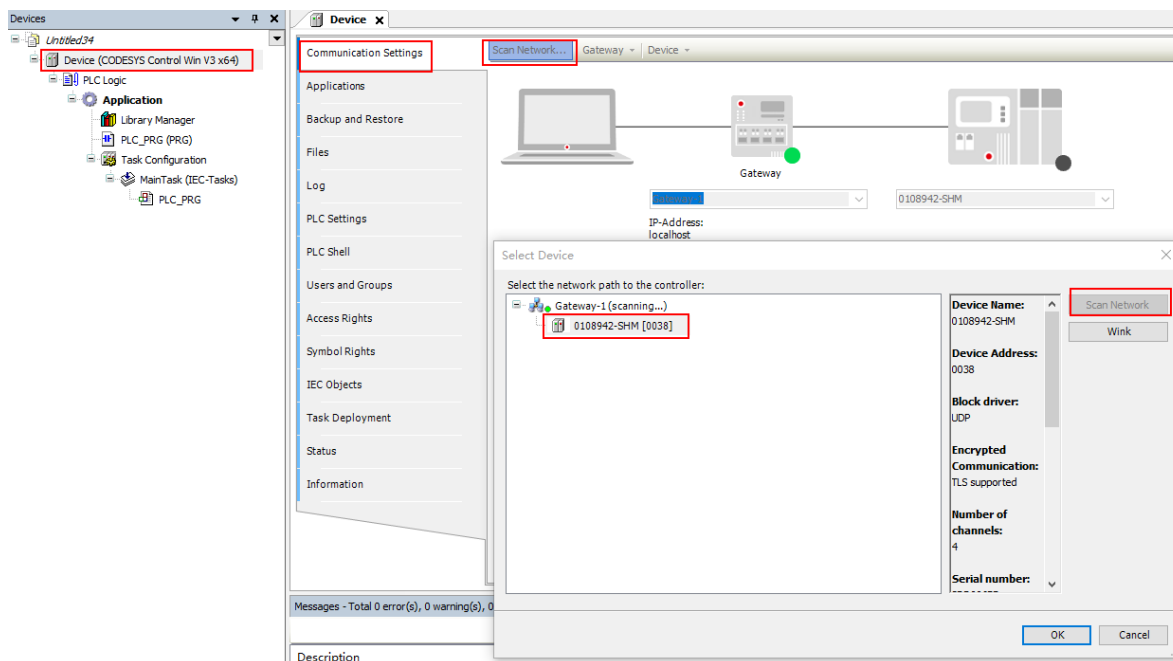


- Scanning network

Step 1 Use "CODESYS Control Win V3 - x64 SysTray" to start the PLC. Locate "CODESYS Control Win V3 - x64 SysTray" in the bottom right corner of the computer, right-click it, and select **Start PLC**.

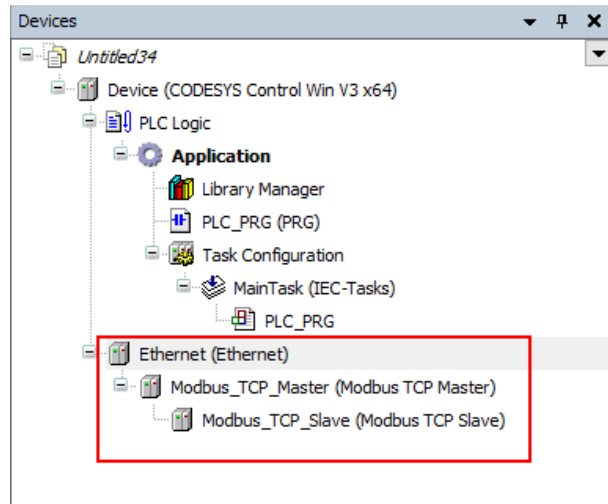
Step 2 Double-click **Device (CODESYS Control Win V3 X64)** in the left navigation tree of CODESYS, and then click on **Scan Network**.

Step 3 Select the device and choose the correct network path to the controller, as shown in the following figure.

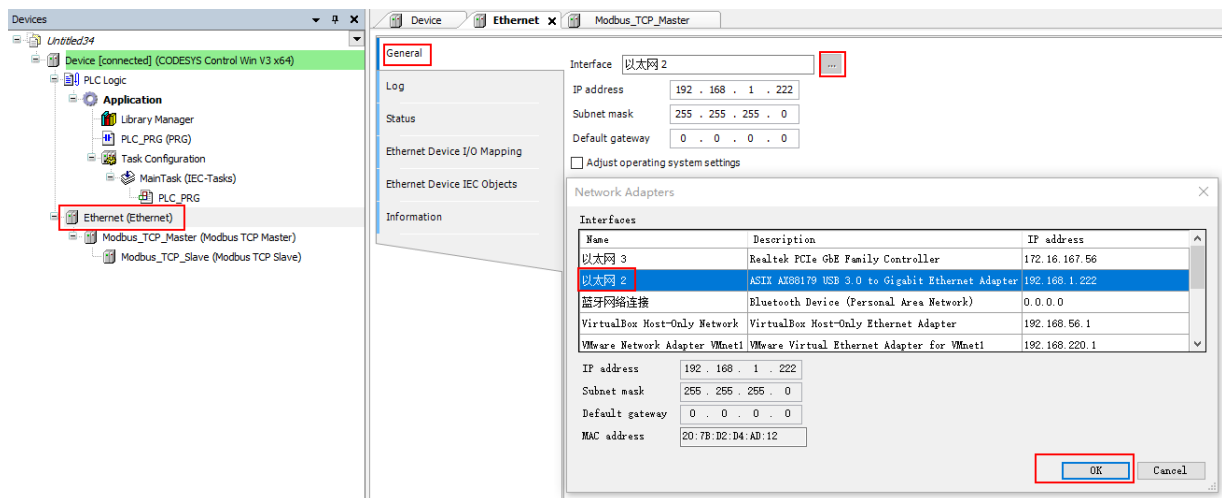


- Adding devices
  - Add Ethernet.
  - Add a ModbusTCP master node.
  - Add a ModbusTCP slave node.

After adding, it appears as shown in the following figure.

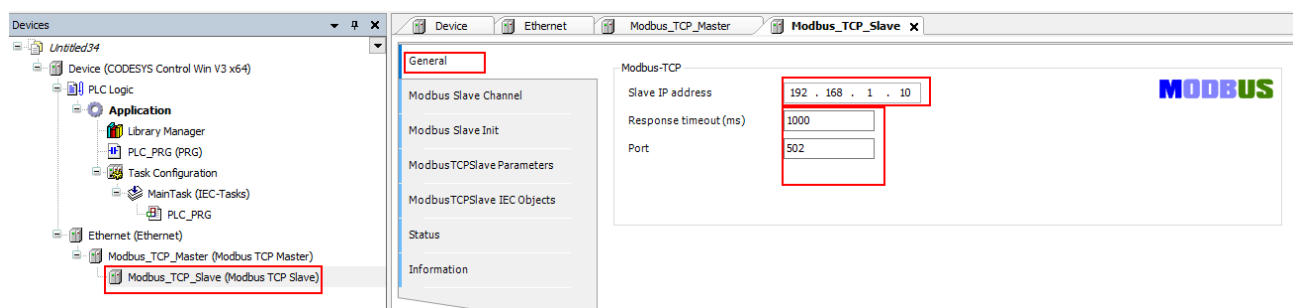


#### ✧ Ethernet configuration



#### ✧ ModbusTCP slave node configuration

##### 1) Configuring the network

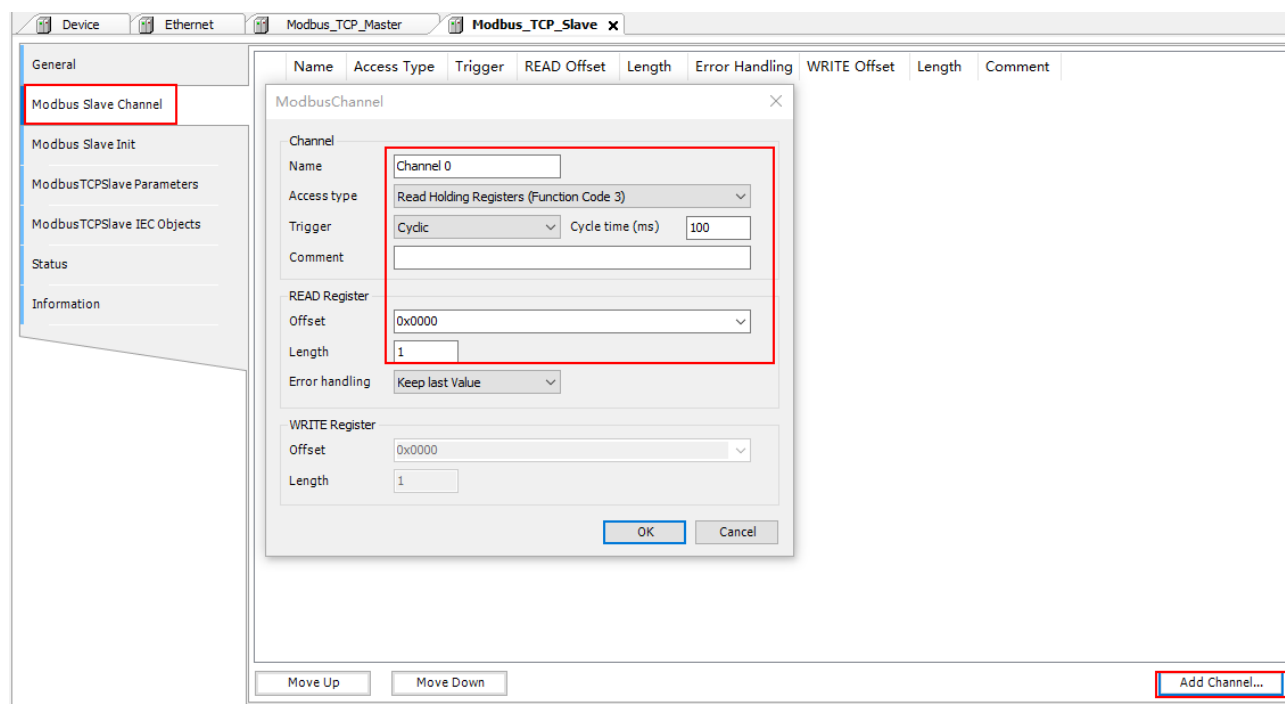


## 2) Configuring the channel

Step 1 With the Ttools-IO software, you can view the topology structure's IO module address mapping table. This table displays the function code for each module, the starting address offset, and the corresponding monitoring address range for the module, as shown in the following figure.

|    | Base Information | Configuration Parameters             | Wiring Diagram                              | Network Settings                         | IO Address Mapping                              | Process Monitor                             | Messages                                           |                                               |
|----|------------------|--------------------------------------|---------------------------------------------|------------------------------------------|-------------------------------------------------|---------------------------------------------|----------------------------------------------------|-----------------------------------------------|
|    | name             | :02<br>Input (Bit)<br>offset:0<br>DI | :01、05、15<br>Output (Bit)<br>offset:0<br>DO | :04、23<br>Input (Word)<br>offset:0<br>AI | :03、06、16、23<br>Output (Word)<br>offset:0<br>AO | :04、23<br>Input (Word)<br>offset:4096<br>DI | :03、06、16、23<br>Output (Word)<br>offset:4096<br>DO | :04、23<br>Input (Word)<br>offset:8192<br>Diag |
| 1  | FL1002_3200DI    | 0~31                                 |                                             |                                          |                                                 | 0~1                                         |                                                    | 0                                             |
| 2  | FL2201_0008DR    |                                      | 0~15                                        |                                          |                                                 |                                             | 0                                                  | 1                                             |
| 3  | FL2102_0016DN    |                                      | 16~31                                       |                                          |                                                 |                                             | 1                                                  | 2                                             |
| 4  | FL4003_4DA       |                                      |                                             |                                          | 0~3                                             |                                             |                                                    | 3~6                                           |
| 5  | FL3003_4AD       |                                      |                                             | 0~3                                      |                                                 |                                             |                                                    | 7~10                                          |
| 6  | FL3203_4TC       |                                      |                                             | 4~11                                     |                                                 |                                             |                                                    | 11~14                                         |
| 7  | FL5005_1616DP    | 32~47                                | 32~47                                       |                                          |                                                 | 2                                           | 2                                                  | 15                                            |
| 8  | FL6112_2EI       |                                      |                                             | 12~28                                    | 4~12                                            |                                             |                                                    | 16~17                                         |
| 9  | FL2003_0032DP    |                                      | 48~79                                       |                                          |                                                 |                                             | 3~4                                                | 18                                            |
| 10 | FL5105_1616DN    | 48~63                                | 80~95                                       |                                          |                                                 | 3                                           | 5                                                  | 19                                            |
| 11 | FL1002_3200DI    | 64~95                                |                                             |                                          |                                                 | 4~5                                         |                                                    | 20                                            |
| 12 | FL2002_0016DP    |                                      | 96~111                                      |                                          |                                                 |                                             | 6                                                  | 21                                            |
| 13 | FL6121-1EI       |                                      |                                             | 29~39                                    | 13~19                                           |                                             |                                                    | 22                                            |
| 14 | FL2103_0032DN    |                                      | 112~143                                     |                                          |                                                 |                                             | 7~8                                                | 23                                            |

Step 2 On the left side of the Modbus\_TCP\_Slave page, click **Modbus Slave Channel**, then click **Add Channel** to open the Channel 0 configuration window, as shown in the following figure.



Step 3 The digital input modules FL1002\_3200DI, FL5005\_1616DP, FL5105\_1616DN, and FL1002\_3200DI have a function code of 02 corresponding to DI (Input Bit), with an offset address of 0x00 and address ranges of 0–31, 32–47, 48–63, and 64–95, totaling 96 bits. In the Channel 0 configuration window, set the Access type to **Read Discrete Inputs (Function Code 2)**, set the **READ Register Offset** to 0 and **Length** to 96, and click **OK**, as shown in the following figure. (You can also customize the offset address and length based on actual needs by referring to the IO module address mapping table.)

Step 4 The digital output modules FL2201\_0008DR, FL2102\_0016DN, FL5005\_1616DP, FL2003\_0032DP, FL5105\_1616DN, FL2002\_0016DP, and FL2103\_0032DN correspond to an address range of 0–8 when using the Output (Word) write function. When configuring Channel 1, set the Access type to **Write Multiple Registers (Function Code 16)** and set the **WRITE Register Offset** to 4096 and **Length** of 9, as shown in the following figure.

| Name        | Access Type                             | Trigger         | READ Offset | Length | Error Handling  | WRITE Offset | Length | Comment |
|-------------|-----------------------------------------|-----------------|-------------|--------|-----------------|--------------|--------|---------|
| 0 Channel 0 | Read Discrete Inputs (Function Code 02) | Cyclic, t#100ms | 16#0000     | 96     | Keep last Value |              |        |         |

**Note:** If the Output (Word) write function is used, the Output (Bit) write operation cannot be performed simultaneously. Otherwise, multiple write operations to the same output point may cause conflicts.



