

# Flex-EC Series Expansion Card User Manual



SHENZHEN INVT ELECTRIC CO., LTD.

# Preface

## Overview

Thank you for choosing INVT Flex-EC series expansion card.

## Target audience

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

## About documentation obtaining

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

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

## Change history

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

| No. | Change description | Version | Release date |
|-----|--------------------|---------|--------------|
| 1   | First release.     | V1.0    | June, 2025   |



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# Safety precautions

## Safety declaration

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

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

## 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.  |

## Personnel requirements

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

## Safety guidelines

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

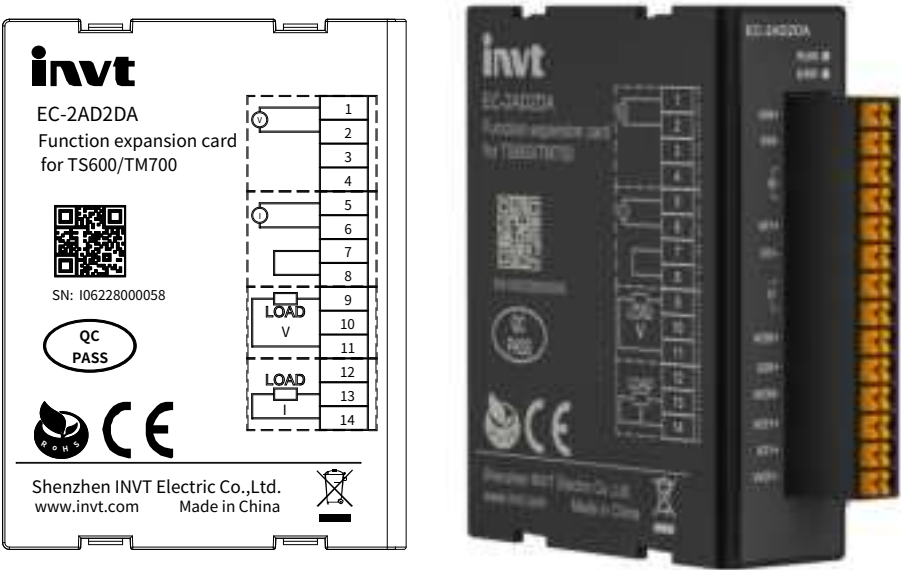
| Moving                                                                              |                                                                                                                                                                                                                     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

| Commissioning and running                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     | <p>protection circuit, a circuit for interlocking between forward and reverse operations, and an anti-equipment-damage switch for interlocking between the position upper limit and lower limit.</p> <ul style="list-style-type: none"> <li>• To ensure the safe running of equipment, design external protection circuits and safety mechanisms for output signals related to major accidents.</li> <li>• Design proper external control circuits to ensure the proper running of equipment, since outputs may be out of control when the control circuit has an exception.</li> </ul>                |
| Maintenance and component replacement                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|    | <ul style="list-style-type: none"> <li>• Keep the product and its parts and components away from combustible materials and ensure they have no combustible materials adhered.</li> <li>• Before carrying out product maintenance or component operations, cut off all power supplies connected to the product.</li> <li>• Prevent the screws, cables and other conductive parts from falling into the product during maintenance or component replacement.</li> <li>• During maintenance and component replacement, take proper anti-static measures on the product and its internal parts.</li> </ul> |
| <b>Note</b>                                                                         | Use proper torque to tighten screws.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Disposal                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|   | <ul style="list-style-type: none"> <li>• The product contains heavy metals. Dispose of a scrap product as industrial waste.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|  | <ul style="list-style-type: none"> <li>• Dispose of a scrap product separately at an appropriate collection point but not place it in the normal waste stream.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                              |

# 1 EC-2AD2DA analog I/O expansion card

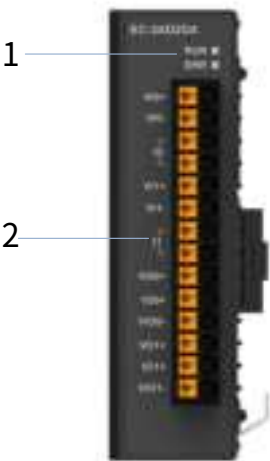
## 1.1 Product overview

### 1.1.1 Product model and nameplate



| Model     | Ordering code | Description                                                                                          | Applicable model                   |
|-----------|---------------|------------------------------------------------------------------------------------------------------|------------------------------------|
| EC-2AD2DA | 11060-00333   | 2-in 2-out analog I/O expansion card<br>(2 channels of analog input and 2 channels of analog output) | Applicable to INVT<br>TS/TM series |

### 1.1.2 Component description



| No.                            | Name             | Description              |                               |                                                                                                                                         |
|--------------------------------|------------------|--------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 1                              | Status indicator | RUN: Yellow green        | Power-on/Run status indicator | On: The expansion card is running.                                                                                                      |
|                                |                  |                          |                               | Slow flashing (2.5 Hz): Waiting for master station configuration                                                                        |
|                                |                  |                          |                               | Off: The module is not powered on or it is abnormal.                                                                                    |
|                                |                  | ERR: Red                 | Module fault indicator        | Steady on: System error                                                                                                                 |
|                                |                  |                          |                               | Slow flashing (2.5 Hz): General error, including configuration error, sampling over-range error, and expansion card communication error |
| Off: The module works normally |                  |                          |                               |                                                                                                                                         |
| 2                              | User terminal    | External wiring terminal |                               |                                                                                                                                         |

### 1.1.3 Basic specifications

| Item         | Specifications     |
|--------------|--------------------|
| IP rating    | IP20               |
| Size (W×H×D) | 70.8mm×20mm×53.5mm |
| Net weight   | 36g                |

### 1.1.4 Power supply specifications

| Item                                   | Specifications              |
|----------------------------------------|-----------------------------|
| Rated input voltage of power interface | 5VDC (4.75VDC–5.25VDC)      |
| Rated input current of power interface | 600mA (Typical value at 5V) |
| Hot swapping function                  | Not supported               |

### 1.1.5 Input specifications

| Item                                         | Specifications                          |
|----------------------------------------------|-----------------------------------------|
| Number of input channels                     | 2 channels                              |
| Voltage input range                          | 0–10V, 0–5V, 1–5V                       |
| Voltage input resistance                     | >400kΩ                                  |
| Converting speed                             | <6ms/channel                            |
| Current input range                          | 0–20mA, 4–20mA                          |
| Current sampling impedance                   | 200Ω                                    |
| Input accuracy (at room temperature of 25°C) | Voltage: ±1%, Current: ±1% (full scale) |
| Input accuracy (in full temperature range)   | Voltage: ±3%, Current: ±3% (full scale) |
| Input signal frequency                       | <20Hz                                   |

| Item          | Specifications |
|---------------|----------------|
| Resolution    | 12 bits        |
| Digital input | 0-20000        |

### 1.1.6 Output specifications

| Item                                          | Specifications                       |
|-----------------------------------------------|--------------------------------------|
| Number of output channels                     | 2 channels                           |
| Output voltage range                          | 0-10V, 0-5V, 1-5V                    |
| Output current range                          | 0-20mA, 4-20mA                       |
| Output voltage load                           | >2k $\Omega$                         |
| Current-driven load                           | <250 $\Omega$                        |
| Conversion time                               | Follows CPU scan cycle, minimum 1 ms |
| Output accuracy (at room temperature of 25°C) | $\pm 1\%$ (full scale)               |
| Output accuracy (in full temperature range)   | $\pm 5\%$ (full scale)               |
| Resolution                                    | 12 bits                              |
| Digital output                                | 0-20000                              |

### 1.1.7 Other specifications

| Item                              | Specifications |
|-----------------------------------|----------------|
| Sampling period                   | 1ms            |
| Communication cycle with the host | 200ms          |
| Isolation method                  | Isolation      |
| Output short-circuit detection    | Not supported  |
| Output open-circuit detection     | Not supported  |

### 1.1.8 Environment requirements

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

| Item                 | Specifications               |
|----------------------|------------------------------|
| level                |                              |
| vibration resistance | Compliant with IEC60068-2-6  |
| Impact resistance    | Compliant with IEC60068-2-27 |

## 1.2 Mechanical installation

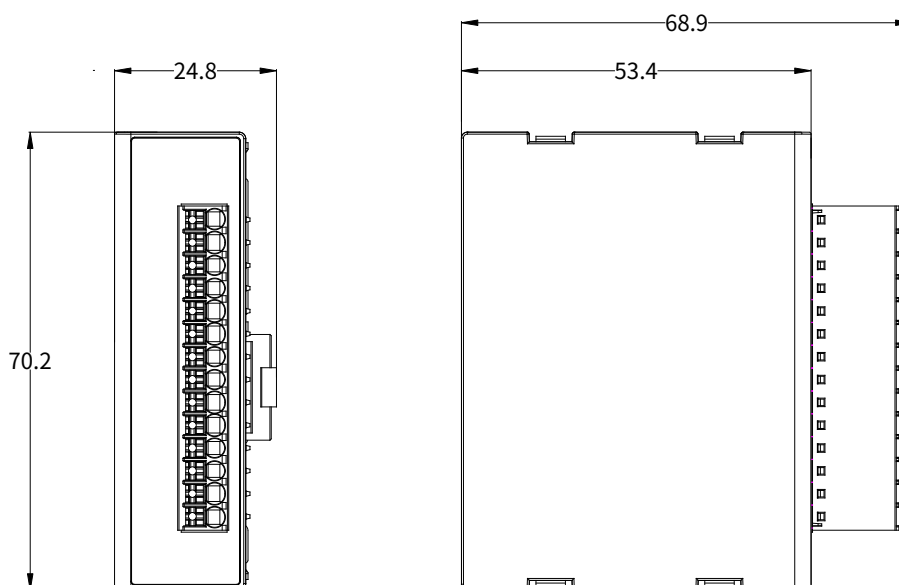
### 1.2.1 Installation environment requirements

When installing this product on a DIN rail, full consideration should be given to operability, maintainability, and environmental resistance before installation.

| Item                                          | Specifications                                                                                                                                |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| IP rating                                     | IP20                                                                                                                                          |
| Pollution degree                              | Level 2: Generally there is only non-conductive pollution, but you shall consider transient conductivity accidentally caused by condensation. |
| Altitude                                      | 2000m (80kPa)                                                                                                                                 |
| Storage temperature and humidity range        | Temperature: -20°C–60°C; RH: <90%, no condensation                                                                                            |
| Transportation temperature and humidity range | Temperature: -40°C–70°C; RH: <95%, no condensation                                                                                            |
| Working temperature and humidity range        | Temperature: -20°C–55°C; RH: <95%, no condensation                                                                                            |

### 1.2.2 Installation dimensions

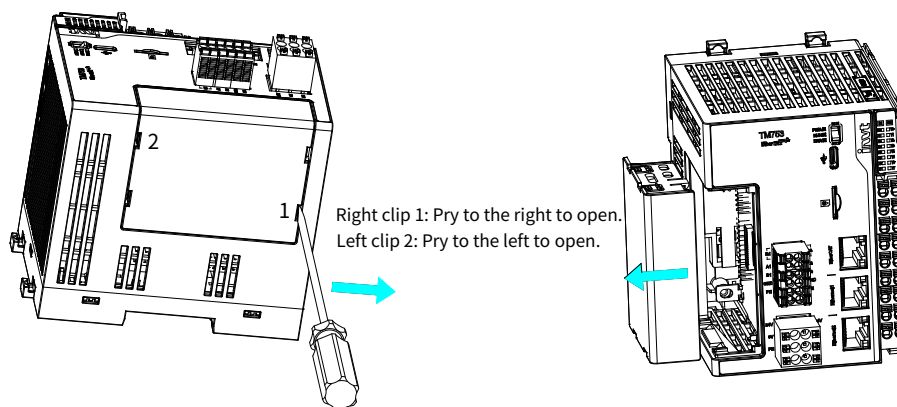
The installation dimensions are shown in the figure below, with units in millimeters (mm).



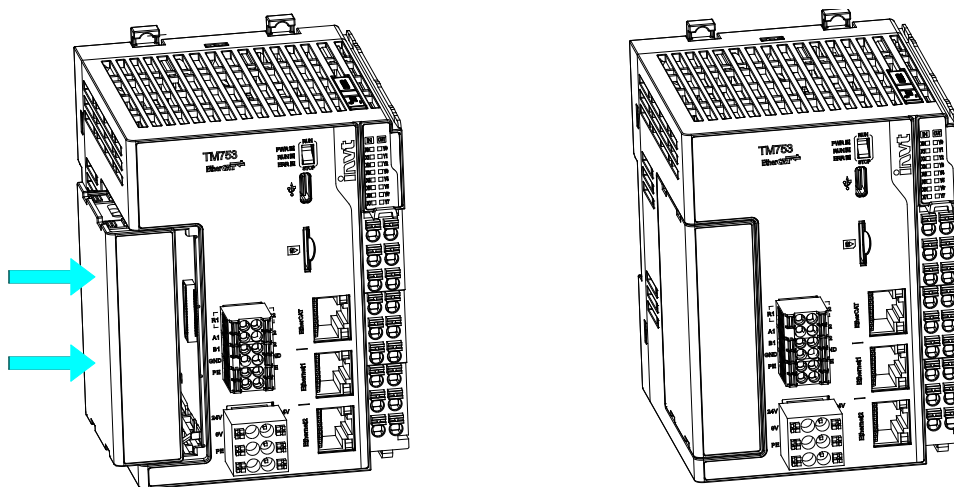
### 1.2.3 Installation

Take out the cover before installing the expansion card. The installation steps are as follows.

Step 1 Gently pry open the cover plate clips with a tool on the side of the product (in the order of positions 1 and 2); Slide the cover plate to the left horizontally and take it out.



Step 2 Slide the expansion card into the guide slot in parallel, then press the clip positions on the upper and lower sides of the expansion card until the expansion card is clamped (there is an obvious sound of clamping after they are installed in place).



### 1.2.4 Disassembly

Use a tool to gently pry the cover snap-fits on the side of the product (in sequence of position 1 and 2), and slide the expansion card to the left to remove it. See Step 1 in 1.2.3 Installation for reference.

