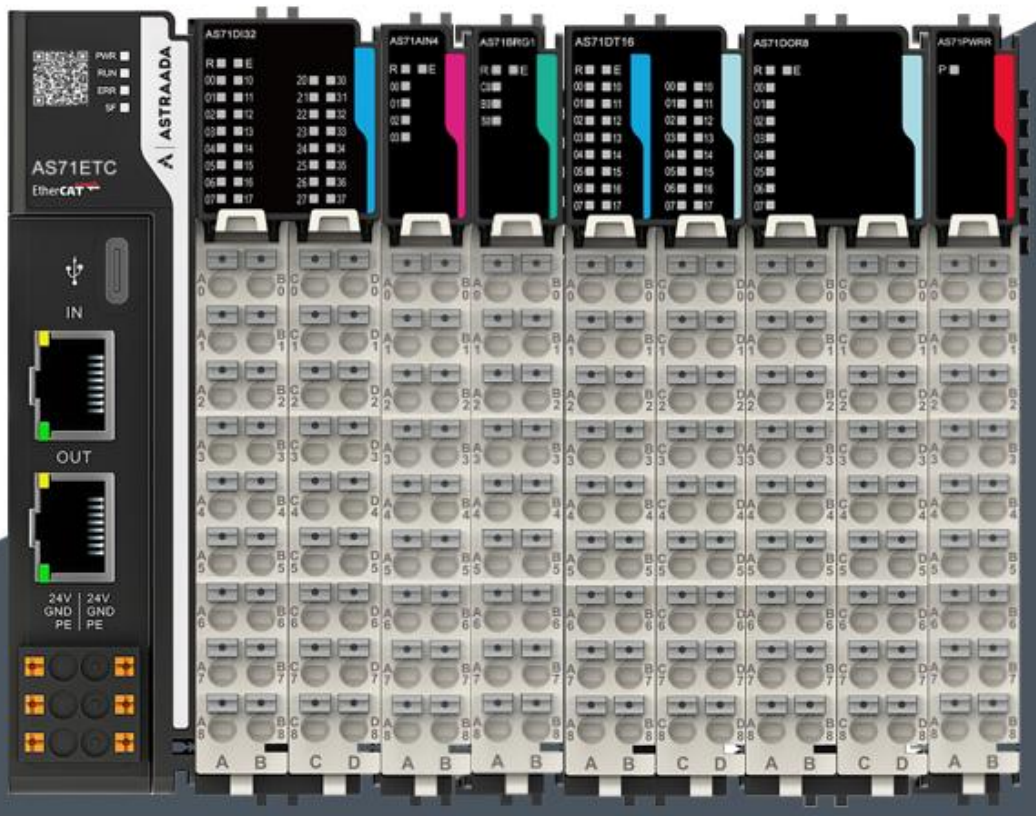
ASTRAADA

# Operation Manual

## Astraada I/O A-Series




The owner of Astraada brand is ASTOR Sp. z o.o.

# Preface

## Overview

Thank you for choosing Astraada A-Series I/O system.

Astraada A-Series I/O system adopts a modular structure, featuring flexible configuration, reliable signal transmission, and robust mechanical design. The system supports connection to various standard communication networks, delivers microsecond-level response performance, and offers a wide range of functional modules to meet diverse industrial automation application requirements. It also improves control cabinet space utilization and is suitable for building cost-effective, customized control systems.

## Target audience

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

## Documentation access

This manual is not delivered with the product. To obtain an electronic version of the PDF file, you can:

Visit our website (https://www.astor.com.pl/wsparcie.html), choose **Astraada > Astraada A-Series**, enter a keyword, and download the manual.

Scan the QR code on the product housing > Astraada A-Series IO > Download the manual.

## Change history

Due to product version upgrade or other reasons, this document will be updated from time to time without notice.

| Version | Release date | Change description |
|---|---|---|
| V1.4.1 | June 2026 | ● Adjusted the document structure.<br>● Updated the input specifications of section 5.5.2 Digital input module–AS71DI32.<br>● Revised the power supply specifications in sections 5.5.12 Digital input/output module–AS71DT08.<br>● Revised the wiring diagrams in sections 5.5.16 Counting and measurement module–AS71AN02, 5.5.17 Counting and measurement module–AS71IN02, 5.5.18 Counting and measurement module–AS71IN01, and 5.5.19 Dual-channel pulse output control module–AS71PUOC.<br>● Added section 5.5.21 Serial communication module–AS71COM2, section 6.1.8 Bridge measurement module (AS71BRG1&AS71BRG2), section 6.1.9 Pulse module (AS71PUOC), section 6.1.10 Serial communication module (AS71COM2), section 6.2.1.2.7 AS71COM2 serial communication module, and section 8.2 Serial communication module exception code description.<br>● Added section 6.3.1.2.8 AS71COM2 serial communication module. |
| V1.2.1 | January 2025 | ● First release |

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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 product. Otherwise, personal injury, equipment damage, or even death may be caused.

We shall not be liable or responsible for any personal injury, equipment damage, or even 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 safety symbols and warnings 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 the procedures and requirements for equipment installation, commissioning, operation, and maintenance, and be able to take measures to avoid or handle emergencies.

## 1.4 Safety guidelines

| General principles | |
|---|---|
|  | • Only trained and qualified professionals are allowed to carry out related operations.<br>• 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.<br>• The product is designed for use in indoor electrical environments of 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.<br>• Do not modify the product unless authorized; otherwise fire, electric shock or other injury may result.<br>• Prevent metal scraps, copper wires, screws, cables, and other conductive objects from falling into the product.<br>• Do not contact the product with damp objects or body parts. Otherwise, electric shock may result. |

| Moving | |
|---|---|
|  | • Select appropriate tools for product delivery, and take mechanical protective measures like wearing safety shoes and working uniforms to avoid personal injury.<br>• Protect the product against physical shock or vibration. |

| Installation | |
|---|---|
|  | • Do not install the product on flammable materials. Keep flammable materials away from the product, and prevent them from adhering to the product.<br>• Do not operate the product if it is damaged or has missing components. |
|  | • Install the product in a lockable control cabinet with IP20 or higher protection to prevent accidental contact by personnel without relevant knowledge of electrical equipment, which 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.<br>• During installation, ensure that all modules are securely connected and fixed in place to prevent communication failures, detachment, or other problems during operation due to loose connections.<br>• After installation, check and ensure that the product vents are not blocked. Otherwise, poor heat dissipation may cause excessive internal temperature, causing the chips to burn out and leading to system control faults or unintended operation. |

| Wiring | |
|---|---|
|  | • 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.<br>• To ensure personnel safety and safe equipment operation, reliably ground the product using cables with proper diameters and specifications.<br>• Route the control signal and communication signal cables separately from cables with strong interference such as power cables.<br>• Apply fastening means to long-distance or heavy cables. |
|  | • Cut off all power supplies connected to the product before performing wiring.<br>• 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.<br>• 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. |

| Commissioning and running | |
|---|---|
|  | • Before power-on for running, ensure that the working environment of the product meets the requirements (see 3.1.2 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.<br>• Do not damage the product's output units, such as relays and transistors; otherwise, their outputs may no longer be controllable to the ON or OFF state.<br>• 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. |

| Commissioning and running | |
|---|---|
| | • In the external circuit of the product, provide an emergency braking circuit, a protective circuit, an interlock circuit for forward/reverse operation, and upper and lower position limit interlock switches to prevent machine damage.<br>• To ensure the safe running of equipment, design external protection circuits and safety mechanisms for output signals related to major accidents.<br>• Design appropriate external control circuits to ensure proper equipment operation, as a controller system fault may cause outputs to become uncontrollable. |

| Maintenance, servicing, and component replacement | |
|---|---|
|  | • Keep the product and its components away from combustible materials, and prevent combustible materials from adhering to them.<br>• Before carrying out product maintenance or component operations, cut off all power supplies connected to the product.<br>• During maintenance, servicing, or component replacement, prevent metal scraps, copper wires, screws, cables and other conductive parts from falling into the interior of the product.<br>• During maintenance and component replacement, take proper anti-static measures on the product and its internal parts. |
| **Note** | • Use proper torque to tighten screws. |

| Disposal | |
|---|---|
|  | • The product contains heavy metals. Dispose of the product as industrial waste when it is scrapped. |
|  | • Dispose of a scrap product separately at an appropriate collection point but do not place it in the normal waste stream. |

# 2 System overview

## 2.1 System introduction

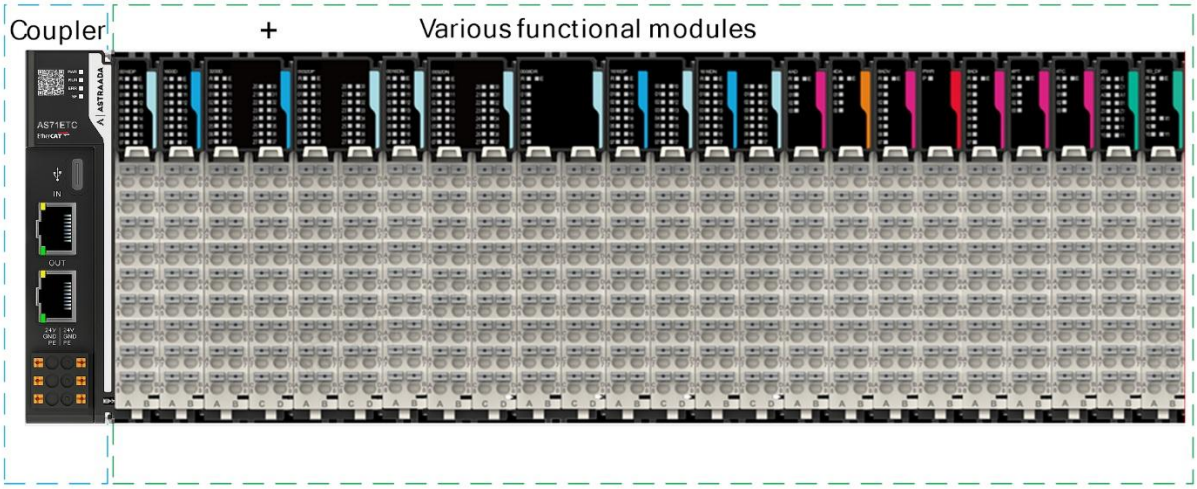
The Astraada A-Series I/O system is a remote I/O expansion solution designed for signal acquisition and signal distribution control, applicable to a wide range of industrial automation applications. Featuring an open and modular architecture, the system supports multiple mainstream industrial fieldbus protocols and offers flexible configuration options, enabling seamless integration with various PLCs and controllers.

By importing the device description file, module configuration can be completed directly within a third-party controller or supervisory system, eliminating the need for dedicated configuration software. The system is equipped with a 100 Mbps backplane bus and supports microsecond-level I/O refresh, enabling high-speed data exchange.

The product adopts a press-fit connection structure and 5 μin gold-plating process, providing excellent corrosion resistance and contact reliability. The entire series is coated with conformal coating to adapt to harsh operating conditions. With a compact module structure and a thickness of only 12 mm, it effectively saves control cabinet space. The PUSH IN wiring method improves wiring efficiency and supports fast tool-free installation. Clear module identification and intuitive status indicators make identification and maintenance easier.

## 2.2 System composition

The A-Series I/O system consists of couplers supporting different communication protocols and various functional modules, such as digital, analog, temperature acquisition, counter, and encoder modules. These components can be flexibly combined and configured according to actual application requirements.



# 3 Installation

## 3.1 Installation preparation

### 3.1.1 Installation precautions

| Before installation | |
|---|---|
| ⚠ | ● Make sure all product modules have been powered off before installation.<br>● Before installation, check the planned overall system dimensions to ensure that there is sufficient space to accommodate all modules. The module shall be installed in a control cabinet, with at least 50 mm of clearance around it to ensure proper heat dissipation of the hardware system. |

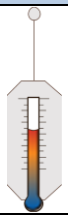
| During installation | |
|---|---|
| ⚠ | ● During installation, use parts that meet the requirements, such as screws and washers.<br>● During installation, prevent wire clippings, debris, screws, and other objects from falling into the product. Otherwise, short circuits may occur, or heat dissipation may be impaired. |

| After installation | |
|---|---|
| ⚠ | ● Ensure that the connected communication cables and terminals are securely fastened.<br>● Ensure that the rail on which the module is mounted is securely fixed.<br>● Ensure that power cables and signal cables are routed separately and arranged neatly inside the cabinet to avoid disorderly wiring that may affect heat dissipation.<br>● After installation, remove the sticker from the module ventilation holes to ensure proper heat dissipation.<br>● After installation, check the air circulation around the module. |

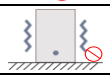
### 3.1.2 Installation environment and site

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 before installation.

■ **Environment requirements**

| Environment | | Requirement |
|---|---|---|
| Temperature |  | ● -20 ℃–55 ℃<br>● There is no sudden temperature change.<br>● When the product is installed in an enclosed space rated IP20, such as a cabinet, use a fan for ventilation and heat dissipation if necessary. |
| Humidity |  | ● 5–95% RH, no condensation |

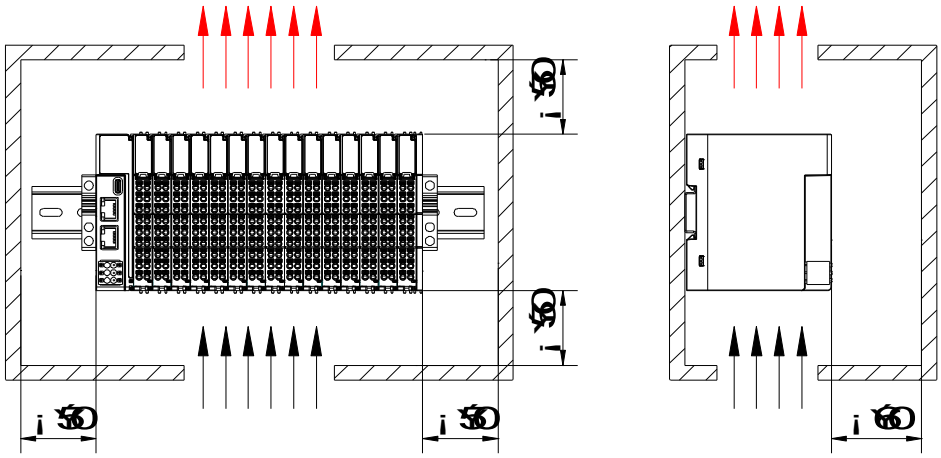
■ **Site requirement**

| Site | Requirement | |
|---|---|---|
| Indoor, overvoltage category 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 or flammable gases |
| |  | ● No direct vibration or transmitted shock acting on the product. |

### 3.1.3 Installation space

Reserve sufficient clearance above and below the module from the cabinet and other components to facilitate product replacement, ventilation, and heat dissipation.

Figure 3-1 Installation space (unit: mm)

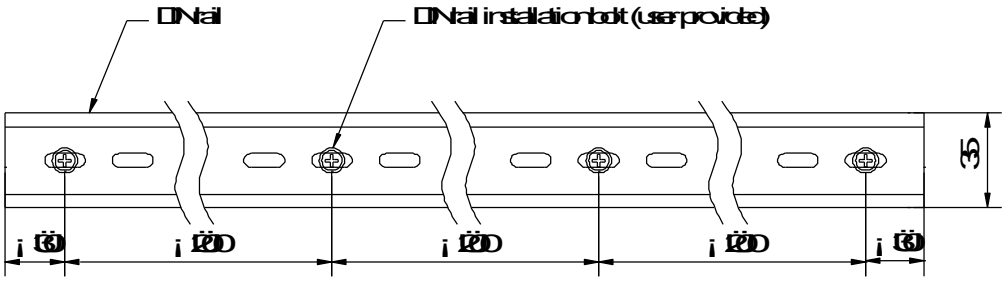


## 3.2 DIN rail model selection

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

| Model | Length × 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 3-2 DIN rail installation dimensions (unit: mm)

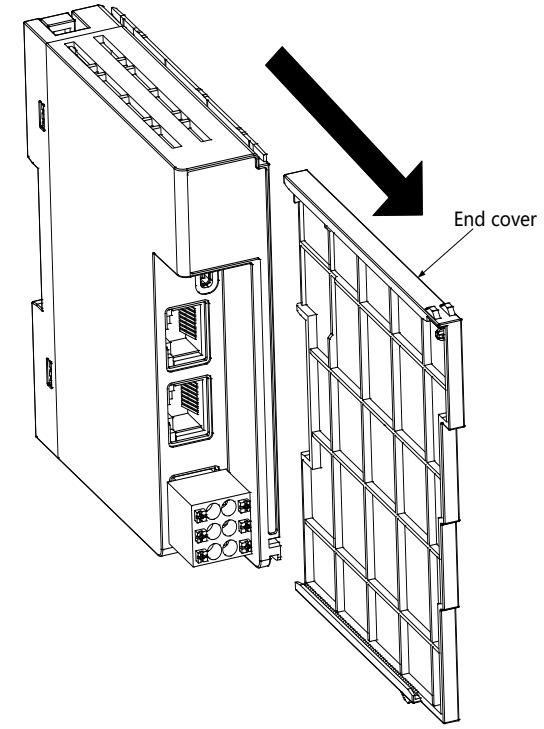



**Note:** To ensure the strength of the DIN rail, install the user-provided DIN rail mounting bolts within 30 mm from each end of the DIN rail (for details, see Figure 3-2), and ensure that the spacing between two adjacent bolts does not exceed 200 mm.

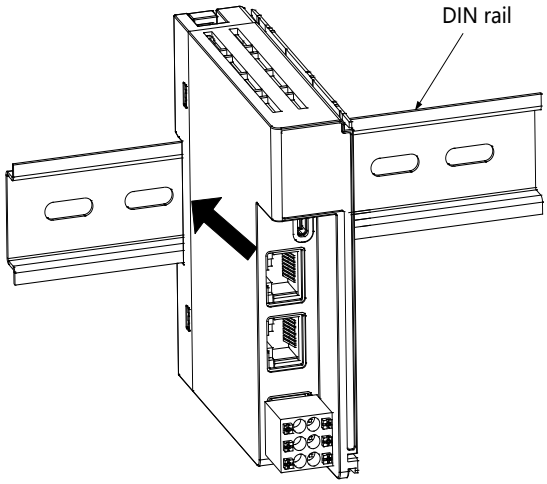
## 3.3 Installation procedure

The installation steps are as follows.

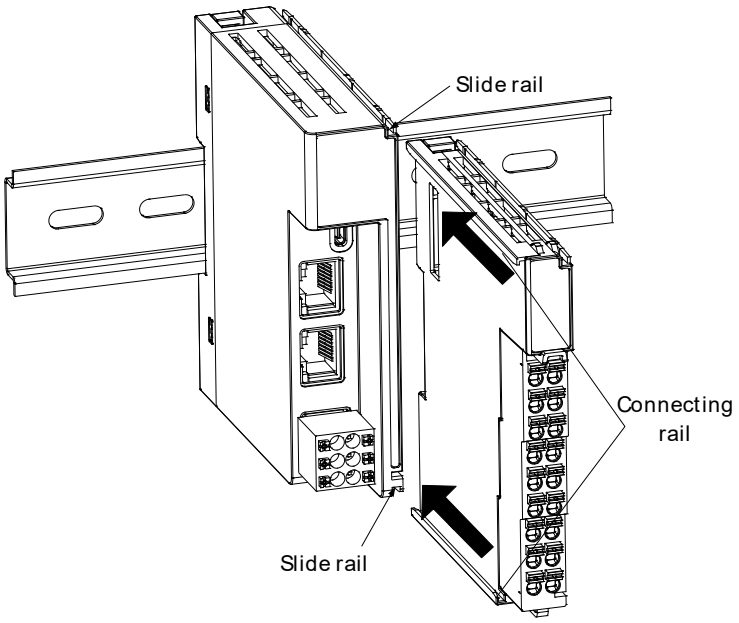
Step 1 Slide the right end cover of the communication coupler forward and remove it.



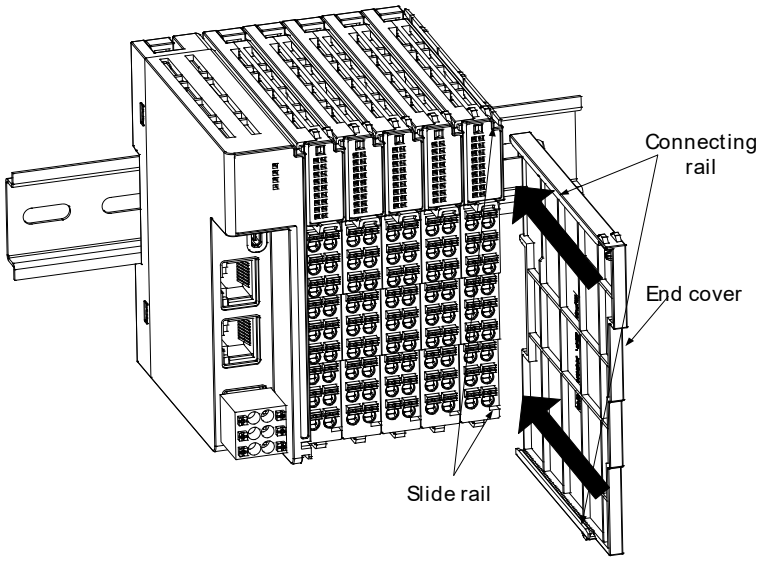

Step 2 Align the communication coupler module with the DIN rail and press inward until the module engages with the DIN rail (there is a noticeable sound of engagement when installed in place).



Step 3 Align the connecting rails of the module to be installed with the slide rails of the module already secured to the DIN rail, and push it inward until the module with the connecting rails engages with the DIN rail (there is a noticeable sound of engagement when installed in place).

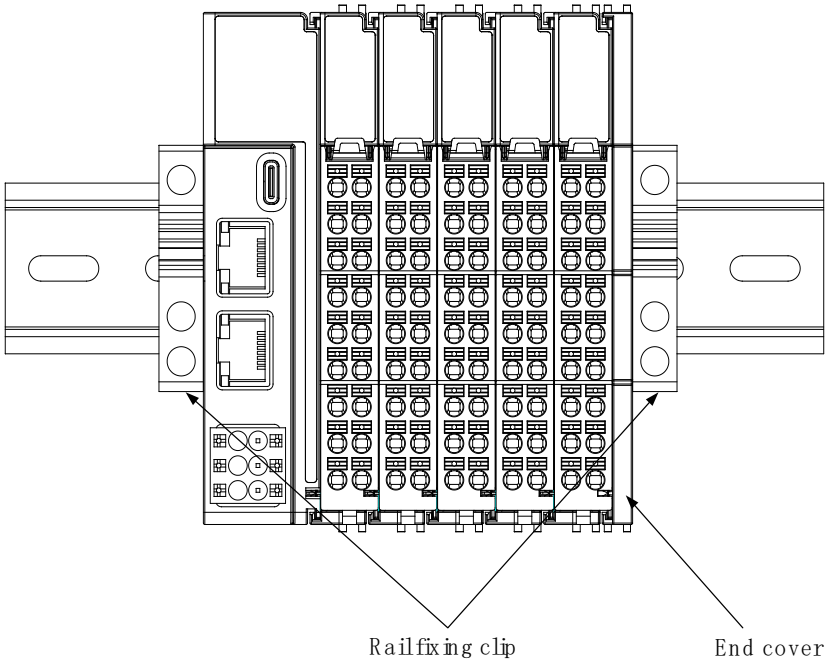



Step 4 Slide the end cover with the connecting rail onto the last I/O module.




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

Step 5 Install one rail fixing clip at each end of the module assembly to prevent the module assembly from sliding sideways.




**Note:**

- For product installation dimensions, see Appendix A Product dimensions.
- Remove the end cover before installing the modules, and install the end cover on the rightmost module when the modules are installed.
- After the module is installed, the DIN rail locking latch automatically engages. If the latch does not lock automatically, press the top of the locking latch toward the DIN rail to secure the module in place.
- The rail fixing clips are user-supplied.

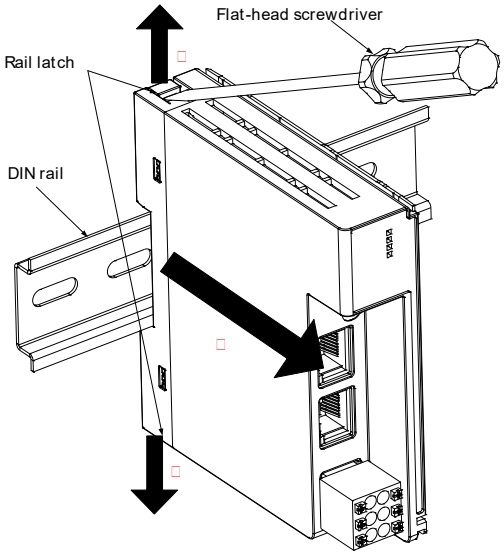
# 3.4 Disassembly procedure

The disassembly steps are as follows:

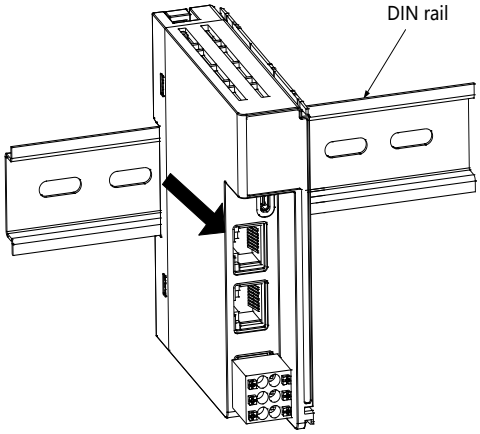
Step 1 Loosen the rail fixing clip to ensure that there is sufficient clearance to pull away the module from the DIN rail.

**Note:** The rail fixing clips are user-supplied.

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




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




**Note:** Refer to 3.3 Installation procedure to remove the end cover.

# 4 Wiring

## 4.1 Wiring requirements

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

  **Note:** Do not overtighten terminal screws. Otherwise, the screws or modules may be damaged, or the screws may fall off, resulting in short circuits or faults.
- Ensure that there are no foreign objects, such as metal shavings or wiring residues, inside each module. The foreign objects may cause short circuit, fire, or incorrect operation.

## 4.2 Grounding requirements

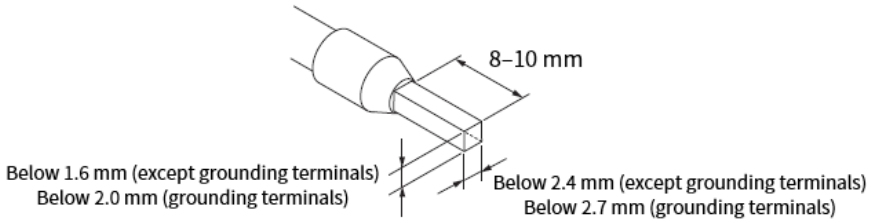
- **Power cable grounding**
  - Ensure proper independent grounding.
  - Use a grounding cable with a cross-sectional area of ≥ 2 mm² and a length of ≤ 30 cm, and connect the grounding terminal of the power supply module to ground ⏚.
  - If the grounding point is close to the product, ensure that the grounding cable is secure.
- **Shielded cable grounding**
  - Use shielded cables for cables transmitting sensitive signals, such as analog I/O, RS485, and EtherCAT signals.
  - The grounding point should be as close as possible to the module.
  - For the exposed shield after a section of the outer sheath of the shielded cable is stripped, connect it to the conductive backplane with the largest possible contact area to ensure good grounding contact.

## 4.3 Cable specifications

| Cable material | Applicable cable size | | Crimping tool |
|---|---|---|---|
| | GB size (mm²) | American Wire Gauge (AWG) | |
| Tubular cable lug | 0.3 | 22 | Use a proper crimping tool. |
| | 0.5 | 20 | |
| | 0.75 | 18 | |
| | 1.0 | 18 | |
| | 1.5 | 16 | |

**Note:**

- The cable sizes applicable to the tubular cable lugs in the table above are for reference only and can be adjusted based on actual conditions.
- When using other tubular cable lugs, crimp stranded cables according to the following processing dimension requirements:



# 5 Product specifications

## 5.1 Overview

This chapter provides a detailed description of the design, functions, interfaces, hardware specifications, software specifications, and environmental requirements of the communication couplers and I/O modules in the A-Series I/O system.

## 5.2 Basic information

| Model | Ordering code | Description | Applicable to |
|---|---|---|---|
| AS71ETC | 11016–00005 | Communication coupler, EtherCAT, 24 VDC, RoHS | Applicable to ASTRAADA and third-party EtherCAT master devices |
| AS71PNS | 11016–00012 | Communication coupler, PROFINET, 24 VDC, RoHS | Applicable to PROFINET master devices |
| AS71EIP | 11016–00018 | Communication coupler, EtherNet/IP, 24 VDC, RoHS | Applicable to EtherNet/IP master devices |
| AS71TCP | 11016–00029 | Communication coupler, Modbus TCP, 24 VDC, RoHS | Applicable to Modbus TCP master devices |
| AS71DI16 | 11016–00004 | Digital input module, 16 channels, source/sink, 500 mA @ 24 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71DI32 | 11016–00016 | Digital input module, 32 channels, source/sink, 500 mA @ 24 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71DO16 | 11016–00006 | Digital output module, 16 channels of PNP transistor output, 500 mA @ 24 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71DO32 | 11016–00013 | Digital output module, 32 channels of PNP transistor output, 500 mA @ 24 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71DOR8 | 11016–00009 | Digital output module, 8 channels of relay outputs, dry contacts, 3 A @ 30 VDC/250 VAC; RoHS | Applicable to ASTRAADA A-Series |
| AS71AIN4 | 11016–00011 | Analog input module, 4 channels, 16-bit resolution, room temperature accuracy ±0.1% FS, RoHS | Applicable to ASTRAADA A-Series |
| AS71AIV8 | 11016–00026 | Analog input module, 8 channels, voltage signal, 16-bit resolution, room temperature accuracy ±0.15% FS, RoHS | Applicable to ASTRAADA A-Series |
| AS71AIC8 | 11016–00027 | Analog input module, 8 channels, current signal, 16-bit resolution, room temperature accuracy ±0.15% | Applicable to ASTRAADA A-Series |

| Model | Ordering code | Description | Applicable to |
|---|---|---|---|
| | | FS, RoHS | |
| AS71AOU4 | 11016–00008 | Analog output module, 4 channels, 16-bit resolution, room temperature accuracy ±0.1% FS, RoHS | Applicable to ASTRAADA A-Series |
| AS71RTD4 | 11016–00007 | Resistance temperature detector (RTD) module, 4 channels, 24-bit resolution, sensitivity 0.1 °C/°F, RoHS | Applicable to ASTRAADA A-Series |
| AS71THC4 | 11016–00010 | Thermocouple module, 4 channels, 24-bit resolution, sensitivity 0.1 ℃/℉, RoHS | Applicable to ASTRAADA A-Series |
| AS71DT16 | 11016–00015 | Digital input/output module, 16 channels of input and 16 channels of output (PNP), 500 mA @ 24 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71BRG1 | 11016–00030 | Bridge measurement module, 4-/6-wire resistor bridge sensor input, 1 channel, 24-bit, 5 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71BRG2 | 11016–00031 | Bridge measurement module, 4-/6-wire resistor bridge sensor input, 2 channels, 24-bit, 5 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71PWRR | 11016–00028 | Power feed module, 24 VDC input, 5 VDC 2.5 A output, RoHS | Applicable to ASTRAADA A-Series |
| AS71AN02 | 11016–00022 | SSI absolute encoder input module, 2 channels, 24 VDC, 2 MHz, RoHS | Applicable to ASTRAADA A-Series |
| AS71IN02 | 11016–00019 | Incremental encoder input module, 2 channels, 24 V single-ended, 200 kHz, RoHS | Applicable to ASTRAADA A-Series |
| AS71IN01 | 11016–00021 | Incremental encoder input module, 1 channel, 5 VDC differential, 2 MHz, RoHS | Applicable to ASTRAADA A-Series |
| AS71DT08 | 11016–00045 | Digital input/output module, 8 channels of input and 8 channels of output (PNP), 500 mA @ 24 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71PUOC | 11016–00025 | I/O module, pulse output control, 2 channels, 24 VDC, RoHS | Applicable to ASTRAADA A-Series |
| AS71COM2 | 11016–00056 | I/O module, serial communication module, 2 channels, configurable RS485/RS232, supports master, slave, and free protocol communication, RoHS | Applicable to ASTRAADA A-Series |

# 5.3 Environmental requirements

| Item | Specifications |
|---|---|
| Working environment temperature | -20 ℃–+55 ℃ |
| Working environment relative humidity (RH) | < 95% RH, no condensation |
| Storage temperature | -40 ℃–+70 ℃ |
| Storage environment RH | < 90% RH, no condensation |
| Air | No corrosive gas |
| Altitude | Lower than 3000 m |
| Pollution degree | Below degree 2 |
| Immunity | Power lines: 2 kV, compliant with IEC 61000-4-4 |
| Overvoltage category | Category II |
| EMC immunity | Zone B, compliant with IEC 61131-2 |
| Vibration resistance | Compliant with IEC 60068-2-6 |
| Shock resistance | Compliant with IEC 60068-2-27 |

# 5.4 Communication coupler

## 5.4.1 EtherCAT communication coupler—AS71ETC

Figure 5-1 AS71ETC appearance

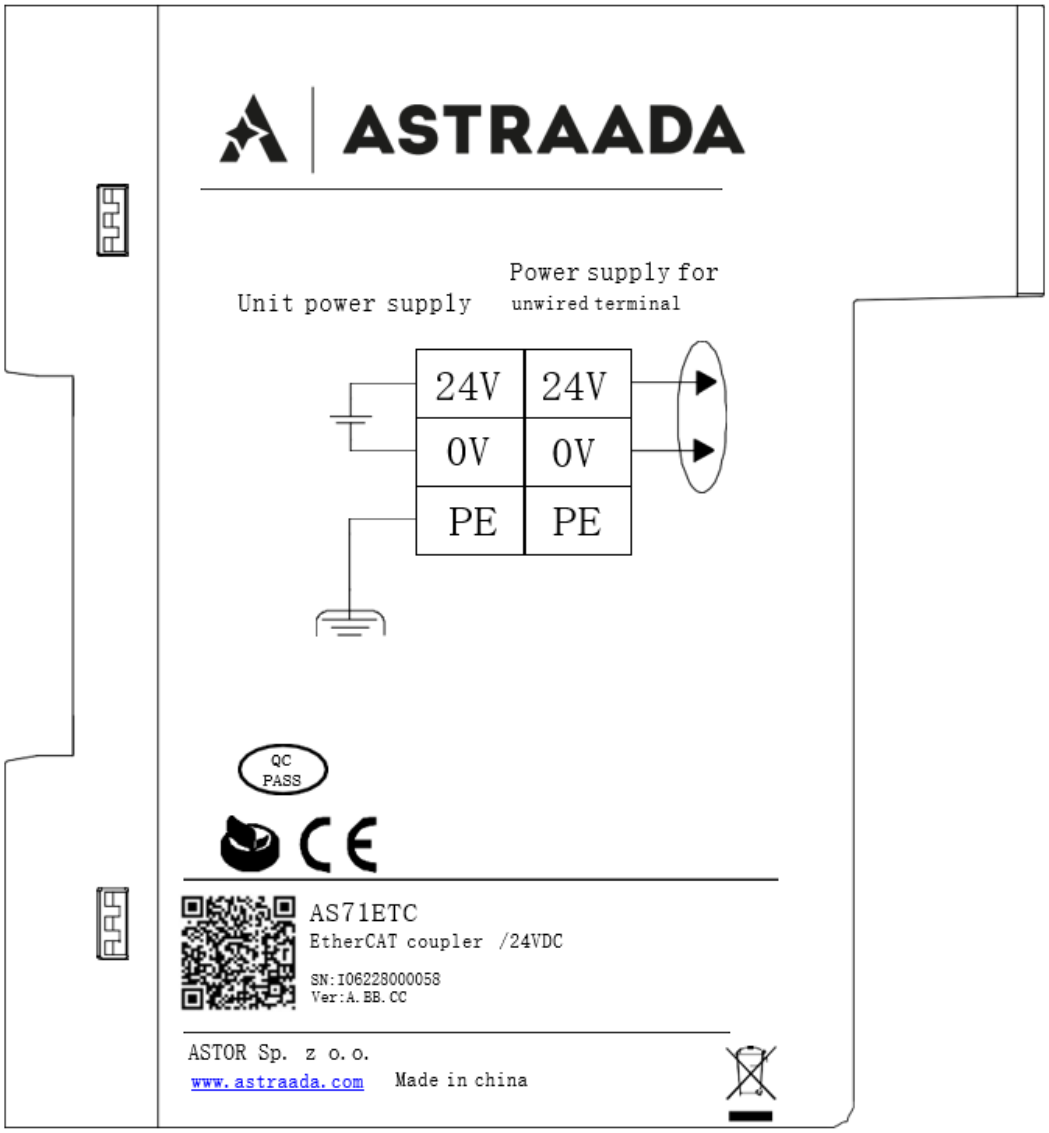


Figure 5-2 Component diagram

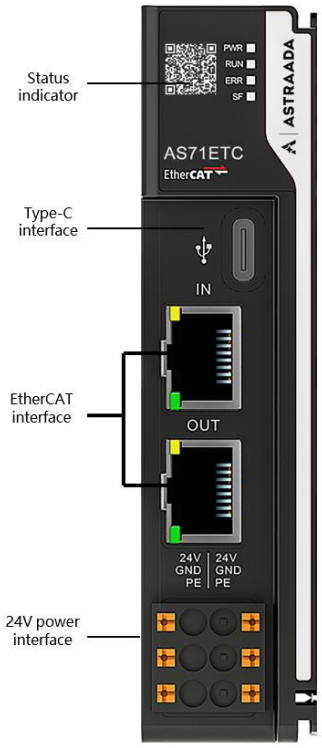


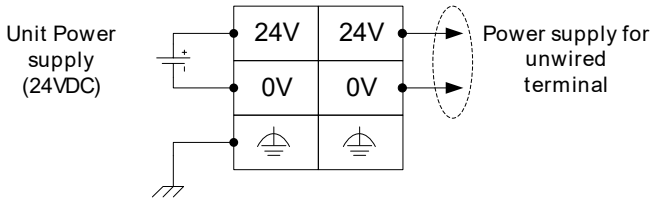

Table 5-1 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Power supply indicator | Green | PWR | Off: The power connection is abnormal.<br>On: The power connection is normal. |
| Run indicator | Green | RUN | Off: The communication coupler module is in the INIT state.<br>Blinking: The communication coupler module is in the Pre-Operational state.<br>Single flash: The communication coupler module is in the Safe-Operational state.<br>On: The communication coupler module is in the Operational state. |
| Fault indicator | Red | ERR | Off: The EtherCAT communication is in the normal state.<br>Blinking: An invalid EtherCAT state transition command has been received.<br>Single flash: Network disconnection or a communication coupler module synchronization error has occurred.<br>Double flash: An EtherCAT communication watchdog error has occurred. |
| Bus fault indicator | Red | SF | Off: The device is operating normally.<br>Blinking: Configuration error occurs.<br>On: A communication coupler FPGA fault occurs. |
| Type-C interface | Used for single-board software upgrade | | |
| EtherCAT interface | IN: EtherCAT input port | | |
| | OUT: EtherCAT output port | | |
| 24 V power supply interface | 24 VDC power input interface of module | | |

- **Terminal definition**

| Diagram | Left signal | Left terminal | Right terminal | Right signal |
|---|---|---|---|---|
|  | 24V | **24V** | **24V** | 24V |
| | 0V | **GND** | **GND** | 0V |
| | ⏚ | **PE** | **PE** | ⏚ |

- **Terminal wiring**




- **Hardware specifications**

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

- **Software specifications**

| Item | Specifications |
|---|---|
| Alias access | Supports EtherCAT alias access. The station alias can be configured through the configuration interface, with an alias range of 1–65535.<br>**Note:** The expansion modules connected downstream of the EtherCAT communication coupler do not support alias access or setup. |
| Input/output PDO data size | Max. 768 bytes |
| Input/output mailbox size | Max. 128 bytes |
| Max. number of expansion modules | 16 |
| Supported min. synchronization interval | 512 μs |

## 5.4.2 PROFINET communication coupler—AS71PNS

Figure 5-3 AS71PNS appearance

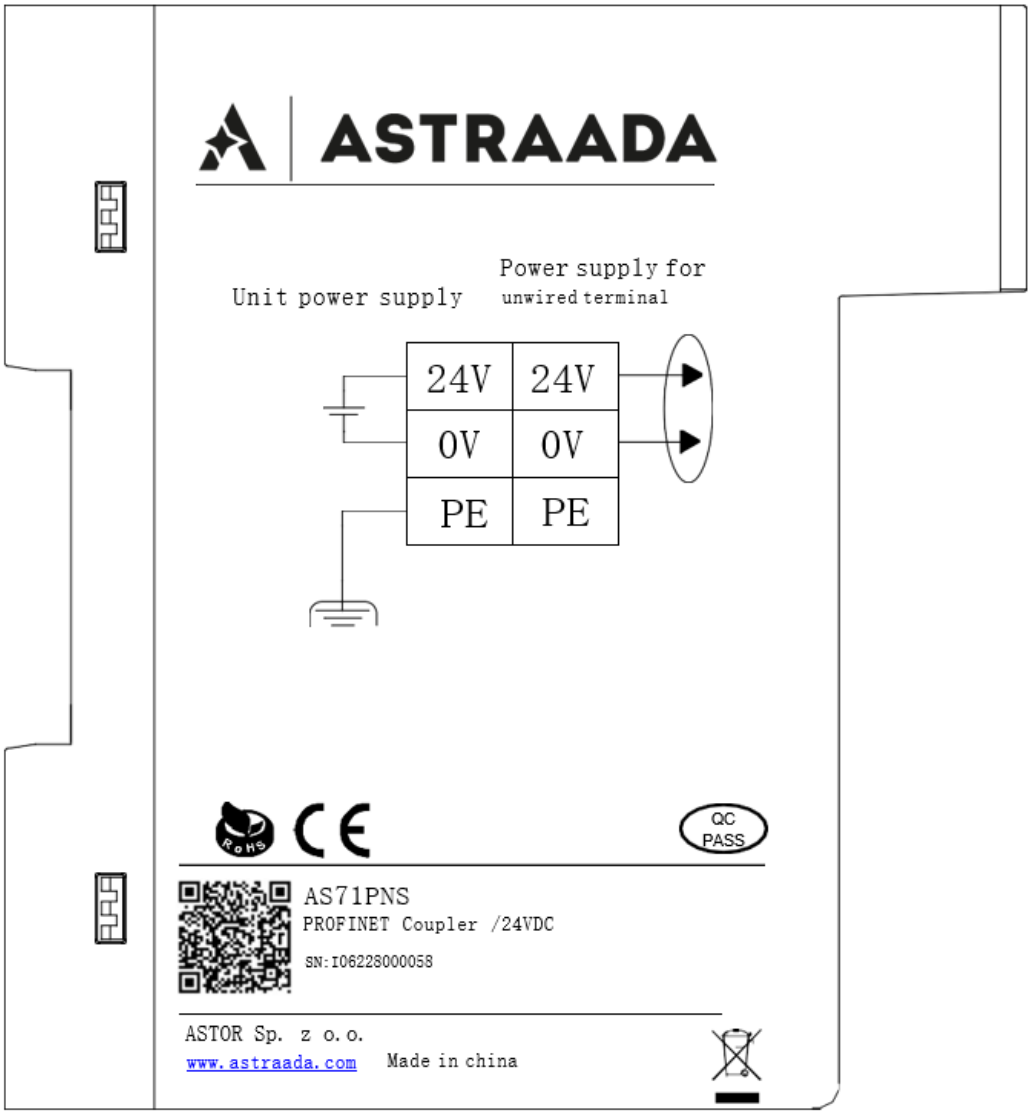


Figure 5-4 Component diagram

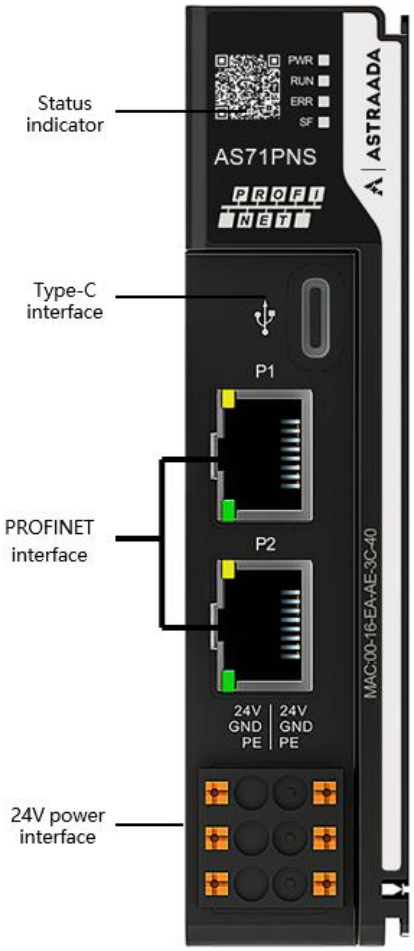


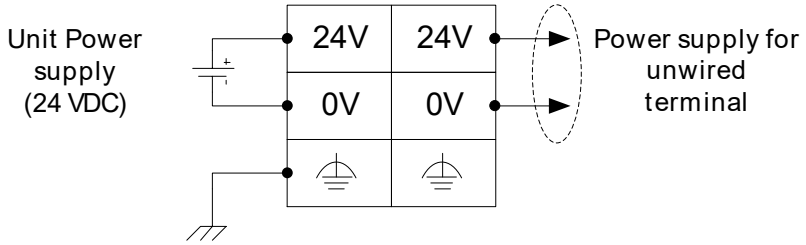

Table 5-2 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Power supply indicator | Green | PWR | Off: The power connection is abnormal.<br>On: The power connection is normal. |
| Run indicator | Green | RUN | Off: Initial state<br>Fast blinking: Waiting for connection/Connecting<br>Slow blinking: Safety mode<br>On: The communication is normal |
| Fault indicator | Red | ERR | Off: Normal<br>Fast blinking: Communication fault<br>Slow blinking: Expansion module error |
| Bus fault indicator | Red | SF | Off: The device is operating normally.<br>Blinking: Configuration inconsistency<br>On: Expansion function fault |
| Type-C interface | Used for single-board software upgrade | | |
| PROFINET interface | P1: PROFINET interface 1 | | |
| | P2: PROFINET interface 2 | | |
| 24 V power supply interface | 24 VDC power input interface of module | | |

- **Terminal definition**

| Diagram | Left signal | Left terminal | Right terminal | Right signal |
|---|---|---|---|---|
|  | 24V | **24V** | **24V** | 24V |
| | 0V | **GND** | **GND** | 0V |
| | ⏚ | **PE** | **PE** | ⏚ |

- **Terminal wiring**




- **Hardware specifications**

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

- **Software specifications**

| Item | Specifications |
|---|---|
| Communication mode | RT mode |
| Min. communication period | 1 ms |
| I&M data | From I&M0 to I&M3 |
| PROFINET version | V2.43 |
| Expansion capability | Supports up to 16 modules |
| Number of PROFINET interfaces | 2 |
| PROFINET switch function | Supports networking |
| Supported open Industrial Ethernet protocols | TCP/IP, SNMP, and LLDP |
| Alarm/Diagnosis/Status information | Supports uploading local diagnostic codes to the PLC. |
| Physical layer | 100BASE-TX |
| Communication rate | 10 Mbit/s (standard Ethernet)<br>100 Mbit/s (PROFINET) |
| Transmission mode | Full duplex |

| Item | Specifications |
|---|---|
| Topology structure | Line, star, or tree topology |
| Transmission medium | Category 5e or higher network cable |
| Transmission distance | Distance between two nodes: < 100 m |
| Startup with priority | Reserved |
| Port disabling | Not supported |
| Device replacement without configuration | Supported (PN module of the same type) |
| Restoring factory settings | Supported |

### 5.4.3 EtherNet/IP communication coupler–AS71EIP

Figure 5-5 AS71EIP appearance

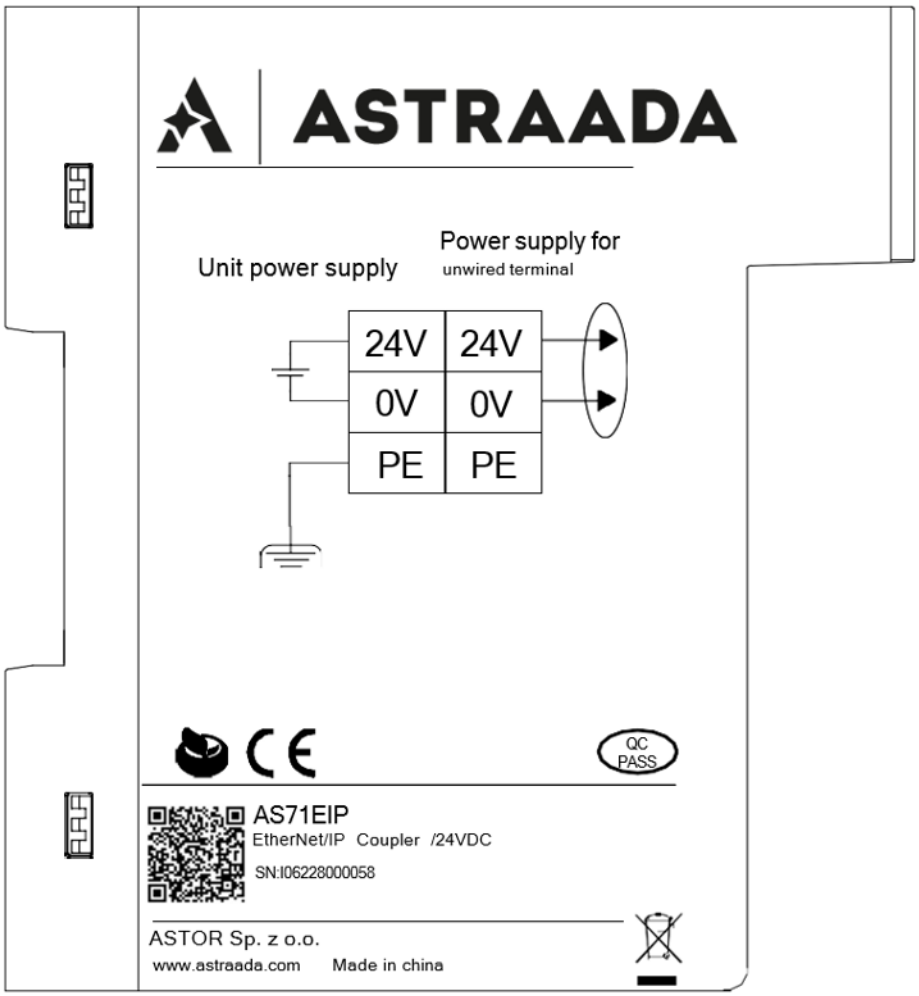


Figure 5-6 Component diagram

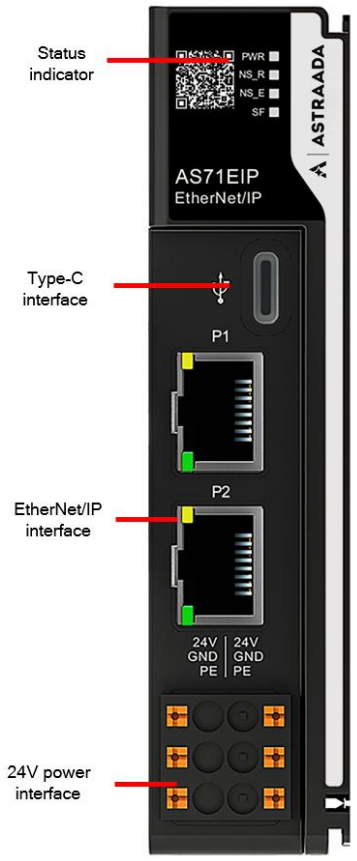


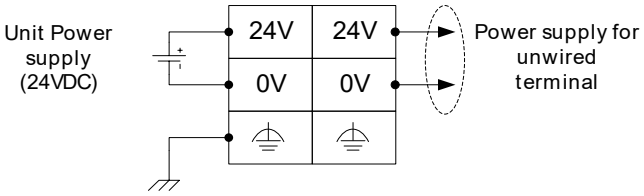

Table 5-3 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Power supply indicator | Green | PWR | Off: The power connection is abnormal.<br>On: The power connection is normal. |
| Network status indicator | Green | NS_R | Off: No IP address configured, no Ethernet connection.<br>Blinking (1 Hz): Not connected.<br>Steady on: Connected. |
| Network status indicator | Red | NS_E | Off: The network is working properly.<br>Blinking (1 Hz): Connection timed out.<br>Steady on: Duplicate IP address |
| Bus fault indicator | Red | SF | Off: The device is normal.<br>Blinking (1 Hz): Configuration error occurs.<br>Blinking (0.5 Hz): Exception in communication coupler MPU device initialization.<br>On: A communication coupler FPGA fault occurs. |
| Type-C interface | For functions such as single-board software upgrades, EDS file export, and IP/MAC address configuration | | |
| EtherNet/IP interface | Green | P1, P2 | Link indicator<br>Off: Ethernet connection is not established.<br>On: Ethernet connection is successful. |
| | Yellow | P1, P2 | ACK indicator<br>Off: There is no data exchange.<br>On: There is data exchange. |
| 24 V power supply interface | 24 VDC power input interface of module | | |

- **Terminal definition**

| Diagram | Left signal | Left terminal | Right terminal | Right signal |
|---|---|---|---|---|
|  | 24V | **24V** | **24V** | 24V |
| | 0V | **GND** | **GND** | 0V |
| | ⏚ | **PE** | **PE** | ⏚ |

- **Terminal wiring**




- **Hardware specifications**

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

- **Software specifications**

| Item | Specifications |
|---|---|
| Fieldbus protocol | EtherNet/IP |
| Fieldbus rate | 10/100 Mbps, auto-negotiation, full duplex |
| Max. number of IO expansion modules | 32 |
| Max. number of output/input bytes | 504 bytes |
| Network topology | Line, star, tree, or ring topology |

## 5.4.4 Modbus TCP communication coupler–AS71TCP

Figure 5-7 AS71TCP appearance

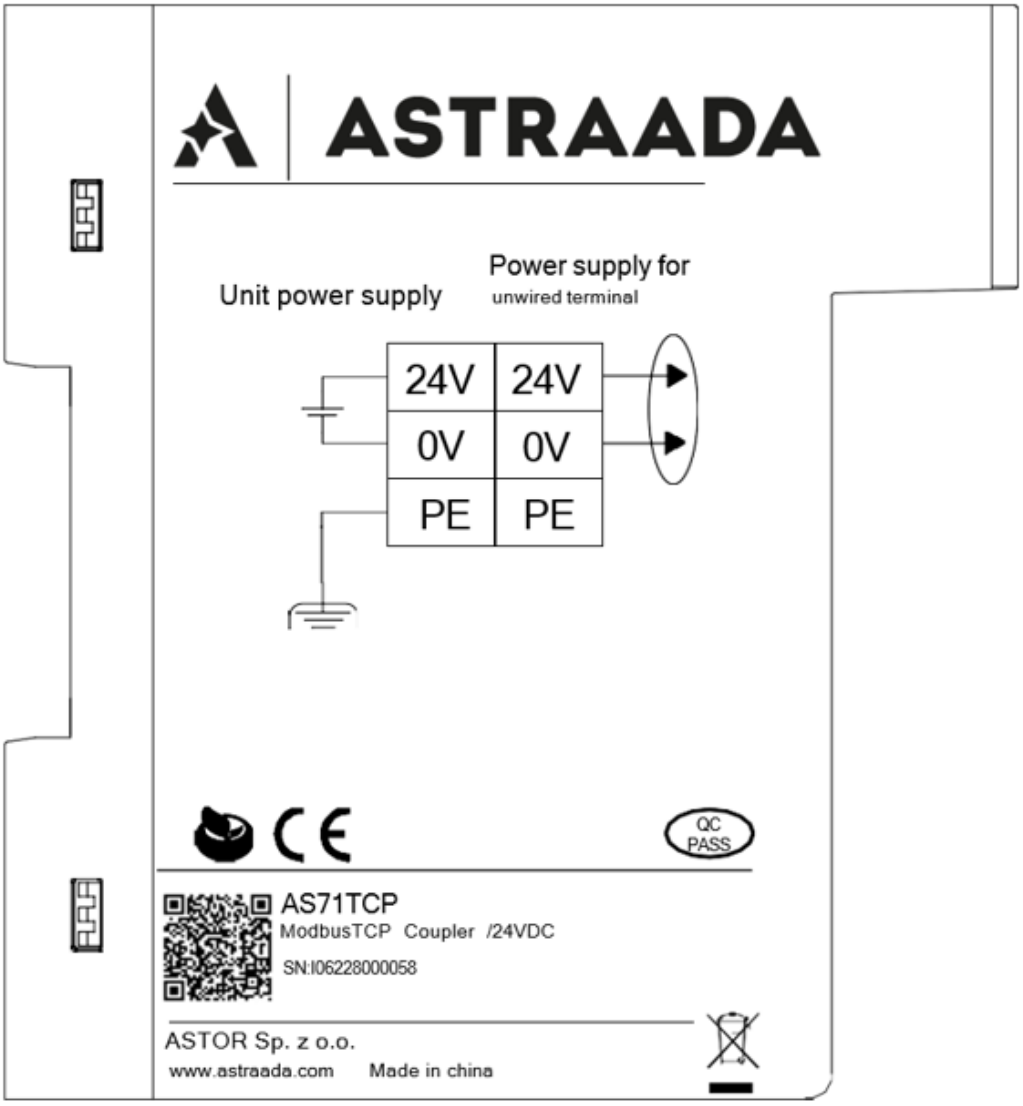


Figure 5-8 Component diagram

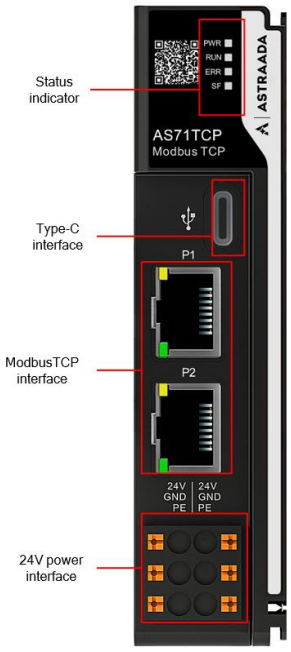


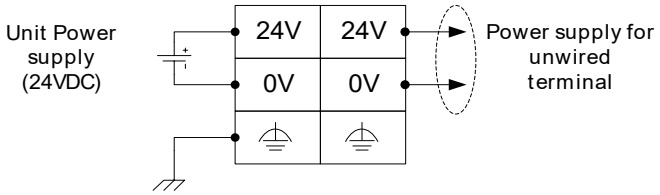

Table 5-4 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Green | PWR | Power supply indicator<br>Off: The power connection is abnormal.<br>On: The power connection is normal. |
| | Green | RUN | Network operation status indicator<br>Off: Not connected to the network.<br>Blinking (500 ms): Waiting for connection/Connecting.<br>On: The communication is normal. |
| | Red | ERR | Network error status indicator<br>Off: The network is working properly.<br>Blinking (500 ms): The network is disconnected abnormally after successful connection.<br>On: IP conflict. |
| | Red | SF | System fault indicator<br>Off: The device is normal.<br>Blinking (500 ms): Configuration error occurs.<br>Blinking (1000 ms): Exception in communication coupler MPU device initialization.<br>On: A communication coupler initialization failure occurs. |
| Type-C interface | For functions such as single-board software upgrades, EDS file export, and IP/MAC address configuration | | |
| Modbus TCP interface | Green | P1, P2 | Link indicator<br>Off: Not connected to the network.<br>On: Connected to the network. |
| | Yellow | P1, P2 | ACK indicator<br>Off: There is no data exchange.<br>On: There is data exchange. |
| 24 V power supply interface | 24 VDC power input interface of module | | |

- **Terminal definition**

| Diagram | Left signal | Left terminal | Right terminal | Right signal |
|---|---|---|---|---|
|  | 24V | **24V** | **24V** | 24V |
| | 0V | **GND** | **GND** | 0V |
| | ⏚ | **PE** | **PE** | ⏚ |

- **Terminal wiring**




**Note:**

- The terminal PE needs to be well grounded through a cable, and the ground resistance is less than 4 Ω.
- Configure an independent system power supply for the coupler whenever possible to avoid sharing it with the external field power supply of expansion modules.

- **Hardware specifications**

| Item | Specifications |
|---|---|
| Rated input voltage | 24 VDC (-15%–+20%) |
| Rated input current | 0.8 A |
| Rated backplane bus output voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Rated backplane bus output current | 2.5 A (Typical value) |
| Isolation | No |
| Power supply protection | Protection against reverse connection and overcurrent |

- **Software specifications**

| Item | Specifications |
|---|---|
| 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 Astraada A-Series IO Studio software |
| Diagnostic function | Supported |
| Physical layer | 100BASE-TX |
| Communication rate | 10/100 Mbps, auto-negotiation |
| Transmission mode | Full duplex |
| Topology structure | Line, star, or tree topology |
| Transmission medium | Category 5e or higher network cable |
| Transmission distance | Max. segment length is 100 m. |

# 5.5 I/O module

## 5.5.1 Digital input module–AS71DI16

Figure 5-9 AS71DI16 appearance



Figure 5-10 Component diagram

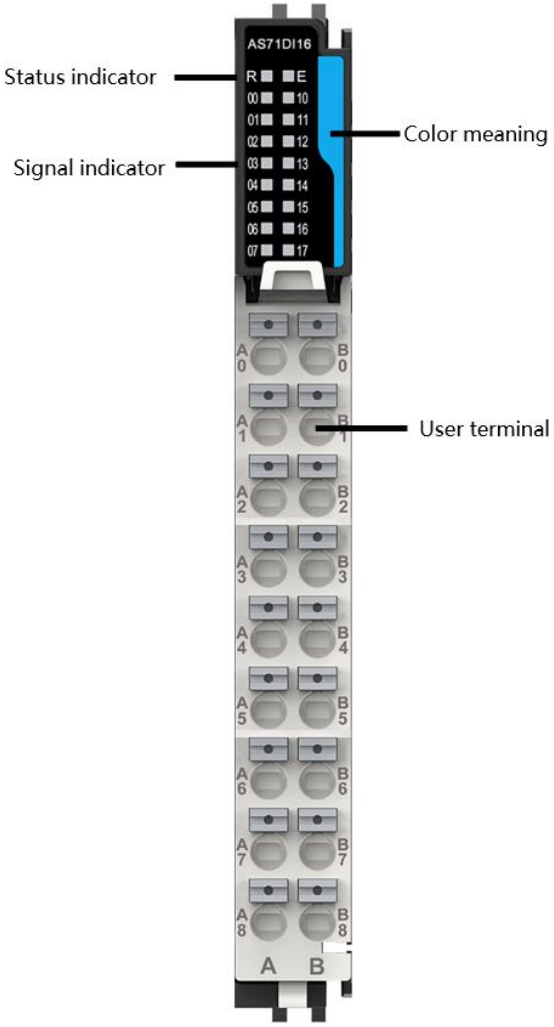
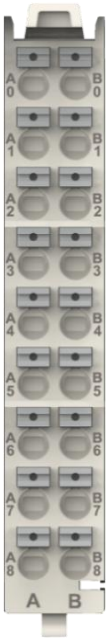


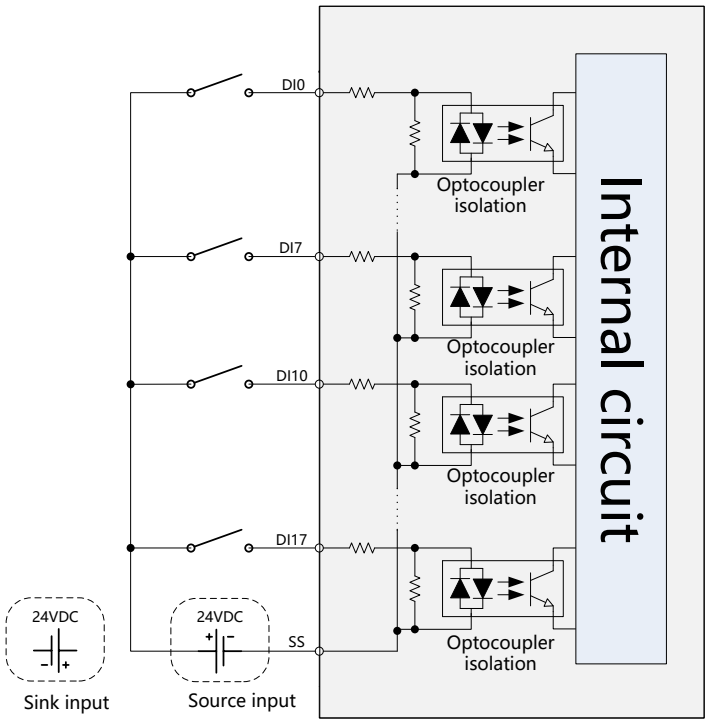

Table 5-5 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): Incorrect parameter settings.<br>Off: The module works normally. |
| Signal indicator | Green | 00–07<br>10–17 | Input signal indicators (corresponding to each input channel)<br>On: The input is active.<br>Off: The input is inactive. |
| User terminal | I/O terminals for external wiringModule hot swapping | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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**




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 150 mA (Typical value at 5 VDC) |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Input type | Digital input |
| Input mode | Source/Sink |
| Input channel | 16 |
| Input voltage class | 24 VDC ±10% (21.6 VDC–26.4 VDC) |
| Input current (Typical) | 7 mA (Typical value at 24 VDC) |
| ON voltage | >15 V |
| OFF voltage | <5 V |
| Hardware ON/OFF response time | 100 μs |
| Software filter time | Supported |
| Input resistance | Reference value about 3.4 kΩ |
| Isolation | Yes |
| Input action display | When the input is in driving state, the input indicator is on. |
| Input derating | Derate to 75% when operating at 55°C (no more than 12 input points can be ON simultaneously), or reduce the allowable ambient temperature by 10°C when all input points are ON. |

- **Software specifications**

| Item | Specifications |
|---|---|
| Software input filter time | Setting range: 1–65535 (Default: 1000)<br>Unit: 10 μs; 1000 indicates 10 ms.<br>Supports two groups of filter parameters, with 8 channels per group. Channels in the same group share one filter parameter. |
| Input channel logic level configuration | Not supported |
| Independent channel enable configuration | Not supported |
| Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| In stop mode | Outputs are not refreshed; inputs support refreshing in the Safe-Operational state. |
| I/O mapping | Supports bit-level access mapping. |

## 5.5.2 Digital input module–AS71DI32

Figure 5-11 AS71DI32 appearance

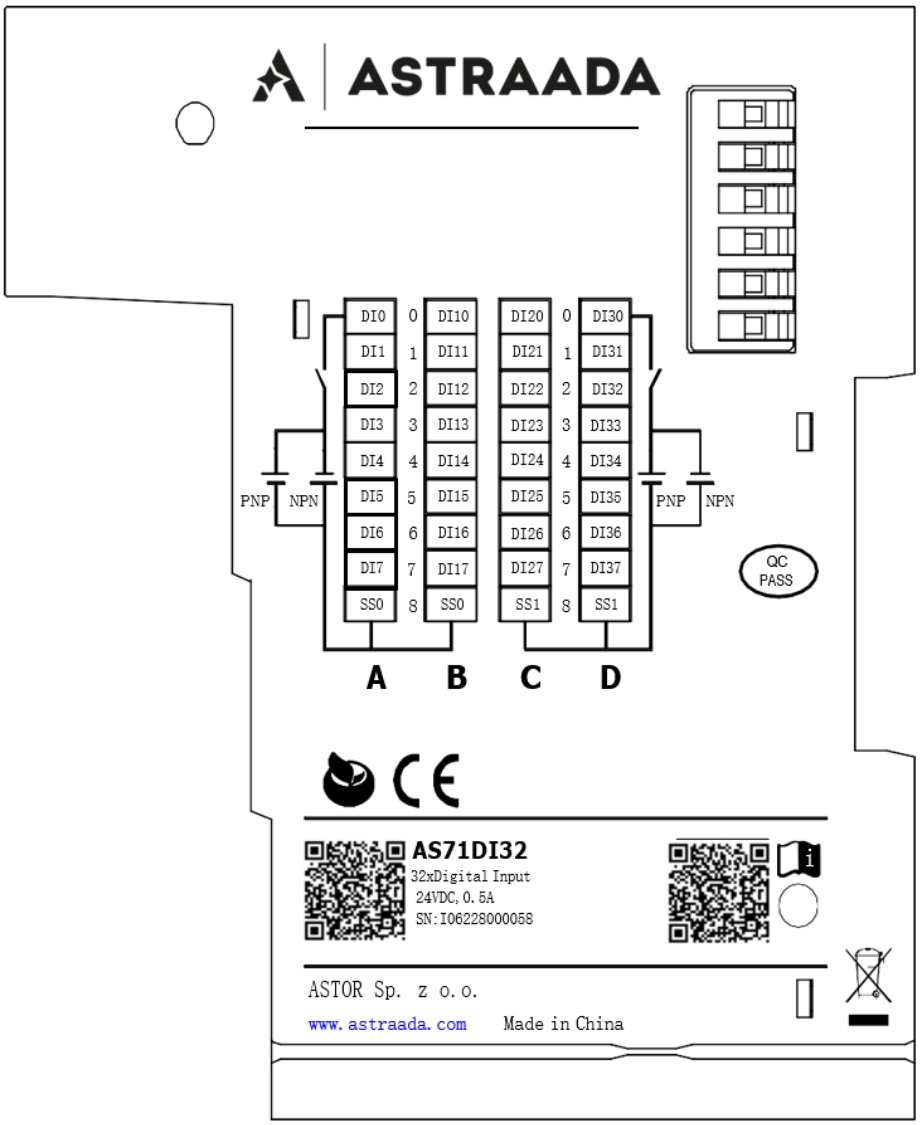


Figure 5-12 Component diagram

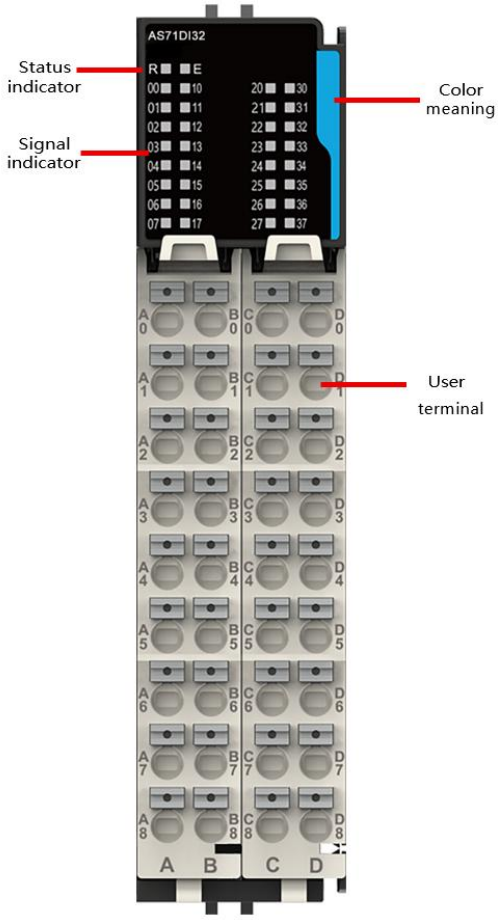
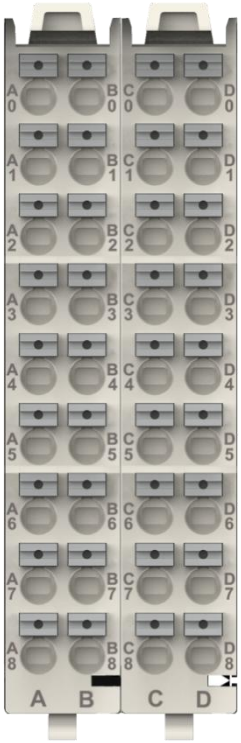



Table 5-6 Component description

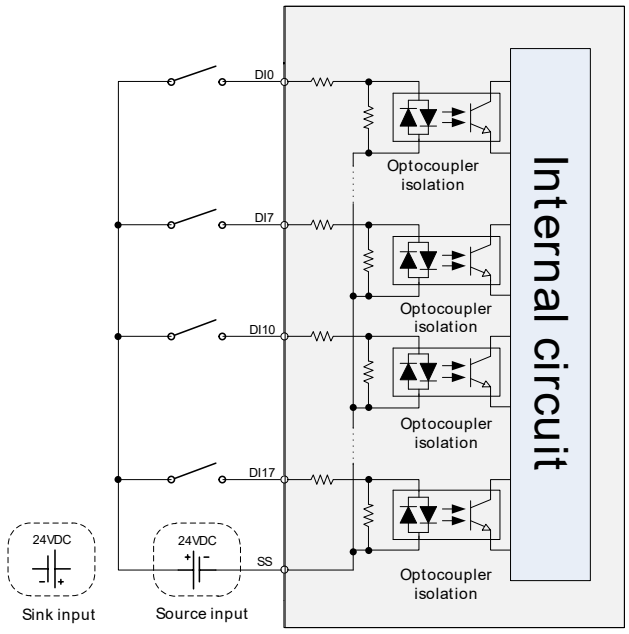
| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): Incorrect parameter settings.<br>Off: The module works normally. |
| Signal indicator | Green | 00–07<br>10–17<br>20–27<br>30–37 | Input signal indicators (corresponding to each input channel)<br>On: The input is active.<br>Off: The input is inactive. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

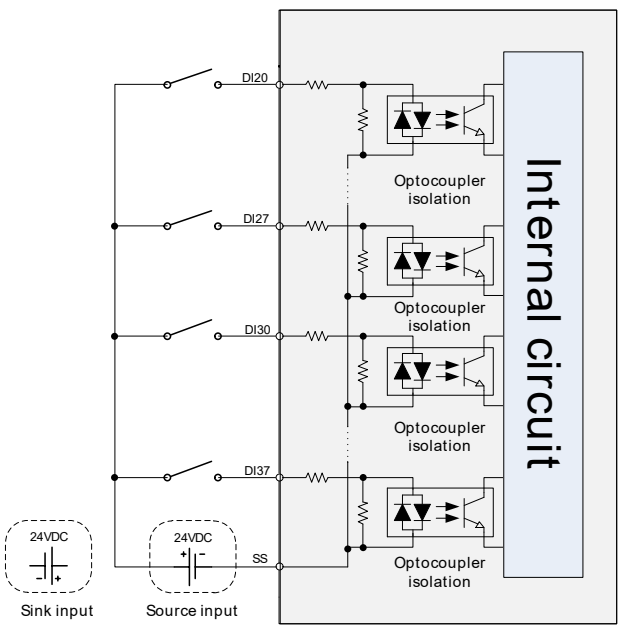
| Diagram | Left signal | Left terminal | Right terminal | Right signal |
|---|---|---|---|---|
|  | DI0 | **A0** | **B0** | DI10 |
| | DI1 | **A1** | **B1** | DI11 |
| | DI2 | **A2** | **B2** | DI12 |
| | DI3 | **A3** | **B3** | DI13 |
| | DI4 | **A4** | **B4** | DI14 |
| | DI5 | **A5** | **B5** | DI15 |
| | 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**

A/B terminal




C/D terminal




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 150 mA (Typical value at 5 VDC) |

| Item | Specifications |
|---|---|
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Input type | Digital input |
| Input mode | Source/Sink |
| Input channel | 32 |
| Input voltage class | 24 VDC ±10% (21.6 VDC–26.4 VDC) |
| Input current (Typical) | 7 mA (Typical value at 24 VDC) |
| ON voltage | >15 V |
| OFF voltage | <5 V |
| Hardware ON/OFF response time | 100 μs |
| Software filter time | Supported |
| Input resistance | Reference value about 3.4 kΩ |
| Isolation | Yes |
| Input action display | When the input is in driving state, the input indicator is on. |
| Input derating | Derate to 75% when operating at 55°C (no more than 12 input points can be ON simultaneously), or reduce the allowable ambient temperature by 10°C when all input points are ON. |