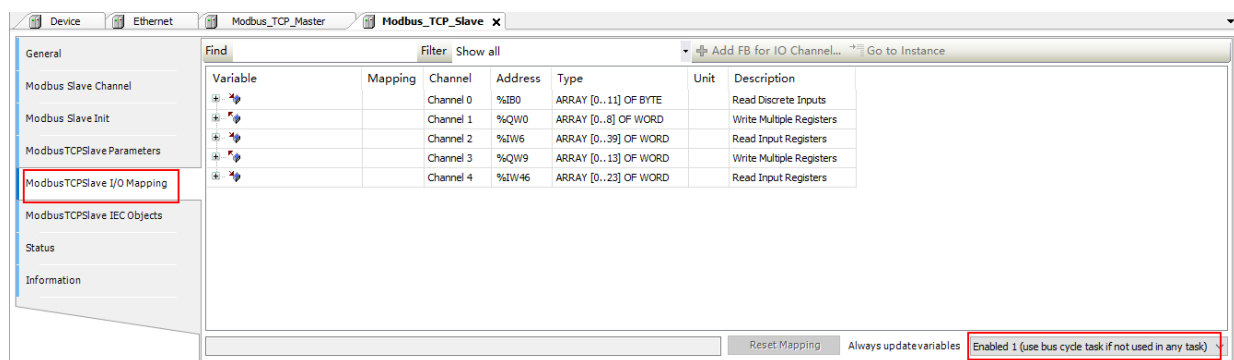
Configure the other channels in sequence as follows:

| Device                     | Ethernet | Modbus_TCP_Master | Modbus_TCP_Slave |
|----------------------------|----------|-------------------|------------------|
| General                    |          |                   |                  |
| Modbus Slave Channel       |          |                   |                  |
| Modbus Slave Init          |          |                   |                  |
| ModbusTCPSlave Parameters  |          |                   |                  |
| ModbusTCPSlave I/O Mapping |          |                   |                  |
| ModbusTCPSlave IEC Objects |          |                   |                  |

| Name        | Access Type                                 | Trigger         | READ Offset | Length | Error Handling  | WRITE Offset | Length | Comment |
|-------------|---------------------------------------------|-----------------|-------------|--------|-----------------|--------------|--------|---------|
| 0 Channel 0 | Read Discrete Inputs (Function Code 02)     | Cyclic, t#100ms | 16#0000     | 96     | Keep last Value |              |        |         |
| 1 Channel 1 | Write Multiple Registers (Function Code 16) | Cyclic, t#100ms |             |        |                 | 16#1000      | 9      |         |
| 2 Channel 2 | Read Input Registers (Function Code 04)     | Cyclic, t#100ms | 16#0000     | 40     | Keep last Value |              |        |         |
| 3 Channel 3 | Write Multiple Registers (Function Code 16) | Cyclic, t#100ms |             |        |                 | 16#0000      | 14     |         |
| 4 Channel 4 | Read Input Registers (Function Code 04)     | Cyclic, t#100ms | 16#2000     | 24     | Keep last Value |              |        |         |

- Verifying

Step 1 On the left side of the Modbus\_TCP\_Slave page, click **ModbusTCPSlave I/O Mapping** to monitor the IO modules. In the lower right corner, select **Enabled 1** for **Always update variables**, as shown in the following figure.



Step 2 On the menu bar, click **Build > Build** to start the compilation process.

Step 3 On the menu bar, click **Online > Login** or click the login icon to log in.

Step 4 On the menu bar, click **Online > Multiple Download**, select **Always perform a full download**, and click **OK**.

Step 5 Click the start icon to perform the verification test.

Modify the output value for a simple verification.

| General                    | Find     | Filter  | Show all     | Add FB for IO Channel... Go to Instance |                       |               |                |        |                          |
|----------------------------|----------|---------|--------------|-----------------------------------------|-----------------------|---------------|----------------|--------|--------------------------|
| Modbus Slave Channel       | Variable | Mapping | Channel      | Address                                 | Type                  | Current Value | Prepared Value | Unit   | Description              |
| Modbus Slave Init          |          |         | Channel 0    | %IB0                                    | ARRAY [0..11] OF BYTE |               |                |        | Read Discrete Inputs     |
| ModbusTCPSlave Parameters  |          |         | Channel 1    | %QW0                                    | ARRAY [0..8] OF WORD  |               |                |        | Write Multiple Registers |
| ModbusTCPSlave I/O Mapping |          |         | Channel 1[0] | %QW0                                    | WORD                  | 0             |                | 0x1000 |                          |
| ModbusTCPSlave IEC Objects |          |         | Channel 1[1] | %QW1                                    | WORD                  | 0             |                | 0x1001 |                          |
| Status                     |          |         | Channel 1[2] | %QW2                                    | WORD                  | 0             |                | 0x1002 |                          |
|                            |          |         | Channel 1[3] | %QW3                                    | WORD                  | 0             |                | 0x1003 |                          |
|                            |          |         | Channel 1[4] | %QW4                                    | WORD                  | 0             |                | 0x1004 |                          |
|                            |          |         | Channel 1[5] | %QW5                                    | WORD                  | 0             |                | 0x1005 |                          |
|                            |          |         | Channel 1[6] | %QW6                                    | WORD                  | 0             |                | 0x1006 |                          |

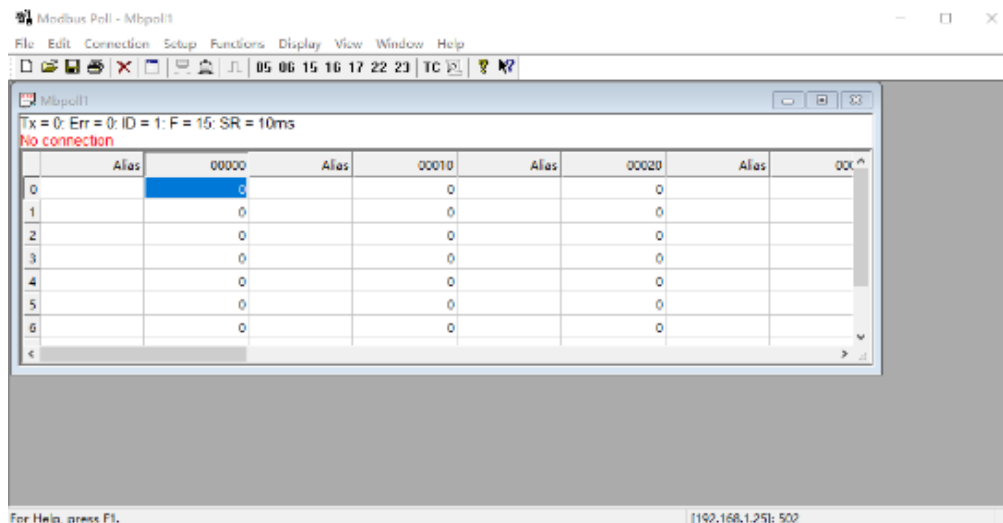
### 6.4.2.2 Modbus Poll example

- Environment

Perform the configuration operation according to the Ttools-IO setup. Power on the coupler and connect the network cable to the computer. Ensure that the IP address of the coupler and the IP address of the computer are in the same subnet. The computer should be pre-installed with the software "Modbus Poll".

- Module connection

Step 1 Open the Modbus Poll software, and the main window is shown in the following figure.



Tx = 0 indicates the number of data frames sent to the master node, which is 0 in the figure.

Err = 0 indicates the number of communication errors, which is 0 in the figure.

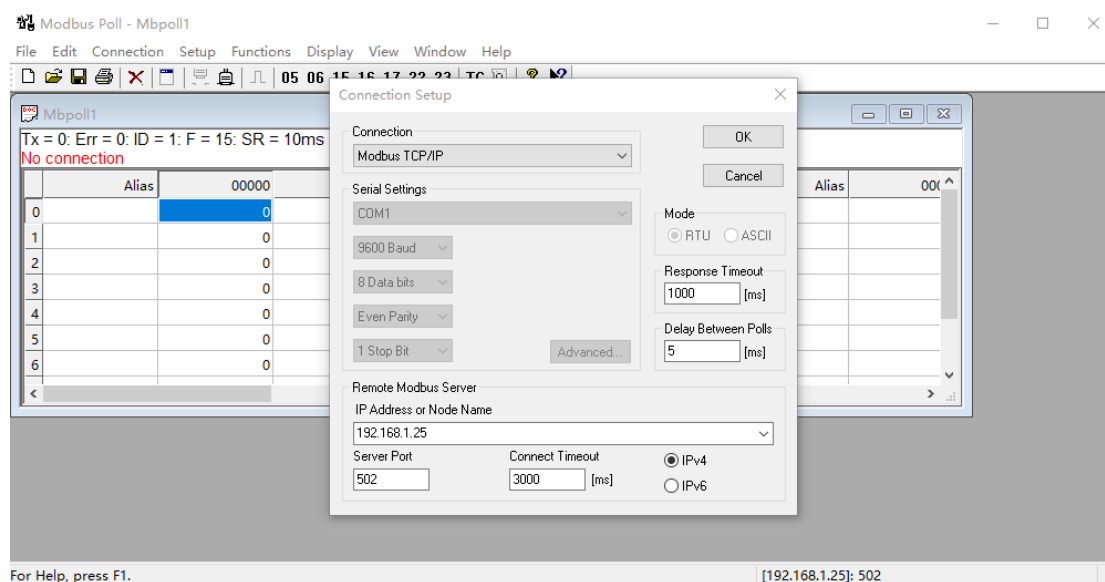
ID = 1 indicates the device address of the simulated Modbus slave device, which is 1 in the figure.

F = 15 indicates the Modbus function code being used, which is function code 15 in the figure.

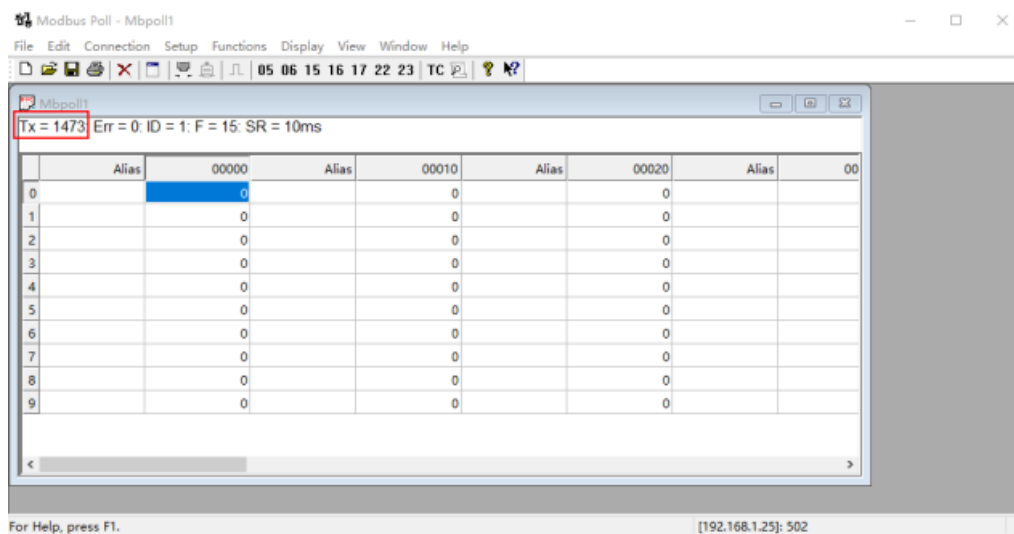
SR = 10ms indicates the scan period, and the red text indicates the current error status.

"No Connection" indicates a disconnected status.

Step 2 On the menu bar, click **Connection** > **Connect** to open the **Connection setup** window. In the **Connection** options, select **Modbus TCP/IP**, which is the communication protocol used by Modbus TCP. Enter the IP address of the coupler in the IP address field, and then click **OK**, as shown in the following figure.



Step 3 After the connection is established, Tx will continue to increase. See the following figure.



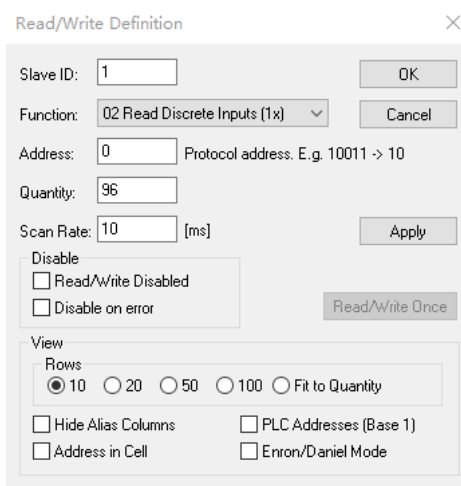
- Channel settings and monitoring

Step 1 With the Ttools-IO software, you can view the topology structure's IO module address mapping table. This table displays the function code for each module, the starting address offset, and the corresponding monitoring address range for the module, as shown in the following figure.

|    | 名称            | 功能码:02<br>Input (Bit)<br>offset:0<br>DI | 功能码:01、05、15<br>Output (Bit)<br>offset:0<br>DO | 功能码:04、23<br>Input (Word)<br>offset:0<br>AI | 功能码:03、06、16、23<br>Output (Word)<br>offset:0<br>AO | 功能码:04、23<br>Input (Word)<br>offset:4096<br>DI | 功能码:03、06、16、23<br>Output (Word)<br>offset:4096<br>DO | 功能码:04、23<br>Input (Word)<br>offset:8192<br>DI |
|----|---------------|-----------------------------------------|------------------------------------------------|---------------------------------------------|----------------------------------------------------|------------------------------------------------|-------------------------------------------------------|------------------------------------------------|
| 1  | FL1002_3200DI | 0~31                                    |                                                |                                             |                                                    | 0~1                                            |                                                       | 0                                              |
| 2  | FL2201_0008DR |                                         | 0~15                                           |                                             |                                                    |                                                | 0                                                     | 1                                              |
| 3  | FL2102_0016DN |                                         | 16~31                                          |                                             |                                                    |                                                | 1                                                     | 2                                              |
| 4  | FL4003_4DA    |                                         |                                                |                                             | 0~3                                                |                                                |                                                       | 3~6                                            |
| 5  | FL3003_4AD    |                                         |                                                | 0~3                                         |                                                    |                                                |                                                       | 7~10                                           |
| 6  | FL3203_4TC    |                                         |                                                | 4~11                                        |                                                    |                                                |                                                       | 11~14                                          |
| 7  | FL5005_1616DP | 32~47                                   | 32~47                                          |                                             |                                                    | 2                                              | 2                                                     | 15                                             |
| 8  | FL6112_2EI    |                                         |                                                | 12~28                                       | 4~8                                                |                                                |                                                       | 16~17                                          |
| 9  | FL2003_0032DP |                                         | 48~79                                          |                                             |                                                    |                                                | 3~4                                                   | 18                                             |
| 10 | FL5105_1616DN | 48~63                                   | 80~95                                          |                                             |                                                    | 3                                              | 5                                                     | 19                                             |
| 11 | FL1002_3200DI | 64~95                                   |                                                |                                             |                                                    | 4~5                                            |                                                       | 20                                             |
| 12 | FL2002_0016DP |                                         | 96~111                                         |                                             |                                                    |                                                | 6                                                     | 21                                             |
| 13 | FL6121-1EI    |                                         |                                                | 29~39                                       | 9~13                                               |                                                |                                                       | 22                                             |
| 14 | FL2103_0032DN |                                         | 112~143                                        |                                             |                                                    |                                                | 7~8                                                   | 23                                             |