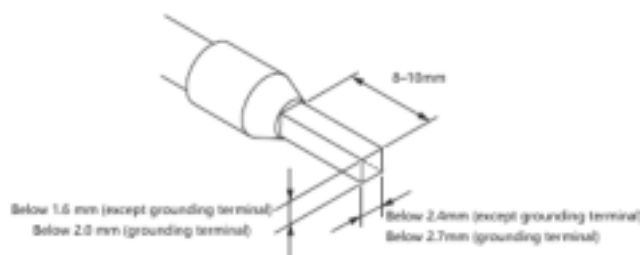
## 1.3 Electrical installation

### 1.3.1 Cable model selection

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

**Note:**

- The cable diameters of the tubular cable lugs in the preceding table is only for reference, which can be adjusted based on actual situations.
- When using other tubular cable lugs, crimp multiple strands of cable, and the processing size requirements are as follows:



### 1.3.2 Terminal definition

| Schematic diagram | Terminal | Terminal signal | Description                                          |
|-------------------|----------|-----------------|------------------------------------------------------|
|                   | 1        | VI0+            | Positive terminal of voltage/current input channel 0 |
|                   | 2        | VI0-            | Negative terminal of voltage/current input channel 0 |
|                   | 3        | I0              | Short-circuit point of current-mode channel 0        |
|                   | 4        |                 |                                                      |
|                   | 5        | VI1+            | Positive terminal of voltage/current input channel 1 |
|                   | 6        | VI1-            | Negative terminal of voltage/current input channel 1 |
|                   | 7        | I1              | Short-circuit point of current-mode channel 1        |
|                   | 8        |                 |                                                      |
|                   | 9        | VO0+            | Positive terminal of voltage output channel 0        |
|                   | 10       | IO0+            | Positive terminal of current output channel 0        |

| Schematic diagram | Terminal | Terminal signal | Description                                           |
|-------------------|----------|-----------------|-------------------------------------------------------|
|                   | 11       | VI00-           | Negative terminal of voltage/current output channel 0 |
|                   | 12       | VO1+            | Positive terminal of voltage output channel 1         |
|                   | 13       | IO1+            | Positive terminal of current output channel 1         |
|                   | 14       | VI01-           | Negative terminal of voltage/current output channel 1 |

### 1.3.3 Terminal wiring

Figure 1-1 Voltage input wiring

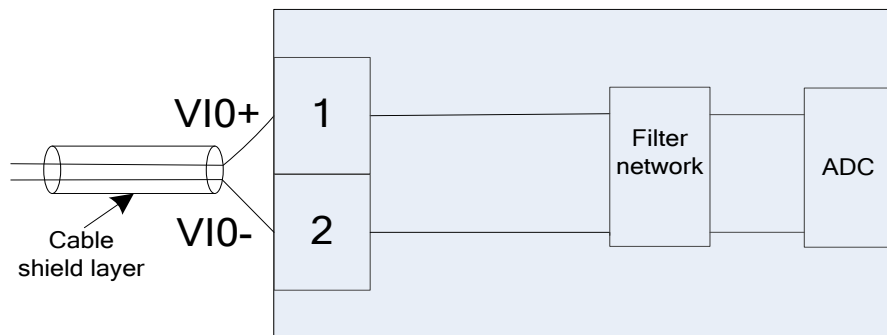


Figure 1-2 Current input wiring

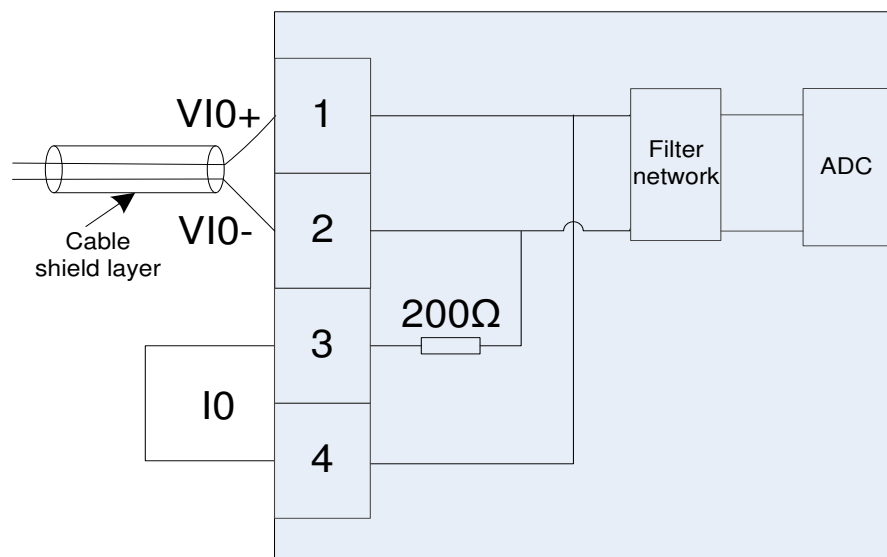


Figure 1-3 Voltage output wiring

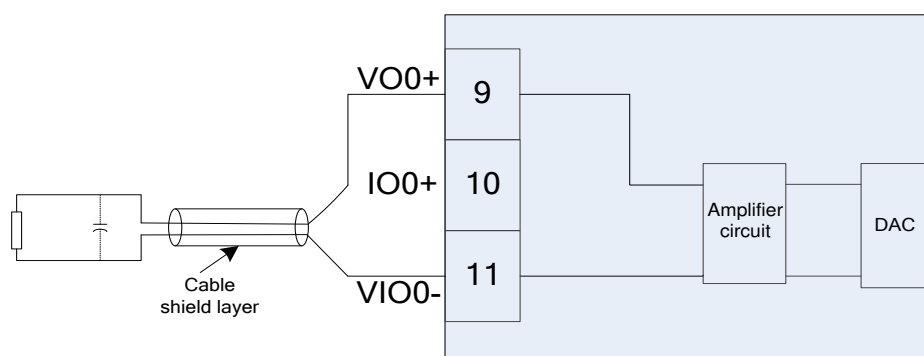
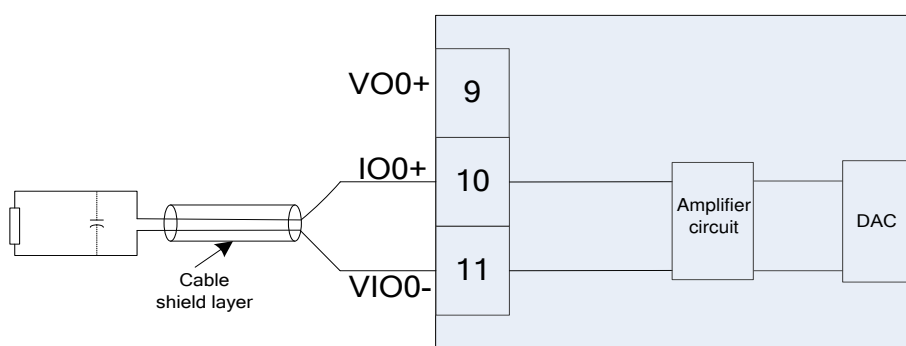


Figure 1-4 Current output wiring



## 1.4 Fault diagnosis

### 1.4.1 Diagnosis method

#### 1.4.1.1 Fault diagnosis methods for TS series PLC

Fault diagnosis methods for the EC-2AD2DA expansion card in the TS series PLC include indicator lights, host controller PLC log files, and host controller PLC error codes.

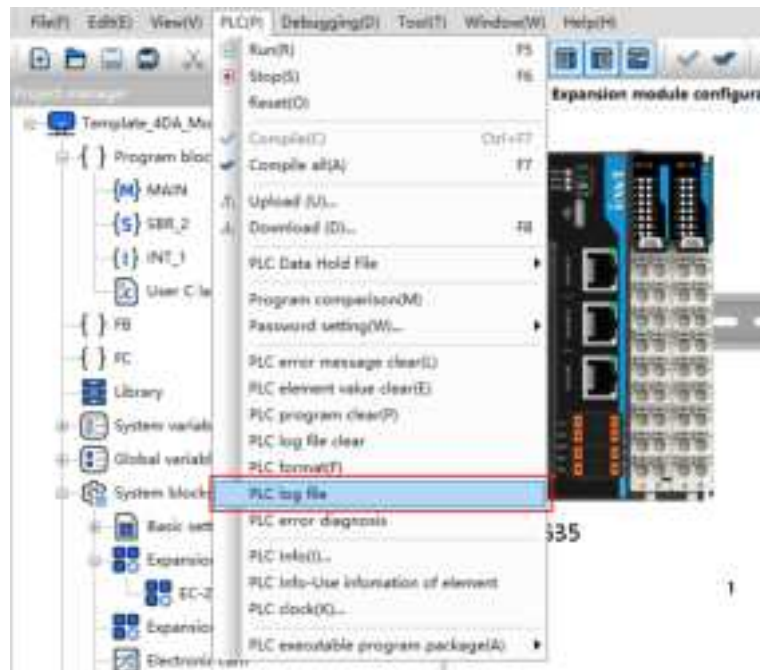
##### ■ Indicator

| Error indicator state  | Description                  | Solution                                                                       |
|------------------------|------------------------------|--------------------------------------------------------------------------------|
| Steady on              | Expansion card system error  | Restart the expansion card. If the error persists, contact the manufacturer.   |
| Slow flashing (2.5 Hz) | Expansion card general error | Determine the error type and solution through the host controller error codes. |
| Off                    | No error                     | -                                                                              |

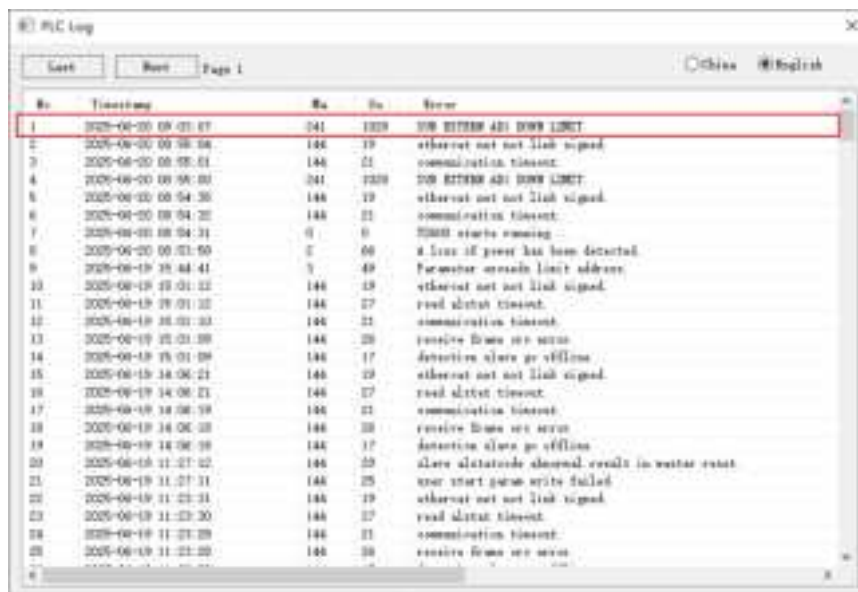
##### ■ Host controller PLC log files

Refer to the following steps:

Step 1 Open the Autostation Pro software in the host controller, then choose **PLC > PLC log file** from the menu bar.



Step 2 Check the latest error information in the **PLC Log** object box.



As shown in the figure above, the current main code 241 (0xF1) and subcode 1028 (0x404) correspond to an input under-limit error on AD channel 1.

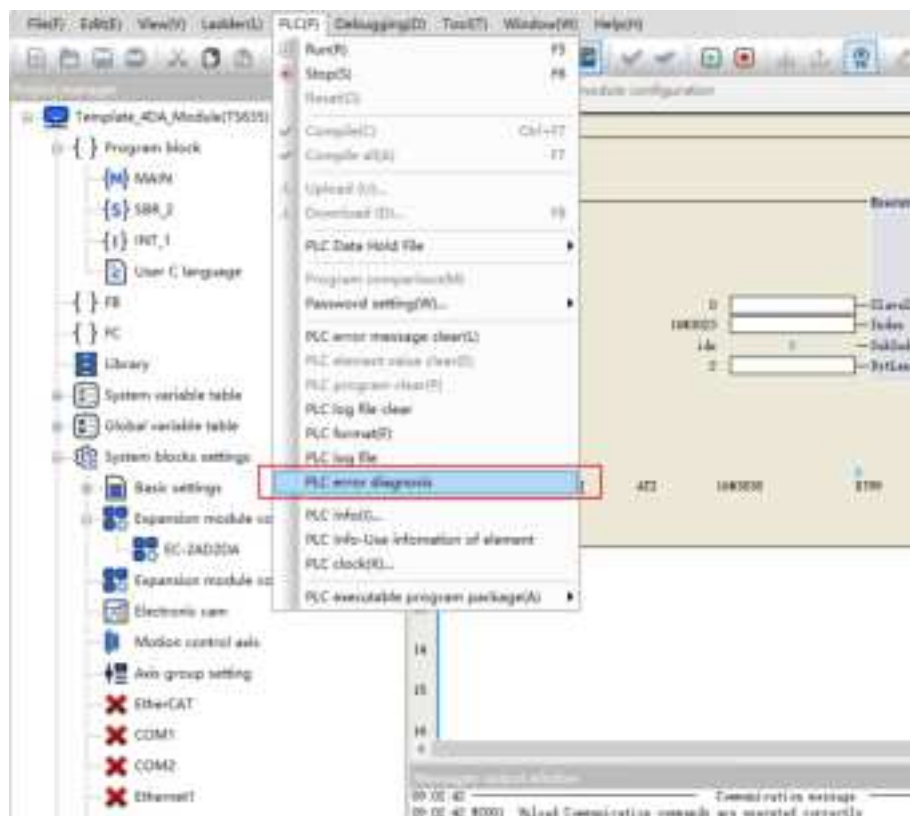
### ■ Host controller PLC error diagnosis

Step 1 Open the error diagnosis interface in the Autostation Pro on the host controller.