- **Software specifications**

| Item | Specifications |
|---|---|
| Software input filter time | Setting range: 1–65535 (Default: 1000)<br>Unit: 10 μs; 1000 indicates 10 ms.<br>Supports four groups of filter parameters, with 8 channels per group. Channels in the same group share one filter parameter. |
| Input channel logic level configuration | Not supported |
| Independent channel enable configuration | Not supported |
| Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| In stop mode | Outputs are not refreshed; inputs support refreshing in the Safe-Operational state. |
| I/O mapping | Supports bit-level access mapping. |

## 5.5.3 Digital output module (source)–AS71DO16

Figure 5-13 AS71DO16 appearance

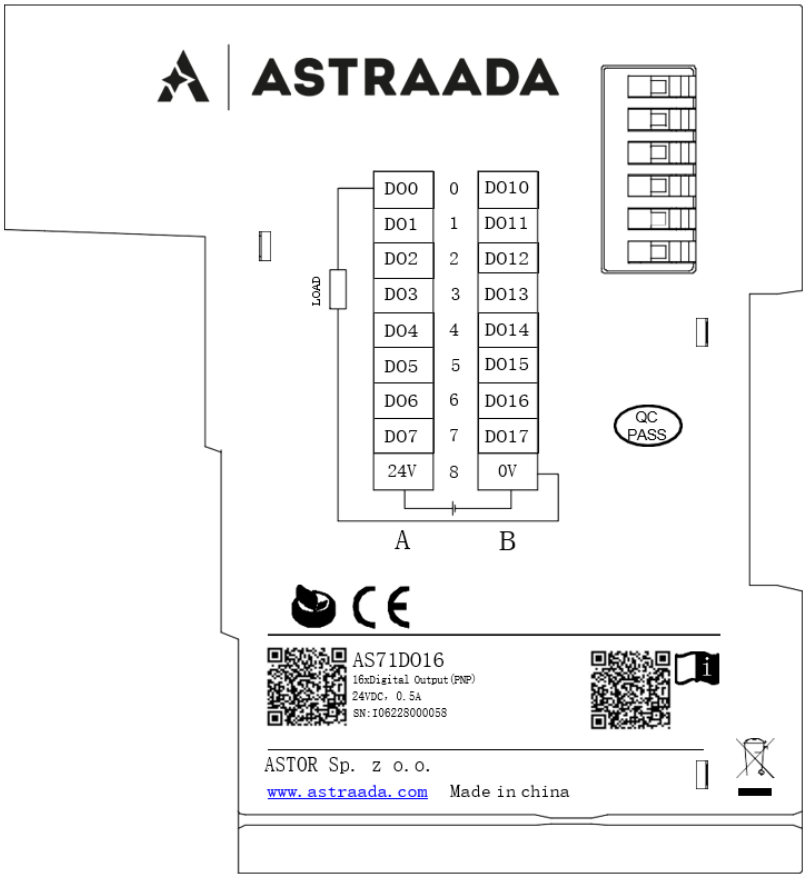


Figure 5-14 Component diagram

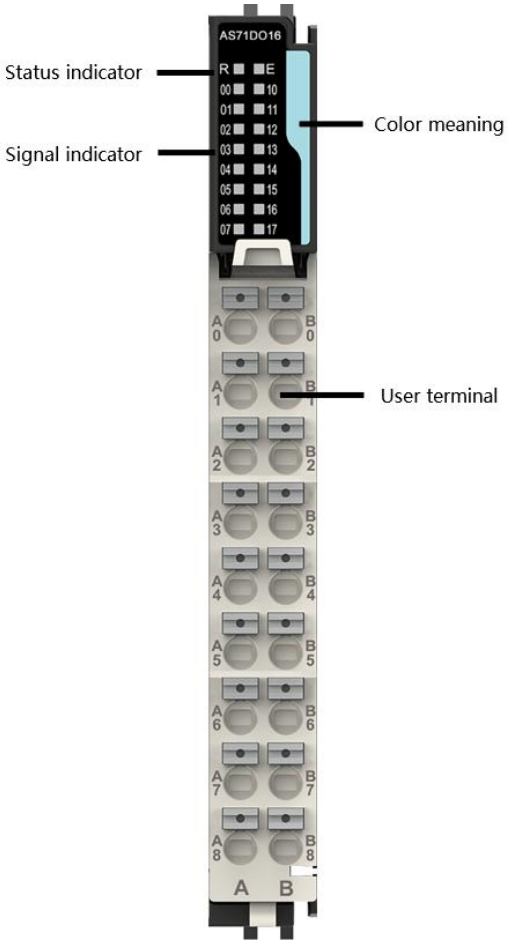
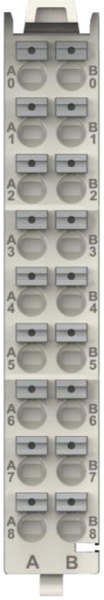


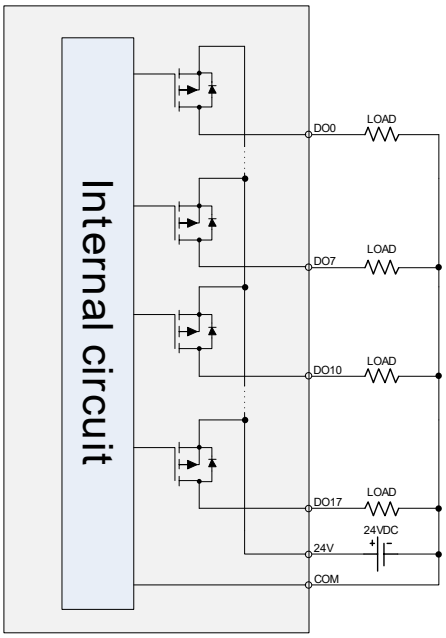

Table 5-7 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Off: The module works normally. |
| Signal indicator | Green | 00–07<br>10–17 | Output signal indicators (corresponding to each output channel)<br>On: Output enabled.<br>Off: Output disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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 |
| | 24 VDC | **A8** | **B8** | COM |

- **Terminal wiring**




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 150 mA |
| Terminal input power rated voltage | 24 VDC (20.4 VDC–28.8 VDC) |
| Terminal input power rated current | 2 A (Typical value at 24 VDC) |
| Module hot swapping | Not supported |

- **Output specifications**

| Item | Specifications |
|---|---|
| Output type | Digital output, high-side output |
| Output mode | Source type |
| Output channel | 16 |
| Output voltage class | 24 VDC ±10% (21.6 VDC–26.4 VDC) |
| Output load (Resistive load) | 0.5 A/point, 2 A/module |
| Output load (Inductive load) | 7.2 W/point, 12 W/module |
| Output load (Lamp load) | 5 W/point, 18 W/module |
| Hardware ON/OFF response time | 100 μs |
| Leakage current at OFF | 10 μA |
| Switch frequency | 100 Hz for resistive load, 0.5 Hz for inductive load, and 10 Hz for lamp load |
| Isolation | Yes |
| Output action display | When the output is in driving state, the output indicator is on. |
| Protection function | Protection against short circuits and overcurrent |

- **Software specifications**

| Item | Specifications |
|---|---|
| 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 logic level configuration | Not supported |
| Configuration of independent channel enabling | Not supported |
| Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| In stop mode | Outputs are set according to the stop/offline output mode and preset output values, and the output data are no longer refreshed. |
| I/O mapping | Supports bit-level access mapping. |

## 5.5.4 Digital output module (source)–AS71DO32

Figure 5-15 AS71DO32 appearance



Figure 5-16 Component diagram

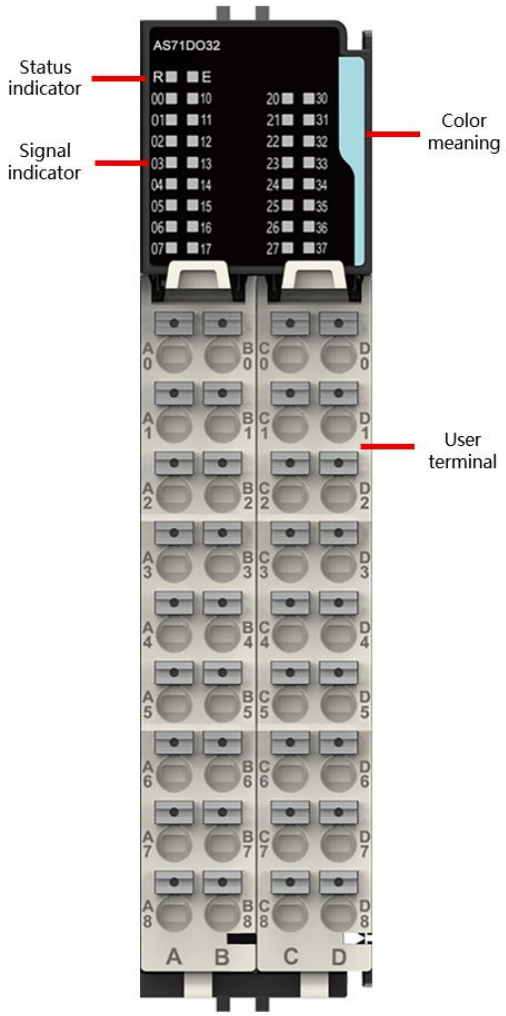
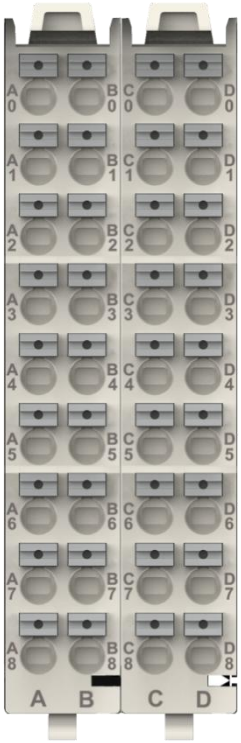



Table 5-8 Component description

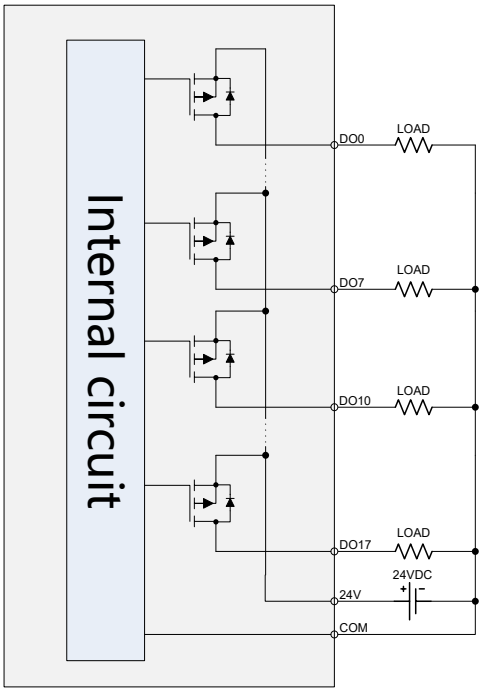
| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Off: The module works normally. |
| Signal indicator | Green | 00–07<br>10–17<br>20–27<br>30–37 | Output signal indicators (corresponding to each output channel)<br>On: Output enabled.<br>Off: Output disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

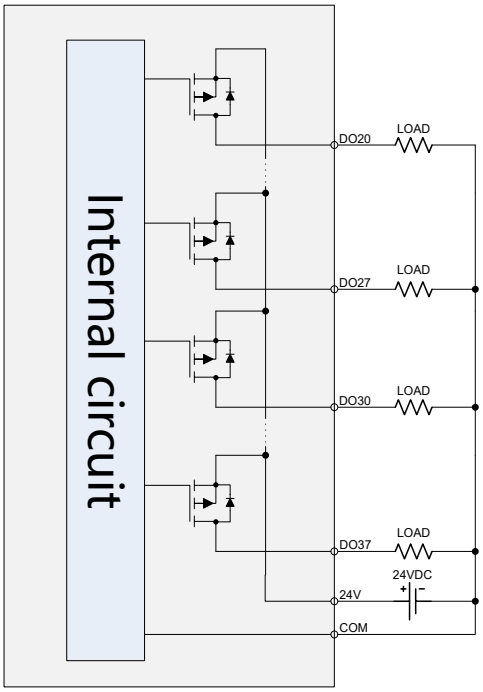
| Diagram | Left signal | Left terminal | Right terminal | Right signal |
|---|---|---|---|---|
|  | DO0 | **A0** | **B0** | DO10 |
| | DO1 | **A1** | **B1** | DO11 |
| | DO2 | **A2** | **B2** | DO12 |
| | DO3 | **A3** | **B3** | DO13 |
| | DO4 | **A4** | **B4** | DO14 |
| | DO5 | **A5** | **B5** | DO15 |
| | DO6 | **A6** | **B6** | DO16 |
| | DO7 | **A7** | **B7** | DO17 |
| | 24 VDC | **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 |
| | 24 VDC | **C8** | **D8** | COM |

- **Terminal wiring**

A/B terminal




C/D terminal




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |

| Item | Specifications |
|---|---|
| Bus input power rated current | 150 mA |
| Terminal input power rated voltage | 24 VDC (20.4 VDC–28.8 VDC) |
| Terminal input power rated current | 2 A (Typical value at 24 VDC) |
| Module hot swapping | Not supported |

- **Output specifications**

| Item | Specifications |
|---|---|
| Output type | Digital output, high-side output |
| Output mode | Source type |
| Output channel | 32 |
| Output voltage class | 24 VDC ±10% (21.6 VDC–26.4 VDC) |
| Output load (Resistive load) | 0.5 A/point, 2 A/module |
| Output load (Inductive load) | 7.2 W/point, 12 W/module |
| Output load (Lamp load) | 5 W/point, 18 W/module |
| Hardware ON/OFF response time | 100 μs |
| Leakage current at OFF | 10 μA |
| Switch frequency | 100 Hz for resistive load, 0.5 Hz for inductive load, and 10 Hz for lamp load |
| Isolation | Yes |
| Output action display | When the output is in driving state, the output indicator is on. |
| Protection function | Protection against short circuits and overcurrent |

- **Software specifications**

| Item | Specifications |
|---|---|
| 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 logic level configuration | Not supported |
| Configuration of independent channel enabling | Not supported |
| Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| In stop mode | Outputs are set according to the stop/offline output mode and preset output values, and the output data are no longer refreshed. |
| I/O mapping | Supports bit-level access mapping. |

## 5.5.5 Digital output module (relay)–AS71DOR8

Figure 5-17 AS71DOR8 appearance



Figure 5-18 Component diagram

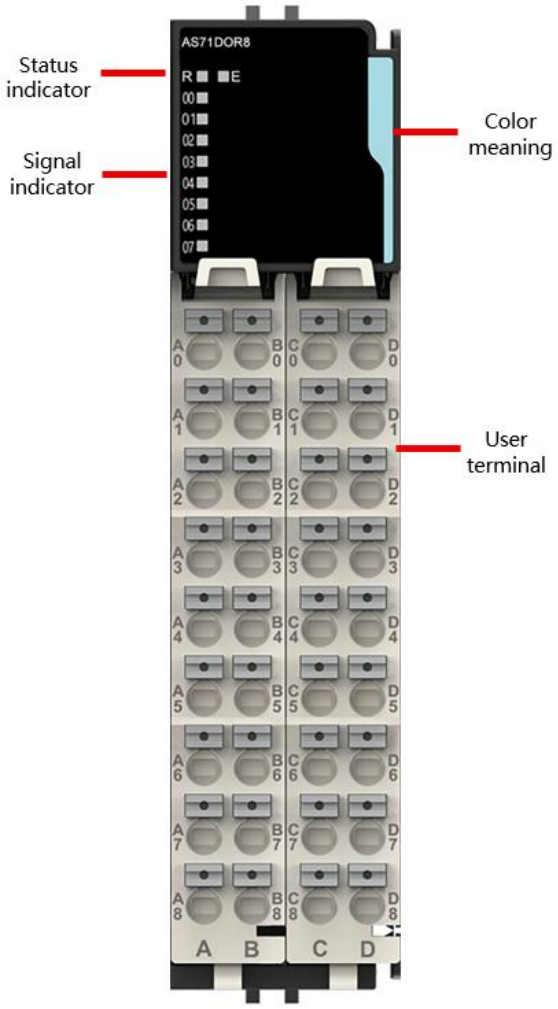
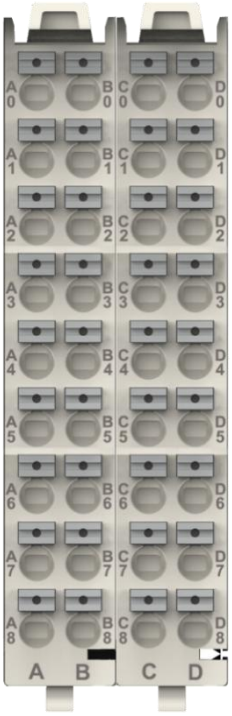


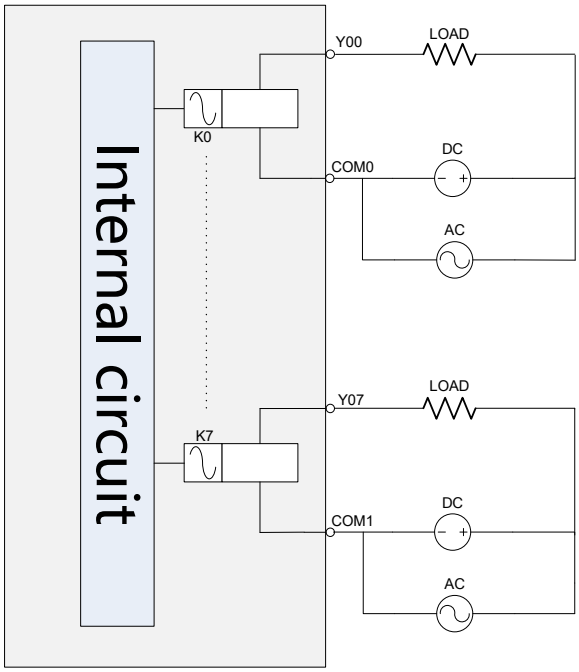

Table 5-9 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Slow blinking (500 ms): Incorrect parameter settings.<br>Fast blinking (100 ms): The module is offline.<br>Off: The module works normally. |
| Signal indicator | Green | 00–07 | Output signal indicators (corresponding to each output channel)<br>On: Output enabled.<br>Off: Output disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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**




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 300 mA |
| Module hot swapping | Not supported |

- **Output specifications**

| Item | Specifications |
|---|---|
| Output mode | Relay N.O. |
| Output channel | 8 |
| Contact load (resistive load) | 3 A 250 VAC/30 VDC |
| Max. switching voltage | 250 VAC/125 VDC (@0.3 A) |
| Max. switching current | 3 A |
| Contact resistance | < 100 mΩ (1 A 6 VDC) |
| Min. load | 5 VDC 10 mA |
| Isolation | Power circuits isolated from signal circuits |

- **Software specifications**

| Item | Specifications |
|---|---|
| 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 |
| Diagnostic reporting function configuration | Not supported |
| In stop mode | Outputs are set according to the stop/offline output mode and preset output values, and the output data are no longer refreshed. |
| I/O mapping | Supports bit-level access mapping. |

## 5.5.6 Analog input module–AS71AIN4

Figure 5-19 AS71AIN4 appearance



Figure 5-20 Component diagram

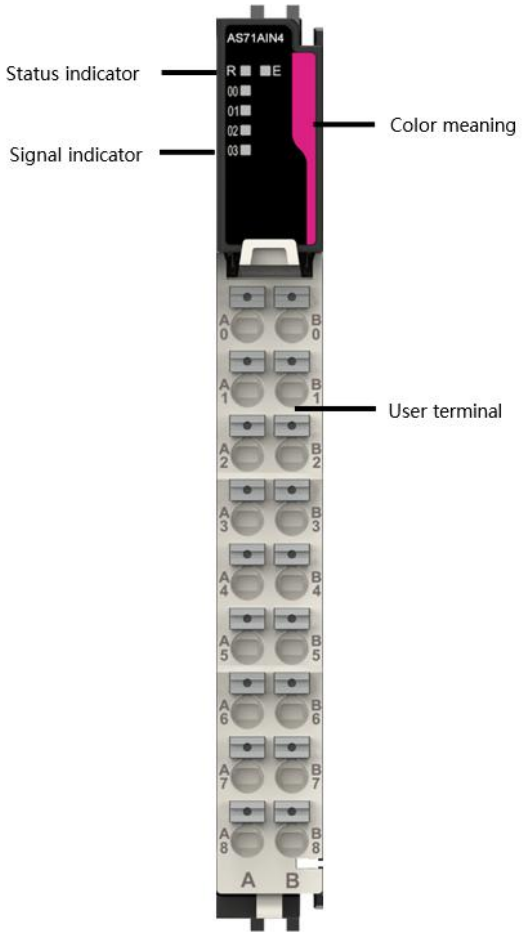
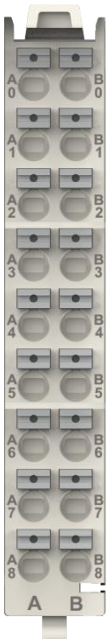



Table 5-10 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): ADC chip fault or incorrect parameter settings.<br>Off: The module works normally. |
| Signal indicator | Green | 00–03 | Channel status indicator<br>On: Channel enabled<br>Slow blinking (500 ms): Input signal over-range, over-limit, or channel parameter configuration error<br>Fast blinking (100 ms): Disconnection in voltage mode<br>Off: The channel is disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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 5-21 Voltage input wiring

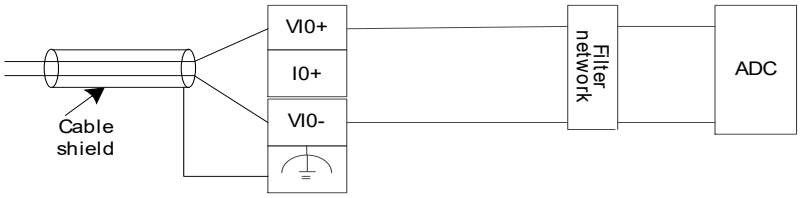
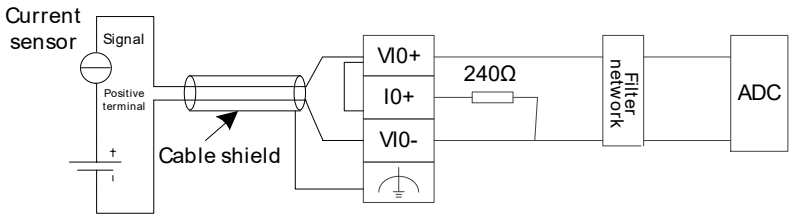
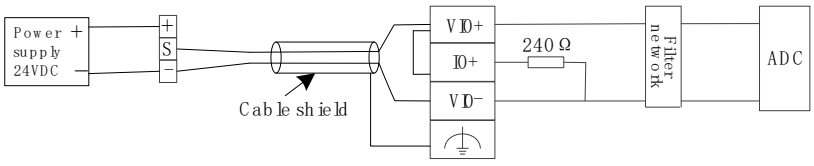



Figure 5-22 Current input wiring (2-wire)



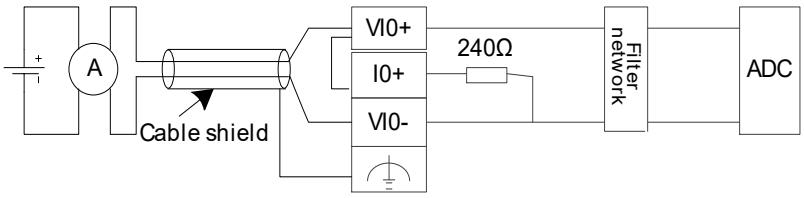

**Two-wire current input**

Figure 5-23 Current input wiring (3-wire)




**Three-wire current input**

Figure 5-24 Current input wiring (4-wire)




**Four-wire current input**

- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 200 mA |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Input type | Analog input |
| Input mode | Voltage/current |
| Input channel | 4 |
| Resolution | 16-bit |
| Conversion time | 320 μs/channel |
| Voltage input range | 0–5 V, 0–10 V, -5–+5 V, -10–+10 V |
| Voltage input impedance | 2.4 MΩ |
| Voltage input accuracy (25 ℃) | ±0.1% |
| Voltage input accuracy (in full temperature range) | ±0.2% |
| Voltage input limit | ±12 V |
| Voltage input diagnosis | Disconnection detection supported |
| Current input range | ±20 mA, 0–20 mA, 4–20 mA |
| Current input resistance | 240 Ω |
| Current input accuracy (25 ℃) | ±0.1% |
| Current input accuracy (in full temperature range) | ±0.2% |
| Current input limit | ±24 mA |
| Current input diagnosis | Not supported |
| Isolation | No isolation between interface channels; voltage isolated from interface; interface isolated from bus |

- **Software specifications**

| Item | Specifications |
|---|---|
| Configuration of independent channel enabling | Supported |
| Diagnostic reporting | Supported |

| Item | Specifications |
|---|---|
| function configuration | |
| Diagnostic detection enable configuration | Voltage-mode disconnection detection, over-range detection, and over-limit detection |
| Conversion mode configuration | 0–5 V, 0–10 V, ±5 V, ±10 V, 4–20 mA, 0–20 mA, ±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. |
| Over-limit detection enable configuration | Supported |
| Peak hold enable configuration | Not supported |
| Converted digital range configuration | ±20000 |
| Sampling time | 1.28 ms for 4 channels |
| Sampling refresh | Refreshed asynchronously according to the sampling time; synchronization with the bus cycle is not required. |
| Stop mode | Holds the current value and stops refreshing. |

## 5.5.7 Analog input module–AS71AIV8

Figure 5-25 AS71AIV8 appearance



Figure 5-26 Component diagram

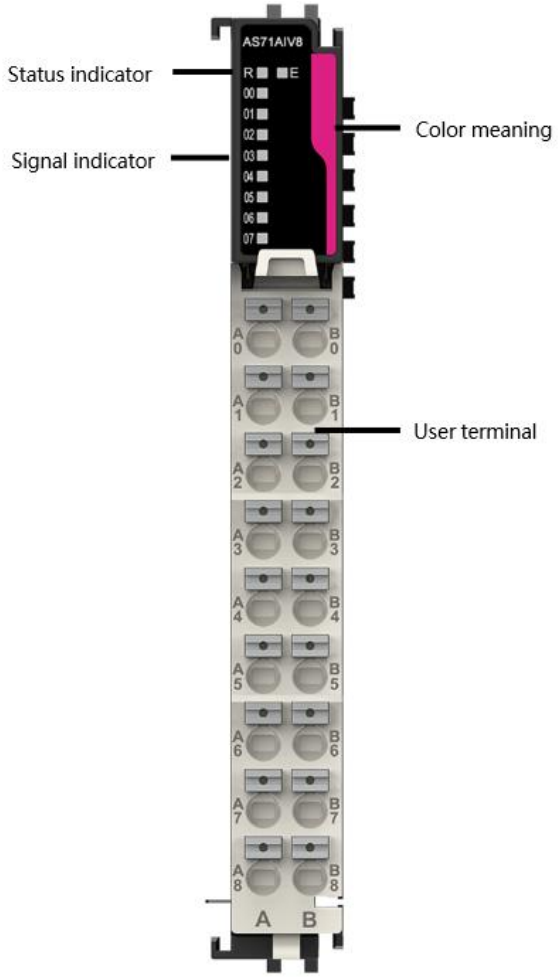
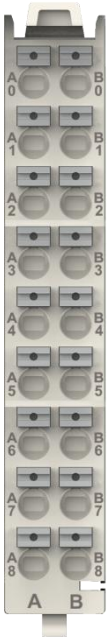



Table 5-11 Component description

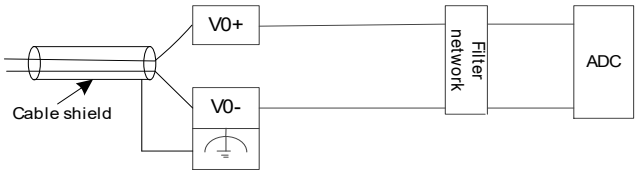
| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E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

- **Terminal definition**

| Diagram | Left signal | Left terminal | Right terminal | Right signal |
|---|---|---|---|---|
|  | V0+ | **A0** | **B0** | V0- |
| | V1+ | **A1** | **B1** | V1- |
| | V2+ | **A2** | **B2** | V2- |
| | V3+ | **A3** | **B3** | V3- |
| | V4+ | **A4** | **B4** | V4- |
| | V5+ | **A5** | **B5** | V5- |
| | V6+ | **A6** | **B6** | V6- |
| | V7+ | **A7** | **B7** | V7- |
| | PE | **A8** | **B8** | PE |

- **Terminal wiring**

Figure 5-27 Voltage input wiring




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 200 mA |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Input type | Analog input |
| Input mode | Voltage (Differential) |
| Input channel | 8 |
| Resolution | 16-bit |
| Conversion time | <170 μs/channel |
| Voltage input range | 0–5 V, 0–10 V, -5–+5 V, -10–+10 V |
| Voltage input impedance | 1 MΩ |
| Voltage input accuracy (25 ℃) | ±0.15% |
| Voltage input accuracy (in full temperature range) | ±0.3% |

| Item | Specifications |
|---|---|
| Voltage input limit | ±15 V |
| Voltage input diagnosis | Over-limit detection, over-range detection supported; disconnection detection not supported |
| Isolation | No isolation between interface channels; voltage isolated from interface; interface isolated from bus |

- **Software specifications**

| Item | | Specifications |
|---|---|---|
| Configuration of independent channel enabling | | Supported |
| Diagnostic reporting function configuration | | Supported |
| Diagnostic detection enable configuration | | Over-range detection; over-limit detection |
| Conversion mode configuration | | 0–5 V, 0–10 V, ±5 V, ±10 V, 1–5V |
| 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. |
| Over-limit detection enable configuration | | Supported |
| Peak hold enable configuration | | Not supported |
| Converted digital range configuration | -10–+10 VDC | -20000–20000, -32000–32000, -27648–27648 |
| | 0–10 VDC | 0–20000, 0–32000, 0–27648 |
| | -5–+5 VDC | -20000–20000, -32000–32000, -27648–27648 |
| | 0–5 VDC | 0–20000, 0–32000, 0–27648 |
| | 1–5 VDC | 0–20000, 0–32000, 0–27648 |
| Sampling time | | <170 μs/channel |
| Sampling refresh | | Refreshed asynchronously according to the sampling time; synchronization with the bus cycle is not required. |

## 5.5.8 Analog input module–AS71AIC8

Figure 5-28 AS71AIC8 appearance



Figure 5-29 Component diagram

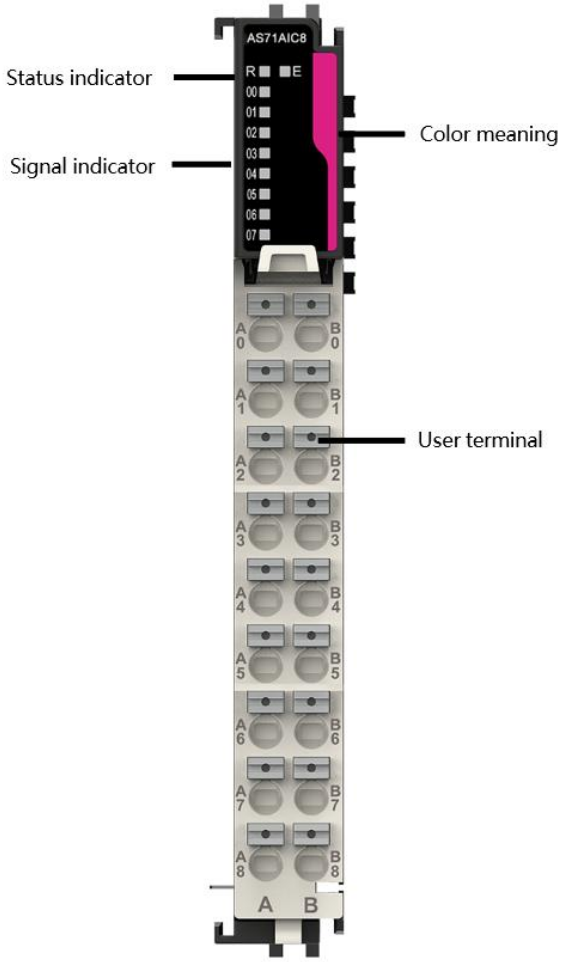



Table 5-12 Component description

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

- **Terminal definition**

| 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 5-30 Current input wiring (2-wire)

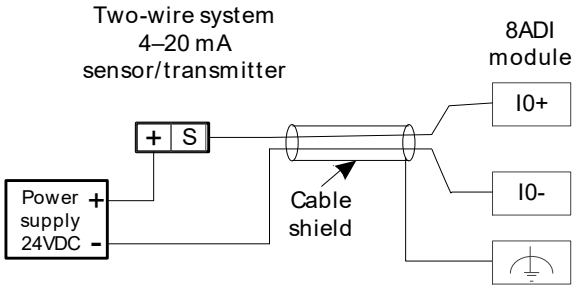



Figure 5-31 Current input wiring (3-wire)

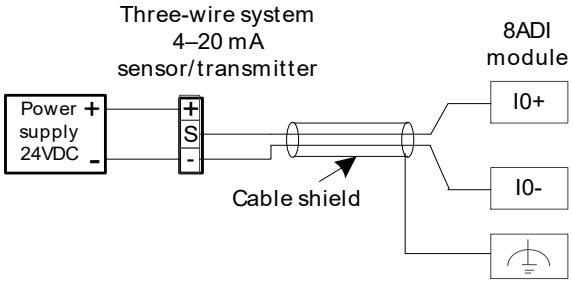
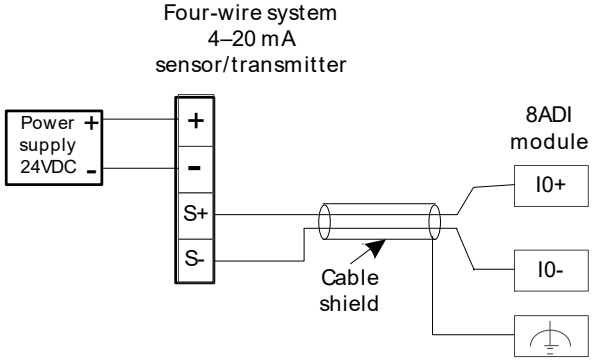



Figure 5-32 Current input wiring (4-wire)



- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 200 mA |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Input type | Analog input |
| Input mode | Current (Differential) |
| Input channel | 8 |
| Resolution | 16-bit |
| Conversion time | <170 μs/channel |
| Current input range | ±20 mA, 0–20 mA, 4–20 mA |
| Current input resistance | 240 Ω |
| Current input accuracy (25 ℃) | ±0.15% |
| Current input accuracy (in full temperature range) | ±0.3% |
| Current input limit | ±30 mA |
| Isolation | No isolation between interface channels; current isolated from interface; interface isolated from bus |

- **Software specifications**

| Item | | Specifications |
|---|---|---|
| Configuration of independent channel enabling | | Supported |
| Diagnostic reporting function configuration | | Supported |
| Diagnostic detection enable configuration | | Over-range detection; over-limit detection |
| Conversion mode configuration | | 4–20 mA, 0–20 mA, ±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. |
| Over-limit detection enable configuration | | Supported |
| Peak hold enable configuration | | Not supported |
| Converted digital range configuration | -20 mA–20 mA | -20000–20000, -32000–32000, -27648–27648 |
| | 0 mA–20 mA | 0–20000, 0–32000, 0–27648 |
| | 4 mA–20 mA | 0–20000, 0–32000, 0–27648 |
| Sampling time | | <170 μs/channel |
| Sampling refresh | | Refreshed asynchronously according to the sampling time; synchronization with the bus cycle is not required. |

## 5.5.9 Analog output module–AS71AOU4

Figure 5-33 AS71AOU4 appearance



Figure 5-34 Component diagram

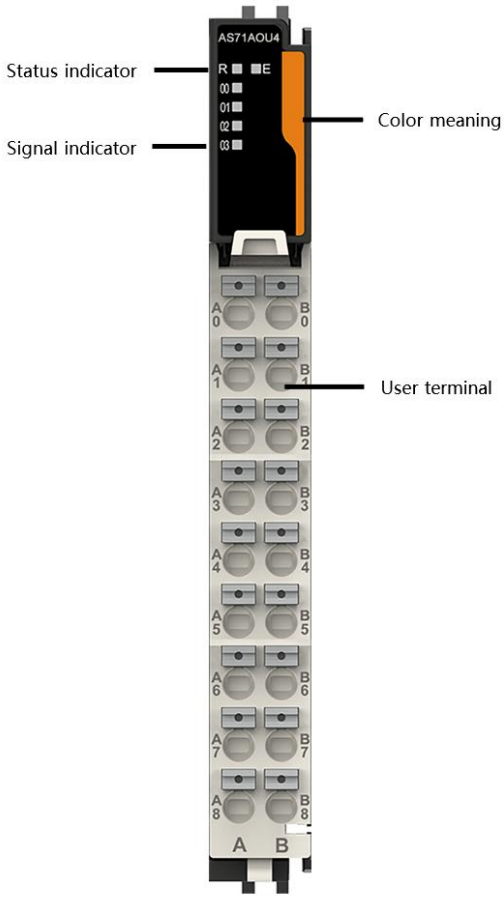
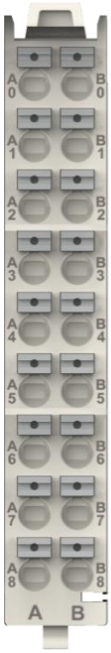


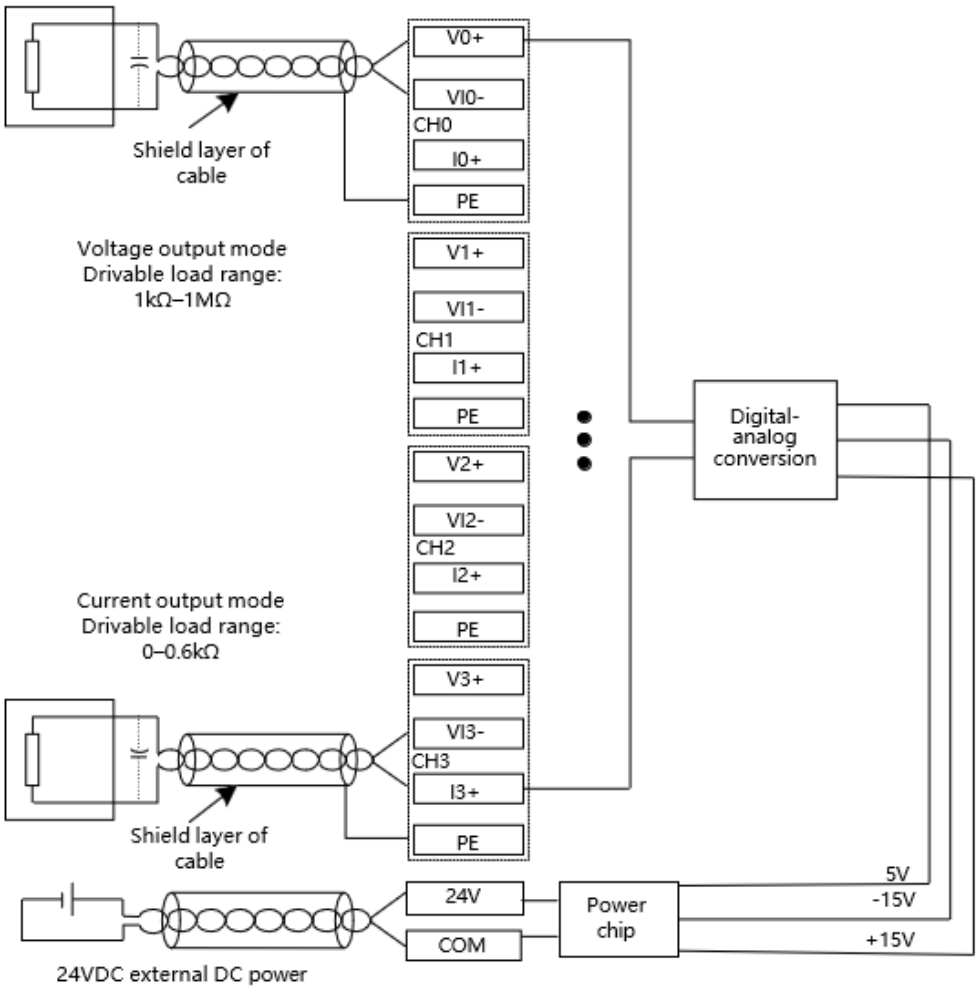

Table 5-13 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): DAC chip external power supply abnormal or parameter configuration error<br>Off: The module works normally. |
| | Green | 00–03 | Channel status indicator<br>On: Channel enabled<br>Slow blinking (500 ms): Voltage output short circuit or channel parameter configuration error<br>Fast blinking (100 ms): Current disconnection<br>Off: The channel is disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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 |
| | 24 V | **A8** | **B8** | COM |

- **Terminal wiring**



- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 150 mA |
| Terminal input power rated voltage | 24 VDC (20.4 VDC–28.8 VDC) |
| Terminal input power rated current | 100 mA (Typical value at 24 VDC) |
| Module hot swapping | Not supported |

- **Output specifications**

| Item | Specifications |
|---|---|
| Output type | Analog output |
| Output mode | Voltage/current |
| Output channel | 4 |
| Resolution | 16-bit |
| Conversion time | 40 μs/channel |
| Voltage output range | 0–5 V, 0–10 V, -5–+5 V, -10–+10 V |
| Voltage output load | 1 kΩ |
| Voltage output accuracy (25 ℃) | ±0.1% |
| Voltage output accuracy (in full temperature range) | ±0.5% |
| Voltage output diagnosis | Short circuit detection and overtemperature protection supported |
| Current output range | 0–20 mA, 4–20 mA |
| Current output load | <600 Ω |
| Current output accuracy (25 ℃) | ±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 |

- **Software specifications**

| Item | Specifications |
|---|---|
| Configuration of independent channel enabling | Supported |
| Diagnostic reporting function configuration | Supported |
| Diagnostic detection enable configuration | Short circuit detection for voltage, and disconnection detection for current |
| Conversion mode configuration | 0–5 V, 0–10 V, ±5 V, ±10 V, 4–20 mA, 0–20 mA |
| Output status configuration after stop | Clearing, holding the present output, or outputting the preset value |

| Item | Specifications |
| --- | --- |
| Preset value output after stop | Supported |
| Converted digital range configuration | ±20000 |
| Sampling time | 160 μs for 4 channels |
| Sampling refresh | Refreshed asynchronously according to the sampling time; synchronization with the bus cycle is not required. |
| Stop mode | Output according to the fault-caused stop mode or the preset value, without refreshing any more |

## 5.5.10 Temperature detection module (RTD)–AS71RTD4

Figure 5-35 AS71RTD4 appearance



Figure 5-36 Component diagram

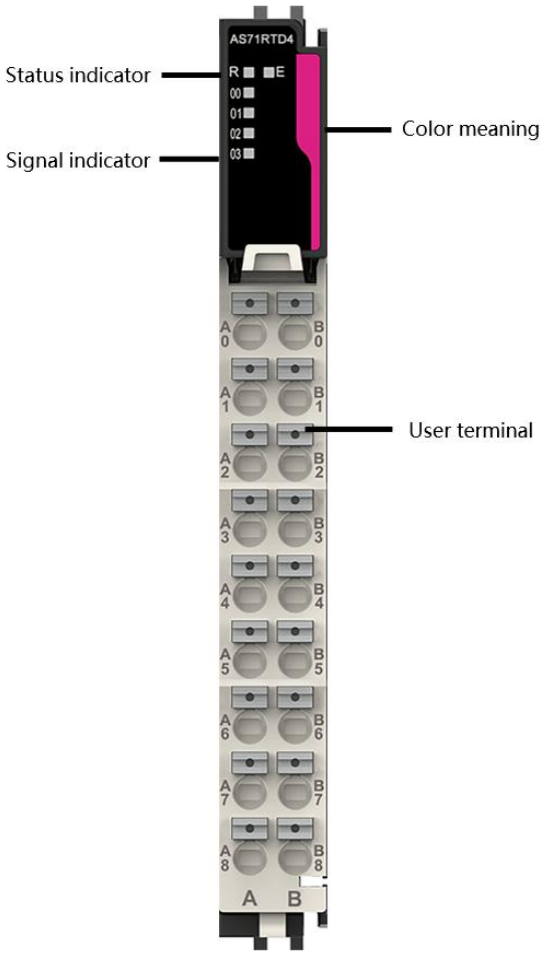
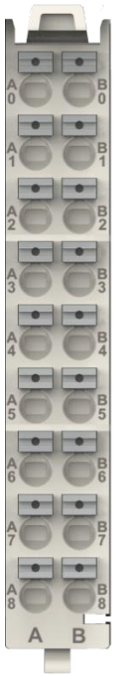


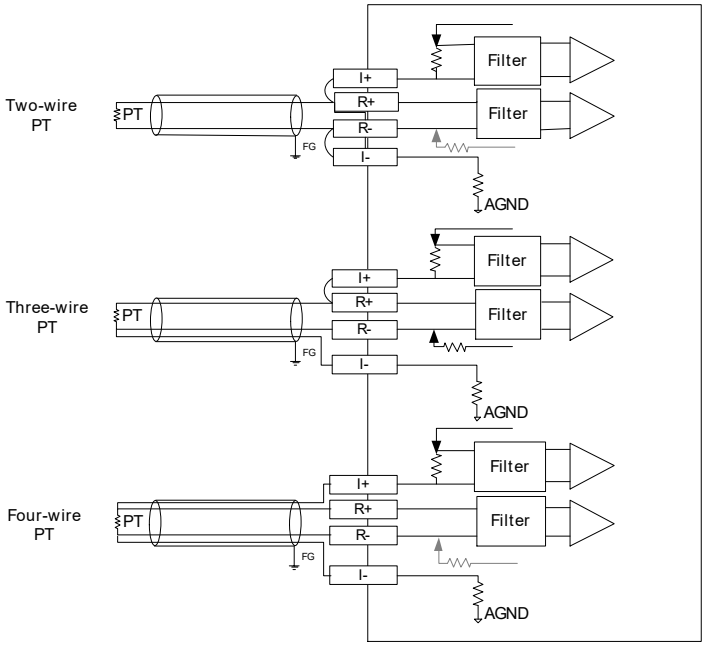

Table 5-14 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): Error in temperature detection.<br>Off: The module works normally. |
| | Green | 00–03 | Channel status indicator<br>On: Channel enabled<br>Slow blinking (500 ms): Input signal over-range/over-limit<br>Fast blinking (100 ms): disconnection<br>Off: The channel is disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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**




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 250 mA |
| Module hot swapping | Not supported |

- **Input specifications**

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

- **Software specifications**

| Item | Specifications |
|---|---|
| Diagnostic reporting function configuration | Supported |
| Diagnostic detection enable configuration | Over-limit detection and disconnection detection supported |
| Over-limit detection enable configuration | Supported |
| Independent channel configuration | Supported |
| Temperature offset enable configuration | Supported |
| Temperature 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.<br>When both channels within a group are enabled and one channel is configured as a three-wire system, the sampling period is 480 ms per channel, and in other cases, the sampling period is 240 ms per channel. |
| Display mode | Celsius (℃), Fahrenheit (℉) |
| Sensitivity | 0.0625 ℃, 0.0625 ℉ |
| Sampling refresh | Refreshed asynchronously according to the sampling time; synchronization with the bus cycle is not required. |
| Disconnection or over-limit | Outputs the max. value plus 10°C. Disconnection detection supported. |
| System diagnosis | Not supported |
| Channel diagnosis | Above upper limit alarm and below lower limit alarm |

| Item | Specifications |
|---|---|
| Software diagnosis | Not supported |
| Configuration diagnosis | Identifying configuration errors, including channel parameter configuration errors. |

## 5.5.11 Temperature detection module (thermocouple)–AS71THC4

Figure 5-37 AS71THC4 appearance



Figure 5-38 Component diagram

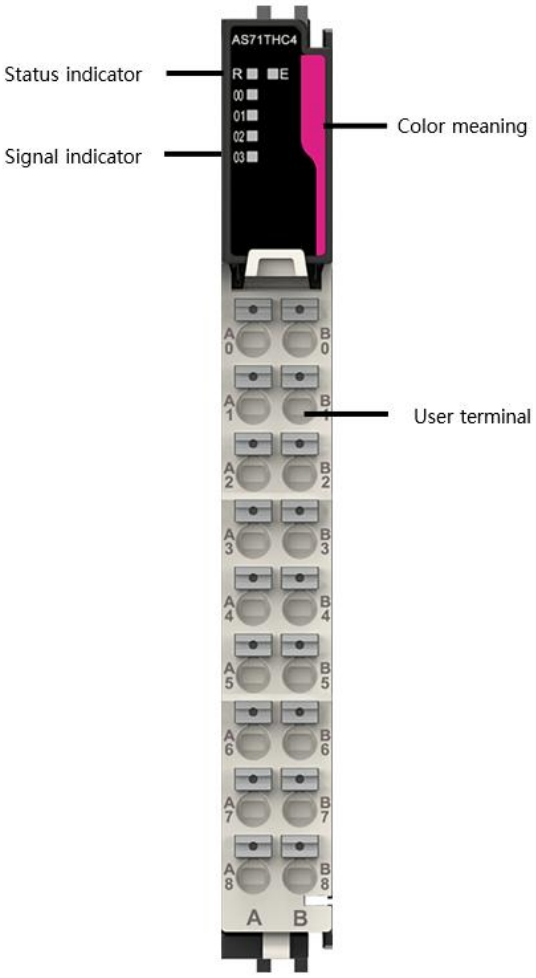
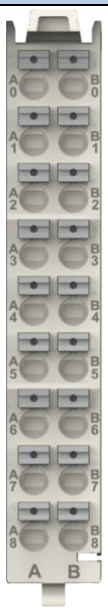


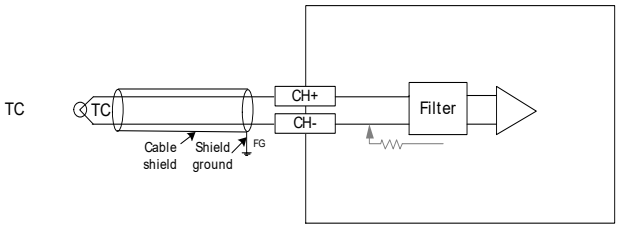

Table 5-15 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): Error in temperature detection.<br>Off: The module works normally. |
| | Green | 00–03 | Channel status indicator<br>On: Channel enabled<br>Slow blinking (500 ms): Input signal over-range/over-limit<br>Fast blinking (100 ms): disconnection<br>Off: The channel is disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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**




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 250 mA |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Input channel | 4 |
| Resolution | 24-bit |
| Display sensitivity | 0.0625 ℃, 0.0625 °F |
| Input terminals | 4 thermocouple inputs |
| Thermocouple type | B, E, N, J, K, R, S, T |
| Compensation method | Internal cold junction compensation |
| Accuracy (room temperature 25°C) | ±0.1% FS + cold junction compensation error |
| Accuracy (room temperature -20 ℃–55 ℃) | ±0.3% FS + cold junction compensation error |
| Isolation | I/O terminals insulated from the power supply;<br>No insulation between channels |

| Item | Specifications |
|---|---|
| Over-limit and disconnection detection | Supported |

- **Cold junction compensation**

| Installation direction | Cold junction compensation error (-20 ℃–+55 ℃) |
|---|---|
| Horizontal upright installation | ±3 ℃ |
| Non-horizontal upright installation | ±6 ℃ |

- **Software specifications**

| Item | Specifications |
|---|---|
| Diagnostic reporting function configuration | Supported |
| Diagnostic detection enable configuration | 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 |
| Over-limit detection enable configuration | Supported |
| Independent channel configuration | Supported |
| Temperature offset enable configuration | Supported |
| Temperature setting range | -204.8–204.7 (temperature unit) |
| Sampling period | 360 ms per channel |
| Display mode | Celsius (℃), Fahrenheit (℉) |
| Sensitivity | 0.0625 ℃, 0.0625 ℉ |
| Sampling refresh | Refreshed asynchronously according to the sampling time; synchronization with the bus cycle is not required. |
| Disconnection or over-limit | Output the max. value plus 10°C. |
| System diagnosis | Not supported |
| Channel diagnosis | Above upper limit alarm, below lower limit alarm, and disconnection alarm |
| Software diagnosis | Not supported |
| Configuration diagnosis | Identifying configuration errors, including channel parameter configuration errors. |

## 5.5.12 Digital input/output module–AS71DT08

Figure 5-39 AS71DT08 appearance



Figure 5-40 Component diagram

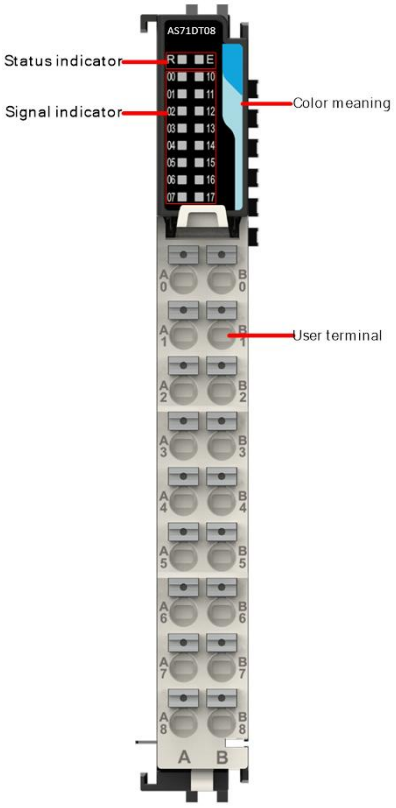


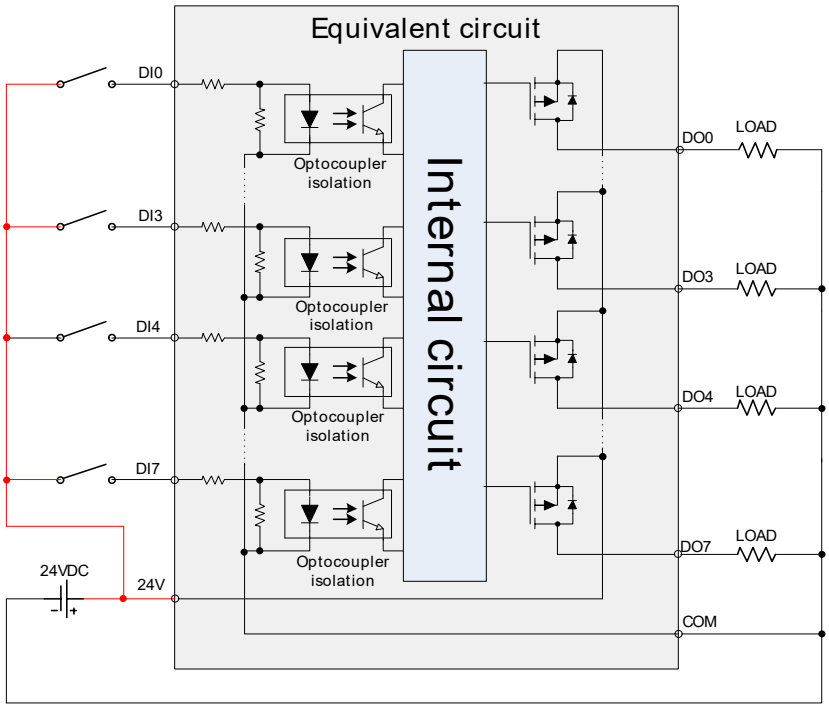

Table 5-16 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Fast blinking (100 ms): The module is offline.<br>Off: The module works normally. |
| Input signal indicator | Green | 00–07 | Input signal indicators (corresponding to each input channel)<br>On: The input is active.<br>Off: The input is inactive. |
| Output signal indicator | Green | 10–17 | Output signal indicators (corresponding to each output channel)<br>On: Output enabled.<br>Off: Output disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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 |
| | 24 VDC | **A8** | **B8** | COM |

- **Terminal wiring**




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 150 mA (Typical value at 5 VDC) |
| Terminal input power rated voltage | 24 VDC (20.4 VDC–28.8 VDC) |
| Terminal input power rated current | 2 A (Typical value at 24 VDC) |

| Item | Specifications |
|---|---|
| Terminal output power rated voltage | None |
| Terminal output power rated current | None |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Input type | Digital input |
| Input mode | Source type |
| Input channel | 8 |
| Input voltage class | 24 VDC ±10% (21.6 VDC–26.4 VDC) |
| Input current (Typical) | 4.6 mA (Typical value at 24 VDC) |
| ON voltage | >15 V |
| OFF voltage | <5 V |
| Hardware ON/OFF response time | 300 μs/300 μs |
| Software filter time | Supported |
| Input resistance | Reference value about 5.2 kΩ |
| Isolation | Yes |
| Input action display | When the input is in driving state, the input indicator is on. |
| Input derating | Derate to 50% when operating at 55 °C (no more than 4 input points can be ON simultaneously), or reduce the allowable ambient temperature by 10°C when all input points are ON. |

- **Output specifications**

| Item | Specifications |
|---|---|
| Output type | Digital output, high-side output |
| Output mode | Source type |
| Output channel | 8 |
| Output voltage class | 24 VDC ±10% (21.6 VDC–26.4 VDC) |
| Output load (Resistive load) | 0.5 A/point, 2 A/module |
| Output load (Inductive load) | 7.2 W/point, 12 W/module |
| Output load (Lamp load) | 5 W/point, 9 W/module |
| Hardware ON/OFF response time | 100 μs/100 μs |
| Leakage current at OFF | 10 μA |
| Switch frequency | 100 Hz for resistive load, 0.5 Hz for inductive load, and 10 Hz for lamp load |
| Isolation | Yes |
| Output action display | When the output is in driving state, the output indicator is on. |
| Protection function | Protection against short circuits and overcurrent |

- **Software specifications**

| Item | | Specifications |
|---|---|---|
| Input | Software input filter time | Software filter setting supported:<br>Setting range: 1–65535 (default: 1000); filter time unit: 10 μs; default software filter time: 10 ms |
| | Input port exception detection and indication | None |
| | Input channel logic level configuration | Not supported |
| | Independent channel enable configuration | Not supported |
| | Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| | In stop mode | Outputs are not refreshed; inputs support refreshing in the Safe-Operational state. |
| | I/O mapping | Supports bit-level and byte-level access mapping. |
| 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 |
| | Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| | In stop mode | Outputs are set according to the stop/offline output mode and preset output values, and the output data are no longer refreshed. |
| | I/O mapping | Supports bit-level and byte-level access mapping. |

## 5.5.13 Digital input/output module–AS71DT16

Figure 5-41 AS71DT16 appearance



Figure 5-42 Component diagram

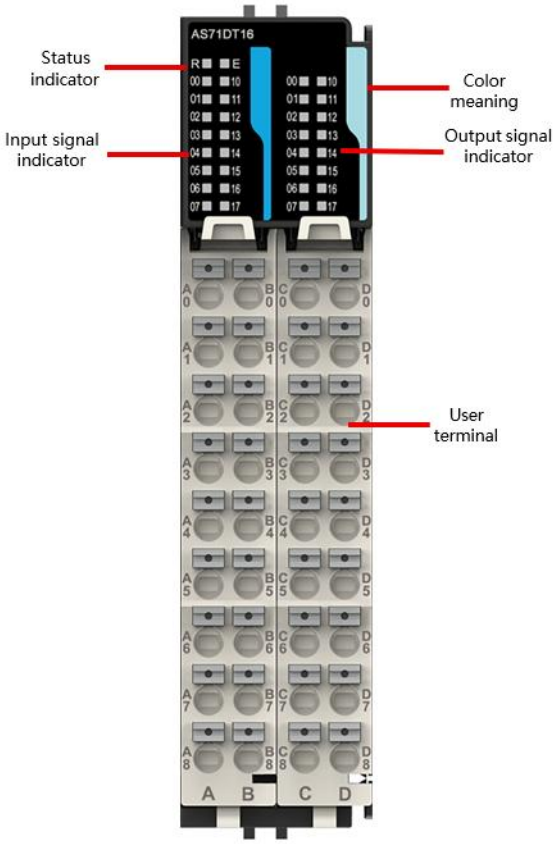
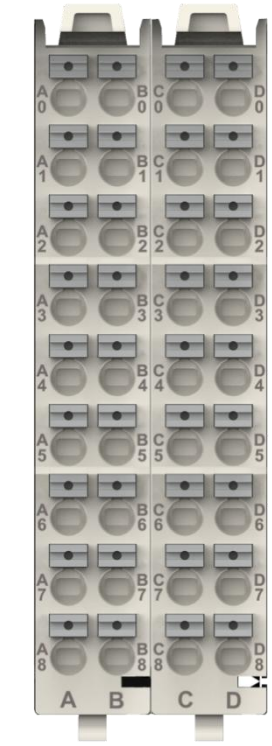


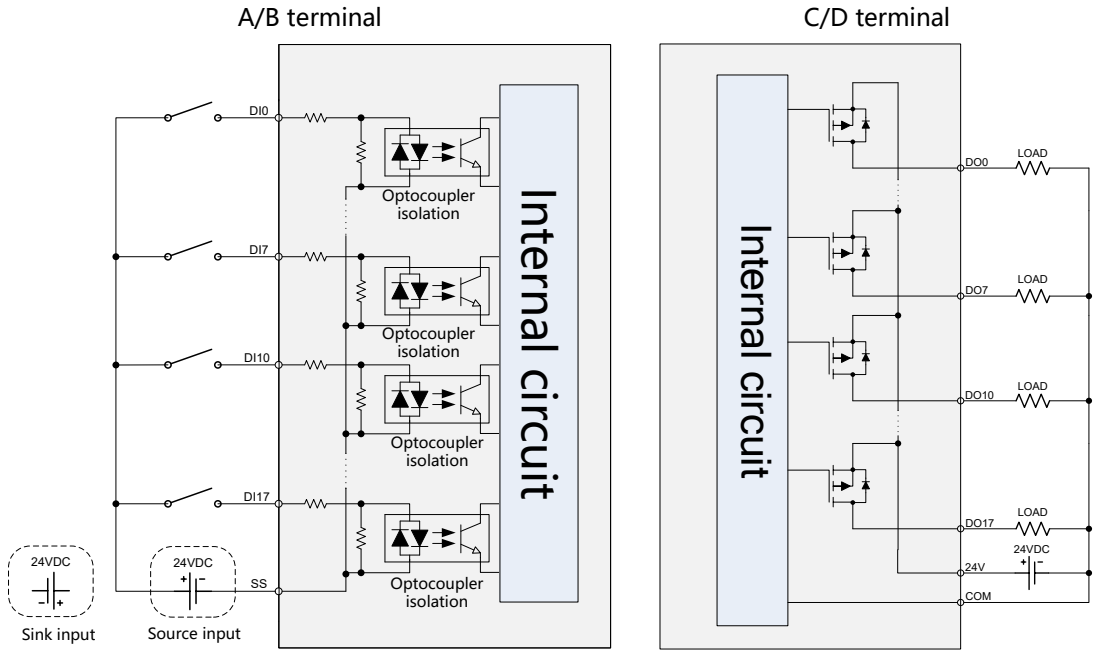

Table 5-17 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Fast blinking (100 ms): The module is offline.<br>Off: The module works normally. |
| Input signal indicator | Green | 00–07<br>10–17 | Input signal indicators (corresponding to each input channel)<br>On: The input is active.<br>Off: The input is inactive. |
| Output signal indicator | Green | 00–07<br>10–17 | Output signal indicators (corresponding to each output channel)<br>On: Output enabled.<br>Off: Output disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay) | | : Analog input (voltage, current, thermocouple, RTD)<br>: Analog output |

- **Terminal definition**

| 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 |
| | 24 VDC | **C8** | **D8** | COM |

- **Terminal wiring**




- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 150 mA (Typical value at 5 VDC) |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Input type | Digital input |
| Input mode | Source/Sink |
| Input channel | 16 |
| Input voltage class | 24 VDC ±10% (21.6 VDC–26.4 VDC) |
| Input current (Typical) | 7 mA (Typical value at 24 VDC) |
| ON voltage | >15 V |
| OFF voltage | <5 V |
| Hardware ON/OFF response time | 100 μs |
| Software filter time | Supported |
| Input resistance | Reference value about 3.4 kΩ |
| Isolation | Yes |
| Input action display | When the input is in driving state, the input indicator is on. |
| Input derating | Derate to 75% when operating at 55°C (no more than 12 input points can be ON simultaneously), or reduce the allowable ambient temperature by 10°C when all input points are ON. |

- **Output specifications**

| Item | Specifications |
|---|---|
| Output type | Digital output, high-side output |
| Output mode | Source type |
| Output channel | 16 |
| Output voltage class | 24 VDC ±10% (21.6 VDC–26.4 VDC) |
| Output load (Resistive load) | 0.5 A/point, 2 A/module |
| Output load (Inductive load) | 7.2 W/point, 12 W/module |
| Output load (Lamp load) | 5 W/point, 18 W/module |
| Hardware ON/OFF response time | 100 μs |
| Leakage current at OFF | 10 μA |
| Switch frequency | 100 Hz for resistive load, 0.5 Hz for inductive load, and 10 Hz for lamp load |
| Isolation | Yes |
| Output action display | When the output is in driving state, the output indicator is on. |
| Protection function | Protection against short circuits and overcurrent |

- **Software specifications**

| Item | Specifications |
|---|---|
| Software input filter time | Setting range: 1–65535 (Default: 1000)<br>Unit: 10 μs; 1000 indicates 10 ms.<br>Supports two groups of filter parameters, with 8 channels per group. Channels in the same group share one filter parameter. |
| Input channel logic level configuration | Not supported |
| Independent channel | Not supported |

| Item | Specifications |
|---|---|
| enable configuration | |
| Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| In stop mode | Outputs are not refreshed; inputs support refreshing in the Safe-Operational state. |
| I/O mapping | Supports bit-level access mapping. |

## 5.5.14 Bridge measurement module–AS71BRG1

Figure 5-43 AS71BRG1 appearance



Figure 5-44 Component diagram

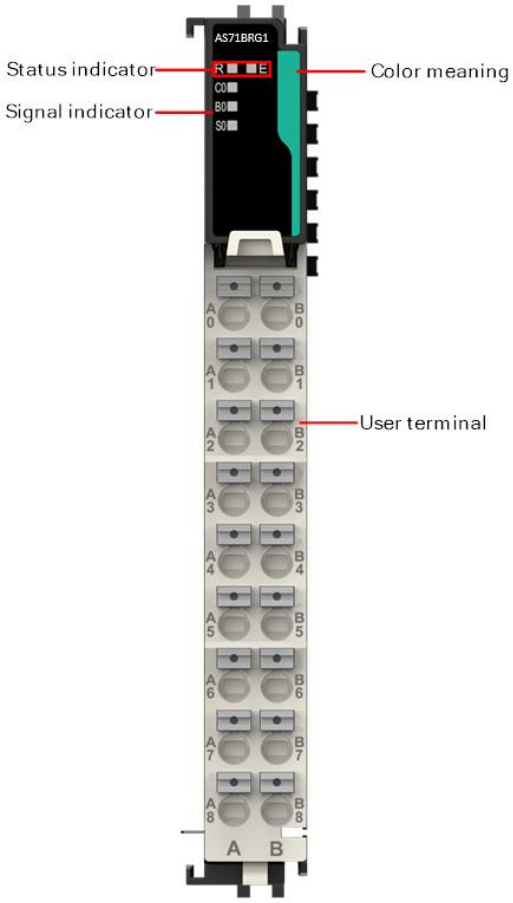



Table 5-18 Component description

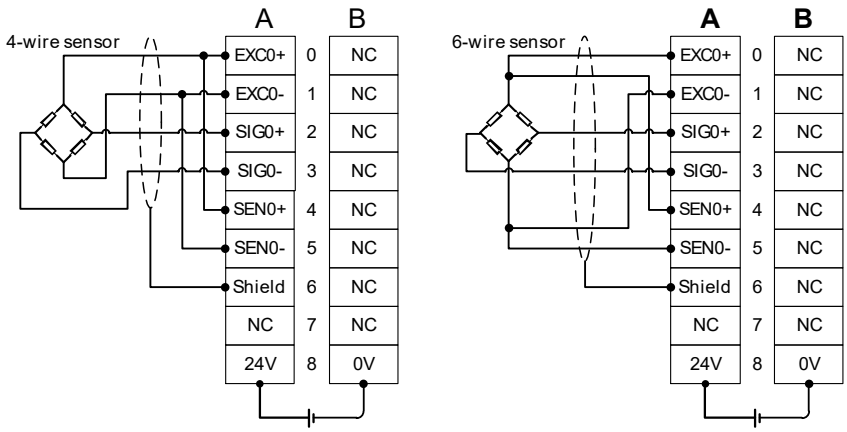
| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Run indicator | Green | R | On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| Error indicator | Red | E | Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Fast blinking (100 ms): The module is offline.<br>Off: The module works normally. |
| Enable indicator | Green | C0 | On: Channel enabled<br>Slow blinking (500 ms): Input signal over-range, over-limit, or channel parameter configuration error<br>Off: The channel is disabled. |
| Disconnection detection indicator | Red | B0 | On: The signal wire is disconnected.<br>Off: The signal wire is operating normally. |
| Short-circuit detection indicator | Red | S0 | On: The excitation power output is short-circuited.<br>Off: The excitation power output is not short-circuited. |

■ **Terminal definition**

| 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 |
| | 24 V | **A8** | **B8** | 0 V |

| Pin | Name | Description | Specifications |
|---|---|---|---|
| A0 | EXC0+ | Positive terminal of the excitation voltage output for Channel 0 | Input type: Differential input<br>Input voltage range: ±30 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 | Shield cable ground for Channel 0 bridge | |
| A7 | - | - | |
| A8 | 24 V | Positive terminal of the external 24 V power input | Module power input: 24 VDC (20.4 VDC–28.8 VDC) |
| B8 | 0 V | Negative terminal of the external 24 V power input | |

■ **Terminal wiring**




**Note:**

- Avoid bundling sensor cables together with power cables (high voltage, high current) or other cables that transmit strong interference signals. Route them separately and avoid parallel routing.
- Keep the sensor and the module grounded at the same potential whenever possible.

■ **Power supply specifications**

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

■ **Input/output specifications**

| Item | Specifications |
|---|---|
| Number of channels | 1 channel |
| Input mode | Differential |
| Voltage range | ±30 mVDC |
| Input sensor type | 4-wire or 6-wire bridge sensors |
| Load cell sensitivity | (1, 2, 4, 6) mV/V |
| Load range | 40–4010 Ω |
| Accuracy | ±0.01% FS (25 °C, sampling rate ≥ 80 ms, and load cell sensitivity > 2 mV/V)<br>±0.05% FS (-25 °C to +55 °C, sampling rate ≥ 80 ms, and load cell sensitivity > 2 mV/V)<br>±1% FS (25°C, under CE-certified standard interference conditions) |
| Max. excitation power | 5 V @ 250 mA |
| Disconnection detection | Supported (signal wire) |
| Over-limit detection | Supported |
| Over-range detection | Supported |

| Item | Specifications |
| --- | --- |
| Isolation | No isolation between channels |

- **Software specifications**

| Item | Specifications |
| --- | --- |
| Conversion time | 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 40 ms, 80 ms, 200 ms, 400 ms |
| Input channel logic level configuration | Not supported |
| Independent channel enable configuration | Not supported |
| Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| In stop mode | Outputs are not refreshed; inputs support refreshing in the Safe-Operational state. |
| I/O mapping | Supports bit-level access mapping. |

## 5.5.15 Bridge measurement module–AS71BRG2

Figure 5-45 AS71BRG2 appearance

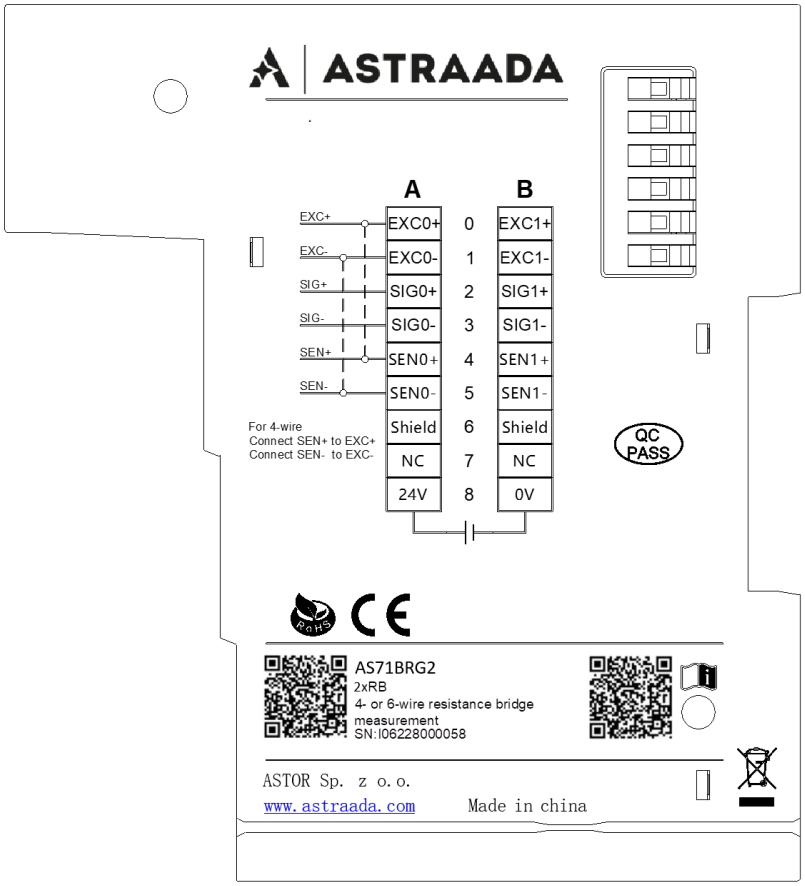


Figure 5-46 Component diagram

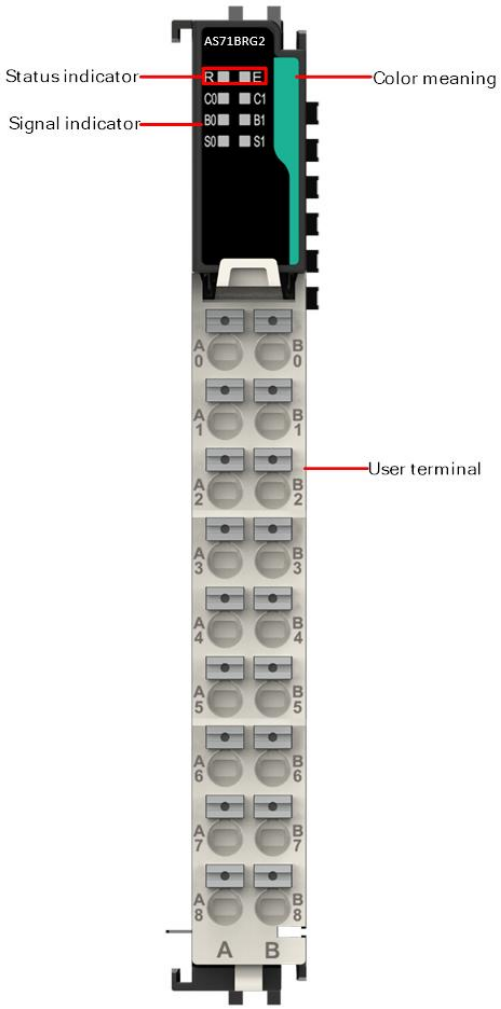



Table 5-19 Component description

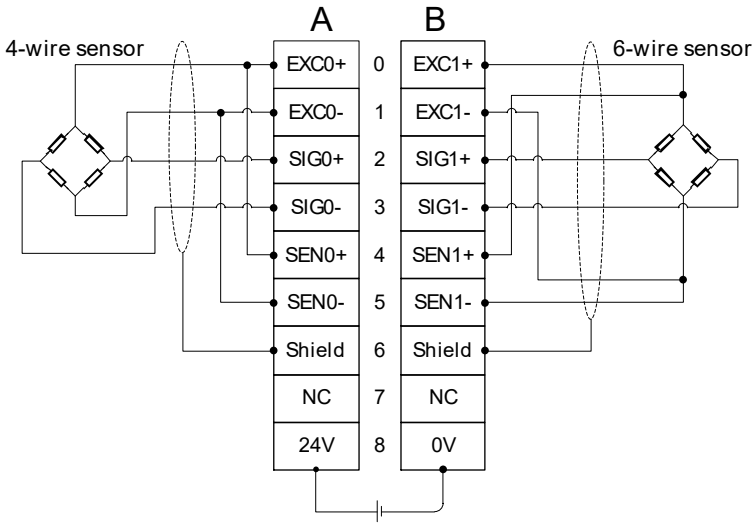
| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Run indicator | Green | R | On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| Error indicator | Red | E | Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Fast blinking (100 ms): The module is offline.<br>Off: The module works normally. |
| Enable indicator | Green | C0, C1 | On: Channel enabled<br>Slow blinking (500 ms): Input signal over-range, over-limit, or channel parameter configuration error<br>Off: The channel is disabled. |
| Disconnection detection indicator | Red | B0, B1 | On: The signal wire is disconnected.<br>Off: The signal wire is operating normally. |
| Short-circuit detection indicator | Red | S0, S1 | On: The excitation power output is short-circuited.<br>Off: The excitation power output is not short-circuited. |

■ **Terminal definition**

| 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 |
| | 24 V | **A8** | **B8** | 0 V |

| Pin | Name | Description | Specifications |
|---|---|---|---|
| A0 | EXC0+ | Positive terminal of the excitation voltage output for Channel 0 | Input type: Differential input<br>Input voltage range: ±30 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 | |
| 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 | Shield cable ground for Channel 0 bridge | |
| B6 | Shield | Shield cable ground for Channel 1 bridge | |
| A7 | - | - | |
| B7 | - | - | |
| A8 | 24 V | Positive terminal of the external 24 V power input | Module power input: 24 VDC (20.4 VDC–28.8 VDC) |
| B8 | 0 V | Negative terminal of the external 24 V power input | |

■ **Terminal wiring**




**Note:**

- Avoid bundling sensor cables together with power cables (high voltage, high current) or other cables that transmit strong interference signals. Route them separately and avoid parallel routing.
- Keep the sensor and the module grounded at the same potential whenever possible.