Step 2 Configure the channels as follows according to the table above:

A. Function code 2, Input (bit), offset: 0, length: 96



## B. Function code 15, Output(bit), offset: 0, length: 144

Read/Write Definition

Slave ID:  OK Cancel

Function:  OK Cancel

Address:  Protocol address. E.g. 10011 -> 10

Quantity:

Scan Rate:  [ms] Apply

Disable  
☐ Read/Write Disabled  
☐ Disable on error

Read/Write Once

View  
Rows  
☒ 10 ☐ 20 ☐ 50 ☐ 100 ☐ Fit to Quantity  
☐ Hide Alias Columns ☐ PLC Addresses (Base 1)  
☐ Address in Cell ☐ Enron/Daniel Mode

## C. Function code 04, Input(Word), offset: 0, length: 40

Read/Write Definition

Slave ID:  OK Cancel

Function:  OK Cancel

Address:  Protocol address. E.g. 30011 -> 10

Quantity:

Scan Rate:  [ms] Apply

Disable  
☐ Read/Write Disabled  
☐ Disable on error

Read/Write Once

View  
Rows  
☒ 10 ☐ 20 ☐ 50 ☐ 100 ☐ Fit to Quantity  
☐ Hide Alias Columns ☐ PLC Addresses (Base 1)  
☐ Address in Cell ☐ Enron/Daniel Mode

## D. Function code 16, Output(Word), offset: 0, length: 14

Read/Write Definition

Slave ID:  OK Cancel

Function:  OK Cancel

Address:  Protocol address. E.g. 40011 -> 10

Quantity:

Scan Rate:  [ms] Apply

Disable  
☐ Read/Write Disabled  
☐ Disable on error

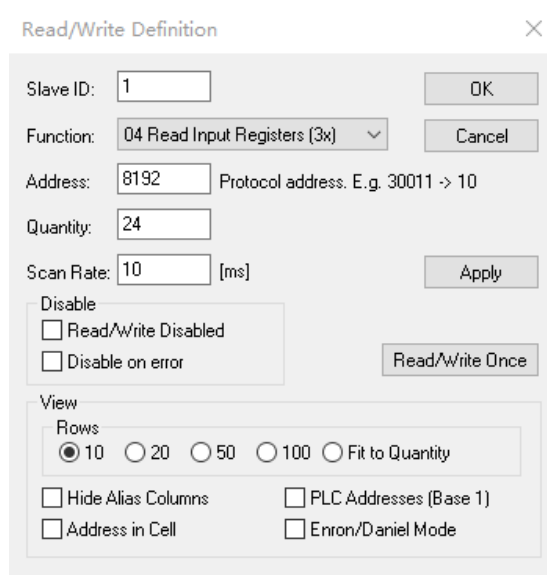
Read/Write Once

View  
Rows  
☒ 10 ☐ 20 ☐ 50 ☐ 100 ☐ Fit to Quantity  
☐ Hide Alias Columns ☐ PLC Addresses (Base 1)  
☐ Address in Cell ☐ Enron/Daniel Mode

**Note:** Input (Word), offset: 4096; and Output (Word), offset: 4096 are the digital Word access mappings. They correspond to the same signals as Input (Bit), offset: 0; and Output (Bit), offset: 0. Generally, use them as needed, but do not access both Bit and Word simultaneously. Concurrent write operations on outputs may lead to conflicts.

Step 3 Configure the diagnostic information as follows:

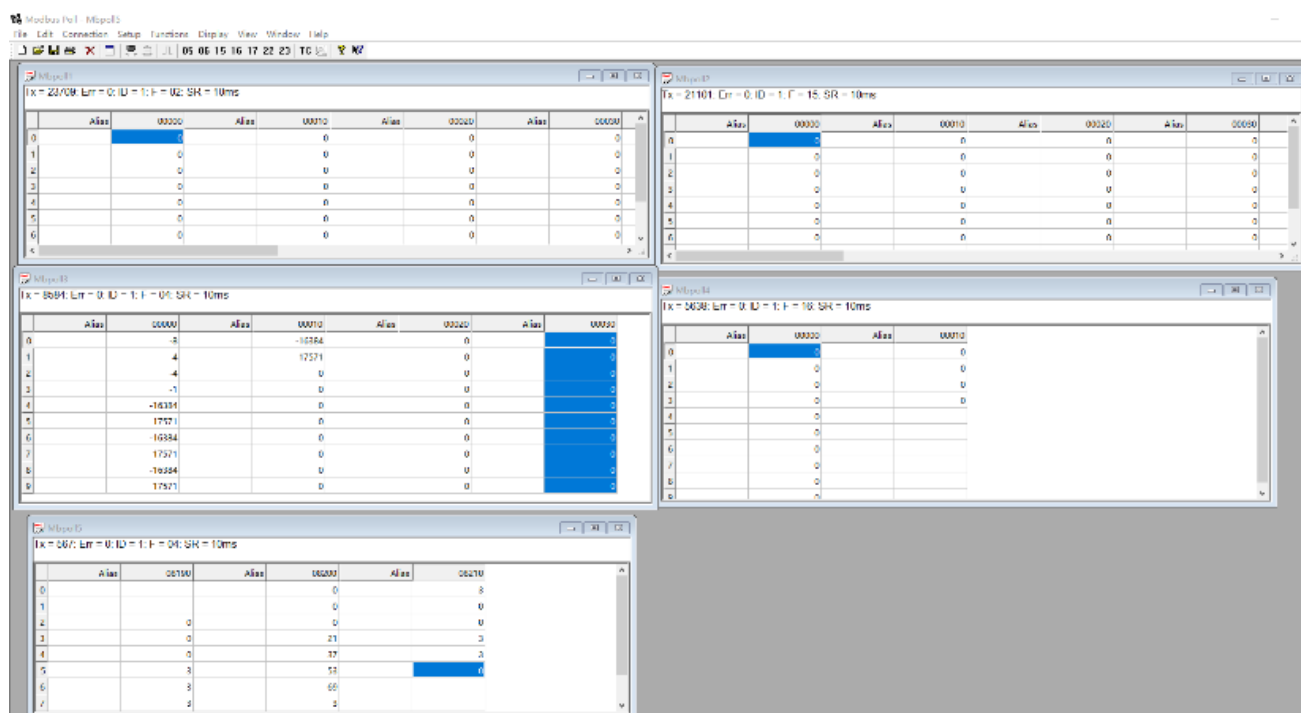
Function code 04, Input(Word), offset: 8192, length: 24



The dialog box 'Read/Write Definition' contains the following fields and options:

- Slave ID: 1
- Function: 04 Read Input Registers (3x)
- Address: 8192
- Quantity: 24
- Scan Rate: 10 [ms]
- Buttons: OK, Cancel, Apply, Read/Write Once
- Disable section:
  - ☐ Read/Write Disabled
  - ☐ Disable on error
- View section:
  - Rows: ☒ 10, ☐ 20, ☐ 50, ☐ 100, ☐ Fit to Quantity
  - ☐ Hide Alias Columns
  - ☐ PLC Addresses (Base 1)
  - ☐ Address in Cell
  - ☐ Enron/Daniel Mode

The result is as shown in the following figure:



The screenshot shows four Modbus Poll windows displaying data for different slave IDs and function codes. Each window has a title bar with the slave ID and function code, and a status bar with the same information.

**Window 1: Slave ID 1, Function Code 04**

| Alias | 00000 | Alias | 00010 | Alias | 00020 | Alias | 00030 |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 0     | 0     |       | 0     |       | 0     |       | 0     |
| 1     | 0     |       | 0     |       | 0     |       | 0     |
| 2     | 0     |       | 0     |       | 0     |       | 0     |
| 3     | 0     |       | 0     |       | 0     |       | 0     |
| 4     | 0     |       | 0     |       | 0     |       | 0     |
| 5     | 0     |       | 0     |       | 0     |       | 0     |
| 6     | 0     |       | 0     |       | 0     |       | 0     |

**Window 2: Slave ID 1, Function Code 04**

| Alias | 00000  | Alias | 00010  | Alias | 00020 | Alias | 00030 |
|-------|--------|-------|--------|-------|-------|-------|-------|
| 0     | -3     |       | -15384 |       | 0     |       | 0     |
| 1     | 4      |       | 17571  |       | 0     |       | 0     |
| 2     | -4     |       | 0      |       | 0     |       | 0     |
| 3     | -1     |       | 0      |       | 0     |       | 0     |
| 4     | -16394 |       | 0      |       | 0     |       | 0     |
| 5     | 17571  |       | 0      |       | 0     |       | 0     |
| 6     | -16384 |       | 0      |       | 0     |       | 0     |
| 7     | 17571  |       | 0      |       | 0     |       | 0     |
| 8     | -16384 |       | 0      |       | 0     |       | 0     |
| 9     | 17571  |       | 0      |       | 0     |       | 0     |

**Window 3: Slave ID 1, Function Code 04**

| Alias | 00000 | Alias | 00010 | Alias | 00020 | Alias | 00030 |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 0     | 0     |       | 0     |       | 0     |       | 0     |
| 1     | 0     |       | 0     |       | 0     |       | 0     |
| 2     | 0     |       | 0     |       | 0     |       | 0     |
| 3     | 0     |       | 0     |       | 0     |       | 0     |
| 4     | 0     |       | 0     |       | 0     |       | 0     |
| 5     | 0     |       | 0     |       | 0     |       | 0     |
| 6     | 0     |       | 0     |       | 0     |       | 0     |
| 7     | 0     |       | 0     |       | 0     |       | 0     |
| 8     | 0     |       | 0     |       | 0     |       | 0     |
| 9     | 0     |       | 0     |       | 0     |       | 0     |

**Window 4: Slave ID 1, Function Code 04**

| Alias | 00000 | Alias | 00010 | Alias | 00020 | Alias | 00030 |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 0     | 0     |       | 0     |       | 0     |       | 0     |
| 1     | 0     |       | 0     |       | 0     |       | 0     |
| 2     | 0     |       | 0     |       | 0     |       | 0     |
| 3     | 0     |       | 0     |       | 0     |       | 0     |
| 4     | 0     |       | 0     |       | 0     |       | 0     |
| 5     | 0     |       | 0     |       | 0     |       | 0     |
| 6     | 0     |       | 0     |       | 0     |       | 0     |
| 7     | 0     |       | 0     |       | 0     |       | 0     |
| 8     | 0     |       | 0     |       | 0     |       | 0     |
| 9     | 0     |       | 0     |       | 0     |       | 0     |

# 7 Common functions of Ttools-IO software

The following are the main commonly used functions of Ttools-IO software:

- Coupler firmware upgrade
- Creating a new project
- Opening an existing project
- Scanning a module
- Adding a module
- Adjusting module order
- Deleting a module
- Editing parameters
- Downloading project parameters
- EDS export
- Module firmware upgrade
- Online monitoring
- Viewing logs
- Checking for updates

 **Note:**

- The following common functions of Ttools-IO software are illustrated using the FK1300 module as an example.
- The minimum version of EIP for firmware compatibility is 103. Users need to confirm the firmware version during operation.

## ■ Operating environment

| Type                    | Description                                                                                                                                                                                                               |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OS                      | Windows7, Windows10                                                                                                                                                                                                       |
| Communication interface | USB                                                                                                                                                                                                                       |
| Power supply            | 24V                                                                                                                                                                                                                       |
| Module                  | FL1001-1600DI, FL1002-3200DI, FL2002-0016DP, FL2003-0032DP, FL2102-0016DN, FL2103-0032DN, FL2201-0008DR, FL3003-4AD, FL3103-4PT, FL3203-4TC, FL4003-4DA, FL5005-1616DP, FL5105-1616DN, FL6002-2ES, FL6112-2EI, FL6121-1EI |

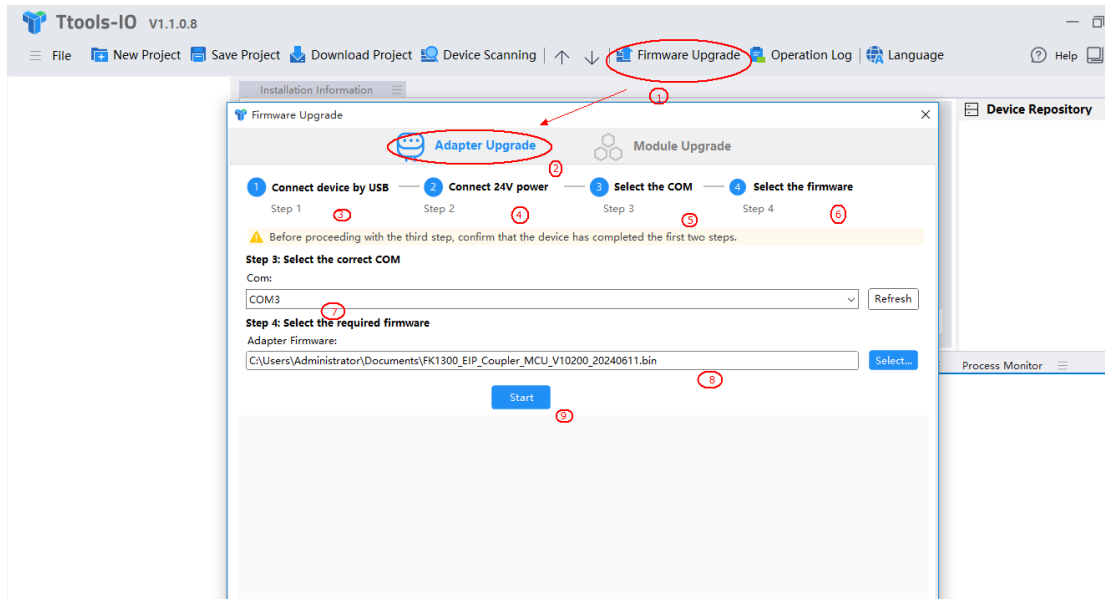
## ■ Precautions

1. When upgrading the coupler firmware, first connect the USB, and then connect the power supply. It is very important to follow the correct sequence for the upgrade to proceed normally.
2. For module scanning, module upgrading, and parameter downloading, the power supply must be connected first, followed by the USB cable. The correct connection order is necessary for normal operation.
3. Some operations require power to be turned off and then back on to take effect, such as firmware upgrades, module upgrades, and IP modifications. Pay attention to the prompt information during

these operations.