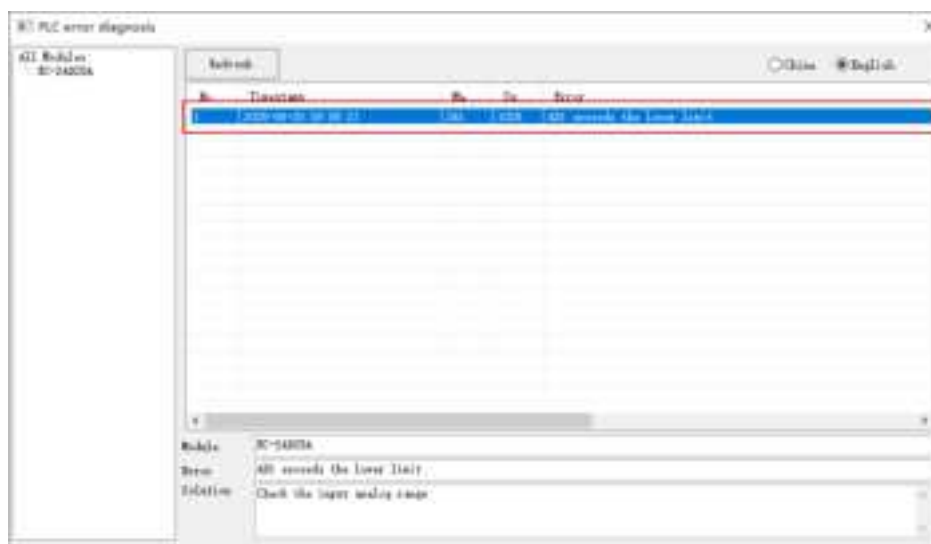
Method 1: Double-click the error indicator in the **Messages output window** below.



Method 2: Click on **PLC > PLC error diagnosis** in the menu bar.

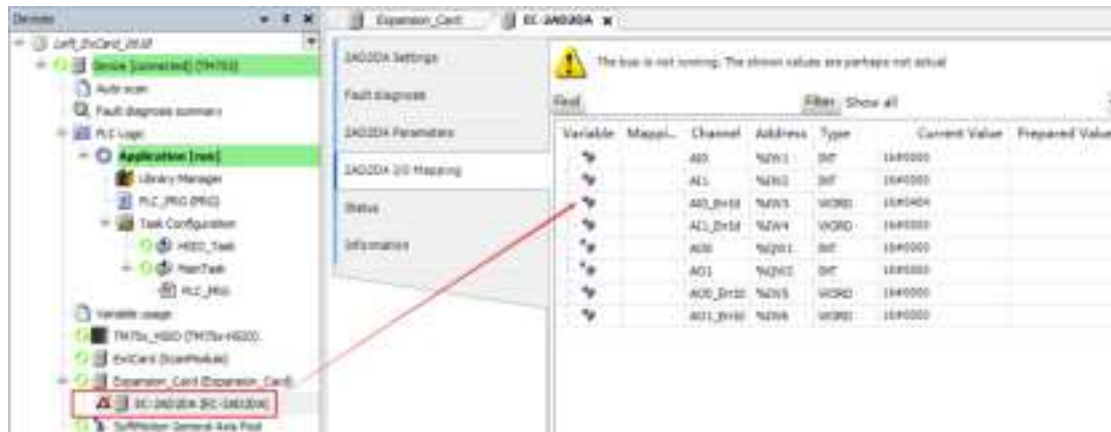


You can view the error occurrence time, main error code, sub error code, module information, error description, and solution in the **PLC error diagnosis** window.



#### 1.4.1.2 Fault diagnosis methods for TM series PLC

Diagnosis method for TM series: When an error occurs, the device icon in the device panel of the host controller's Invtmatic Studio will change. At this time, you can obtain the specific error code value through the I/O mapping interface.



## 1.4.2 Fault code

| Main error code | Sub error code | Error description                             | Solution                                                                              |
|-----------------|----------------|-----------------------------------------------|---------------------------------------------------------------------------------------|
| 0xF1            | 0x0001         | SPI initialization error                      | Check whether the factory system version of the TS series supports SPI initialization |
|                 | 0x0002         | Expansion card information verification error | Check whether the expansion card type matches                                         |
|                 | 0x0003         | SPI device transmission timeout               | Check whether the expansion card is in an error state.                                |
|                 | 0x0005         | Expansion card module configuration failed    | Check whether the expansion card is in an error state.                                |
|                 | 0x0401         | MCU fault                                     | Restart the expansion card or replace it.                                             |
|                 | 0x0402         | AD1 configuration fault                       | Check AD1 configuration                                                               |
|                 | 0x0403         | AD1 over-range                                | Check the input analog range                                                          |
|                 | 0x0404         | AD1 under-range                               | Check the input analog range                                                          |
|                 | 0x0405         | AD2 configuration fault                       | Check AD2 configuration                                                               |
|                 | 0x0406         | AD2 over-range                                | Check the input analog range                                                          |
|                 | 0x0407         | AD2 under-range                               | Check the input analog range                                                          |
|                 | 0x0408         | DA1 configuration fault                       | Check DA1 configuration                                                               |
|                 | 0x0409         | DA2 configuration fault                       | Check DA2 configuration                                                               |

## 1.5 Programming instance

### 1.5.1 TS600 series programming instance

#### Note:

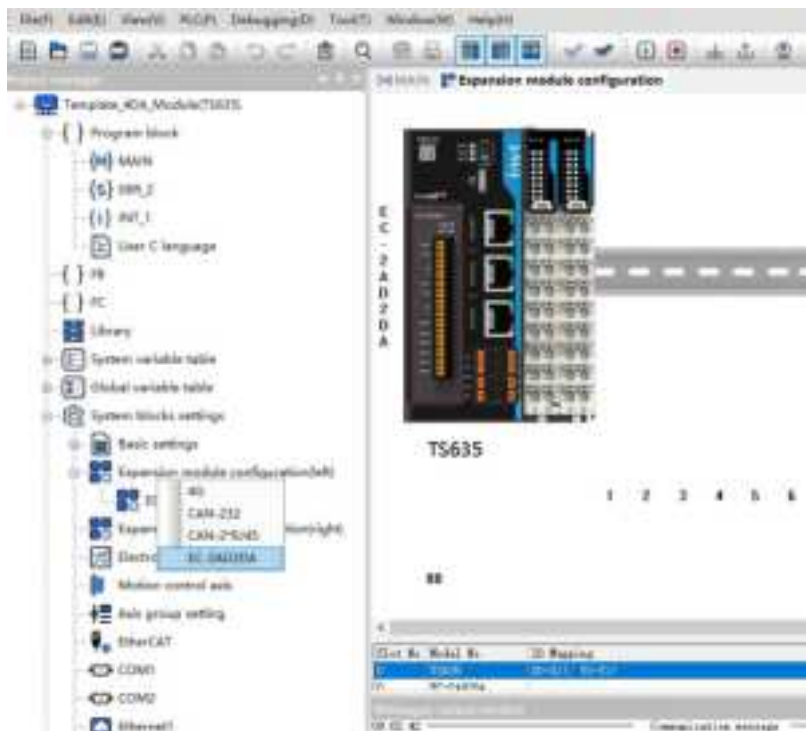
- The type ID of EC-2AD2DA expansion card is 4. During configuration, ensure that the configured expansion card type matches the actual installed card.
- You can check the configured expansion card type ID by viewing the value of the variable “\_sExtCard.CfgType” in the system variable table “\_SYS\_INFO”. The actual installed expansion

card type ID can be viewed via the variable “\_sExtCard.ActType” in the same table.

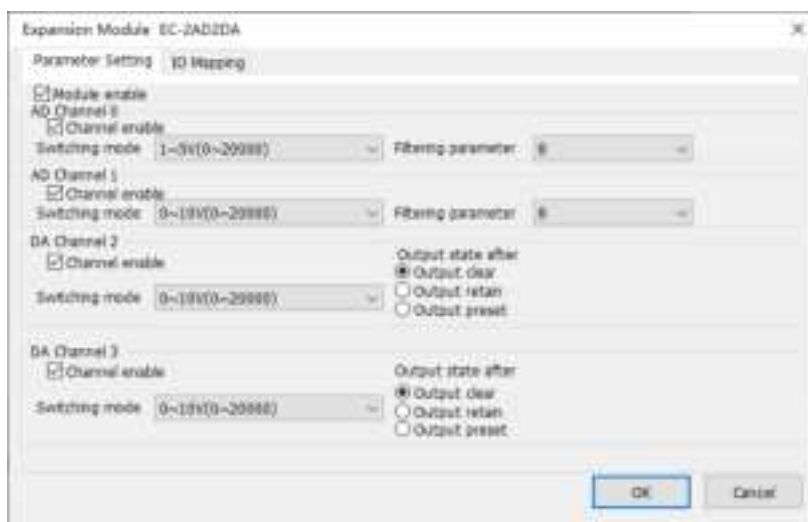
The operating steps are as follows:

Step 1 Create a new project.

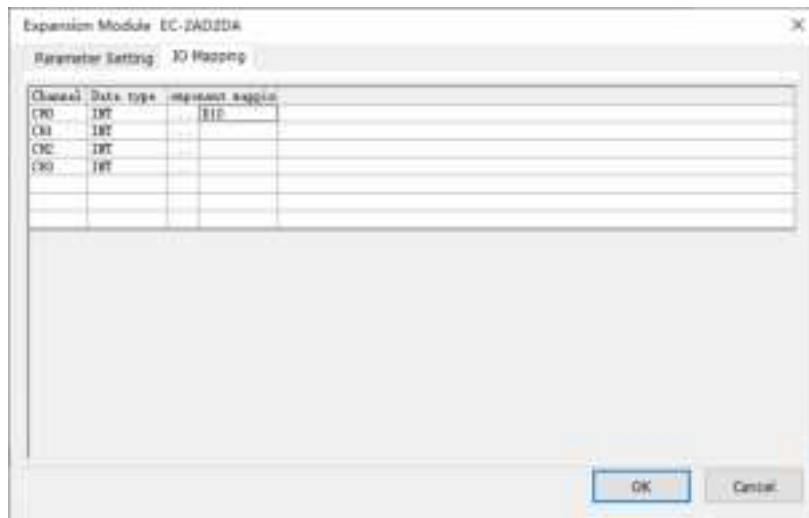
Step 2 In the **Project manager** window, right-click **System blocks settings > Expansion module configuration (left)**, and choose **EC-2AD2DA**.



Step 3 Double-click **EC-2AD2DA** to open the parameter setting interface. Enable each channel, and modify the **Switching mode**, **Filtering parameter**, and **Output state after stop** as needed, as shown in the figure below.



- Step 4 Click **IO Mapping** to configure the channel IO mapping for the EC-2AD2DA expansion card. You can choose to map channel data to currently unused component variables, as shown in the figure below.

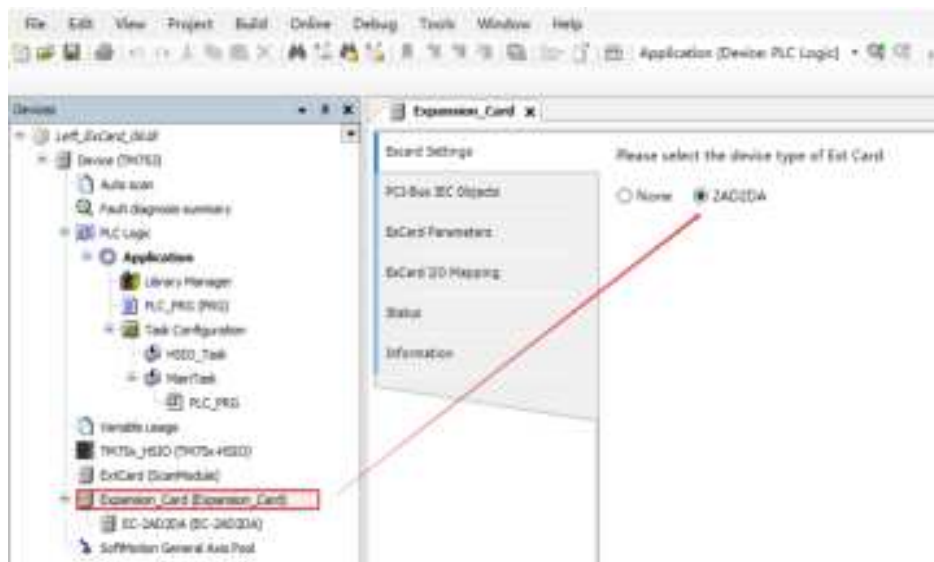


- Step 5 Compile and download the program to run.

## 1.5.2 TM700 series programming instance

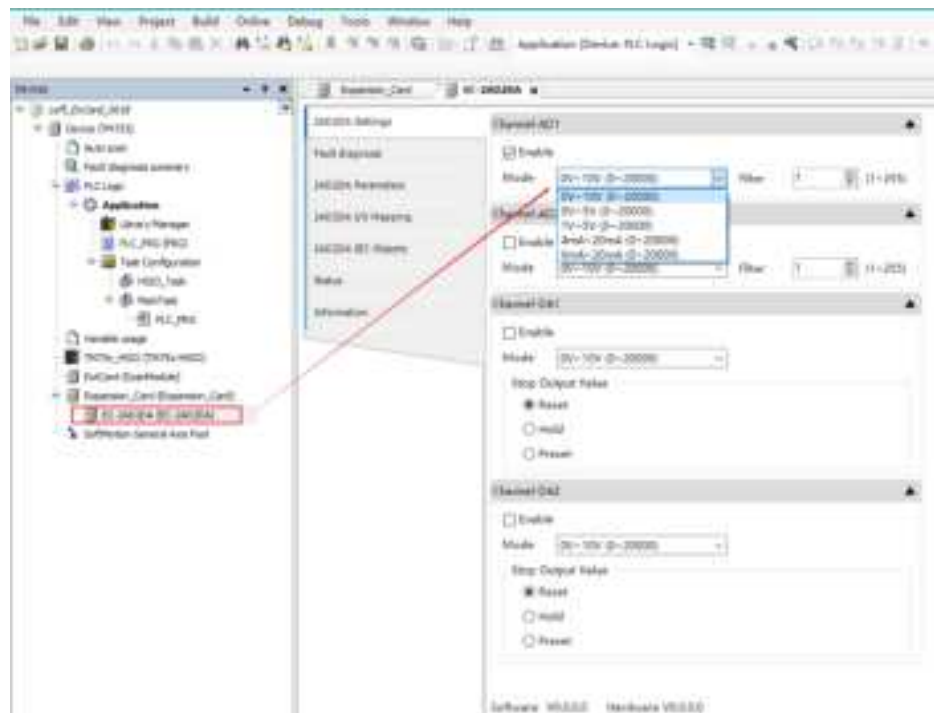
### Step 1 Add devices.