■ **Power supply specifications**

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

■ **Input/output specifications**

| Item | Specifications |
|---|---|
| Number of channels | 2 channels |
| Input mode | Differential |
| Voltage range | ±30 mVDC |
| Input sensor type | 4-wire or 6-wire bridge sensors |
| Load cell sensitivity | (1, 2, 4, 6) mV/V |
| Load range | 40–4010 Ω |
| Accuracy | ±0.01% FS (25 °C, sampling rate ≥ 80 ms, and load cell sensitivity > 2 mV/V)<br>±0.05% FS (-25 °C to +55 °C, sampling rate ≥ 80 ms, and load cell sensitivity > 2 mV/V)<br>±1% FS (25°C, under CE-certified standard interference conditions) |
| Max. excitation power | 5 V @ 250 mA |
| Disconnection detection | Supported (signal wire) |
| Over-limit detection | Supported |

| Item | Specifications |
| --- | --- |
| Over-range detection | Supported |
| Isolation | No isolation between channels |

- **Software specifications**

| Item | Specifications |
| --- | --- |
| Conversion time | 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 40 ms, 80 ms, 200 ms, 400 ms |
| Input channel logic level configuration | Not supported |
| Independent channel enable configuration | Not supported |
| Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| In stop mode | Outputs are not refreshed; inputs support refreshing in the Safe-Operational state. |
| I/O mapping | Supports bit-level access mapping. |

## 5.5.16 Counting and measurement module–AS71AN02

Figure 5-47 AS71AN02 appearance



Figure 5-48 Component diagram

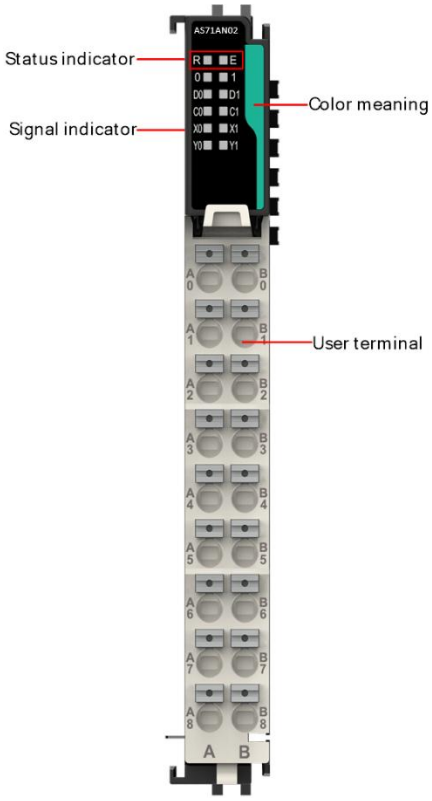
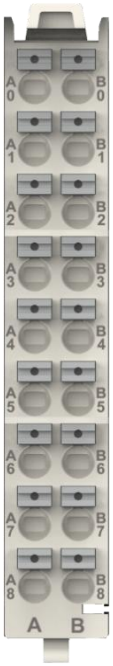


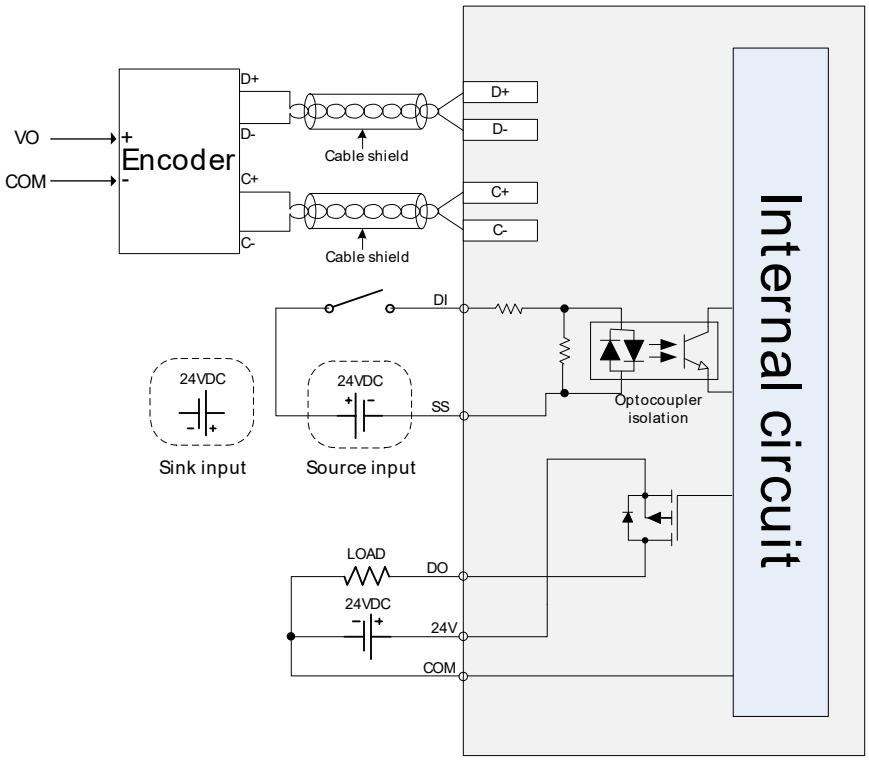

Table 5-20 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Off: The module works normally. |
| Signal indicator | Green | D0, C0<br>D1, C1 | SSI encoder signal detection indicator<br>On: The data/clock differential voltage remains positive.<br>Off: The data/clock differential voltage remains negative. |
| | Green | X0, X1 | Digital input signal indicator<br>On: Input signal active<br>Off: Input signal inactive |
| | Green | Y0, Y1 | Digital output signal indicator<br>On: Output enabled.<br>Off: Output disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay)<br>: Analog input (voltage, current, thermocouple, RTD) | | : Analog output<br>: Power feed<br>: Counting and measurement |

- **Terminal definition**

| 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 |
| | 24 V | **A8** | **B8** | 0 V |

- **Terminal wiring**




- **Power supply specifications**

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

| Item | Specifications |
|---|---|
| Terminal input power rated voltage | 24 VDC (20.4 VDC–28.8 VDC) |
| Terminal input power rated current | 2 A (Typical value at 24 VDC) |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Encoder type | SSI absolute encoder |
| Input mode | RS-422 level standard, differential input |
| Input channel | 2 |
| Encoder voltage | 24 VDC ± 15% |
| SSI frame length | 10–40 (Default: 13) |
| SSI clock frequency (Hz) | 125 kHz, 250 kHz, 500 kHz, 1 MHz, 1.5 MHz, 2 MHz |
| Signal type | Binary/Gray (default) |
| Number of DI channels | 2 |
| DI detection electrical level | 24 VDC |
| DI type | PNP (source), NPN (sink) |
| DI edge selection | Rising edge/Falling edge/Rising and falling edge |
| DI filter time setting | (0–65535) × 0.1 μs |
| DI function | Latch, preset, and reset |
| Number of DO channels | 2 |
| DO level | 24 VDC |
| DO type | PNP (source), rated output current: 0.16 A |
| DO function | Comparison output |
| ON voltage | >15 V |
| OFF voltage | <5 V |
| Hardware ON/OFF response time | 100 μs |
| Input resistance | Reference value about 3.4 kΩ |
| Isolation | Yes |
| Measurement variable | Frequency/Speed |
| Update time of the measurement function | 20 ms, 100 ms, 500 ms, 1000 ms |
| Gating function | Software gate |

- **Software specifications**

| Item | Specifications |
|---|---|
| Software input filter time | Setting range: 0–65535 (Default: 1000)<br>Unit: 0.1 μs |
| Diagnostic reporting function configuration | Diagnostic information is uploaded by default. |
| In stop mode | Outputs are not refreshed; inputs support refreshing in the Safe-Operational state. |

## 5.5.17 Counting and measurement module–AS71IN02

Figure 5-49 AS71IN02 appearance

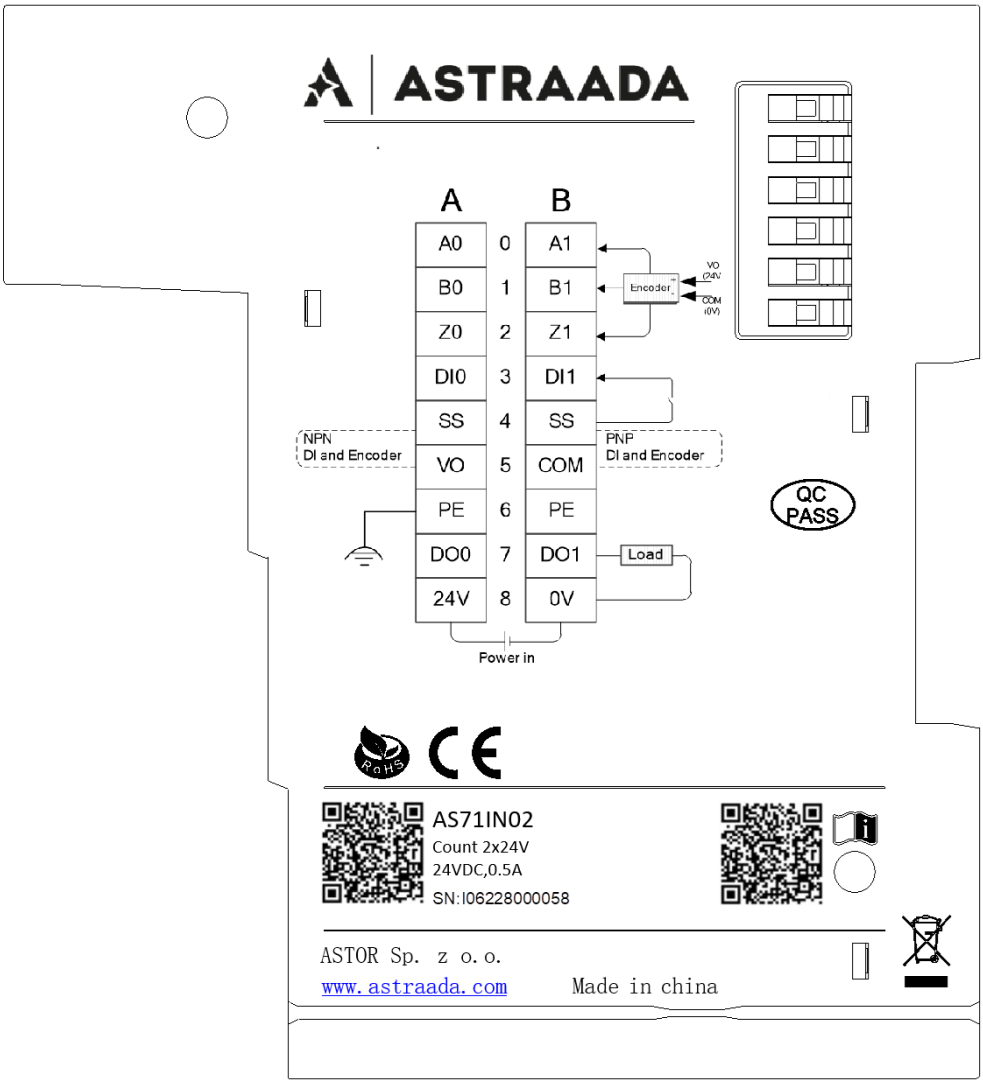


Figure 5-50 Component diagram

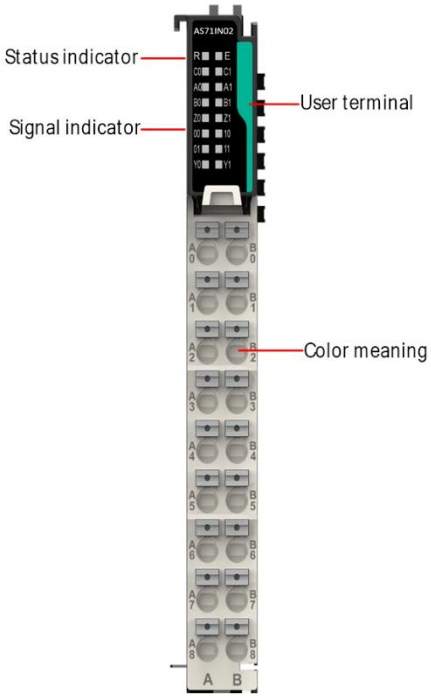


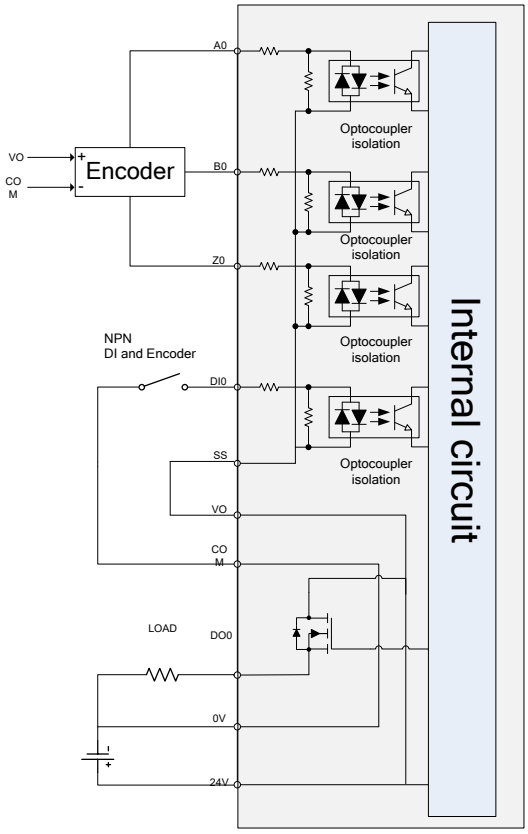

Table 5-21 Component description

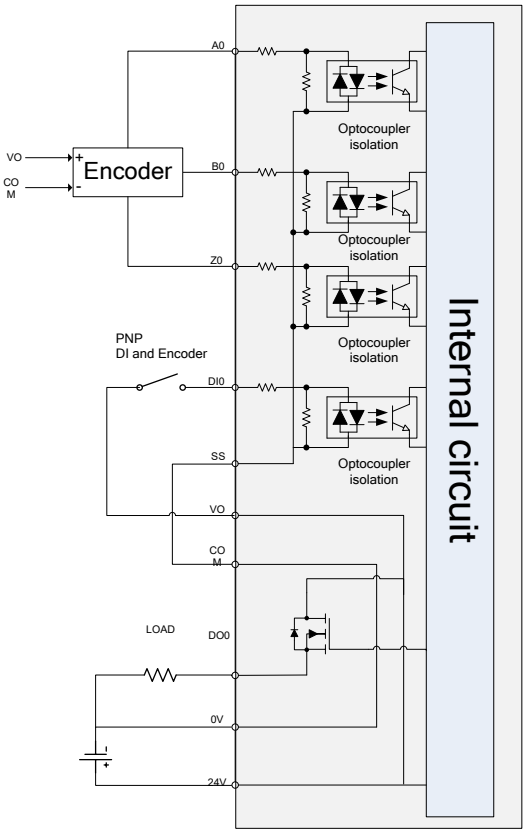
| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | R | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Off: The module works normally. |
| | Green | C0, C1 | Channel 0/1 enable status indicators<br>On: Encoder channel enabled.<br>Off: Encoder channel disabled. |
| Signal indicator | Green | A0, B0, Z0<br>A1, B1, Z1 | Encoder Channel 0/1 input signal indicators<br>On: Input signal active<br>Off: Input signal inactive |
| | Green | 00, 01<br>10, 11 | Channel 0/1 digital input indicators<br>On: Input signal active<br>Off: Input signal inactive |
| | Green | Y0, Y1 | Channel 0/1 digital output indicators<br>On: Output enabled.<br>Off: Output disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay)<br>: Analog input (voltage, current, thermocouple, RTD) | | : Analog output<br>: Power feed<br>: Counting and measurement |

- **Terminal definition**

| 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**




- **Power supply specifications**

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

| Item | Specifications |
|---|---|
| Terminal input power rated voltage | 24 VDC (20.4 VDC–28.8 VDC) |
| Terminal input power rated current | 2 A (Typical value at 24 VDC) |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Encoder type | Incremental encoder |
| Input channel | 2 channels |
| Encoder voltage | 24 VDC ± 15% |
| Pulse mode | Quadrature pulse input, pulse + direction input (direction signal optional) |
| Counting range | -2147483648–2147483647 |
| Pulse frequency | 200 kHz |
| Frequency multiplication mode | x1, x2, x4 |
| Resolution | 1–65535 PPR (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) × 0.1 μs per channel |
| Number of DI channels | 2 |
| DI function | Latch |
| DI detection electrical level | 24 VDC |
| DI type | PNP (source), NPN (sink) |
| DI edge selection | Rising edge/Falling edge/Rising and falling edge |
| DI filter time setting | (0–65535) × 0.1 μs |
| Number of DO channels | 2 |
| DO function | Comparison output |
| DO level | 24 VDC |
| DO type | PNP (source), rated output current: 0.16 A |
| DO function | Comparison output |
| ON voltage | >15 V |
| OFF voltage | <5 V |
| Hardware ON/OFF response time | 100 μs |
| Input resistance | Reference value about 3.4 kΩ |
| Isolation | Yes |

- **Software specifications**

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

## 5.5.18 Counting and measurement module–AS71IN01

Figure 5-51 AS71IN01 appearance



Figure 5-52 Component diagram

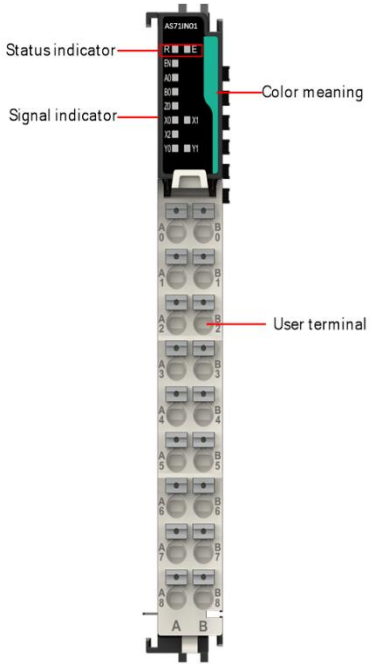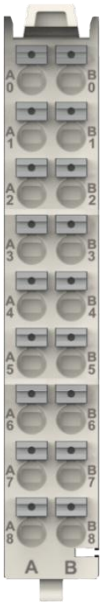


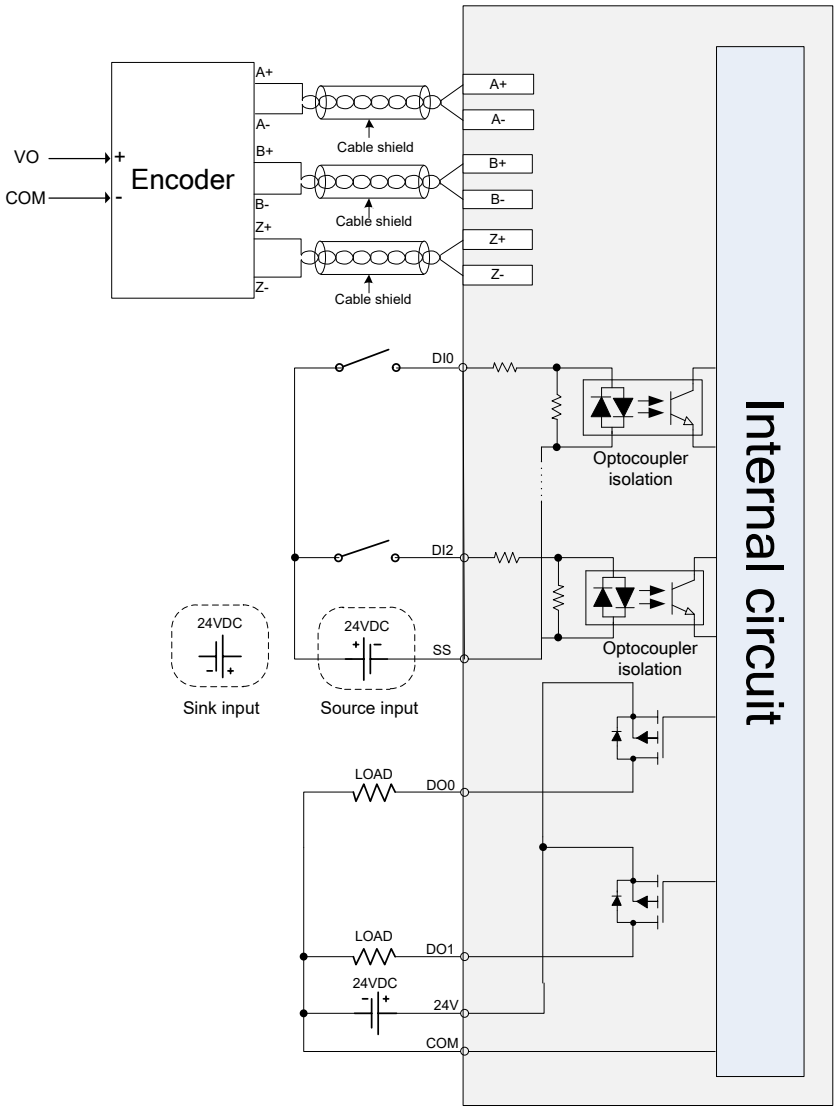

Table 5-22 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Off: The module works normally. |
| | Green | EN | Enabling status indicator<br>On: Encoder channel enabled.<br>Off: Encoder channel disabled. |
| Signal indicator | Green | A0, B0, Z0 | Encoder channel input signal indicator<br>On: Input signal active<br>Off: Input signal inactive |
| | Green | X0, X1, X2 | Digital input indicator<br>On: Input signal active<br>Off: Input signal inactive |
| | Green | Y0, Y1 | Digital output indicator<br>On: Output enabled.<br>Off: Output disabled. |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay)<br>: Analog input (voltage, current, thermocouple, RTD) | | : Analog output<br>: Power feed<br>: Counting and measurement |

- **Terminal definition**

| 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 |
| | 24 V | **A8** | **B8** | 0 V |

- **Terminal wiring**



- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 140 mA (Typical value at 5 VDC) |
| Terminal input power rated voltage | 24 VDC (20.4 VDC–28.8 VDC) |
| Terminal input power rated current | 2 A (Typical value at 24 VDC) |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Encoder type | Incremental encoder |
| Input channel | 1 channel |
| Encoder voltage | 5 VDC |
| Input type | RS-422 level standard, differential input |
| Pulse mode | Quadrature pulse input, pulse + direction input (direction signal optional) |
| Counting range | -2147483648–2147483647 |
| Pulse frequency | 100 Hz–2 MkHz |
| Frequency multiplication mode | x1, x2, x4 |
| Resolution | 1–65535 PPR (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) × 10 ns per channel |
| Number of DI channels | 3 |
| DI function | Latch, preset, and reset |
| DI detection electrical level | 24 VDC |
| DI type | PNP (source), NPN (sink) |
| DI edge selection | Rising edge/Falling edge/Rising and falling edge |
| DI filter time setting | (0–65535) × 10 ns |
| Hardware reset | Rising edge reset |
| Number of DO channels | 2 |
| DO function | Comparison output |
| DO level | 24 VDC |
| DO type | PNP (source), rated output current: 0.16 A |
| ON voltage | >15 V |
| OFF voltage | <5 V |
| Hardware ON/OFF response time | 100 μs |
| Input resistance | Reference value about 3.4 kΩ |
| Isolation | Yes |

■ **Software specifications**

| Item | Specifications |
|---|---|
| Input filter time | Setting range: 0–65535 (Default: 1000)<br>Unit: 10 ns |
| Measurement variable | Frequency, speed |
| Update time of the measurement function | 20 ms, 100 ms, 500 ms, 1000 ms |
| Gating function | Software gate |

## 5.5.19 Dual-channel pulse output control module–AS71PUOC

Figure 5-53 AS71PUOC appearance



Figure 5-54 Component diagram

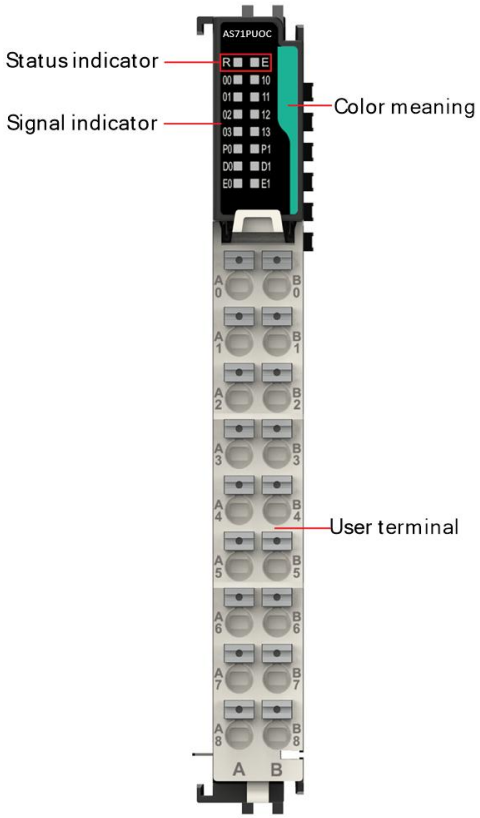



Table 5-23 Component description

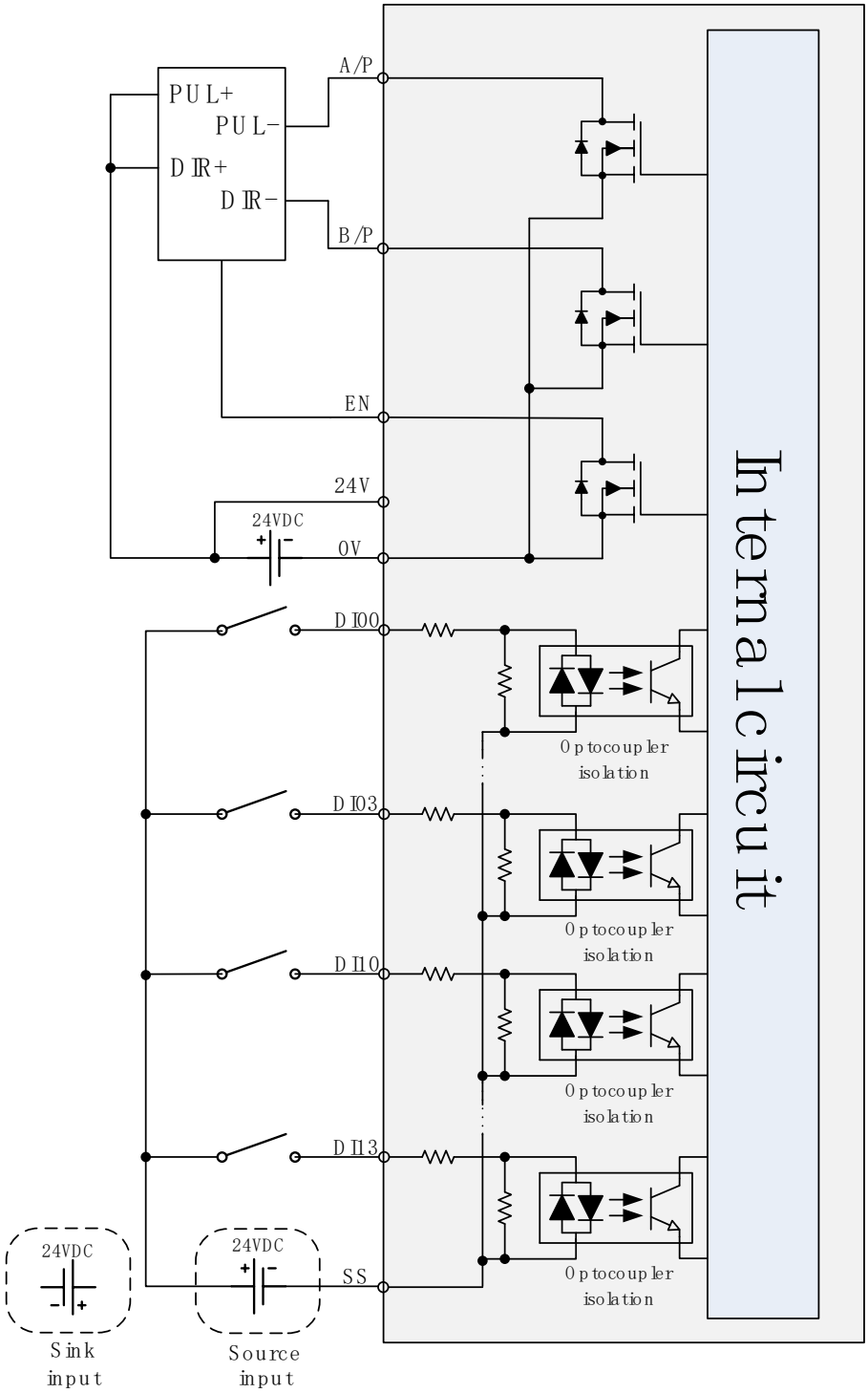
| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | Power-on/Run status indicator<br>On: The module is running.<br>Slow blinking (500 ms): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Module fault indicator<br>Fast blinking (100 ms): The module is offline.<br>Slow blinking (500 ms): External power supply not connected or incorrect parameter settings.<br>Off: The module works normally. |
| Signal indicator | Green | P0, D0, E0, P1, D1, E1 | Pulse output indicator<br>On: NPN pulse output active<br>Off: NPN pulse output inactive |
| | Green | 00–03, 10–13 | Digital input indicator<br>On: Input signal active<br>Off: Input signal inactive |
| User terminal | I/O terminals for external wiring | | |

■ **Terminal definition**

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

| Pin | Name | Description | Terminal function |
|---|---|---|---|
| A0 | DI00 | Positive limit signal input for Channel 0 | Internal impedance: 1.8 kΩ<br>15–30 V voltage input is acceptable.<br>Supports sink input<br>Max. input frequency: 200 kHz |
| 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>Max. output frequency: 200 kHz<br>Peak load drive current < 1 A; continuous current < 0.5 A<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 | |
| A7 | EN0 | Enable signal output for Channel 0 | Enable signal output (reserved; interface performance is similar to pulse output) |
| B7 | EN1 | Enable signal output for Channel 1 | |
| A8 | 24 V | Positive terminal of the external 24 V power input | Pulse output module power supply input: (12–24 VDC) ±15% |
| B8 | 0 V | Negative terminal of the external 24 V power input | |

■ **Terminal wiring**




■ **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 140 mA (Typical value at 5 VDC) |
| Module hot swapping | Not supported |

- **Input/output specifications**

| Item | Specifications |
|---|---|
| Output type | Digital pulse output, low-side output |
| Output mode | Sink |
| Output channel | Dual channels |
| Output voltage class | (12 VDC–24 VDC) ±15% |
| Max. output frequency | 200 kHz |
| Output load | Peak drive current per point < 1 A; continuous current < 0.5 A |
| Hardware ON/OFF response time | 100 μs |
| Isolation | Yes |
| Output action display | When the output is in driving state, the output indicator is on. |
| Protection function | Protection against short circuits and overcurrent |
| DI type | Digital input |
| DI mode | Source/Sink |
| Number of DI channels | 8 |
| Input voltage class | 15 VDC–30 VDC |
| Max. input frequency | 200 kHz |
| Hardware ON/OFF response time | 100 μs |
| Software filter time | Supported |
| Input resistance | Reference value about 1.8 kΩ |
| Isolation | Yes |
| Input action display | When the input is in driving state, the input indicator is on. |

- **Software specifications**

| Item | Specifications |
|---|---|
| Pulse output mode | Supports single-pulse output (pulse + direction) and dual-pulse output (CW/CCW) |
| Motion mode | Supports absolute position mode, relative position mode, and speed mode |
| Trapezoidal acceleration/deceleration | Supported |
| Motion merge | Supported |
| Homing mode | Supports 4 homing modes (19, 21, 24, 28) |
| Software input filter time | Setting range: 1–65535; unit: 10 μs |

## 5.5.20 Power feed module–AS71PWRR

Figure 5-55 AS71PWRR appearance

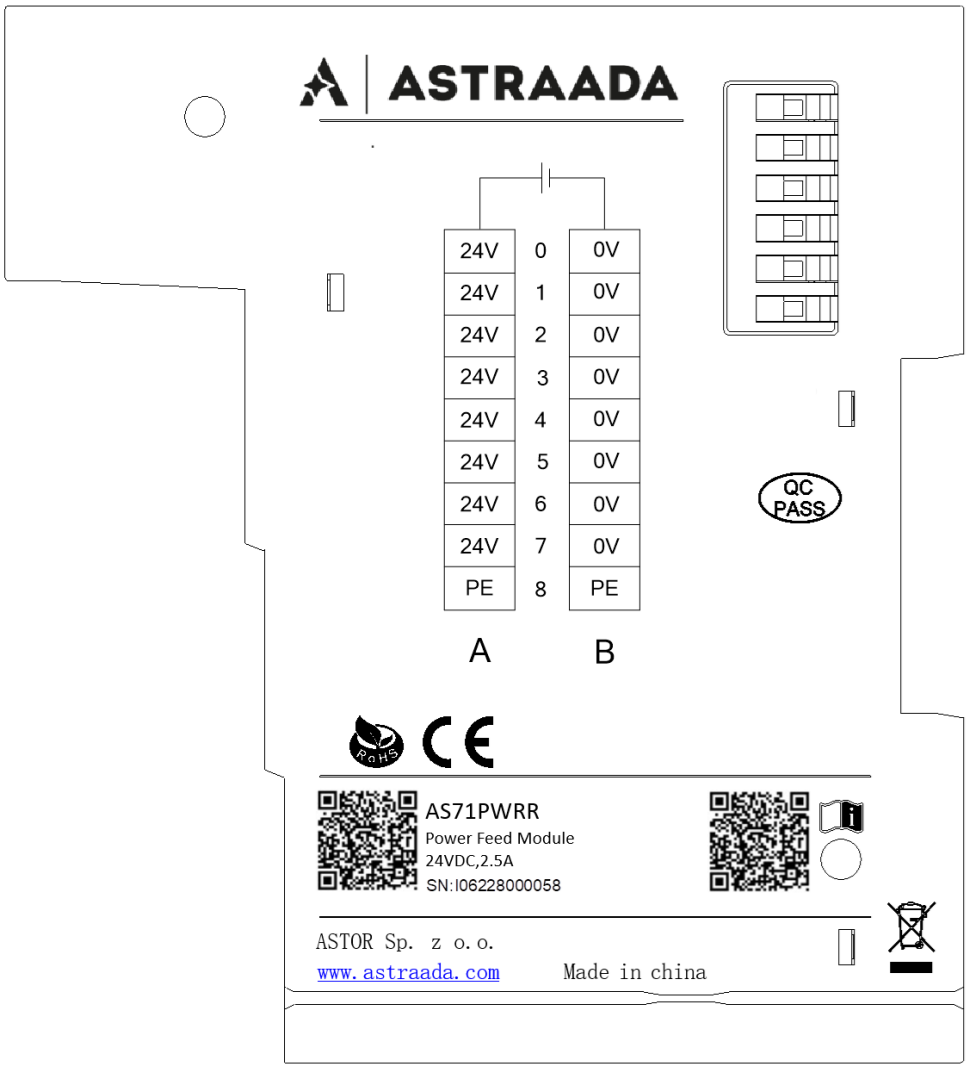


Figure 5-56 Component diagram

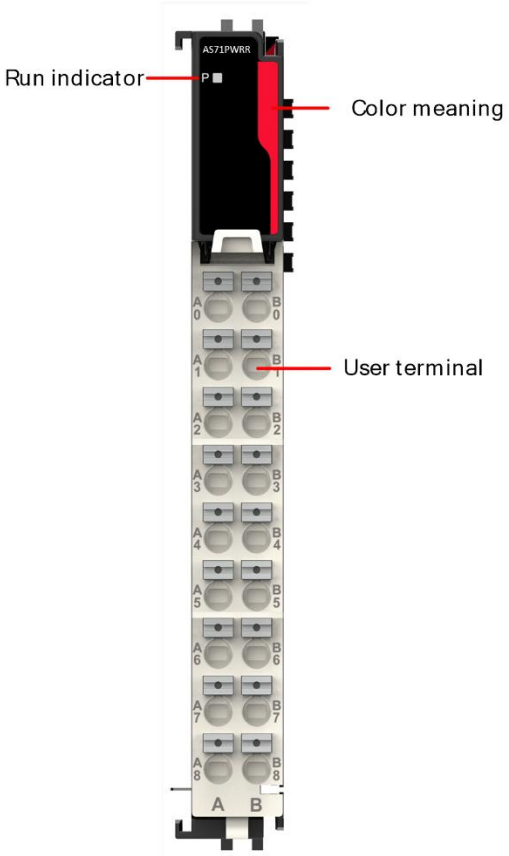


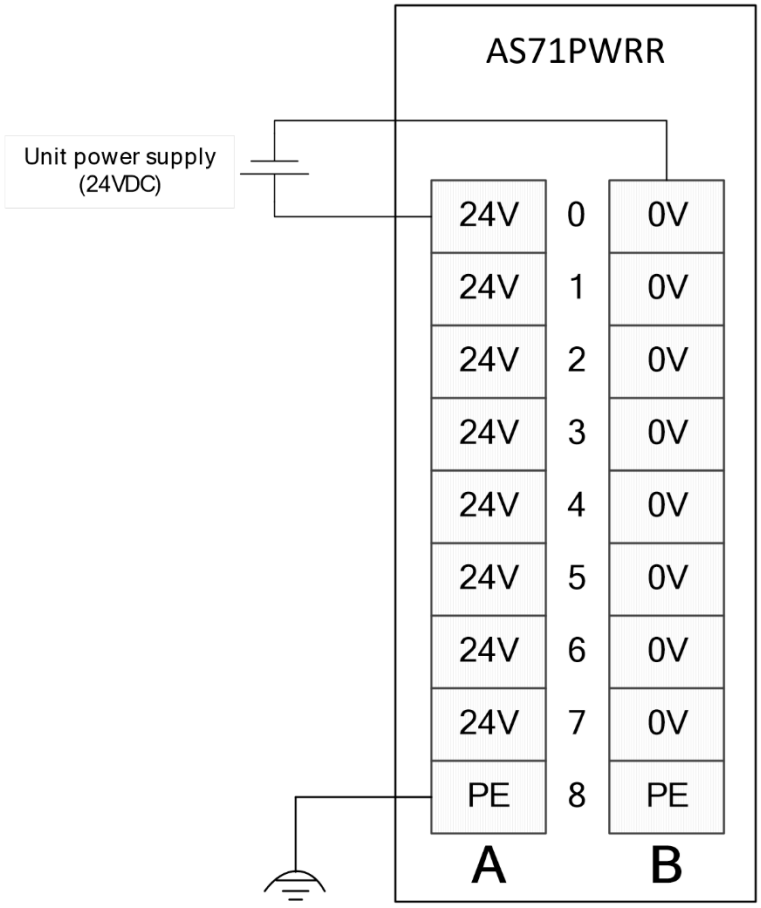

Table 5-24 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Run indicator | Green | P | On: The module is running.<br>Off: The module is not powered on or it is abnormal. |
| User terminal | I/O terminals for external wiring | | |

■ **Terminal definition**

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

- **Terminal wiring**




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

- **Power supply specifications**

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

- **Software specifications**

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

## 5.5.21 Serial communication module–AS71COM2

Figure 5-57 AS71COM2 appearance



Figure 5-58 Component diagram

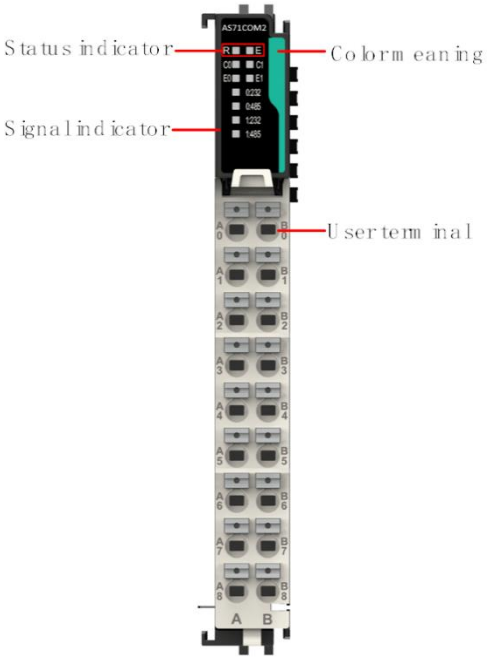
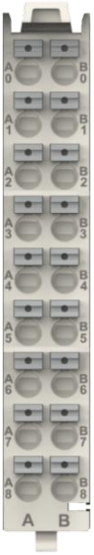


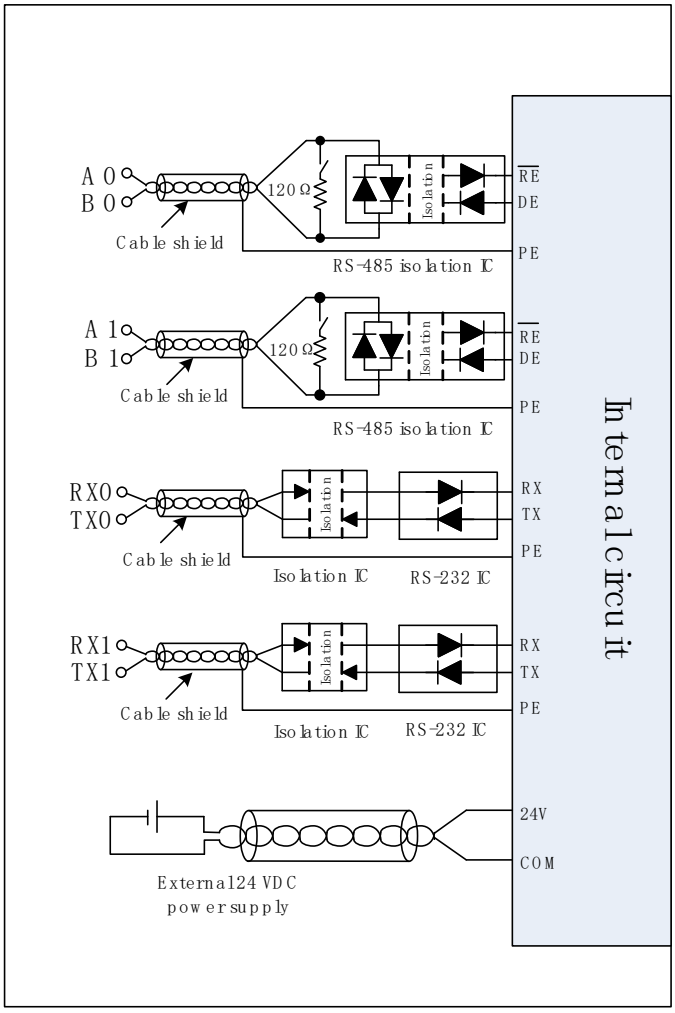

Table 5-25 Component description

| Name | Color | Silkscreen | Description |
|---|---|---|---|
| Status indicator | Yellow-green | R | On: The module is running.<br>Slow blinking (2.5 Hz): The module is establishing communication.<br>Off: The module is not powered on or it is abnormal. |
| | Red | E | Off: The module works normally.<br>Fast blinking (10 Hz): The module is offline.<br>Slow blinking (2.5 Hz): Incorrect parameter settings. |
| | Green | C0 C1 | Blinking: There is data interaction.<br>Off: There is no data interaction. |
| | Red | E0 E1 | Steady on: Communication fault<br>Off: Communication normal |
| Signal indicator | Green | 0:232 | On: Channel 0 operates in RS232 mode<br>Off: Channel 0 operates in non-RS232 mode |
| | Green | 1:232 | On: Channel 1 operates in RS232 mode<br>Off: Channel 1 operates in non-RS232 mode |
| | Green | 0:485 | On: Channel 0 operates in RS485 mode<br>Off: Channel 0 operates in non-RS485 mode |
| | Green | 1:485 | On: Channel 1 operates in RS485 mode<br>Off: Channel 1 operates in non-RS485 mode |
| User terminal | I/O terminals for external wiring | | |
| Color meaning | : Digital input<br>: Digital output (source, sink, relay)<br>: Analog input (voltage, current, thermocouple, RTD) | | : Analog output<br>: Power feed<br>: Counting and measurement |

- **Terminal definition**

| Diagram | Left signal | Left terminal | Right terminal | Right signal |
|---|---|---|---|---|
|  | R0+ | **A0** | **B0** | R1+ |
| | R0- | **A1** | **B1** | R1- |
| | 485_A0 | **A2** | **B2** | 485_A1 |
| | 485_B0 | **A3** | **B3** | 485_B1 |
| | GND | **A4** | **B4** | GND |
| | 232_TX0 | **A5** | **B5** | 232_TX1 |
| | 232_RX0 | **A6** | **B6** | 232_RX1 |
| | PE | **A7** | **B7** | PE |
| | 24 V | **A8** | **B8** | 0 V |

- **Terminal wiring**



- **Power supply specifications**

| Item | Specifications |
|---|---|
| Bus input power rated voltage | 5 VDC (4.75 VDC–5.25 VDC) |
| Bus input power rated current | 180 mA |
| Module hot swapping | Not supported |

- **Input specifications**

| Item | Specifications |
|---|---|
| Supported protocols | Modbus RTU master/slave, free protocol |
| Input PDO data size | Max. 1024 bytes |
| Output PDO data size | Max. 1024 bytes |
| Number of channels | 2 |
| Communication interface type | ● The module supports 2-channel serial communication simultaneously.<br>● Provides two RS485 physical-layer channels and two RS232 physical-layer channels. |
| Data transmission rate | ● 1200/2400/4800/9600/19200/38400/57600/115200<br>● Default value: 19200<br>● Unit: bit/s |
| Data bit | 7 or 8 bits; default: 8 bits (The 7-data-bit setting cannot be used with no parity; otherwise, a serial-port parameter configuration error is reported.). |
| Start bit | Fixed at 1 bit |
| Stop bit | 1 bit or 2 bits; default: 1 bit |
| Parity bit | Odd parity, even parity, or no parity; default: even parity |
| Number of slaves | ● In RS485 mode, each channel supports up to 31 Modbus RTU slaves.<br>● In RS232 mode, each channel supports only 1 Modbus RTU slave, and the entire module supports a total of 2 slaves. |
| Communication distance | ● RS232: Max. 15 m @ 4800 bit/s. The transmission distance ≈ [(15 m × 4800) / actual baud rate]. Cable distributed capacitance ≤ 100 pF/m.<br>● RS485:<br>➢ 1000 m @ 1200 bit/s<br>➢ 800 m @ 2400 bit/s<br>➢ 600 m @ 4800 bit/s<br>➢ 300 m @ 19200 bit/s<br>➢ 200 m @ 38400 bit/s<br>➢ 200 m @ 57600 bit/s<br>➢ 100 m @ 115200 bit/s<br>➢ (a. Measured using AWG24 shielded twisted-pair cable with a 120 Ω termination resistor and cable distributed capacitance of ≤ 100 pF/m.<br>b. The actual communication distance depends on cable quality, electromagnetic environment, number of nodes, and connector quality.) |
| Isolation method | ● Channels are isolated from internal system signals.<br>● No isolation between channels |
| Termination resistor | Implemented by user wiring at the terminal; matching resistance: 120 Ω |

| Item | Specifications |
|---|---|
| Diagnostic reporting function configuration | Supported |
| Communication data refresh mode | Free refresh |

- **Software specifications**

| Item | Specifications |
|---|---|
| Frame end idle time | ● Receive frame end detection time; range: 0–10000<br>● Unit: 0.1 character<br>● Default value: 35 |
| Response timeout | ● Timeout for the master to wait for a slave response; range: 10–65535<br>● Unit: ms<br>● Default value: 1000 |
| Polling delay | ● Delay from when the master receives a slave response frame to when it sends the next command; range: 0–65535<br>● Unit: ms<br>● Default value: 3 |
| Read timeout handling mode | ● Holds the last input value or clears the input value.<br>● Default value: holds the last input value |
| Response delay | ● Delay from when the slave receives a query frame to when it sends a response frame; range: 0–65535<br>● Unit: ms<br>● Default value: 50<br>● This parameter is valid only in slave mode. |
| Module control function | When the read/write commands of Modbus RTU need to be controlled, select the enable mode. The read/write commands of Modbus RTU are controlled by controlling the value of "Module control output". The default value is Disabled. |
| Module control mode | Modes: level trigger (continuously active), rising-edge trigger (single trigger), and polling mode are supported. |
| Function code | ● Standard commands: 01/02/03/04/05/06/15/16 |
| Slave ID | ● Range: 1–247<br>● Default value: 1<br>● This parameter is valid only in slave mode. |

# 6 Configuration

## 6.1 Parameter description

### 6.1.1 Coupler

#### 6.1.1.1 AS71ETC

| Name | Index--Subindex | Parameter | Type | Meaning |
|---|---|---|---|---|
| Configuration parameter SDO | 0x3000: 00 | Module Enable | UDINT | Expansion module enable/disable control bit. These bits control the enabled/disabled status of the expansion modules connected downstream of the coupler. Each bit controls the enabled/disabled status of one module (1: enable; 0: disable).<br>Bit 0 controls the 1st module.<br>Bit 1 controls the 2nd module<br>…<br>Bit 31 controls the 32nd module. |
| Control parameter RxPDO | - | - | - | - |
| Feedback parameter TxPDO | - | - | - | - |
| Status 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 |

#### 6.1.1.2 AS71EIP

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| hwVersion | UINT | Coupler hardware version | Input Data(T→O) |
| swVersion | UINT | Coupler software version | |
| SLOT 1–8 Module Enable | USINT | Expansion module enable/disable control bit: controls the | - |

<table>
<tr><th>Parameter</th><th>Type</th><th>Meaning</th><th>Data type</th></tr>
<tr><td></td><td></td><td>enabled/disabled status of the expansion modules connected downstream of the coupler. Each bit controls the enabled/disabled status of one module.<table><tr><th>Bit7</th><th>...</th><th>Bit0</th></tr><tr><td>Controls the 8th module</td><td>...</td><td>Controls the 1st module</td></tr></table>TRUE: Enable. FALSE: Disable.</td><td></td></tr>
<tr><td>SLOT 9–16 Module Enable</td><td>USINT</td><td>Expansion module enable/disable control bit: controls the enabled/disabled status of the expansion modules connected downstream of the coupler. Each bit controls the enabled/disabled status of one 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>TRUE: Enable. FALSE: Disable.</td><td>-</td></tr>
<tr><td>SLOT 17–24 Module Enable</td><td>USINT</td><td>Expansion module enable/disable control bit: controls the enabled/disabled status of the expansion modules connected downstream of the coupler. Each bit controls the enabled/disabled status of one module.<table><tr><th>Bit7</th><th>...</th><th>Bit0</th></tr><tr><td>Controls module 24.</td><td>...</td><td>Controls module 17.</td></tr></table>TRUE: Enable. FALSE: Disable.</td><td>-</td></tr>
<tr><td>SLOT 25–32 Module Enable</td><td>USINT</td><td>Expansion module enable/disable control bit: controls the enabled/disabled status of the expansion modules connected downstream of the coupler. Each bit controls the enabled/disabled status of one module.<table><tr><th>Bit7</th><th>...</th><th>Bit0</th></tr><tr><td>Controls module 32.</td><td>...</td><td>Controls module 25.</td></tr></table>TRUE: enable; FALSE: disable</td><td>-</td></tr>
</table>

## 6.1.2 Digital input module

### 6.1.2.1 AS71DI16

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8001+0x80*n | 1600DI SDO Cfg | - | 1600DI module filter configuration parameter | Config Param |
| | Subindex 0x01 | Filt0 | UINT | I0–I7 filter parameter. Unit: 10 μs | |
| | Subindex 0x02 | Filt1 | UINT | Filter parameters I10–I17. Unit: 10 μs | |
| Control parameter RxPDO | - | - | - | - | - |
| Feedback parameter TxPDO | 0x6001+0x80*n | 1600DI TxPDO | - | 1600DI module status feedback parameter | - |
| | Subindex 0x01 | ErrID | UINT | Fault ID | Diagnosis Data |
| | Subindex 0x02 | I0 | BIT | I0 status feedback | Input (T→O) |
| | Subindex 0x03 | I1 | BIT | I1 status feedback | |
| | … | … | … | … | |
| | Subindex 0x11 | I17 | BIT | I17 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, and n∈[0,31]. | | | | | |

### 6.1.2.2 AS71DI32

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8002+0x80*n | 3200DI SDO Cfg | - | 3200DI module filter configuration parameter | Config Param |
| | Subindex 0x01 | Filt0 | UINT | Filter parameters I0–I7. Unit: 10 μs | |
| | Subindex 0x02 | Filt1 | UINT | Filter parameters I10–I17. Unit: 10 μs | |
| | Subindex 0x03 | Filt2 | UINT | Filter parameters I20–I27. Unit: 10 μs | |
| | Subindex 0x04 | Filt3 | UINT | Filter parameters I30–I37. Unit: 10 μs | |
| Control parameter RxPDO | - | - | - | - | - |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Feedback parameter TxPDO | 0x6002+0x80*n | 3200DI TxPDO | - | 3200DI module status feedback parameter | - |
| | Subindex 0x01 | ErrID | UINT | Fault ID | Diagnosis Data |
| | Subindex 0x02 | I0 | BIT | I0 status feedback | Input (T→O) |
| | 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, and n∈[0,31]. | | | | | |

## 6.1.3 Digital output module

### 6.1.3.1 AS71DO16

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8005+ 0x80*n | 0016D* SDO Cfg | - | 0016DP/DN module stop/offline configuration parameter | Config Param |
| | Subindex 0x01 | Stop Mode0 | UINT | Stop/offline output mode<br>Q0 Bit1bit0<br>Q1 Bit3bit2<br>... ...<br>Q7 Bit15bit14<br>2#00: Hold output in stop/offline mode<br>2#01: Clear output in stop/offline mode<br>2#10: Preset output in stop/offline mode | |
| | Subindex 0x02 | Stop Mode1 | UINT | Stop/offline output mode<br>Q10 Bit1bit0<br>Q11 Bit3bit2<br>... ...<br>Q17 Bit15bit14<br>2#00: Hold output in stop/offline mode<br>2#01: Clear output in stop/offline mode<br>2#10: Preset output in stop/offline mode | |
| | Subindex 0x03 | Stop Output0 | USINT | Preset value of stop/offline output | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | Bit0: Q0 preset output value in stop/offline mode<br>Bit1: Q1 preset output value in stop/offline mode<br>...<br>Bit7: Q7 preset output value in stop/offline mode | |
| | Subindex 0x04 | Stop Output1 | USINT | Preset value of stop/offline output<br>Bit0: Q10 preset output value in stop/offline mode<br>Bit1: Q11 preset output value in stop/offline mode<br>...<br>Bit7: Q17 preset output value in stop/offline mode | |
| Control parameter RxPDO | 0x7005+0x80*n | 0016D* RxPDO | - | 0016DP/DN module output control value | Output (O→T) |
| | 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 ID | Diagnosis Data (Input(T→O)) |
| 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, and n∈[0,31]. | | | | | |

### 6.1.3.2 AS71DO32

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8006+0x80*n | 0032D* SDO Cfg | - | 0032DP/DN module stop/offline configuration parameter | Config Param |
| | Subindex 0x01 | Stop Mode0 | UINT | Stop/offline output mode<br>Q0 Bit1bit0<br>Q1 Bit3bit2<br>... ...<br>Q7 Bit15bit14 | |

<table>
<tr><th>Name</th><th>Index--<br>Subindex</th><th>Parameter</th><th>Type</th><th>Meaning</th><th>Data type</th></tr>
<tr><td rowspan="4"></td><td></td><td></td><td></td><td>2#00: Hold output in stop/offline mode<br>2#01: Clear output in stop/offline mode<br>2#10: Preset output in stop/offline mode</td><td rowspan="4"></td></tr>
<tr><td>Subindex 0x02</td><td>Stop Mode1</td><td>UINT</td><td>Stop/offline output mode<br><table><tr><td>Q10</td><td>Bit1bit0</td></tr><tr><td>Q11</td><td>Bit3bit2</td></tr><tr><td>...</td><td>...</td></tr><tr><td>Q17</td><td>Bit15bit14</td></tr></table>2#00: Hold output in stop/offline mode<br>2#01: Clear output in stop/offline mode<br>2#10: Preset output in stop/offline mode</td></tr>
<tr><td>Subindex 0x03</td><td>Stop Mode2</td><td>UINT</td><td>Stop/offline output mode<br><table><tr><td>Q20</td><td>Bit1bit0</td></tr><tr><td>Q21</td><td>Bit3bit2</td></tr><tr><td>...</td><td>...</td></tr><tr><td>Q27</td><td>Bit15bit14</td></tr></table>2#00: Hold output in stop/offline mode<br>2#01: Clear output in stop/offline mode<br>2#10: Preset output in stop/offline mode</td></tr>
<tr><td>Subindex 0x04</td><td>Stop Mode3</td><td>UINT</td><td>Stop/offline output mode<br><table><tr><td>Q30</td><td>Bit1bit0</td></tr><tr><td>Q31</td><td>Bit3bit2</td></tr><tr><td>...</td><td>...</td></tr><tr><td>Q37</td><td>Bit15bit14</td></tr></table>2#00: Hold output in stop/offline mode<br>2#01: Clear output in stop/offline mode<br>2#10: Preset output in stop/offline mode</td></tr>
</table>

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | Subindex 0x05 | Stop Output0 | USINT | Preset value of stop/offline output<br>Bit0: Q0 preset output value in stop/offline mode<br>Bit1: Q1 preset output value in stop/offline mode<br>...<br>Bit7: Q7 preset output value in stop/offline mode | |
| | Subindex 0x06 | Stop Output1 | USINT | Preset value of stop/offline output<br>Bit0: Q10 preset output value in stop/offline mode<br>Bit1: Q11 preset output value in stop/offline mode<br>...<br>Bit7: Q17 preset output value in stop/offline mode | |
| | Subindex 0x07 | Stop Output2 | USINT | Preset value of stop/offline output<br>Bit0: Q20 preset output value in stop/offline mode<br>Bit1: Q21 preset output value in stop/offline mode<br>...<br>Bit7: Q27 preset output value in stop/offline mode | |
| | Subindex 0x08 | Stop Output3 | USINT | Preset value of stop/offline output<br>Bit0: Q30 preset output value in stop/offline mode<br>Bit1: Q31 preset output value in stop/offline mode<br>...<br>Bit7: Q37 preset output value in stop/offline mode | |
| Control parameter RxPDO | 0x7006+0x80*n | 0032D* RxPDO | - | 0032DP/DN module output control value | Output (O→T) |
| | 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 ID | Diagnosis Data (Input(T→O)) |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| 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, and n∈[0,31]. | | | | | |

### 6.1.3.3 AS71DOR8

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8004+0x80*n | 0008DR SDO Cfg | - | 0008DR module stop/offline configuration parameter | Config Param |
| | Subindex 0x01 | Stop Mode | UINT | Stop/offline output mode<br>Q0 Bit1bit0<br>Q1 Bit3bit2<br>... ...<br>Q7 Bit15bit14<br>2#00: Hold output in stop/offline mode<br>2#01: Clear output in stop/offline mode<br>2#10: Preset output in stop/offline mode | |
| | Subindex 0x02 | Stop Output | USINT | Preset value of stop/offline output<br>Bit0: Q0 preset output value in stop/offline mode<br>Bit1: Q1 preset output value in stop/offline mode<br>...<br>Bit7: Q7 preset output value in stop/offline mode | |
| Control parameter RxPDO | 0x7004+0x80*n | 0008DR RxPDO | - | 0008DR module output control value | Output (O→T) |
| | Subindex 0x01 | Q0 | BIT | Q0 output control | |
| | 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 ID | Diagnosis Data (Input(T→O)) |
| Status parameter | 0x8078+0x80*n | Module Info | - | Module information | - |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| SDO | 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, and n∈[0,31]. | | | | | |

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 |
|---|---|
| 00 | Stop/offline output retained |
| 01 | Stop/offline output cleared |
| 10 | Stop/offline output preset |

If Q0 to Q7 are all configured to hold output, the value of Stop Mode0 of 0016DP is 0, that is, 0b0000000000000000.

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

## 6.1.4 Analog input module

### 6.1.4.1 AS71AIN4

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8015+0x80*n | 4AD SDO Cfg | - | 4AD module configuration parameter | Config Param |
| | Subindex 0x01 | AI0 Cfg | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enable control (0: disabled; 1: enabled)<br>Bit1: Open-circuit detection enable control (0: disabled; 1: enabled)<br>Bit2: Over-limit detection enable control (0: disabled; 1: enabled)<br>Bit3: Over-range detection enable control (0: disabled; 1: enabled)<br>Bit4: Enhanced filter enable control (0: disabled; 1: enabled)<br>Bit7–bit5: Channel | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | conversion mode<br>2#000: Voltage 0–5 V<br>Corresponding code value: 0–20000<br>2#001: Voltage 0–10 V<br>Corresponding code value: 0–20000<br>2#010: Voltage -5–5 V<br>Corresponding code value: 20000–20000<br>2#011: Voltage -10–10 V<br>Corresponding code value: 20000–20000<br>2#100: Current 4–20 mA<br>Corresponding code value: 0–20000<br>2#101: Current 0–20 mA<br>Corresponding code value: 0–20000<br>2#110: reserved<br>2#111: Current -20–20 mA<br>Corresponding code value: 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 parameter for channel 0 | |
| | Subindex 0x05 | AI0 Filt | USINT | Filter parameter for channel 0<br>Range: 1–255. A larger value improves filtering performance but increases delay. | |
| | Subindex 0x06 | AI1 Filt | USINT | Same as Channel 0 filter parameter | |
| | Subindex 0x07 | AI2 Filt | USINT | Same as Channel 0 filter parameter | |
| | Subindex 0x08 | AI3 Filt | USINT | Same as Channel 0 filter parameter | |
| Control parameter RxPDO | - | - | - | - | - |
| Feedback parameter TxPDO | 0x6015+0x80*n | 4AD TxPDO | - | 4AD module status feedback parameter | Input(T→O) |
| | Subindex 0x01 | AI0 | INT | Conversion value for channel 0. | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | 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. | Diagnosis Data (Input(T→O)) |
| | Subindex 0x06 | AI1_ErrID | UINT | Fault code for channel 1. | |
| | Subindex 0x07 | AI2_ErrID | UINT | Fault code for channel 2. | |
| | Subindex 0x08 | AI3_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, and n∈[0,31]. | | | | | |

### 6.1.4.2 AS71AIV8

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8016+0x80*n | 8ADV SDO Cfg | - | 8ADV module configuration parameter | Config Param |
| | Subindex 0x01 | AI0 Cfg | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enable flag (0: disabled; 1: enabled)<br>Bit1: Over-range detection enable flag (0: disabled; 1: enabled)<br>Bit2: Enhanced filter enable flag (0: disabled; 1: enhanced filter enabled; 50 Hz/60 Hz suppressed simultaneously)<br>Bit4–bit3: Conversion range selection<br>2#00: (0–20000) or (-20000–20000)<br>2#01: (0–27648) or (-27648–27648)<br>2#10: (0–32000) or (-32000–32000)<br>2#11: (0–32767) or (-32768–32767)<br>Bit7–bit5: Conversion mode selection<br>2#000: voltage 0–5 V | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | 2#001: voltage 0–10 V<br>2#010: voltage -5–5 V<br>2#011: voltage -10–10 V<br>2#100: voltage 1–5 V<br>2#101: reserved<br>2#110: reserved<br>2#111: reserved | |
| | 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 parameter for channel 0 | |
| | Subindex 0x05 | AI4 Cfg | USINT | Same as the configuration parameter for channel 0 | |
| | Subindex 0x06 | AI5 Cfg | USINT | Same as the configuration parameter for channel 0 | |
| | Subindex 0x07 | AI6 Cfg | USINT | Same as the configuration parameter for channel 0 | |
| | Subindex 0x08 | AI7 Cfg | USINT | Same as the configuration parameter for channel 0 | |
| | Subindex 0x09 | AI0 Filt | USINT | Filter parameter for channel 0<br>Range: 1–255. A larger value improves filtering performance but increases delay. | |
| | Subindex 0x0A | AI1 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0B | AI2 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0C | AI3 Filt | USINT | Same as Channel 0 filter parameter | |
| | Subindex 0x0D | AI4 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0E | AI5 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0F | AI6 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x10 | AI7 Filt | USINT | Same as channel 0 filter parameter | |
| Control parameter RxPDO | - | - | - | - | - |
| Feedback parameter TxPDO | 0x6016+0x80*n | 8ADV TxPDO | - | 8ADV module status feedback parameter | Input(T→O) |
| | 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. | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | Subindex 0x05 | AI4 | INT | Conversion value for channel 4. | |
| | Subindex 0x06 | AI5 | INT | Conversion value for channel 5. | |
| | Subindex 0x07 | AI6 | INT | Conversion value for channel 6. | |
| | Subindex 0x08 | AI7 | INT | Conversion value for channel 7. | |
| | Subindex 0x09 | AI0_ErrID | UINT | Fault code for channel 0. | Diagnosis Data (Input (T→O)) |
| | Subindex 0x0A | AI1_ErrID | UINT | Fault code for channel 1. | |
| | Subindex 0x0B | AI2_ErrID | UINT | Fault code for channel 2. | |
| | Subindex 0x0C | AI3_ErrID | UINT | Fault code for channel 3. | |
| | Subindex 0x0D | AI4_ErrID | UINT | Fault code for channel 4. | |
| | Subindex 0x0E | AI5_ErrID | UINT | Fault code for channel 5. | |
| | Subindex 0x0F | AI6_ErrID | UINT | Fault code for channel 6. | |
| | Subindex 0x10 | AI7_ErrID | UINT | Fault code for channel 7. | |
| Status parameter SDO | 0x8078+0x80*n | Module Info | - | Module information | - |
| | Subindex 0x01 | HW Version | UINT | Manufacturer hardware version | - |
| | Subindex 0x02 | FPGA Version | UINT | Module hardware version number | - |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

### 6.1.4.3 AS71AIC8

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8016+0x80*n | 8ADI SDO Cfg | - | 8ADI module configuration parameter | Config Param |
| | Subindex 0x01 | AI0 Cfg | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enable flag (0: disabled; 1: enabled)<br>Bit1: Over-range detection enable flag (0: disabled; 1: enabled)<br>Bit2: Enhanced filter enable flag (0: disabled; 1: enhanced filter enabled; 50 Hz/60 Hz suppressed simultaneously)<br>Bit4–bit3: Conversion range selection<br>2#00: (0–20000) or (-20000–20000)<br>2#01: (0–27648) or (-27648–27648)<br>2#10: (0–32000) or (-32000–32000)<br>2#11: (0–32767) or (-32768–32767)<br>Bit7–bit5: Conversion mode | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | selection<br>2#000: reserved<br>2#001: reserved<br>2#010: reserved<br>2#011: reserved<br>2#100: reserved<br>2#101: Current 4–20 mA<br>2#110: Current 0–20 mA<br>2#111: Current -20–20 mA | |
| | 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 parameter for channel 0 | |
| | Subindex 0x05 | AI4 Cfg | USINT | Same as the configuration parameter for channel 0 | |
| | Subindex 0x06 | AI5 Cfg | USINT | Same as the configuration parameter for channel 0 | |
| | Subindex 0x07 | AI6 Cfg | USINT | Same as the configuration parameter for channel 0 | |
| | Subindex 0x08 | AI7 Cfg | USINT | Same as the configuration parameter for channel 0 | |
| | Subindex 0x09 | AI0 Filt | USINT | Filter parameter for channel 0<br>Range: 1–255. A larger value improves filtering performance but increases delay. | |
| | Subindex 0x0A | AI1 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0B | AI2 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0C | AI3 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0D | AI4 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0E | AI5 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x0F | AI6 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x10 | AI7 Filt | USINT | Same as channel 0 filter parameter | |
| Control parameter RxPDO | - | - | - | - | |
| Feedback | 0x6016+0x80*n | 8ADI | - | 8ADI module status feedback | Input(T→O) |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| parameter TxPDO | | TxPDO | | 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 | AI4 | INT | Conversion value for channel 4. | |
| | Subindex 0x06 | AI5 | INT | Conversion value for channel 5. | |
| | Subindex 0x07 | AI6 | INT | Conversion value for channel 6. | |
| | Subindex 0x08 | AI7 | INT | Conversion value for channel 7. | |
| | Subindex 0x09 | AI0_ErrID | UINT | Fault code for channel 0. | Diagnosis Data (Input(T→O)) |
| | Subindex 0x0A | AI1_ErrID | UINT | Fault code for channel 1. | |
| | Subindex 0x0B | AI2_ErrID | UINT | Fault code for channel 2. | |
| | Subindex 0x0C | AI3_ErrID | UINT | Fault code for channel 3. | |
| | Subindex 0x0D | AI4_ErrID | UINT | Fault code for channel 4. | |
| | Subindex 0x0E | AI5_ErrID | UINT | Fault code for channel 5. | |
| | Subindex 0x0F | AI6_ErrID | UINT | Fault code for channel 6. | |
| | Subindex 0x10 | AI7_ErrID | UINT | Fault code for channel 7. | |
| 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, and n∈[0,31]. | | | | | |

Taking Channel 0 as an example, the parameter type is USINT. See the following table for detailed data definition of AI0 Cfg of AS71AIN4:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|
| Channel conversion mode (range configuration) | | | Enhanced filter enable | Over-range enable | Over-range detection enable | Open-circuit detection enable | Channel enable |
| 2#000: 0–5 V<br>2#001: 0–10 V<br>2#010:-5 V–+5 V<br>2#011:-10 V–+10 V | 2#100: 4–20 mA<br>2#101: 0–20 mA<br>2#110: reserved<br>2#111: -20–+20 mA | | 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 configured as follows: channel enabled, open-circuit detection disabled, over-range detection enabled, over-range enabled, enhanced filter disabled, and the range is 4–20 mA. The value should be 141,

that is, 0b10001101. Details are as follows:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|
| 100 | | | 0 | 1 | 1 | 0 | 1 |
| 100: 4–20 mA | | | 0: Disable | 1: Enable | 1: Enable | 0: Disable | 1: Enable |

Range conversion:

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

| Measurement range | Current (I) /Voltage (U) | Decimal (D) | Hexadecimal | Range | Conversion formula |
|---|---|---|---|---|---|
| | -22.2136 mA | -32768 | 0x8000 | limit | |
| 0–20 mA | 32.767 mA | 32767 | 0x7FFF | Above upper limit | D = 20000×I/20<br>I = D×20/20000 |
| | 20 mA | 20000 | 0x4E20 | Rated range | |
| | 10 mA | 10000 | 0x2710 | | |
| | 0 mA | 0 | 0x0000 | | |
| | -10 mA | -10000 | 0xD8F0 | Below lower limit | |
| | -20 mA | -20000 | 0xB1E0 | | |
| | -32.767 mA | -32768 | 0x8000 | | |
| ±20 mA | 32.767 mA | 32767 | 0x7FFF | Above upper limit | D = 20000×I/20<br>I = D×20/20000 |
| | 20 mA | 20000 | 0x4E20 | Rated range | |
| | 10 mA | 10000 | 0x2710 | | |
| | 0 mA | 0 | 0x0000 | | |
| | -10 mA | -10000 | 0xD8F0 | | |
| | -20 mA | -20000 | 0xB1E0 | | |
| | -32.767 mA | -32768 | 0x8000 | Below lower limit | |

## 6.1.5 Analog output module

### 6.1.5.1 AS71AOU4

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8019+0x80*n | 4DA SDO Cfg | - | 4DA module configuration parameter | Config Param |
| | Subindex 0x01 | AO0 Cfg | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enable control (0: disabled; 1: enabled)<br>Bit1: Output fault detection enable control (0: disabled; 1: enabled)<br>Bit3–bit2: Offline output mode.<br>2#00: Hold output when offline<br>2#01: Clear output when offline<br>2#10: Preset output when offline<br>Bit 4: Reserved<br>Bit7–bit5: Channel conversion mode<br>2#000: Voltage 0–5 V<br>Corresponding code value: 0–20000<br>2#001: Voltage 0–10 V | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | Corresponding code value: 0–20000<br>2#010: Voltage -5–5 V<br>Corresponding code value: 20000–20000<br>2#011: Voltage -10–10 V<br>Corresponding code value: 20000–20000<br>2#100: Current 4–20 mA<br>Corresponding code value: 0–20000<br>2#101: Current 0–20 mA<br>Corresponding code value: 0–20000<br>2#110: reserved<br>2#111: reserved | |
| | 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 | Output(O→T) |
| | 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. | |
| Feedback parameter TxPDO | 0x6019+0x80*n | 4DA TxPDO | - | 4DA module status feedback parameter | Diagnosis Data (Input(T→O)) |
| | 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 | UINT | Module hardware version | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | Version | | number | |
| | Subindex 0x02 | FPGA Version | UINT | Module FPGA software version number | |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

## 6.1.6 Temperature detection module

### 6.1.6.1 AS71RTD4

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8029+0x80*n | 4PT SDO Cfg | - | 4PT module configuration parameter | Config Param |
| | Subindex 0x01 | Temp0 Cfg | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enable control<br>(0: disabled; 1: enabled)<br>Bit1: Over-range detection enable control<br>(0: disabled; 1: enabled)<br>bit3–bit2: RTD wiring mode<br>2#00: Two-wire system<br>2#01: Three-wire system<br>2#10: Four-wire system<br>Bit4: Temperature unit<br>(0: °C; 1: °F)<br>Bit7–bit5: Channel conversion mode<br>2#000: reserved<br>2#001: PT100<br>2#010: PT500<br>2#011: reserved<br>2#100: PT1000<br>2#101: reserved<br>2#110: reserved<br>2#111: CU100 | |
| | 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 | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | 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 larger value improves filtering performance but increases delay. | |
| | Subindex 0x06 | Temp1 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x07 | Temp2 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x08 | Temp3 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x09 | Temp0 Offset | INT | Channel 0 temperature offset value<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 channel 0 temperature offset value | |
| | Subindex 0xB | Temp2 Offset | INT | Same as channel 1 temperature offset value | |
| | Subindex 0xC | Temp3 Offset | INT | Same as channel 2 temperature offset value | |
| | Subindex 0xD | Temp0 Up | INT | Channel 0 temperature upper limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0xE | Temp1 Up | INT | Channel 1 temperature upper limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0xF | Temp2 Up | INT | Channel 2 temperature upper limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0x10 | Temp3 Up | INT | Channel 3 temperature upper limit (reserved)<br>Uses the inherent limit of the sensor. | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | Subindex 0x11 | Temp0 Low | INT | Channel 0 temperature lower limit (reserved) Uses the inherent limit of the sensor. | |
| | Subindex 0x12 | Temp1 Low | INT | Channel 1 temperature lower limit (reserved) Uses the inherent limit of the sensor. | |
| | Subindex 0x13 | Temp2 Low | INT | Channel 2 temperature lower limit (reserved) Uses the inherent limit of the sensor. | |
| | Subindex 0x14 | Temp3 Low | INT | Channel 3 temperature lower limit (reserved) Uses the inherent limit of the sensor. | |
| Control parameter RxPDO | - | - | - | - | - |
| Feedback parameter TxPDO | 0x6029+0x80*n | 4PT TxPDO | - | 4PT module status feedback parameter | Input(T→O) |
| | 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. | Diagnosis Data (Input(T → O)) |
| | 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, and n∈[0,31]. | | | | | |