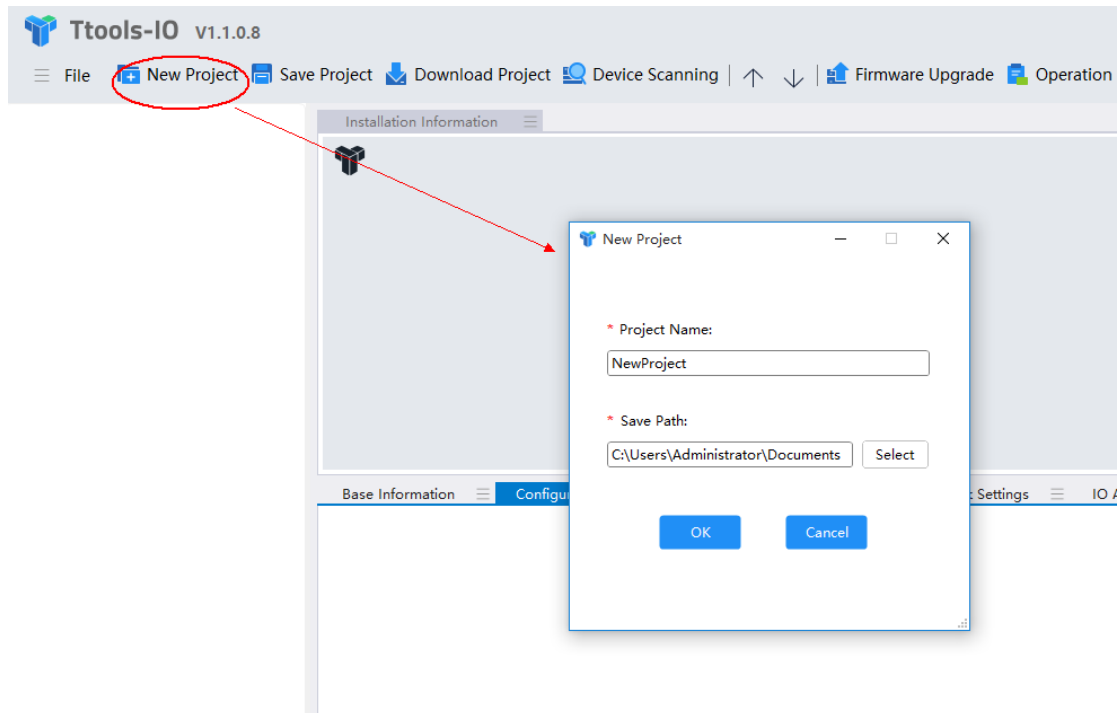
4. The coupler module can connect a maximum of 32 modules. If the total power of the modules exceeds the output power provided by the coupler, a power relay module must be used to ensure stable operation of the entire module configuration.
5. When connecting the USB to the coupler, be sure to select the correct COM port to avoid errors. It is recommended to connect only one set of couplers for operation at a time.

## 7.1 Coupler firmware upgrade



As shown in the above figure, select **Firmware Upgrade**, and then select **Adapter Upgrade** in the pop-up window. Next, select the corresponding COM port and the required firmware, and finally click **Start** to start the upgrade.

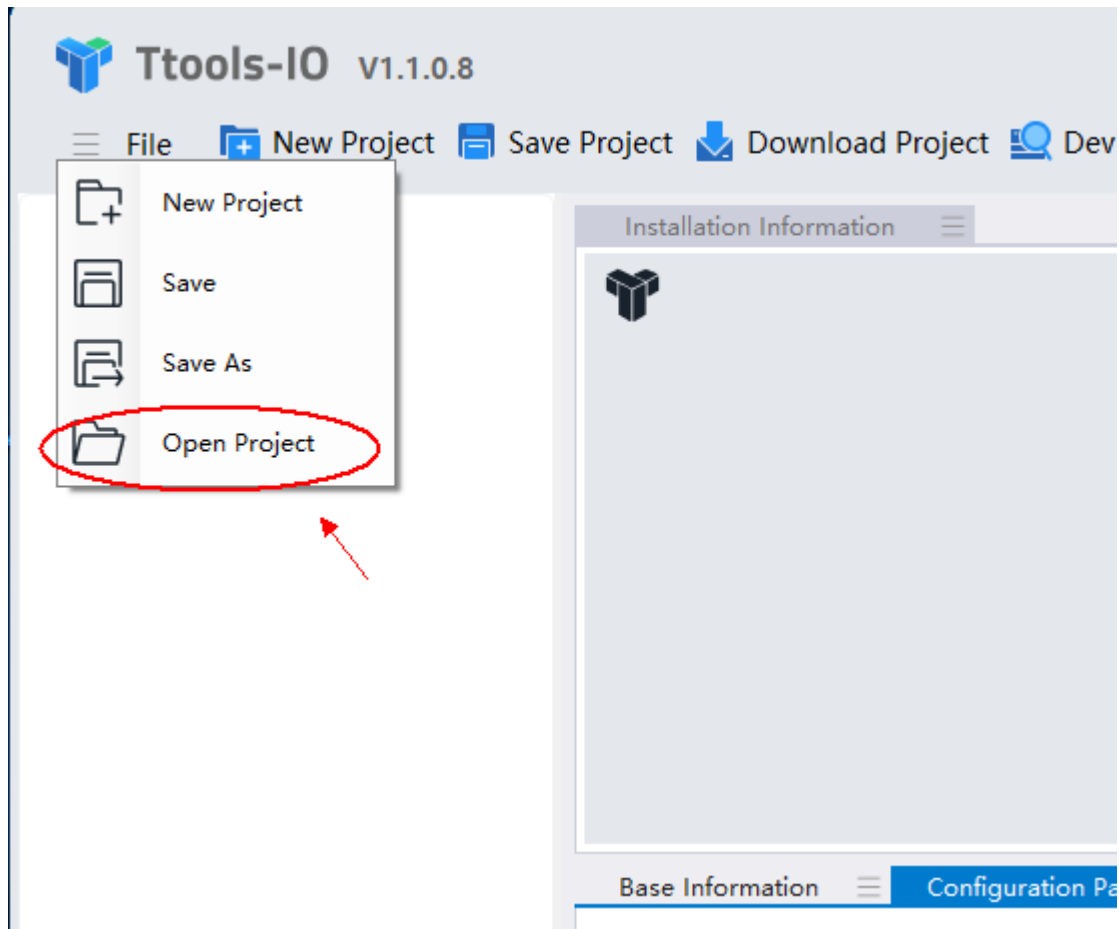
## 7.2 Creating a new project



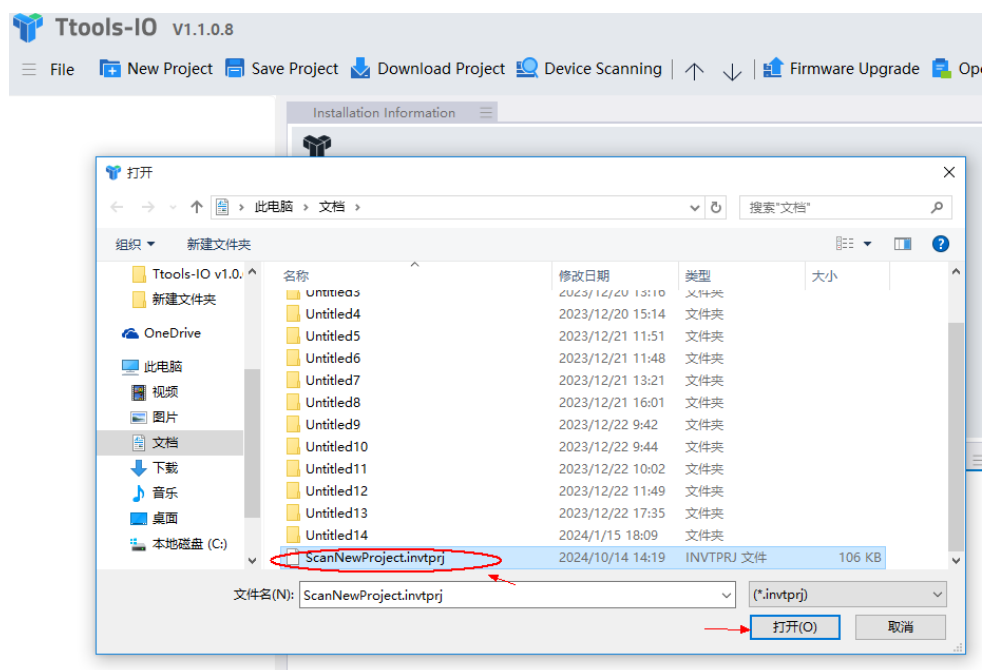
As shown in the above figure, you can manually create a new project by clicking the **New Project** button in the menu bar to open the corresponding window. Enter a project name, select a save path, and click **OK** to create a new project.



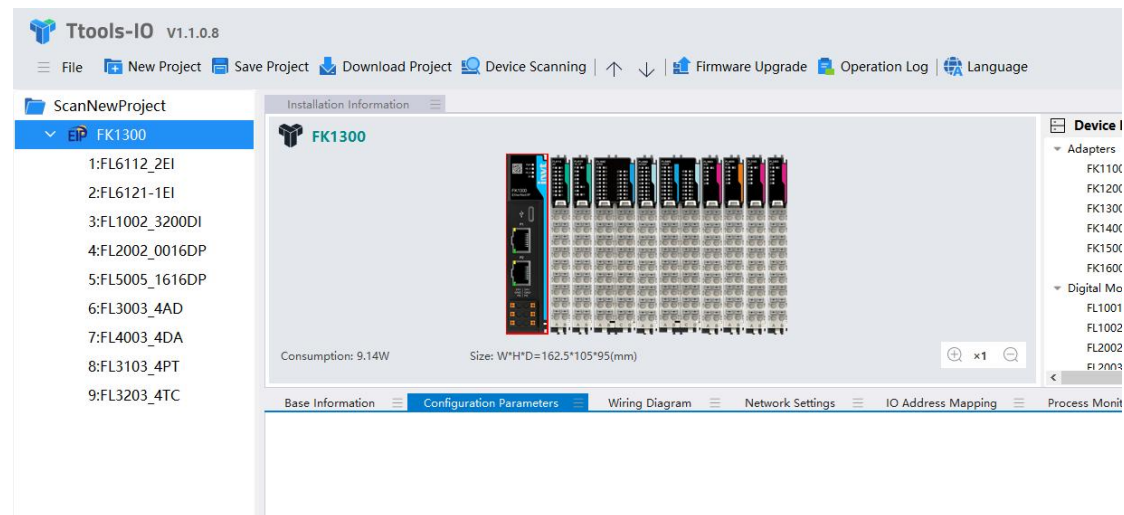
## 7.3 Opening an existing project



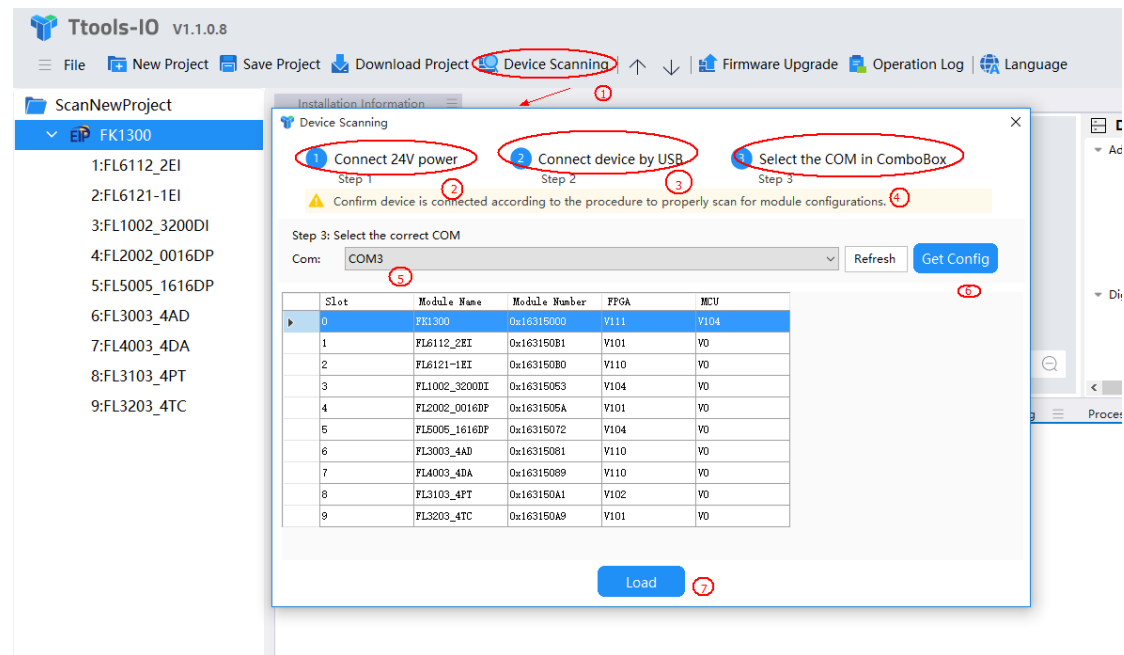
Click **File > Open Project** from the menu bar. The following operation interface will be displayed. Select the required project and click **Open** to open the project.



The interface shown in the following figure indicates that the project has been successfully opened.

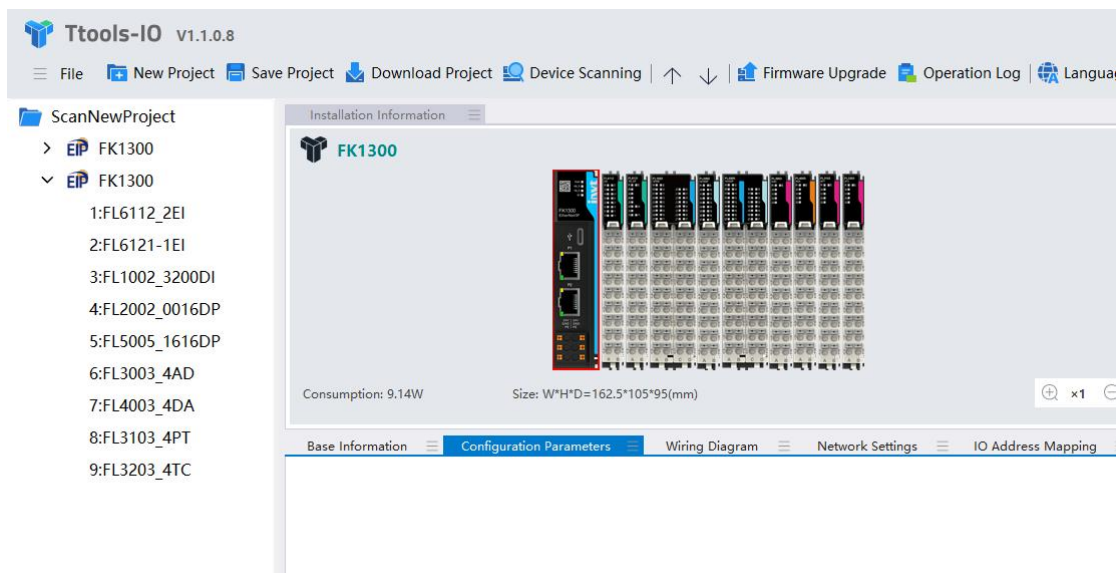


## 7.4 Scanning a module

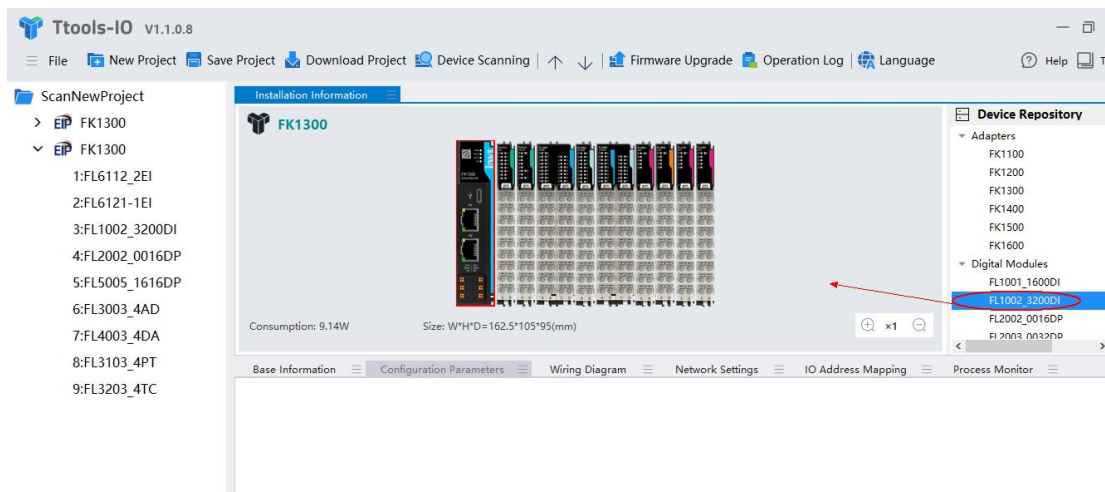


Module scanning is used to obtain information about the physical configuration. Once the scanning is complete, you can load it into the project by clicking the **Load** button, creating a saveable software project that facilitates subsequent parameter editing and downloading.