Create a new project and choose the TM700 series controller. In the **Devices** section, double-click **Expansion\_Card**, then choose **2AD2DA**.



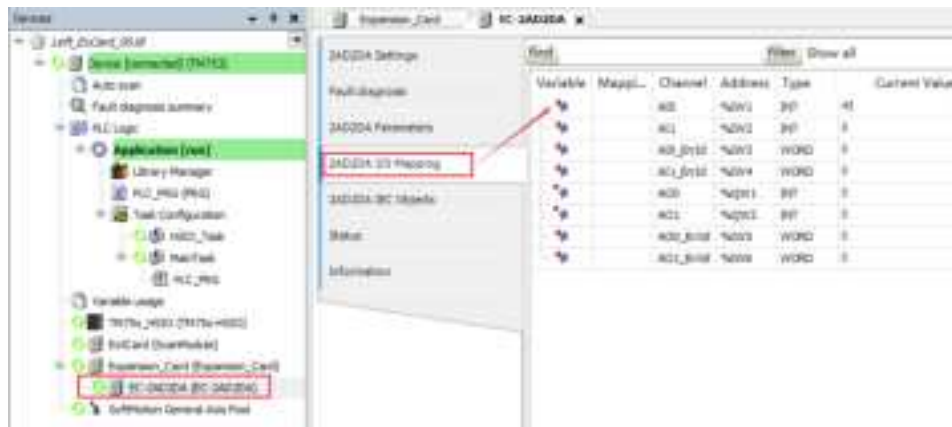
### Step 2 Configure parameters.

Double-click the **EC-2AD2DA** device and configure it as needed by checking the required options.



### Step 3 Read or write process data

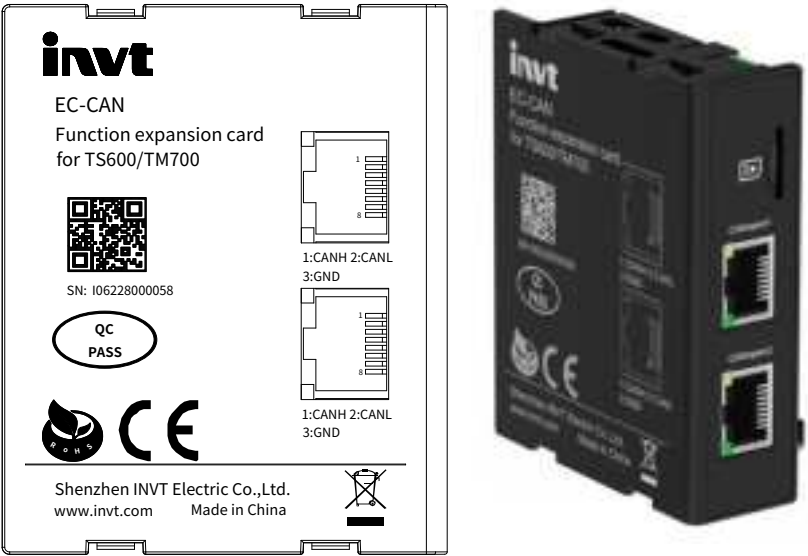
After the device is connected and the project is downloaded, you can obtain or write AD/DA data through the I/O Mapping interface. Channel AD1, after being enabled, converts and outputs a specific value based on the configuration. The same applies to the other channels.



# 2 EC-CAN expansion card

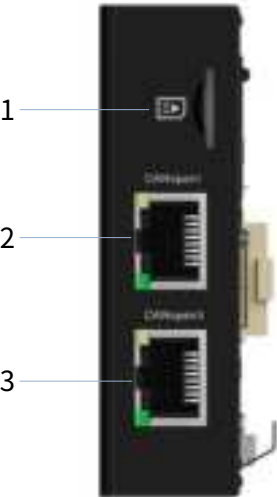
## 2.1 Product overview

### 2.1.1 Product model and nameplate



| Model  | Ordering code | Description                                                                                                        | Applicable model                |
|--------|---------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------|
| EC-CAN | 11060-00332   | CAN expansion card with 2 RJ45 ports, supporting MicroSD card (SD card interface is only supported for TS series). | Applicable to INVT TS/TM series |

### 2.1.2 Component description



| No. | Port type         | Interface sign | Definition          | Description                                       |
|-----|-------------------|----------------|---------------------|---------------------------------------------------|
| 1   | SD card socket    | SD             | Micro SD            | Standard definition                               |
| 2   | CANopen interface | CANopen1       | CANopen interface 1 | See the specific definition in the later sections |
| 3   | CANopen interface | CANopen2       | CANopen interface 2 | See the specific definition in the later sections |

When CANopen communicates, you can judge the working state according to the CANopen indicator. The definitions of the CANopen indicator states are as follows:

| LED indicator              | CAN running (Green light) | CAN error (Yellow light)                                                          |
|----------------------------|---------------------------|-----------------------------------------------------------------------------------|
| Off                        | None                      | No error                                                                          |
| On                         | Working state             | Bus off                                                                           |
| Slow flash (cycle: 0.8s)   | Pre-running status        | Pre-running status                                                                |
| Single flash (cycle: 1.2s) | Stopped state             | At least one error count of the CAN controller reaches or exceeds a warning value |
| Double flash (cycle: 1.6s) | None                      | Error control event (heartbeat timeout)                                           |

### 2.1.3 Basic specifications

| Item         | Specifications     |
|--------------|--------------------|
| IP rating    | IP20               |
| Size (W×H×D) | 70.8mm×20mm×53.5mm |
| Net weight   | 39g                |

### 2.1.4 Power supply specifications

| Item                                        | Specifications                                   |
|---------------------------------------------|--------------------------------------------------|
| Rated input voltage of power interface      | 5VDC (4.75VDC–5.25VDC)<br>3.3VDC (3.2VDC–3.4VDC) |
| Rated input power of power supply interface | 250mW                                            |
| Hot swapping function                       | Not supported                                    |

### 2.1.5 Communication specifications

| Item                               | Specifications |             |
|------------------------------------|----------------|-------------|
|                                    | Slave          | Master      |
| Supported protocols                | DS301 V4.02    | DS301 V4.02 |
| Number of slave nodes              | -              | 30          |
| Maximum supported number of RxPDOs | 4              | 64          |
| Maximum supported number of TxPDOs | 4              | 64          |

| Item                                 | Specifications                                                                                         |                                                                                                        |
|--------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Baud rate and communication distance | 1Mbps/20m<br>800kbps/40m<br>500kbps/70m<br>250kbps/140m<br>125kbps/280m<br>100kbps/350m<br>50kbps/700m | 1Mbps/20m<br>800kbps/40m<br>500kbps/70m<br>250kbps/140m<br>125kbps/280m<br>100kbps/350m<br>50kbps/700m |
| Terminal resistor                    | Built-in 120Ω termination resistor, which can be connected or disconnected via the onboard DIP switch. |                                                                                                        |
| Isolation method                     | Capacitive isolation                                                                                   |                                                                                                        |

## 2.1.6 SD card specifications

| Item                    | Specifications |
|-------------------------|----------------|
| Communication interface | SDIO           |
| SD card specifications  | Micro SD       |
| SD card capacity        | Up to 32GB     |
| SD card hot swapping    | Supported      |

## 2.1.7 Environment requirements

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

## 2.2 Mechanical installation

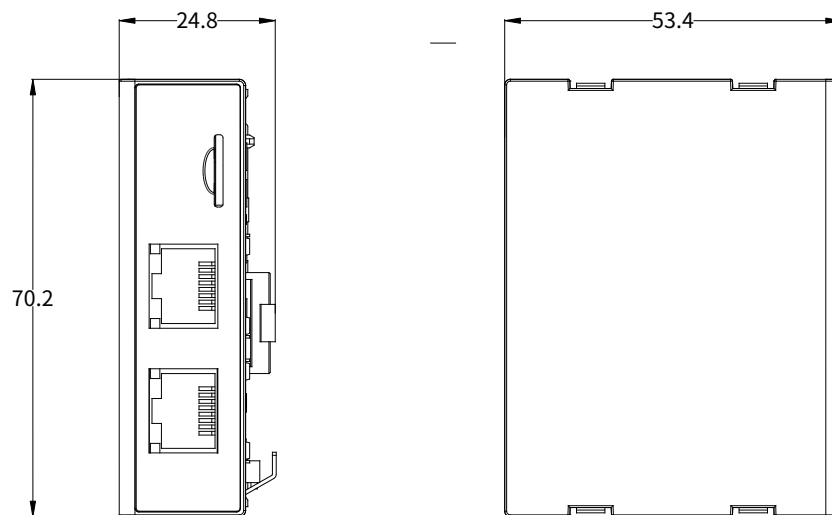
### 2.2.1 Installation environment requirements

When installing this product on a DIN rail, full consideration should be given to operability, maintainability, and environmental resistance before installation.

| Item                                          | Specifications                                                                                                                                |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| IP rating                                     | IP20                                                                                                                                          |
| Pollution degree                              | Level 2: Generally there is only non-conductive pollution, but you shall consider transient conductivity accidentally caused by condensation. |
| Altitude                                      | 2000m (80kPa)                                                                                                                                 |
| Storage temperature and humidity range        | Temperature: -20°C–60°C; RH <90%, no condensation                                                                                             |
| Transportation temperature and humidity range | Temperature: -40°C–70°C; RH <95%, no condensation                                                                                             |
| Working temperature and humidity range        | Temperature: -20°C–55°C; RH <95%, no condensation                                                                                             |

## 2.2.2 Installation dimensions

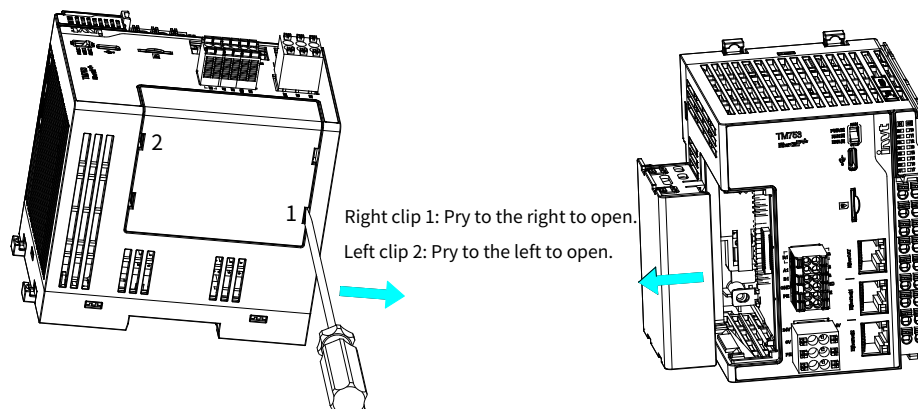
The installation dimensions are shown in the figure below, with units in millimeters (mm).



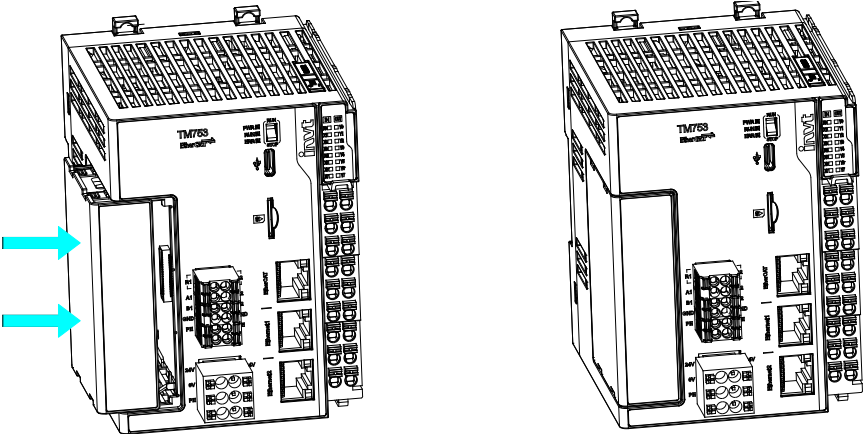
## 2.2.3 Installation

Take out the cover before installing the expansion card. The installation steps are as follows.

Step 1 Gently pry open the cover plate clips with a tool on the side of the product (in the order of positions 1 and 2); Slide the cover plate to the left horizontally and take it out.



Step 2 Slide the expansion card into the guide slot in parallel, then press the clip positions on the upper and lower sides of the expansion card until the expansion card is clamped (there is an obvious sound of clamping after they are installed in place).



2.2.4 Disassembly

Use a tool to gently pry the clips of the SD card on the side of the product (in sequence of position 1 and 2), and take out the SD card horizontally to the left. Refer to Step 1 in 2.2.3 Installation.