### 6.1.6.2 AS71THC4

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x802D+0x80*n | 4TC SDO Cfg | - | 4TC module configuration parameter | Config Param |
| | Subindex 0x01 | Temp0 Cfg | USINT | Configuration parameter for channel 0.<br>Bit0: Channel enable control<br>(0: disabled; 1: enabled)<br>Bit1: Over-range detection enable control<br>(0: disabled; 1: enabled)<br>Bit3–bit2: Reserved<br>Bit 4: Temperature unit<br>(0: ℃; 1: ℉)<br>Bit7–bit5: Channel conversion mode<br>2#000: Type B thermocouple<br>2#001: Type E thermocouple<br>2#010: Type J thermocouple<br>2#011: Type K thermocouple<br>2#100: Type N thermocouple<br>2#101: Type R thermocouple<br>2#110: Type S thermocouple<br>2#111: Type T thermocouple | |
| | 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 larger value improves filtering performance but increases delay. | |
| | Subindex 0x06 | Temp1 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x07 | Temp2 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x08 | Temp3 Filt | USINT | Same as channel 0 filter parameter | |
| | Subindex 0x09 | Temp0 | INT | Channel 0 temperature offset | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | Offset | | value<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 channel 0 temperature offset value | |
| | Subindex 0xB | Temp2 Offset | INT | Same as channel 1 temperature offset value | |
| | Subindex 0xC | Temp3 Offset | INT | Same as channel 2 temperature offset value | |
| | Subindex 0xD | Temp0 Up | INT | Channel 0 temperature upper limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0xE | Temp1 Up | INT | Channel 1 temperature upper limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0xF | Temp2 Up | INT | Channel 2 temperature upper limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0x10 | Temp3 Up | INT | Channel 3 temperature upper limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0x11 | Temp0 Low | INT | Channel 0 temperature lower limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0x12 | Temp1 Low | INT | Channel 1 temperature lower limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0x13 | Temp2 Low | INT | Channel 2 temperature lower limit (reserved)<br>Uses the inherent limit of the sensor. | |
| | Subindex 0x14 | Temp3 Low | INT | Channel 3 temperature lower limit (reserved)<br>Uses the inherent limit of the sensor. | |
| Control parameter RxPDO | - | - | - | - | |
| Feedback | 0x602D+0x80* | 4TC TxPDO | - | 4TC module status feedback | Input (T→O) |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| parameter TxPDO | n | | | 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. | Diagnosis Data (Input(T→O)) |
| | 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, and n∈[0,31]. | | | | | |

## 6.1.7 Incremental encoder input detection module

### 6.1.7.1 AS71IN02

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| 2EI_Cnt0_Cfg | UINT | Bit1–bit0: Channel mode configuration<br>2#00: A/B-phase ×4 mode<br>2#01: A/B-phase ×2 mode<br>2#10: A/B-phase ×1 mode<br>2#11: Pulse + direction (high level indicates the positive direction)<br>Bit3–bit2: Frequency measurement period<br>2#00: 20 ms<br>2#01: 100 ms<br>2#10: 500 ms<br>2#11: 1000 ms<br>Bit5–bit4: Edge latch counter value enable<br>2#00: Disable<br>2#01: Rising edge<br>2#10: Falling edge<br>2#11: Both edges<br>Bit7–bit6: Reserved | Config Param |

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| | | Bit9–bit8: Comparison match output pulse width<br>2#00: 1 ms<br>2#01: 2 ms<br>2#10: 4 ms<br>2#11: 8 ms<br>Bit11–bit10: DO comparison output mode<br>2#00: Comparison match output<br>2#01: Output between [lower limit of count, comparison value]<br>2#10: Output between [comparison value, upper limit of count]<br>2#11: Reserved (comparison match output)<br>Bit15–bit12: Reserved | |
| 2EI_Cnt1_Cfg | UINT | Bit1–bit0: Channel mode configuration<br>2#00: A/B-phase ×4 mode<br>2#01: A/B-phase ×2 mode<br>2#10: A/B-phase ×1 mode<br>2#11: Pulse + direction (high level indicates the positive direction)<br>Bit3–bit2: Frequency measurement period<br>2#00: 20 ms<br>2#01: 100 ms<br>2#10: 500 ms<br>2#11: 1000 ms<br>Bit5–bit4: Edge latch counter value enable<br>2#00: Disable<br>2#01: Rising edge<br>2#10: Falling edge<br>2#11: Both edges<br>Bit7–bit6: Reserved<br>Bit9–bit8: Comparison match output pulse width<br>2#00: 1 ms<br>2#01: 2 ms<br>2#10: 4 ms<br>2#11: 8 ms<br>Bit11–bit10: DO comparison output mode<br>2#00: Comparison match output<br>2#01: Output between [lower limit of count, comparison value]<br>2#10: Output between [comparison value, upper limit of count]<br>2#11: Reserved (comparison match output)<br>Bit15–bit12: Reserved | |
| 2EI_Cnt0_Filt | UINT | Filter parameter for Cnt A/B/Z/L/R terminals; unit: 0.1 μs | |
| 2EI_Cnt1_Filt | UINT | Filter parameter for Cnt A/B/Z/L/R terminals; unit: 0.1 μs | |
| 2EI_Cnt0_Ratio | UINT | Encoder resolution, that is, the number of pulses fed back per revolution and the pulse increment | |

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| | | between two Z pulses | |
| 2EI_Cnt1_Ratio | UINT | Encoder resolution, that is, the number of pulses fed back per revolution and the pulse increment between two Z pulses | |
| 2EI_Cnt0_Status | USINT | Counter status feedback | Input (T→O) |
| 2EI_Cnt1_Status | USINT | Bit0: Forward run flag<br>Bit1: Reverse run flag<br>Bit2: Overflow flag bit<br>Bit3: Underflow flag bit<br>Bit4: L0 latch completion flag<br>Bit7–bit5: 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 | Error code | Diagnosis Data (Input(T → O)) |
| 2EI_Cnt1_ErrID | UINT | Error code | |
| 2EI_Cnt0_Ctrl | USINT | Bit0: Counter enable, active high<br>Bit1: Clear counter value, rising edge active<br>Bit2: Write counter preset value, rising edge active<br>Bit3: Clear counter overflow flag, rising edge active<br>Bit4: Counter comparison function enable, active high (requires counter enable first)<br>Bit7–bit5: Reserved | Output (O→T) |
| 2EI_Cnt1_Ctrl | USINT | | |
| 2EI_Cnt0_CmpVal | DINT | Counter comparison value | |
| 2EI_Cnt1_CmpVal | DINT | Counter comparison value | |
| 2EI_Cnt0_PresetVal | DINT | Counter preset value | |
| 2EI_Cnt1_PresetVal | DINT | Counter preset value | |

## 6.1.8 Bridge measurement module (AS71BRG1&AS71BRG2)

### 6.1.8.1 AS71BRG1

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| 1RB_RB_Cfg | UINT | Bit0: Channel enable<br>Bit1: Tare mode. 0: Automatic tare; 1: Manual tare<br>Bit3–bit2: Sensor sensitivity<br>2#00: 1 mV/V<br>2#01: 2 mV/V<br>2#10: 4 mV/V<br>2#11: 6 mV/V<br>Bit7–bit4: Conversion time<br>4#0000: 1 ms<br>4#0001: 2 ms | Config Param |

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| | | 4#0010: 5 ms<br>4#0011: 10 ms<br>4#0100: 20 ms<br>4#0101: 40 ms<br>4#0110: 80 ms<br>4#0111: 200 ms<br>4#1000: 400 ms<br>Bit15–bit8: Reserved | |
| 1RB_RB_FullCode | DINT | Channel full-scale code value | |
| 1RB_RB_Status | UINT | Status feedback<br>Bit0: Zero calibration status<br>Bit1: Gain calibration status<br>Bit2: Tare status<br>Bit3–bit15: Reserved | Input (T→O) |
| 1RB_RB_SampleCode | DINT | Channel measurement code value | |
| 1RB_RB_TareCode | DINT | Channel tare code value | |
| 1RB_RB_ErrId | UINT | Channel fault code | Diagnosis Data (Input(T → O)) |
| 1RB_RB_Ctrl | USINT | Bit0: Enable zero calibration, rising edge active<br>Bit1: Enable gain calibration, rising edge active<br>Bit2: Update tare value by software, rising edge active<br>Bit3: Restore factory settings, rising edge active<br>Bit7–bit4: Reserved | Output (O→T) |
| 1RB_RB_GainCode | DINT | Gain calibration code value, converted based on the full-scale code value | |
| 1RB_RB_ManualTareCode | DINT | Manual tare code value, converted based on the full-scale code value | |

### 6.1.8.2 AS71BRG2

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| 2RB_RB0_Cfg | UINT | Bit0: Channel enable<br>Bit1: Tare mode. 0: Automatic tare; 1: Manual tare<br>Bit3–bit2: Sensor sensitivity<br>2#00: 1 mV/V<br>2#01: 2 mV/V<br>2#10: 4 mV/V<br>2#11: 6 mV/V<br>Bit7–bit4: Conversion time<br>4#0000: 1 ms<br>4#0001: 2 ms<br>4#0010: 5 ms<br>4#0011: 10 ms<br>4#0100: 20 ms<br>4#0101: 40 ms<br>4#0110: 80 ms | Config Param |
| 2RB_RB1_Cfg | | | |

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| | | 4#0111: 200 ms<br>4#1000: 400 ms<br>Bit15–bit8: Reserved | |
| 2RB_RB0_FullCode | DINT | Channel full-scale code value | |
| 2RB_RB1_FullCode | | | |
| 2RB_RB0_Status | USINT | Status feedback<br>Bit0: Zero calibration status<br>Bit1: Gain calibration status<br>Bit2: Tare status<br>Bit15–bit3: Reserved | Input (T→O) |
| 2RB_RB1_Status | | | |
| 2RB_RB0_SampleCode | DINT | Channel measurement code value | |
| 2RB_RB1_SampleCode | | | |
| 2RB_RB0_TareCode | DINT | Channel tare code value | |
| 2RB_RB1_TareCode | | | |
| 2RB_RB0_ErrId | UINT | Channel fault code | Diagnosis Data (Input(T → O)) |
| 2RB_RB1_ErrId | | | |
| 2RB_RB0_Ctrl | USINT | Bit0: Enable zero calibration, rising edge active<br>Bit1: Enable gain calibration, rising edge active<br>Bit2: Update tare value by software, rising edge active<br>Bit3: Restore factory settings, rising edge active<br>Bit7–bit4: Reserved | Output (O→T) |
| 2RB_RB1_Ctrl | | | |
| 2RB_RB0_GainCode | DINT | Gain calibration code value, converted based on the full-scale code value | |
| 2RB_RB1_GainCode | | | |
| 2RB_RB0_ManualTareCode | DINT | Manual tare code value, converted based on the full-scale code value | |
| 2RB_RB1_ManualTareCode | | | |

## 6.1.9 Pulse module (AS71PUOC)

### 6.1.9.1 AS71PUOC

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| 2PTO_Ch0_Filt | UINT | Filter parameters (limit, brake, and home), unit: 10 μs | Config Param |
| 2PTO_Ch1_Filt | | | |
| 2PTO_Ch0_Brake Time | UINT | Brake time: [20, 5000], unit: ms | |
| 2PTO_Ch1_Brake Time | | | |
| 2PTO_Ch0_Scale | UINT | Scale factor, similar to a gear ratio. It defines the conversion relationship from user unit (u) to pulse unit (p).<br>Example: 10000 indicates 1u = 10000p. A speed of 1 u/s indicates 10000 p/s.<br>If 10000p = 1r for the controlled object, it indicates 1 r/s. | |
| 2PTO_Ch1_Scale | | | |
| 2PTO_Ch0_Cfg | USINT | Configuration parameter<br>Bit1–bit0: Pulse output mode | |
| 2PTO_Ch1_Cfg | | | |

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| | | 0: Pulse + direction<br>1: CW/CCW<br>2: Reserved<br>3: Reserved<br>Bit2: Positive limit input signal logic. 0: normally open; 1: normally closed<br>Bit3: Negative limit input signal logic. 0: normally open; 1: normally closed<br>Bit4: Home input signal logic. 0: normally open; 1: normally closed<br>Bit5: Brake input signal logic. 0: normally open; 1: normally closed<br>Bit 6: Safe output mode. Processing method for the original motion when a specified parameter value error occurs. 0: brake; 1: keep the original operation<br>Bit7: Reserved | |
| 2PTO_Ch0_HomingMode<br>2PTO_Ch1_HomingMode | USINT | Homing mode<br>0: mode 19<br>1: mode 21<br>2: mode 24<br>3: mode 28 | |
| 2PTO_Ch0_HomingSpeed<br>2PTO_Ch1_HomingSpeed | DINT | Homing speed [u/s] ≤ 200 kHz | |
| 2PTO_Ch0_HomingApproach Speed<br>2PTO_Ch1_HomingApproach Speed | DINT | Homing approach speed [u/s] < Homing speed | |
| 2PTO_Ch0_Status<br>2PTO_Ch1_Status | USINT | Status feedback<br>Bit0: Homing status. 1: Homing completed<br>Bit1: Speed status. 1: Speed reached<br>Bit2: Position status. 1: Position reached<br>Bit3: Actual output direction. 1: Forward rotation; 0: Reverse rotation<br>Bit5–bit4: Actual output status<br>0: No output<br>1: Accelerating<br>2: Decelerating<br>3: Running at constant speed<br>Bit7–bit6: Current operation mode<br>0: Homing mode<br>1: Speed mode<br>2: Relative position mode<br>3: Absolute position mode<br>Bit8: Positive limit status<br>Bit9: Negative limit status<br>Bit10: Home status | Input (T→O) |

| Parameter | Type | Meaning | Data type |
|---|---|---|---|
| | | Bit11: Brake status<br>Bit15–bit12: Reserved | |
| 2PTO_Ch0_ActVel | DINT | Current speed [u/s] | |
| 2PTO_Ch1_ActVel | | | |
| 2PTO_Ch0_ActPos | DINT | Current position [u] | |
| 2PTO_Ch1_ActPos | | | |
| 2PTO_Ch0_ErrId | UINT | Channel fault code | Diagnosis Data (Input(T → O)) |
| 2PTO_Ch1_ErrId | | | |
| 2PTO_Ch0_MoveMode | USINT | Operation mode<br>0: Homing mode<br>1: Speed mode<br>2: Relative position mode<br>3: Absolute position mode | Output (O→T) |
| 2PTO_Ch1_MoveMode | | | |
| 2PTO_Ch0_TargetVel | DINT | Target speed [u/s]. After scale conversion: ≤ 200 kHz. A negative value indicates the running direction only in speed mode. Negative speed values are not allowed in other modes. | |
| 2PTO_Ch1_TargetVel | | | |
| 2PTO_Ch0_TargetPos | DINT | Target position [u] | |
| 2PTO_Ch1_TargetPos | | | |
| 2PTO_Ch0_AccTime | UINT | Acceleration time, ms | |
| 2PTO_Ch1_AccTime | | | |
| 2PTO_Ch0_DecTime | UINT | Deceleration time, ms | |
| 2PTO_Ch1_DecTime | | | |
| 2PTO_Ch0_MoveCtrl | USINT | Motion control<br>Bit0: Start operation (rising edge active)<br>Bit1: Position reset to zero (rising edge active)<br>Bit2: Software brake (active high; signal logic applies only to external input signals) | |
| 2PTO_Ch1_MoveCtrl | | | |

## 6.1.10 Serial communication module (AS71COM2)

The AS71COM2 serial communication module consists of the local AS71COM2 module and virtual Modbus RTU master, slave, and free-protocol modules. Virtual modules can be bound to local channels through startup parameter configuration. The operating mode of each bound channel must be configured to match that of the corresponding virtual module. The configuration parameters and PDO parameters of these modules are described below.

"M/S/F" in parentheses in the local parameters indicates the following:

M: Modbus RTU master parameter

S: Modbus RTU slave parameter

F: Free-protocol module parameter

### 6.1.10.1 Serial communication module–AS71COM2_2COM

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8040+0x80*n | 2COM SDO Cfg | - | Serial communication module configuration parameter | Config Param |
| | Subindex 0x01 | Com0_Enable (M/S/F) | USINT | 1: Enable Com0 port (default)<br>2: Disable Com0 port | |
| | Subindex 0x02 | Com0_Mode(M/S/F) | USINT | 1: RS232 (default)<br>2: RS485 | |
| | Subindex 0x03 | Com0_Baudrate(M/S/F) | USINT | 0: 1200 bps<br>1: 2400 bps<br>2: 4800 bps<br>3: 9600 bps<br>4: 19200 bps (default)<br>5: 38400 bps<br>6: 57600 bps<br>7: 115200 bps | |
| | Subindex 0x04 | Com0_DataBit (M/S/F) | USINT | 1: 7 bits<br>2: 8 bits (default) | |
| | Subindex 0x05 | Com0_StopBit (M/S/F) | USINT | 1: 1 bit (default)<br>2: 2 bits | |
| | Subindex 0x06 | Com0_Parity (M/S/F) | USINT | 0: No parity<br>1: Odd parity<br>2: Even parity (default) | |
| | Subindex 0x07 | Com0_Type(M/S/F) | USINT | 1: Modbus RTU Master, that is, RTU master mode (default)<br>2: Modbus RTU Slave, that is, RTU slave mode<br>3: Free Mode, that is, serial free-protocol mode | |
| | Subindex 0x08 | Com0_SlaveID(S) | USINT | 1–247 (The default slave ID is 1. In slave mode, each serial port has only one slave ID) | |
| | Subindex 0x09 | Com0_ResponseDelay(S) | UINT | Default: 50 ms; configurable range: 0–65535 ms | |
| | Subindex 0xA | Com0_Frame interval (ms)(M/S/F) | UINT | Default: 3 ms; configurable range: 0–65535 ms | |
| | Subindex 0xB | Com0_ResponseTimedout(ms)(M) | UINT | If the slave does not respond within the set time, the master retransmits the command. Range: 10–65535 ms; default: 1000 ms | |
| | Subindex 0xC | Com0_Polling Delay (ms)(M) | UINT | This parameter is valid only in polling mode. Range: 0–65535 ms; default: 100 ms. | |
| | Subindex 0xD | Com0_ByteSwap(M) | USINT | 0: Disable swap (default) | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | 1: Enable swap | |
| | Subindex 0xE | Com0_WordSwap(M) | USINT | 0: Disable swap (default)<br>1: Enable swap | |
| | Subindex 0xF | Com0_ReissuedNum (M) | USINT | If the slave does not respond within the set time, the master retransmits the command. Range: 0–255; default: 3 times | |
| | Subindex 0x10 | Com0_ Errorhanding (M) | USINT | 0: Hold the last output value<br>1: Clear output to zero (default) | |
| | Subindex 0x11 | Com0_OutputMode(M) | USINT | 0: Disable the data-change event triggering function (default)<br>1: Enable the data-change event triggering function: A write command is sent only when Modbus output data changes.<br>This parameter is valid only in polling mode. | |
| | Subindex 0x12 | Com1_Enable (M/S/F) | USINT | 1: Enable Com1 port (default)<br>2: Disable Com1 port | |
| | Subindex 0x13 | Com1_Mode(M/S/F) | USINT | 1: RS232<br>2: RS485 (default) | |
| | Subindex 0x14 | Com1_Baudrate(M/S/F) | USINT | 0: 1200 bps<br>1: 2400 bps<br>2: 4800 bps<br>3: 9600 bps<br>4: 19200 bps (default)<br>5: 38400 bps<br>6: 57600 bps<br>7: 115200 bps | |
| | Subindex 0x15 | Com1_DataBit(M/S/F) | USINT | 1: 7 bits<br>2: 8 bits (default) | |
| | Subindex 0x16 | Com1_StopBit(M/S/F) | USINT | 1: 1 bit (default)<br>2: 2 bits | |
| | Subindex 0x17 | Com1_Parity(M/S/F) | USINT | 0: No parity<br>1: Odd parity<br>2: Even parity (default) | |
| | Subindex 0x18 | Com1_Type(M/S/F) | USINT | 1: Modbus RTU Master, that is, RTU master mode (default)<br>2: Modbus RTU Slave, that is, RTU slave mode | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | 3: Free Mode, that is, serial free-protocol mode | |
| | Subindex 0x19 | Com1_SlaveID(S) | USINT | 1–247 (The default slave ID is 1. In slave mode, each serial port has only one slave ID) | |
| | Subindex 0x1A | Com1_ResponseDelay(S) | UINT | Default: 50 ms; configurable range: 0–65535 ms | |
| | Subindex 0x1B | Com1_Frame interval (ms)(M/S/F) | UINT | Default: 3 ms; configurable range: 0–65535 ms | |
| | Subindex 0x1C | Com1_ResponseTimedout(ms)(M) | UINT | If the slave does not respond within the set time, the master retransmits the command. Range: 10–65535 ms; default: 1000 ms | |
| | Subindex 0x1D | Com1_Polling Delay (ms)(M) | UINT | This parameter is valid only in polling mode. Range: 0–65535 ms; default: 100 ms. | |
| | Subindex 0x1E | Com1_ByteSwap(M) | USINT | 0: Disable swap (default)<br>1: Enable swap | |
| | Subindex 0x1F | Com1_ WordSwap(M) | USINT | 0: Disable swap (default)<br>1: Enable swap | |
| | Subindex 0x20 | Com1_ReissuedNum(M) | USINT | If the slave does not respond within the set time, the master retransmits the command. Range: 0–255; default: 3 times | |
| | Subindex 0x21 | Com1_ Errorhanding (M) | USINT | 0: Hold the last output value<br>1: Clear output to zero (default) | |
| | Subindex 0x22 | Com1_OutputMode(M) | USINT | 0: Disable the data-change event triggering function (default)<br>1: Enable the data-change event triggering function: A write command is sent only when Modbus output data changes.<br>This parameter is valid only in polling mode. | |
| Control parameter RxPDO | 0x7040+0x80*n | 2COM Out-Map | - | Serial communication module control parameter | - |
| | Subindex 0x01 | Triger0 | BIT | Trigger control bit: Valid when Triger0-Riseedge or | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | Triger0-levelcontinue is configured for the master module. | |
| | ..... | ..... | ..... | Triger1–Triger30 | |
| | Subindex 0x20 | Triger31 | BIT | Trigger control bit: Valid when Triger31-Riseedge or Triger31-levelcontinue is configured for the master module. | |
| Feedback parameter TxPDO | 0x6040+0x80*n | 2COM In-Map | - | Serial communication module status feedback parameter | - |
| | Subindex 0x01 | ModuleErrID | UINT | Module error code. See 8.1 Common faults and solutions. | |
| | Subindex 0x02 | Slaver0_errno | USINT | Communication fault code of channel 0 slave. See 8.2 Serial communication module exception code description | |
| | Subindex 0x03 | Slaver1_errno | USINT | Communication fault code of channel 1 slave. See 8.2 Serial communication module exception code description | |
| 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, and n∈[0,31]. | | | | | |

### 6.1.10.2 Serial communication module – Modbus RTU master virtual module

The Modbus RTU master virtual modules are as follows:

| No. | Name | Function | Supported function code |
|---|---|---|---|
| 1 | M: rw 4 Words | Master virtual module, can access 4 Words of input/output data | 01/02/03/04/05/06/15/16 |
| 2 | M: rw 8 Words | Master virtual module, can access 8 Words of input/output data | 01/02/03/04/05/06/15/16 |
| 3 | M: rw 16 Words | Master virtual module, can access 16 Words of input/output data | 01/02/03/04/05/06/15/16 |
| 4 | M: rw 32 Words | Master virtual module, can access 32 Words of input/output data | 01/02/03/04/05/06/15/16 |
| 5 | M: rw 64 Words | Master virtual module, can access 64 Words of input/output data | 01/02/03/04/05/06/15/16 |

| No. | Name | Function | Supported function code |
|---|---|---|---|
| 6 | M: rw 128 Words | Master virtual module, can access 128 Words of input/output data | 01/02/03/04/05/06/15/16 |

M: rw 4 Words: 0x8041+0x80*n

M: rw 8 Words: 0x8042+0x80*n

M: rw 16 Words: 0x8043+0x80*n

M: rw 32 Words: 0x8044+0x80*n

M: rw 64 Words: 0x8045+0x80*n

M: rw 128 Words: 0x8046+0x80*n

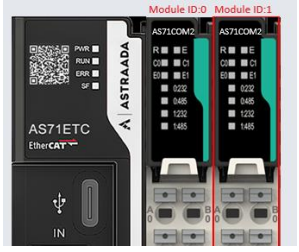
The six master virtual modules have the same parameters, but support different accessible address lengths. Select a module with an appropriate length according to the actual application.

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8041+0x80*n | Config | - | Virtual module configuration parameter | Config Param |
| | Subindex 0x01 | ModuleID | USINT | See the description after the table.<br>The ID of the serial communication module closest to the coupler in the configuration is 0, and the ID of the second serial communication module is 1. The IDs are counted sequentially in this order.<br>Default: 0 | |
| | Subindex 0x02 | PortID | USINT | 0: Serial port 0 (default)<br>1: Serial port 1 | |
| | Subindex 0x03 | ControlMode | USINT | See the description after the table.<br>0: PollingMode, polling mode<br>1: Triger0-Riseedge<br>Triger0 rising-edge trigger control<br>2: Triger1-Riseedge<br>Triger1 rising-edge trigger control<br>.....<br>32: Triger31-Riseedge<br>Triger31 rising-edge trigger control<br>33: Triger0-levelcontinue<br>Triger0 high-level continuous active control<br>34: Triger1-levelcontinue<br>Triger1 high-level continuous active control | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | ……<br>64: Triger31- levelcontinue<br>Triger31 high-level continuous active control | |
| Control parameter RxPDO | 0x7041+0x80*n | Output-Map | - | Master virtual module control parameter | - |
| | Subindex 0x01 | SlaveID | USINT | Slave ID: ID of the slave to be read, 1–247 | |
| | Subindex 0x02 | Cmd | USINT | Function code:<br>01/02/03/04/05/06/15/16 | |
| | Subindex 0x03 | Address | UINT | Register address | |
| | Subindex 0x04 | Len | UINT | Length (The unit is Word or Bit, depending on the function code) | |
| | Subindex 0x05 | OutputData1 | UINT | Corresponds to Address | |
| | Subindex 0x06 | OutputData2 | UINT | Corresponds to Address+1 | |
| | Subindex 0x07 | OutputData3 | UINT | Corresponds to Address+2 | |
| | Subindex 0x08 | OutputData4 | UINT | Corresponds to Address+3 | |
| Feedback parameter TxPDO | 0x6041+0x80*n | In-Map | - | Master virtual module status feedback parameter | - |
| | Subindex 0x01 | StateWord | UINT | =0: Idle; trigger bit is 0<br>=1: Executing; trigger bit level is 1, and sending has started<br>=2: Execution complete; sent and response received. | |
| | Subindex 0x02 | CmdErrno | UINT | See 8.2 Serial communication module exception code description | |
| | Subindex 0x03 | InputData1 | UINT | Corresponds to Address | |
| | Subindex 0x04 | InputData2 | UINT | Corresponds to Address+1 | |
| | Subindex 0x05 | InputData3 | UINT | Corresponds to Address+2 | |
| | Subindex 0x06 | InputData4 | UINT | Corresponds to Address+3 | |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

**ModuleID parameter description:**

This parameter indicates which serial communication module is bound. In the configuration, there may be multiple serial communication modules. The serial communication module closest to the coupler is numbered 0, and the following modules are numbered sequentially by adding 1. For example, if there are two serial communication modules in one configuration, as shown below:




If the virtual module needs to be bound to the first module, set ModuleID to 0. If it needs to be bound to the second module, set ModuleID to 1.

**ControlMode parameter description:**

The master module can be configured in modes such as polling, rising-edge trigger, and level trigger. The trigger bit for trigger mode is associated with the PDO control parameters Triger0–Triger31 of the local serial communication module AS71COM2. Selecting Triger0-Riseedge associates the rising-edge trigger of Triger0, while selecting Triger31-Riseedge associates the rising-edge trigger of Triger31. Different master modules can select the same trigger bit or different trigger bits. Level triggering is the same as rising-edge triggering.

### 6.1.10.3 Serial communication module–Modbus RTU slave virtual module

When a channel needs to be configured in slave mode, define the following resource lengths according to the Modbus protocol:

| Resource | Object type | Access type | Function code |
|---|---|---|---|
| Discrete Inputs | Bit operation | Read only | 02 |
| Coils | Bit operation | Read/Write | 01/05/15 |
| Input Register | Word operation | Read only | 04 |
| Holding Register | Word operation | Read/Write | 03/06/16 |

Start address convention: For virtual modules of the same type under the same channel, the virtual module closest to the coupler in the configuration starts from address 0, and the addresses increase sequentially for subsequent modules.

#### 6.1.10.3.1 Discrete input module

| No. | Name | Function | Supported function code |
|---|---|---|---|
| 1 | S: 16 Discrete Inputs | Defines 16-bit discrete inputs | 02 |
| 2 | S: 64 Discrete Inputs | Defines 64-bit discrete inputs | 02 |
| 3 | S: 256 Discrete Inputs | Defines 256-bit discrete inputs | 02 |
| 4 | S: 1024 Discrete Inputs | Defines 1024-bit discrete inputs | 02 |

The four virtual modules have the same parameters, but support different accessible address lengths. Select a module with an appropriate length according to the actual application.

S: 16 Discrete Inputs: 0x804B+0x80*n

S: 64 Discrete Inputs: 0x804C+0x80*n

S: 256 Discrete Inputs: 0x804D+0x80*n

S: 1024 Discrete Inputs: 0x804E+0x80*n

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x804B+0x80*n | Config | - | Virtual discrete input module configuration parameter | Config Param |
| | Subindex 0x01 | ModuleID | USINT | The ID of the serial communication module closest to the coupler in the configuration is 0, and the ID of the second serial communication module is 1. The IDs are counted sequentially in this order. | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | Default: 0 | |
| | Subindex 0x02 | PortID | USINT | 0: Serial port 0 (default)<br>1: Serial port 1 | |
| Control parameter RxPDO | 0x704B+0x80*n | Output-Map | - | Discrete input virtual module control parameter | - |
| | Subindex 0x01 | DO0 | BIT | Input 0 | |
| | Subindex 0x02 | DO1 | BIT | Input 1 | |
| | Subindex 0x03 | DO2 | BIT | Input 2 | |
| | Subindex... | DO... | BIT | Input... | |
| | Subindex 0x11 | DO15 | BIT | Input 15 | |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

### 6.1.10.3.2 Coil module

| No. | Name | Function | Supported function code |
|---|---|---|---|
| 1 | S: 16 Coils | Defines 16-bit coils | 01/05/15 |
| 2 | S: 64 Coils | Defines 64-bit coils | 01/05/15 |
| 3 | S: 256 Coils | Defines 256-bit coils | 01/05/15 |
| 4 | S: 1024 Coils | Defines 1024-bit coils | 01/05/15 |

The four virtual modules have the same parameters, but support different accessible address lengths. Select a module with an appropriate length according to the actual application.

S: 16 Coils: 0x804F+0x80*n

S: 64 Coils: 0x8050+0x80*n

S: 256 Coils: 0x8051+0x80*n

S: 1024 Coils: 0x8052+0x80*n

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x804F+0x80*n | Config | - | Virtual coil output module configuration parameter | Config Param |
| | Subindex 0x01 | ModuleID | USINT | The ID of the serial communication module closest to the coupler in the configuration is 0, and the ID of the second serial communication module is 1. The IDs are counted sequentially in this order.<br>Default: 0 | |
| | Subindex 0x02 | PortID | USINT | 0: Serial port 0 (default)<br>1: Serial port 1 | |
| Feedback parameter TxPDO | 0x604B+0x80*n | Input-Map | - | Virtual coil output module control parameter | - |
| | Subindex 0x01 | DI0 | BIT | Output 0 | |
| | Subindex 0x02 | DI1 | BIT | Output 1 | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | Subindex 0x03 | DI2 | BIT | Output 2 | |
| | Subindex... | DI... | BIT | Output... | |
| | Subindex 0x11 | DI15 | BIT | Output 15 | |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

### 6.1.10.3.3 Input register module

| No. | Name | Function | Supported function code |
|---|---|---|---|
| 1 | S: 4 Input Register | Defines 4 input registers | 04 |
| 2 | S: 8 Input Register | Defines 8 input registers | 04 |
| 3 | S: 16 Input Register | Defines 16 input registers | 04 |
| 4 | S: 32 Input Register | Defines 32 input registers | 04 |
| 5 | S: 64 Input Register | Defines 64 input registers | 04 |

The five virtual modules have the same parameters, but support different accessible address lengths. Select a module with an appropriate length according to the actual application.

S: 4 Input Register: 0x8053+0x80*n

S: 8 Input Register: 0x8054+0x80*n

S: 16 Input Register: 0x8055+0x80*n

S: 32 Input Register: 0x8056+0x80*n

S: 64 Input Register: 0x8057+0x80*n

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8053+0x80*n | Config | - | Input register virtual module configuration parameter | Config Param |
| | Subindex 0x01 | ModuleID | USINT | The ID of the serial communication module closest to the coupler in the configuration is 0, and the ID of the second serial communication module is 1. The IDs are counted sequentially in this order.<br>Default: 0 | |
| | Subindex 0x02 | PortID | USINT | 0: Serial port 0 (default)<br>1: Serial port 1 | |
| Control parameter RxPDO | 0x7053+0x80*n | Output-Map | - | Input register virtual module control parameter | - |
| | Subindex 0x01 | OutputData1 | UINT | Register 1 | |
| | Subindex 0x02 | OutputData2 | UINT | Register 2 | |
| | Subindex 0x03 | OutputData3 | UINT | Register 3 | |
| | Subindex 0x04 | OutputData4 | UINT | Register 4 | |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

### 6.1.10.3.4 Holding register module

| No. | Name | Function | Supported function code |
|---|---|---|---|
| 1 | S: 4 Holding Register | Defines 4 holding registers | 03/06/16 |
| 2 | S: 8 Holding Register | Defines 8 holding registers | 03/06/16 |
| 3 | S: 16 Holding Register | Defines 16 holding registers | 03/06/16 |
| 4 | S: 32 Holding Register | Defines 32 holding registers | 03/06/16 |
| 5 | S: 64 Holding Register | Defines 64 holding registers | 03/06/16 |

The five virtual modules have the same parameters, but support different accessible address lengths. Select a module with an appropriate length according to the actual application.

S: 4 Holding Register: 0x8058+0x80*n

S: 8 Holding Register: 0x8059+0x80*n

S: 16 Holding Register: 0x805A+0x80*n

S: 32 Holding Register: 0x805B+0x80*n

S: 64 Holding Register: 0x805C+0x80*n

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8058+0x80*n | Config | - | Holding register virtual module configuration parameter | Config Param |
| | Subindex 0x01 | ModuleID | USINT | The ID of the serial communication module closest to the coupler in the configuration is 0, and the ID of the second serial communication module is 1. The IDs are counted sequentially in this order.<br>Default: 0 | |
| | Subindex 0x02 | PortID | USINT | 0: Serial port 0 (default)<br>1: Serial port 1 | |
| Feedback parameter TxPDO | 0x6058+0x80*n | Input-Map | - | Output register virtual module control parameter | - |
| | Subindex 0x01 | InputData1 | UINT | Register 1 | |
| | Subindex 0x02 | InputData2 | UINT | Register 2 | |
| | Subindex 0x03 | InputData3 | UINT | Register 3 | |
| | Subindex 0x04 | InputData4 | UINT | Register 4 | |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

### 6.1.10.4 Serial communication module–Free-protocol virtual module

### 6.1.10.4.1 Free-protocol transmit module

| No. | Name | Function |
|---|---|---|
| 1 | F: Send 16 Bytes | Module that can send up to 16 bytes |
| 2 | F: Send 32 Bytes | Module that can send up to 32 bytes |

| No. | Name | Function |
|---|---|---|
| 3 | F: Send 64 Bytes | Module that can send up to 64 bytes |
| 4 | F: Send 128 Bytes | Module that can send up to 128 bytes |
| 5 | F: Send 256 Bytes | Module that can send up to 256 bytes |
| 6 | F: Send 512 Bytes | Module that can send up to 512 bytes |

The six virtual modules have the same parameters, but support different accessible address lengths. Select a module with an appropriate length according to the actual application.

F: Send 16 Bytes: 0x8060+0x80*n

F: Send 32 Bytes: 0x8061+0x80*n

F: Send 64 Bytes: 0x8062+0x80*n

F: Send 128 Bytes: 0x8063+0x80*n

F: Send 256 Bytes: 0x8064+0x80*n

F: Send 512 Bytes: 0x8065+0x80*n

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8060+0x80*n | Config | - | Free-protocol transmit virtual module configuration parameter | Config Param |
| | Subindex 0x01 | ModuleID | USINT | The ID of the serial communication module closest to the coupler in the configuration is 0, and the ID of the second serial communication module is 1. The IDs are counted sequentially in this order. Default: 0 | |
| | Subindex 0x02 | PortID | USINT | 0: Serial port 0 (default)<br>1: Serial port 1 | |
| Control parameter RxPDO | 0x7060+0x80*n | Output-Map | - | Free-protocol transmit virtual module control parameter | - |
| | Subindex 0x01 | ControlWord | UINT | Control word<br>0: Clear error / return to ready-to-send state<br>1: Normal transmission | |
| | Subindex 0x02 | Sendlen | UINT | Transmission length | |
| | Subindex 0x03 | OutputData | ARRAY[0..15] | Data | |
| Feedback parameter TxPDO | 0x6060+0x80*n | Input-Map | - | Free-protocol transmit virtual module feedback parameter | - |
| | Subindex 0x01 | SendState | UINT | Transmission status:<br>0: Idle<br>1: Transmitting<br>2: Transmission successful<br>3: Transmission failed<br>4: Transmission timeout<br>5: Parameter setting error (send length exceeds | |

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| | | | | module capacity or is 0)<br>11: Serial port busy | |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

### 6.1.10.4.2 Free-protocol receive module

| No. | Name | Function |
|---|---|---|
| 1 | F: Receive 16 Bytes | Module that can receive up to 16 bytes |
| 2 | F: Receive 32 Bytes | Module that can receive up to 32 bytes |
| 3 | F: Receive 64 Bytes | Module that can receive up to 64 bytes |
| 4 | F: Receive 128 Bytes | Module that can receive up to 128 bytes |
| 5 | F: Receive 256 Bytes | Module that can receive up to 256 bytes |
| 6 | F: Receive 512 Bytes | Module that can receive up to 512 bytes |

The six virtual modules share the same parameters, but support different accessible address lengths. Select an appropriate module according to the actual application requirements.

F: Receive 16 Bytes: 0x8066+0x80*n

F: Receive 32 Bytes: 0x8067+0x80*n

F: Receive 64 Bytes: 0x8068+0x80*n

F: Receive 128 Bytes: 0x8069+0x80*n

F: Receive 256 Bytes: 0x806A+0x80*n

F: Receive 512 Bytes: 0x806B+0x80*n

| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Configuration parameter SDO | 0x8066+0x80*n | Config | - | Free-protocol receive virtual module configuration parameter | Config Param |
| | Subindex 0x01 | ModuleID | USINT | The ID of the serial communication module closest to the coupler in the configuration is 0, and the ID of the second serial communication module is 1. The IDs are counted sequentially in this order. Default: 0 | |
| | Subindex 0x02 | PortID | USINT | 0: Serial port 0 (default)<br>1: Serial port 1 | |
| Control parameter RxPDO | 0x7066+0x80*n | Output-Map | - | Free-protocol receive virtual module control parameter | - |
| | Subindex 0x01 | ControlWord | UINT | Control word<br>0: Clear error / return to ready-to-receive state<br>1: Receive | |
| | Subindex 0x02 | Reserve | UINT | Reserved | |

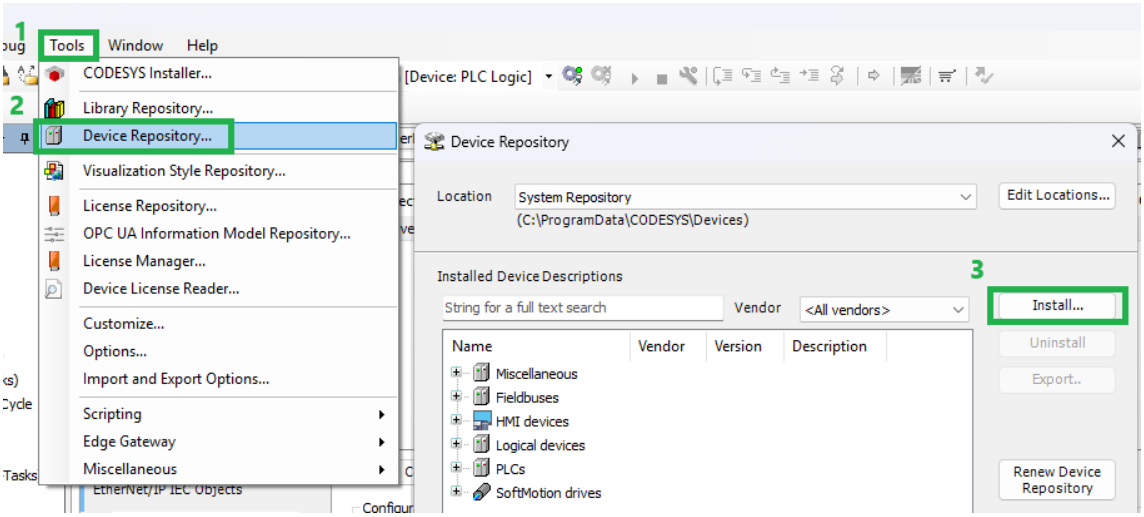
| Name | Index--Subindex | Parameter | Type | Meaning | Data type |
|---|---|---|---|---|---|
| Feedback parameter TxPDO | 0x6066+0x80*n | Input-Map | - | Free-protocol receive virtual module feedback parameter | - |
| | Subindex 0x01 | ReceiveState | UINT | Receive status:<br>0: Idle<br>1: Receiving<br>2: Receive successful<br>3: Receive failed<br>4: Receive timeout<br>10: Received length exceeds module capacity<br>11: Serial port busy | |
| | Subindex 0x02 | ActRecLen | UINT | Actual received data length | |
| | Subindex 0x03 | InputData | ARRAY[0..15] | Data | |
| **Note:** n represents the slot where the expansion module is located, and n∈[0,31]. | | | | | |

# 6.2 EtherCAT configuration

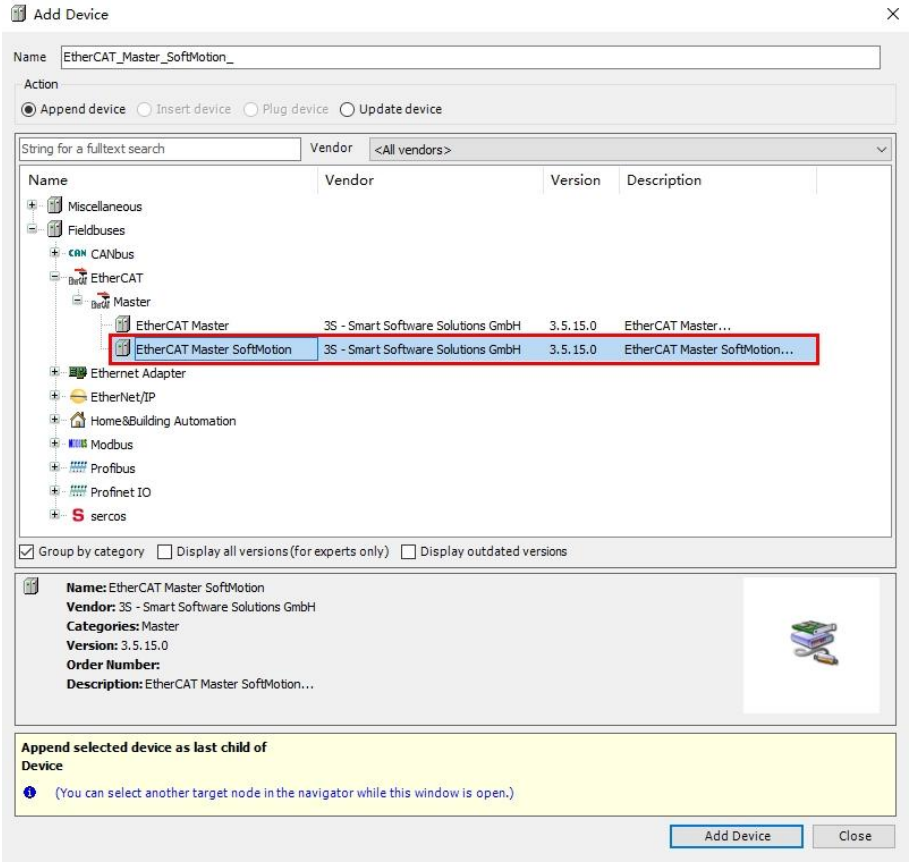
## 6.2.1 CODESYS configuration

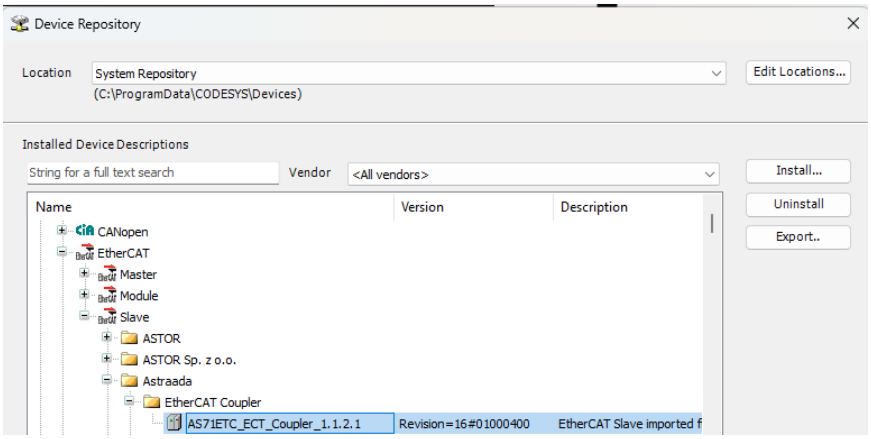
### 6.2.1.1 EtherCAT communication coupler

Step 1 Click **Install**, and select the device description file. The file name is typically "AS71ETC_ECT_Coupler_x.x.x.x.xml", then click **Open**.

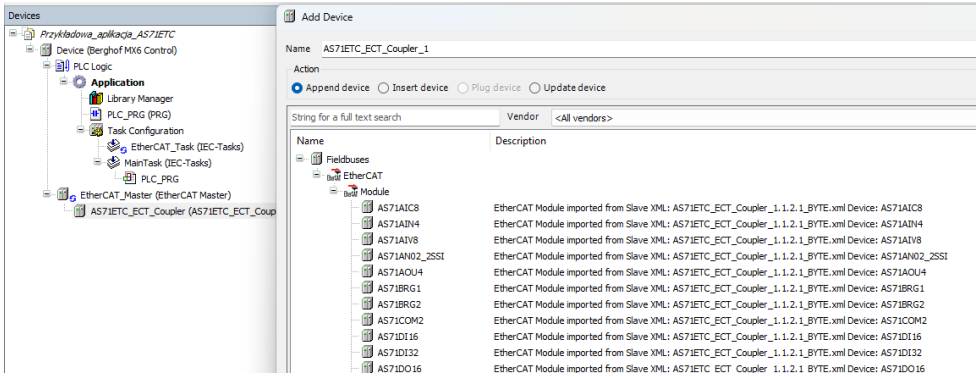


Step 2 Click **Add Device** to add the master and slave devices respectively.




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



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

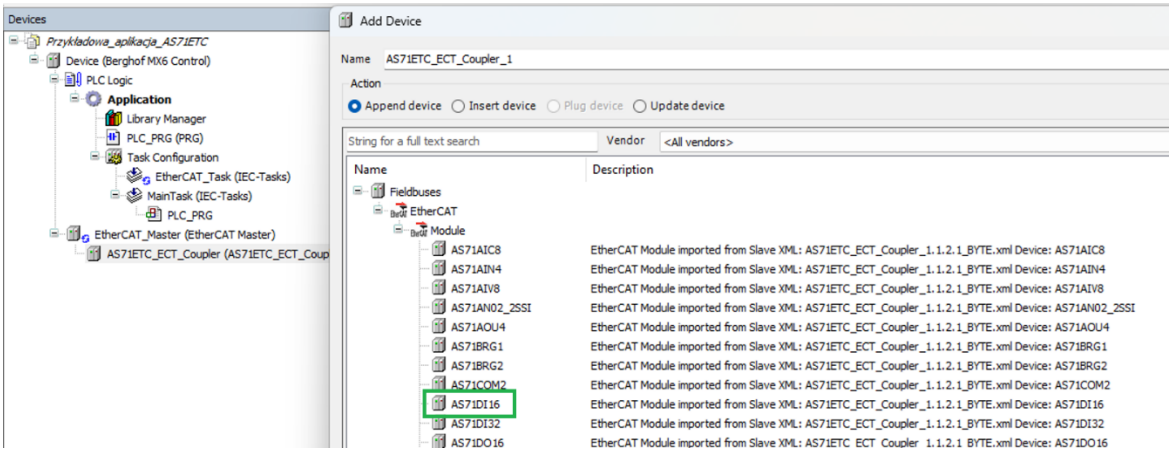
Step 5 (Optional) Enable or disable the module based on actual needs.

For detailed parameter descriptions, refer to section 6.1 Parameter description.

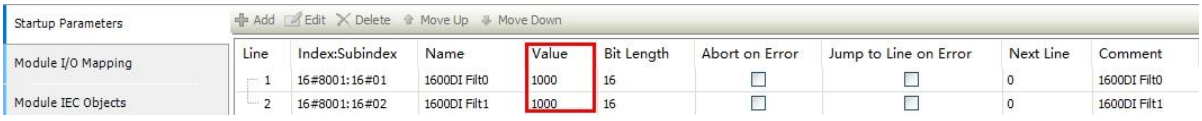
### 6.2.1.2 Module configuration

#### 6.2.1.2.1 Digital input module

Step 1 Click **Add Device** and add the AS71DI16 module.




Step 2 Set the filter parameter value. The digital input module is divided into groups of 8 points, and different filter parameters can be configured per group. In the startup parameters, adjust the port filter mode according to actual requirements. The unit is 10 μs, and the default value is 10 ms.

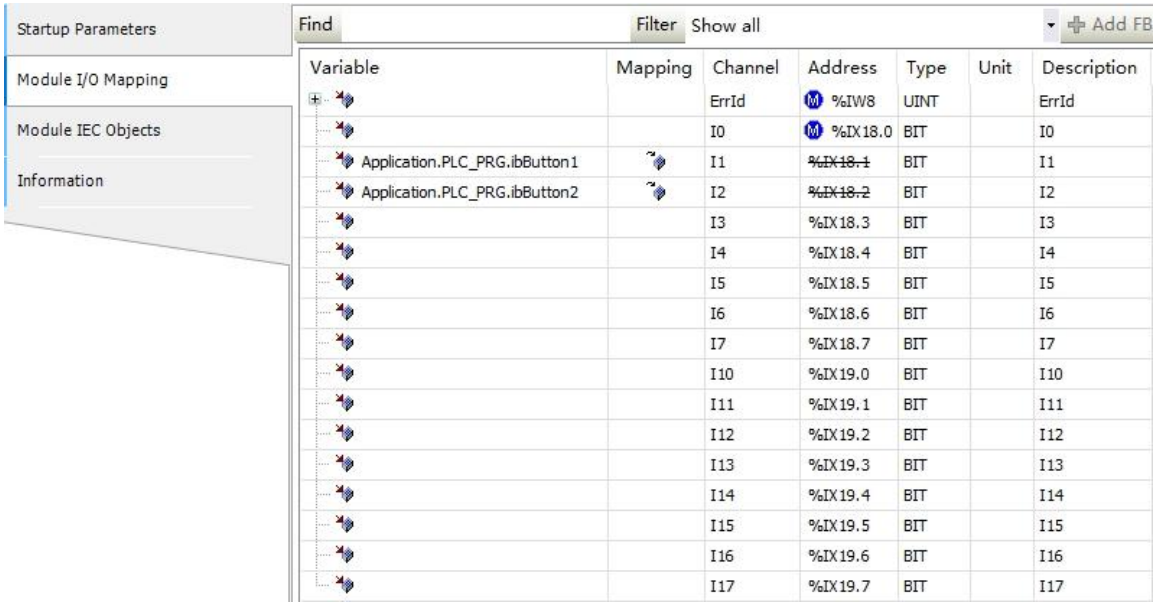



Step 3 Define BOOL variables **ibButton1** and **ibButton2** in the program.

```
VAR
ibButton1      : BOOL;
ibButton2      : BOOL;

END_VAR
```

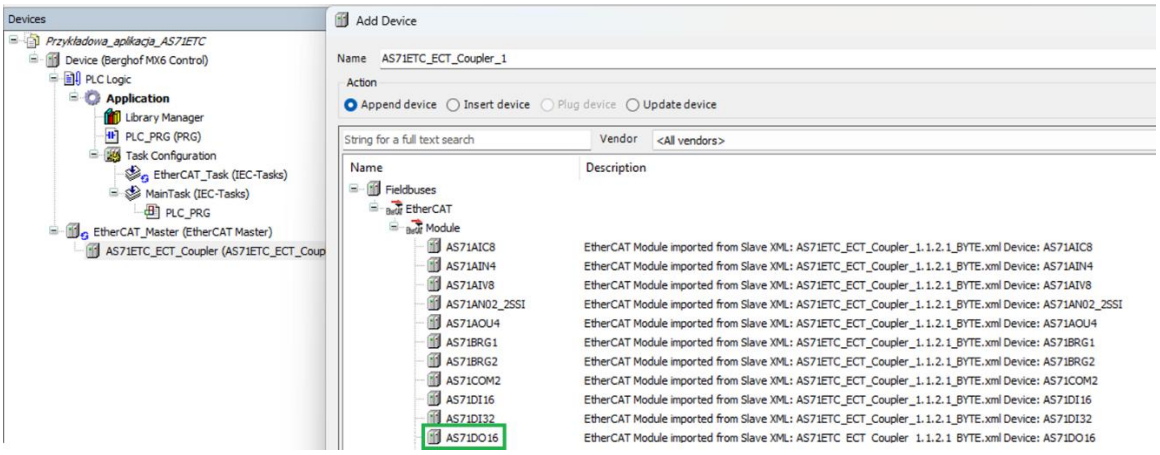
Step 4 Map variables **ibButton1** and **ibButton2** to the corresponding input points in **Module I/O Mapping**. The mapped variables can then be used directly in the program.



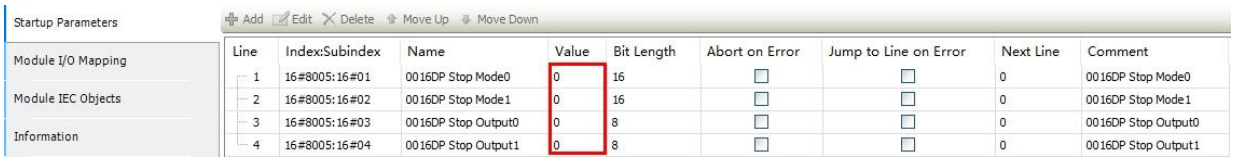

**Note:** For detailed parameter descriptions, refer to section 6.1 Parameter description.

### 6.2.1.2.2 Digital output module

Step 1 Click **Add Device** and add the AS71DO16 module.




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




The digital output module divides every eight channels into a group. Taking configuration of Stop Mode0 as an example, the corresponding output channels are Q0–Q7. Stop Mode0 uses a UINT data type, and every 2 bits define one output stop mode. The data definition is shown in the parameter table below.

| Q7 | | Q6 | | Q5 | | Q4 | | Q3 | | Q2 | | Q1 | | Q0 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit15 | Bit14 | Bit13 | Bit12 | Bit11 | Bit10 | Bit9 | Bit8 | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |

Modes corresponding to the two-bit values of each output channel are as follows:

| Value | Mode |
|---|---|
| 2#00 | Stop/offline output retained |
| 2#01 | Stop/offline output cleared |
| 2#10 | Stop/offline output preset |

Example: If Q0 is set to Stop/offline output retained, Q1 is set to Stop/offline output cleared, and Q2–Q7 are all set to Stop/offline output preset, the value of Stop Mode0 is 43684, that is 2#1010101010100100.

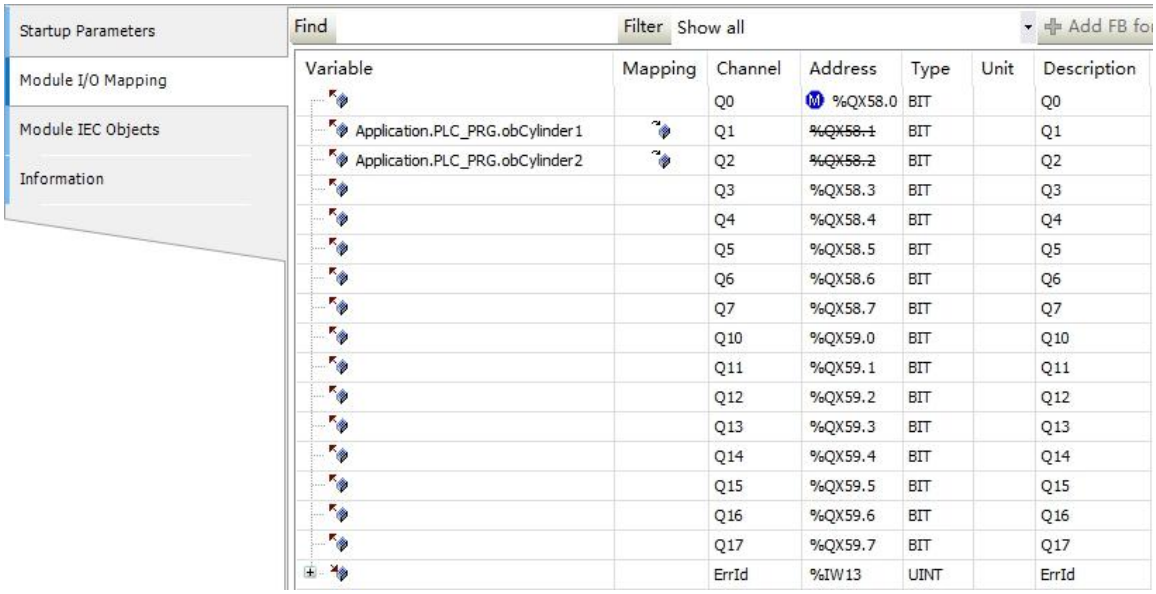
| Q7 | | Q6 | | Q5 | | Q4 | | Q3 | | Q2 | | Q1 | | Q0 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |

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

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

END_VAR
```

Step 4 Map variables **obCylinder1** and **obCylinder2** to the corresponding output points in **Module I/O Mapping**. The mapped variables can then be used directly in the program.

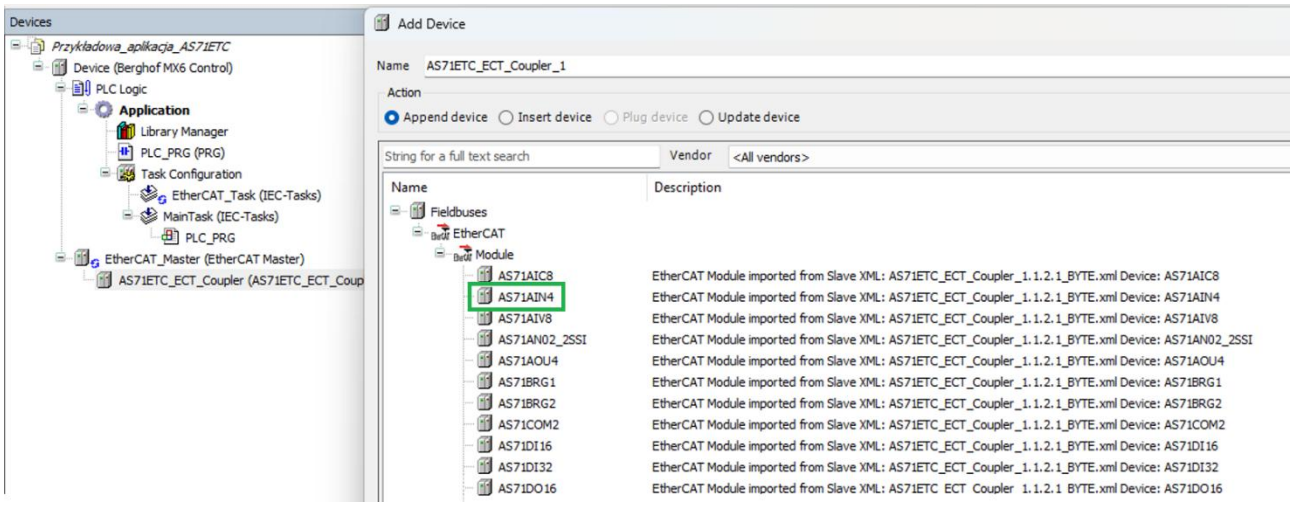



| Variable | Mapping | Channel | Address | Type | Unit | Description |
|---|---|---|---|---|---|---|
| | | Q0 | %QX58.0 | BIT | | Q0 |
| Application.PLC_PRG.obCylinder1 | | Q1 | ~~%QX58.1~~ | BIT | | Q1 |
| Application.PLC_PRG.obCylinder2 | | Q2 | ~~%QX58.2~~ | BIT | | Q2 |
| | | Q3 | %QX58.3 | BIT | | 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 |

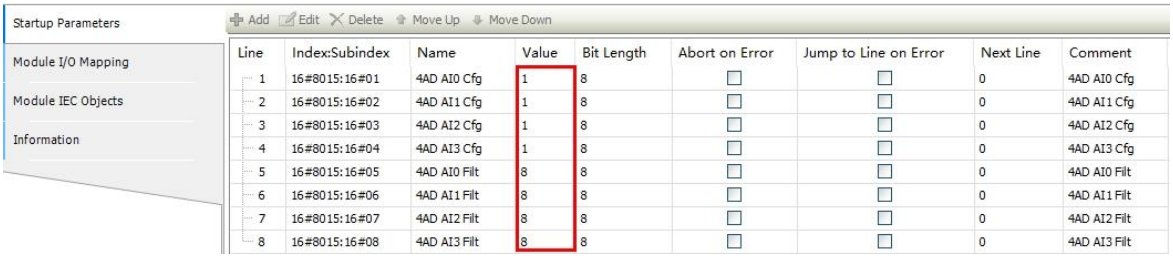
**Note:** For detailed parameter descriptions, refer to section 6.1 Parameter description.

### 6.2.1.2.3 Analog input module

Step 1 Click **Add Device** and add the AS71AIN4 module.




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




AIx_Cfg (x = 0, 1, 2, 3) is the channel configuration parameter, with data type USINT. Taking Channel 0 as an example, the data definition is as follows:

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|
| Channel conversion mode (range configuration) | | | Enhanced filter enable | Over-range enable | Over-range detection enable | Open-circuit detection enable | Channel enable |
| 2#000: 0–5 V<br>2#001: 0–10 V<br>2#010:-5 V–5 V<br>2#011:-10 V–+10 V | | 2#100: 4–20 mA<br>2#101: 0–20 mA<br>2#110: reserved<br>2#111: -20–+20 mA | 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 |

Example: If Channel 0 is configured as channel enabled, open-circuit detection disabled, over-range detection enabled, over-range enabled, enhanced filter disabled, and range set to 4–20 mA, the resulting value is 141, that is, 0b10001101.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|
| 2#100 | | | 0 | 1 | 1 | 0 | 1 |
| 2#100: 4–20 mA | | | 0: Disable | 1: Enable | 1: Enable | 0: Disable | 1: Enable |

For range conversion, refer to section 6.1.4 Analog input module.

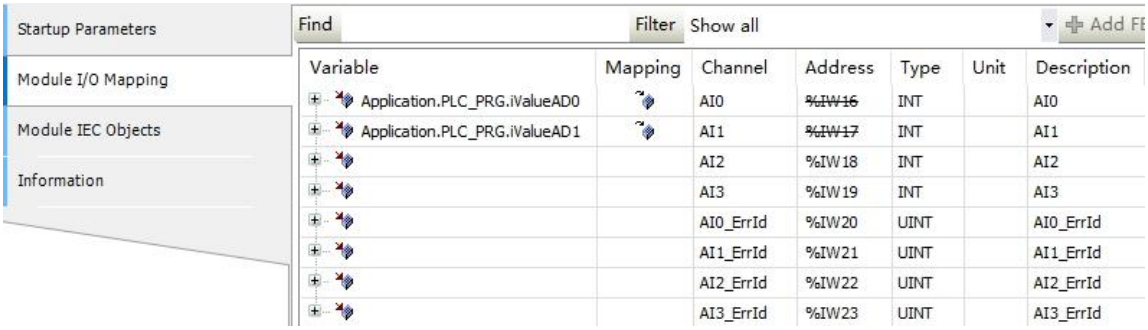
AIx_Filt (x = 0, 1, 2, 3) is the channel filter parameter, with data type USINT. The adjustable range is 1–255. A larger value generally provides better suppression of high-frequency interference, but results in greater delay. Adjustment should be made according to actual application conditions.

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

```
VAR
iValueAD0      : INT;
iValueAD1      : INT;

END_VAR
```

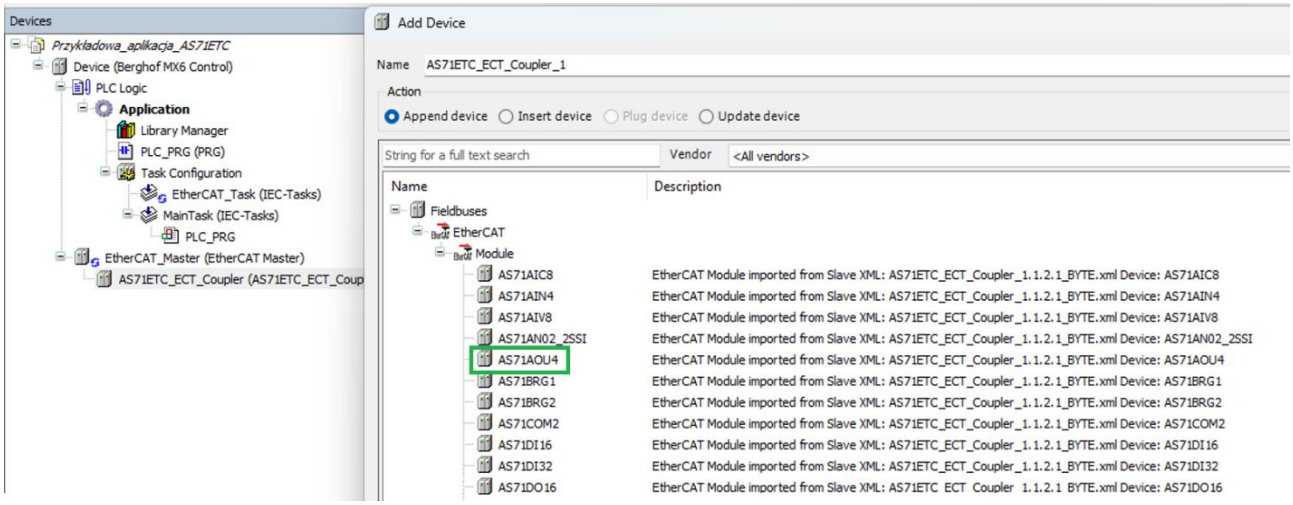
Step 4 Map variables **iValueAD0** and **iValueAD1** to the corresponding input channels in **Module I/O Mapping**. The mapped variables can then be used directly in the program.



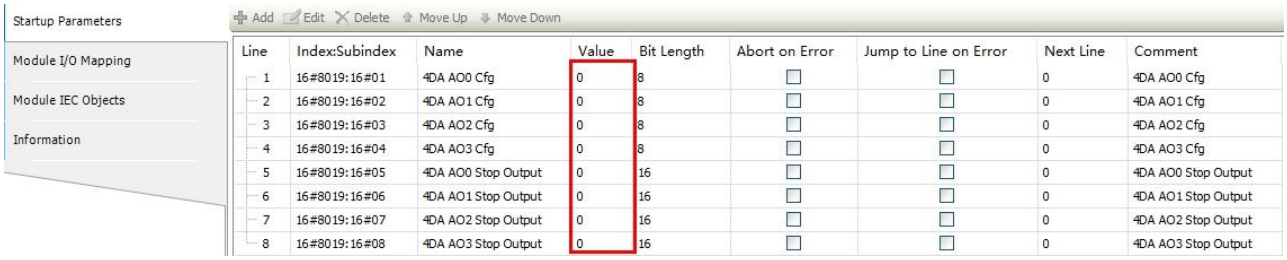

**Note:** For detailed parameter descriptions, refer to section 6.1 Parameter description.

### 6.2.1.2.4 Analog output module

Step 1 Click **Add Device** and add the AS71AOU4 module.




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




AOx_Cfg (x = 0, 1, 2, 3) is the channel configuration parameter, with data type USINT. Taking Channel 0 as an example, the data definition is as follows:

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|
| Channel conversion mode | | | Reserved | Output when offline | | Output fault detection enable control | Channel enable control |
| 2#000: 0–5 V<br>2#001: 0–10 V<br>2#010: -5–5 V<br>2#011: -10–+10 V | 2#100: 4–20 mA<br>2#101: 0–20 mA<br>2#110: reserved<br>2#111: reserved | | - | 2#00: Hold output when offline<br>2#01: Clear output when offline<br>2#10: Preset output when offline | | 0: Disable<br>1: Enable | 0: Disable<br>1: Enable |

Example: If Channel 0 is configured as channel enabled, output fault detection enabled, offline output cleared, and channel conversion mode set to 4–20 mA, the value should be 135, that is, 0b10000111.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|
| 2#100 | | | 0 | 2#01 | | 1 | 1 |
| 2#100: 4–20 mA | | | - | 2#01: Clear output when offline | | 1: Enable | 1: Enable |

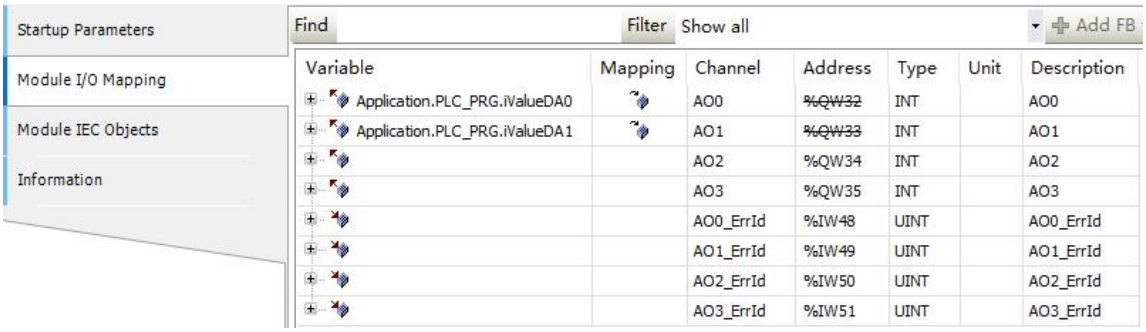
AIx_Stop Output (x = 0, 1, 2, 3) is used to control the stop/offline output mode. The configuration method is similar to that described in section 6.2.1.2.1 Digital input module.

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

```
VAR
iValueDA0      : INT;
iValueDA1      : INT;

END_VAR
```

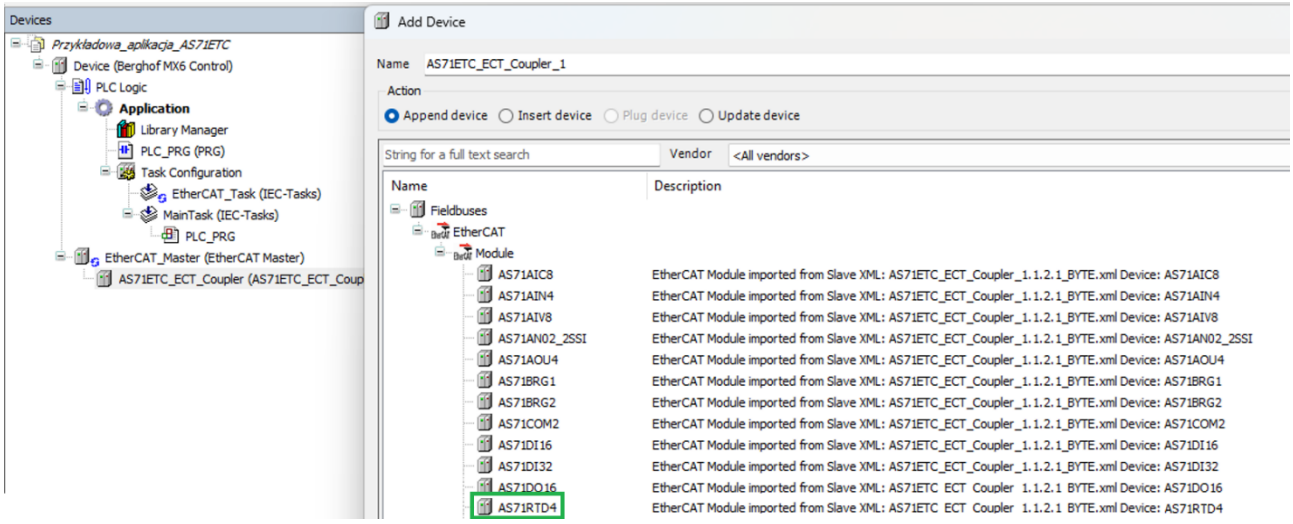
Step 4 Map variables **iValueDA0** and **iValueDA1** to the corresponding output channels in **Module I/O Mapping**. The mapped variables can then be used directly in the program.



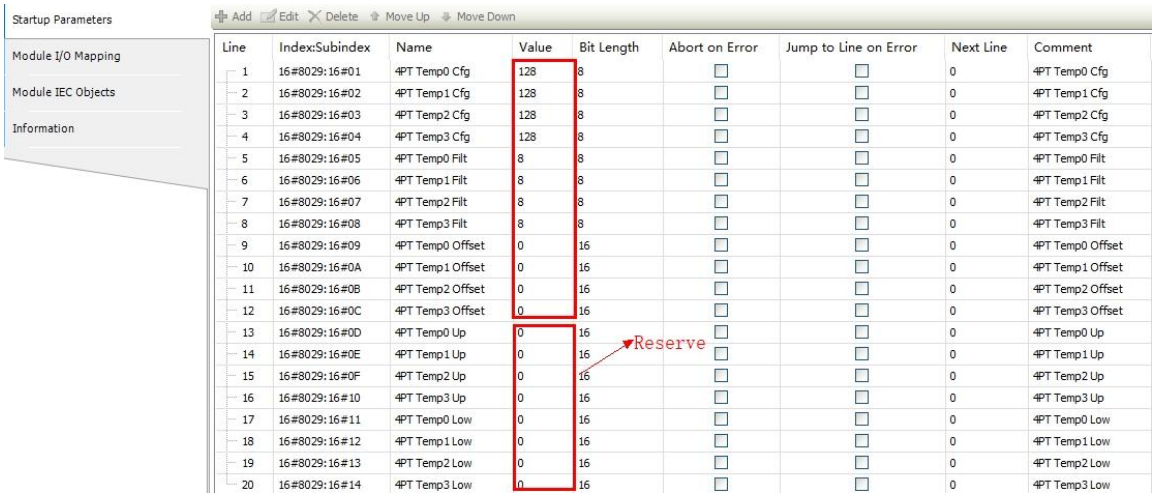

**Note:** For detailed parameter descriptions, refer to section 6.1 Parameter description.

### 6.2.1.2.5 Temperature detection module

Step 1 Click **Add Device** and add the AS71RTD4 module.




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




**Note:** The temperature upper limit and lower limit are reserved configuration parameters and do not need to be configured.

- Tempx_Cfg (x = 0, 1, 2, 3) is the channel configuration parameter, with data type USINT. Taking Channel 0 as an example, the data definition is as follows:

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|
| Channel conversion mode (sensor type) | | | Temperature unit | RTD wiring compensation | | Over-range detection enable control | Channel enable control |
| 2#000: reserved<br>2#001: PT100<br>2#010: PT500<br>2#011: reserved | 2#100: PT1000<br>2#101: reserved<br>2#110: reserved<br>2#111: CU100 | | 2#0: ℃<br>2#1: ℉ | 2#00: Two-wire system<br>2#01: Three-wire system<br>2#10: Four-wire system<br>2#11: reserved | | 2#0: Disable<br>2#1: Enable | 2#0: Disable<br>2#1: Enable |

Example: Channel 0 is configured as channel enabled, over-range detection enabled, 3-wire system, temperature unit set to Celsius (°C), and sensor type set to PT1000. The value of Temp0_Cfg is 135, that is, 0b10000111, as shown below:

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|
| 100 | | | 0 | 01 | | 1 | 1 |
| 100: PT1000 | | | 0: ℃ | 01: Three-wire system | | 1: Enable | 1: Enable |

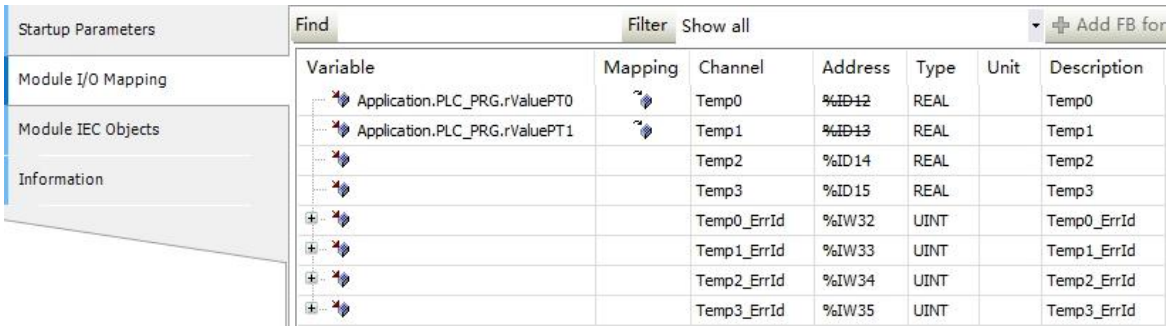
- Tempx_Filt (x = 0, 1, 2, 3) is the channel filter parameter setting. The parameter type is USINT, and the valid range is 1–255. A larger value generally provides better suppression of high-frequency interference, but also results in greater delay. The parameter should be tuned and used according to the actual application requirements.
- Tempx Offset (x = 0, 1, 2, 3) specifies the temperature offset value. The parameter type is USINT. The value is scaled by a factor of 10; for example, a setting of 999 represents 99.9. Measured value = actual value + offset value.

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