The interface shown in the following figure indicates that the scanned module has been successfully loaded.

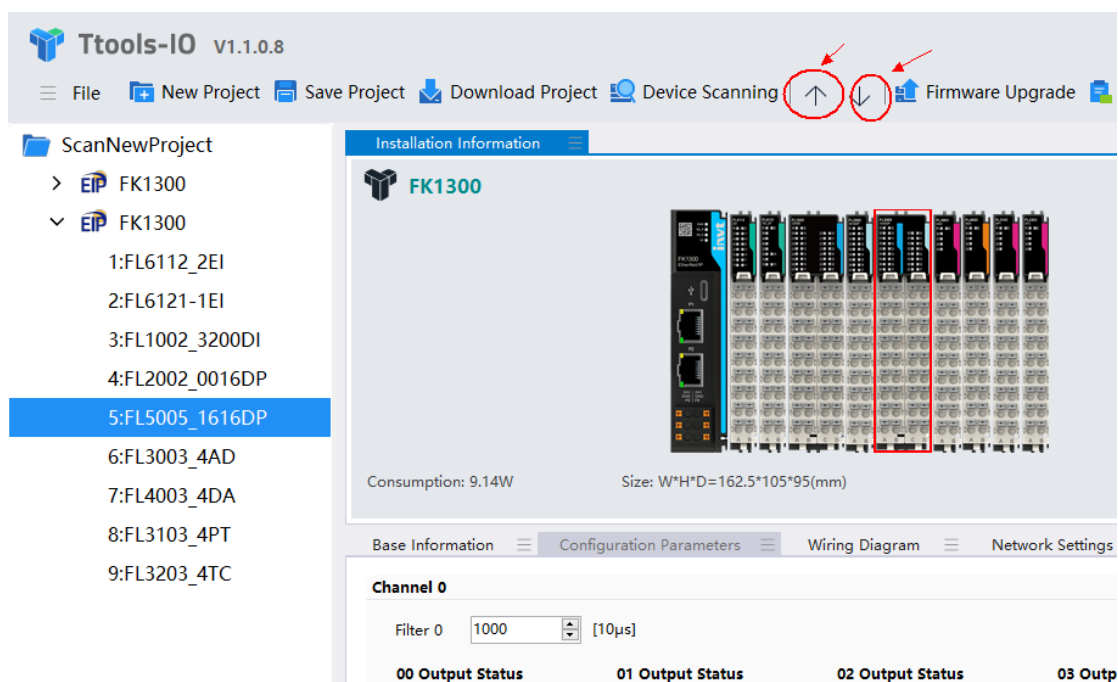


## 7.5 Adding a module



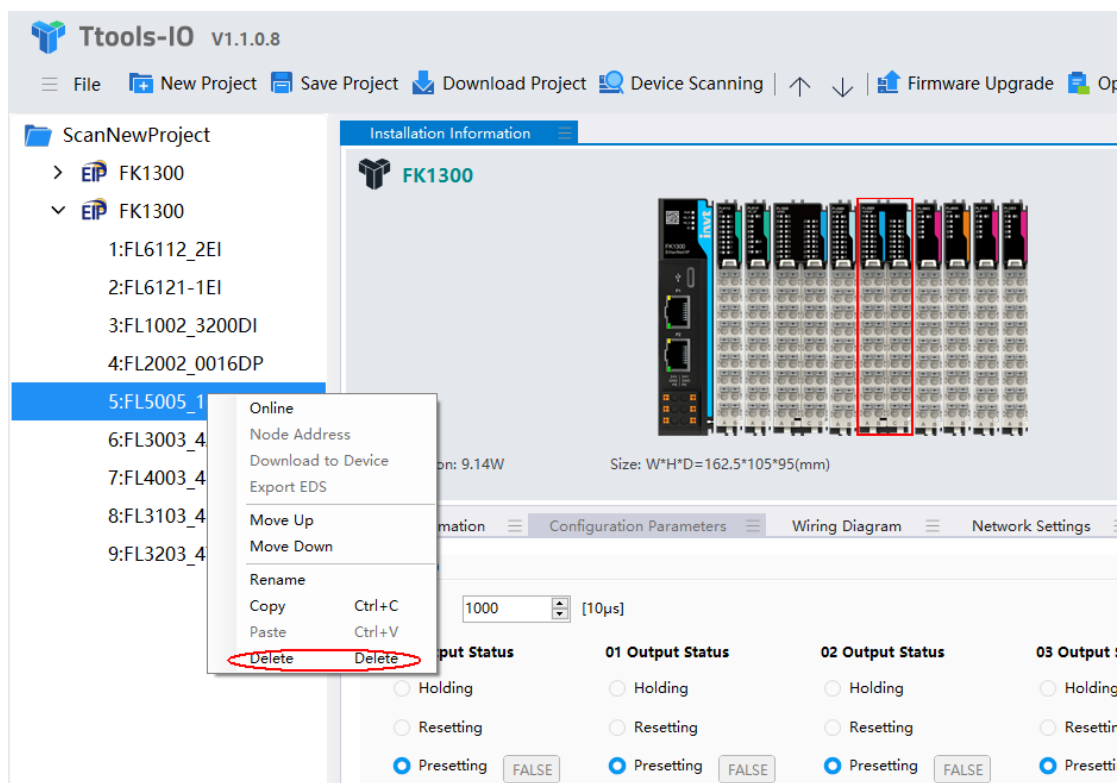
For an opened project, you can add modules by double-clicking the corresponding module in the device tree or by dragging the module into the software view.

## 7.6 Adjusting module order



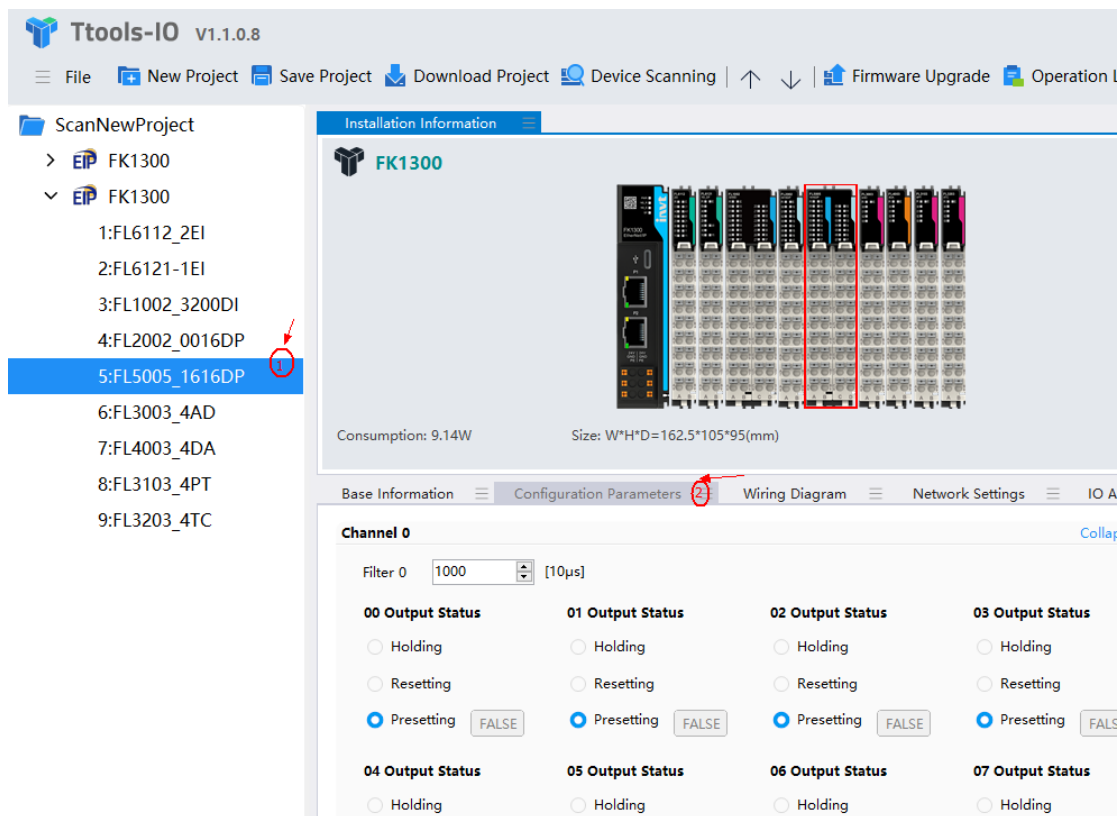
1. When selecting a module in the project tree, you can adjust the module order using the move up and move down buttons.
2. When selecting the **Configuration** window in the **Installation Information** section, you can adjust the window order using the left and right arrow keys or through the right-click menu.

## 7.7 Deleting a module



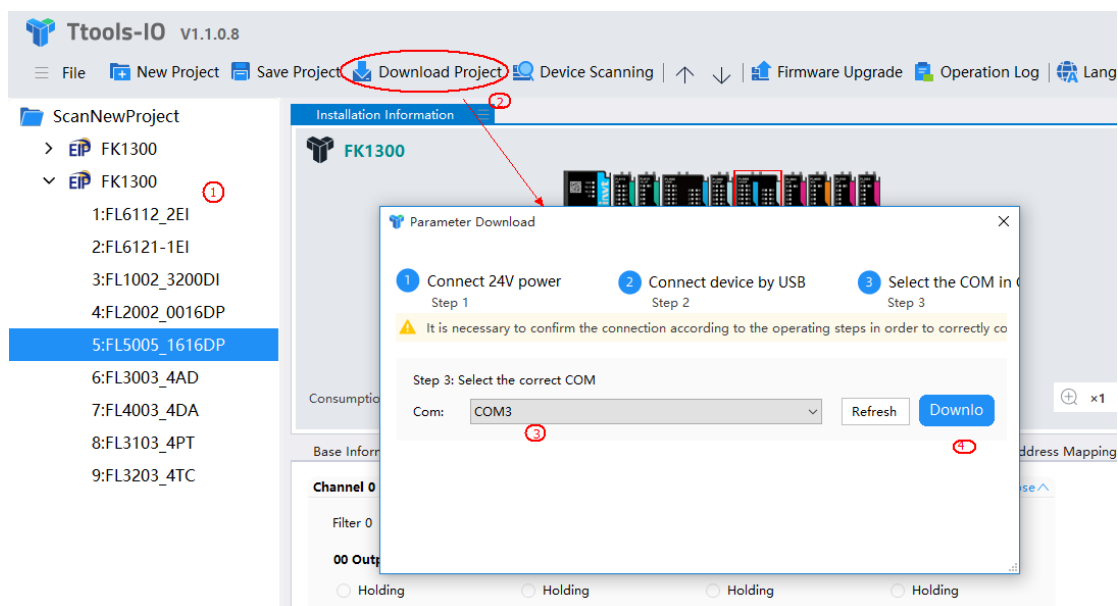
1. When selecting a module in the project tree, you can delete the module using the Delete key on the keyboard or through the right-click menu.
2. When selecting the **Configuration** window in the **Installation Information** section, you can delete the corresponding module using the right-click menu.

## 7.8 Editing parameters



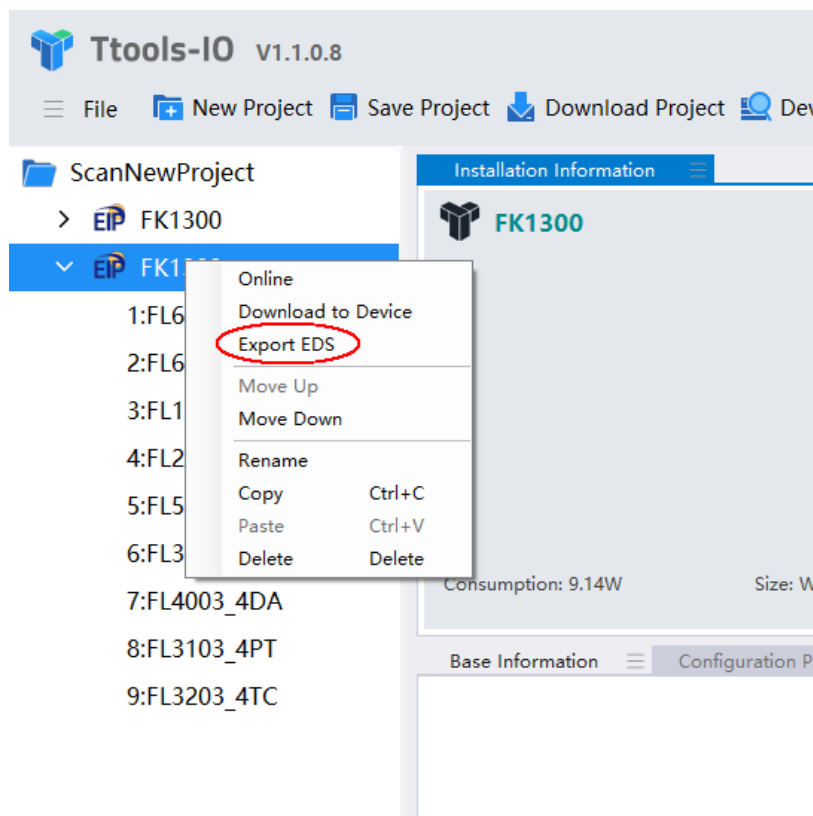
In the project tree interface, after selecting a module or installation information, you can select the **Configuration Parameters** tab to edit the corresponding module's parameters. Once you have finished editing, please remember to save the project.