2.3 Electrical installation

2.3.1 Cable model selection

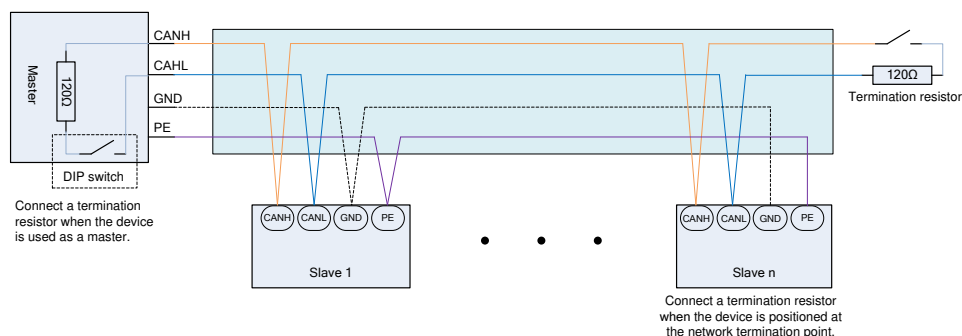
It is recommended to use Ethernet cables for CAN communication. Stripping wires for separate connections is not advised. If separate connection is necessary, refer to 2.3.2 Terminal definition for the RJ45 pin definitions.

2.3.2 Terminal definition

The CANopen interface is defined as follows:

|  |            |                                                    |
|--|------------|----------------------------------------------------|
|  | <b>PIN</b> | <b>Definition Description</b>                      |
|  | 1          | CANH: CAN communication signal positive (CAN High) |
|  | 2          | CANL: CAN communication signal negative (CAN Low)  |
|  | 3          | GND: Communication ground                          |
|  | 4          | NC                                                 |
|  | 5          | NC                                                 |
|  | 6          | NC                                                 |
|  | 7          | NC                                                 |
|  | 8          | NC                                                 |

## 2.3.3 Terminal wiring



**Note:** For the CANopen bus cable, use Category 5e shielded Ethernet cable.

## 2.4 Fault Diagnosis

### 2.4.1 Diagnosis method:

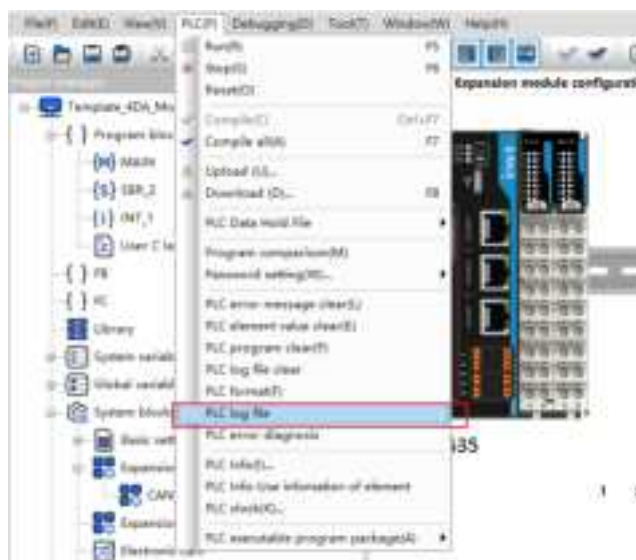
#### 2.4.1.1 Fault diagnosis methods for TS series PLC

Fault diagnosis methods for the EC-CAN expansion card in the TS series PLC include the host controller PLC log files and PLC error diagnosis. SDO errors and emergency error codes during communication can be viewed through the commissioning interface.

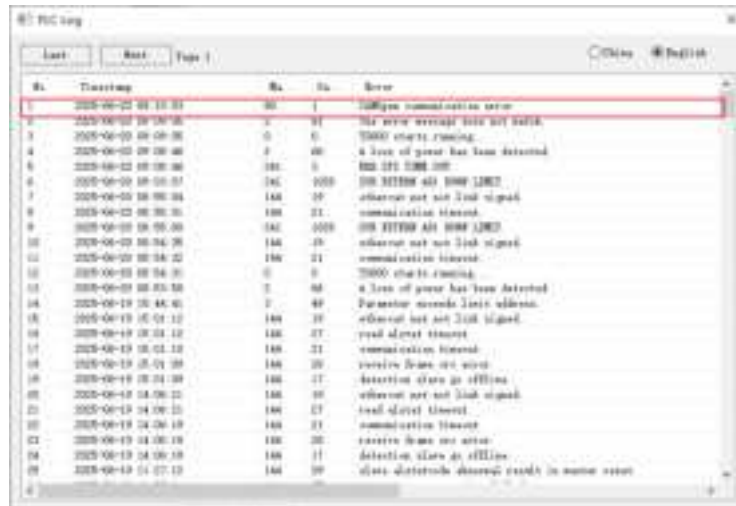
##### ■ Host controller PLC log files

Refer to the following steps:

Step 1 Open the Autostation Pro and choose **PLC > PLC log file** from the menu bar.



Step 2 Check the latest error information in the **PLC log** object box.



As shown in the figure above, the current main code is 80 (0x0050), and the subcode is 1 (0x0001), corresponding to a CANOpen communication error.

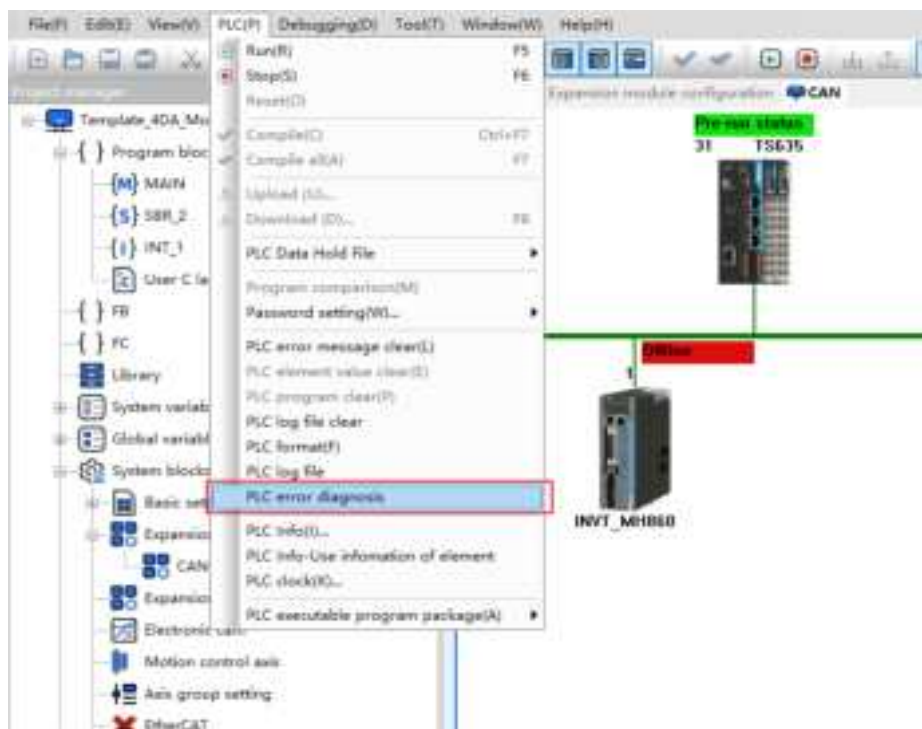
#### ■ Host controller PLC error diagnosis

Open the error diagnosis interface in the Autostation Pro.

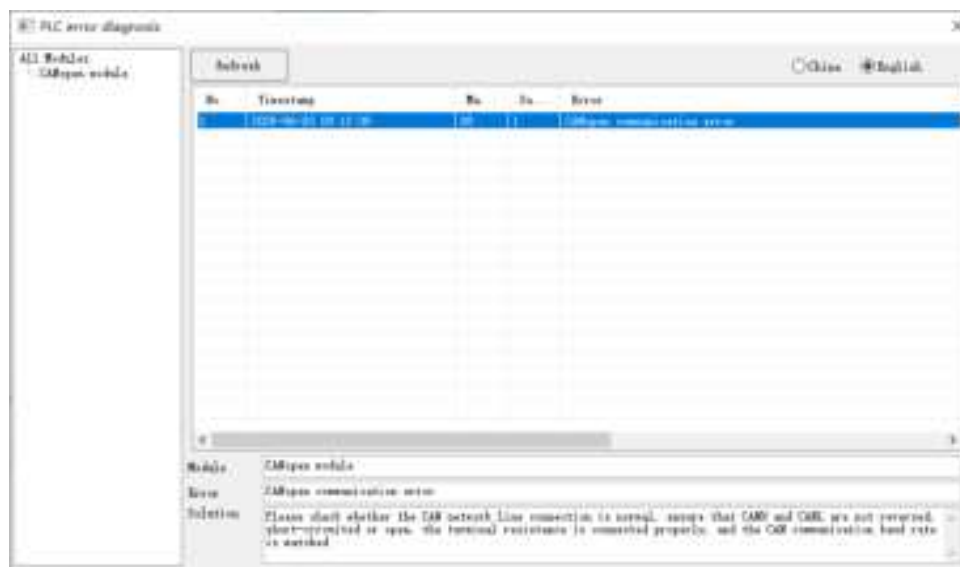
Method 1: Double-click the error indicator in the **Messages output window**.



Method 2: Click on **PLC > PLC error diagnosis** in the menu bar.



In the **PLC error diagnosis** window, you can view the error occurrence time, main error code, sub error code, module information, error message, and solution.



#### ■ SDO error and emergency message error code diagnosis

Through the online debugging interface, you can view the current SDO error codes and emergency message error codes. Refer to 2.5.1.6 Online debugging function for details, and 2.4.2 Fault code for troubleshooting the error causes.

### 2.4.1.2 Fault diagnosis methods for TM series PLC

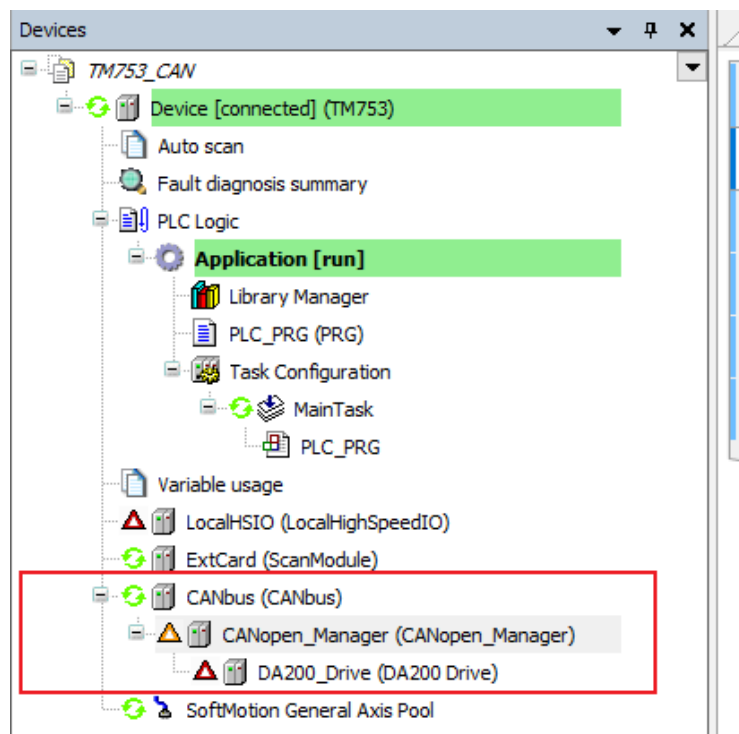
In the configuration interface, the diagnostic status of each communication module is indicated by different icons to represent various states. The status icons are described as follows:

: Running state. The device is running normally with no faults.

⚠: Stopped state. The device is not running and is in a stopped state.

🔴: Fault state. The device is in a fault state and cannot run normally.

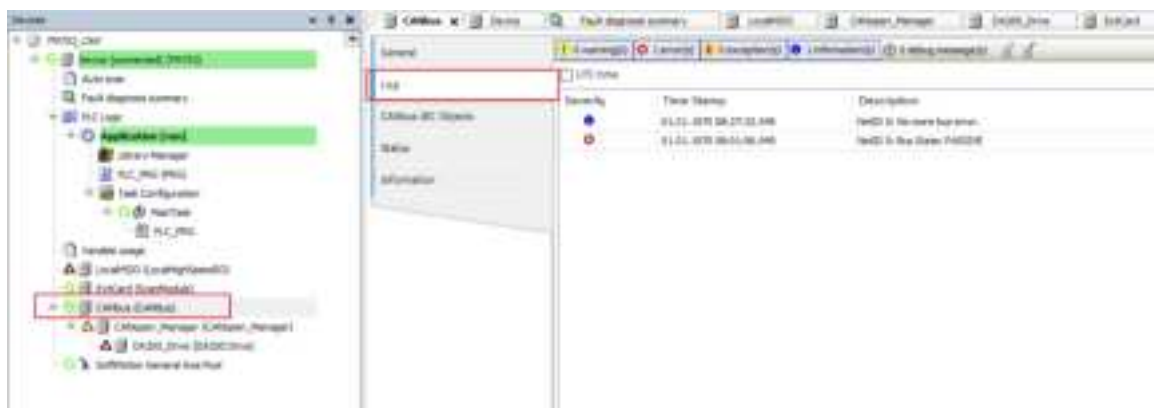
You can directly view the device's running state in the configuration interface.



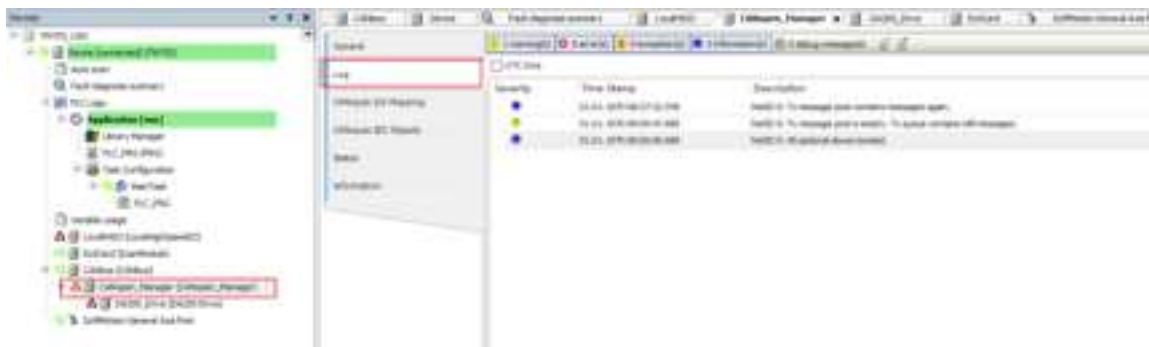
As shown in the figure above, the CAN bus has started, but the DA200 servo drive has not connected successfully.