```
VAR
rValuePT0      : REAL;
rValuePT1      : REAL;

END_VAR
```

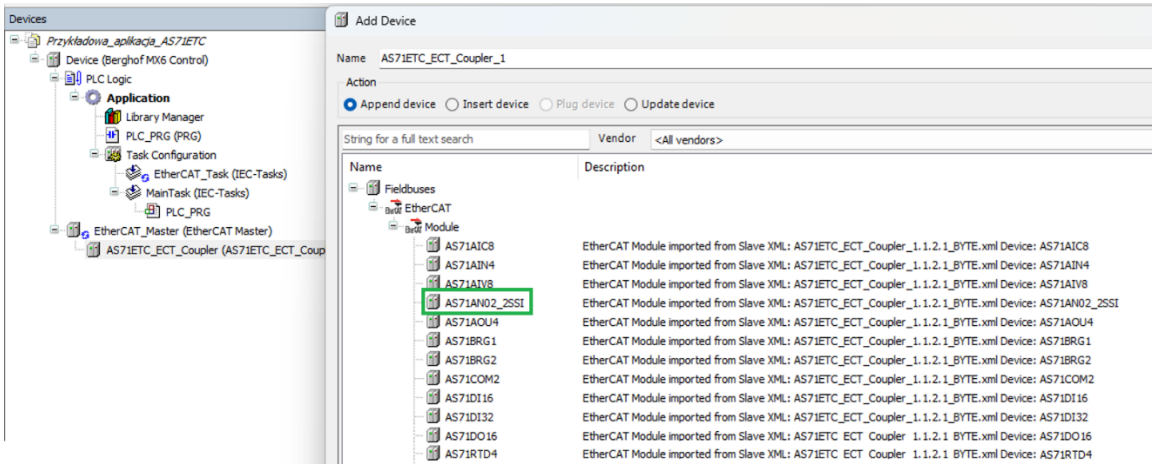
Step 4 Map variables **rValuePT0** and **rValuePT1** to the corresponding input channels in **Module I/O Mapping**. The mapped variables can then be used directly in the program.



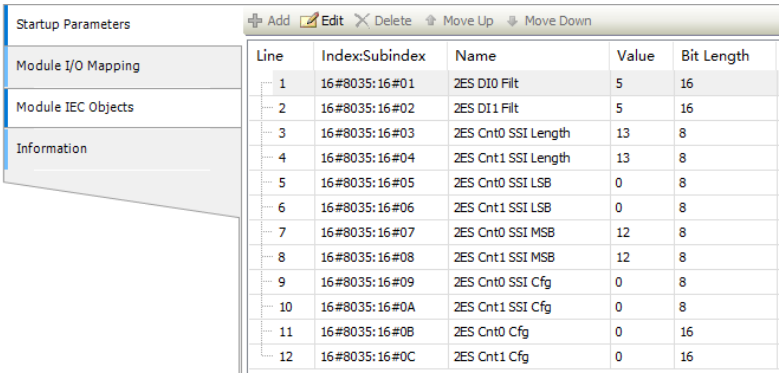

**Note:** For detailed parameter descriptions, refer to section 6.1 Parameter description.

### 6.2.1.2.6 Counting and measurement module

Step 1 Click **Add Device** and add the AS71AN02_2SSI module.



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




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

- DIx Filt (x = 0, 1) is the filter parameter for the external DI channel. The unit is 0.1 μs, and the default value is 5. If it is set to 10, it means that only signals that remain stable and do not jump within 1 μs are sampled.
- Cntx SSI Length (x = 0, 1) is the SSI communication frame length of the encoder. The configurable range is 10–40, and the default value is 13. If a 23-bit multi-turn encoder is used, indicating that the position value has 23 bits, set this parameter to 23.
- Cntx SSI LSB (x = 0, 1) indicates the bit position of the least significant bit of the position value in the SSI communication frame. The default value is 0. If a 23-bit multi-turn encoder is used, indicating that the position value has 23 bits, set this parameter to 0.
- Cntx SSI MSB (x = 0, 1) indicates the bit position of the most significant bit of the position value in the SSI communication frame. The default value is 12. If a 23-bit multi-turn encoder is used, indicating that the position value has 23 bits, set this parameter to 22.

**Note:** Configure the SSI Length/SSI LSB/SSI MSB parameters by referring to the manual of the connected encoder and according to the actual application.

- Cntx SSI Cfg (x = 0, 1) is the SSI communication configuration parameter of the counter. The parameter type is USINT. The data definition is shown in the parameter table below.

| Bit | Name | Parameter description |
|---|---|---|
| Bit2–bit0 | SSI clock frequency | 2#000: 125 kHz (default)<br>2#001: 250 kHz<br>2#010: 500 kHz<br>2#011: 1 MHz<br>2#100: 1.5 MHz<br>2#101: 2 MHz<br>2#110: reserved<br>2#111: reserved |
| Bit3 | SSI data format | 2#0: Binary (default)<br>2#1: Gray code |
| Bit7–bit4 | Read interval of SSI communication position | Unit: 100 μs; default value: 0.<br>For example, 2#0001 (decimal 1) indicates 100 μs;<br>2#1001 (decimal 9) indicates 900 μs. |

- If the counter SSI clock frequency is configured to 500 kHz, the SSI data format is Gray code, and the position read interval is 500 μs, Cntx-SSI-Cfg (x = 0, 1) should be configured to 90, that is, 0b01011010, as shown in the table below.

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

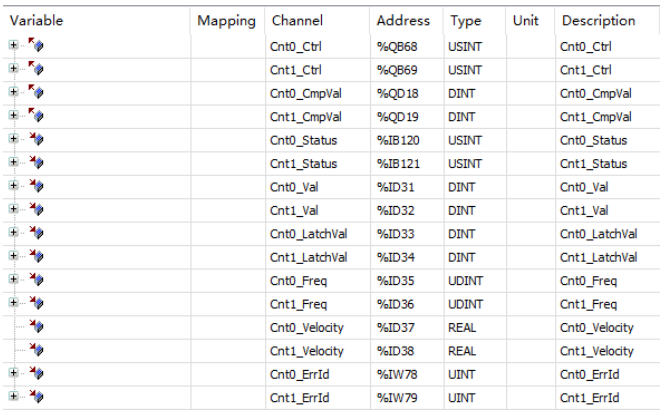
- Cntx Cfg (x = 0, 1) is the counter configuration parameter. The parameter type is UINT. The data definition is shown in the parameter table below.

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

If the counter is configured with a frequency measurement period of 100 ms, DI rising-edge latch enabled, comparison match output pulse width of 8 ms, and comparison output mode set to output within [comparison value, count upper limit], then Cntx Cfg (x = 0, 1) should be configured to 53, that is, 0b0000000000110101, as shown in the table below.

| Bit15–bit8 | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|
| 00000000 | 00 | | 11 | | 01 | | 01 | |
| Reserved | Comparison match output | | 8 ms | | Rising edge | | 100 ms | |

Step 3 After configuring the above 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 | %QB68 | USINT | | Cnt0_Ctrl |
| | | Cnt1_Ctrl | %QB69 | USINT | | Cnt1_Ctrl |
| | | Cnt0_CmpVal | %QD18 | DINT | | Cnt0_CmpVal |
| | | Cnt1_CmpVal | %QD19 | DINT | | Cnt1_CmpVal |
| | | Cnt0_Status | %IB120 | USINT | | Cnt0_Status |
| | | Cnt1_Status | %IB121 | USINT | | Cnt1_Status |
| | | Cnt0_Val | %ID31 | DINT | | Cnt0_Val |
| | | Cnt1_Val | %ID32 | DINT | | Cnt1_Val |
| | | Cnt0_LatchVal | %ID33 | DINT | | Cnt0_LatchVal |
| | | Cnt1_LatchVal | %ID34 | DINT | | Cnt1_LatchVal |
| | | Cnt0_Freq | %ID35 | UDINT | | Cnt0_Freq |
| | | Cnt1_Freq | %ID36 | UDINT | | Cnt1_Freq |
| | | Cnt0_Velocity | %ID37 | REAL | | Cnt0_Velocity |
| | | Cnt1_Velocity | %ID38 | REAL | | Cnt1_Velocity |
| | | Cnt0_ErrId | %IW78 | UINT | | Cnt0_ErrId |
| | | Cnt1_ErrId | %IW79 | UINT | | Cnt1_ErrId |

- Cntx_Ctrl (x = 0, 1) is the counter control parameter. The data definition is shown in the parameter table below.

| Bit | Name | Parameter description |
|---|---|---|
| Bit0 | Count enable | 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 the counter comparison value. The parameter type is DINT.

Assuming that Cntx_CmpVal is set to 1000000, set Cntx_Ctrl to 17, that is, 0b00010001, to enable the counter and comparison function, as shown below.

| Bit7–bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|
| 000 | 1 | 0 | 0 | 0 | 1 |
| Reserved | Enable | Rising edge active | Reserved | Reserved | Enable |

- Cntx_Val (x = 0, 1) is the counter count value. The parameter type is DINT.

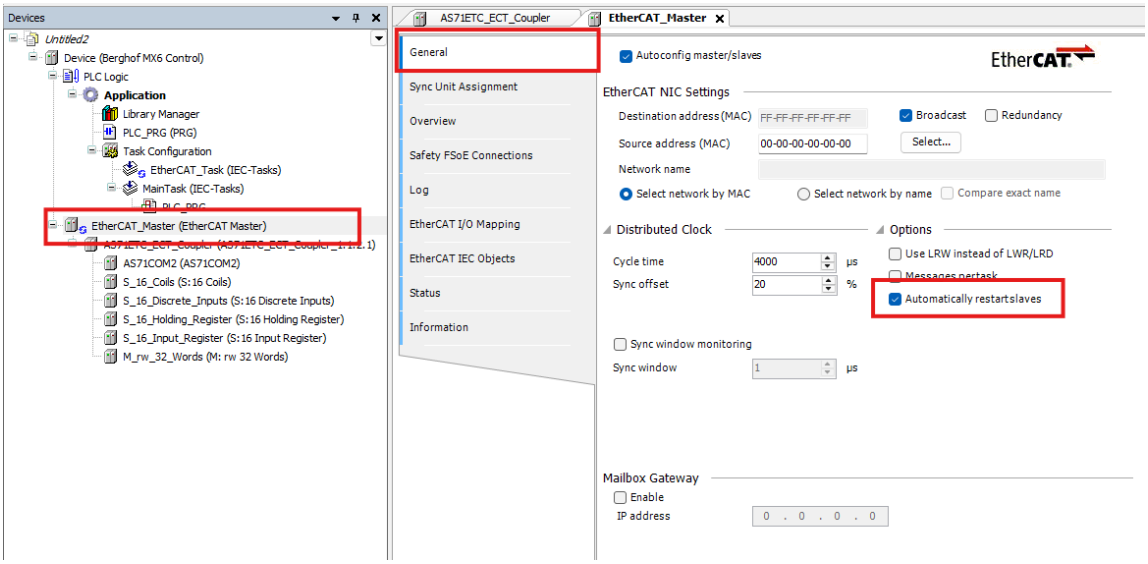
According to the preceding configuration value 53 of Cntx-Cfg (x = 0, 1), which enables DO comparison match output and sets the output pulse width to 8 ms, when the count value Cntx_Val (x = 0, 1) is equal to 1000000, DO outputs for 8 ms.

**Note:** DI0/DI1 are counter latch inputs, and the corresponding latched value is Cntx_LatchVal (x = 0, 1). For details about the parameter description, see section 6.1 Parameter description.

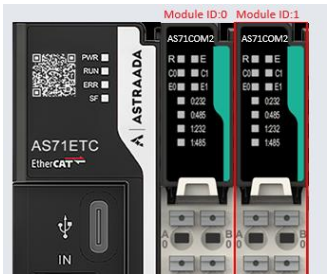
### 6.2.1.2.7 AS71COM2 serial communication module

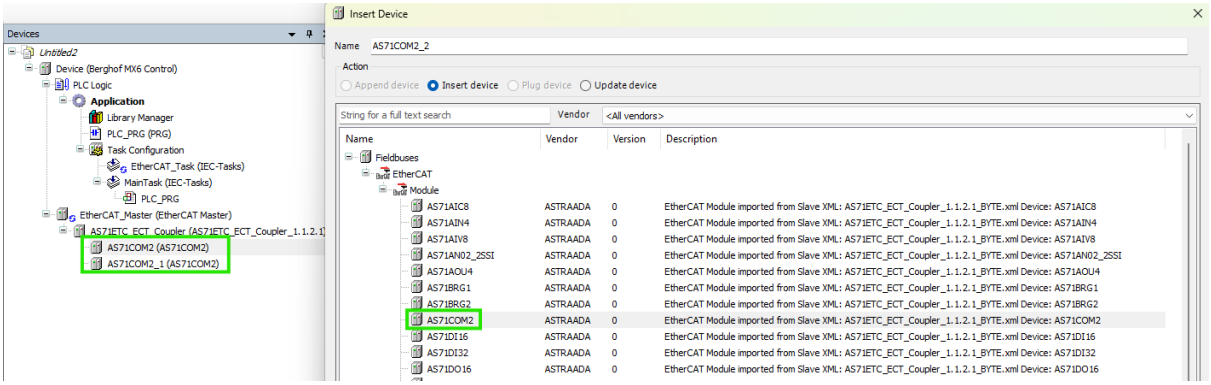
The AS71COM2 serial communication module is a dual-channel module. It can be configured as RS485 or RS232, and can operate in Modbus RTU master/slave mode or free-protocol mode.

**Note:** The serial communication module implements its functions through a local module and virtual modules. The virtual modules occupy configuration slots. Before the master configuration is downloaded, the coupler does not know how many virtual modules are configured. Therefore, during the first download, the actual configuration may fail to match the master configuration, preventing the module from entering the OP state. After receiving the configuration for the first time, the coupler saves the configuration, resets, restarts, and then waits for the master to establish the connection again. If the master supports automatic slave restart, select this function. If the master does not support automatic slave restart, restart the master (for example, an Omron PLC).




In the following example, two AS71COM2 serial communication modules are used. The configuration is shown below, where the related channels are configured to operate in Modbus RTU master/slave mode, and free-protocol mode.



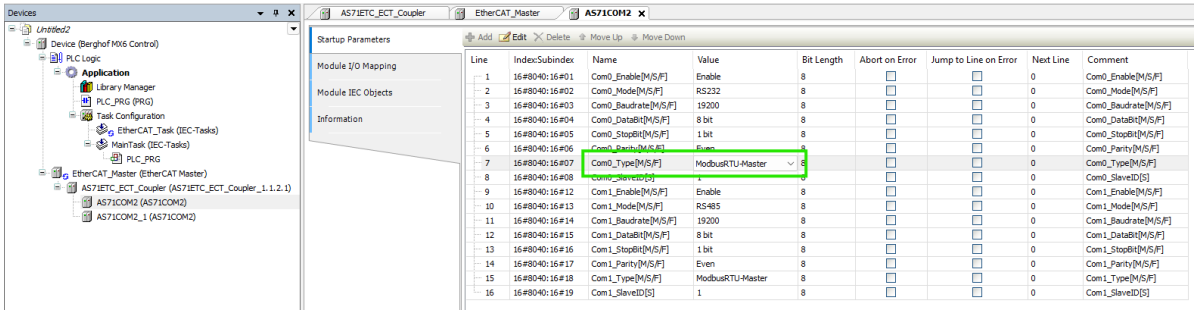

## 6.2.1.2.7.1 Modbus RTU master operating instructions

Supported function codes of master module

| Function code | Name | Description | Operation type |
|---|---|---|---|
| 0x01 | Read Coils | Read coils | Bit operation (multiple) |
| 0x02 | Read Discrete Inputs | Read discrete inputs | Bit operation (multiple) |
| 0x03 | Read Holding Registers | Read holding registers | Word operation (multiple) |

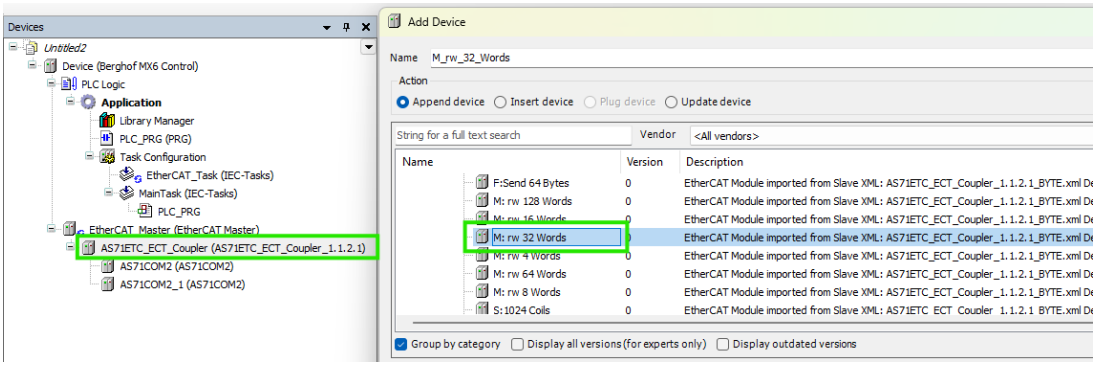
| Function code | Name | Description | Operation type |
|---|---|---|---|
| 0x04 | Read Input Registers | Read input registers | Word operation (multiple) |
| 0x05 | Write Single Coil | Write a single coil | Bit operation (single) |
| 0x06 | Write Single Register | Write a single holding register | Word operation (single) |
| 0x0F | Write Multiple Coils | Write multiple coils | Bit operation (multiple) |
| 0x10 | Write Multiple Registers | Write multiple holding registers | Word operation (multiple) |

When the system is configured as a Modbus RTU master, the PDO size allows virtual communication modules with valid data lengths of 4, 8, 16, 32, 64, or 128 words to be configured, enabling users to reasonably allocate PDO resources according to application scenarios. For available virtual module types, refer to section 6.1.10.2 Serial communication module – Modbus RTU master virtual module.

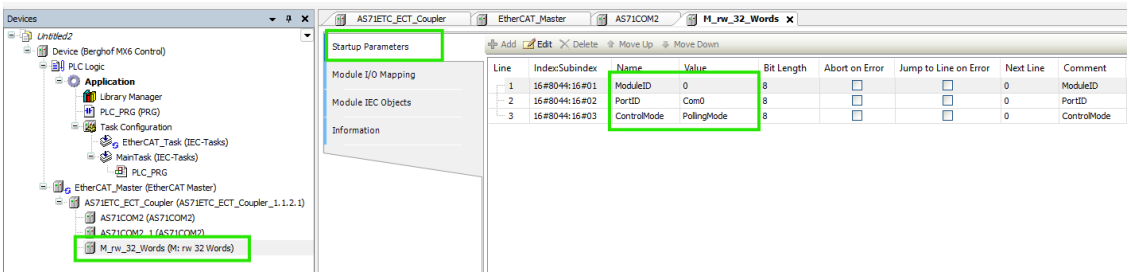


Example: Channel 0 of the first AS71COM2 serial communication module configured as master mode

- **Add a master virtual module: M: rw 32 Words**



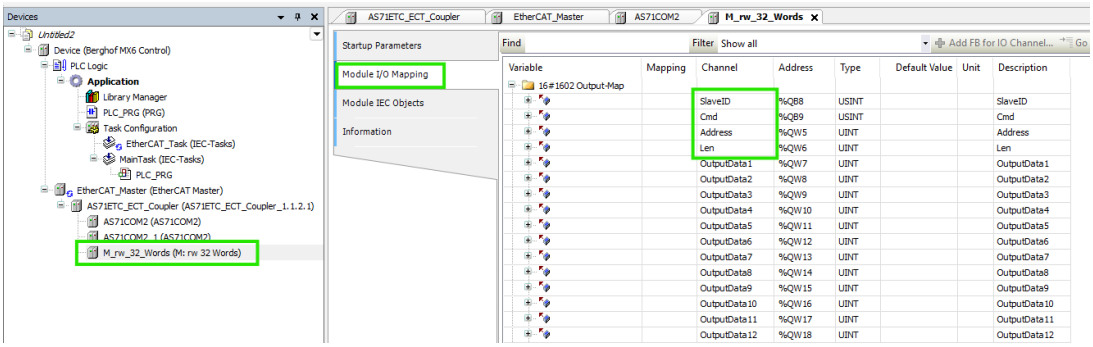

- **M: Startup parameter configuration of the rw 32 Words virtual module**




Multiple master virtual modules can be configured under the same channel.

After a channel is bound to a master virtual module, the module can be configured to operate in polling, trigger, or other operating modes. For details about the parameters, refer to section 6.1.10.2 Serial communication module – Modbus RTU master virtual module.

- **PDO parameters**

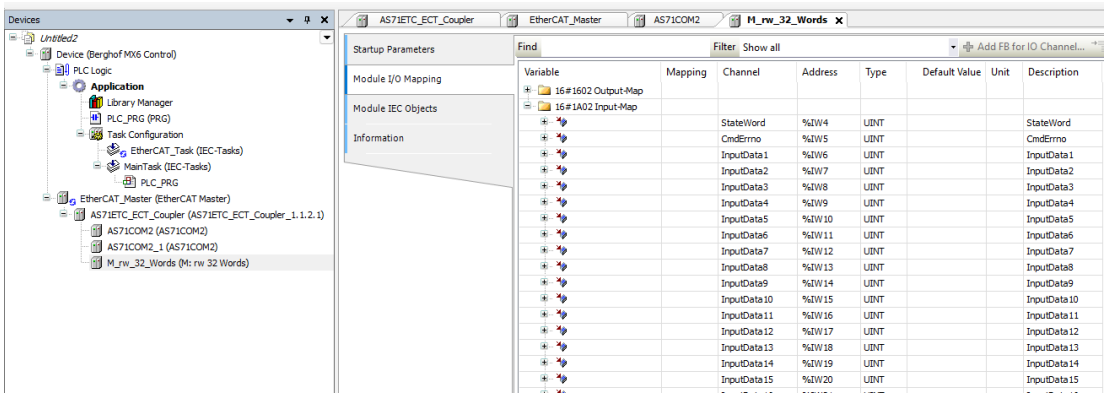


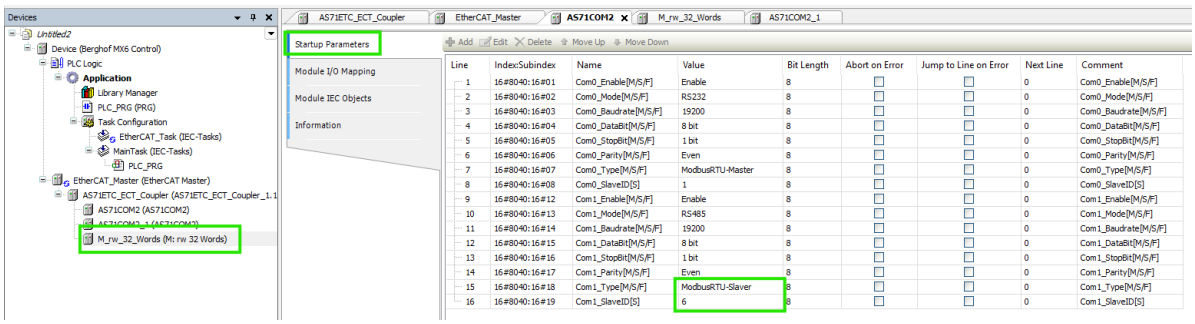

The application can access Modbus RTU slave devices through the bound channel by changing the values of the SlaveID, Cmd, Address, and Len parameters.

## 6.2.1.2.7.2 Modbus RTU slave operating instructions

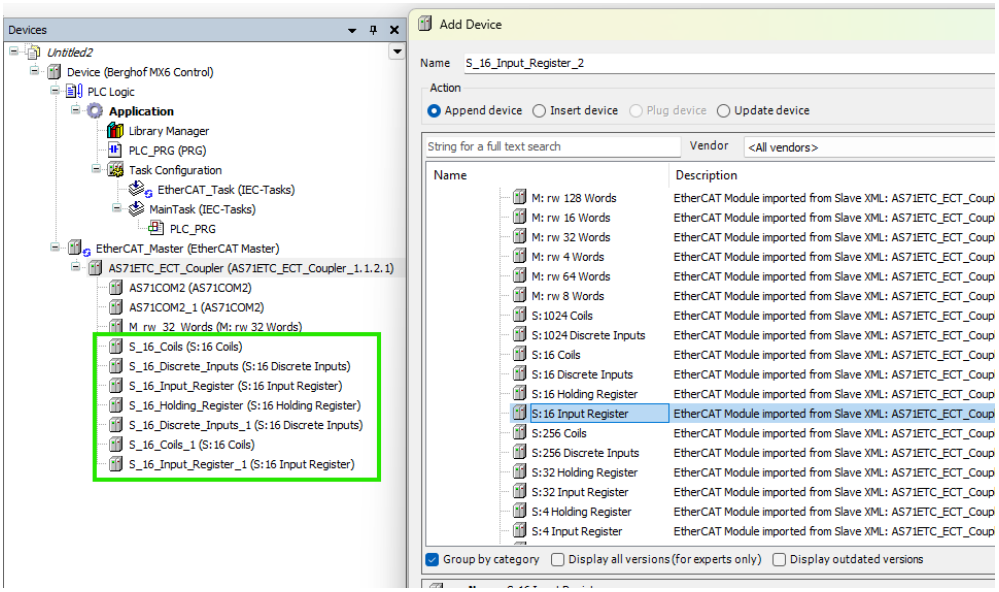
When a channel is configured as slave mode, refer to
section 6.1.10.3 Serial communication module–Modbus RTU slave virtual module for available virtual module types.

Example: Channel 1 of the first AS71COM2 serial communication module configured as slave mode with Slave ID = 6:

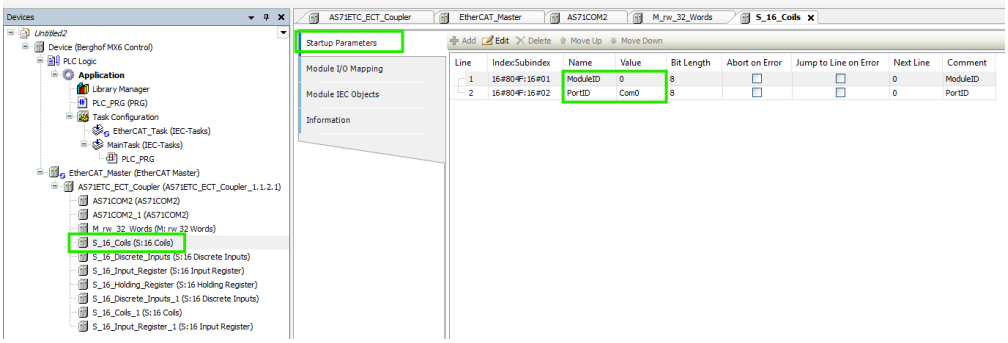


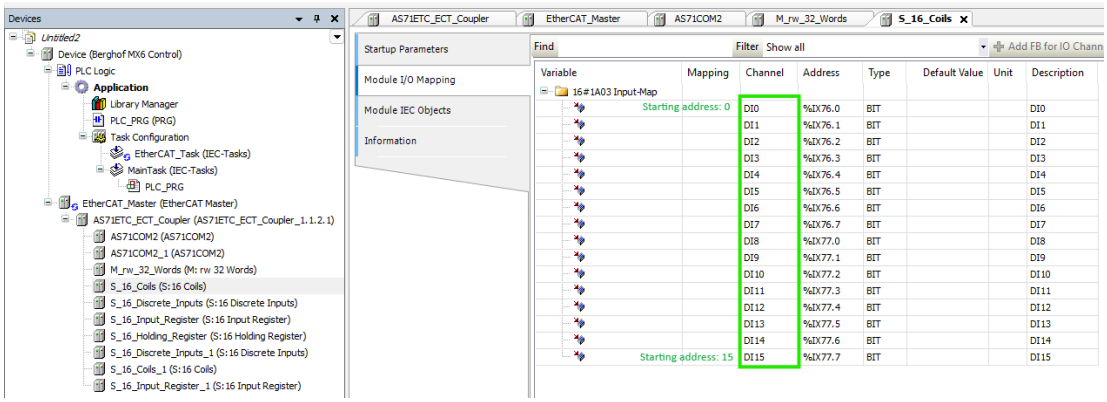
- **Add the following slave virtual modules:**



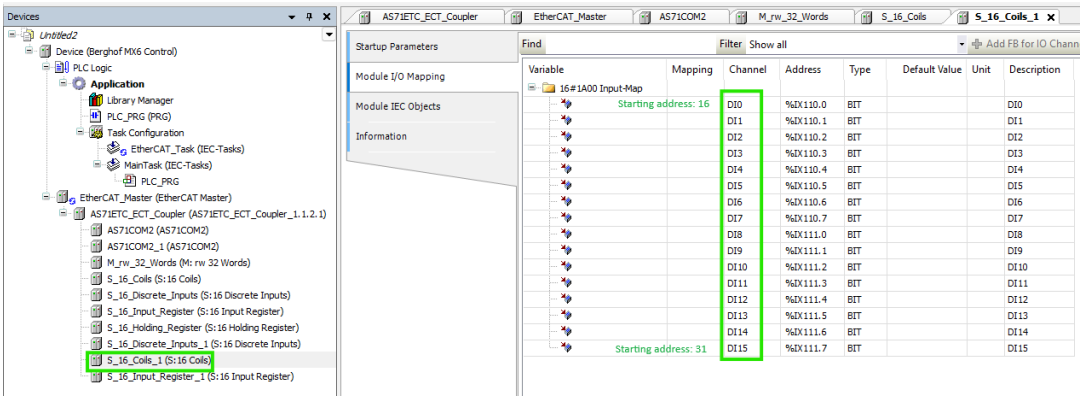

- **Configure slave virtual module startup parameters and bind them to Channel 1 of the first AS71COM2 module:**




- **The start address of the same type of slave virtual modules follows allocation rules: The first virtual module starts from address 0:**

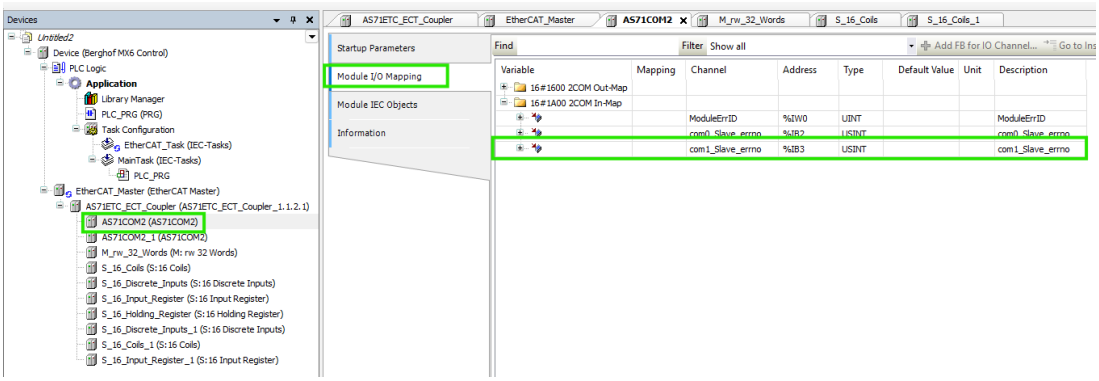


- **The second Coils module continues from the last address of the first module: Starts from 16:**




For the function codes used to access the slave virtual module, see 6.1.10.3 Serial communication module–Modbus RTU slave virtual module. For example, when the master accesses the Coils module defined above, function codes 01, 05, and 15 can be used.

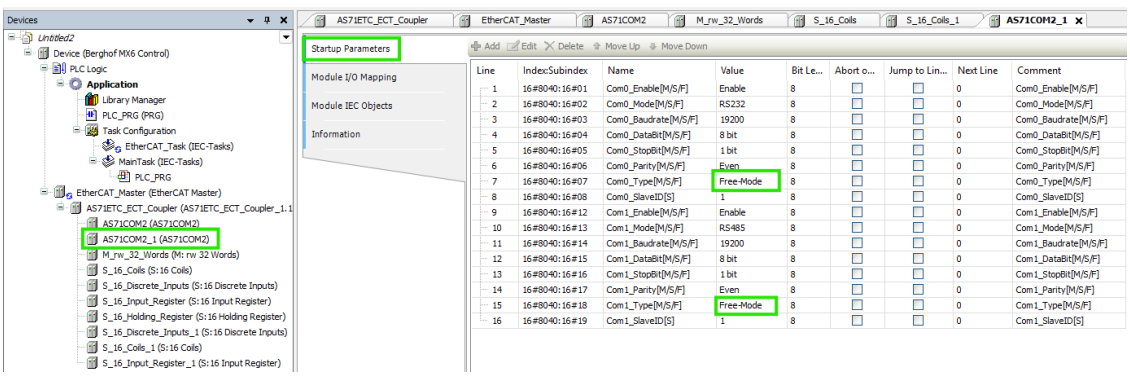
Slave exception codes can be viewed through the feedback parameters of the bound serial communication module.



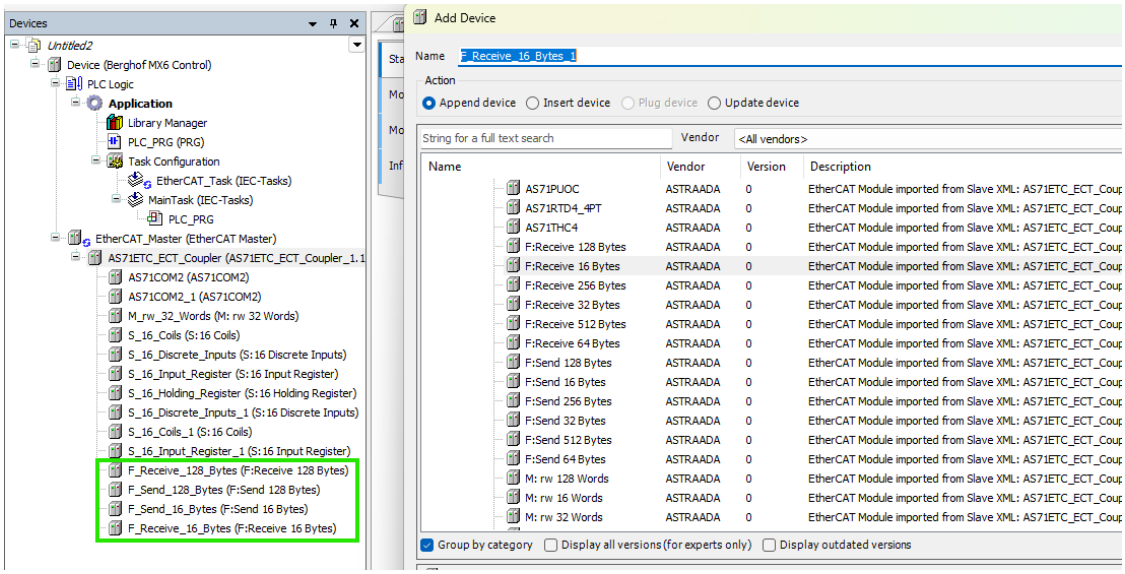

## 6.2.1.2.7.3 Free-protocol operating instructions

The maximum length of a free-protocol data frame is 512 bytes. Within the same channel, transmit and receive virtual modules can be configured simultaneously. RS232 supports simultaneous transmit and receive without blocking. RS485 does not support simultaneous transmit and receive. For details, refer to section 6.1.10.4 Serial communication module–Free-protocol virtual module.

Example: Channel 0 of the second AS71COM2 serial communication module is configured for free protocol and bound to two free-protocol virtual modules; Channel 1 is also configured for free protocol and bound to two free-protocol virtual modules:

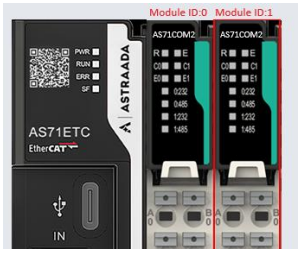


- **Add 4 free-protocol virtual modules.**

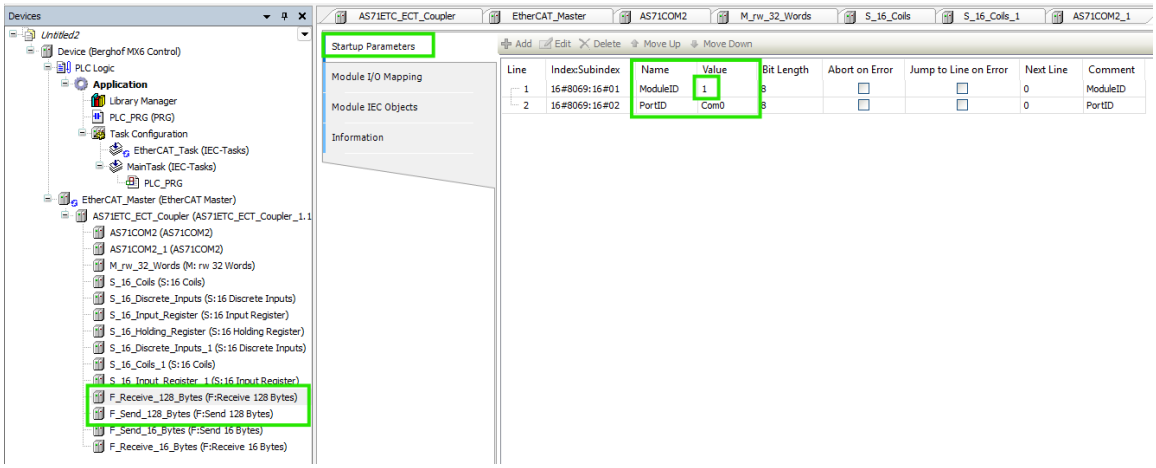



**As a reminder: ModuleID parameter description**

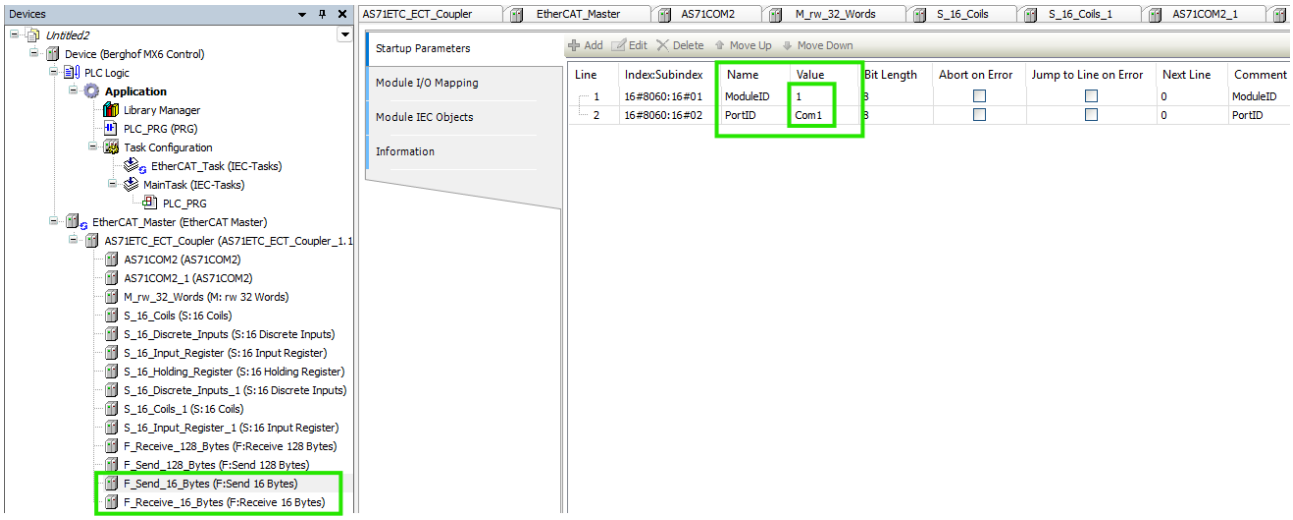
This parameter indicates which serial communication module is bound. In the configuration, there may be multiple serial communication modules. The serial communication module closest to the coupler is numbered 0, and the following modules are numbered sequentially by adding 1. For example, if there are two serial communication modules in one configuration, as shown below:




- **Configure the startup parameters for two free-protocol virtual modules and bind them to Channel 0 (COM 0) of the second AS71COM2 (Module ID 1) serial communication module:**



- **Configure the startup parameters for two free-protocol virtual modules and bind them to Channel 1 (COM 1) of the second AS71COM2 (Module ID 1) serial communication module:**




The free-protocol transmit module sends data by setting the ControlWord to 1, specifying the SendLen and the transmit data, and then the required data can be transmitted.

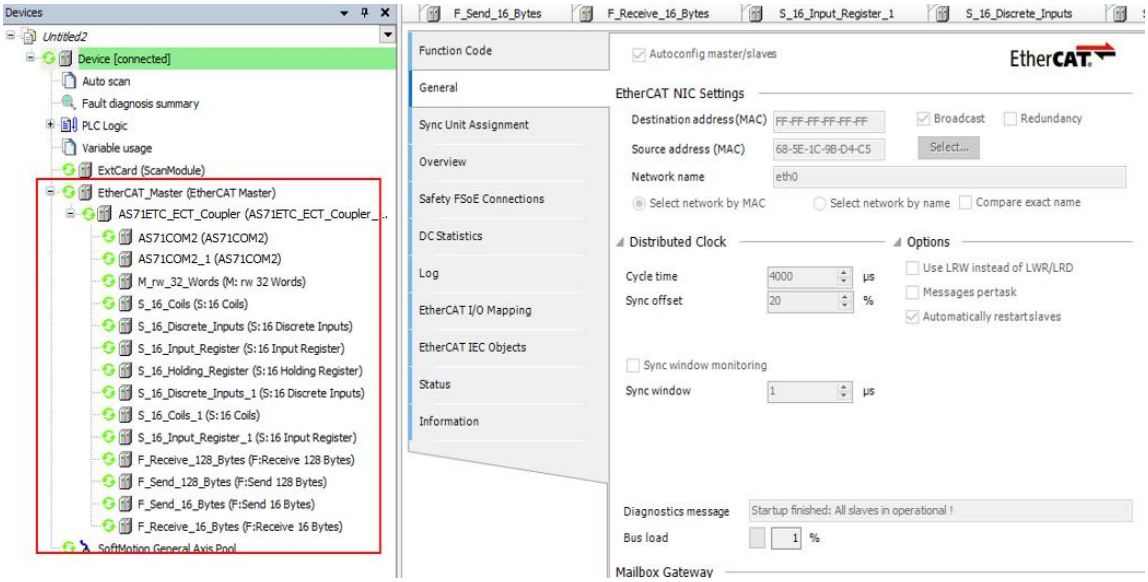
The free-protocol receive module enters the receive state by setting the ControlWord to 1. It does not require a specified receive length. The end of a frame is determined by the frame interval time. If the received frame length exceeds the total receive capacity of the virtual module, the reception fails; otherwise, the reception is successful.

To perform another transmission or reception, the ControlWord must first be set to 0 and then set back to 1 to re-enter the operation state.

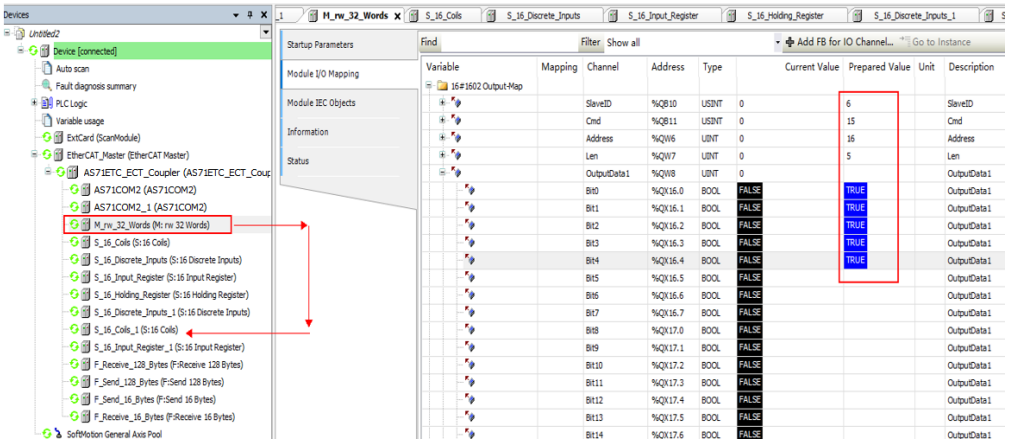
In this example, both channels of the serial communication module are configured to operate in RS485 mode with the same baud rate. The A and B terminals of Channel 0 and Channel 1 are connected so that the two channels can communicate with each other.

Now start the test.

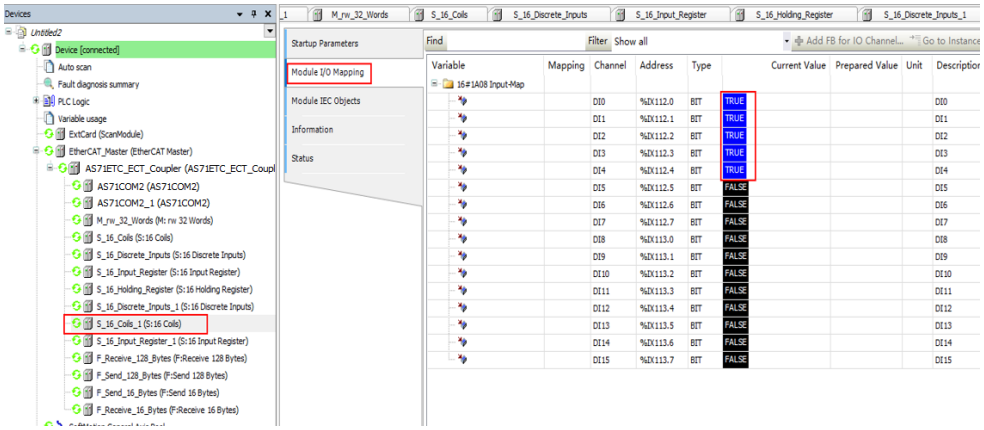
- **After clicking download and run:**



Use Channel 0 (master) of the first module and the virtual module M_rw_32_Words to operate the second Coils module under Channel 1.



- **Result is shown below:**



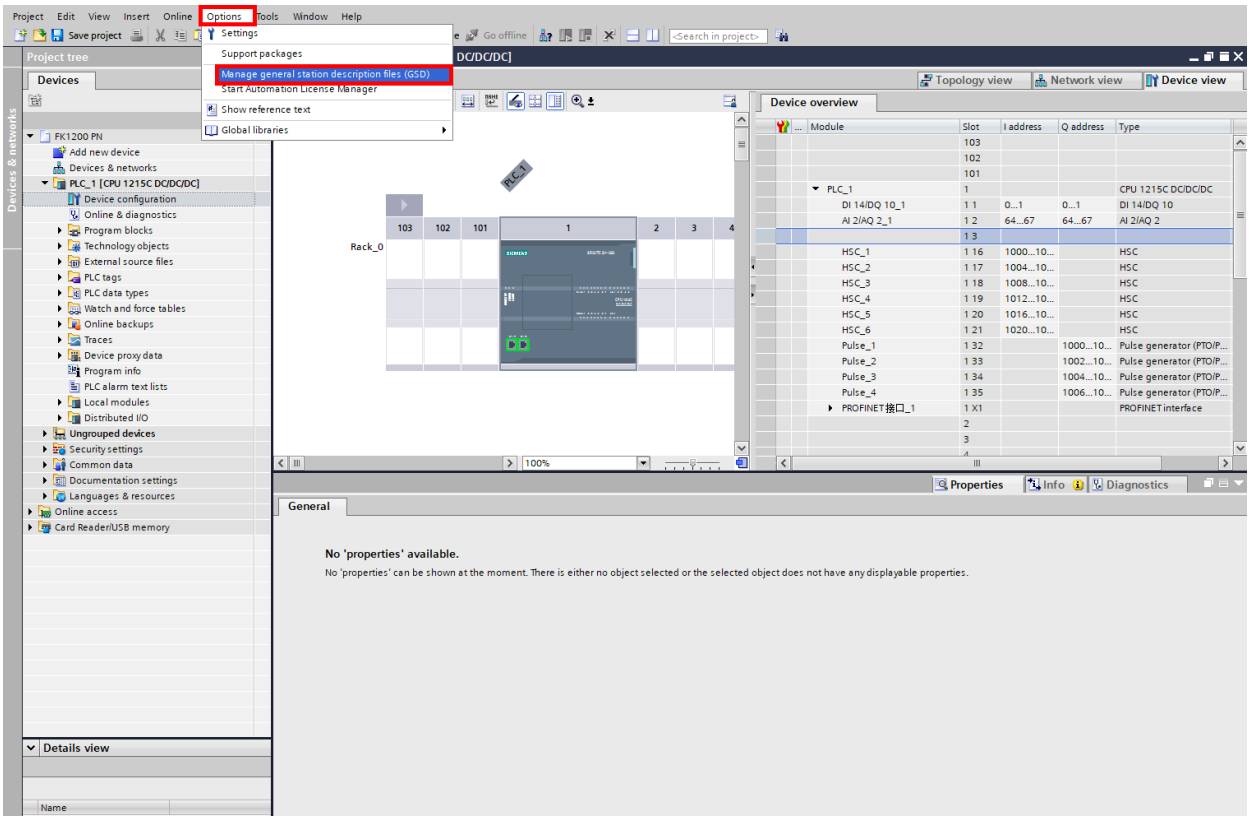
# 6.3 PROFINET configuration

## 6.3.1 TIA Portal configuration example

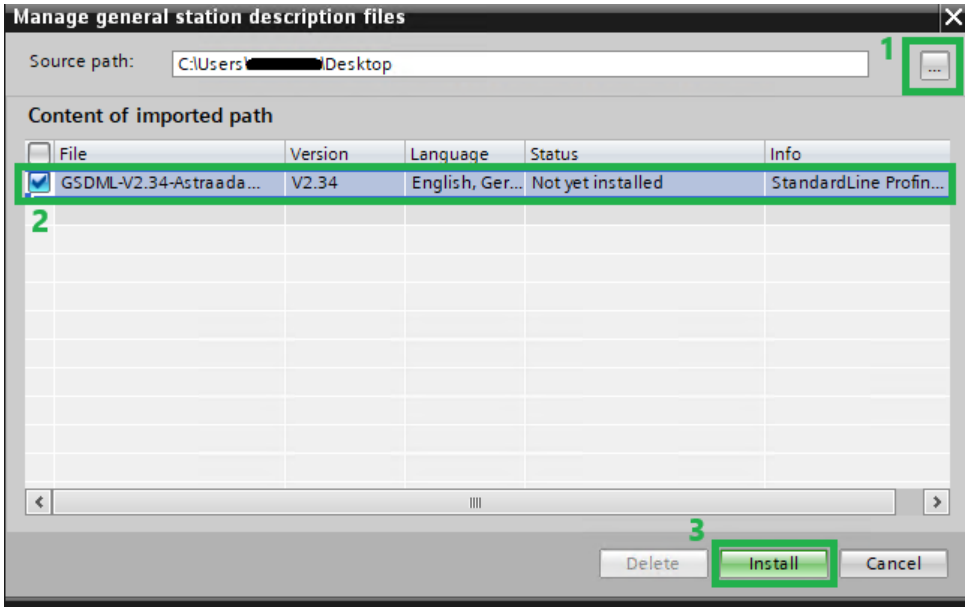
### 6.3.1.1 PROFINET communication coupler configuration

Step 1 Install the device description file named in the format of GSDML-V2.43-ASTRAADA-AS71PNS-xxxxxxxx.xml.

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

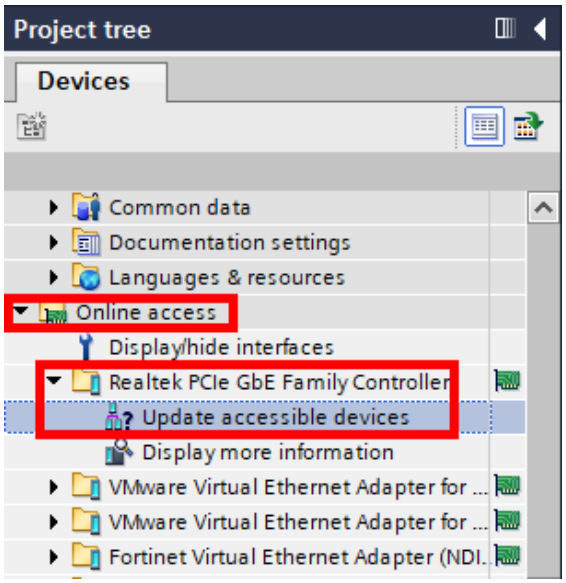



B. In the **Manage general station description files** window that appears, set **Source path** to the GSD file saving path, select the GSD file to be installed, and then click **Install**.



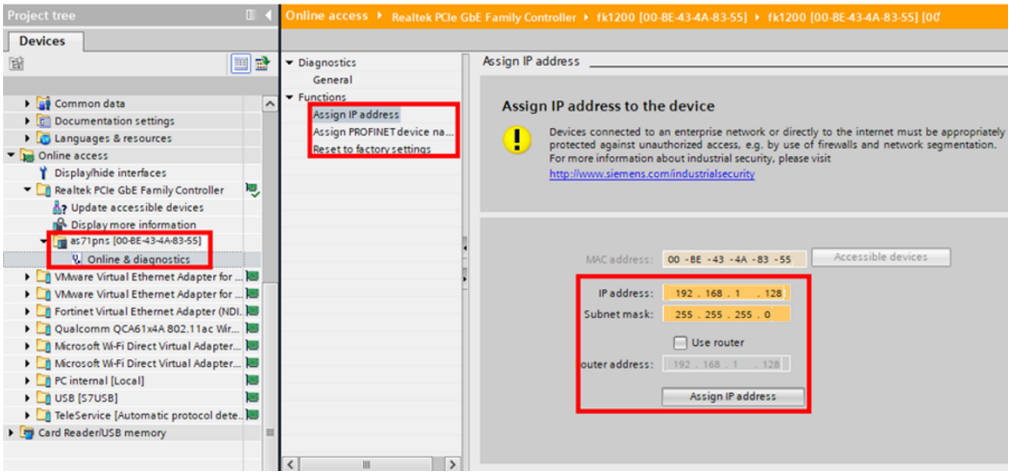
Step 2 Set the PN device name and IP address.

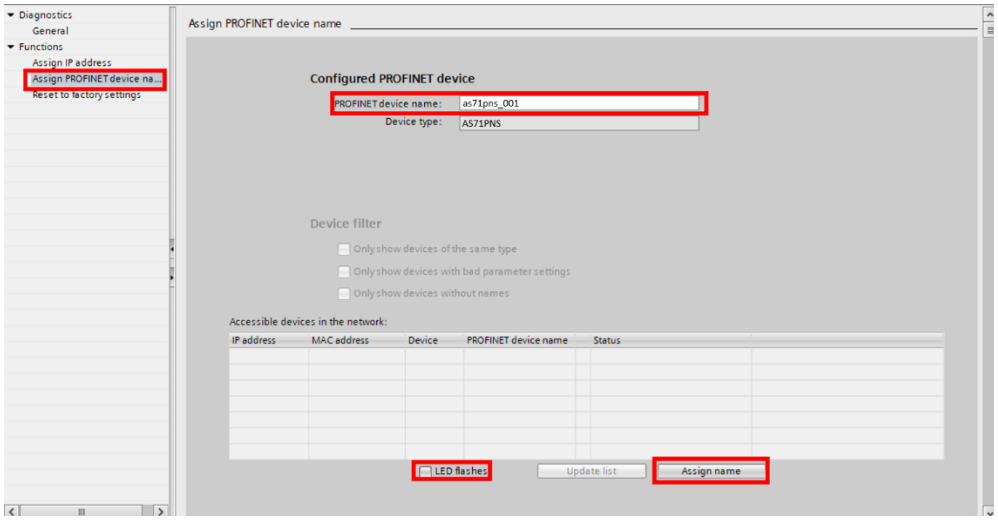
A. Complete the actual physical connection. Under **Project tree**, choose **Devices** > **Online access** > **Realtek PCIe GbE Family Controller** > **Update accessible devices**.




B. Choose the refreshed PN coupler device (you can confirm the device according to the MAC address).

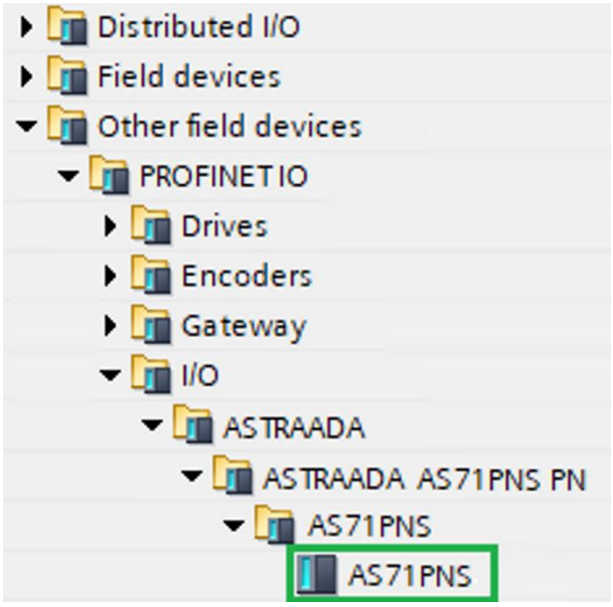
Choose **Online & diagnostics** under **AS71PNS**, choose **Functions** > **Assign IP address**, set **IP address** and **Subnet mask**, and click **Assign IP address**. After the IP address assignment, choose **Assign PROFINET device name**, set **PROFINET device name**, and click **Assign name**.



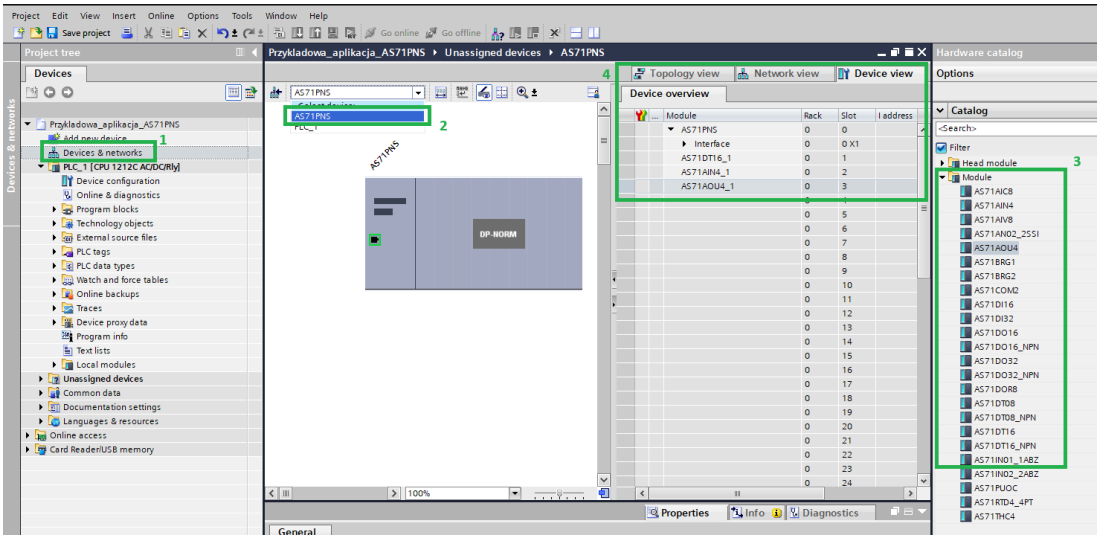



Step 3 Network configuration

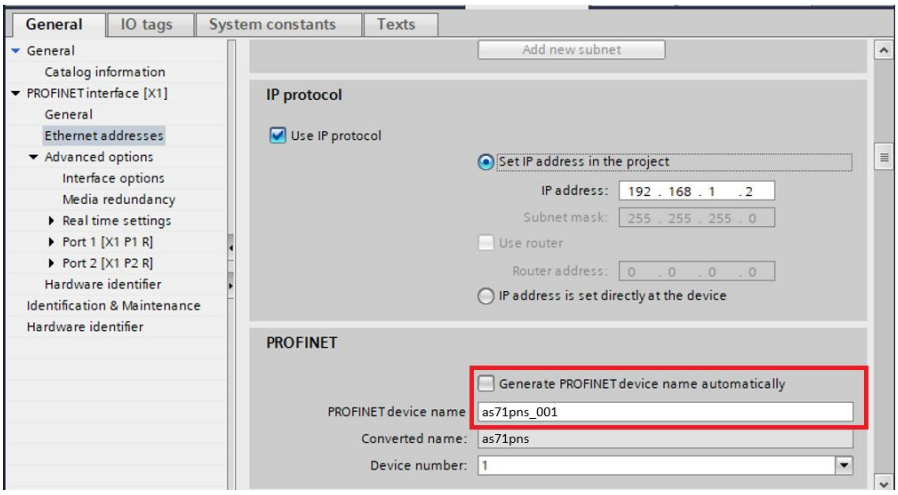
A. Choose **PLC_1** > **Device configuration** on the left, click **Network view** in the main interface, click **Hardware catalog** on the right, choose **Other field devices** > **PROFINET IO** > **I/O** > **ASTRAADA** > **ASTRAADA AS71PNS PN**> **AS71PNS** > **AS71PNS**.



B. Choose **PLC_1** > **Device configuration** on the left, click **Device view** in the main interface, choose the AS71PNS devices, and add modules to the slots according to actual physical configuration on the right.



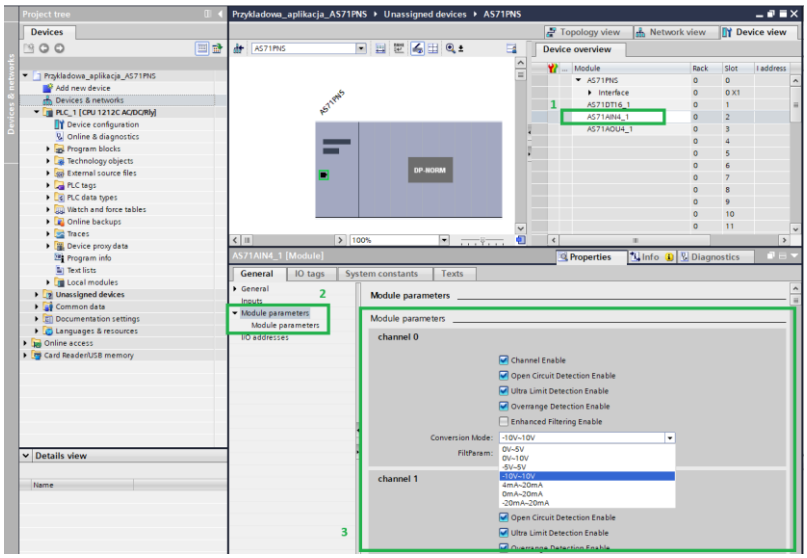
C. In the **Device view** interface, double-click **AS71PNS**. At the bottom of the window, choose **Properties** > **General** > **PROFINET interface [X1]** > **Ethernet addresses**, deselect **Generate PROFINET device automatically**, and set **PROFINET device name** to the current device name.



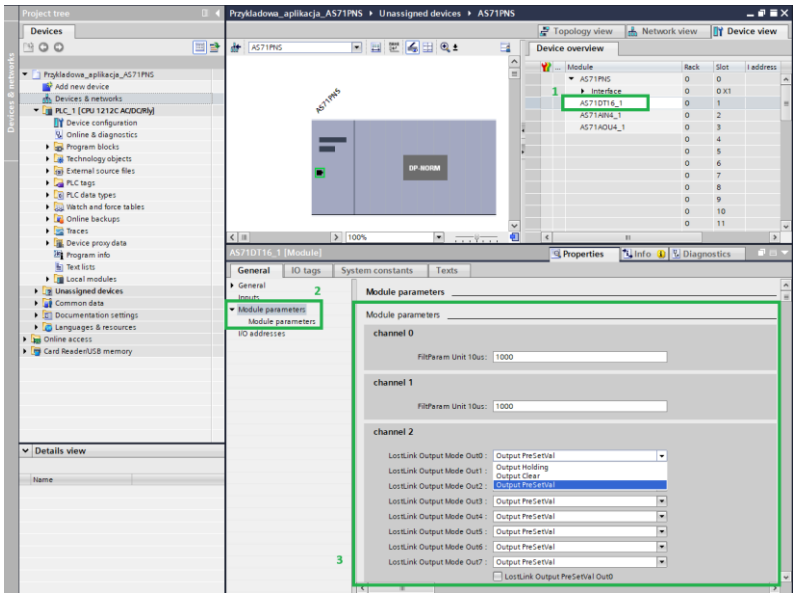

**Note:** In PROFINET communication, devices are identified through device names. Therefore, the set device names must match the actual device names of modules, and each device name must be unique.

D. Set module parameters.

Example 1: In the **Device view** interface, double-click **AS71AIN4-4AD** under **Module**, choose **Properties** > **General** > **Module parameters** > **General parameters**, and then set module initialization parameters.



Example 2: In the **Device view** interface, double-click **AS71DT16** under **Module**, choose **Properties** > **General** > **Module parameters**, and then set module initialization parameters.

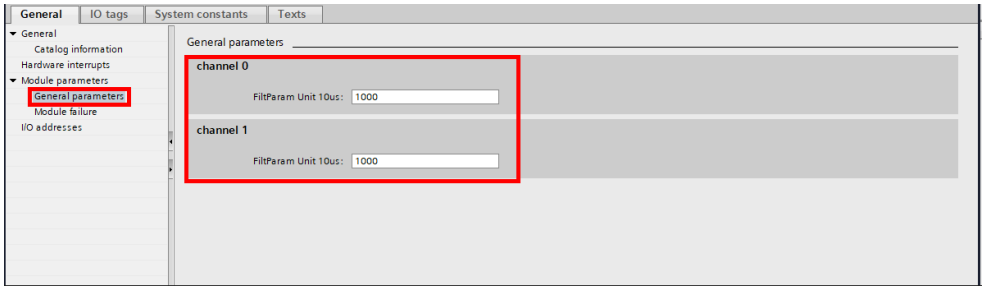


E. After completing the network configuration, set all module configuration parameters. Once compiled, the program can be downloaded and run.

### 6.3.1.2 Module configuration

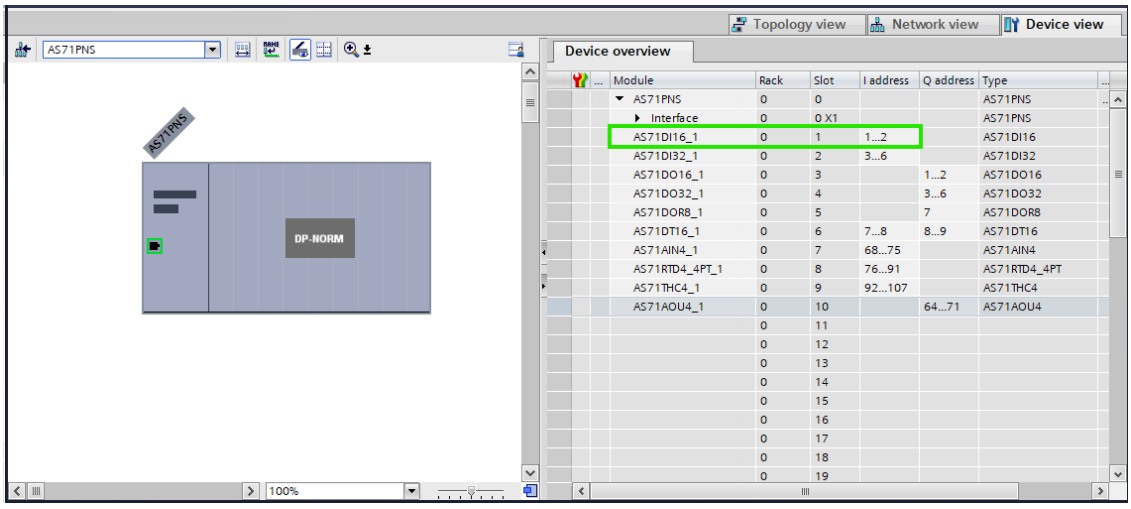
#### 6.3.1.2.1 Digital input module

Step 1 In the **Device view** interface, add **AS71DI16-1600DI**, double-click **AS71DI16-1600DI** under **Module**, choose **Properties** > **General** > **Module parameters** > **General parameters**, and then set module initialization parameters.



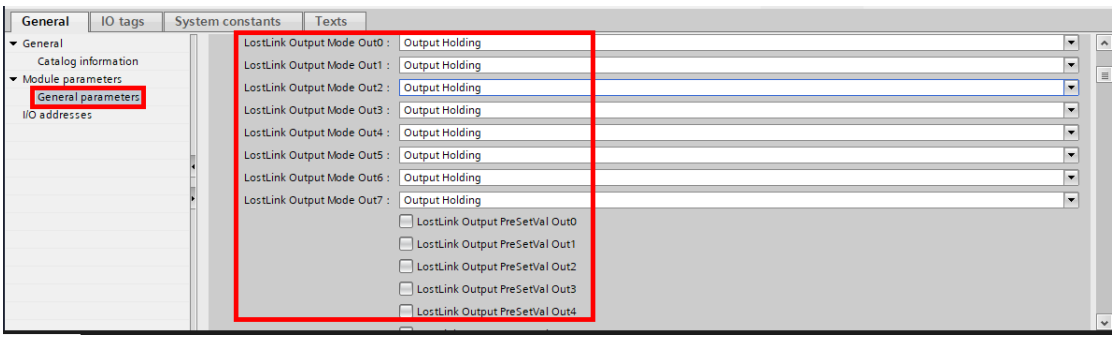

**Note:** For filtering parameter setting, the digital input module divides every 8 points into a group, and different filtering parameters can be set for each group. In the startup parameters, adjust the port filter mode according to actual requirements. The unit is 10 μs, and the default value is 10 ms.

Step 2 Obtain sampling values through I addresses.

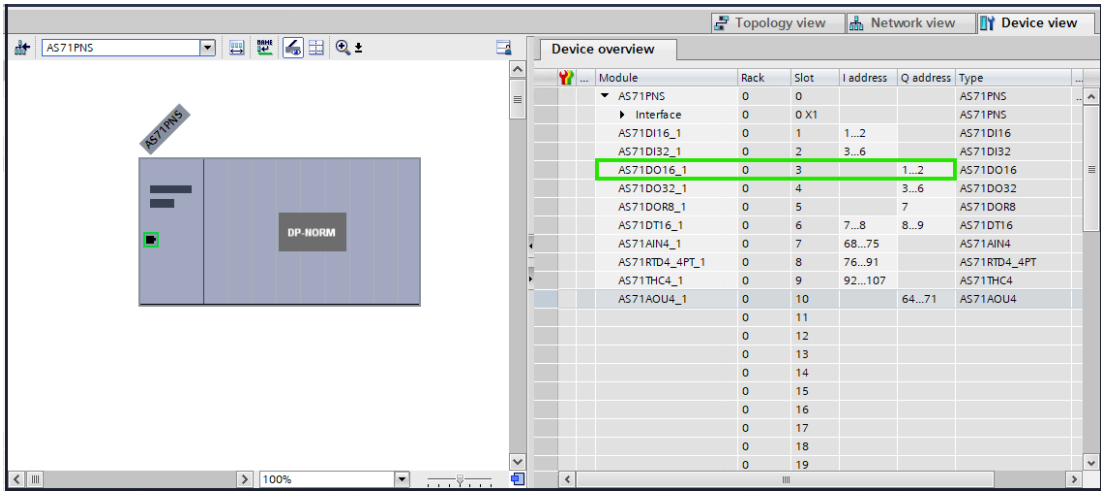



#### 6.3.1.2.2 Digital output module

Step 1 In the **Device view** interface, add **AS71DO16-0016DP**, double-click **AS71DO16-0016DP** under **Module**, choose **Properties** > **General** > **Module parameters** > **General parameters**, and then set module initialization parameters.

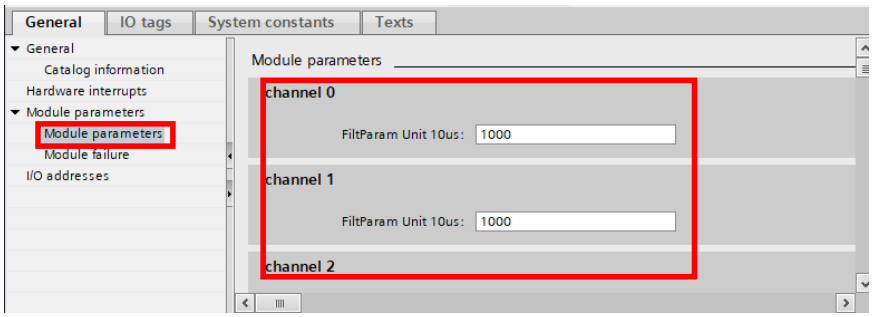


Step 2 Control output through Q addresses.

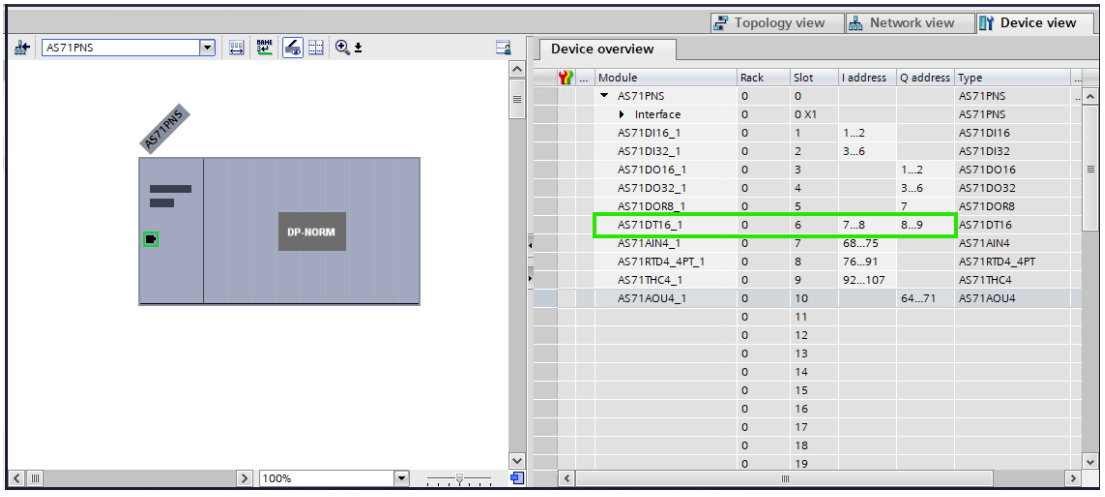



## 6.3.1.2.3 Digital input/output module

Step 1 In the **Device view** interface, add **AS71DT16**, double-click **AS71DT16** under **Module**, choose **Properties** > **General** > **Module parameters**, and then set module initialization parameters.

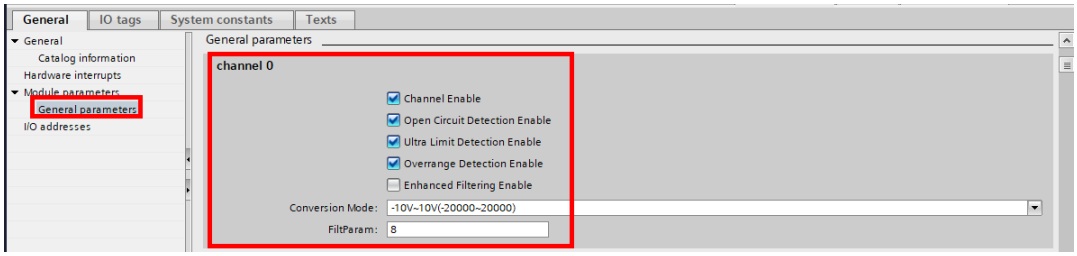



Step 2 Obtain sampling values through I addresses and control output through Q addresses.

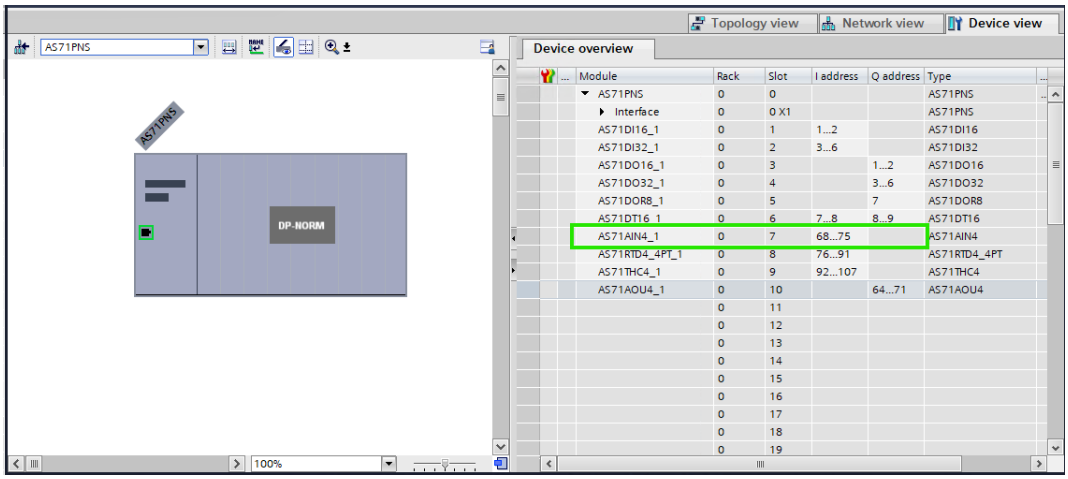


### 6.3.1.2.4 Analog input module

Step 1 In the **Device view** interface, add **AS71AIN4**, double-click **AS71AIN4** under **Module**, choose **Properties** > **General** > **Module parameters > General parameters**, and then set module initialization parameters.

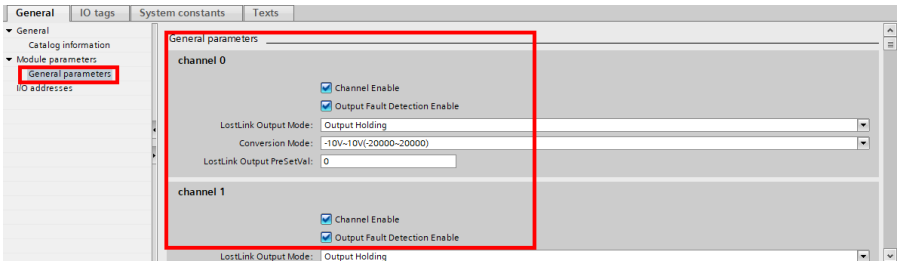



Step 2 Obtain sampling values through I addresses.

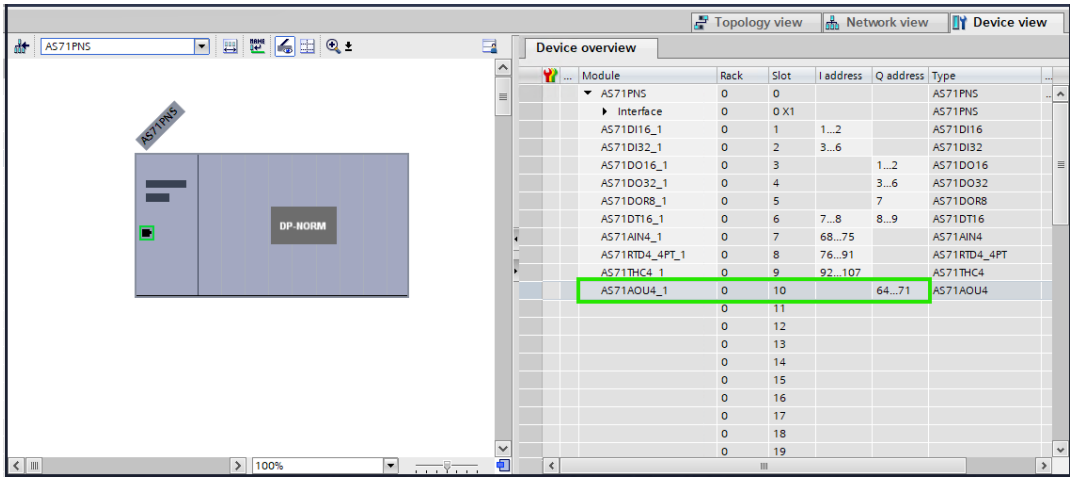



### 6.3.1.2.5 Analog output module

Step 1 In the **Device view** interface, add **AS71AOU4**, double-click **AS71AOU4** under **Module**, choose **Properties** > **General** > **Module parameters > General parameters**, and then set module initialization parameters.

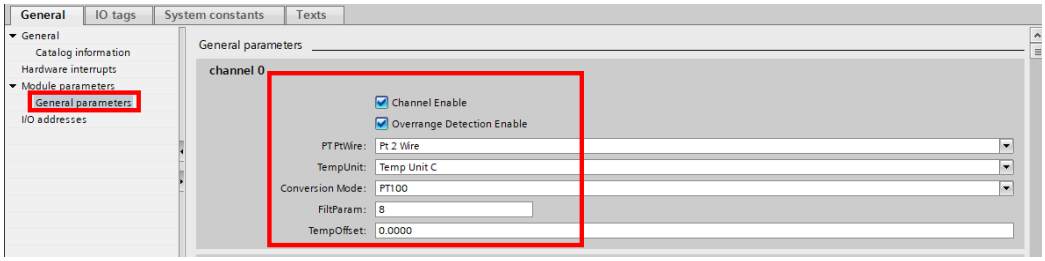


Step 2 Control output through Q addresses.

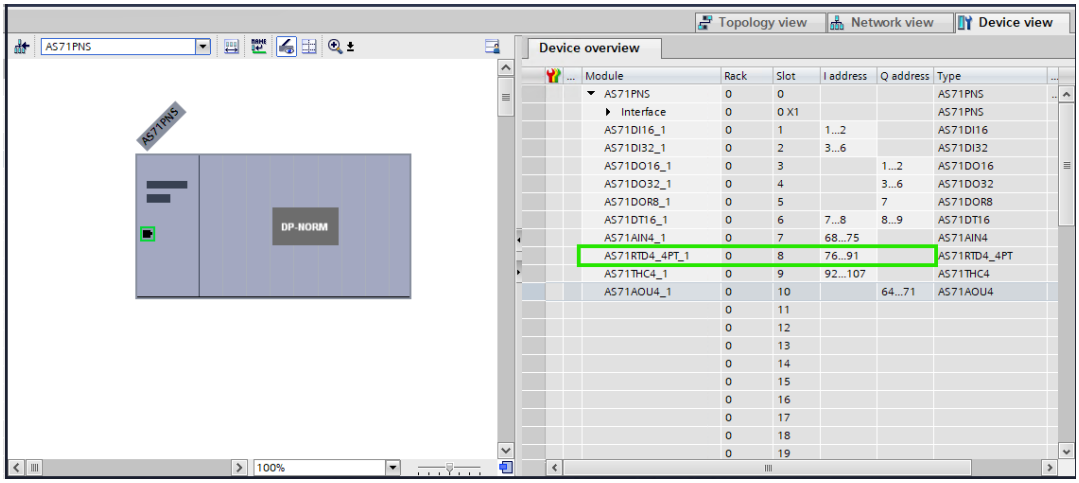



## 6.3.1.2.6 Temperature detection module

Step 1 In the **Device view** interface, add **AS71RTD4** , double-click **AS71RTD4** under **Module**, choose **Properties** > **General** > **Module parameters** > **General parameters**, and then set module initialization parameters.

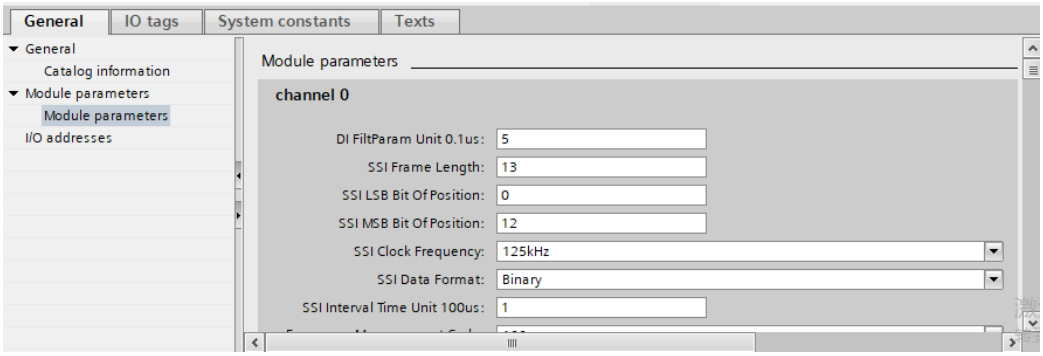



Step 2 Obtain sampling values through I addresses.



### 6.3.1.2.7 Counting and measurement module

Step 1 In the **Device view** interface, add **AS71AN02** , double-click **AS71AN02** 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.

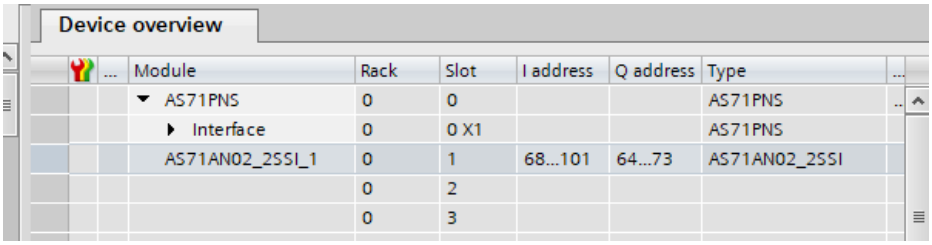



Table 6-1 Q address description

| Address | Parameter name | Type | Meaning |
|---|---|---|---|
| %QB64 | Cnt0_Ctrl | USINT | Control parameter for counter 0.<br>Bit0: Counter enable, active high<br>Bit 1: Reserved<br>Bit2: Reserved<br>Bit3: Reserved<br>Bit4: Counter comparison function enable, active high (requires counter enable first)<br>Bit7–bit5: Reserved |
| %QB65 | Cnt1_Ctrl | USINT | Control parameter for counter 1.<br>Bit0: Counter enable, active high<br>Bit 1: Reserved<br>Bit2: Reserved<br>Bit3: Reserved<br>Bit4: Counter comparison function enable, active high (requires counter enable first)<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<br>Bit1: Reverse run flag<br>Bit2: Reserved<br>Bit3: Reserved<br>Bit4: DI latch completion flag |

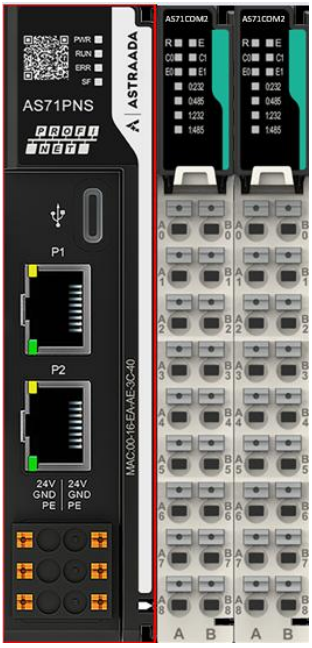
| Address | Parameter name | Type | Meaning |
|---|---|---|---|
| | | | Bit5: Reserved<br>Bit6: Data line idle status<br>Bit7: Reserved |
| %IB69 | Cnt0_Status | USINT | Counter 1 count state feedback<br>Bit0: Forward run flag<br>Bit1: Reverse run flag<br>Bit2: Reserved<br>Bit3: Reserved<br>Bit4: DI latch completion flag<br>Bit5: Reserved<br>Bit6: Data line idle status<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) |

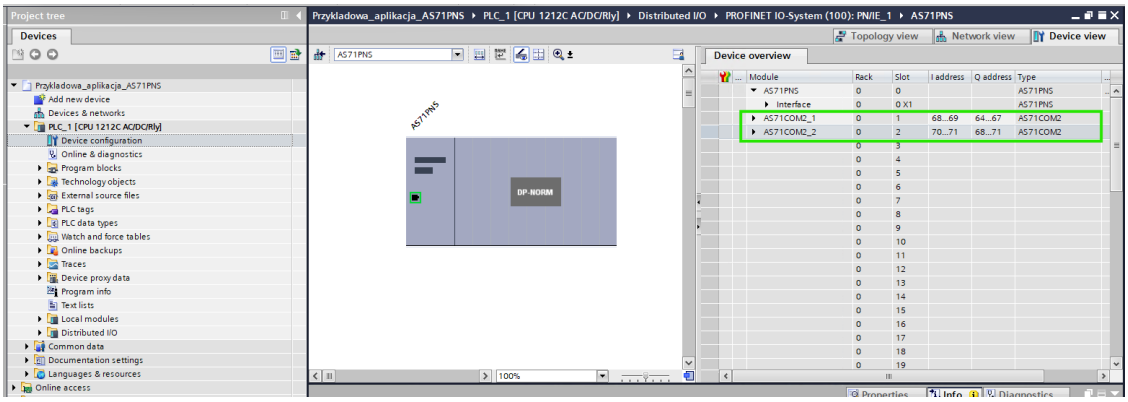
#### 6.3.1.2.8 AS71COM2 serial communication module

The AS71COM2 serial communication module adopts a dual-channel design. It can be configured for RS485 or RS232 communication and can operate in Modbus RTU master/slave mode or free-protocol communication mode.

**Note:** The serial communication module implements its functions through the base module and function-code subslots. Each function code occupies one subslot, and one serial communication module supports a maximum of 31 subslot configurations.

The configuration is described using two AS71COM2 serial communication modules as an example. Each communication channel in the system can be configured separately as Modbus RTU master, Modbus RTU slave, or free-protocol mode to meet the communication requirements of different application scenarios.



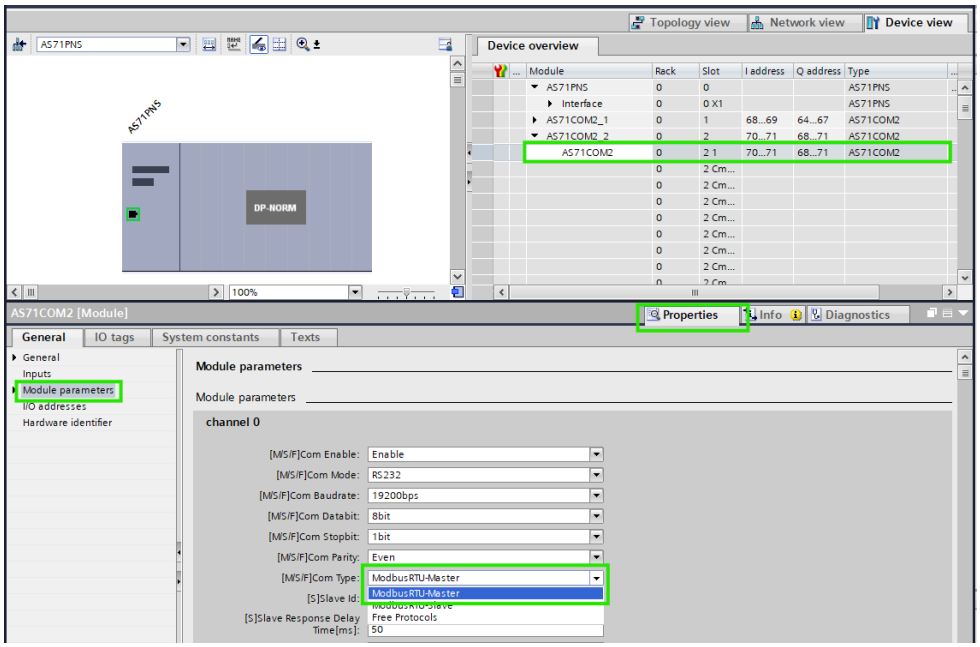

## 6.3.1.2.8.1 Modbus RTU master instructions

The master module supports the following function codes:

| Function code | Name | Description | Operation type |
|---|---|---|---|
| 0x01 | Read Coils | Read coils | Bit operation (multiple) |
| 0x02 | Read Discrete Inputs | Read discrete inputs | Bit operation (multiple) |
| 0x03 | Read Holding Registers | Read holding registers | Word operation (multiple) |
| 0x04 | Read Input Registers | Read input registers | Word operation (multiple) |
| 0x05 | Write Single Coil | Write a single coil | Bit operation (single) |
| 0x06 | Write Single Register | Write a single holding | Word operation |

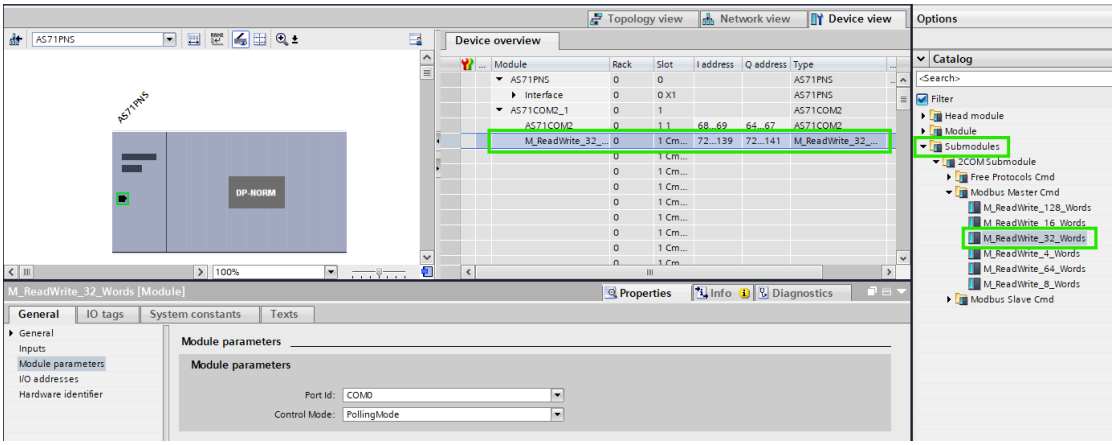
| Function code | Name | Description | Operation type |
|---|---|---|---|
| | | register | (single) |
| 0x0F | Write Multiple Coils | Write multiple coils | Bit operation (multiple) |
| 0x10 | Write Multiple Registers | Write multiple holding registers | Word operation (multiple) |

When the serial communication module is configured as a Modbus RTU master, function-code subslots with read/write data sizes of 4, 8, 16, 32, 64, or 128 words can be configured, allowing users to allocate input/output resources properly according to the application scenario. For the configurable function-code subslot types, see section 6.1.10.2 Serial communication module – Modbus RTU master virtual module.

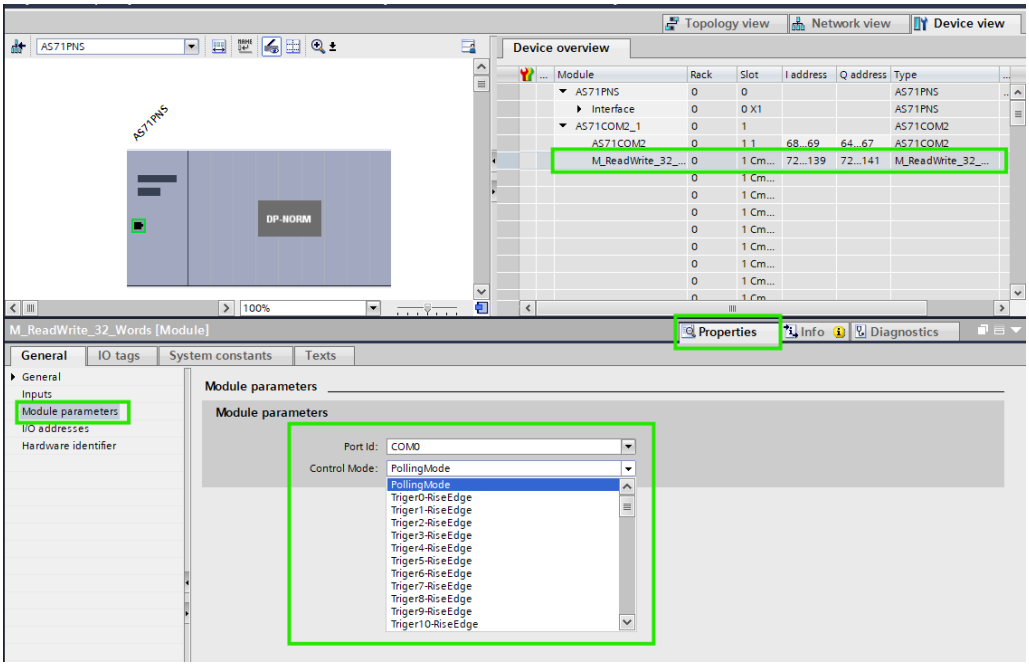



Example: Channel 0 of the first AS71COM2 serial communication module configured as master mode:

- **Add a master function-code subslot: M_ReadWrite_32_Words**



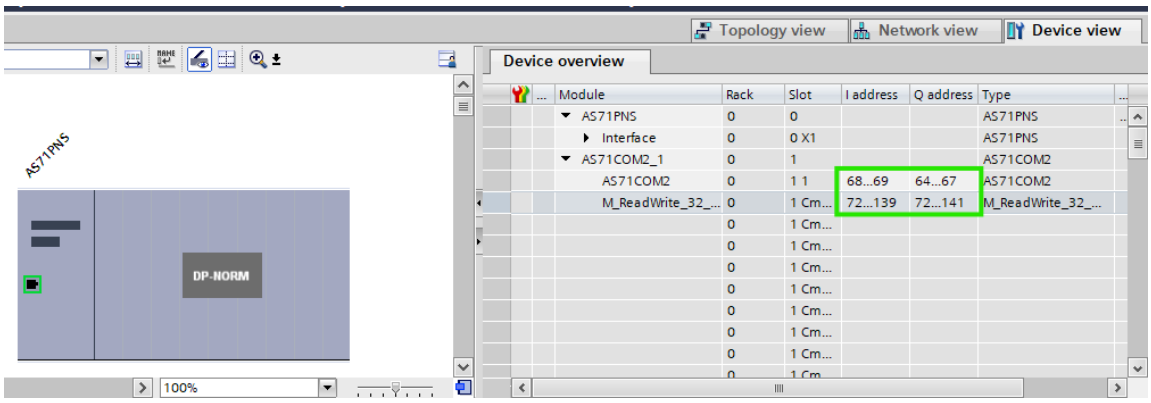

- **Parameter configuration of the M_ReadWrite_32_Words function-code subslot**




Multiple master function-code subslots can be configured under the same module channel.

After a channel is bound to a master function-code subslot, the subslot can be configured to operate in polling, trigger, or other operating modes. For details about the parameters, refer to section 6.1.10.2 Serial communication module – Modbus RTU master virtual module.

- **Input/Output data**




For the meanings of the I-area addresses assigned to input data, refer to the TxPDO feedback parameters of the corresponding submodules in section 6.1.10 Serial communication module (AS71COM2). For the meanings of the Q-area addresses assigned to output data, refer to the RxPDO control parameters of the corresponding submodules in section 6.1.10 Serial communication module (AS71COM2).