## 7.9 Downloading project parameters

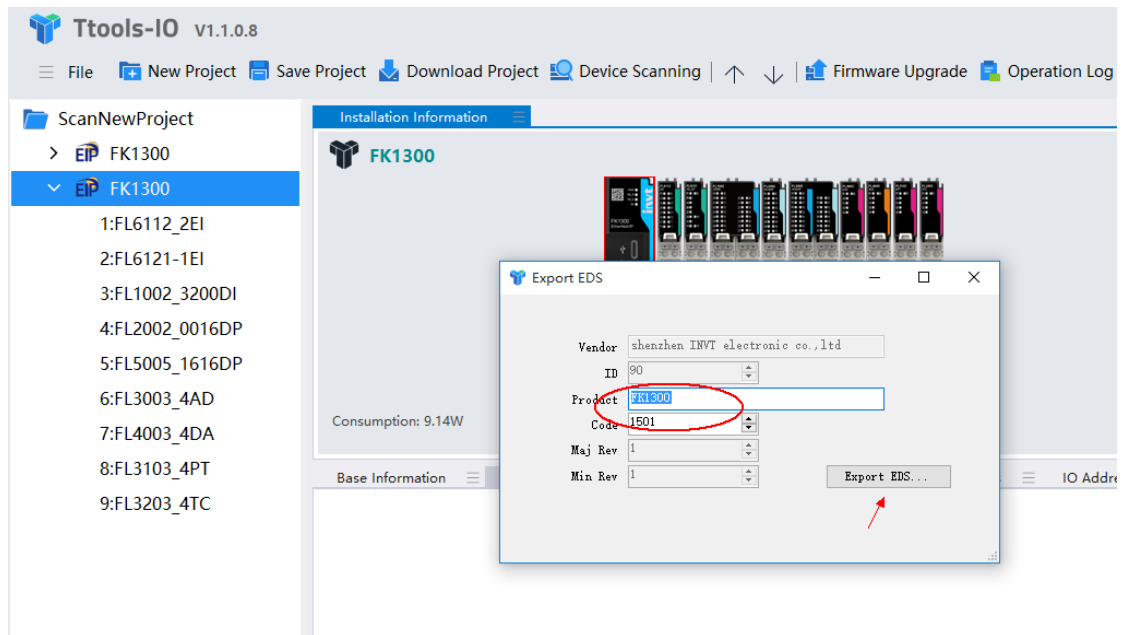


In the project tree interface, select the coupler for which you need to download parameters. Click **Download Project** in the menu bar to open the corresponding operation interface, where you can download parameters for all edited modules to the device.

## 7.10 EDS export

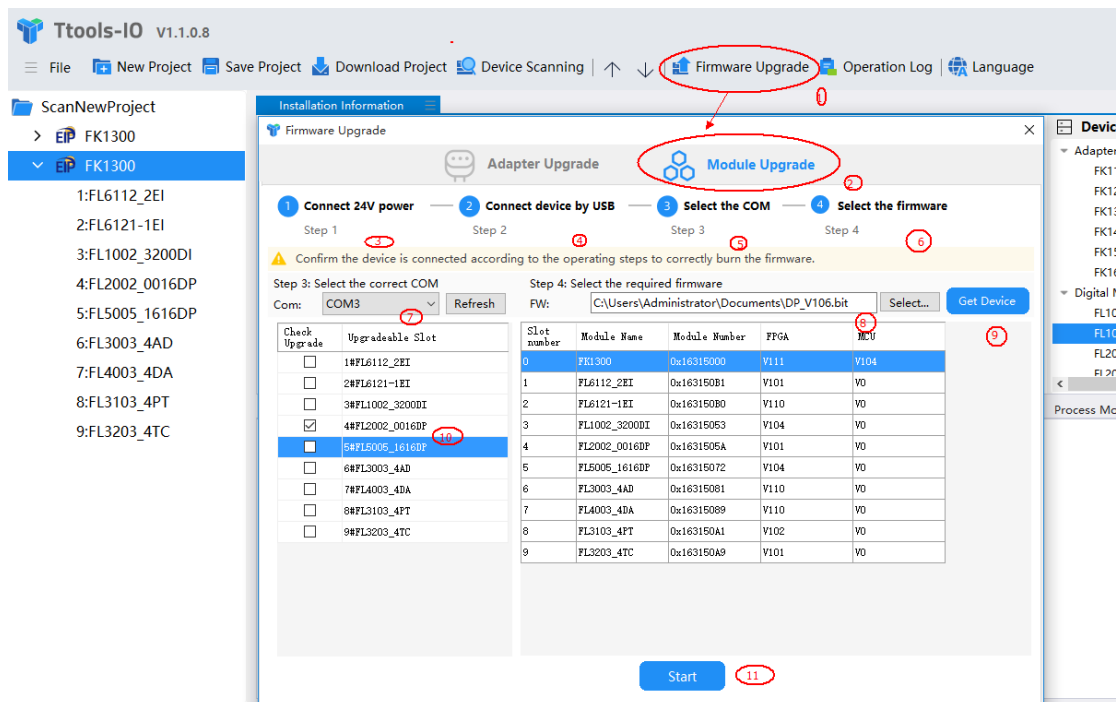


Right-click the coupler that you need to export the EDS file for, and select **Export EDS** from the menu.



On the pop-up windows, enter a product name and product code, and click Export EDS to save the exported file in the selected path.

## 7.11 Module firmware upgrade

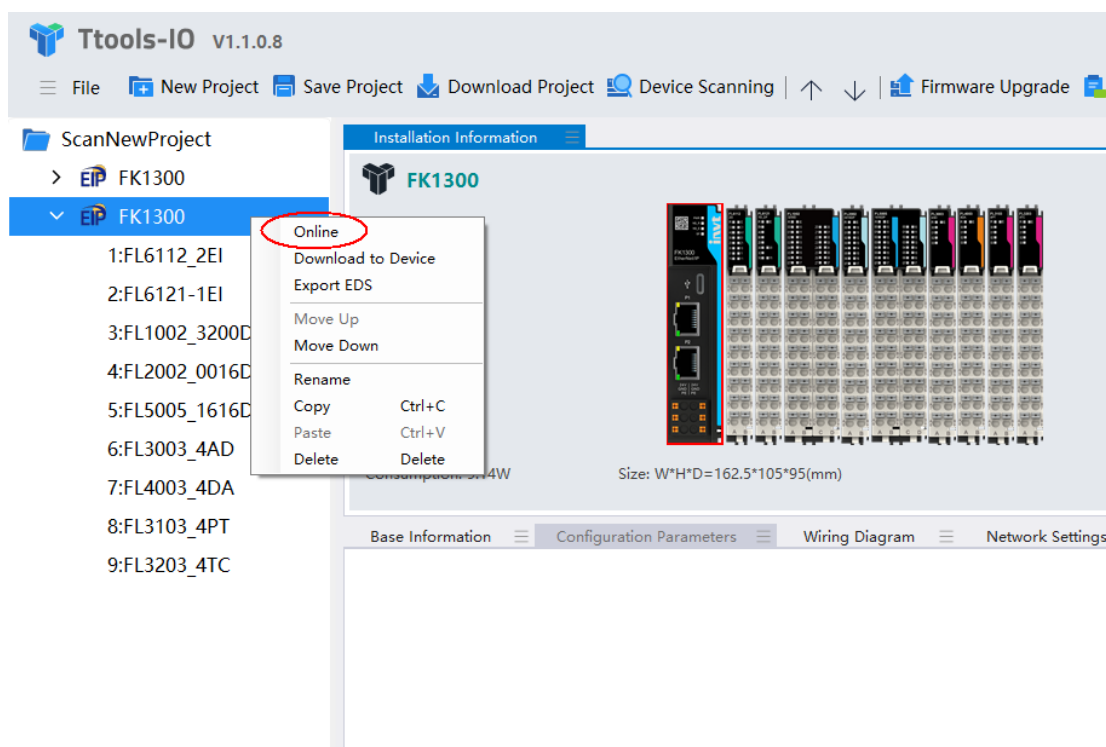


Module upgrades are performed on the modules connected to the coupler. Select **Firmware Upgrade** from the menu bar, then choose **Module Upgrade** in the pop-up interface. Follow the prompts to connect the coupler and select the appropriate serial port to obtain the physical configuration, which will be displayed on the interface.

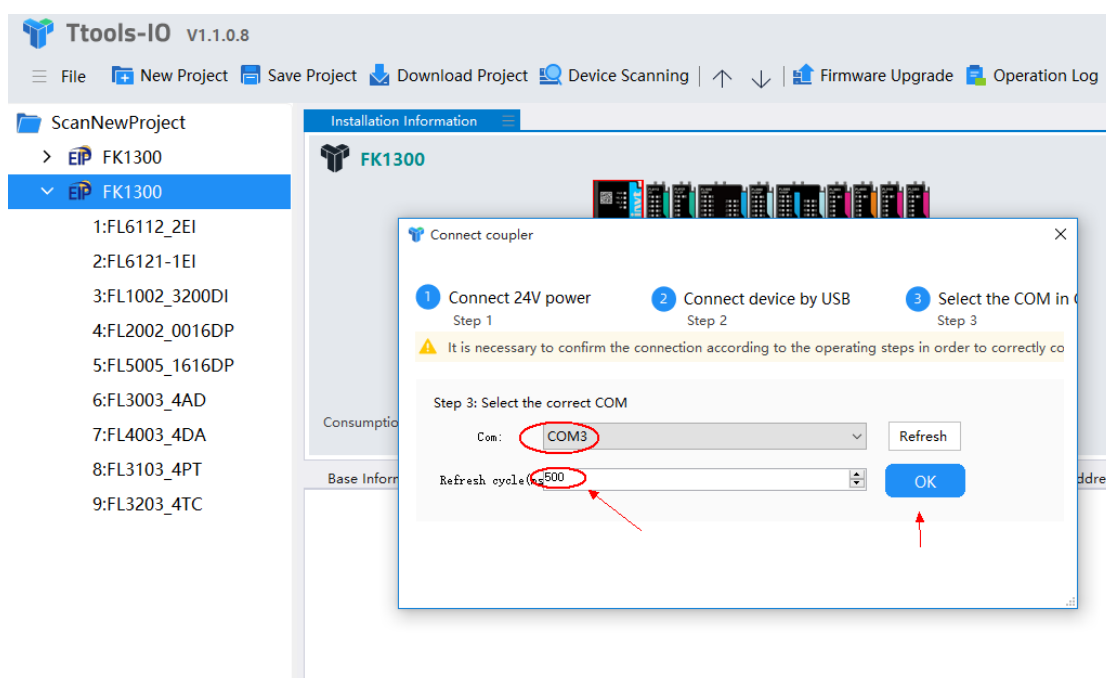
When selecting the firmware to upgrade, please note that only one type of module can be upgraded at a time. You can select modules one by one for upgrading, or you can select multiple modules of the same type at once, but you cannot select different types of modules for upgrading simultaneously. Once the upgrade is complete, be sure to reconnect the power and proceed with subsequent operations via USB.

**Note:** Currently, only coupler firmware upgrades are supported. Module firmware upgrades are not available at this time.

## 7.12 Online monitoring

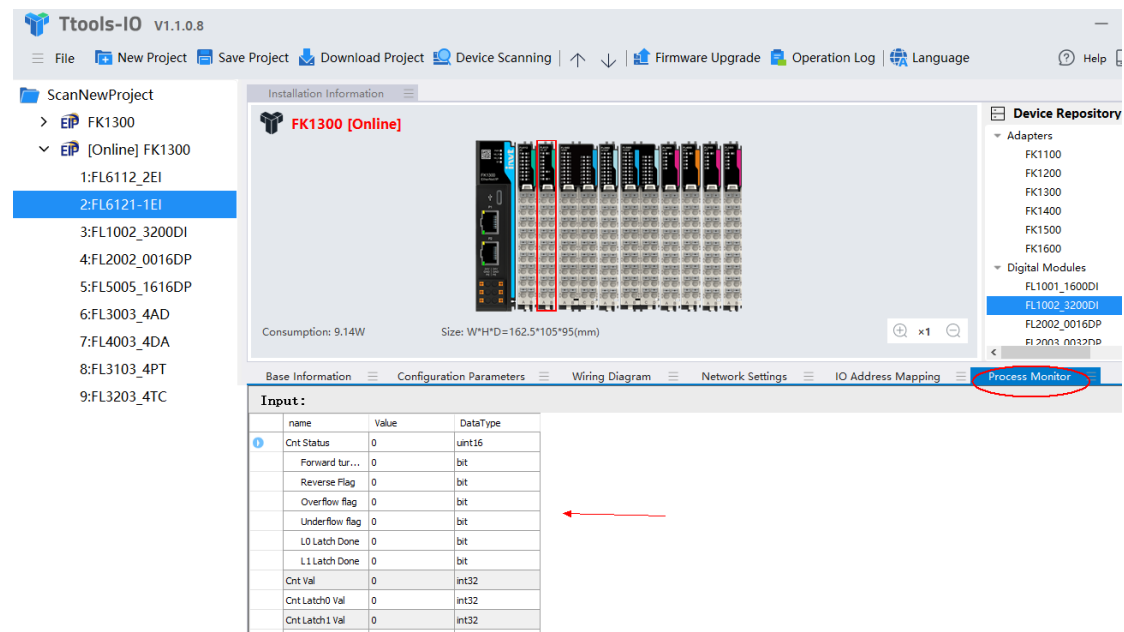


As shown in the above figure, right-click the coupler in the project tree, select **Online** from the menu, and then select the corresponding serial port for the coupler in the pop-up window to start the online monitoring function.