The steps to view CANopen error logs are as follows:

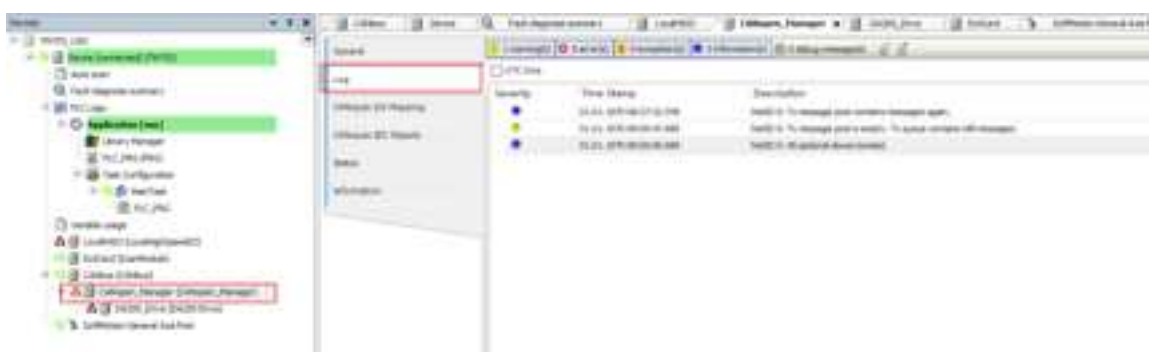
Step 1 Double-click **CANbus** in the device tree and choose **Log** to view the CAN bus error logs.



Step 2 Click **CANbus > CANopen\_Manager** (master device) and go to the **Log** tab to view the CANopen master error logs.



Step 3 Click **CANopen\_Manager > DA200\_Drive** (slave device) > **Log** to view the CANopen slave device error logs.



## 2.4.2 Fault code

### 2.4.2.1 PLC error code

| Main error code | Sub error code | Description                   | Solution                                                                                                                                                                                                                                                |
|-----------------|----------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x0050          | 0x0001         | CANopen communication error   | Check whether the CAN network wiring is properly connected.                                                                                                                                                                                             |
|                 | 0x0002         | CANopen configuration error   | Check whether the configuration on the host controller matches the actual situation.                                                                                                                                                                    |
|                 | 0x0003         | CANopen load rate is too high | Detect whether too many PDOs are configured, and whether there are devices on the bus that transmit CAN messages autonomously, such as CAN analyzers or multiple CANopen masters. These conditions may lead to poor communication status and data loss. |

### 2.4.2.2 SDO error code

| Interruption code (hexadecimal) | Code function description                                                                         | Interruption code (hexadecimal) | Code function description                                           |
|---------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------------------------------------|
| 0503 0000                       | Triggering bit not alternated                                                                     | 0601 0002                       | Attempts to write information to a read-only object                 |
| 05040000                        | SDO protocol times out                                                                            | 0602 0000                       | Object cannot be found in the object dictionary                     |
| 0504 0001                       | Illegal or unknown Client/Server instruction word                                                 | 0604 0041                       | Object cannot be mapped to PDO                                      |
| 0504 0002                       | Invalid block size (Block Transfer mode only)                                                     | 0604 0042                       | Number and length of the object to be mapped exceeds the PDO length |
| 0504 0003                       | Invalid serial number (Block Transfer mode)                                                       | 0604 0043                       | Common parameter incompatibility                                    |
| 0503 0004                       | CRC Error (Block Transfer mode)                                                                   | 0604 0047                       | Common internal incompatibility of the device                       |
| 0503 0005                       | Memory overflow                                                                                   | 0606 0000                       | Object access failure caused by hardware error                      |
| 0601 0000                       | No access to the object                                                                           | 0607 0010                       | Data type not matched; service parameter length not matched         |
| 0601 0001                       | Attempts to read a write-only object                                                              | 0607 0012                       | Data type mismatch, service parameter length is too long            |
| 0601 0002                       | Attempts to write information to a read-only object                                               | 0607 0013                       | Data type mismatch, service parameter length is too short           |
| 0602 0000                       | Object cannot be found in the object dictionary                                                   | 0609 0011                       | Subindex does not exist                                             |
| 06040041                        | Object cannot be mapped to PDO                                                                    | 0609 0030                       | Out of value range of parameter (on write access)                   |
| 0800 0000                       | Common error                                                                                      | 0609 0031                       | Written parameter value too large                                   |
| 08000020                        | Data failed to be transmitted or stored in the application                                        | 0609 0032                       | Written parameter value too small                                   |
| 0800 0022                       | Data failed to be transmitted or stored in the application due to the current state of the device | 0609 0036                       | Max. value less than Min. value                                     |

### 2.4.2.3 Emergency error code

| Emergency error (hexadecimal) | Description             | Emergency error code (hexadecimal) | Description                 |
|-------------------------------|-------------------------|------------------------------------|-----------------------------|
| 0000                          | Error reset or no error | 6300                               | Data setting                |
| 1000                          | General error           | 7000                               | Additional module error     |
| 2000                          | Current error           | 8000                               | Monitoring error            |
| 2100                          | Device input current    | 8100                               | General communication error |

| Emergency error (hexadecimal) | Description             | Emergency error code (hexadecimal) | Description                        |
|-------------------------------|-------------------------|------------------------------------|------------------------------------|
| 2200                          | Internal device current | 8110                               | CAN communication overload         |
| 2300                          | Device output current   | 8120                               | CAN passive mode error             |
| 3000                          | Voltage error           | 8130                               | Node protection or heartbeat error |
| 3100                          | Power supply voltage    | 8140                               | Bus off restore                    |
| 3200                          | Internal device voltage | 8150                               | CAN-ID conflict                    |
| 3300                          | Output voltage          | 8200                               | Protocol error                     |
| 4000                          | Temperature error       | 8210                               | PDO length error                   |
| 4100                          | Ambient temperature     | 8220                               | PDO length overrun                 |
| 4200                          | Device temperature      | 8240                               | Unrecognized SYNC data length      |
| 5000                          | Device hardware error   | 8250                               | RPDO timeout                       |
| 6000                          | Device software error   | 9000                               | External error                     |
| 6100                          | Internal error          | F000                               | Additional function error          |
| 6200                          | User software           | FF00                               | Special device error               |

## 2.5 Programming instance

### 2.5.1 TS600 series programming instance

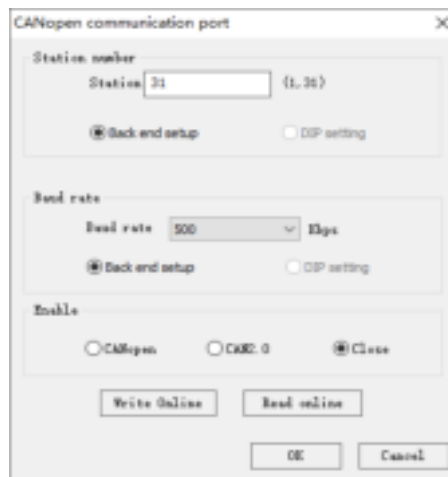
#### 2.5.1.1 CANopen configuration

When **CAN-232** or **CAN-2\*RJ45** is selected for the expansion card, the CAN communication configuration option will appear. When the CANopen communication protocol is enabled, the system will decide whether the local computer is the CANopen master or the CANopen slave according to whether there is CANopen configuration.

Step 1 After establishing the project, right-click **Setting>EXP** and choose the corresponding physical expansion module **CAN-232** or **CAN-2\*RJ45**.

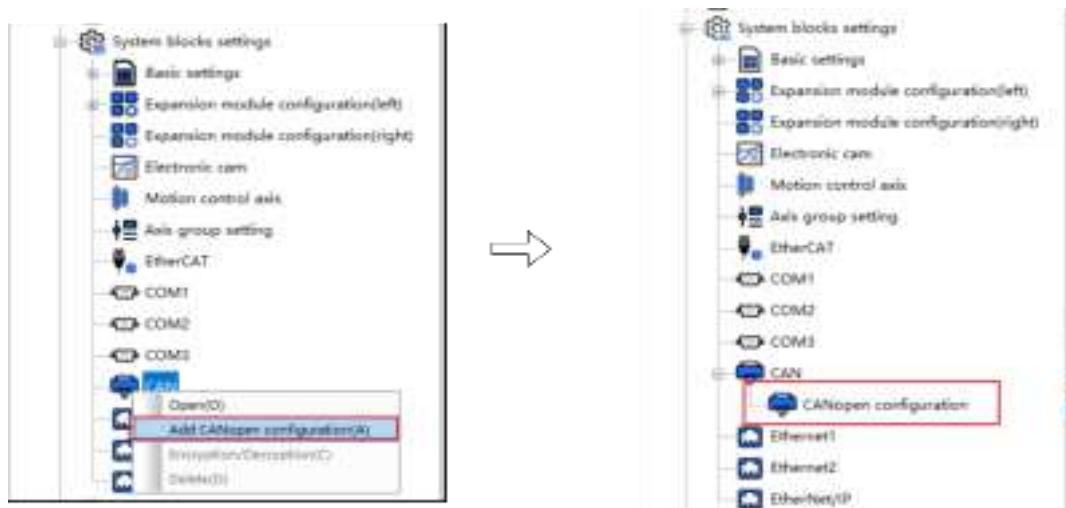


Step 2 Double-click **CAN** in **Setting** to pop up the following window.



Step 3 Check to **Enable CANopen**, and set the **Station number** and **Baud rate** as required, and then click **OK**.

CAN, which is configured as the CANopen slave currently, can be configured as the CANopen master by clicking **Setting** > **CAN** and choosing **Add CANopen configuration** in the pop-up menu, as shown in the following figure.



Step 4 Double-click **CANopen configuration** to open the CANopen configuration interface, as shown in the following figure.



Step 5 Double-click the CANopen slave you want to add in the **CANopen device list**.



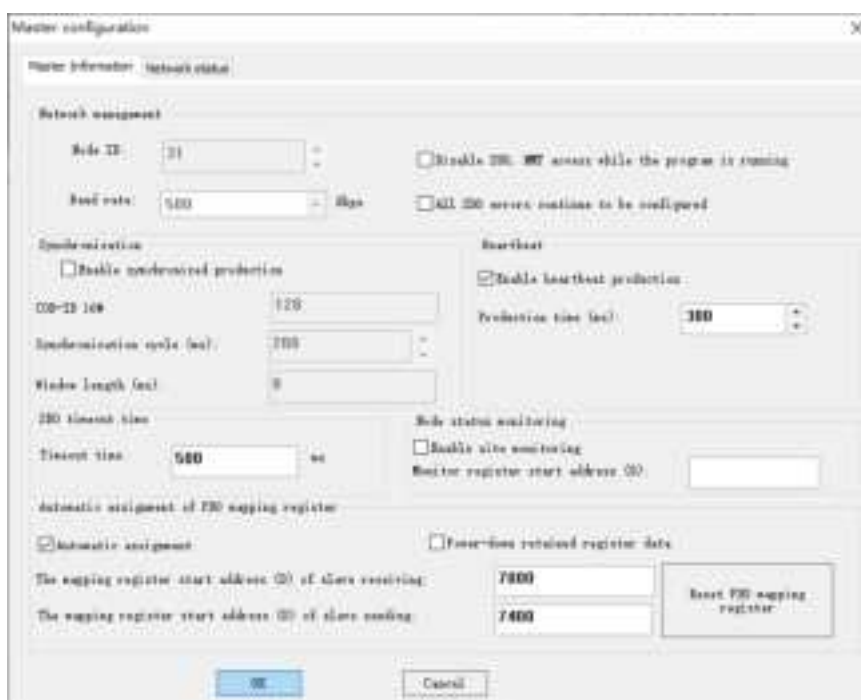
**Note:** If the slave device is not in the list, right-click on the **CANopen device list** and click **Import EDS** file (available from the device vendor).



### 2.5.1.2 Master configuration

#### ■ Master information

Set the master parameters, double-click the TS635 master in the network, and the following window appears.



- **Network management**

Node ID: Set the network master number.

- ✧ When the node number is the same as the node number of the PLC itself, the PLC is initialized as the CANopen master.
- ✧ When the node number is different from the node number of the PLC itself, the PLC is initialized as a CANopen slave.

Baud rate: The valid communication baud rate of the master.

Disable SDO, NMT access while the program is running: After checking this function, online commissioning function will not be used during program running.

 **Note:** This function only limits background software.

All SDO errors continue to be configured:

- ✧ After checking this function, if SDO is configured incorrectly, it will continue to configure; This function is valid for all slaves.
- ✧ If this function is not checked, the master will broadcast reset the slave if SDO error occurs.

- **Synchronization**

Enable synchronization production: When checking this option, the node will transmit synchronization frames according to the time cycle set in **synchronization cycle (ms)**.

COB-ID: Synchronization frame transmit ID, which defaults to 0x80 and is not allowed to be changed.

Synchronization cycle (ms): The cycle period of sending synchronization frame, default to 200 (unit: ms).

Window length (ms): This parameter defaults to 0, and is not allowed to be changed.

 **Note:** Only one synchronous message can be sent at the same time in a CANopen network

- **Heartbeat**

Enable heartbeat production: When checking this option, the node will transmit heartbeat frames according to the time cycle set in **Production time (ms)**.

Production time (ms): The cycle period of sending heartbeat, default to 300 (unit: ms).

 **Note:** The default heartbeat monitoring consumption time of the master is 2.5 times the heartbeat production time.

- **SDO timeout**

Timeout time: SDO wait time, default to 500 (unit: ms).

SDO frames are mainly used for network configuration. If SDO does not receive the return frame on time within before timeout, the master determines the configuration timeout. This time is the waiting interval time of each frame.