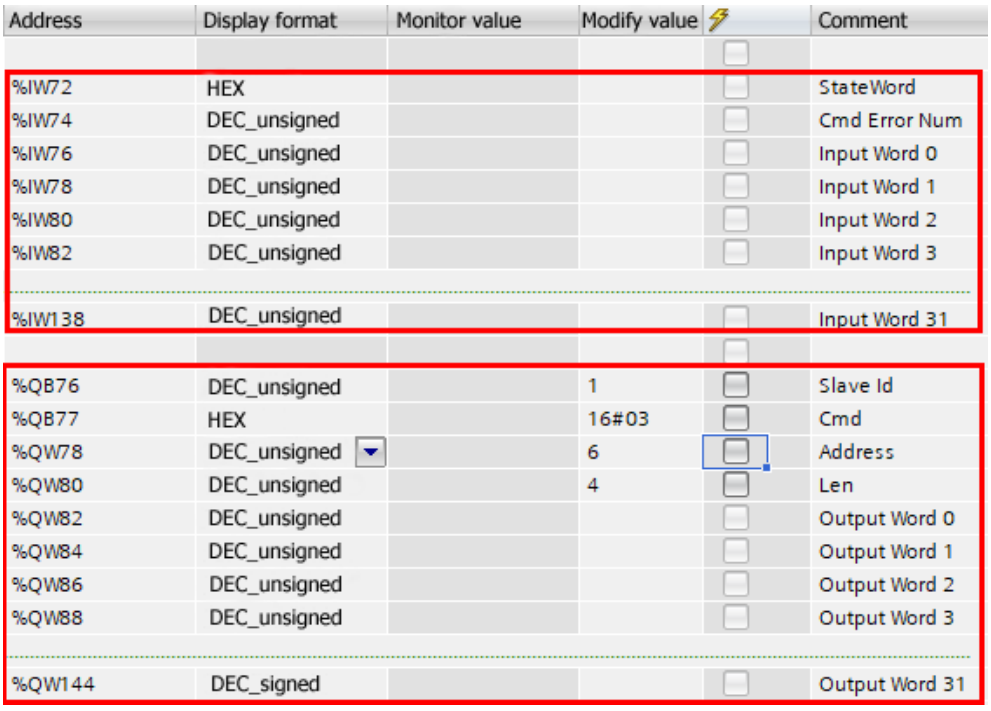
Example 1: The I-area addresses of the AS71COM2module are %IB68 to %IB69. For their meanings, refer to the TxPDO feedback parameters of the submodules in section 6.1.10.1 Serial communication module–AS71COM2_2COM. The Q-area addresses are %QB68 to %QB71. For their meanings, refer to the RxPDO control parameters of the submodules in section 6.1.10.1 Serial communication module–AS71COM2_2COM. The meanings are as follows:

| Name | Display format | Monitor value | Modify value | Comment |
|---|---|---|---|---|
| %IB68 | DEC_unsigned | | | com0 err |
| %IB69 | DEC_unsigned | | | com1 err |
| | | | | |
| %QB68 | HEX | | | triger00~07 |
| %QB69 | HEX | | | triger10~17 |
| %QB70 | HEX | | | triger20~27 |
| %QB71 | HEX | | | triger30~37 |

| Classification | Index/Subindex | Name | Data type | Description |
|---|---|---|---|---|
| **Control parameter RxPDO** | 0x7040+0x80*n | 2COM Out-Map | - | Serial communication module control parameter |
| | Subindex 0x01 | Triger0 | BIT | Trigger control bit: Valid when Triger0-Riseedge or Triger0-levelcontinue is configured for the master module. |
| | ..... | ..... | ..... | Triger1–Triger30 |
| | Subindex 0x20 | Triger31 | BIT | Trigger control bit: Valid when Triger31-Riseedge or Triger31-levelcontinue is configured for the master module. |
| **Feedback parameter TxPDO** | 0x6040+0x80*n | 2COM In-Map | - | Serial communication module status feedback parameter |
| | Subindex 0x01 | ModuleErrID | UINT | For module error codes, see 8.1 Common faults and solutions. |
| | Subindex 0x02 | Slaver0_errno | USINT | Communication fault code of Channel 0 slave. See 8.2 Serial communication module exception code description. |
| | Subindex 0x03 | Slaver1_errno | USINT | Communication fault code of Channel 1 slave. See 8.2 Serial communication module exception code description. |

**Note:** The only exception is that the I-area addresses of the AS71COM2module do not include the ModuleErrID data in TxPDO.

Example 2: The I-area addresses of the M_ReadWrite_32_Words function-code subslot are %IB72 to %IB139. For their meanings, refer to the TxPDO feedback parameters of the submodules in section 6.1.10.2 Serial communication module – Modbus RTU master virtual module. The Q-area addresses are %QB76 to %QB145. For their meanings, refer to the RxPDO control parameters of the submodules in section 6.1.10.2 Serial communication module – Modbus RTU master virtual module. The meanings are as follows:



| Address | Display format | Monitor value | Modify value | Comment |
|---|---|---|---|---|
| %IW72 | HEX | | | StateWord |
| %IW74 | DEC_unsigned | | | Cmd Error Num |
| %IW76 | DEC_unsigned | | | Input Word 0 |
| %IW78 | DEC_unsigned | | | Input Word 1 |
| %IW80 | DEC_unsigned | | | Input Word 2 |
| %IW82 | DEC_unsigned | | | Input Word 3 |
| %IW138 | DEC_unsigned | | | Input Word 31 |
| %QB76 | DEC_unsigned | | 1 | Slave Id |
| %QB77 | HEX | | 16#03 | Cmd |
| %QW78 | DEC_unsigned | | 6 | Address |
| %QW80 | DEC_unsigned | | 4 | Len |
| %QW82 | DEC_unsigned | | | Output Word 0 |
| %QW84 | DEC_unsigned | | | Output Word 1 |
| %QW86 | DEC_unsigned | | | Output Word 2 |
| %QW88 | DEC_unsigned | | | Output Word 3 |
| %QW144 | DEC_signed | | | Output Word 31 |

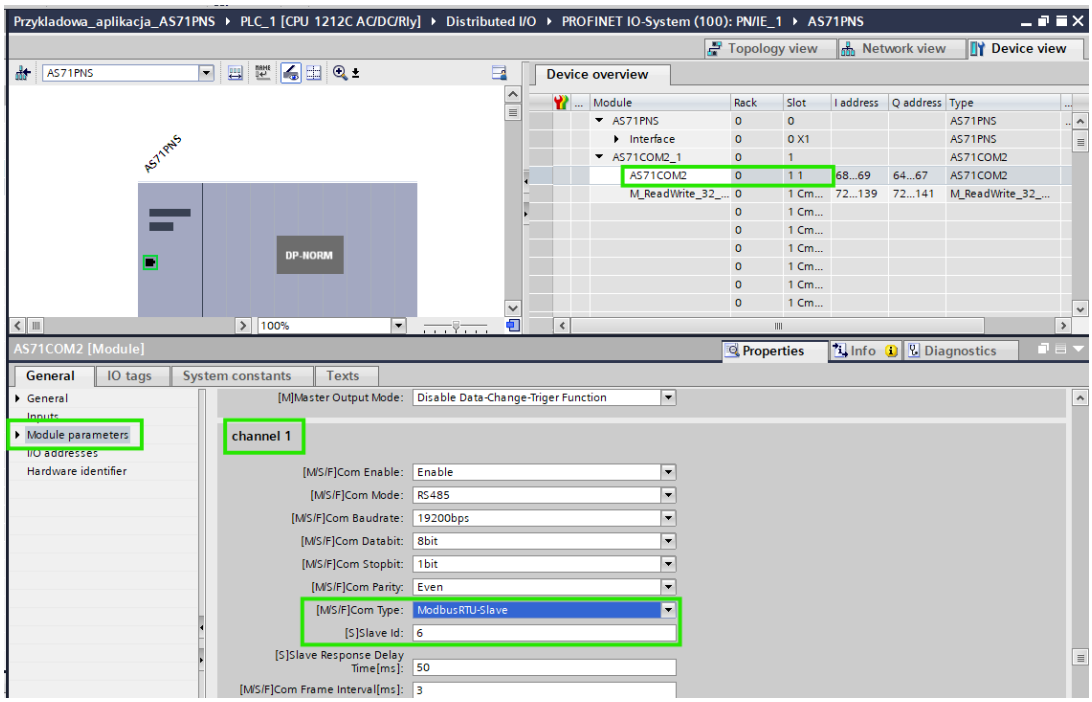
| Classification | Index/Subindex | Name | Data type | Description |
|---|---|---|---|---|
| **Control parameter RxPDO** | 0x7041+0x80*n | Output-Map | - | Master virtual module control parameter |
| | Subindex 0x01 | SlaveID | USINT | Slave ID: ID of the slave to be read, 1–247 |
| | Subindex 0x02 | Cmd | USINT | Function code: 01/02/03/04/05/06/15/16 |
| | Subindex 0x03 | Address | UINT | Register address |
| | Subindex 0x04 | Len | UINT | Length (The unit is Word or Bit, depending on the function code) |
| | Subindex 0x05 | OutputData1 | UINT | Corresponds to Address |
| | Subindex 0x06 | OutputData2 | UINT | Corresponds to Address+1 |
| | Subindex 0x07 | OutputData3 | UINT | Corresponds to Address+2 |
| | Subindex 0x08 | OutputData4 | UINT | Corresponds to Address+3 |
| **Feedback parameter TxPDO** | 0x6041+0x80*n | In-Map | - | Master virtual module status feedback parameter |
| | Subindex 0x01 | StateWord | UINT | =0: Idle; trigger bit is 0<br>=1: Executing; trigger bit level is 1, and sending has started<br>=2: Execution complete; sent and response received |
| | Subindex 0x02 | CmdErrno | UINT | See 8.2 Serial communication module exception code description |
| | Subindex 0x03 | InputData1 | UINT | Corresponds to Address |
| | Subindex 0x04 | InputData2 | UINT | Corresponds to Address+1 |
| | Subindex 0x05 | InputData3 | UINT | Corresponds to Address+2 |
| | Subindex 0x06 | InputData4 | UINT | Corresponds to Address+3 |

The application can access Modbus RTU slave devices through the bound channel by changing the values of the SlaveID, Cmd, Address, and Len parameters and using the configured control mode, either polling or trigger mode.

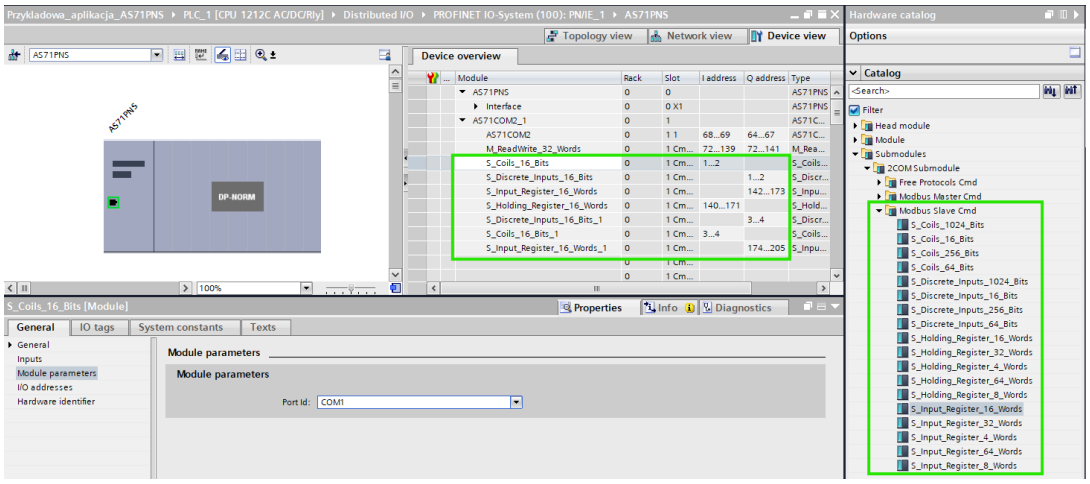
## 6.3.1.2.8.2 Modbus RTU slave instructions

When a channel is configured as slave mode, the configurable function-code subslot types are described in section 6.1.10.3 Serial communication module–Modbus RTU slave virtual module.

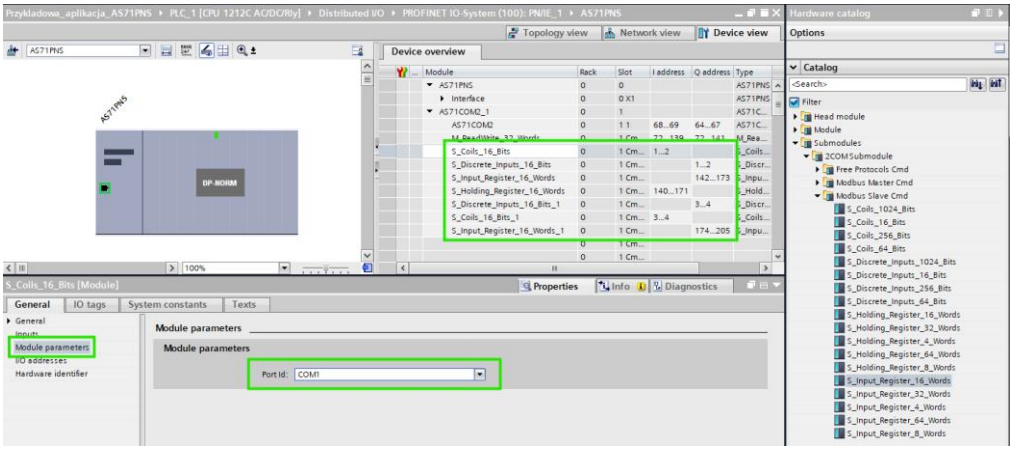
Example: Configure Channel 1 of the AS71COM2 serial communication module as slave mode, and set the slave ID to 6.




- **Add the following slave function-code subslots.**

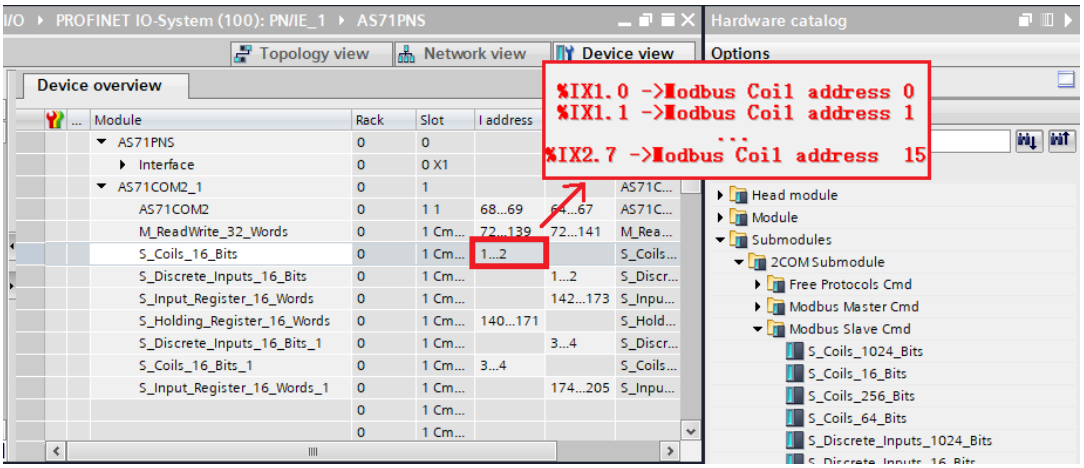


- **Configure the slave function-code subslot parameters and bind them to channel 1 of the AS71COM2 serial communication module.**



- **For slave function-code subslots of the same type, start addresses are assigned according to the allocation rules. The start address of the first function-code subslot starts from 0.**

- **The start address of the second Coils subslot continues from the address following the last address of the previous subslot, starting from 16.**




For the function codes used to access slave function-code subslots, see section 6.1.10.3 Serial communication module–Modbus RTU slave virtual module. For example, the master can use function codes 01/05/15 to access the Coils module defined above.

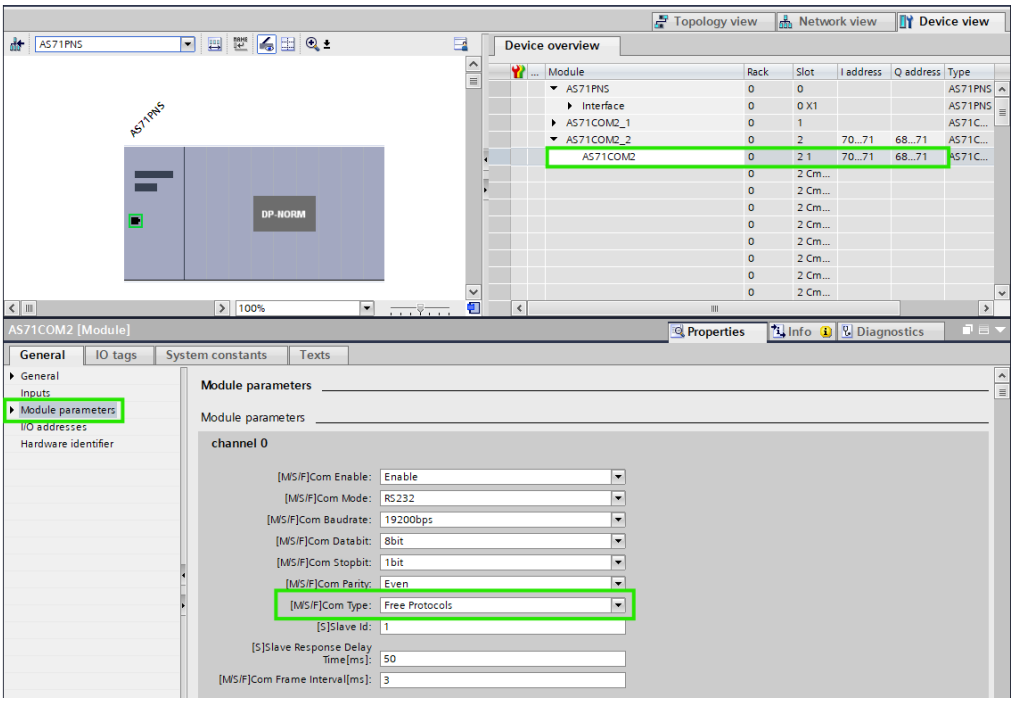
Channel error codes can be viewed through the feedback parameters com0 err and com1 err of the bound serial communication module, as shown in the following figure.

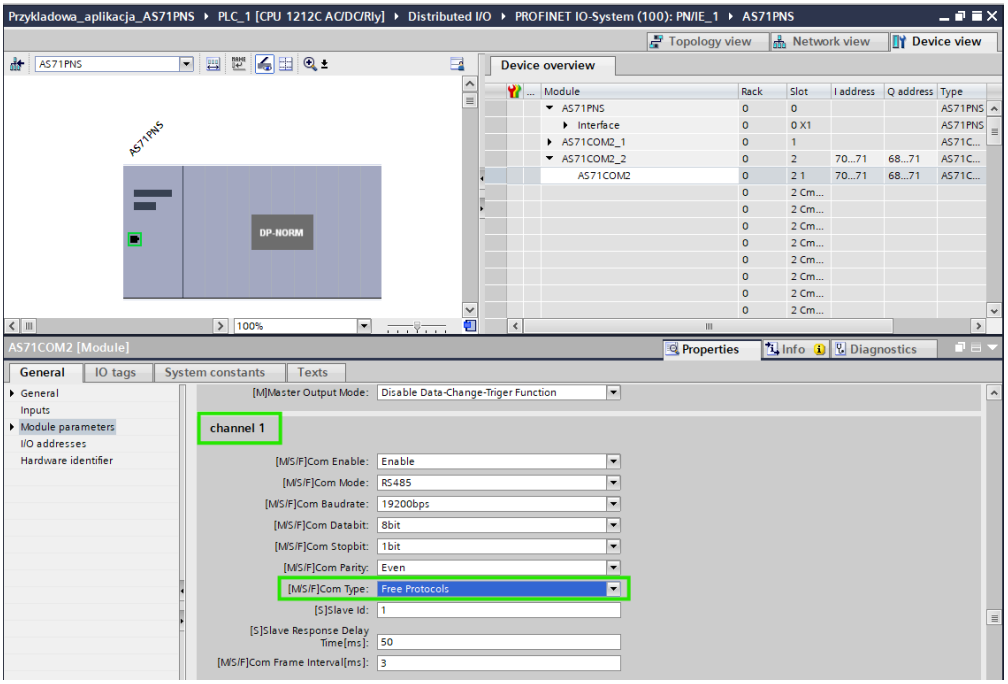
| Address | Display format | Monitor value | Modify value | Comment |
|---|---|---|---|---|
| %IB68 | DEC_unsigned | | | com0 err |
| %IB69 | DEC_unsigned | | | com1 err |
| | | | | |
| %QB68 | HEX | | | triger00~07 |
| %QB69 | HEX | | | triger10~17 |
| %QB70 | HEX | | | triger20~27 |
| %QB71 | HEX | | | triger30~37 |

### 6.3.1.2.8.3 Free protocol instructions

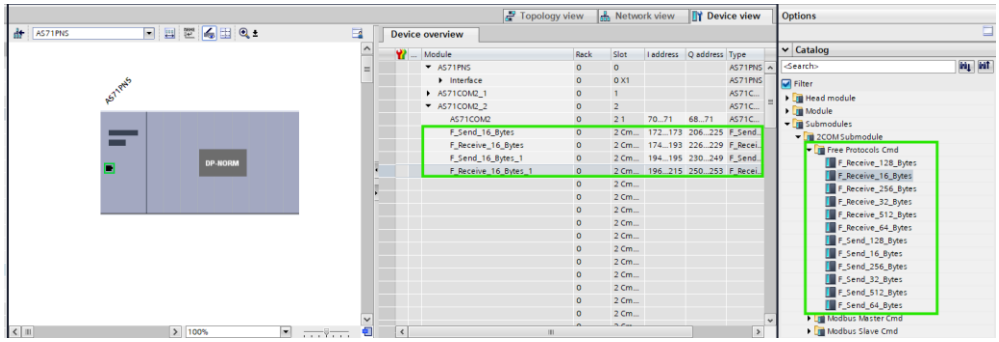
The maximum data frame length supported by the free protocol is 512 bytes. Transmit and receive subslots can be configured together on the same channel. RS232 supports simultaneous transmission and reception without blocking. RS485 does not support simultaneous transmission and reception. For details, see 6.1.10.4 Serial communication module–Free-protocol virtual module.

Example: Configure Channel 0 of the second AS71COM2 serial communication module for the free protocol and bind two free-protocol function subslots to it. Configure Channel 1 for the free protocol as well and bind two free-protocol function subslots to it.

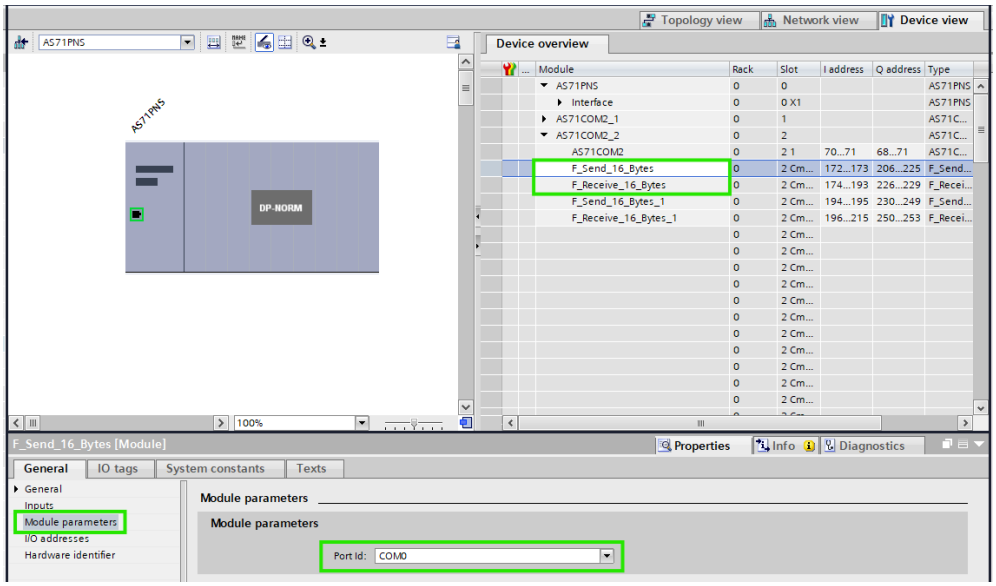


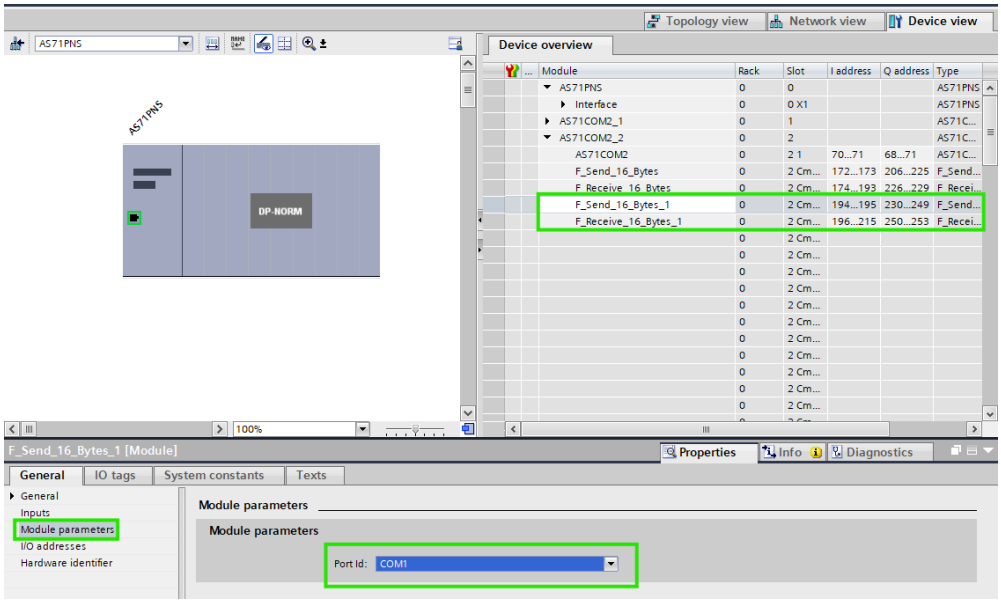
- **Add four free-protocol function subslots.**



- **Configure the parameters of two free-protocol function subslots and bind them to Channel 0 of the second AS71COM2 serial communication module.**



- **Configure the parameters of two free-protocol function subslots and bind them to Channel 1 of the second AS71COM2 serial communication module.**



For free-protocol function subslots, the meanings of the I-area addresses assigned to input data are

described in the TxPDO feedback parameters of the corresponding submodules in section 6.1.10.4 Serial communication module–Free-protocol virtual module. The meanings of the Q-area addresses assigned to output data are described in the RxPDO control parameters of the corresponding submodules in section 6.1.10.4 Serial communication module–Free-protocol virtual module.

Example 1: The I-area addresses of F_Send_16_Bytes are %IB172 to %IB173. For their meanings, refer to the TxPDO feedback parameters of the submodules in section 6.1.10.4.1 Free-protocol transmit module. The Q-area addresses are %QB210 to %QB229. For their meanings, refer to the RxPDO control parameters of the submodules in section 6.1.10.4.1 Free-protocol transmit module. The meanings are as follows:

| Address | Display format | Monitor value | Modify value | | Comment |
|---|---|---|---|---|---|
| | | | | | |
| %IW172 | HEX | | | | SendState |
| | | | | | |
| %QW210 | DEC_unsigned | | | | ControlWord |
| %QW212 | DEC_unsigned | | | | SendLen |
| %QB214 | DEC_unsigned | | | | OutputData0 |
| %QB215 | DEC_unsigned | | | | OutputData1 |
| %QB216 | DEC_unsigned | | | | OutputData2 |
| %QB217 | DEC_unsigned | | | | OutputData3 |
| %QB218 | DEC_unsigned | | | | OutputData4 |
| %QB219 | DEC_unsigned | | | | OutputData5 |
| %QB220 | DEC_unsigned | | | | OutputData6 |
| %QB221 | DEC_unsigned | | | | OutputData7 |
| %QB222 | DEC_unsigned | | | | OutputData8 |
| %QB223 | DEC_unsigned | | | | OutputData9 |
| %QB224 | DEC_unsigned | | | | OutputData10 |
| %QB225 | DEC_unsigned | | | | OutputData11 |
| %QB226 | DEC_unsigned | | | | OutputData12 |
| %QB227 | DEC_unsigned | | | | OutputData13 |
| %QB228 | DEC_unsigned | | | | OutputData14 |
| %QB229 | DEC_unsigned | | | | OutputData15 |

Example 2: The I-area addresses of F_Receive_16_Bytes are %IB174 to %IB193. For the their meanings, see the TxPDO feedback parameters of the submodule in 6.1.10.4.2 Free-protocol receive module. The Q-area addresses are %QB230 to %QB233. For their meanings, see the RxPDO control parameters of the submodule in 6.1.10.4.2 Free-protocol receive module, as described below:

| Address | Display format | Monitor value | Modify value | | Comment |
|---|---|---|---|---|---|
| | | | | | |
| %IW174 | HEX | | | | ReceiveState |
| %IW176 | DEC_unsigned | | | | ActRecLen |
| %IB178 | DEC_unsigned | | | | InputData0 |
| %IB179 | DEC_unsigned | | | | InputData1 |
| %IB180 | DEC_unsigned | | | | InputData2 |
| %IB181 | DEC_unsigned | | | | InputData3 |
| %IB182 | DEC_unsigned | | | | InputData4 |
| %IB183 | DEC_unsigned | | | | InputData5 |
| %IB184 | DEC_unsigned | | | | InputData6 |
| %IB185 | DEC_unsigned | | | | InputData7 |
| %IB186 | DEC_unsigned | | | | InputData8 |
| %IB187 | DEC_unsigned | | | | InputData9 |
| %IB188 | DEC_unsigned | | | | InputData10 |
| %IB189 | DEC_unsigned | | | | InputData11 |
| %IB190 | DEC_unsigned | | | | InputData12 |
| %IB191 | DEC_unsigned | | | | InputData13 |
| %IB192 | DEC_unsigned | | | | InputData14 |
| %IB193 | DEC_unsigned | | | | InputData15 |
| | | | | | |
| %QW230 | HEX | | | | ControlWord |
| %QW232 | DEC_unsigned | | | | ReceiveLen |

The free-protocol transmit module sends data by setting the ControlWord to 1, specifying the SendLen and the transmit data, and then the required data can be transmitted.

The free-protocol receive module enters the receive state by setting the ControlWord to 1. It does not require a specified receive length. The end of a frame is determined by the frame interval time. If the received frame length exceeds the total receive capacity of the virtual module, the reception fails; otherwise, the reception is successful.

To perform another transmission or reception, the ControlWord must first be set to 0 and then set back to 1 to re-enter the operation state.

# 6.4 EtherNet/IP configuration

## 6.4.1 Overview

This section describes how the A-Series I/O system connects to the EtherNet/IP network via the AS71EIP coupler, enabling real-time data exchange with a host controller or PLC.

In EtherNet/IP communication, the Electronic Data Sheet (EDS) file is a prerequisite for system configuration. It not only defines the communication parameters, I/O mapping, and object dictionary information of the coupler and expansion modules, but also provides device identification and data exchange capabilities for the master station software. The master station software can correctly recognize the AS71EIP coupler and its connected I/O modules only after importing the EDS file.

The EDS file of the AS71EIP EtherNet/IP coupler is available in two forms: one is a generic EDS file, and the other is a dedicated EDS file generated by the Astraada A-Series IO Studio configuration software based on the actual system configuration.

### 6.4.1.1 Generic EDS file

The generic EDS file (AS71EIP_universal_V1.0.eds) can be used directly in most PLC or configuration software environments. It is independent of specific expansion module configurations. The master station software can use this file to correctly identify the coupler and establish basic communication.

The EDS file defines six connection types:

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 6-2 Number of bytes occupied by I/O modules

| No. | Module | Input(T→O): bytes | Output(O→T): bytes |
|---|---|---|---|
| 0 | AS71EIP | 4 | 0 |
| 1 | AS71DI16 | 2 | 0 |
| 2 | AS71DI32 | 4 | 0 |
| 3 | AS71DO16 | 0 | 2 |
| 4 | AS71DO32 | 0 | 4 |

| No. | Module | Input(T→O): bytes | Output(O→T): bytes |
|---|---|---|---|
| 5 | AS71DOR8 | 0 | 2 |
| 6 | AS71AIN4 | 8 | 0 |
| 7 | AS71RTD4 | 16 | 0 |
| 8 | AS71THC4 | 16 | 0 |
| 9 | AS71AOU4 | 0 | 8 |
| 10 | AS71DT16 | 2 | 2 |
| 11 | AS71IN02 | 34 | 18 |

Table 6-3 Parameter names for byte mapping of T→O and O→T

| T→O byte | T→O parameter name |
|---|---|
| 0 | hwVersion |
| 1 | |
| 2 | swVersion |
| 3 | |
| 4 | 1600DI_IN0 |
| 5 | 1600DI_IN1 |
| 6 | 4PT-Temp0 |
| 7 | |
| 8 | |
| 9 | |
| 10 | 4PT-Temp1 |
| 11 | |
| 12 | |
| 13 | |
| 14 | 4PT-Temp2 |
| 15 | |
| 16 | |
| 17 | |
| 18 | 4PT-Temp3 |
| 19 | |
| 20 | |
| 21 | |
| **O→T byte** | **O→T parameter name** |
| 0 | 0008DR-OUT0 |
| 1 | Satisfy Parameter (Empty parameter) |

For example, combination of AS71EIP + AS71DI16 + AS71RTD4 + AS71DOR8

After checking the table:

AS71EIP: 4bytes Input(T→O), Parameter name: hwVersion, swVersion

AS71DI16_1600DI: 2bytes Input(T→O), Parameter name: 1600DI -IN0, 1600DI –IN1

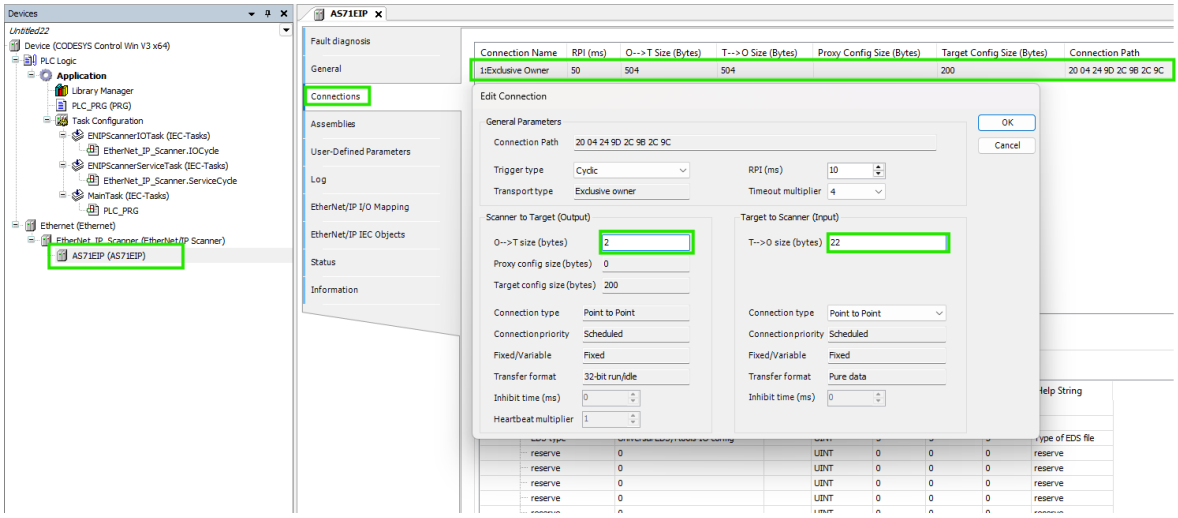
AS71RTD4_4PT: 16bytes Input(T→O), Parameter name: 4PT-Temp0–4PT-Temp4

AS71DOR8_0008DR: 2bytes Output(O→T), Parameter name: 0008DR-OUT0, 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 AS71EIP 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 |
|---|---|---|---|---|
| AS71EIP | EDS type | 0<br>1 | 1 | No |
| | 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 |
| AS71DI16 | slot1_FlexIO (AS71DI16) | 6<br>7<br>8<br>9 | 372330578 | No |
| | slot1_1600DI_Filt0 | 10<br>11 | 1000 | Yes |
| | slot1_1600DI_Filt1 | 12<br>13 | 1000 | Yes |
| AS71DI32 | slot2_FlexIO (AS71DI32) | 14<br>15<br>16<br>17 | 372330579 | No |
| | slot2_3200DI_Filt0 | 18<br>19 | 1000 | Yes |
| | slot2_3200DI_Filt1 | 20<br>21 | 1000 | Yes |

| Module | Configuration parameter name | Offset | Default value | Configurable |
|---|---|---|---|---|
| | slot2_3200DI_Filt2 | 22<br>23 | 1000 | Yes |
| | slot2_3200DI_Filt3 | 24<br>25 | 1000 | Yes |
| AS71DO16 | slot3_FlexIO (AS71DO16) | 26<br>27<br>28<br>29 | 372330586 | No |
| | slot3_0016DP_Stop_Mode0 | 30<br>31 | 0 | Yes |
| | slot3_0016DP_Stop_Mode1 | 32<br>33 | 0 | Yes |
| | slot3_0016DP_Stop_Output0 | 34 | 0 | Yes |
| | slot3_0016DP_Stop_Output1 | 35 | 0 | Yes |
| AS71DO32 | slot4_FlexIO (AS71DO32) | 36<br>37<br>38<br>39 | 372330587 | No |
| | slot4_0032DP_Stop_Mode0 | 40<br>41 | 0 | Yes |
| | slot4_0032DP_Stop_Mode1 | 42<br>43 | 0 | Yes |
| | slot4_0032DP_Stop_Mode2 | 44<br>45 | 0 | Yes |
| | slot4_0032DP_Stop_Mode3 | 46<br>47 | 0 | Yes |
| | slot4_0032DP_Stop_Output0 | 48 | 0 | Yes |
| | slot4_0032DP_Stop_Output1 | 49 | 0 | Yes |
| | slot4_0032DP_Stop_Output2 | 50 | 0 | Yes |
| | slot4_0032DP_Stop_Output3 | 51 | 0 | Yes |
| AS71DOR8 | slot7_FlexIO (AS71DOR8) | 78<br>79<br>80<br>81 | 372330601 | No |
| | slot7_0008DR_Stop_Mode | 82<br>83 | 0 | Yes |
| | slot7_0008DR_Stop_Output | 84 | 0 | Yes |
| AS71AIN4 | slot8_FlexIO (AS71AIN4) | 85<br>86<br>87<br>88 | 372330625 | No |
| | 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 |

| Module | Configuration parameter name | Offset | Default value | Configurable |
|---|---|---|---|---|
| | slot8_4AD_AI3_Filt | 96 | 8 | Yes |
| AS71RTD4 | slot9_FlexIO (AS71RTD4) | 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 | | |
| AS71THC4 | slot10_FlexIO (AS71THC4) | 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 | | |
| | slot10_4TC_Temp3_Offset | 135 | 0 | Yes |
| | | 136 | | |
| AS71AOU4 | slot11_FlexIO (AS71AOU4) | 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 |

| Module | Configuration parameter name | Offset | Default value | Configurable |
|---|---|---|---|---|
| | 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 | | |
| AS71DT16 | slot12_FlexIO (AS71DT16) | 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 |
| AS71IN02 | slot14_FlexIO (AS71IN02) | 181 | 372330673 | No |
| | | 182 | | |
| | | 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 | | |
| AS71EIP | Satisfy Parameter | 205 | 0 | No |

**Note:** For parameter configuration, refer to section 6.1 Parameter description.

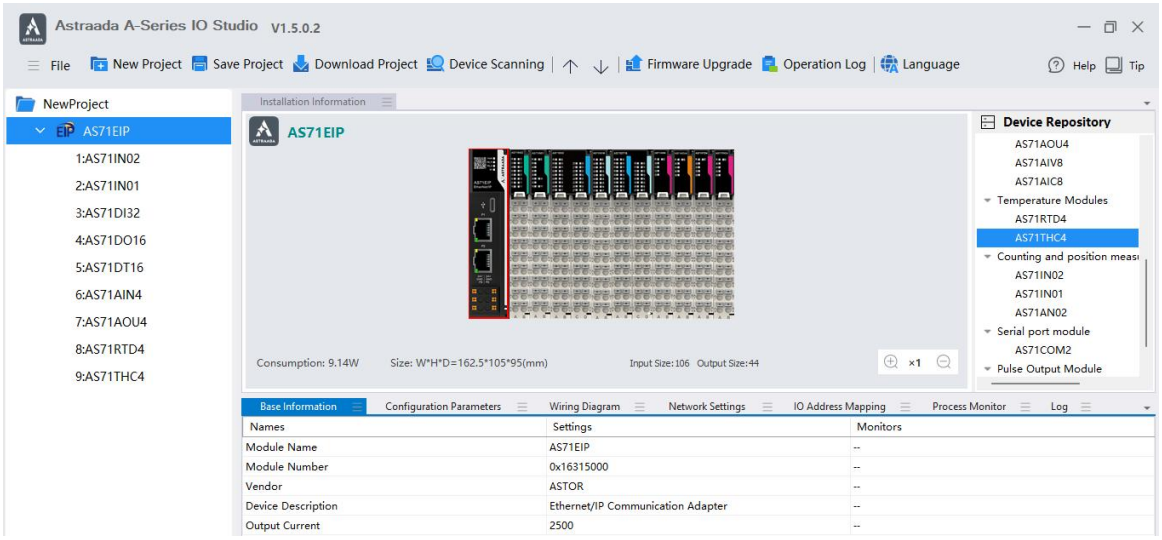
### 6.4.1.2 Dedicated EDS file

The dedicated EDS file can be automatically generated using the Astraada A-Series IO Studio.exe software tool according to the actual configuration. When configuring the master station, it is not necessary to manually set the Input(T→O) Size/Output(O → T) Size.

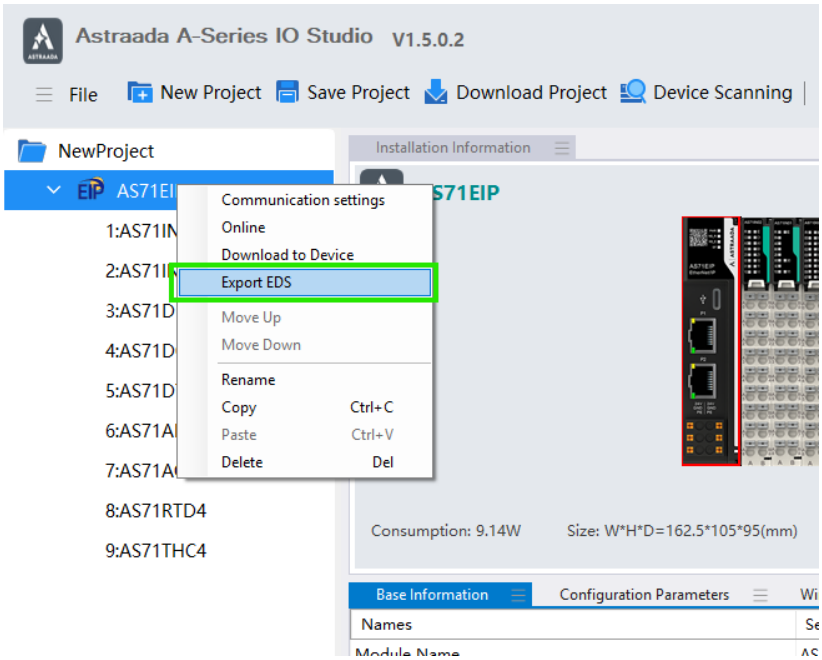
**Note:** Please use Astraada A-Series IO Studio.exe V1.1.0.10 or later.

- Taking AS71EIP as an example, the steps to generate a dedicated EDS file are as follows:

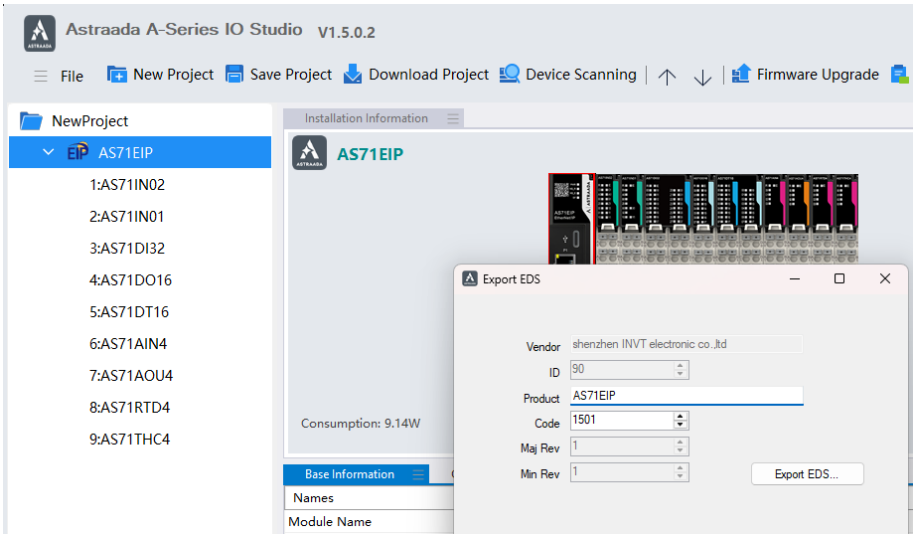
1. Power on the coupler, connect it to the PC using a Type-C cable, and run the Astraada A-Series IO Studio software.




2. Right-click AS71EIP > **EDS export**.

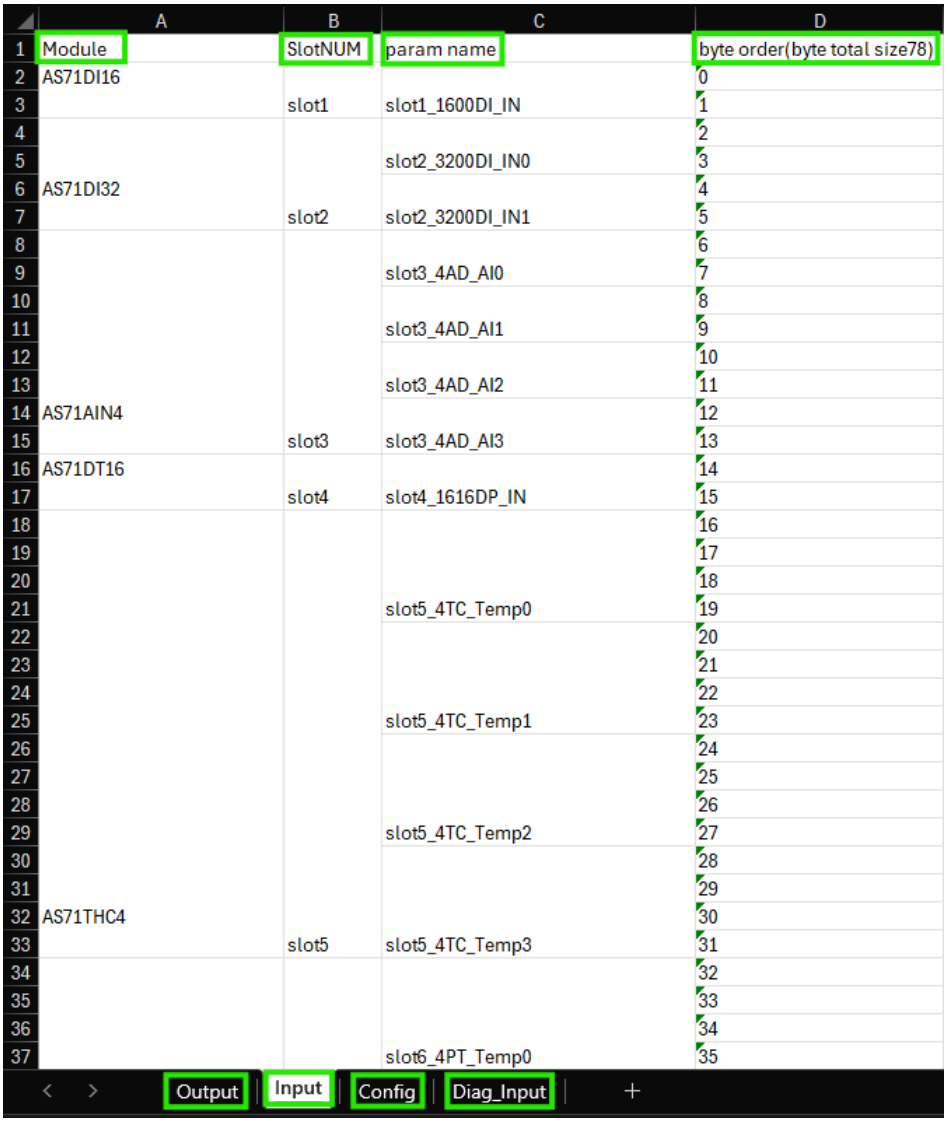


3. Click **Export EDS...**.




**Note:** The product code can be modified to distinguish non-configured EDS files.

After completing the above steps, two files must be generated: A dedicated EDS file (AS71EIP.eds) and an I/O mapping table (AS71EIP_IO.xlsx). The I/O mapping table includes Input (input process data), Output (output process data), and Config (configuration data). Each mapping table consists of module, name, and byte index. The name is composed of the slot name, module name, and parameter name. From the name, the slot and module type can be identified. From the byte index, the offset address and the number of occupied bytes can be determined. A schematic diagram is shown below:



| | A | B | C | D |
|---|---|---|---|---|
| 1 | Module | SlotNUM | param name | byte order(byte total size78) |
| 2 | AS71DI16 | | | 0 |
| 3 | | slot1 | slot1_1600DI_IN | 1 |
| 4 | | | | 2 |
| 5 | | | slot2_3200DI_IN0 | 3 |
| 6 | AS71DI32 | | | 4 |
| 7 | | slot2 | slot2_3200DI_IN1 | 5 |
| 8 | | | | 6 |
| 9 | | | slot3_4AD_AI0 | 7 |
| 10 | | | | 8 |
| 11 | | | slot3_4AD_AI1 | 9 |
| 12 | | | | 10 |
| 13 | | | slot3_4AD_AI2 | 11 |
| 14 | AS71AIN4 | | | 12 |
| 15 | | slot3 | slot3_4AD_AI3 | 13 |
| 16 | AS71DT16 | | | 14 |
| 17 | | slot4 | slot4_1616DP_IN | 15 |
| 18 | | | | 16 |
| 19 | | | | 17 |
| 20 | | | | 18 |
| 21 | | | slot5_4TC_Temp0 | 19 |
| 22 | | | | 20 |
| 23 | | | | 21 |
| 24 | | | | 22 |
| 25 | | | slot5_4TC_Temp1 | 23 |
| 26 | | | | 24 |
| 27 | | | | 25 |
| 28 | | | | 26 |
| 29 | | | slot5_4TC_Temp2 | 27 |
| 30 | | | | 28 |
| 31 | | | | 29 |
| 32 | AS71THC4 | | | 30 |
| 33 | | slot5 | slot5_4TC_Temp3 | 31 |
| 34 | | | | 32 |
| 35 | | | | 33 |
| 36 | | | | 34 |
| 37 | | | slot6_4PT_Temp0 | 35 |

Output | Input | Config | Diag_Input | +

- **Name description**
  - **slot1_1600DI_IN**: slot1 is the first slot counted from the coupler end, the module is 1600DI, and the parameter is **IN**.
  - **slot5_4TC_Temp0**: slot5 is the tenth slot counted from the coupler end, the module is 4TC, and the parameter is **Temp0**.
- **Parameter description**

  See 6.1 Parameter description for the specific module configuration description.

### 6.4.1.3 Object information

Object attributes can be read or configured via UCMM using the Get Attribute Single (0x0E) and Set Attribute Single (0x10) services. Common object attributes are listed in the table below.

| Data object | Class | Instance | Attribute | Service | Remarks |
|---|---|---|---|---|---|
| Coupler information | 0x04 | 0x68 | 0x03 | 0x0E | Byte 0–1: Number of Act num modules<br>Byte 2–3: Hw version<br>Byte 4–5: Sw version<br>Byte 6–7: Fpga version |
| Module configuration | 0x04 | 0x69 | 0x03 | 0x0E | Byte 0–31: Slot 1–32 module type<br>Module does not exist: 0x00 |

| Data object | Class | Instance | Attribute | Service | Remarks |
|---|---|---|---|---|---|
| | | | | | AS71DI16: 0x12<br>AS71DO16: 0x1A<br>AS71DOR8: 0x29<br>AS71AIN4:0x41<br>AS71AOU4: 0x49<br>AS71RTD4: 0x61<br>AS71THC4: 0x69 |
| Slot 1 module info | 0x04 | 0x70 | 0x03 | 0x0E | Byte 0–1: Hw version<br>Byte 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 | - |

## 6.4.2 CODESYS configuration example

### 6.4.2.1 Preparation

- **Hardware**

| Type | Model | Quantity | Slot |
|---|---|---|---|
| PC | PC (CODESYS V3.5 installed) | 1 | - |
| Network cable | Configured according to actual requirements | 1 | - |
| Power supply | | 1 | - |
| PLC | CODESYS Control WIN V3 – x64 SysTray | 1 | - |
| Coupler | AS71EIP | 1 | 0 |
| I/O module | AS71DI32 | 1 | 1 |
| | AS71THC4 | 1 | 2 |
| | AS71AIN4 | 1 | 3 |
| | AS71AOU4 | 1 | 4 |
| | AS71IN02 | 1 | 5 |
| | AS71DI16 | 1 | 6 |
| | AS71DT16 | 1 | 7 |
| | AS71DOR8 | 1 | 8 |
| | AS71RTD4 | 1 | 9 |
| | AS71DO32 | 1 | 10 |
| | AS71DO16 | 1 | 11 |
| Bottom cover | Bottom cover | 1 | 12 |

For hardware configuration and connection, see the requirements and operations described in chapters 3 Installation and 4 Wiring.

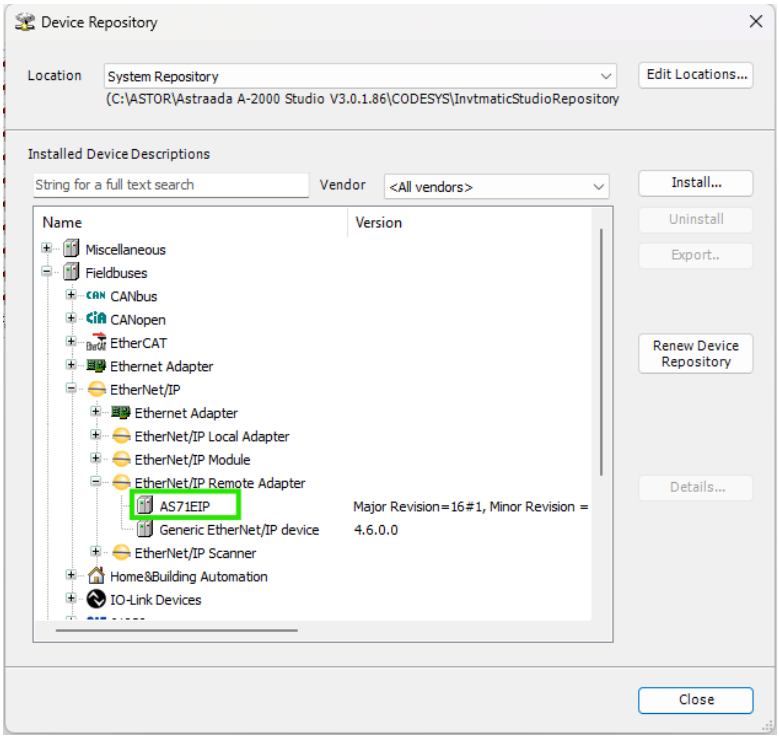
- **Software**

Device configuration file (Choose one of the following two options)

- Generic EDS file: **AS71EIP_universal_V1.0.eds**
- Dedicated EDS file: Generated using the Astraada A-Series IO Studio software based on the description in section 6.4.1.2 Dedicated EDS file, resulting in AS71EIP.eds.

### 6.4.2.2 EDS file installation

Open the CODESYS software, choose **Tools** > **Device Repository**, click **Install**, and select **AS71EIP_universal_V1.0.eds** to install. The installation is successful as shown in the figure below.

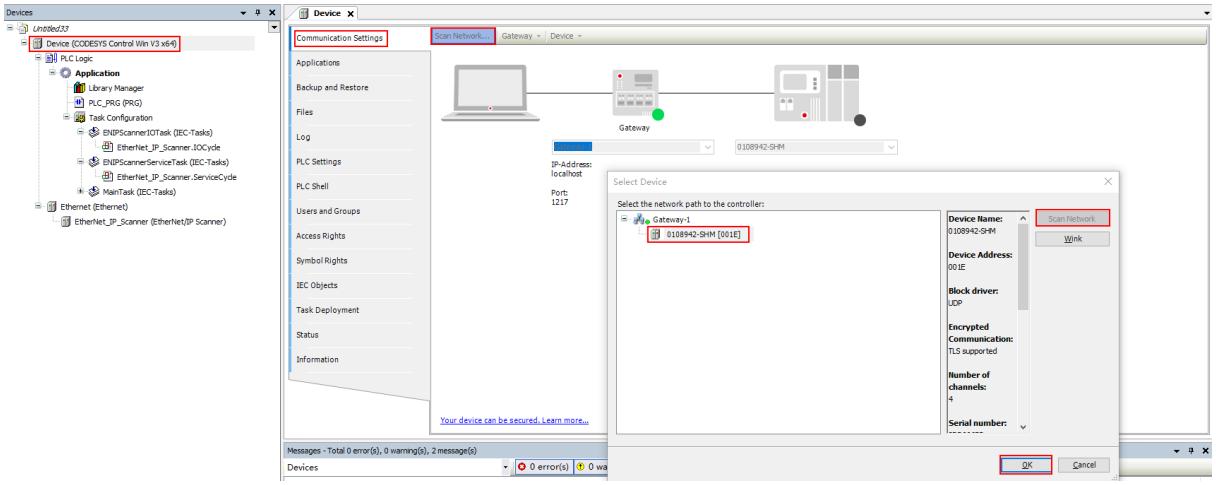



### 6.4.2.3 Project creation

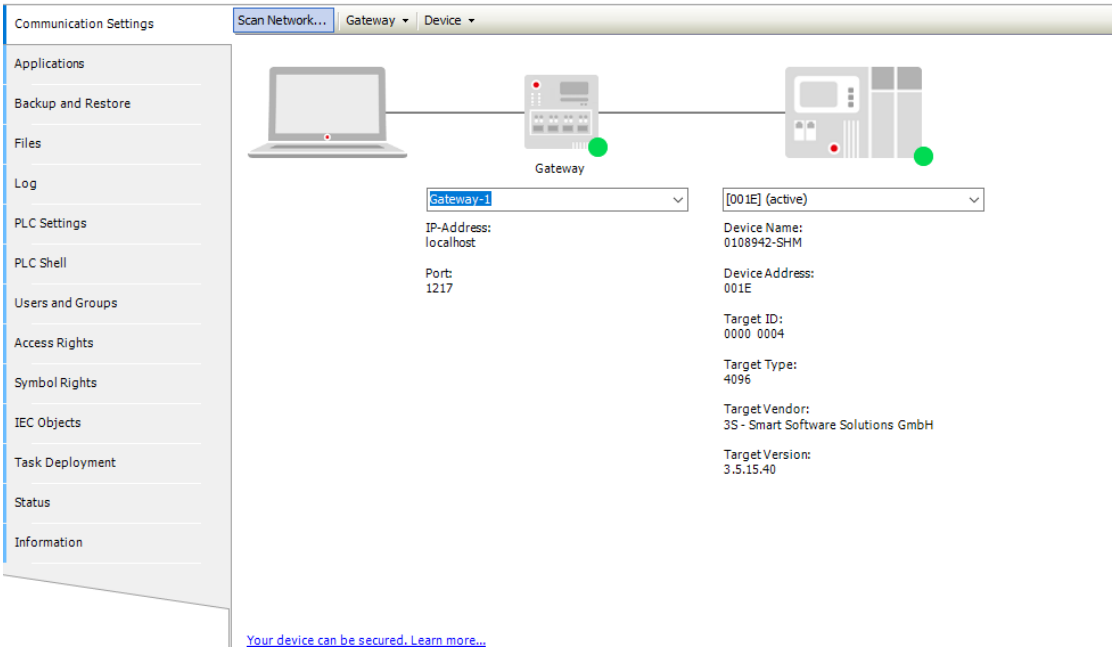
Step 1 Start the PLC: **CODESYS Control Win V3 - x64 SysTray**.

Step 2 Double-click **Device (CODESYS Control Win V3 x64)** on the left, then click **Scan Network** on the right.

Step 3 In the device selection interface, click **Scan Network**, select the network path, and click **OK**.

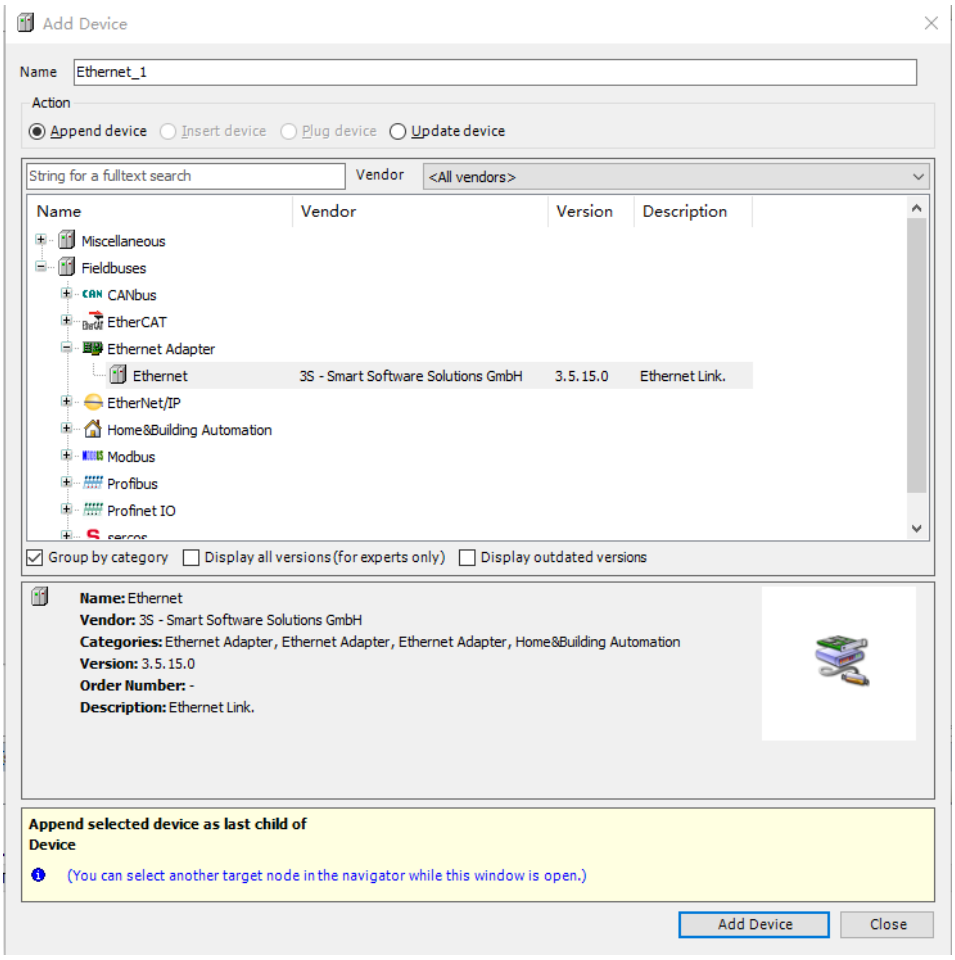


The network status is shown as active, as illustrated below.



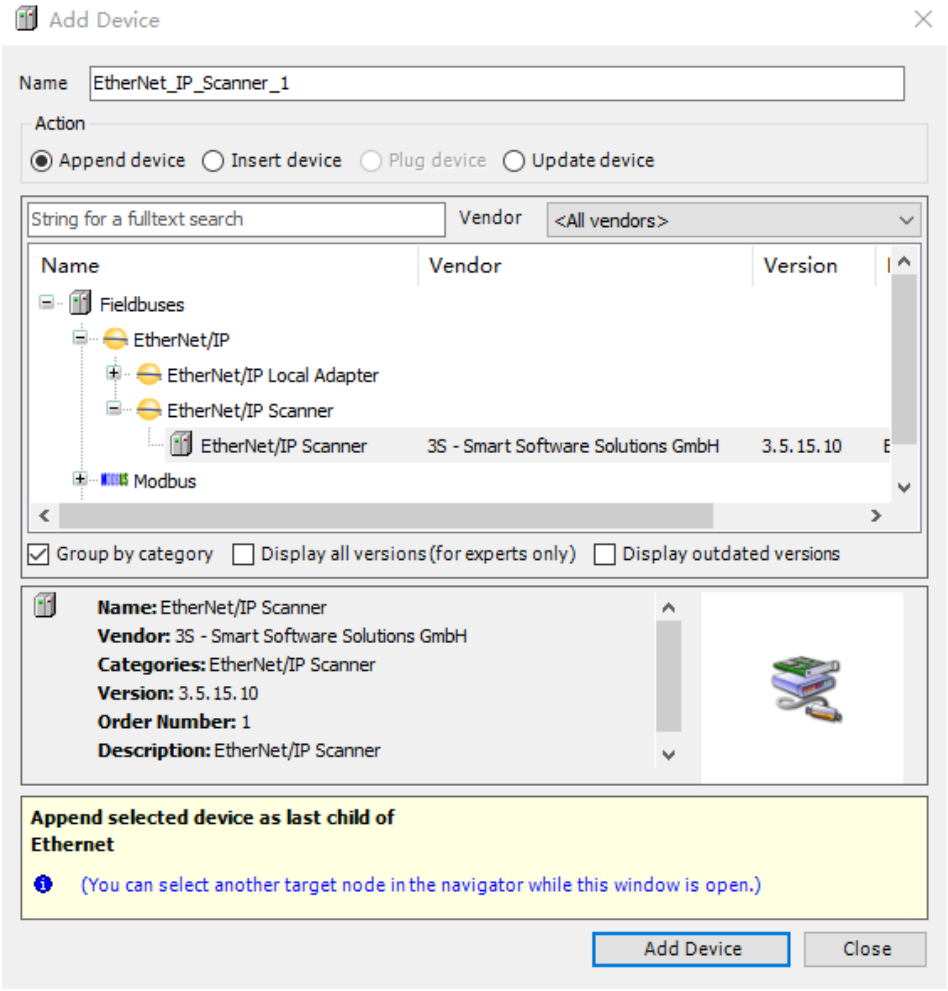

Step 4 Select **Device (CODESYS Control Win V3 x64)** on the left, right-click it, and choose **Add Device**.

Step 5 Select **EthernetIP** > **Ethernet Adapter** > **Ethernet**.

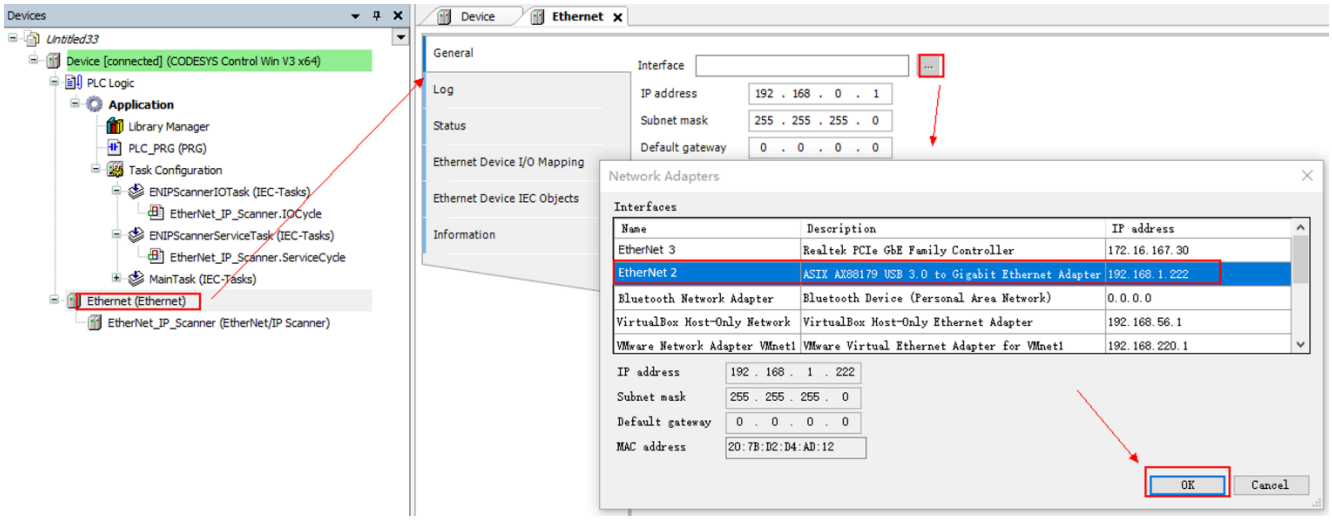


Step 6 Select **Ethernet (Ethernet)** on the left, right-click it, and choose **Add Device**.

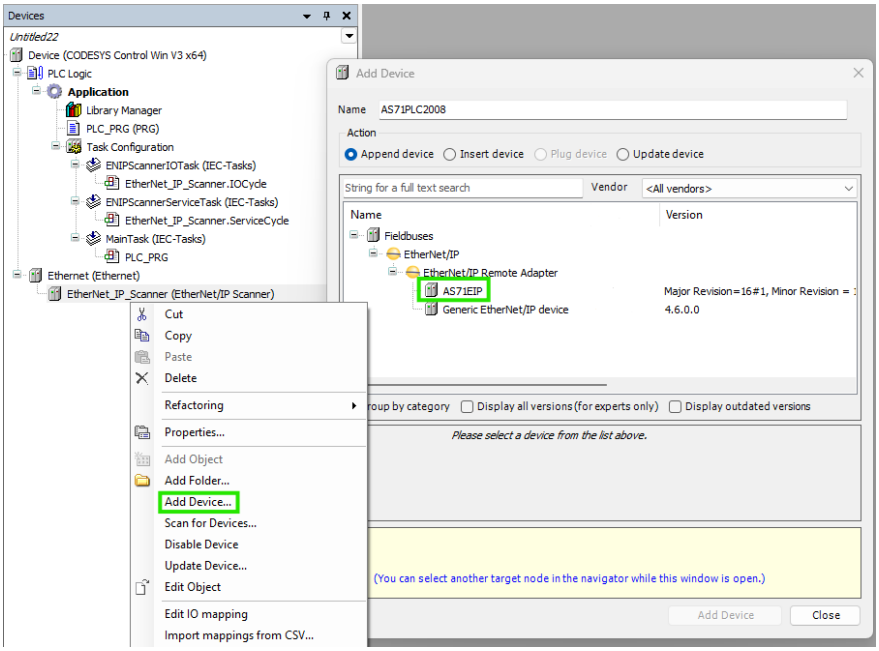
Step 7 Select **EthernetIP** > **EthernetIP Scanner** > **Ethernet/IP Scanner**.




Step 8 Double-click **Ethernet (Ethernet)** on the left. On the **General** page, click the ellipsis (**...**) button to the right of **Interface** and select the network adapter.

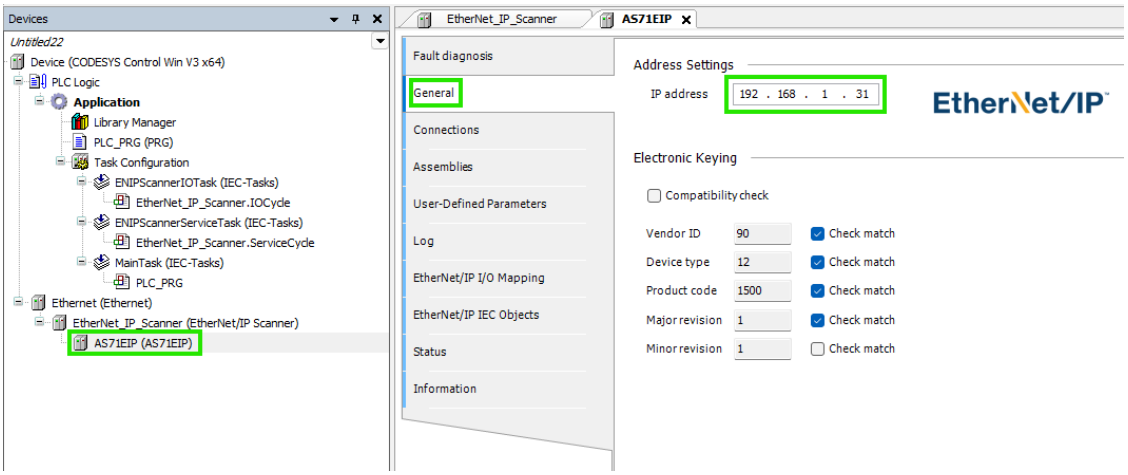


Step 9 Select **EtherNet/IP_Scanner**, right-click it, and in the pop-up window select the appropriate coupler, then click **Add Device**.

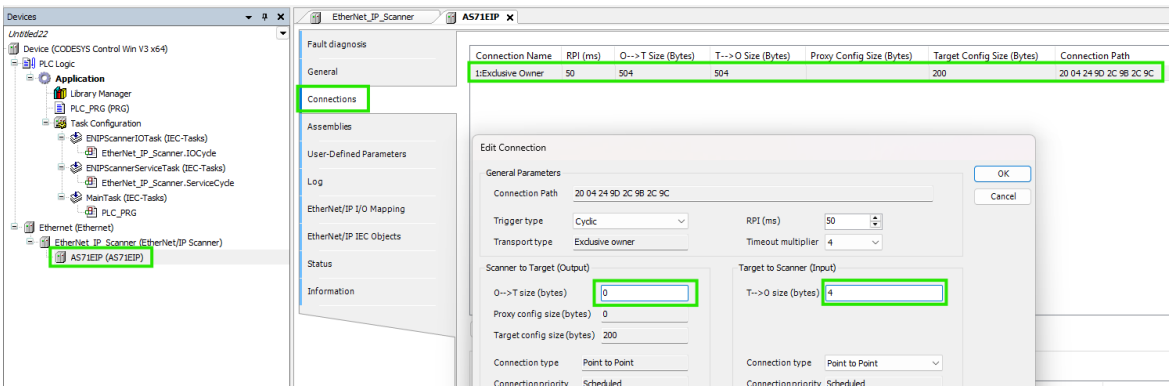