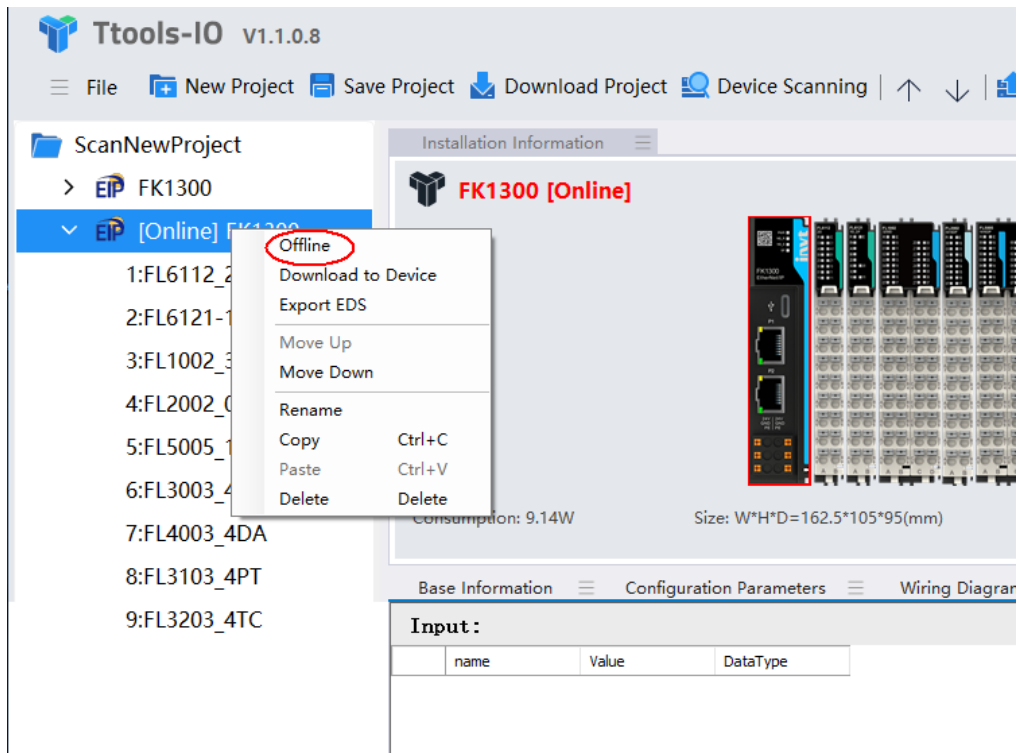




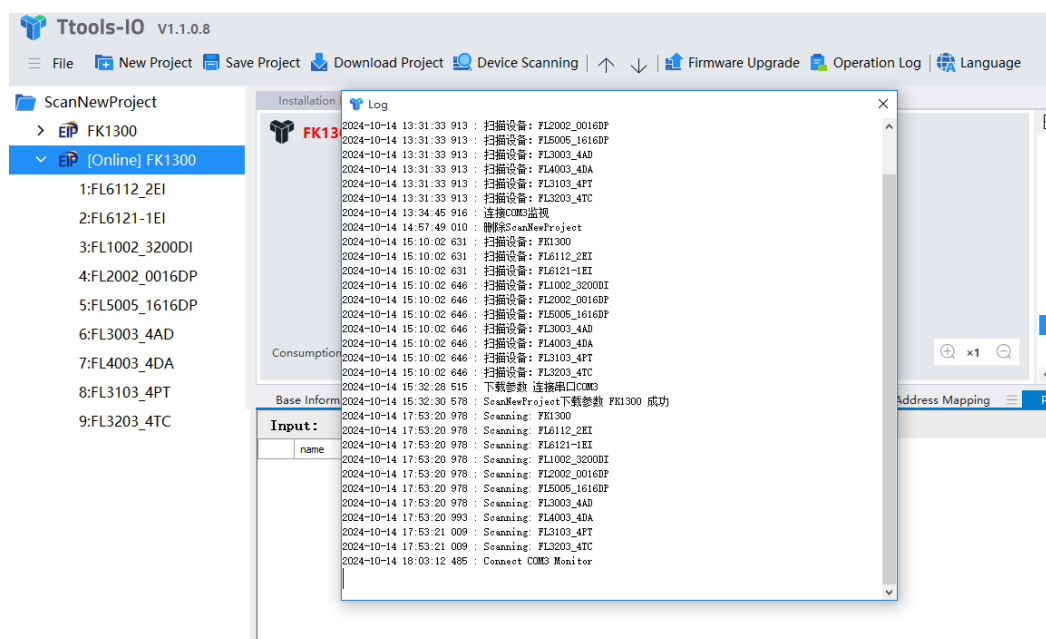
After selecting the module you wish to monitor, you can view the real-time data in the **Value** column.



To stop the online monitoring function, right-click the coupler or module, and select **Offline** in the menu.

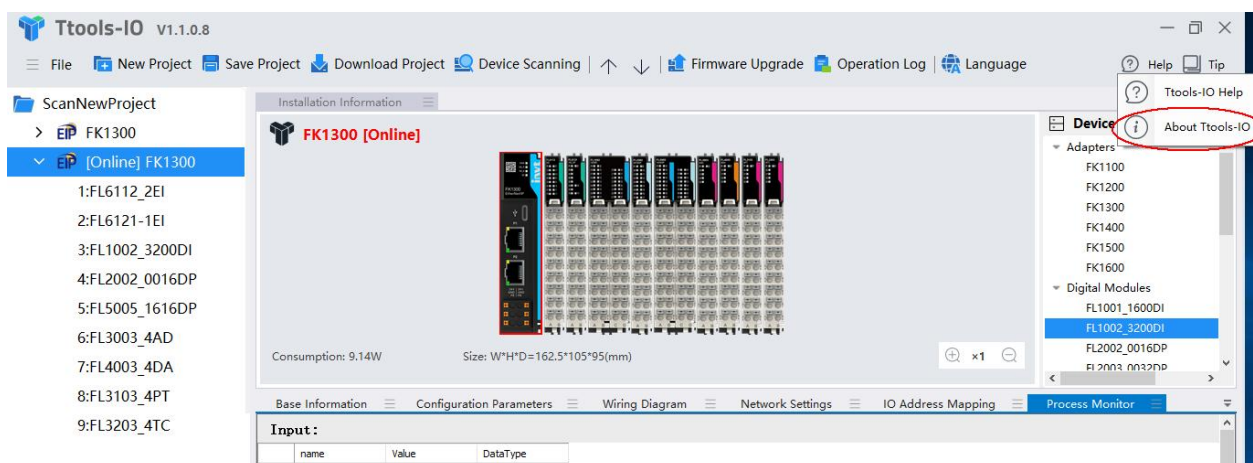


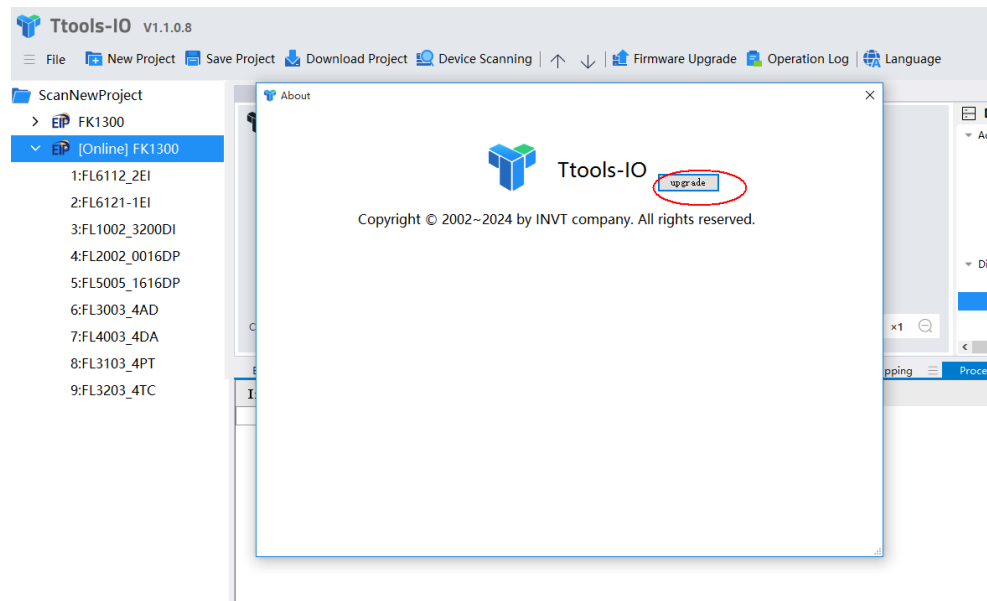
## 7.13 Viewing logs



The log viewing function is primarily designed to track records of key operations.

## 7.14 Checking for updates





If there are updates available, a prompt will appear. Follow the instructions to download and then install the updates.

## 8 Fault code

| Fault code | Fault code (in hex.) | Fault Type                                                           | Solution                                                                                    |
|------------|----------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1          | 0x0001               | Module configuration fault                                           | Ensure the correct mapping between module network configuration and physical configuration. |
| 2          | 0x0002               | Incorrect module parameter setting                                   | Ensure that module parameter settings are correct.                                          |
| 3          | 0x0003               | Module output port power supply fault                                | Ensure that the module output port power supply is normal.                                  |
| 4          | 0x0004               | Module output fault                                                  | Ensure that the module output port load is within the specified range.                      |
| 18         | 0x0012               | Incorrect parameter setting for channel 0                            | Ensure that the parameter settings for channel 0 are correct.                               |
| 20         | 0x0014               | Output fault on channel 0                                            | Ensure that the output of channel 0 has no short circuit or open circuit.                   |
| 21         | 0x0015               | Signal source open circuit fault on channel 0                        | Ensure that the signal source physical connection of channel 0 is normal.                   |
| 22         | 0x0016               | Sampling signal limit exceeding fault on channel 0                   | Ensure that the sampling signal on channel 0 does not exceed the chip limit.                |
| 23         | 0x0017               | Sampling signal measurement upper limit exceeding fault on channel 0 | Ensure that the sampling signal on channel 0 does not exceed the measurement upper limit.   |
| 24         | 0x0018               | Sampling signal measurement lower limit exceeding fault on channel 0 | Ensure that the sampling signal on channel 0 does not exceed the measurement lower limit.   |
| 34         | 0x0022               | Incorrect parameter setting for channel 1                            | Ensure that the parameter settings for channel 1 are correct.                               |
| 36         | 0x0024               | Output fault on channel 1                                            | Ensure that the output of channel 1 has no short circuit or open circuit.                   |
| 37         | 0x0025               | Signal source open circuit fault on channel 1                        | Ensure that the signal source physical connection of channel 1 is normal.                   |
| 38         | 0x0026               | Sampling signal limit exceeding fault on channel 1                   | Ensure that the sampling signal on channel 1 does not exceed the chip limit.                |
| 39         | 0x0027               | Sampling signal measurement upper limit exceeding fault on channel 1 | Ensure that the sampling signal on channel 1 does not exceed the measurement upper limit.   |
| 40         | 0x0028               | Sampling signal measurement lower limit exceeding fault on channel 1 | Ensure that the sampling signal on channel 1 does not exceed the measurement lower limit.   |
| 50         | 0x0032               | Incorrect parameter setting for channel 2                            | Ensure that the parameter settings for channel 2 are correct.                               |
| 52         | 0x0034               | Output fault on channel 2                                            | Ensure that the output of channel 2 has no short circuit or open circuit.                   |
| 53         | 0x0035               | Signal source open circuit fault on channel 2                        | Ensure that the signal source physical connection of channel 2 is normal.                   |

| Fault code | Fault code (in hex.) | Fault Type                                                           | Solution                                                                                  |
|------------|----------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 54         | 0x0036               | Sampling signal limit exceeding fault on channel 2                   | Ensure that the sampling signal on channel 2 does not exceed the chip limit.              |
| 55         | 0x0037               | Sampling signal measurement upper limit exceeding fault on channel 2 | Ensure that the sampling signal on channel 2 does not exceed the measurement upper limit. |
| 56         | 0x0038               | Sampling signal measurement lower limit exceeding fault on channel 2 | Ensure that the sampling signal on channel 2 does not exceed the measurement lower limit. |
| 66         | 0x0042               | Incorrect parameter setting for channel 3                            | Ensure that the parameter settings for channel 3 are correct.                             |
| 68         | 0x0044               | Output fault on channel 3                                            | Ensure that the output of channel 3 has no short circuit or open circuit.                 |
| 69         | 0x0045               | Signal source open circuit fault on channel 3                        | Ensure that the signal source physical connection of channel 3 is normal.                 |
| 70         | 0x0046               | Sampling signal limit exceeding fault on channel 3                   | Ensure that the sampling signal on channel 3 does not exceed the chip limit.              |
| 71         | 0x0047               | Sampling signal measurement upper limit exceeding fault on channel 3 | Ensure that the sampling signal on channel 3 does not exceed the measurement upper limit. |
| 72         | 0x0048               | Sampling signal measurement lower limit exceeding fault on channel 3 | Ensure that the sampling signal on channel 3 does not exceed the measurement lower limit. |

## 9 EtherCAT functions

### 9.1 Basic functions

FK1100 ECT Coupler is an EtherCAT coupler that enables our Flex series expansion modules to connect to a high-speed EtherCAT network. In this way, Flex series expansion modules of different types can be configured as an EtherCAT slave node, reducing the number of slave nodes connected.

### 9.2 Object dictionary overview

According to the definition of the standard protocol, the device object dictionary is uniformly divided, and all devices must be divided according to the rules of the protocol. The general structure allocation of the object dictionary is shown in the following table:

| Index         | Description                                                                        |
|---------------|------------------------------------------------------------------------------------|
| 0x0000–0x0FFF | Data type                                                                          |
| 0x1000–0x1FFF | EtherCAT standard communication object dictionary                                  |
| 0x2000–0x5FFF | Manufacturer defined parameters                                                    |
| 0x6000–0x6FFF | TxPDO, used to map the output process data of the expansion module.                |
| 0x7000–0x7FFF | RxPDO, used to map the input process data of the expansion module.                 |
| 0x8000–0x8FFF | SDO, used for parameter configuration and status feedback of the expansion module. |
| 0xF000–0xFFFF | Device description area, coupler configuration object dictionary                   |

### 9.3 Expansion module object dictionary allocation

Each expansion module connected to the FK1100 ECT Coupler module is standardized as a module type, and the configuration parameters and process data of each module are instantiated as object dictionaries for management. The index of the module object dictionary is dynamically allocated and related to the location of the module. The object dictionary dynamic allocation range is as follows.

| Type             | Module 0      | Module 1      | Module n                      | Module 31     |
|------------------|---------------|---------------|-------------------------------|---------------|
| RxPDO mapping    | 0x1600        | 0x1601        | $0x1600+n*0x01$               | 0x161F        |
| TxPDO mapping    | 0x1A00        | 0x1A01        | $0x1A00+n*0x01$               | 0x1A1F        |
| TxPDO parameter  | 0x6000–0x607F | 0x6080–0x60FF | $0x6000+n*0x80-0x607F+n*0x80$ | 0x6F80–0x6FFF |
| RxPDO parameters | 0x7000–0x707F | 0x7080–0x70FF | $0x7000+n*0x80-0x707F+n*0x80$ | 0x7F80–0x7FFF |
| SDO parameter    | 0x8000–0x807F | 0x8080–0x80FF | $0x8000+n*0x80-0x807F+n*0x80$ | 0x8F80–0x8FFF |

Each Flex series expansion module connected to the EtherCAT coupler is assigned a unique object dictionary base value. This base object dictionary is used to calculate the dynamic allocation of PDO mappings, PDO data, and SDO parameters based on the slot position of the module.

The calculation methods for the RxPDO and TxPDO mappings of expansion modules are as follows:

$$\text{Object dictionary index} = \text{Object dictionary base value} + \text{Module position } n * 0x01$$

The calculation methods for the RxPDO parameters, TxPDO parameters, and SDO parameters of expansion modules are as follows:

$$\text{Object dictionary index} = \text{Object dictionary base value} + \text{Module position } n * 0x80$$

 **Note:** Module position  $n$  is calculated starting from 0, representing the position number of the slot where the module is located.