- **Node status monitoring**

The node's online status is updated to the system variable `_sCANOpen.NodeState[64]`, where `_sCANOpen.NodeState[0]` is the local state and `_sCANOpen.NodeState[node number]` is the corresponding slave state.

| Numerical value | State                |
|-----------------|----------------------|
| 0               | Initialization state |
| 4               | Stopped state        |
| 5               | Running state        |
| 127             | Pre-running status   |

| Numerical value | State         |
|-----------------|---------------|
| 255             | Offline state |

 **Note:** This function only makes sense when the slave enables the heartbeat, because this state is fed back by the slave heartbeat.

- **Automatic assignment of mapping register**

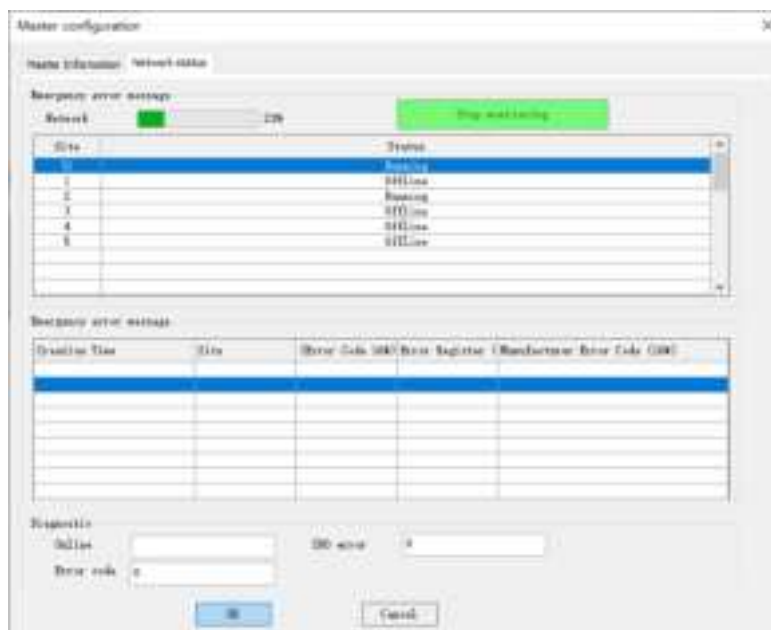
Automatic assignment: This function is checked by default.

- ✧ If this function is selected, the register address for master-slave data interaction will be automatically assigned.
- ✧ If this function is not selected, you need to manually set the start address of data interaction (set the start address of each PDO separately).

The mapping register start address (D) of slave receiving: The start address of the data sent by the master is automatically allocated (it makes sense only when automatic assignment is checked).

The mapping register start address (D) of slave sending: The start address of the data received by the master is automatically allocated (it makes sense only when automatic assignment is checked).

- **Network status**



**Start monitoring / Stop monitoring:** Click this option to start status monitoring on this page. When monitoring is started, click **Stop monitoring** to exit network monitoring.

**Network:** Monitors the real-time load status of the CAN network.

**Network status:** Displays the current running status of network nodes. This status is retrieved from the node status system variable.

**Emergency error message:**

- ✧ Displays the current emergency error information in the network. The PLC master only stores the latest error message. If this page is not closed, up to 5 messages can be cached in the background.
- ✧ For details on emergency error message, refer to 2.4.2.3 Emergency error code.

**SDO configuration:**

- ✧ **Node number:** The incorrect node number for SDO configuration.

- ✧ Error step number: The number of the SDO error. Check the corresponding number information in the **Service Data Object** tab of the slave with the corresponding error parameter.
- ✧ Error code: The SDO error code (CANopen standard error code).

### 2.5.1.3 Slave configuration

This section takes EC-TX105 as an example to introduce the configuration process and related parameters of CANopen slaves.

#### ■ Slave Configuration

After checking **Enabling experts**, the window as shown on the right below appears.



#### ● Regular

Node ID: The slave node number to be configured.

Enabling experts: When this option is selected, detailed slave configuration will be displayed. This option is not selected by default.

SDO errors continue to be configured: This option is not selected by default.

- ✧ Valid: Skip to the next configuration item if configuration error occurs.
- ✧ Invalid: The master will not proceed with the configuration if configuration error occurs, and the node will be re-configured.

Create all SDOs: When this option is selected, all writable object dictionaries in the EDS will be added and initialized during configuration. This option is not selected by default.

#### ● Error control

Enable heartbeat: When this option is checked, the slave will generate heartbeats. After the slave heartbeat is checked, the master monitors the heartbeat status of the slave by default.

Production time (ms): The cycle time when the heartbeat is sent.

Modify heartbeat consumption attributes: This option is not selected by default.

- ✧ This function is used to set the heartbeats of other nodes that will be monitored by this slave.
- ✧ This function also requires the slave to support heartbeat monitoring function.

#### ● Synchronization generator (if supported by slave)

Enable synchronization generator: When checking this option, the node will transmit synchronization frames according to the time cycle set in **Synchronization cycle (ms)**.

COB-ID: Synchronization frame transmit ID, which defaults to 0x80 and is not allowed to be changed.

Synchronization cycle (ms): The cycle period of sending synchronization frame, default to 200 (unit: ms).

Window length: This parameter defaults to 0, and is not allowed to be changed.

 **Note:** Only one synchronization frame can be sent in a CANopen network.

### ● Emergency message

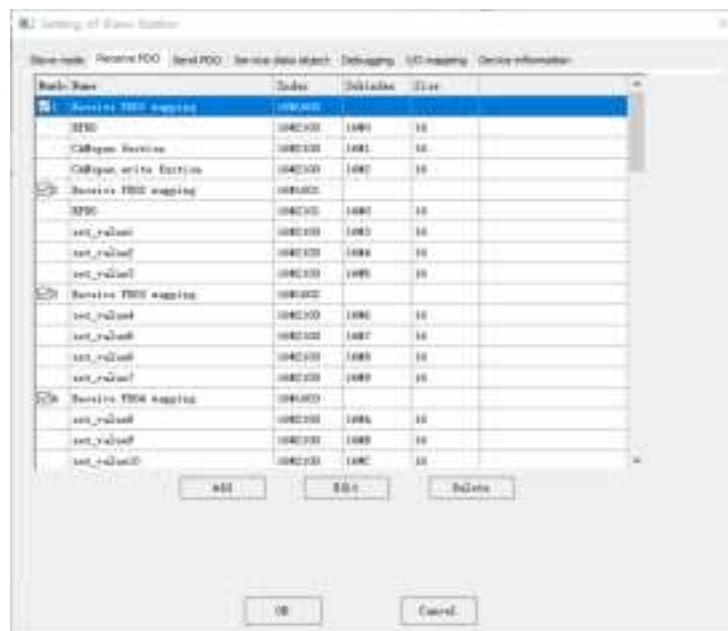
Enable emergency message: If this function is checked, the COB-ID of emergency packets will be set in the configuration process, but it is not checked by default.

Reboot check

Check suppliers, Check product ID, Check version: When checking the corresponding function, the relevant check will be carried out before starting slave configuration. If the check fails, the node cannot be started.

### ■ Receive PDO/Send PDO

Click to choose **Receive PDO/Send PDO**, and the interface will appear:



Receive PDO: master -> slave data

Send PDO: slave -> master data

### ■ PDO enabling

The checkbox before the index number is used to determine whether the PDO is active. If the PDO does not contain any mapped objects, it cannot be checked. PDOs that are enabled by default in the slave's EDS file are pre-checked.

### ■ PDO mapping editing

You can edit the PDO mapping through the **Add**, **Edit** and **Delete** buttons in the window.

### 2.5.1.4 PDO attribute settings

The PDO attribute interface appears as follows:

■ **COB-ID(16#)**

ID number used for PDO transmission.

■ **Transmission type**

| Type                                            | Data Transmission Conditions                                                                                    | Data Effective Conditions                                                                                                    |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Acyclic-synchronous (Type 0)                    | Data changes and a synchronization frame is received                                                            | It does not take effect immediately after receiving data, and it takes effect only after receiving one frame synchronization |
| Cyclic-synchronous (Type 1- 240)                | The data is transmitted after receiving the synchronization frame of the corresponding "synchronization number" | It does not take effect immediately after receiving data, and it takes effect only after receiving one frame synchronization |
| Asynchronous-Manufacturer-specific (Type 254)   | Customized by each manufacturer                                                                                 | Customized by each manufacturer                                                                                              |
| Asynchronous-Device Profile-specific (Type 255) | The time when data changes or meets the event, and the change frequency is less than the suppression time       | Effective immediately                                                                                                        |

**Note:** When setting up a certain node for synchronous transmission, it is necessary to enable synchronous production of the master

■ **Synchronization number**

Used to set the synchronization number, only valid after choosing **Cyclic-synchronous (Type 1-240)**.

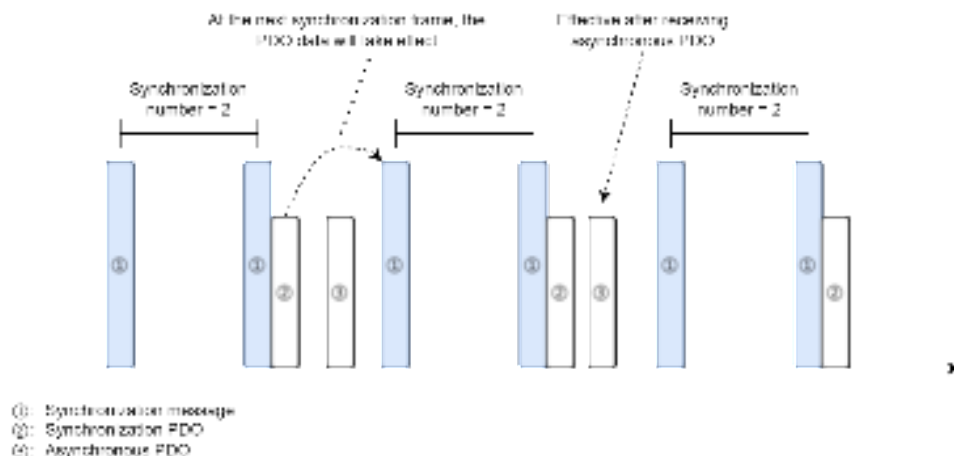
■ **Inhibition time**

Available only after choosing **Asynchronous-Device Profile-specific (Type 255)**. This function is invalid when set to 0; If it is not 0, it indicates the minimum interval for frame transmission.

### ■ Event time

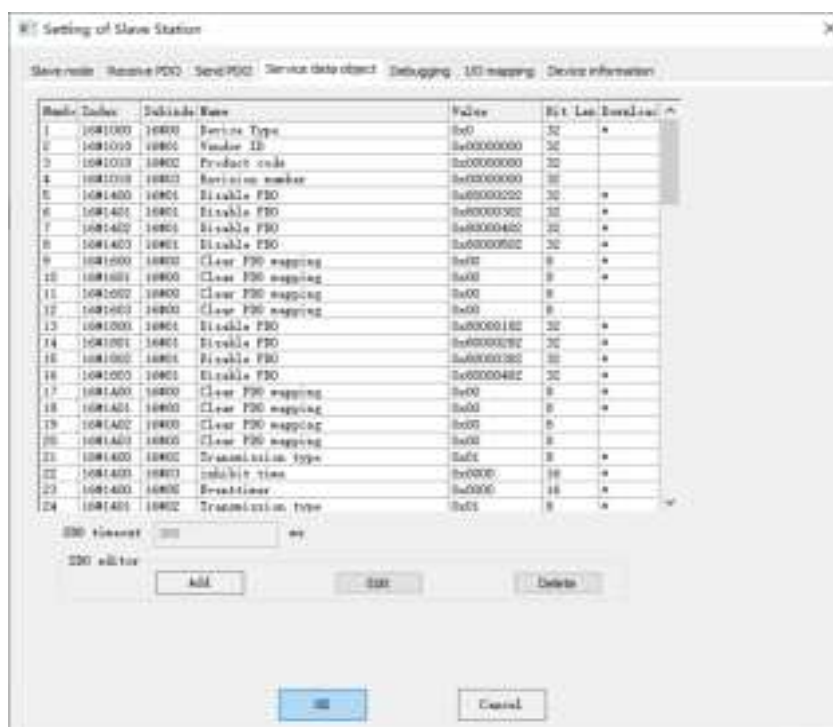
Available only after choosing **Asynchronous-Device Profile-specific (Type 255)**. This function is invalid when set to 0. If it is not 0, it indicates the period of regular transmission (This transmission condition is also limited by the inhibition time).

The following figure takes Synchronous cycle-synchronous type = 2 as an example.



### 2.5.1.5 Service data object

The **Service data object** tab interface is shown below (using DA200 as an example). This table automatically generates SDO configuration data based on the EDS file and user settings.

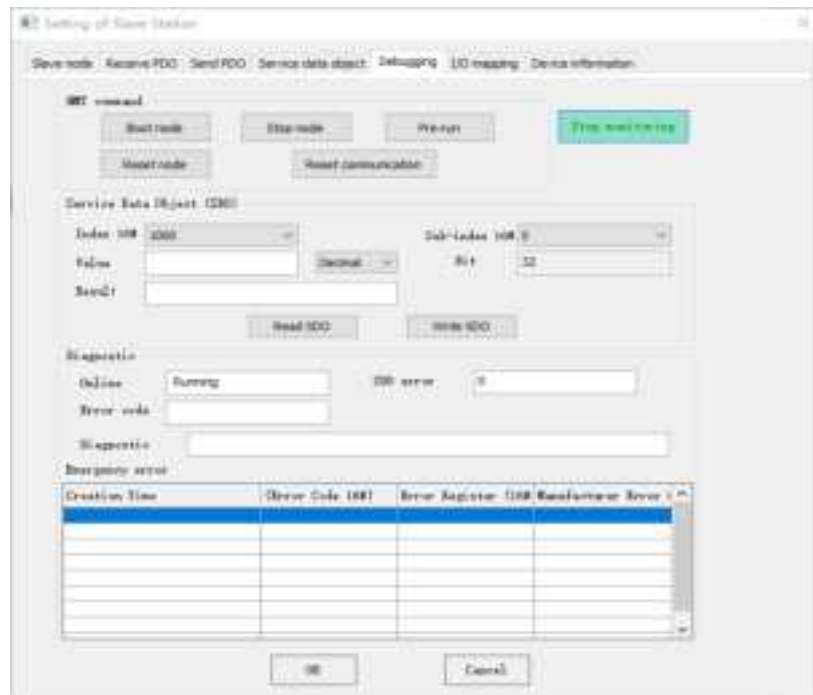


SDO Edit options description:

- Add: Adds a user-defined configuration. Mainly used to assign initial values to the object dictionary.
- Edit: Re-edits user configuration.
- Delete: Deletes user configuration.