Step 10 After adding the device, configure the device communication parameters and set the IP address to the actual coupler IP address.

**Note:** The coupler must be in the same network segment as the EtherNet/IP master.




Step 11 Double-click **AS71EIP** on the left. After the device configuration window opens, switch to the **Connection** interface.



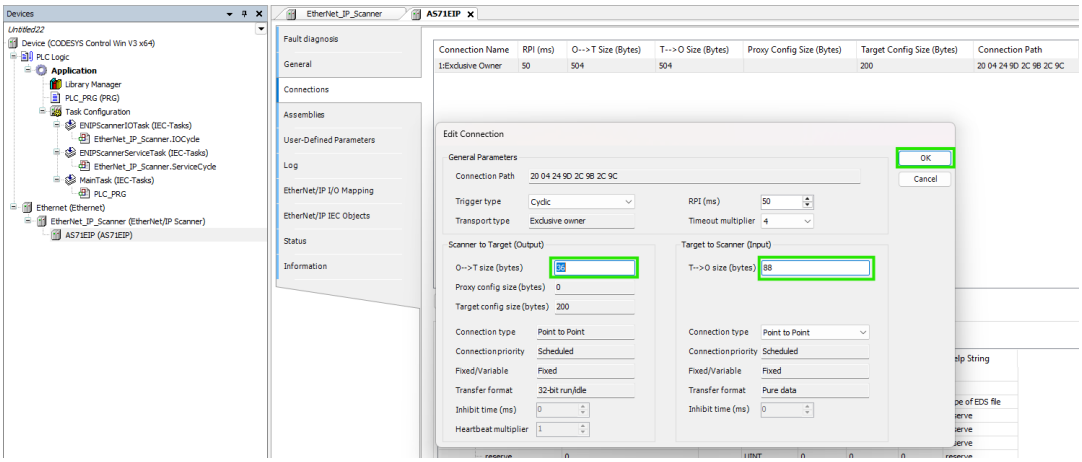
See Table 6-2 Number of bytes occupied by I/O modules for the O→T size (bytes) and T→O size (bytes).

| Type | Model | Slot | T→O size (Bytes) | O→T size (Bytes) |
|---|---|---|---|---|
| I/O module | AS71EIP | 0 | 4 | 0 |
| | AS71DI32 | 1 | 4 | 0 |
| | AS71THC4 | 2 | 16 | 0 |
| | AS71AIN4 | 3 | 8 | 0 |
| | AS71AOU4 | 4 | 0 | 8 |
| | AS71IN02 | 5 | 34 | 10 |
| | AS71DI16 | 6 | 2 | 0 |
| | AS71DT16 | 7 | 2 | 2 |
| | AS71DOR8 | 8 | 0 | 2 |
| | AS71RTD4 | 9 | 16 | 0 |
| | AS71DO32 | 10 | 0 | 4 |
| | AS71DO16 | 11 | 0 | 2 |
| Summary | | | 86 | 28 |

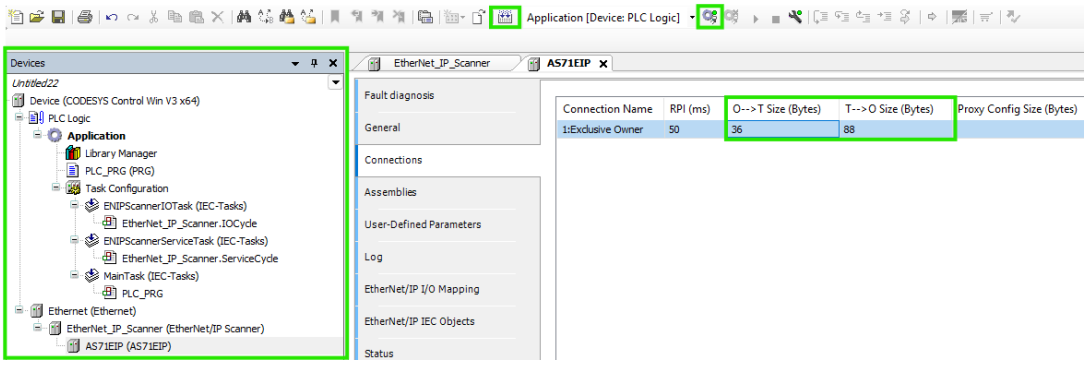
Calculate based on the preceding table: O→T size (bytes): 36

T→O size (Bytes): 88

Enter the parameters in the corresponding fields as shown in the figure below, then click **OK**.




Click the Compile, Download, and Run buttons as shown in the figure below.




Step 12 Configuration is completed and the PLC program can be written and verified.

# 6.5 Modbus TCP configuration

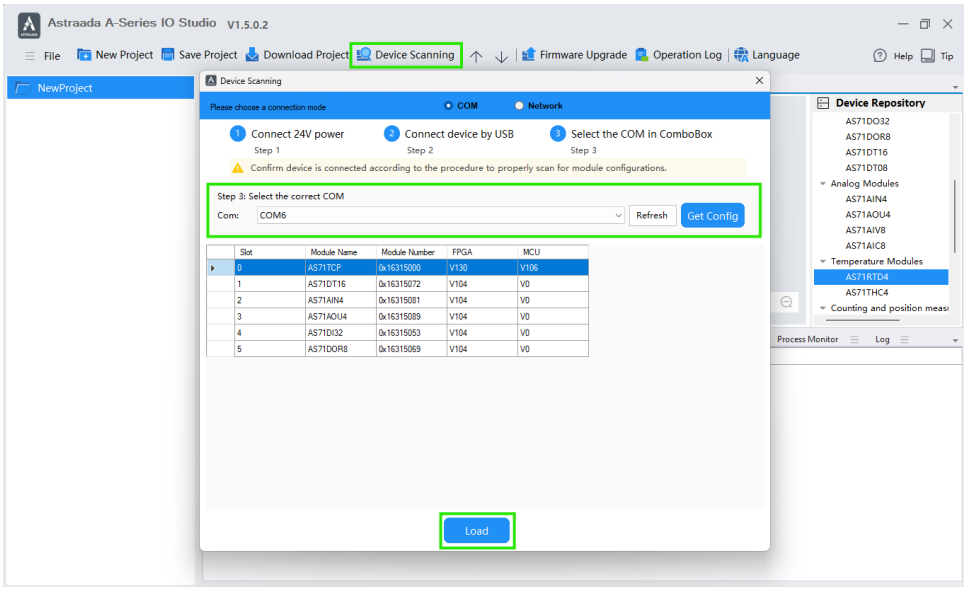
## 6.5.1 Astraada A-Series IO Studio configuration example

This section describes how to use the Astraada A-Series IO Studio software to configure Modbus TCP for the AS71TCP communication coupler, including steps such as configuration reading, IP address setting, module parameter configuration, and configuration writing. Before configuration, power on the AS71TCP and connect it to the PC using a Type-C cable.

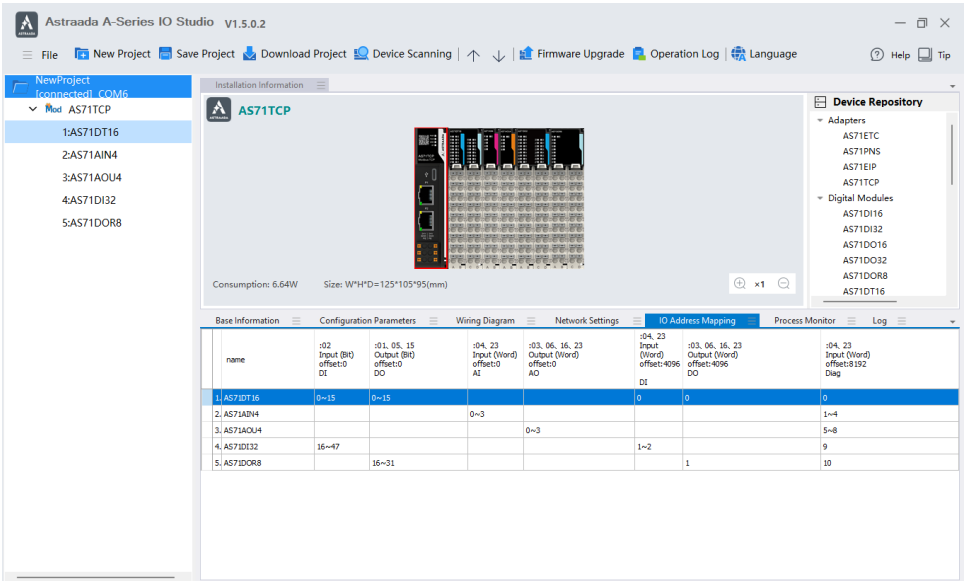
1. Configuration reading

Step 1 Click **Device Scanning** > **Refresh**, and select the COM port corresponding to the device.

Step 2 Click **Get Config**. The software will automatically load the slot numbers and version information of each module in the configuration.




Step 3 Click **Load** to enter the interface shown below:

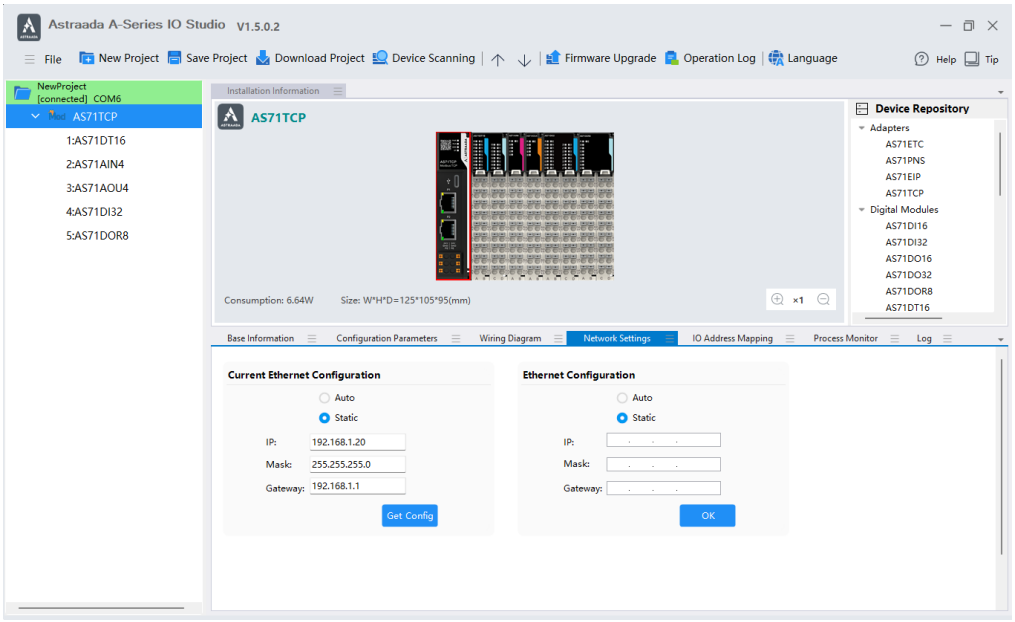



2. IP configuration

Step 1 Click **Network Settings**. In this interface, the current Ethernet configuration information can be read and modified.

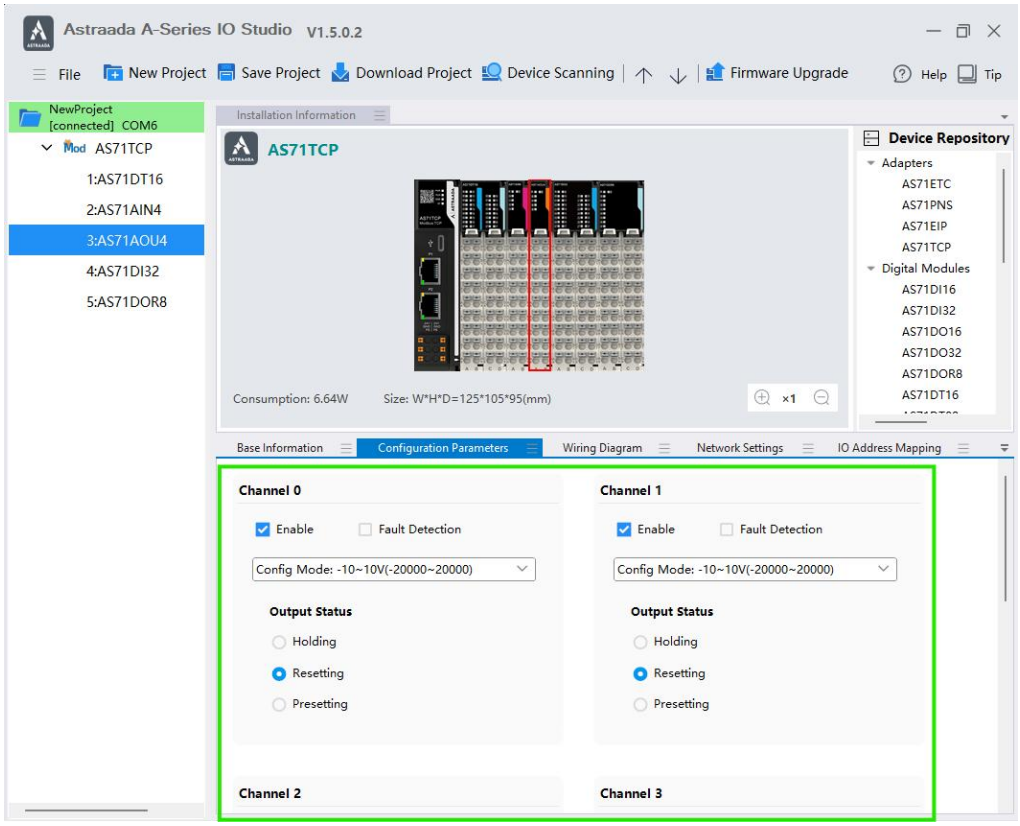
Step 2 Click the **Get Config** button to read the current IP address, subnet mask, and other device configuration information.

Step 3 After entering the IP address, subnet mask, and gateway, click **OK**. The settings will take effect after the device is powered on again.




3. Module parameter configuration

On the left, you can select modules of different slots to enter the **Configuration Parameters** interface, and configure channel parameters as required. The modified parameters will be downloaded to the coupler together with the **Download Project** operation, and the coupler will store the configuration information.



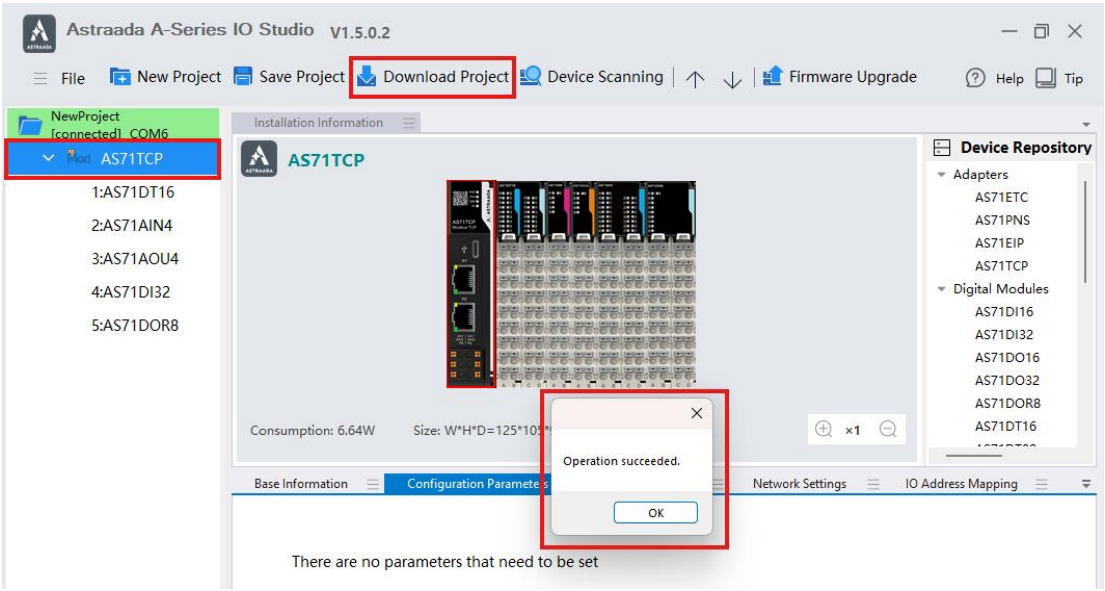

4. Configuration writing

Step 1 When all modules have been configured, click **AS71TCP** > **Download Project**.

Step 2 Click **Refresh** to confirm that the device connection is normal.

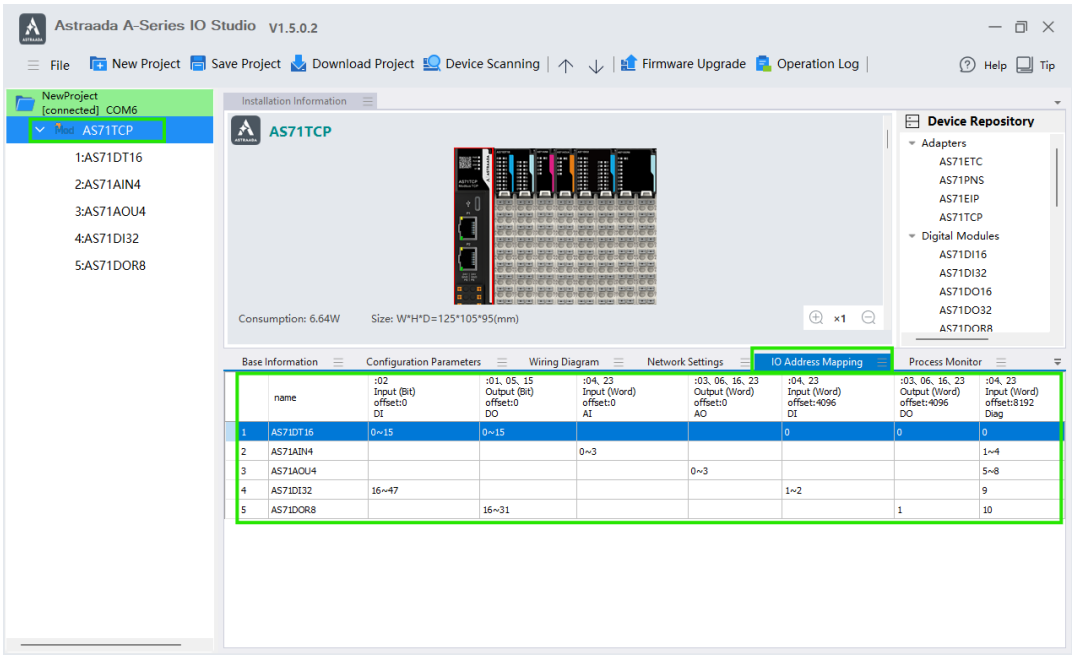
Step 3 Click **Downlo** to write the configuration settings and module configurations to the coupler.

**Note:** 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 interface above matches the actual configuration.




5. Address mapping table

Refer to Appendix B Address mapping table description for operation.




## 6.5.2 Module configuration application example

### 6.5.2.1 CODESYS configuration example

1. Environment preparation

Perform the configuration operation according to the Astraada A-Series IO Studio setup.

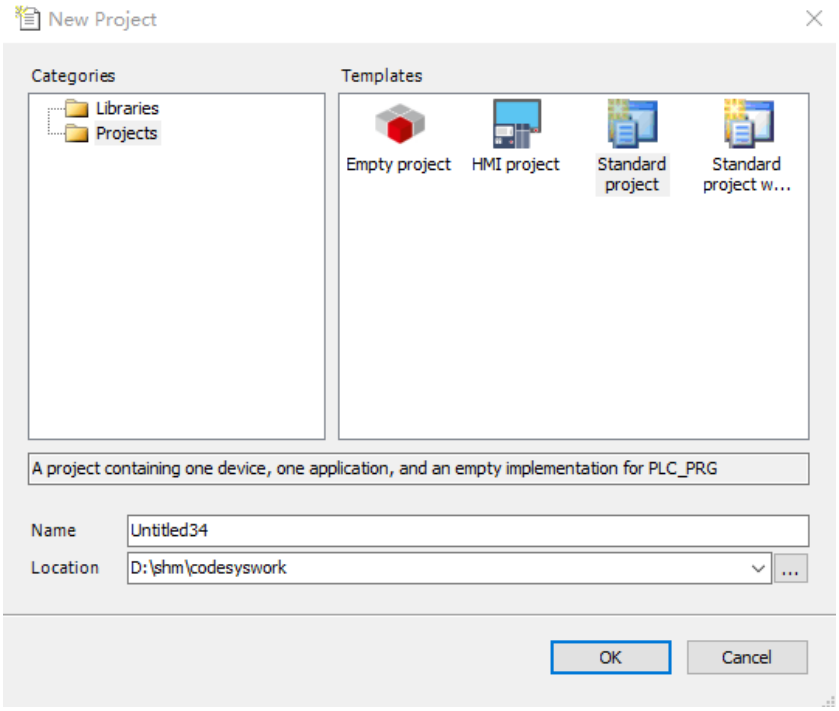
Step 1 Power on the coupler and connect the network cable to the computer.

Step 2 Ensure that the IP address of the coupler and the IP address of the computer are in the same subnet.

Step 3 Pre-install the following software on the PC: CODESYS V3.5 and CODESYS Control Win V3 - x64 SysTray.

2. Creating a new project

Start CODESYS, click **File** > **New Project**, enter the project name, and click **OK** to complete creation, as shown below.

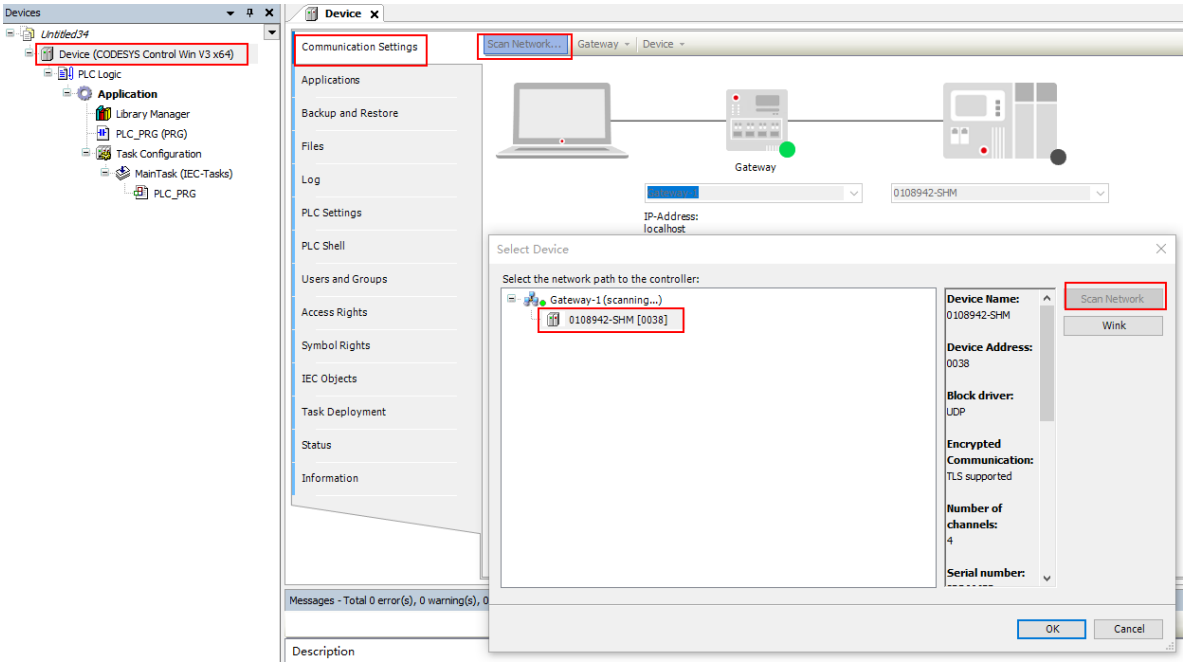



3. Scanning network

Step 1 Start the PLC using **CODESYS Control Win V3 - x64 SysTray**. Locate **CODESYS Control Win V3 - x64 SysTray** in the lower-right corner of the computer, right-click it, and select **Start PLC**.

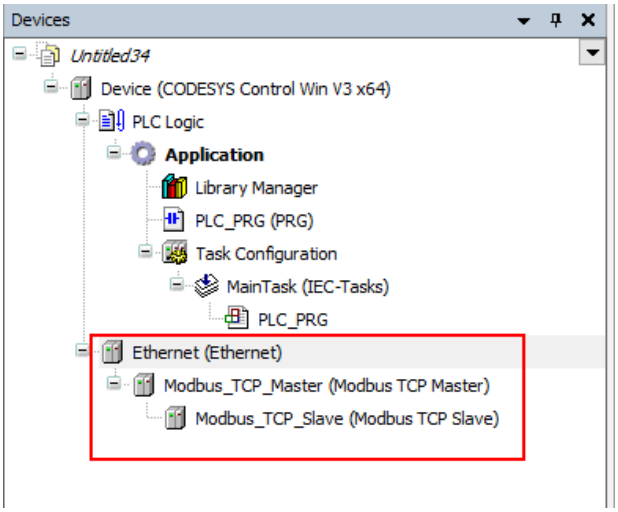
Step 2 Double-click **Device (CODESYS Control Win V3 X64)** in the left navigation tree of **CODESYS**, and then click **Scan Network**.

Step 3 In the scan results, select the target device and choose the correct controller network path, as shown below:



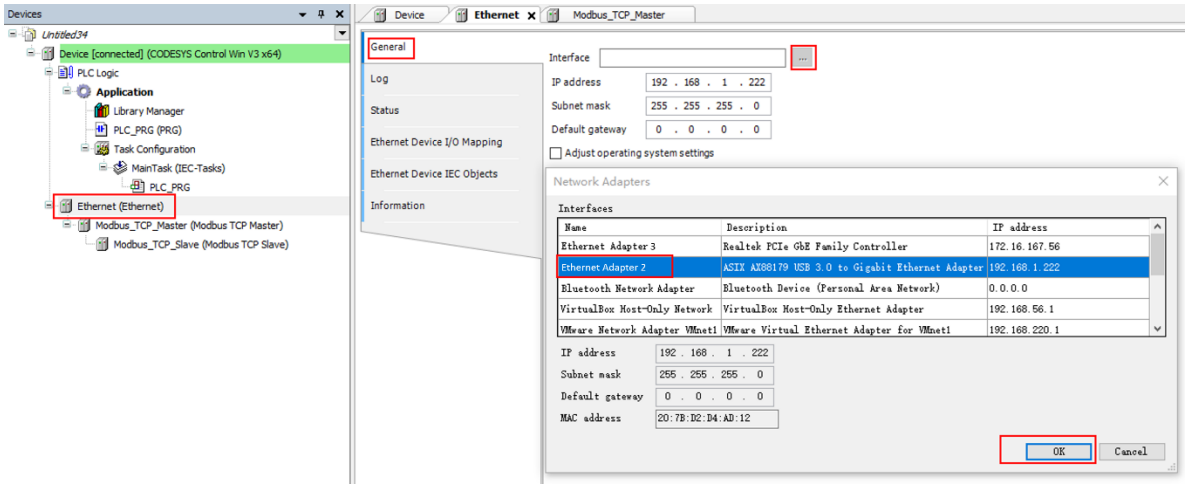

4. Adding devices (Add Ethernet, Modbus TCP Master, and Modbus TCP Slave)

After the devices are successfully added, the interface appears as shown below:




- Ethernet configuration

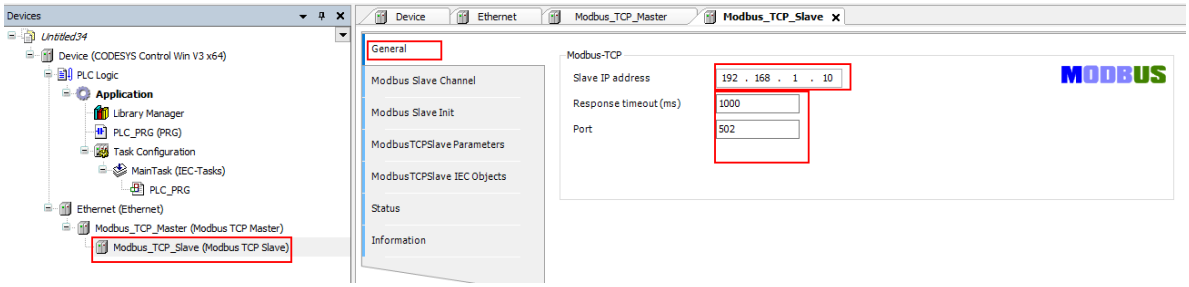
Click **Ethernet (Ethernet)** > **General** > **Interfaces** to configure the parameters, as shown below.




■ Modbus TCP slave configuration

1. Configuring the network

Click **ModbusTCP_Slave (Modbus TCP Slave)** > **General**, and set the **Slave IP address**, **Response timeout**, and **Port**.

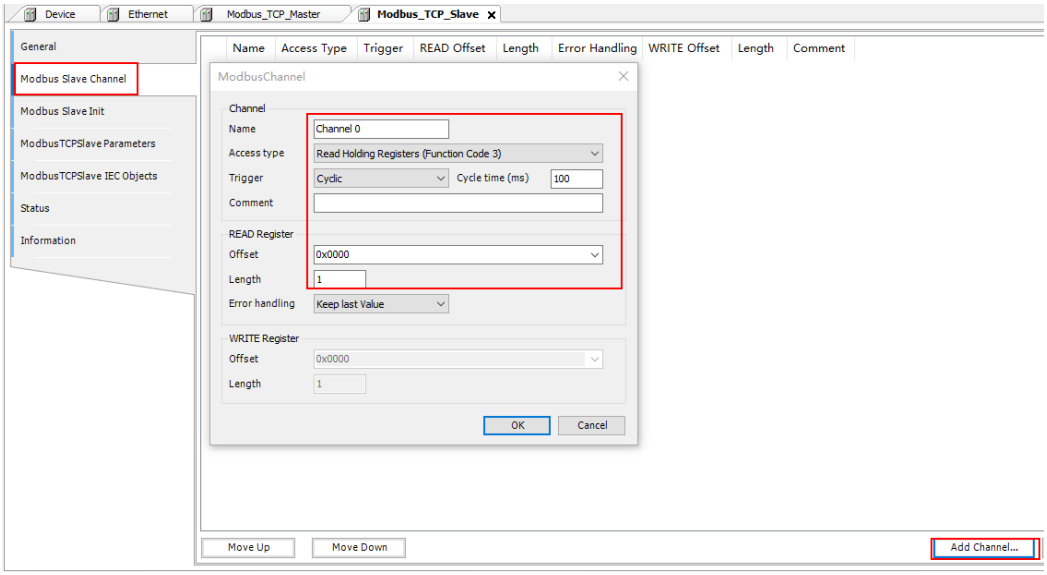



2. Configuring the channel

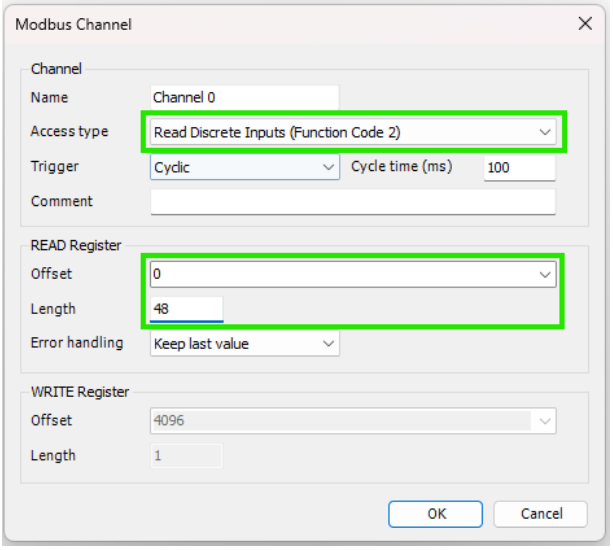
Step 1 Use the Astraada A-Series IO Studio tool to view the system topology and the I/O module address mapping table. The mapping table lists the function code, offset start address, and corresponding monitoring address range of each module, as shown below.

| | 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 | AS71DT16 | 0~15 | 0~15 | | | 0 | 0 | 0 |
| 2 | AS71AIN4 | | | 0~3 | | | | 1~4 |
| 3 | AS71AOU4 | | | | 0~3 | | | 5~8 |
| 4 | AS71DI32 | 16~47 | | | | 1~2 | | 9 |
| 5 | AS71DOR8 | | 16~31 | | | | 1 | 10 |

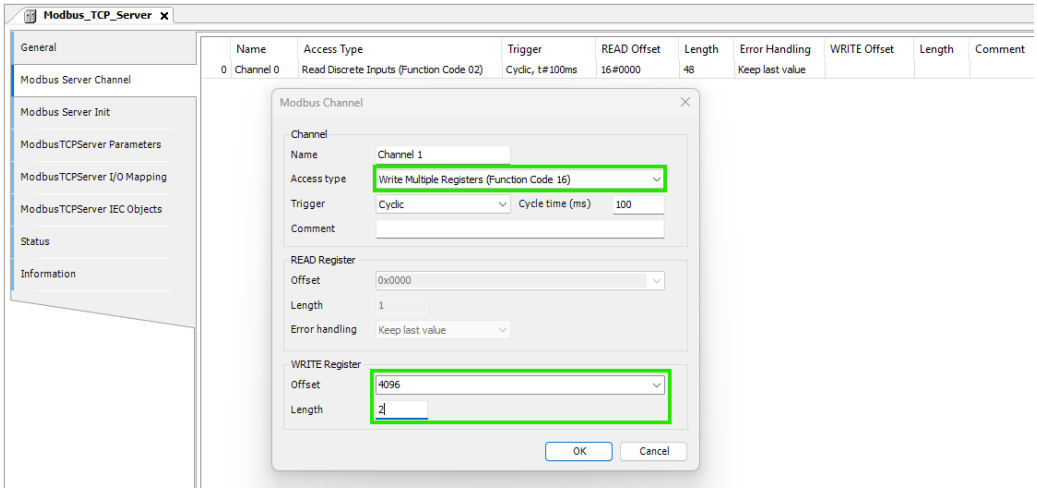
Step 2 On the left side of the Modbus_TCP_Slave page, click **Modbus Slave Channel**, and then click **Add Channel**. A configuration window for Channel 0 will pop up, as shown below.




Step 3 For the following digital input modules: AS71DT16 and AS71DI32, the DI (Input Bit) function code is 02, and the offset address is 0x00. The address ranges are 0–15, 16–47 totaling 48 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 48, and click **OK**, as shown in the following figure. (You may also customize the offset address and length according to actual requirements, referring to the I/O module address mapping table.)

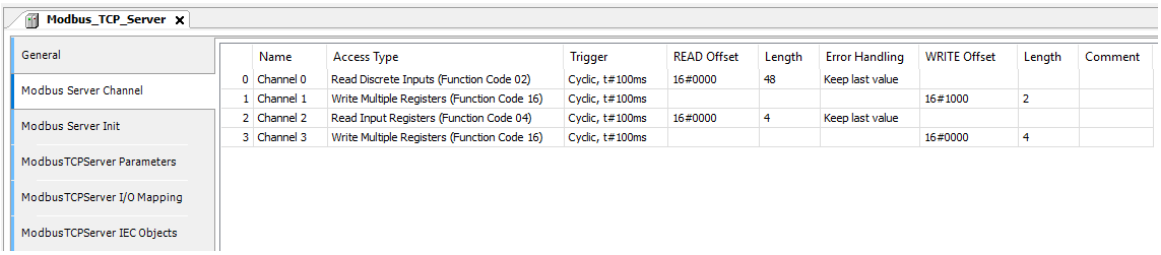


Step 4 For the digital output modules AS71DT16 and AS71DOR8, when using the Output (Word) write function, the corresponding address range is 0–1, the write register offset is 4096, and the length is 2. Select **Write Multiple Registers (Function Code 16)** as the access type to configure Channel 1, as shown below.



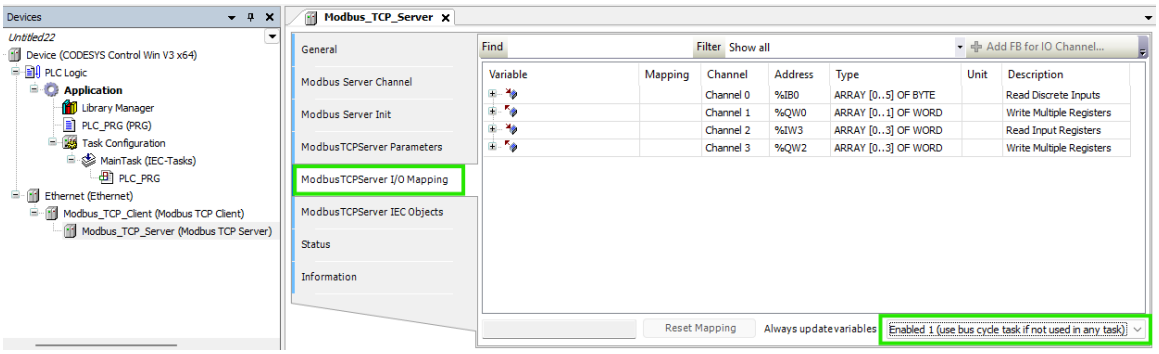

**Note:** If the Output (Word) write function is used, it is not allowed to perform Output (Bit) write operations simultaneously. Otherwise, multiple write sources may access the same output point, which will cause conflicts.

Proceed to configure the remaining channels as follows:




5. Verifying

Step 1 On the left side of the Modbus_TCP_Slave page, click **ModbusTCPSlave I/O Mapping** to monitor the I/O modules. In the lower-right corner of the interface, select **Enabled 1** for **Always update variables**, as shown below.



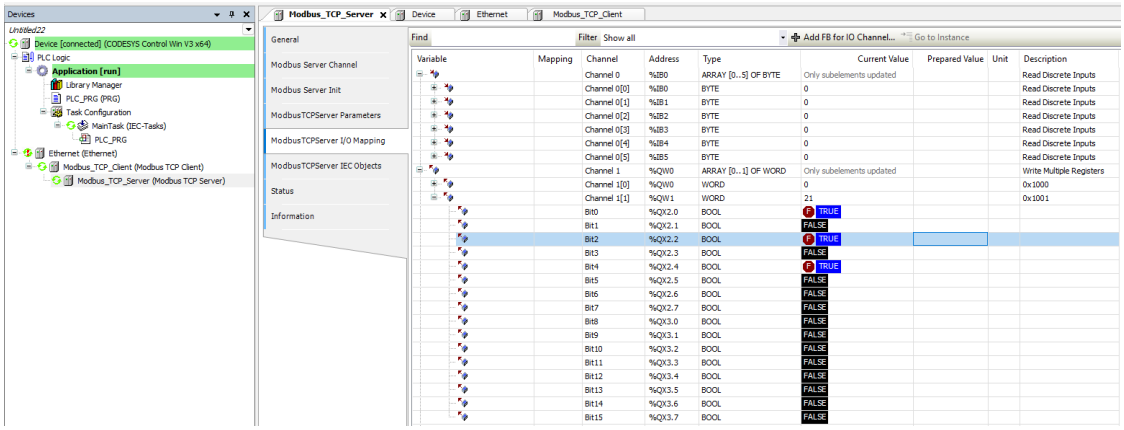
Step 2 On the menu bar, click **Build** > **Build** to start the compilation process.

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.

Output verification: modify the output values and observe the results:



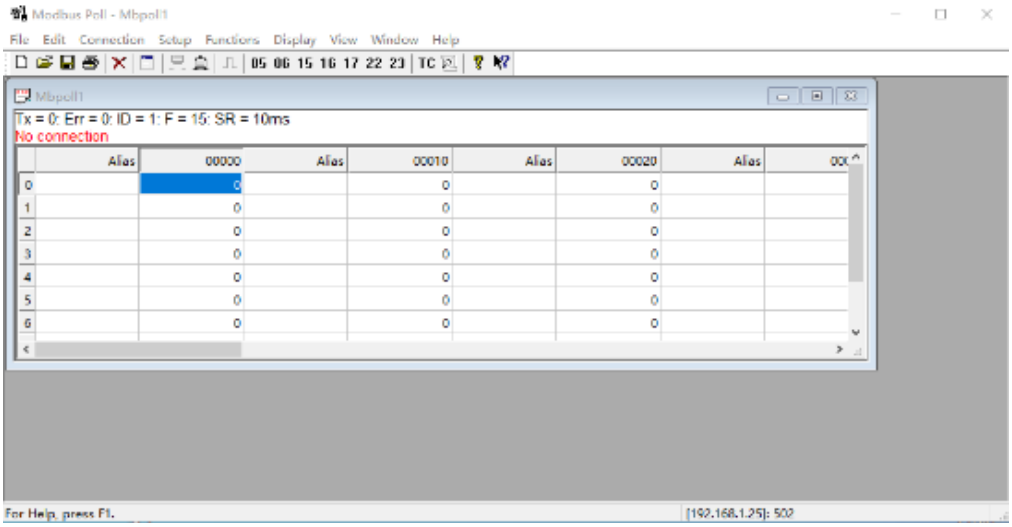
### 6.5.2.2 Modbus Poll example

1. Environment preparation

Perform the configuration operation according to the Astraada A-Series IO Studio 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 Modbus Poll software must be pre-installed on the PC.

2. Module connection

Step 1 Open the **Modbus Poll** software. The main interface is displayed as follows.




Tx = 0: Indicates the number of data frames sent to the master node, currently 0.

Err = 0: Indicates the number of communication errors, currently 0.

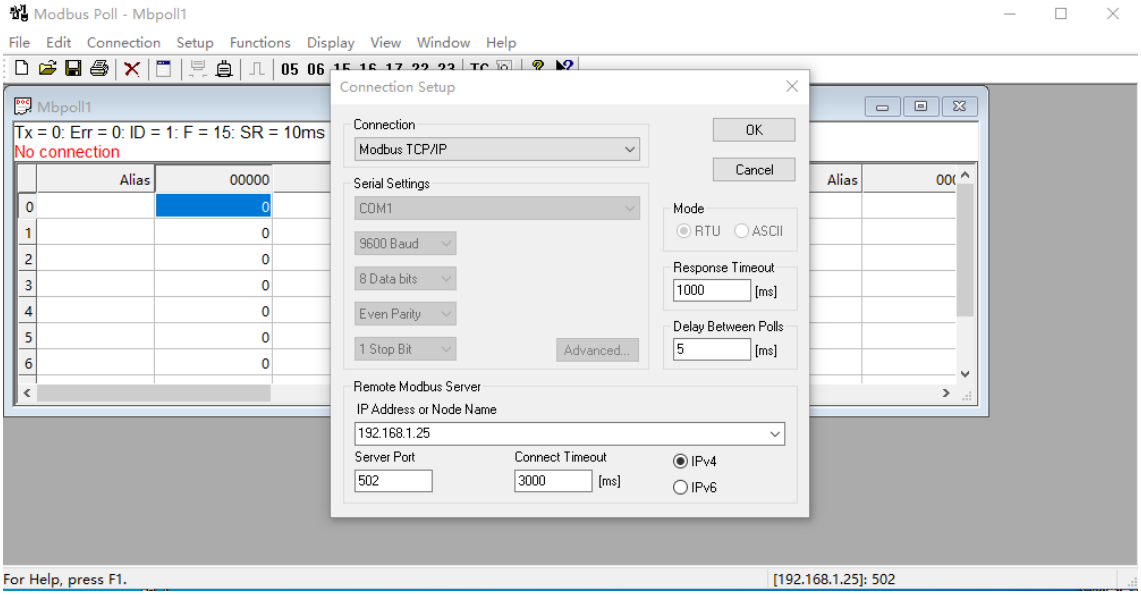
ID = 1: Indicates the device address of the simulated Modbus slave device, currently set to 1.

F = 15: Indicates the Modbus function code in use, currently function code 15.

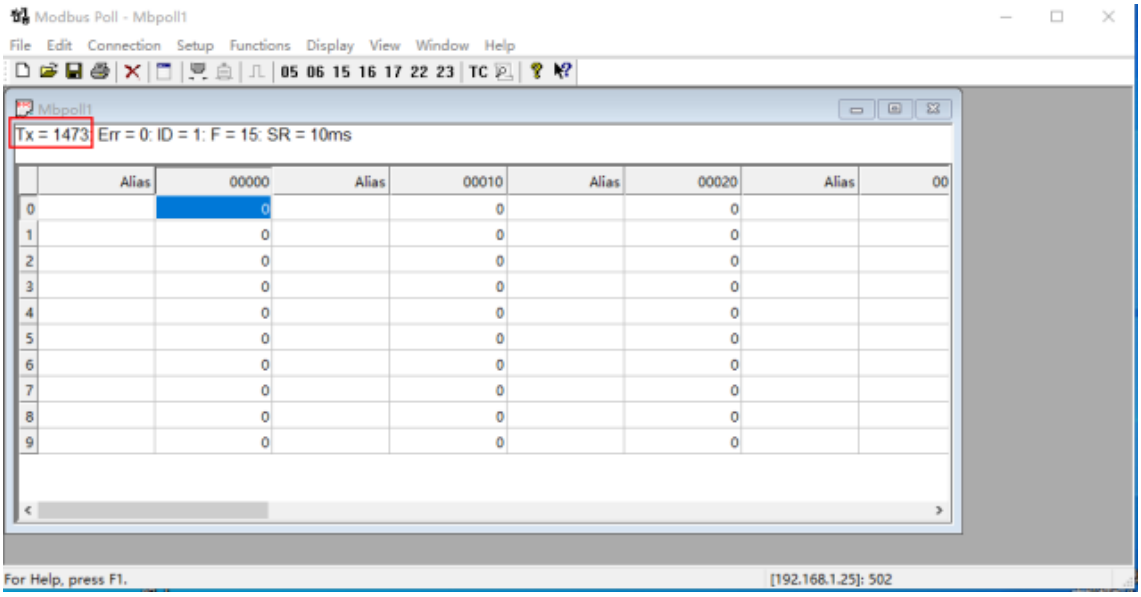
SR = 10 ms: Indicates the scan cycle; the red text shows the current error status.

"No Connection": Indicates that the connection has not been established.

Step 2 Click **Connection** > **Connect** in the menu bar 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 below.




Step 3 After the connection is successful, the Tx value will continuously increase. The interface is shown below.



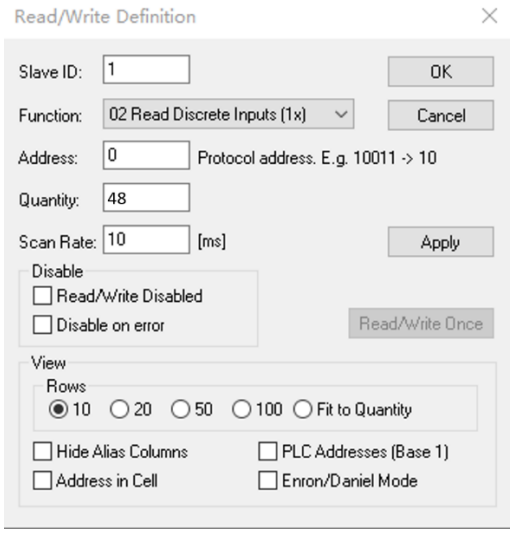

3. Channel configuration and monitoring

Step 1 With the Astraada A-Series IO Studio software, you can view the I/O module address mapping table of the system topology. This table shows the function code, offset start address, and monitoring address range corresponding to each module, as shown below.

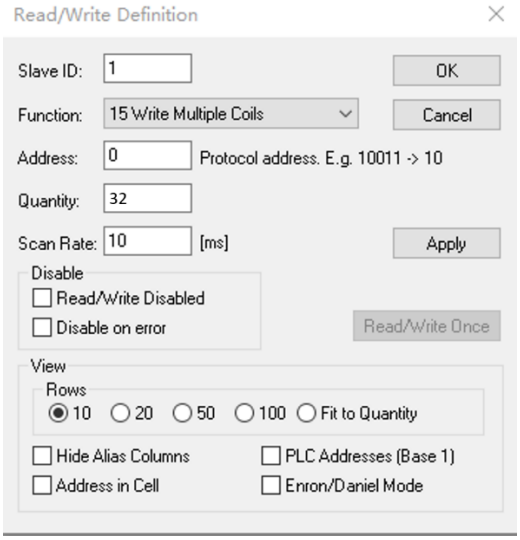
| | name | :02<br>Input (Bit)<br>offset:0<br>DI | :01、05、15<br>Output (Bit)<br>offset:0<br>DO | :04、23<br>Input (Word)<br>offset:0<br>AI | :03、06、16、23<br>Output (Word)<br>offset:0<br>AO | :04、23<br>Input (Word)<br>offset:4096<br>DI | :03、06、16、23<br>Output (Word)<br>offset:4096<br>DO | :04、23<br>Input (Word)<br>offset:8192<br>Diag |
|---|---|---|---|---|---|---|---|---|
| 1 | AS71DT16 | 0~15 | 0~15 | | | 0 | 0 | 0 |
| 2 | AS71AIN4 | | | 0~3 | | | | 1~4 |
| 3 | AS71AOU4 | | | | 0~3 | | | 5~8 |
| 4 | AS71DI32 | 16~47 | | | | 1~2 | | 9 |
| 5 | AS71DOR8 | | 16~31 | | | | 1 | 10 |

Step 2 Based on the table above, configure the channels sequentially.

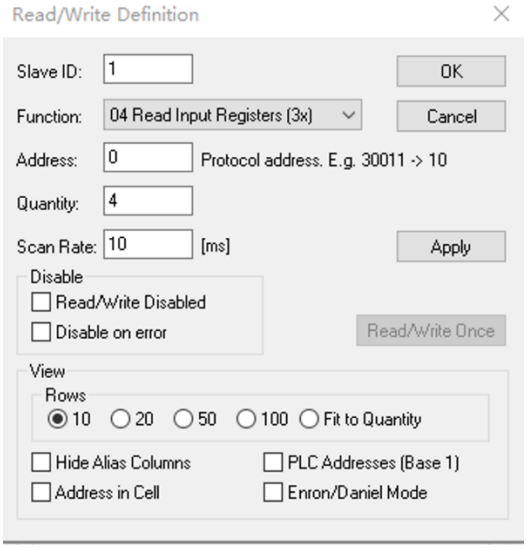
- Function code 2, Input (Bit) offset: 0, length: 48



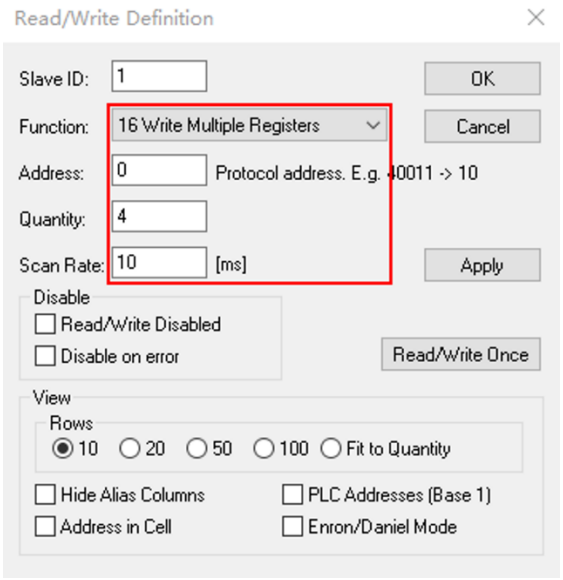

- Function code 15, Output (Bit) offset: 0, length: 32




- Function code 04, Input (Word) offset: 0, length: 4



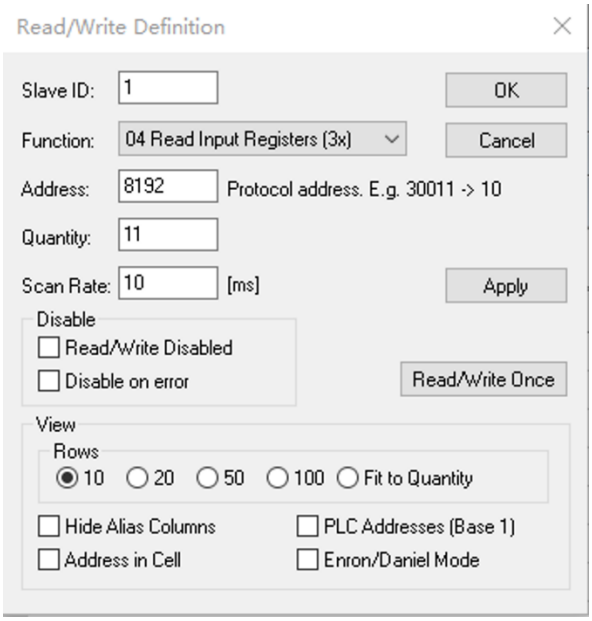
- Function code 16, Output (Word) offset: 0, length: 4




**Note:** The Input (Word), offset: 4096 and Output (Word), offset: 4096 areas are Word-level mapping interfaces for digital signals. They correspond to the same signals as Input (Bit), offset: 0 and Output (Bit), offset: 0. They should generally be used as needed, and simultaneous Bit and Word access should be avoided. Concurrent write operations to the output signals may cause conflicts.

Step 3 Configure the diagnostic information as follows:

Function code 04, Input(Word), offset: 8192, length: 11



# 7 Commissioning

## 7.1 Overview

This chapter describes the use of commissioning tools and methods to ensure the stability and reliability of the I/O system in actual applications, and to quickly identify and eliminate potential problems during system commissioning and operation. This chapter is applicable to commissioning personnel, system integrators, and maintenance engineers with basic knowledge of automation systems.

## 7.2 Commissioning preparation

### 7.2.1 Commissioning requirements

| Type | Description |
|---|---|
| Operating system | Windows 7, Windows 10, Windows 11 |
| Communication interface | USB-C (USB-A <-> USB-C cable must be used) |
| Power supply | 24 V |
| Module | AS71DI16, AS71DI32, AS71DO16, AS71DO32, AS71DOR8, AS71AIN4, AS71RTD4, AS71THC4, AS71BRG1, AS71BRG2, AS71AIV8, AS71AIC8, AS71AOU4, AS71DT16, AS71AN02, AS71IN02, AS71IN01, AS71IN01, AS71COM2, AS71PUOC, AS71PWRR |

### 7.2.2 Operating precautions

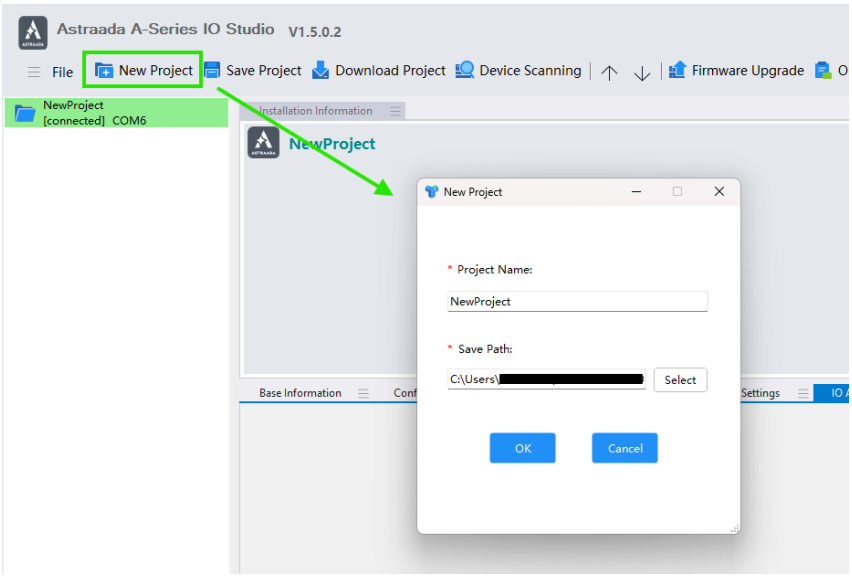
| Item | Description |
|---|---|
| Coupler firmware upgrade sequence | When upgrading the coupler firmware, the USB cable must be connected first, and then the power supply must be turned on. Incorrect connection order may cause upgrade failure. |
| Module operation connection sequence | When performing operations such as module scanning, firmware upgrade, or parameter download, the power supply must be connected first, and then the USB cable must be plugged in; otherwise, modules may not be recognized. |
| Power-off restart effect prompt | Some configuration changes or operations (such as firmware upgrade, module upgrade, or IP address modification) require a power cycle to take effect. Follow the prompts in the software carefully. |
| Coupler module capacity limitation | Each coupler can connect up to 32 modules. When the total power consumption of the modules exceeds the output capacity of the coupler, a power feed module must be added to ensure stable system operation. |
| USB port selection recommendation | When connecting the coupler via USB, ensure that the correct COM port is selected to avoid communication failure caused by incorrect port selection. It is recommended to operate only one coupler device at a time. |
| … | … |

# 7.3 Module identification and project configuration

## 7.3.1 Creating and opening a project

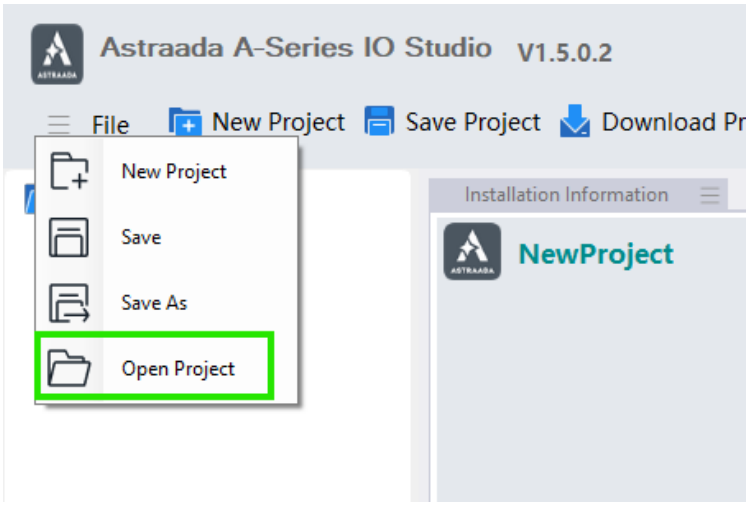
- Creating a new project

1. Click the **New Project** button in the menu bar to open the corresponding window.
2. Enter the project name and select the save path, then click **OK** to create a new project.




- Opening an existing project

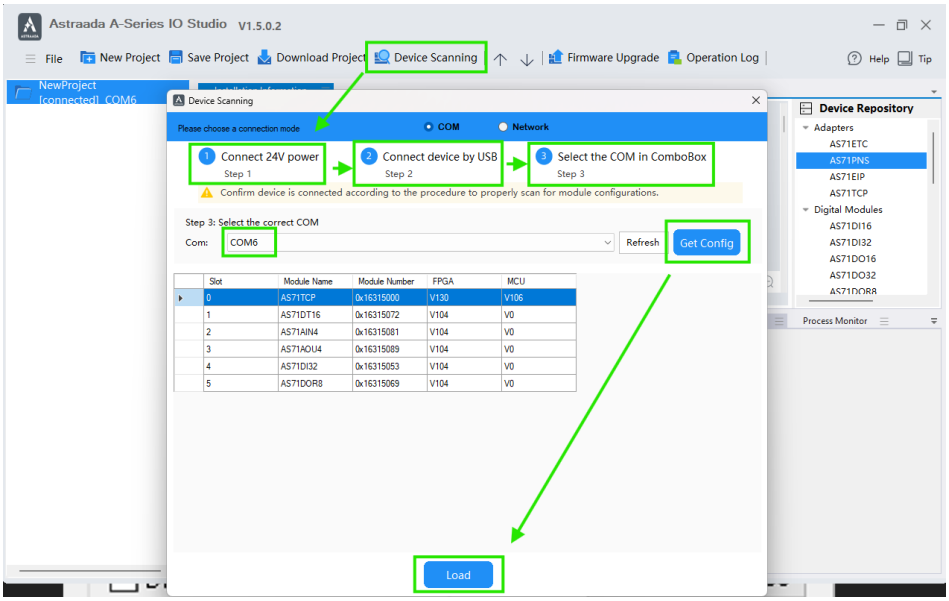
Step 1 Click **File** > **Open Project**.



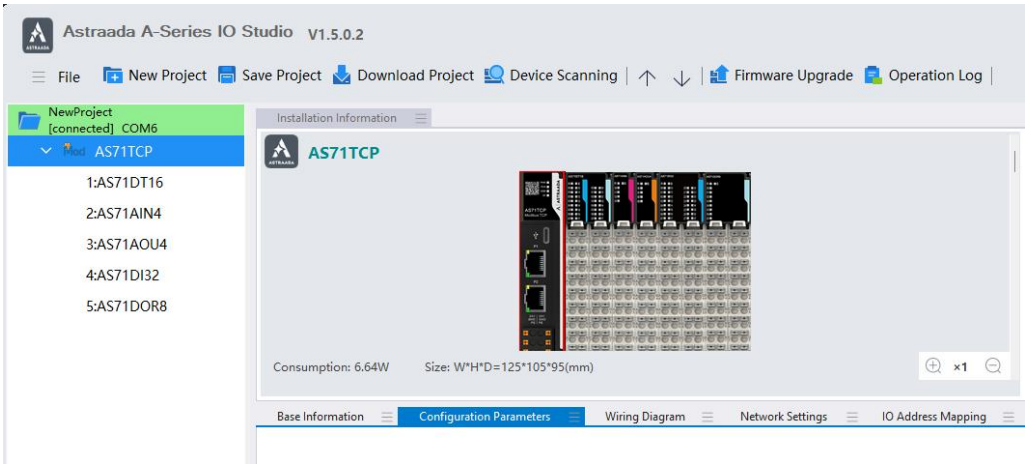

Step 2 In the pop-up window, select the project to be opened and click **OK** to load the existing project.

## 7.3.2 Module scanning and configuration verification

**Device scanning** can be used to obtain the physical topology information and verify whether all modules are correctly identified.



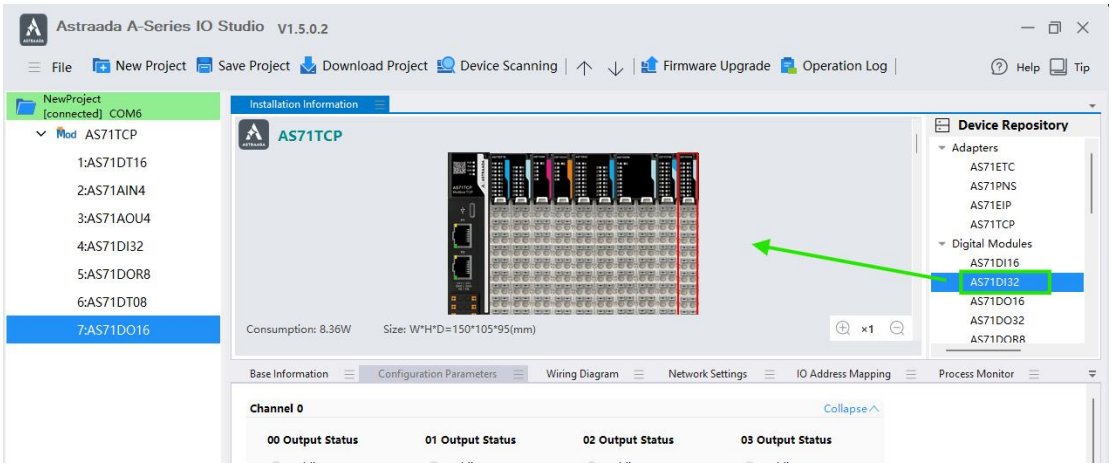

After scanning is completed, you can click the **Load** button to load the module into the project, thereby creating a project that can be saved and facilitating subsequent operations such as parameter editing and download.



## 7.3.3 Module management

- Adding a module

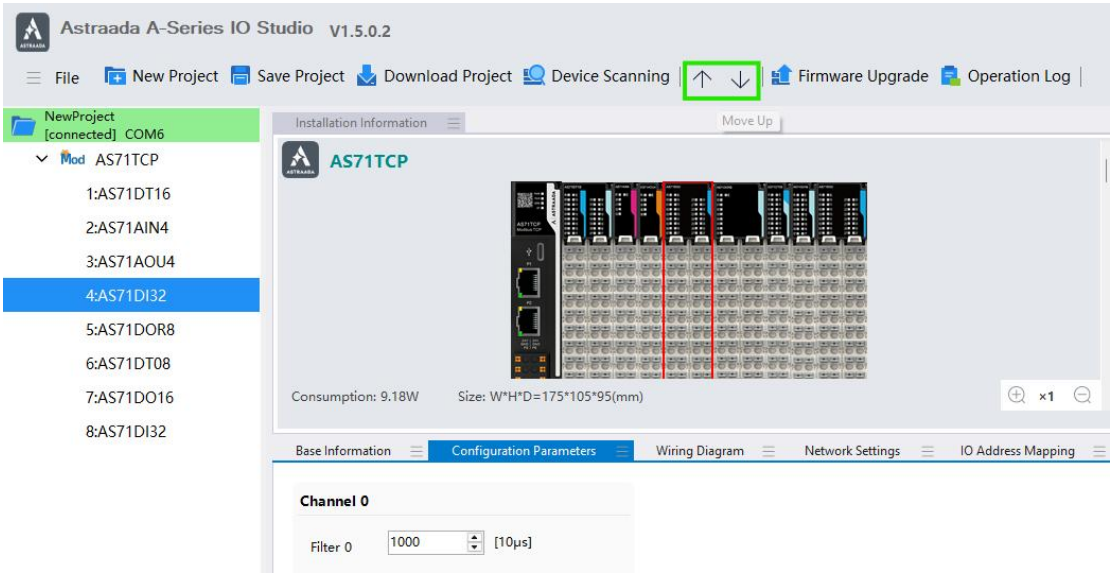
To add a module, double-click the corresponding module in the **Device Repository** or drag the module into the software view.




- Adjusting module order

When selecting a module in the project tree, you can adjust the module order using the move up and move down buttons.

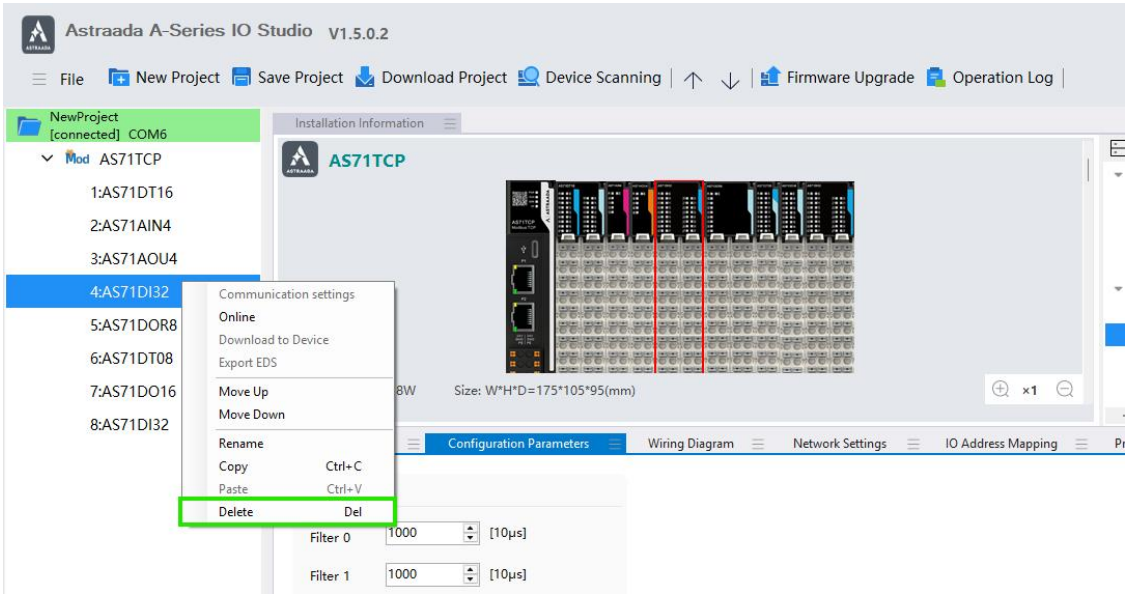
When selecting the configuration window in the **Installation Information** pane, you can adjust the window order using the left and right arrow keys or through the right-click menu.



- Deleting a module

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.

When selecting the configuration window in the **Installation Information** section, you can delete the corresponding module using the right-click menu.

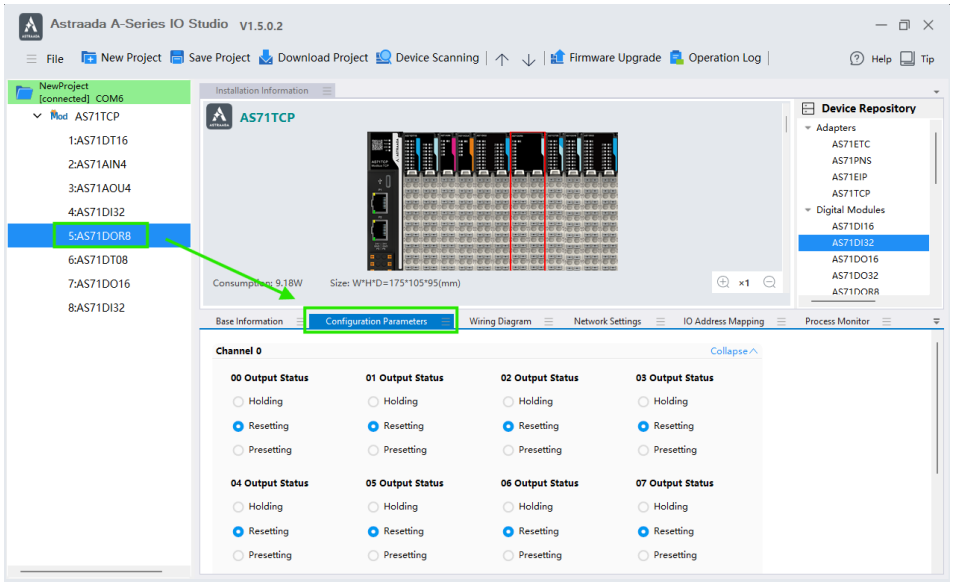



# 7.4 Parameter configuration and download

## 7.4.1 Editing parameters

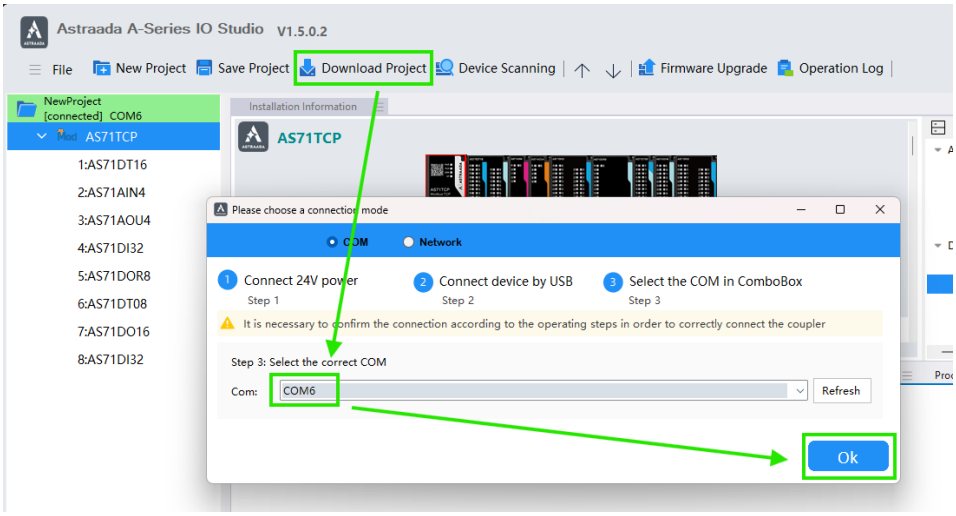
In the project tree interface, after selecting a module or installation information, you can select the **Configuration Parameters** tab to edit the corresponding module's parameters. Once you have finished editing, please remember to save the project.

Save the project promptly after completing the editing to prevent data loss.



## 7.4.2 Downloading project parameters

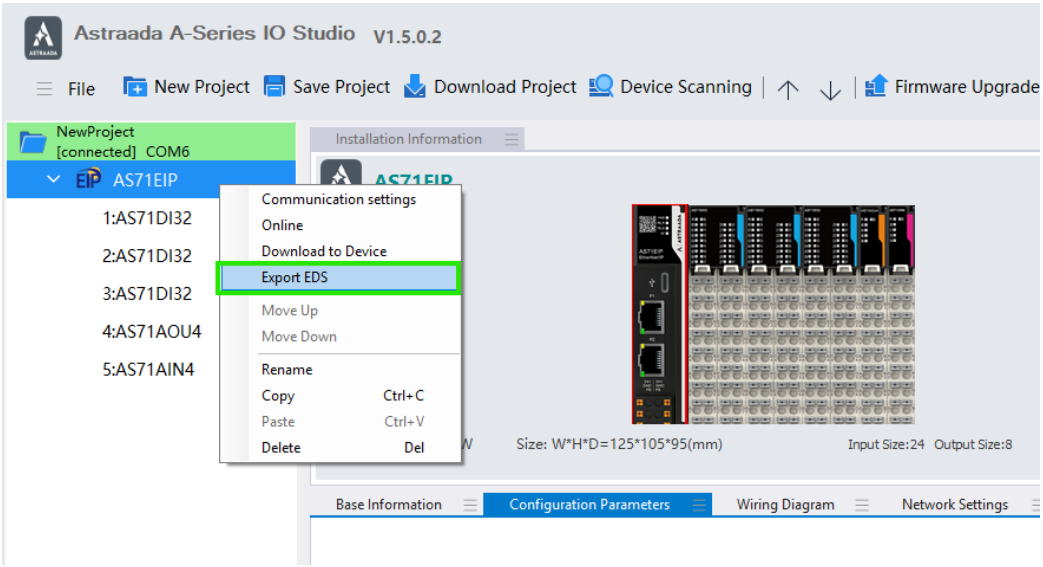
In the project tree, select the coupler and click the **Download Project** button to download all configuration parameters to the module.



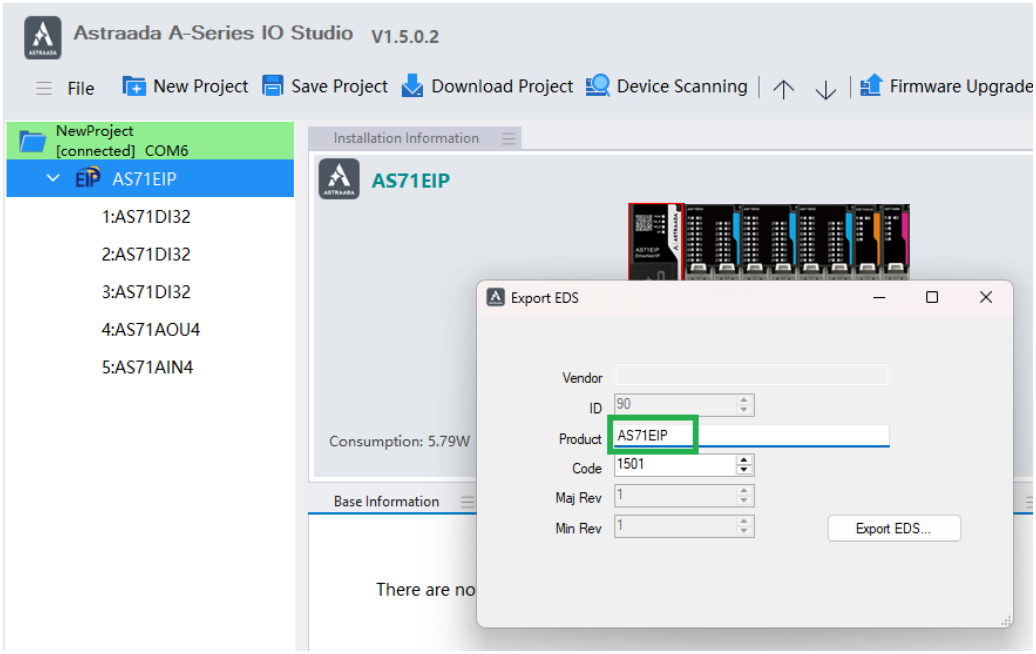

## 7.4.3 EDS export

Steps to export the EDS file are as follows:

Step 1 Right-click the coupler and select **Export EDS**.



Step 2 In the pop-up window, enter the product name and product code, and then click **Export EDS...**.



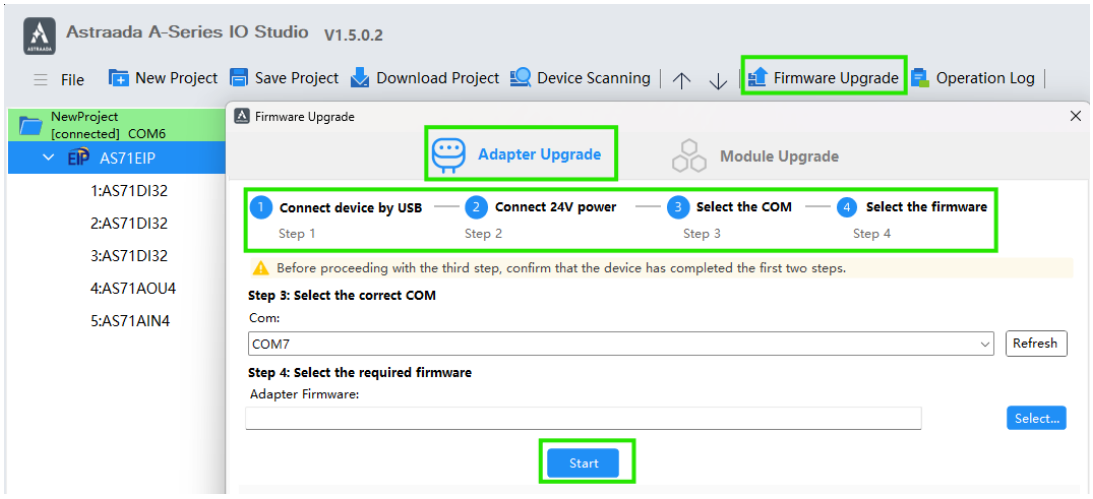

Step 3 Select an appropriate save path.

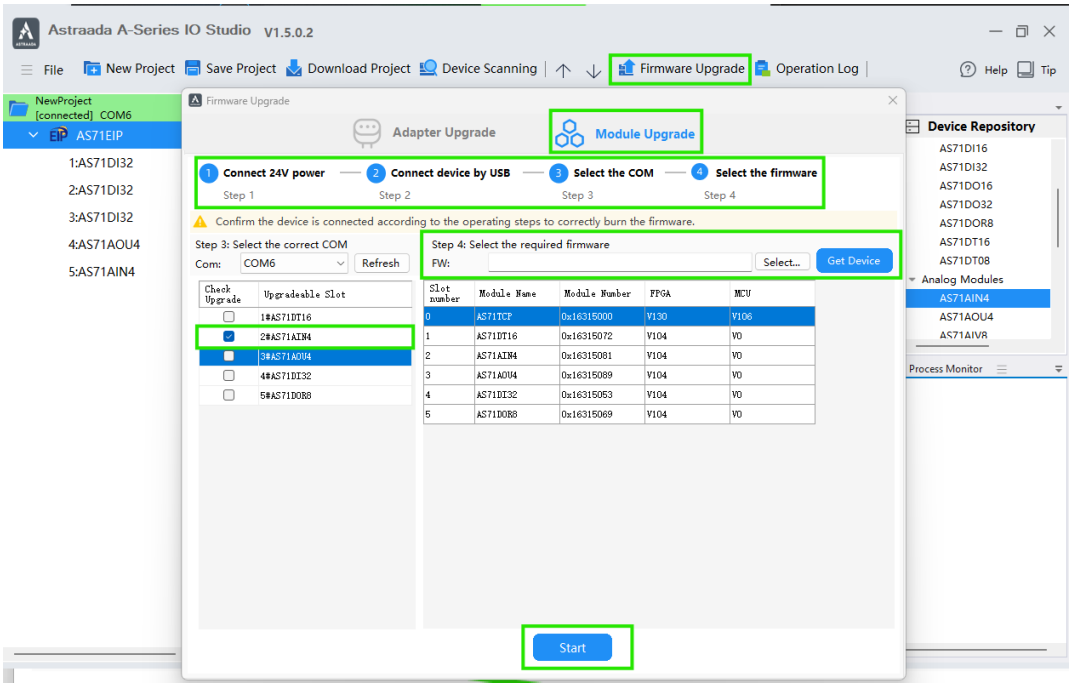
# 7.5 Firmware management and log monitoring

## 7.5.1 Coupler and module firmware upgrade

Firmware upgrade entry: **Firmware Upgrade** > **Adapter Upgrade** / **Module Upgrade**.

When selecting the firmware to be upgraded, note that only one type of module can be upgraded at a time. You may upgrade modules one by one, or select multiple modules of the same type at a time. However, different types of modules cannot be selected for simultaneous upgrade. After the upgrade is completed, be sure to power cycle the device and then continue subsequent operations via USB.





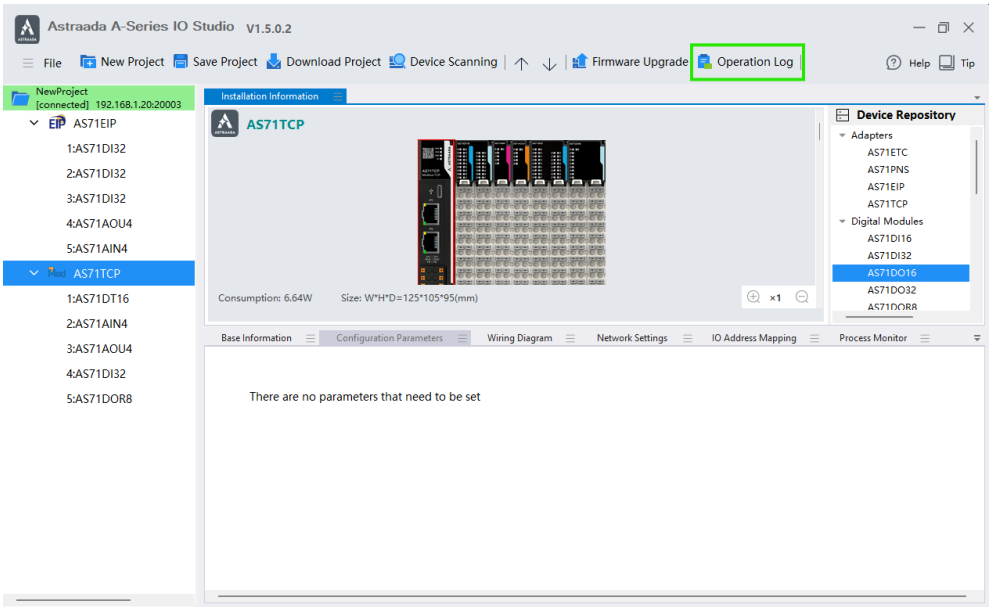

Module firmware upgrade supports batch operations for modules of the same type only, and a power restart is required after upgrading. Module firmware upgrade is performed on the modules connected to the coupler. Select **Firmware Upgrade** from the menu bar, and then choose **Module Upgrade**. Follow the prompts to connect the coupler, select the corresponding COM port, obtain the physical topology, and display it in the interface.

**Note:** Currently, only coupler firmware upgrade is supported, and module firmware upgrade is not supported yet.

## 7.5.2 Log viewing

- Viewing logs

The log records key operation information such as parameter changes and module connections.

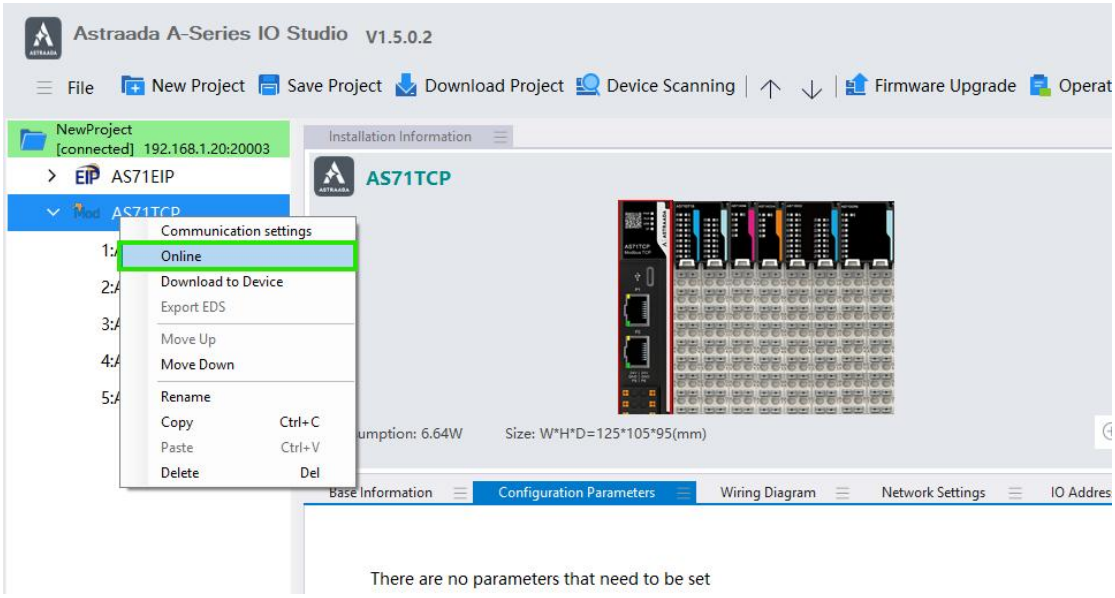


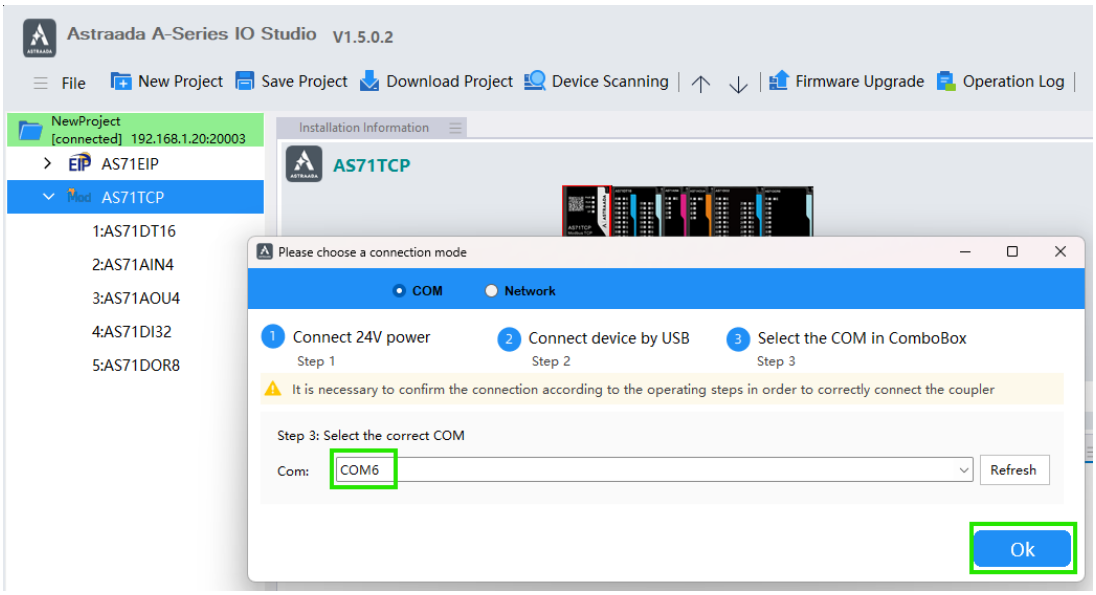
# 7.6 Online monitoring and signal diagnostics

## 7.6.1 Starting and exiting online monitoring

- Starting online monitoring

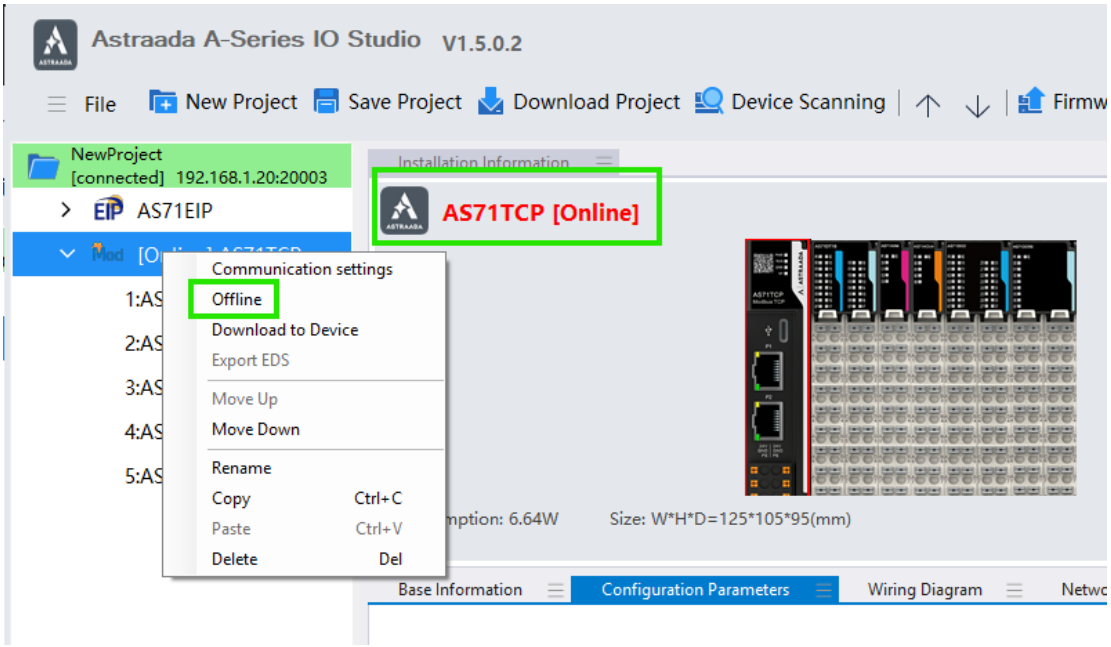
In the project tree, right-click the coupler, select **Online**, and choose the COM port corresponding to the coupler to enter the real-time monitoring interface.



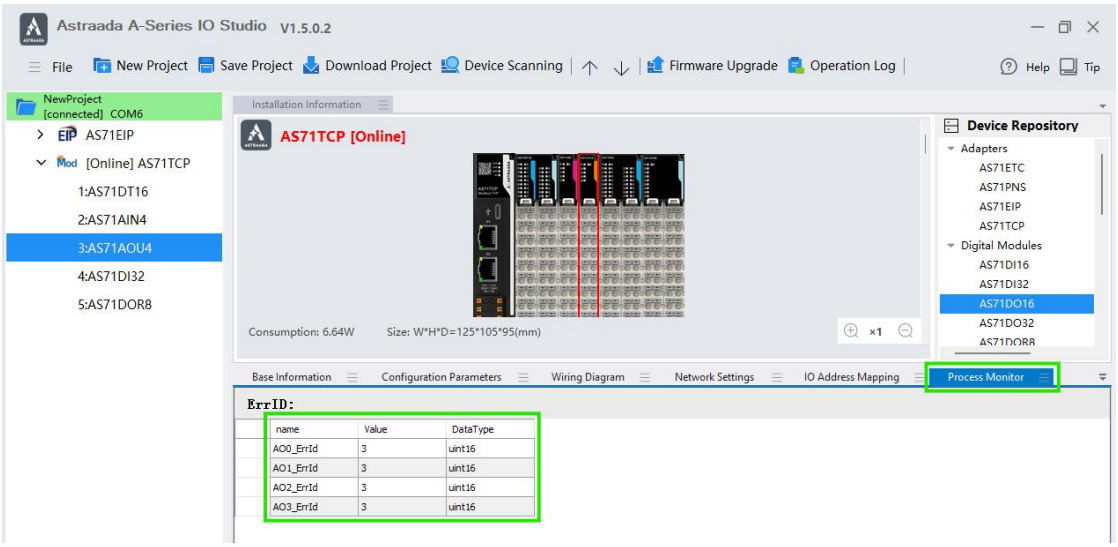
- Exiting online monitoring

Right-click the coupler/module in the project tree and choose **Offline** to stop online monitoring.




## 7.6.2 Data reading and signal verification

In online mode, select the module to view the real-time status values of input and output.



# 7.7 EtherCAT functions and communication commissioning

## 7.7.1 Communication basic verification

The AS71ETC Coupler is an EtherCAT coupler. Through this coupler, the A-Series expansion modules can be integrated into a high-speed EtherCAT network. This enables different types of A-Series expansion modules to be configured as a single EtherCAT slave, helping reduce the number of slave nodes in the network.

Status indicator diagnostics:

| Silkscreen | Status | Meaning | Commissioning action |
|---|---|---|---|
| PWR | Off | Coupler 24 V power supply abnormal | ● Check the power wiring and ensure proper module power connection<br>● Measure terminal voltage to verify sufficient power supply capacity |
| RUN | Off | No EtherCAT communication data | ● Check network cable/switch to ensure physical connection between master and slave is correct<br>● Verify master IP configuration and ensure slave node address mapping is correct |
| | Blinking | EtherCAT communication not in OP state | ● Check system consistency<br>● Optimize SDO transfer cycle; if SDO data volume is large and master performance is insufficient, slave may remain in Pre-Operational state for a long time |
| SF | Blinking | Configuration mismatch | The coupler performs automatic scanning to verify whether the scanned physical configuration matches the actual hardware configuration and network configuration, and determines whether module damage exists |

## 7.7.2 Object dictionary configuration and mapping verification

According to the definition of standard protocols, device object dictionaries are uniformly classified. All devices must follow the rules of the protocol for classification.

- Object dictionary structure:

| Index range | 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 |

- Module index dynamic allocation rules:

Each expansion module connected downstream of the AS71ETC Coupler is treated as an independent module unit. Module configuration parameters, process data (RxPDO/TxPDO), and SDO commands are all

managed as object dictionary entries.

The module object dictionary index is dynamically allocated using the rule: Base value + slot number × offset value (n = 0–31). Each expansion module has a predefined base value (see Table 7-1).

| Type | Calculation formula | Offset | Example (slot n) |
|---|---|---|---|
| RxPDO mapping | Base value + n × 0x01 | 1 byte | 0x1600 + n → 0x161F (n=31) |
| TxPDO mapping | Base value + n × 0x01 | 1 byte | 0x1A00 + n → 0x1A1F (n=31) |
| TxPDO parameter | Base value + n × 0x80 | 128 byte | 0x6000 + n×0x80 → 0x6F80 (n=31) |
| RxPDO parameter | Base value + n × 0x80 | 128 byte | 0x7000 + n×0x80 → 0x7F80 (n=31) |
| SDO parameter | Base value + n × 0x80 | 128 byte | 0x8000 + n×0x80 → 0x8F80 (n=31) |

**Note:**

- n represents the module slot number (0–31), indicating the slot position of the module.
- The upper address limit for slot 31 is 0x8FFF; exceeding this range may cause communication errors.

Table 7-1 Object dictionary base value distribution for A-Series

| Module | Object dictionary | | | | | |
|---|---|---|---|---|---|---|
| | RxPDO mapping | TxPDO mapping | TxPDO parameter | RxPDO parameter | SDO configuration parameter | SDO status parameter |
| AS71DI16 | - | 0x1A00 | 0x6001 | - | 0x8001 | 0x8078 |
| AS71DI32 | - | 0x1A00 | 0x6002 | - | 0x8002 | 0x8078 |
| AS71DOR8 | 0x1600 | 0x1A00 | 0x6004 | 0x7004 | 0x8004 | 0x8078 |
| AS71DO16 | 0x1600 | 0x1A00 | 0x6005 | 0x7005 | 0x8005 | 0x8078 |
| AS71AIN4 | - | 0x1A00 | 0x6015 | - | 0x8015 | 0x8078 |
| AS71AOU4 | 0x1600 | 0x1A00 | 0x6019 | 0x7019 | 0x8019 | 0x8078 |
| AS71RTD4 | - | 0x1A00 | 0x6029 | - | 0x8029 | 0x8078 |
| AS71THC4 | - | 0x1A00 | 0x602D | - | 0x802D | 0x8078 |

For example, the actual configuration is as follows.

AS71ETC_ECT_Coupler + AS71DI16+ AS71DOR8 + AS71AIN4+ AS71AOU4+ AS71THC4

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 |
| AS71DI16 slot 0 | - | 0x1A00 | 0x6001 | - | 0x8001 | 0x8078 |
| AS71DOR8 slot 1 | 0x1601 | 0x1A01 | 0x6085 | 0x7085 | 0x8085 | 0x80F8 |
| AS71AIN4 slot 2 | - | 0x1A02 | 0x6115 | - | 0x8115 | 0x8178 |
| AS71AOU4 slot 3 | 0x1603 | 0x1A03 | 0x6199 | 0x7199 | 0x8199 | 0x81F8 |
| AS71THC4 slot 4 | - | 0x1A04 | 0x622D | - | 0x822D | 0x8278 |

## 7.7.3 Scanning function application and configuration verification

The internal backplane bus protocol stack of the AS71ETC_ECT_Coupler has an automatic scanning function for modules. A-Series modules can be identified and configuration-verified through the automatic scanning mechanism of the AS71ETC_ECT_Coupler. The workflow is as follows:

1. Module identification mechanism

- Each A-Series expansion module has a unique 32-bit device identification code.
- During coupler power-on initialization, the AS71ETC_ECT_Coupler queries the identification codes

sequentially according to slot order (Slot 0–Slot 31).

- The obtained results are written to the object dictionary index 0xF050 subindex 1–32 as the "actual identification result".

2. Master configuration download process

- The master can obtain the expected module configuration either by reading the 0xF050 object dictionary through the scan function to obtain the device identification codes of the expansion modules connected downstream of the AS71ETC_ECT_Coupler, or by configuring the modules manually.
- When the AS71ETC_ECT_Coupler is in Pre-Operational state, the master writes the expected identification codes into object dictionary index 0xF030 subindex 1–32 as the "configuration reference values".

3. Configuration consistency verification

The AS71ETC_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 module identification codes are shown in the table below:

| Expansion module | Module ID identification code |
|---|---|
| AS71ETC_ECT_Coupler | 0x16315000 |
| AS71DI16 | 0x16315052 |
| AS71DI32 | 0x16315053 |
| AS71DOR8 | 0x16315069 |
| AS71DO16 | 0x16315062 |
| AS71AIN4 | 0x16315081 |
| AS71AOU4 | 0x16315089 |
| AS71RTD4 | 0x163150A1 |
| AS71THC4 | 0x163150A9 |