The object dictionary basic value distribution of Flex series is as follows.

| Module        | Object dictionary |               |                 |                 |                             |                      |
|---------------|-------------------|---------------|-----------------|-----------------|-----------------------------|----------------------|
|               | RxPDO mapping     | TxPDO mapping | TxPDO parameter | RxPDO parameter | SDO configuration parameter | SDO status parameter |
| FL1001-1600DI | -                 | 0x1A00        | 0x6001          | -               | 0x8001                      | 0x8078               |
| FL1002-3200DI | -                 | 0x1A00        | 0x6002          | -               | 0x8002                      | 0x8078               |
| FL2201-0008DR | 0x1600            | 0x1A00        | 0x6004          | 0x7004          | 0x8004                      | 0x8078               |
| FL2102-0016DN | 0x1600            | 0x1A00        | 0x6005          | 0x7005          | 0x8005                      | 0x8078               |
| FL2002-0016DP | 0x1600            | 0x1A00        | 0x6005          | 0x7005          | 0x8005                      | 0x8078               |
| FL3003-4AD    | -                 | 0x1A00        | 0x6015          | -               | 0x8015                      | 0x8078               |
| FL4003-4DA    | 0x1600            | 0x1A00        | 0x6019          | 0x7019          | 0x8019                      | 0x8078               |
| FL3101-4PT    | -                 | 0x1A00        | 0x6029          | -               | 0x8029                      | 0x8078               |
| FL3201-4TC    | -                 | 0x1A00        | 0x602D          | -               | 0x802D                      | 0x8078               |

For example, the actual configuration is as follows.

FK1100\_ECT\_Coupler + FL1001-1600DI + FL2102-0016DN + FL3003-4AD + FL4003-4DA + FL3201-4TC

According to the object dictionary allocation rules, the object dictionary for this configuration is as follows.

| Module               | Object dictionary |               |                 |                 |                             |                      |
|----------------------|-------------------|---------------|-----------------|-----------------|-----------------------------|----------------------|
|                      | RxPDO mapping     | TxPDO mapping | TxPDO parameter | RxPDO parameter | SDO configuration parameter | SDO status parameter |
| FL1001-1600DI slot 0 | -                 | 0x1A00        | 0x6001          | -               | 0x8001                      | 0x8078               |
| FL2102-0016DN slot 1 | 0x1601            | 0x1A01        | 0x6085          | 0x7085          | 0x8085                      | 0x80F8               |
| FL3003-4AD slot 2    | -                 | 0x1A02        | 0x6115          | -               | 0x8115                      | 0x8178               |
| FL4003-4DA slot 3    | 0x1603            | 0x1A03        | 0x6199          | 0x7199          | 0x8199                      | 0x81F8               |
| FL3201-4TC slot 4    | -                 | 0x1A04        | 0x622D          | -               | 0x822D                      | 0x8278               |

## 9.4 Expansion module scanning function

The local bus protocol stack inside the FK1100\_ECT Coupler has an automatic scanning function for modules, through this function the master node can directly scan and obtain the types and positions of the Flex series modules connected to the coupler module, and therefore directly determine the actual access module type of each slot, thus determining the configuration relationship of the modules. The configuration settings and scanning of modules are identified through the device identification code of the Flex series modules themselves.

Each Flex series expansion module is assigned a unique device ID, which is a 32-bit long data. During the power-on initialization process, the FK1100\_ECT\_Coupler module queries the identification code of the expansion module in each slot, and then writes them into subindex 1 to subindex 32 of the 0xF050 object dictionary from slot 0 to slot 31. When the master node starts the scanning function, it reads the 0xF050 object dictionary to obtain the device identification codes of the expansion modules connected to

FK1100\_ECT\_Coupler. Through these identification codes, the model of each module connected to each slot behind the coupler can be determined, thereby configuring the modules accordingly.

Regardless of whether the master node obtains the module configuration through manual configuration or scanning, it must send the user-configured network configuration information to the coupler while the FK1100\_ECT\_Coupler module is still in the Pre\_Operational state. Specifically, the master node must write the identification codes of the Flex series modules detected in slot 0 to slot 31 into subindex 1 to subindex 32 of the 0xF030 object dictionary in sequence. The FK1100\_ECT\_Coupler will check whether the device identification codes in index 0xF030 match those in index 0xF050. If they match, the system can start normally; if they do not match, an error will be reported.

The device identification codes for the modules are as follows:

| Expansion module   | Module ID identification code |
|--------------------|-------------------------------|
| FK1100_ECT_Coupler | 0x16315000                    |
| FL1001-1600DI      | 0x16315052                    |
| FL1002-3200DI      | 0x16315053                    |
| FL2201-0008DR      | 0x16315069                    |
| FL2102-0016DN      | 0x1631505A                    |
| FL2002-0016DP      | 0x16315062                    |
| FL3003-4AD         | 0x16315081                    |
| FL4003-4DA         | 0x16315089                    |
| FL3101-4PT         | 0x163150A1                    |
| FL3201-4TC         | 0x163150A9                    |

## 9.5 Fault diagnosis

| Indicator |          | Description                            | Handling method                                                                                                                                                                                                                                                                                       |
|-----------|----------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PWR       | Off      | Coupler 24V power supply exception     | 1. Check whether the module power connection is secure.<br>2. Assess whether the power supply capacity is sufficient.                                                                                                                                                                                 |
| RUN       | Off      | No data in EtherCAT communication      | 1. Check whether the physical connection between the master and slave is secure.<br>2. Check whether the slave node address matches.                                                                                                                                                                  |
|           | Blinking | EtherCAT communication not in OP state | 1. The SDO data volume is large, and the master node's performance in sending SDO data is insufficient, causing the slave node to remain in the Pre-Operational state for a long period of time.<br>2. Check whether the configuration is consistent.                                                 |
| SF        | Blinking | Configuration mismatch                 | 1. Check whether the physical configuration and network configuration are consistent.<br>2. Perform an automatic scan to check whether the scanned physical configuration matches the actual physical configuration and network configuration. This can help determine whether any module is damaged. |



# Appendix A Address mapping table descriptions

## A.1 Function code planning

Supported function codes: 01, 02, 03, 04, 05, 06, 15, 16, 23

### A.1.1 Function codes in Modbus standard

| Function code | Name                          | Definition                            | Operation type            |
|---------------|-------------------------------|---------------------------------------|---------------------------|
| 1             | Read Coils                    | Read coils                            | Bit operation (multiple)  |
| 2             | Read Discrete Inputs          | Read discrete inputs                  | Bit operation (multiple)  |
| 3             | Read Holding Registers        | Read holding registers                | Word operation (multiple) |
| 4             | Read Input Registers          | Read input registers                  | Word operation (multiple) |
| 5             | Write Single Coil             | Write a single coil                   | Bit operation (single)    |
| 6             | Write Single Register         | Write a single holding register       | Word operation (single)   |
| 15            | Write Multiple Coils          | Write multiple coils                  | Bit operation (multiple)  |
| 16            | Write Multiple Registers      | Write multiple holding registers      | Word operation (multiple) |
| 23            | Read/Write Multiple Registers | Read/Write multiple holding registers | Word operation (multiple) |

### A.1.2 BIT access

#### A.1.2.1 BIT read

02: Read Discrete Inputs / Read discrete input status/bit operation (multiple)

This function code allows for bitwise read operations on all digital input modules configured, with address offsets starting from 0 and following the configuration order.

#### A.1.2.2 BIT write

- 01: Read Coils / Read coil status/bit operation (multiple)
- 05: Write Single Coil / Write single coil/bit operation (single)
- 15: Write Multiple Coils / Write multiple coils/bit operation (multiple)

These three function codes allow for bitwise write operations or read back on all digital output modules configured, with address offsets starting from 0 and following the configuration order.

## A.1.3 WORD access

### A.1.3.1 WORD read

- 04: Read Input Registers / Read input registers/word operation (multiple)
- 23: Read/Write Multiple Registers / Read/Write multiple holding registers/word operation (multiple)

 **Note:** The read and write operations for function 23 do not map to the same address.

These two function codes allow for word-wise read operations on the input data of all configured modules. The digital input module can perform bit operations using function code 02, as well as word operations here (offset address 4096). The error diagnostic information for all modules is also mapped to address 8192.

- ✧ The parameters of the analog modules are offset sequentially from address 0 according to the configuration order.
- ✧ The parameters of the digital modules are offset sequentially from address 4096 according to the configuration order.
- ✧ The error diagnostic information parameters for all modules are offset sequentially from address 8192 according to the configuration order.

### A.1.3.2 WORD write

- 03: Read Holding Registers / Read holding registers/word operation (multiple)
- 06: Write Single Register / write single holding register/word operation (single)
- 16: Write Multiple Registers / Write multiple holding registers/word operation (multiple)
- 23: Read/Write Multiple Registers / Read/Write multiple holding registers/word operation (multiple)

 **Note:** The read and write operations for function 23 do not map to the same address.

These four function codes allows for word-wise write operations or reading back the output data of all configured modules. The digital input module can perform bit operations using function code 15, as well as word operations here (offset address 4096). The master node should not perform both bit write operations and word write operations on the same digital output simultaneously, as this will cause conflicts.

- ✧ The parameters of the analog output modules are offset sequentially from address 0 according to the configuration order.
- ✧ The parameters of the digital output modules are offset sequentially from address 4096 according to the configuration order.

## A.2 Address mapping table

### A.2.1 Address allocation

#### A.2.1.1 Area

The address space is divided into four address regions according to the planned access method.

1. BIT read:  
0–2048; Digital input module
2. BIT write:

0–2048; Digital output module

3. WORD read: 0–12288;

0–4095: Corresponding to the analog input module

4096–8191; Corresponding to the digital input module

8192–12287: Corresponding to diagnostic information, including error codes for the module

4. WORD write: 0–8192;

0–4095: Corresponding to the analog output module

4096–8191; Corresponding to the digital output module

### A.2.1.2 Module address count table

| No. | Function code  | 02        | 01, 05,<br>and 15 | 04, 23     | 03, 06, 16,<br>23 | 04, 23     | 03, 06,<br>16, 23 | 04, 23     |
|-----|----------------|-----------|-------------------|------------|-------------------|------------|-------------------|------------|
|     | Offset address | 0         | 0                 | 0          | 0                 | 4096       | 4096              | 8192       |
|     | Function       | Input Bit | Output Bit        | Input Word | Output Word       | Input Word | Output Word       | Input Word |
|     |                | DI        | DO                | AI         | AO                | DI         | DO                | Diag       |
| 0   | <b>FK1400</b>  |           |                   |            |                   |            |                   |            |
| 1   | FL1001_1600DI  | 16        | -                 | -          | -                 | 1          | -                 | 1          |
| 2   | FL1002_3200DI  | 32        | -                 | -          | -                 | 2          | -                 | 1          |
| 3   | FL2002_0016DP  | -         | 16                | -          | -                 | -          | 1                 | 1          |
| 4   | FL2003_0032DP  | -         | 32                | -          | -                 | -          | 2                 | 1          |
| 5   | FL2102_0016DN  | -         | 16                | -          | -                 | -          | 1                 | 1          |
| 6   | FL2103_0032DN  | -         | 32                | -          | -                 | -          | 2                 | 1          |
| 7   | FL2201_0008DR  | -         | 16                | -          | -                 | -          | 1                 | 1          |
| 8   | FL5005_1616DP  | 16        | 16                | -          | -                 | 1          | 1                 | 1          |
| 9   | FL5105_1616DN  | 16        | 16                | -          | -                 | 1          | 1                 | 1          |
| 10  | FL3003_4AD     | -         | -                 | 4          | -                 | -          | -                 | 4          |
| 11  | FL3404-8ADV    | -         | -                 | 8          | -                 | -          | -                 | 8          |
| 12  | FL3504-8ADI    | -         | -                 | 8          | -                 | -          | -                 | 8          |
| 13  | FL3103_4PT     | -         | -                 | 8          | -                 | -          | -                 | 4          |
| 14  | FL3203_4TC     | -         | -                 | 8          | -                 | -          | -                 | 4          |
| 15  | FL4003_4DA     | -         | -                 | -          | 4                 | -          | -                 | 4          |
| 16  | FL6112_2EI     | -         | -                 | 17         | 9                 | -          | -                 | 2          |
| 17  | FL6121-1EI     | -         | -                 | 11         | 7                 | -          | -                 | 1          |
| 18  | FL6002-2ES     | -         | -                 | 17         | 5                 | -          | -                 | 2          |

### A.2.1.3 Example

| Configuration: total number of modules: 18 |                |              |                   |               |                   |               |                   |               |
|--------------------------------------------|----------------|--------------|-------------------|---------------|-------------------|---------------|-------------------|---------------|
| No.                                        | Function code  | 02           | 01, 05,<br>and 15 | 04, 23        | 03, 06,<br>16, 23 | 04, 23        | 03, 06,<br>16, 23 | 04, 23        |
|                                            | Offset address | 0            | 0                 | 0             | 0                 | 4096          | 4096              | 8192          |
|                                            | Function       | Input<br>Bit | Output Bit        | Input<br>Word | Output<br>Word    | Input<br>Word | Output<br>Word    | Input<br>Word |
|                                            |                | DI           | DO                | AI            | AO                | DI            | DO                | Diag          |
| 0                                          | <b>FK1400</b>  |              |                   |               |                   |               |                   |               |
| 1                                          | FL1001_1600DI  | 0-15         | -                 | -             | -                 | 0             | -                 | 0             |
| 2                                          | FL1002_3200DI  | 16-47        | -                 | -             | -                 | 1-2           | -                 | 1             |
| 3                                          | FL2002_0016DP  | -            | 0-15              | -             | -                 | -             | 0                 | 2             |
| 4                                          | FL2003_0032DP  | -            | 16-47             | -             | -                 | -             | 1-2               | 3             |
| 5                                          | FL2102_0016DN  | -            | 48-63             | -             | -                 | -             | 3                 | 4             |
| 6                                          | FL2103_0032DN  | -            | 64-95             | -             | -                 | -             | 4-5               | 5             |
| 7                                          | FL2201_0008DR  | -            | 96-111            | -             | -                 | -             | 6                 | 6             |
| 8                                          | FL5005_1616DP  | 48-63        | 112-127           | -             | -                 | 3             | 7                 | 7             |
| 9                                          | FL5105_1616DN  | 64-79        | 128-143           | -             | -                 | 4             | 8                 | 8             |
| 10                                         | FL3003_4AD     | -            | -                 | 0-3           | -                 | -             | -                 | 9-13          |
| 11                                         | FL3404-8ADV    | -            | -                 | 4-11          | -                 | -             | -                 | 14-21         |
| 12                                         | FL3504-8ADI    | -            | -                 | 12-19         | -                 | -             | -                 | 22-29         |
| 13                                         | FL3103_4PT     | -            | -                 | 20-27         | -                 | -             | -                 | 30-33         |
| 14                                         | FL3203_4TC     | -            | -                 | 28-35         | -                 | -             | -                 | 34-37         |
| 15                                         | FL4003_4DA     | -            | -                 | -             | 0-3               | -             | -                 | 38-41         |
| 16                                         | FL6112_2EI     | -            | -                 | 36-52         | 4-12              | -             | -                 | 42-43         |
| 17                                         | FL6121-1EI     | -            | -                 | 53-63         | 13-19             | -             | -                 | 44            |
| 18                                         | FL6002-2ES     | -            | -                 | 64-80         | 20-24             | -             | -                 | 45-46         |

## A.3 Additional notes

The address range for accessing the above function codes is calculated based on the configuration. If it exceeds the actual configured address range, an 'Illegal data address' error will be reported during access.

Function code 23 reads data from the 'WORD read' area, not from the 'WORD write' area. Therefore, if the master node supports function code 23, it can read and write input and output data simultaneously, improving communication efficiency.

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