# 7.8 Typical commissioning cases

Case 1: System fails to enter OP state after module replacement

**Symptom:**

The original DO module (AS71DO16) was replaced with a new DO module (AS71DO32). After system startup, the RUN indicator on the AS71ETC coupler blinks, and the system cannot enter OP state.

**Troubleshooting process:**

1. Check object dictionary 0xF050 and find that the actual identification code of Slot 1 has changed.
2. Compare with the master-configured identification code in 0xF030, and find a mismatch.
3. Confirm that the module model has indeed been replaced.

**Solution:**

1. Re-scan the module configuration in the master.
2. Confirm that the identification codes have been updated.
3. Write the new configuration identification data to 0xF030.
4. Download the configuration and power-cycle the system.

Case 2: Configuration verification failure due to incorrect module order

**Symptom:**

After the project is downloaded, the system reports an error and the SF indicator on the AS71ETC coupler blinks, causing module operation failure.

**Troubleshooting process:**

1. Check object dictionary 0xF050 and find that the identification order of modules in Slot 2 and Slot 3 does not match the expected configuration.
2. The actual installation order is inconsistent with the master configuration; modules are installed in reverse order.

**Solution:**

1. Remove and reinstall the modules to match the physical order with the project configuration.
2. Ensure a one-to-one correspondence between slot positions and configuration index (0xF030).
3. Restart the coupler, and the system successfully enters OP state.

Case 3: Empty identification code due to module scan failure

**Symptom:**

The master fails to scan modules, and logs show that some slots have no identification code. The corresponding subindex values in object dictionary 0xF050 are 0x00000000.

**Troubleshooting process:**

1. Check the connection status of downstream modules of the AS71ETC coupler.
2. Check the power supply output and find that the supply voltage is below 18 V, preventing the modules from powering on properly.
3. Replace the power supply, after which normal operation is restored.

**Solution:**

1. Ensure the power supply is ≥ 24 V and stable.
2. Power cycle the system, and identification codes will be automatically written to 0xF050.
3. Rescan the modules on the master and update the configuration.

# 8 Troubleshooting

## 8.1 Common faults and solutions

| Fault code (decimal) | Fault code (hexadecimal) | Fault type | Solution |
|---|---|---|---|
| **General module fault** | | | |
| 1 | 0x0001 | Module configuration fault | Check whether the network configuration corresponds to the physical configuration of the module. |
| 2 | 0x0002 | Incorrect module parameter setting | Check whether the module parameter settings are correct; reconfigure as described in the manual. |
| 3 | 0x0003 | Module output port power supply fault | Measure the supply voltage at the module output port to check whether it is normal. Check whether the power supply module or the wiring is loose or disconnected. |
| 4 | 0x0004 | Module output fault | Check whether the load connected to the module output port exceeds the rated specifications. |
| **Parameter configuration fault** | | | |
| 18 | 0x0012 | Incorrect parameter setting for channel 0 | Check whether the parameter settings for channel 0 are within the permissible range; reconfigure as described in the manual. |
| 34 | 0x0022 | Incorrect parameter setting for channel 1 | Same as above; check the parameter configuration for channel 1. |
| 50 | 0x0032 | Incorrect parameter setting for channel 2 | Same as above; check the parameter configuration for channel 2. |
| 66 | 0x0042 | Incorrect parameter setting for channel 3 | Same as above; check the parameter configuration for channel 3. |
| 82 | 0x0052 | Incorrect parameter setting for channel 4 | Same as above; check the parameter configuration for channel 4. |
| 98 | 0x0062 | Incorrect parameter setting for channel 5 | Same as above; check the parameter configuration for channel 5. |
| 114 | 0x0072 | Incorrect parameter setting for channel 6 | Same as above; check the parameter configuration for channel 6. |
| 130 | 0x0082 | Incorrect parameter setting for channel 7 | Same as above; check the parameter configuration for channel 7. |
| **Output fault** | | | |
| 20 | 0x0014 | Output fault on channel 0 | Measure the output terminal voltage/current of channel 0 to check whether it is normal.<br>Check whether the load is short-circuited (impedance too low) or open-circuited (disconnected). |

| Fault code (decimal) | Fault code (hexadecimal) | Fault type | Solution |
|---|---|---|---|
| 36 | 0x0024 | Output fault on channel 1 | Same as above; check the output of channel 1. |
| 52 | 0x0034 | Output fault on channel 2 | Same as above; check the output of channel 2. |
| 68 | 0x0044 | Output fault on channel 3 | Same as above; check the output of channel 3. |
| 84 | 0x0054 | Output fault on channel 4 | Same as above; check the output of channel 4. |
| 100 | 0x0064 | Output fault on channel 5 | Same as above; check the output of channel 5. |
| 116 | 0x0074 | Output fault on channel 6 | Same as above; check the output of channel 6. |
| 132 | 0x0084 | Output fault on channel 7 | Same as above; check the output of channel 7. |
| **Signal source open-circuit fault** | | | |
| 21 | 0x0015 | Signal source open circuit fault on channel 0 | Check whether the physical connection of the signal source (such as sensors or input devices) for channel 0 is secure, and eliminate any open-circuit conditions. |
| 37 | 0x0025 | Signal source open circuit fault on channel 1 | Same as above; check the signal source for channel 1. |
| 53 | 0x0035 | Signal source open circuit fault on channel 2 | Same as above; check the signal source for channel 2. |
| 69 | 0x0045 | Signal source open circuit fault on channel 3 | Same as above; check the signal source for channel 3. |
| 85 | 0x0055 | Signal source open circuit fault on channel 4 | Same as above; check the signal source for channel 4. |
| 101 | 0x0065 | Signal source open circuit fault on channel 5 | Same as above; check the signal source for channel 5. |
| 117 | 0x0075 | Signal source open circuit fault on channel 6 | Same as above; check the signal source for channel 6. |
| 133 | 0x0085 | Signal source open circuit fault on channel 7 | Same as above; check the signal source for channel 7. |
| **Sampling signal out-of-range fault** | | | |
| 22 | 0x0016 | Channel 0 sampling signal out-of-range fault | Check whether the sampling value of channel 0 exceeds the maximum or minimum input range allowed by the chip. Adjust the signal source or the attenuation circuit accordingly. |
| 38 | 0x0026 | Channel 1 sampling signal out-of-range fault | Same as above; check the sampling signal of channel 1. |
| 54 | 0x0036 | Channel 2 sampling signal out-of-range fault | Same as above; check the sampling signal of channel 2. |
| 70 | 0x0046 | Channel 3 sampling signal out-of-range fault | Same as above; check the sampling signal of channel 3. |
| 86 | 0x0056 | Channel 4 sampling signal out-of-range fault | Same as above; check the sampling signal of channel 4. |

| Fault code (decimal) | Fault code (hexadecimal) | Fault type | Solution |
|---|---|---|---|
| 102 | 0x0066 | Channel 5 sampling signal out-of-range fault | Same as above; check the sampling signal of channel 5. |
| 118 | 0x0076 | Channel 6 sampling signal out-of-range fault | Same as above; check the sampling signal of channel 6. |
| 134 | 0x0086 | Channel 7 sampling signal out-of-range fault | Same as above; check the sampling signal of channel 7. |
| **Sampling signal above upper limit fault** | | | |
| 23 | 0x0017 | Channel 0 sampling signal above upper limit fault | Check whether the sampled value of channel 0 is above the set upper limit. Adjust the limit or signal source output. |
| 39 | 0x0027 | Channel 1 sampling signal above upper limit fault | Same as above; check the sampling signal of channel 1. |
| 55 | 0x0037 | Channel 2 sampling signal above upper limit fault | Same as above; check the sampling signal of channel 2. |
| 71 | 0x0047 | Channel 3 sampling signal above upper limit fault | Same as above; check the sampling signal of channel 3. |
| 87 | 0x0057 | Channel 4 sampling signal above upper limit fault | Same as above; check the sampling signal of channel 4. |
| 103 | 0x0067 | Channel 5 sampling signal above upper limit fault | Same as above; check the sampling signal of channel 5. |
| 119 | 0x0077 | Channel 6 sampling signal above upper limit fault | Same as above; check the sampling signal of channel 6. |
| 135 | 0x0087 | Channel 7 sampling signal above upper limit fault | Same as above; check the sampling signal of channel 7. |
| **Sampling signal below lower limit fault** | | | |
| 24 | 0x0018 | Channel 0 sampling signal below lower limit fault | Check whether the sampled value of channel 0 is below the set lower limit. Adjust the limit or signal source output. |
| 40 | 0x0028 | Channel 1 sampling signal below lower limit fault | Same as above; check the sampling signal of channel 1. |
| 56 | 0x0038 | Channel 2 sampling signal below lower limit fault | Same as above; check the sampling signal of channel 2. |
| 72 | 0x0048 | Channel 3 sampling signal below lower limit fault | Same as above; check the sampling signal of channel 3. |
| 88 | 0x0058 | Channel 4 sampling signal below lower limit fault | Same as above; check the sampling signal of channel 4. |
| 104 | 0x0068 | Channel 5 sampling signal below lower limit fault | Same as above; check the sampling signal of channel 5. |
| 120 | 0x0078 | Channel 6 sampling signal below lower limit fault | Same as above; check the sampling signal of channel 6. |
| 136 | 0x0088 | Channel 7 sampling signal below lower limit fault | Same as above; check the sampling signal of channel 7. |
| **Operating speed over-limit fault** | | | |
| 25 | 0x0019 | Channel 0 operating speed over-limit fault | Check whether channel 0 operating speed exceeds the specification limit. |
| 41 | 0x0029 | Channel 1 operating speed over-limit fault | Check whether channel 1 operating speed exceeds the specification limit. |

| Fault code (decimal) | Fault code (hexadecimal) | Fault type | Solution |
|---|---|---|---|
| **ACC/DEC time over-limit fault** | | | |
| 26 | 0x001A | Channel 0 ACC/DEC time over-limit fault | Check whether channel 0 ACC/DEC time exceeds the specification limit. |
| 42 | 0x002A | Channel 1 ACC/DEC time over-limit fault | Check whether channel 1 ACC/DEC time exceeds the specification limit. |

# 8.2 Serial communication module exception code description

The AS71COM2 module provides three exception code parameters: ModuleErrID, which reports faults related to the serial communication module (see section 8.1 Common faults and solutions), and Slaver0_errno / Slaver1_errno, which report slave virtual module exceptions for channel 0 and channel 1. The master virtual module parameter CmdErrno reflects the corresponding module exception.

The exception codes are listed in the table below. The exception code offset rules are defined as follows: slave exception codes are based on the table values plus an offset of 200; master exception codes are based on the table values plus an offset of 10000.

| Exception code (decimal) | Name | Description |
|---|---|---|
| 1 | Illegal function code | For the server (or slave), the function code received in the query is not a permitted operation. This may occur because the function code is only applicable to new devices, and is not implemented in the selected unit. It may also indicate that the server (or slave) is in the wrong state to process this type of request, for example, because it is unconfigured and is being asked to return register values. |
| 2 | Illegal data address | For the server (or slave), the data address received in the query is not a permitted address. More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, a request with an offset of 96 and a length of 4 will succeed, while a request with an offset of 96 and a length of 5 will generate exception code 02. |
| 3 | Illegal data value | For the server (or slave), the value included in the query is not permitted. This value indicates a fault in the remaining structure of the request, such as an incorrect implied length. It does not mean that the Modbus protocol is aware of the meaning of specific register values. A data item stored in a register may have a value outside the expectations of the application. |
| 4 | Slave device failure | An unrecoverable error occurred while the server (or slave) was attempting to execute the requested operation. |
| 12 | CRC error | CRC error |
| 13 | Data error | Data error |
| 14 | Execution error | Execution error |
| 15 | Unknown execution | Unknown execution |
| 16 | Exceeded protocol data | Exceeded protocol data length |

| Exception code (decimal) | Name | Description |
|---|---|---|
| | length | |
| 17 | Slave ID error | Slave ID error |
| 18 | Master module (read/write) length exceeds the maximum module length or is 0 | Master module (read/write) length exceeds the maximum module length or is 0 |
| 19 | Timeout | Timeout |
| 20 | Invalid parameter | Invalid parameter |
| 21 | Incorrect 7-bit mode setting | Incorrect 7-bit mode setting |

# 9 Inspection and maintenance

## 9.1 Daily inspection and regular maintenance

Due to the effects of ambient temperature, humidity, dust, and vibration, components inside the product may age, which may cause potential faults or shorten the service life of the product. Therefore, to extend the product service life and prevent safety hazards, daily inspection and regular maintenance are required.

| Check item | Content | Inspection method |
|---|---|---|
| **Daily inspection: Recommended daily.** | | |
| Ambient environment | Whether the ambient temperature, humidity, vibration, dust, gas, or oil contamination is excessive, and whether there is condensation or water droplets inside and outside the machine | Visual inspection and instrument measurement |
| | Whether foreign matter, such as tools, or dangerous substances are placed nearby | Visual inspection |
| Power supply voltage | Whether the supply voltage is abnormal | Multimeter or voltage meter |
| Indicator | Whether the display is clear | Visual inspection |
| **Regular maintenance: Recommended quarterly, especially in harsh environments with dust, oil, or corrosive gases. Before regular maintenance, cut off the power and wait at least 15 min.** | | |
| Entire machine | Whether the DIN rail fixing clip is loose | Visual inspection |
| | Whether the machine is deformed, cracked, or damaged, or the color changes due to overheating and aging | Visual inspection |
| | Whether excessive dirt or dust is attached | Visual inspection |
| | Whether there is any abnormal noise, vibration, odor, or discoloration | Auditory, olfactory, and visual inspection |
| Connection terminals | ● Whether there is any overheating or damage<br>● Whether the terminals are secure | Visual inspection, instrument-based inspection |
| Ventilation duct | Whether there are foreign matters blocking or attached to the air inlets or air outlets | Visual inspection |

For more details about maintenance, contact the local ASTOR office, or visit our website https://www.astor.com.pl/wsparcie/astor-centrum-wsparcia.html

# Appendix A Product dimensions

## A.1 Communication coupler

This section includes module installation dimensions and weight, cable connection dimensions, and end cover dimensions.

### A.1.1 Module installation dimensions and weight

This section applies to the following models: AS71ETC, AS71PNS, AS71EIP, and AS71TCP.

Figure A-1 Module installation dimensions (unit: mm)

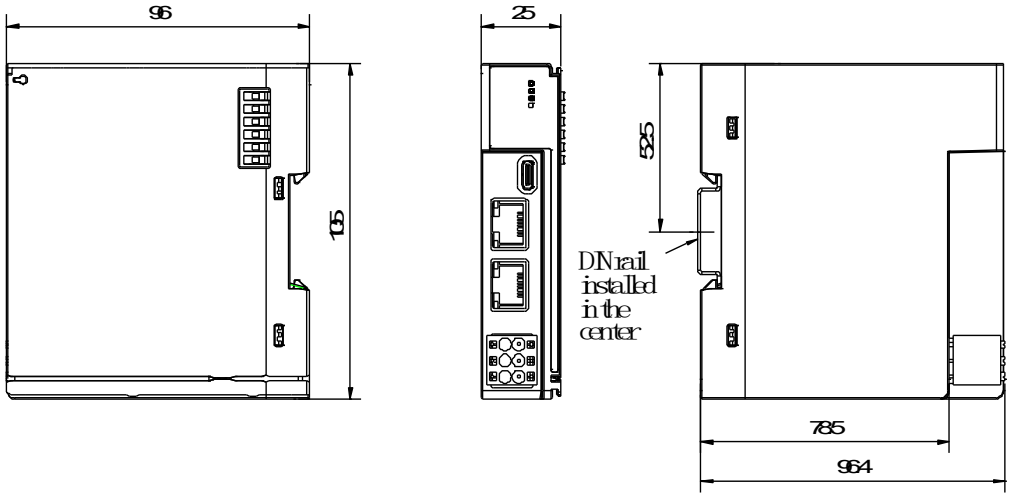


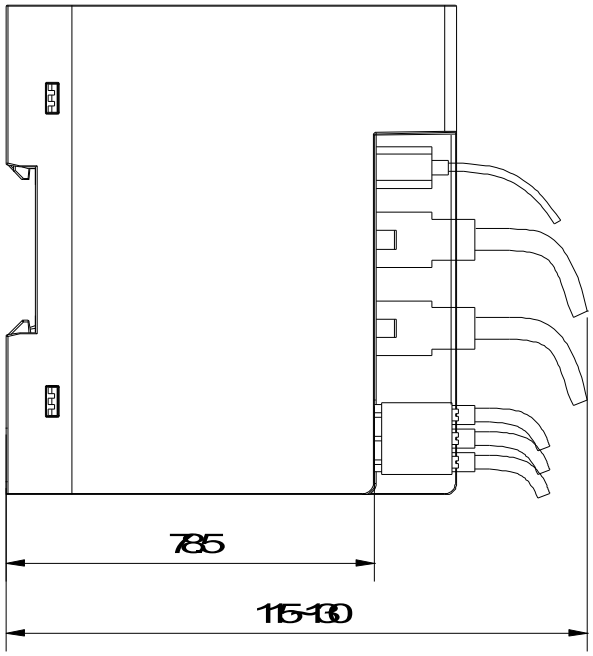

Table A-1 Module dimensions and weight

| Product model | Outline dimensions W×H×D (mm) | Packaging outline dimensions W×H×D (mm) | Standard weight (kg) | Gross weight (kg) |
|---|---|---|---|---|
| AS71ETC | 25×105×96 | 29×109×100 | 0.25 | 0.28 |
| AS71PNS | | | | |
| AS71EIP | | | | |
| AS71TCP | | | | |

## A.1.2 Connection cable dimensions

This section applies to the following models: AS71ETC, AS71PNS, AS71EIP, and AS71TCP.

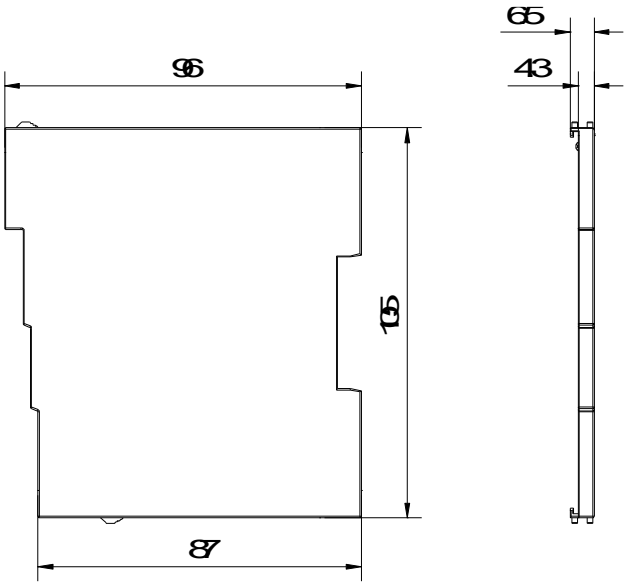
Figure A-2 Connection cable dimensions (unit: mm)




## A.1.3 End cover dimensions

This section applies to the following models: AS71ETC, AS71PNS, AS71EIP, and AS71TCP.

Figure A-3 End cover dimensions (unit: mm)



# A.2 I/O module

This section includes the installation dimensions and weight of the I/O module, as well as cable connection dimensions.

## A.2.1 Module installation dimensions and weight

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

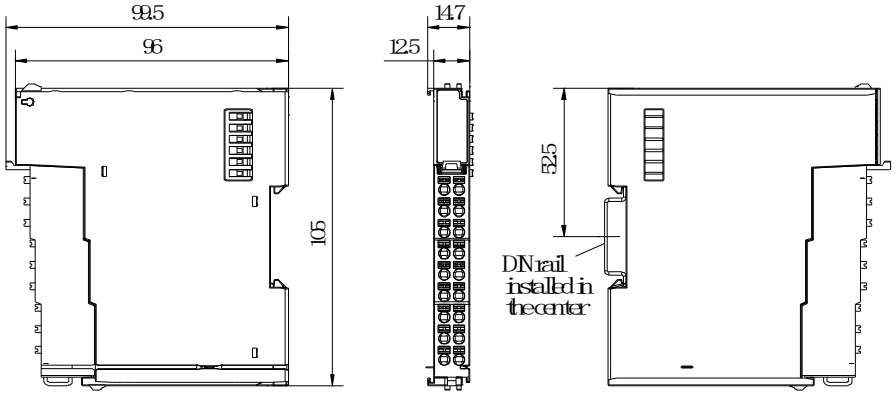



Table A-2 Module dimensions 1 and weight

| Product model | Outline dimensions W×H×D (mm) | Packaging outline dimensions W×H×D (mm) | Standard weight (kg) | Gross weight (kg) |
|---|---|---|---|---|
| AS71DI16 | 12.5×105×96 | 17.5×109×100 | 0.15 | 0.18 |
| AS71DO16 | | | | |
| AS71AIN4 | | | | |
| AS71RTD4 | | | | |
| AS71THC4 | | | | |
| AS71BRG1 | | | | |
| AS71BRG2 | | | | |
| AS71AIV8 | | | | |
| AS71AIC8 | | | | |
| AS71AOU4 | | | | |
| AS71DT08 | | | | |
| AS71AN02 | | | | |
| AS71IN02 | | | | |
| AS71IN01 | | | | |
| AS71PUOC | | | | |
| AS71PWRR | | | | |
| AS71COM2 | | | | |

Figure A-5 Module installation dimensions 2 (unit: mm)

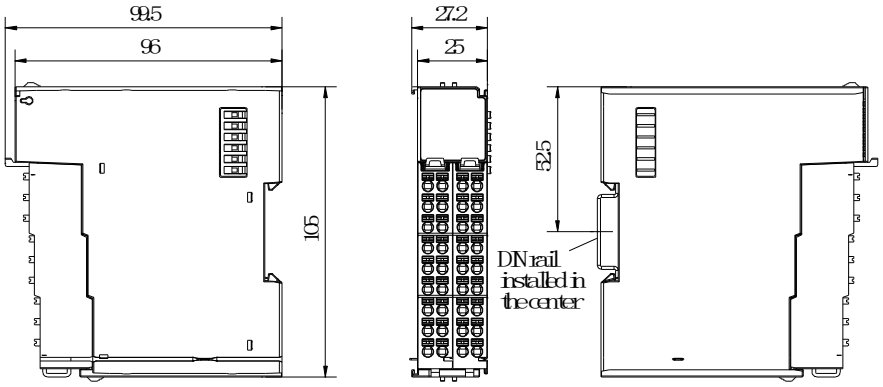


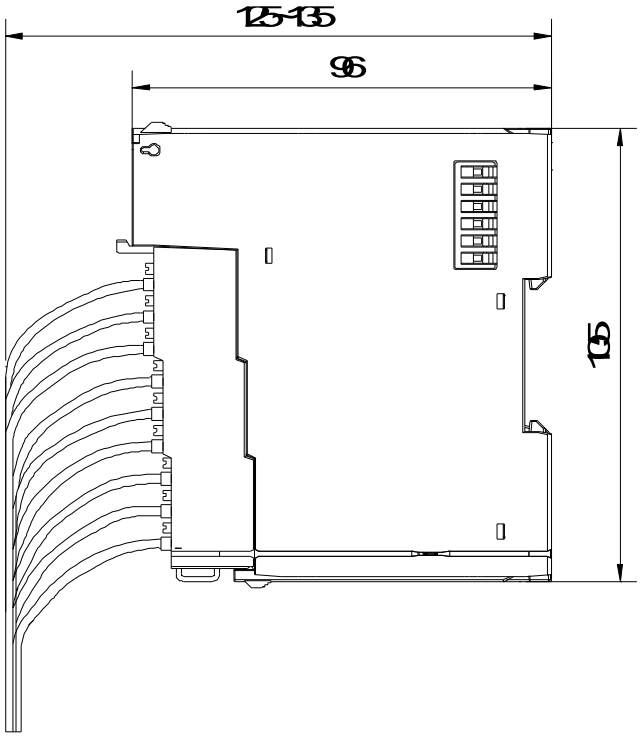

Table A-3 Module dimensions 2 and weight

| Product model | Outline dimensions W×H×D (mm) | Packaging outline dimensions W×H×D (mm) | Standard weight (kg) | Gross weight (kg) |
|---|---|---|---|---|
| AS71DI32 | 25×105×96 | 29×109×100 | 0.30 | 0.33 |
| AS71DO32 | | | | |
| AS71DOR8 | | | | |
| AS71DT16 | | | | |

## A.2.2 Connection cable dimensions

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

Figure A-6 Connection cable dimensions (unit: mm)



# Appendix B Address mapping table description

## B.1 Function code description

The A-Series I/O system supports the following Modbus standard function codes: 01, 02, 03, 04, 05, 06, 15, 16, and 23. The description of the function codes is shown in Table B-1.

### B.1.1 Description of Modbus standard function codes

Table B-1 Function code description

| Function code | Name | Description | Operation type |
|---|---|---|---|
| 01 | Read Coils | Read coils | Bit operation (multiple) |
| 02 | Read Discrete Inputs | Read discrete inputs | Bit operation (multiple) |
| 03 | Read Holding Registers | Read holding registers | Word operation (multiple) |
| 04 | Read Input Registers | Read input registers | Word operation (multiple) |
| 05 | Write Single Coil | Write a single coil | Bit operation (single) |
| 06 | 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) |

### B.1.2 BIT access

#### B.1.2.1 BIT read

02: Read Discrete Inputs / Read discrete input status / Bit operation (multiple)

This function code allows bit-level read operations on all configured digital input modules. The address offset starts from 0 and follows the configuration order.

#### B.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 bit-level write operations or readback on all configured digital output modules. The address offset starts from 0 and follows the configuration order.

### B.1.3 WORD access

#### B.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:** For function code 23, the read and write operations do not share the same address mapping.

These two function codes allow word-level read operations on the input data of all configured modules. Digital input modules support bit-level operations via function code 02, and also support word-level operations in this area (offset address 4096). The error diagnostic information for all modules is also mapped to address 8192.

- Analog module parameters are mapped sequentially starting from offset address 0 in configuration order.
- Digital module parameters are mapped sequentially starting from offset address 4096 in configuration order.
- Error diagnostic information parameters for all modules are mapped sequentially starting from offset address 8192 in configuration order.

#### B.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:** For function code 23, the read and write operations do not share the same address mapping.

These four function codes allow word-level write or readback operations on the output data of all configured modules. For digital output modules, in addition to bit-level operations via function codes 05/15, word-level operations are also supported at offset address 4096. To avoid conflicts, do not perform bit-level and word-level write operations on the same digital output simultaneously from the master.

- Analog output module parameters are mapped sequentially starting from offset address 0 in configuration order.
- Digital output module parameters are mapped sequentially starting from offset address 4096 in configuration order.

# B.2 Address mapping table

## B.2.1 Address allocation

### B.2.1.1 Area

According to the defined access method above, the address space is divided into four areas.

| Address area | Address range | | Data type |
|---|---|---|---|
| BIT read | 0–2048 | | Digital input module |
| BIT write | 0–2048 | | Digital output module |
| WORD read | 0–12288 | 0–4095 | Analog input module |
| | | 4096–8191 | Digital input module |
| | | 8192–12287 | Diagnostic information (module error information) |
| WORD write | 0–8192 | 0–4095 | Analog output module |
| | | 4096–8191 | Digital output module |

### B.2.1.2 Module address count table

| No. | Function code | 02 | 01, 05, 15 | 04, 23 | 03, 06, 16, 23 | 04, 23 | 03, 06, 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 | **AS71TCP** | - | - | - | - | - | - | - |
| 1 | AS71DI16 | 16 | - | - | - | 1 | - | 1 |
| 2 | AS71DI32 | 32 | - | - | - | 2 | - | 1 |
| 3 | AS71DO16 | - | 16 | - | - | - | 1 | 1 |
| 4 | AS71DO32 | - | 32 | - | - | - | 2 | 1 |
| 5 | AS71DOR8 | - | 8 | - | - | - | 1 | 1 |
| 6 | AS71DT16 | 16 | 16 | - | - | 1 | 1 | 1 |
| 7 | AS71AIN4 | - | - | 4 | - | - | - | 4 |
| 8 | AS71AIV8 | - | - | 8 | - | - | - | 8 |
| 9 | AS71AIC8 | - | - | 8 | - | - | - | 8 |
| 10 | AS71RTD4 | - | - | 8 | - | - | - | 4 |
| 11 | AS71THC4 | - | - | 8 | - | - | - | 4 |
| 12 | AS71AOU4 | - | - | - | 4 | - | - | 4 |
| 13 | AS71IN02 | - | - | 17 | 9 | - | - | 2 |
| 14 | AS71IN01 | - | - | 11 | 7 | - | - | 1 |
| 15 | AS71AN02 | - | - | 17 | 5 | - | - | 2 |

### B.2.1.3 Example

| Configuration: Total number of modules: 18 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Function code | 02 | 01, 05, 15 | 04, 23 | 03, 06, 16, 23 | 04, 23 | 03, 06, 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 | AS71TCP | - | - | - | - | - | - | - |
| 1 | AS71DI16 | 0–15 | - | - | - | 0 | - | 0 |
| 2 | AS71DI32 | 16–47 | - | - | - | 1–2 | - | 1 |
| 3 | AS71DO16 | - | 0–15 | - | - | - | 0 | 2 |
| 4 | AS71DO32 | - | 16–47 | - | - | - | 1–2 | 3 |
| 5 | AS71DO16 | - | 48–63 | - | - | - | 3 | 4 |
| 6 | AS71DO32 | - | 64–95 | - | - | - | 4–5 | 5 |
| 7 | AS71DOR8 | - | 96–111 | - | - | - | 6 | 6 |
| 8 | AS71DT16 | 48–63 | 112–127 | - | - | 3 | 7 | 7 |
| 9 | AS71DT16 | 64–79 | 128–143 | - | - | 4 | 8 | 8 |
| 10 | AS71AIN4 | - | - | 0–3 | - | - | - | 9–13 |
| 11 | AS71AIV8 | - | - | 4–11 | - | - | - | 14–21 |
| 12 | AS71AIC8 | - | - | 12–19 | - | - | - | 22–29 |
| 13 | AS71RTD4 | - | - | 20–27 | - | - | - | 30–33 |
| 14 | AS71THC4 | - | - | 28–35 | - | - | - | 34–37 |
| 15 | AS71AOU4 | - | - | - | 0–3 | - | - | 38–41 |
| 16 | AS71IN02 | - | - | 36–52 | 4–12 | - | - | 42–43 |
| 17 | AS71IN01 | - | - | 53–63 | 13–19 | - | - | 44 |
| 18 | AS71AN02 | - | - | 64–80 | 20–24 | - | - | 45–46 |

## B.3 Additional notes

The address range accessed by the above function codes is calculated based on the configuration. If the access exceeds the actual configured address range, an illegal data address error will be reported.

For function code 23, the read operation does not read data from the "WORD Write" area, but from the "WORD Read" area. Therefore, if the master supports function code 23, it can be used to perform simultaneous read and write of input and output data, improving communication efficiency.