### 2.5.1.6 Online debugging function

The interface of the online debugging tab is shown as below.



**Note:** If **Disable SDO, NMT access while the program is running** is selected in the master, this function cannot be used.

#### ■ NMT commands

Boot node: Sends a start node command to this slave.

Stop node: Sends a stop node command to this slave.

Pre-run: Sends a pre-run command to this node.

Reset node: Sends a reset node command to this node.

Reset communication: Sends a reset communication command to this node.

#### ■ Service data object

Index and sub-index: Only the object dictionary provided in the slave EDS can be selected.

Value: The data to be sent or returned.

Bit length: Obtained from the slave EDS object dictionary.

Result: Read and write state information.

Read SDO, Write SDO: Perform the read and write operations of corresponding object dictionary.

#### ■ Diagnosis

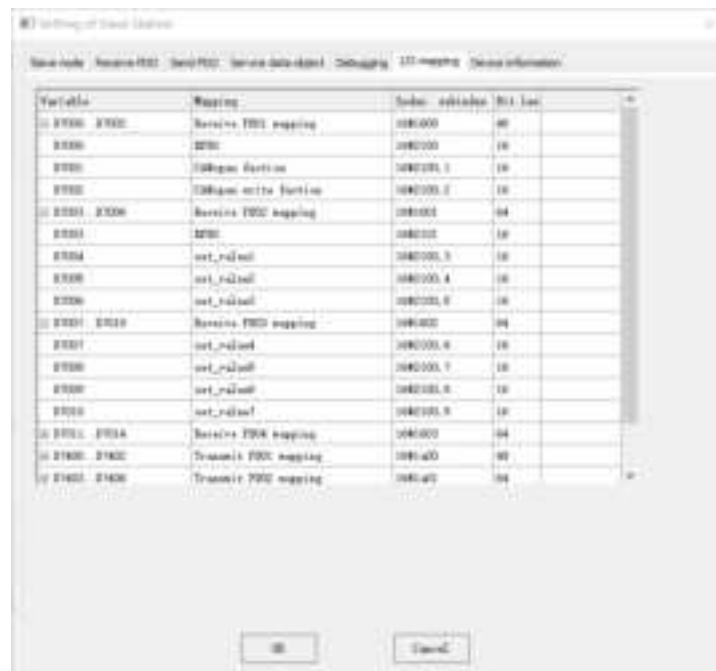
Online: The current status of the slave (based on heartbeat monitoring).

SDO error step number: The step number where an SDO error occurred during configuration. This number corresponds to the entry in the **Service Data Object** tab.

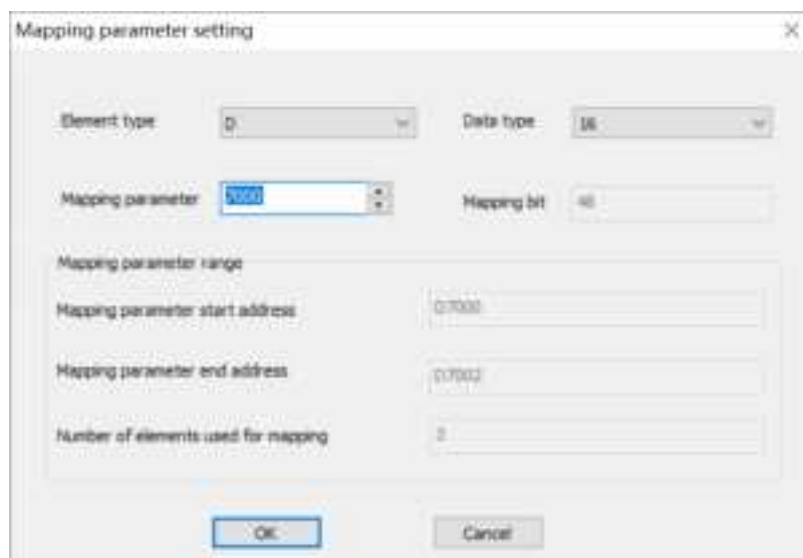
Diagnostic string: The current error message (SDO error). For details, refer to 2.4.2.2 SDO error code.

### 2.5.1.7 I/O mapping

The I/O mapping option interface appears as follows.



This tab is used to set the data communication mapping relationship between master and slave PDO. If **Automatic assignment** is not checked in the master settings, you can double-click one of the mappings to set it, as shown in the following figure. You can set the master register start address corresponding to each slave PDO.



### 2.5.1.8 Device information

The device information interface is displayed as shown in the figure below.



**Note:** The device information of the slave is obtained from the EDS file provided by the device manufacturer.

### 2.5.1.9 CANopen slave instruction

#### ■ Slave Configuration

Step 1 After establishing the project, right-click **Setting>EXP** and choose the corresponding physical expansion module **CAN-232** or **CAN-2\*RJ45**.



Step 2 Double-click **CAN** in **Setting** to pop up the following window.

The image shows a software window titled "CANopen communication port" with a close button (X) in the top right corner. The window is divided into three main sections. The first section, "Station number", contains a text box with "31" and "(1, 31)" next to it, and two radio buttons: "Back end setup" (selected) and "DIP setting". The second section, "Baud rate", contains a dropdown menu showing "500" and "Kbps", and two radio buttons: "Back end setup" (selected) and "DIP setting". The third section, "Enable", contains three radio buttons: "CANopen" (selected), "CAN2.0", and "Close". At the bottom of the window are four buttons: "Write Online", "Read online", "OK", and "Cancel".

Step 3 Check to **enable CANopen**, and set the **Station number** and **Baud rate** as required, and then click **OK**.

**Note:** Do not continue to add CAN configuration by right-clicking, otherwise this machine will act as the CANopen master.

#### ■ Slave CANopen data interaction

The TS600 series programmable logic controller, when used as a slave, supports only 4 TPDOs and 4 RPDOs, with each PDO supporting up to 8 bytes of data. Therefore, 16 16-bit mapped addresses are set in the slave's object dictionary to buffer the transmitted data, and another 16 16-bit mapped addresses are set to buffer the received data. These are respectively bound to the corresponding slave's R500–R531 elements, as shown in the table below.

Table 2-1 Reference for received data

| Index | Sub-index | Name           | Access type | Data type | Slave bound element |
|-------|-----------|----------------|-------------|-----------|---------------------|
| 2109  | 1         | 1st Rx Buffer  | RW          | 16        | R500                |
| 2109  | 2         | 2st Rx Buffer  | RW          | 16        | R501                |
| 2109  | 3         | 3st Rx Buffer  | RW          | 16        | R502                |
| 2109  | 4         | 4st Rx Buffer  | RW          | 16        | R503                |
| 2109  | 5         | 5st Rx Buffer  | RW          | 16        | R504                |
| 2109  | 6         | 6st Rx Buffer  | RW          | 16        | R505                |
| 2109  | 7         | 7st Rx Buffer  | RW          | 16        | R506                |
| 2109  | 8         | 8st Rx Buffer  | RW          | 16        | R507                |
| 2109  | 9         | 9st Rx Buffer  | RW          | 16        | R508                |
| 2109  | 10        | 10st Rx Buffer | RW          | 16        | R509                |
| 2109  | 11        | 11st Rx Buffer | RW          | 16        | R510                |
| 2109  | 12        | 12st Rx Buffer | RW          | 16        | R511                |
| 2109  | 13        | 13st Rx Buffer | RW          | 16        | R512                |
| 2109  | 14        | 14st Rx Buffer | RW          | 16        | R513                |
| 2109  | 15        | 15st Rx Buffer | RW          | 16        | R514                |

| Index | Sub-index | Name           | Access type | Data type | Slave bound element |
|-------|-----------|----------------|-------------|-----------|---------------------|
| 2109  | 16        | 16st Rx Buffer | RW          | 16        | R515                |

Table 2-2 Reference for sent data

| Index | Sub-index | Name           | Access type | Data type | Slave bound element |
|-------|-----------|----------------|-------------|-----------|---------------------|
| 2108  | 1         | 1st Tx Buffer  | RW          | 16        | R516                |
| 2108  | 2         | 2st Tx Buffer  | RW          | 16        | R517                |
| 2108  | 3         | 3st Tx Buffer  | RW          | 16        | R518                |
| 2108  | 4         | 4st Tx Buffer  | RW          | 16        | R519                |
| 2108  | 5         | 5st Tx Buffer  | RW          | 16        | R520                |
| 2108  | 6         | 6st Tx Buffer  | RW          | 16        | R521                |
| 2108  | 7         | 7st Tx Buffer  | RW          | 16        | R522                |
| 2108  | 8         | 8st Tx Buffer  | RW          | 16        | R523                |
| 2108  | 9         | 9st Tx Buffer  | RW          | 16        | R524                |
| 2108  | 10        | 10st Tx Buffer | RW          | 16        | R525                |
| 2108  | 11        | 11st Tx Buffer | RW          | 16        | R526                |
| 2108  | 12        | 12st Tx Buffer | RW          | 16        | R527                |
| 2108  | 13        | 13st Tx Buffer | RW          | 16        | R528                |
| 2108  | 14        | 14st Tx Buffer | RW          | 16        | R529                |
| 2108  | 15        | 15st Tx Buffer | RW          | 16        | R530                |
| 2108  | 16        | 16st Tx Buffer | RW          | 16        | R531                |

## 2.5.2 TM700 series programming instance

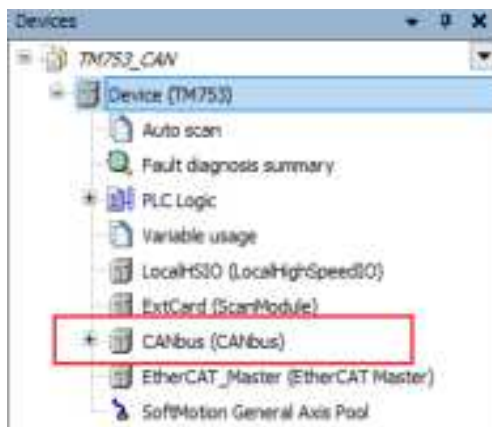
### 2.5.2.1 Master node usage process

Step 1 Install the CANopen slave devices.

The associated CANopen slave device profile must first be installed into the system. The device profile can be a \*.devdesc.xml file or an EDS (Electronic Data Sheet) file for the manufacturer.

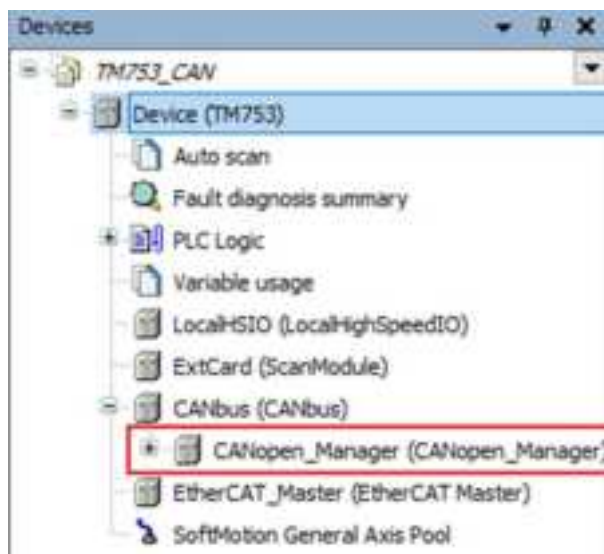
Step 2 Add **CANbus** to the device tree.

The base node of CANopen (the uppermost entry in the CANbus configuration tree) must be a CANbus object. A CAN bus can be inserted under the programmable controller device node. The diagram after adding the CAN bus is shown below.



### 2.5.2.2 Adding CANopen management device

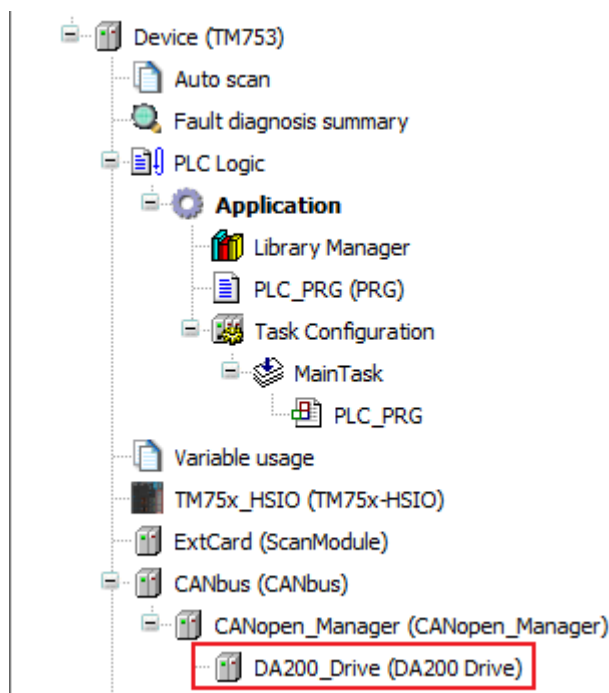
Under the CANbus, add a **CANopen\_Management** device, which can be used as a CANopen master. The diagram after adding is shown below.



### 2.5.2.3 Adding CANopen slave node

Take INVT DA200 CANopen slave as an example. Add the DA200 slave device under CANopen Manager after adding the EDS file of this slave, as shown in the following diagram.

Figure 2-1 Device tree structure with a CANopen slave



The software configuration of the CANopen master is complete.

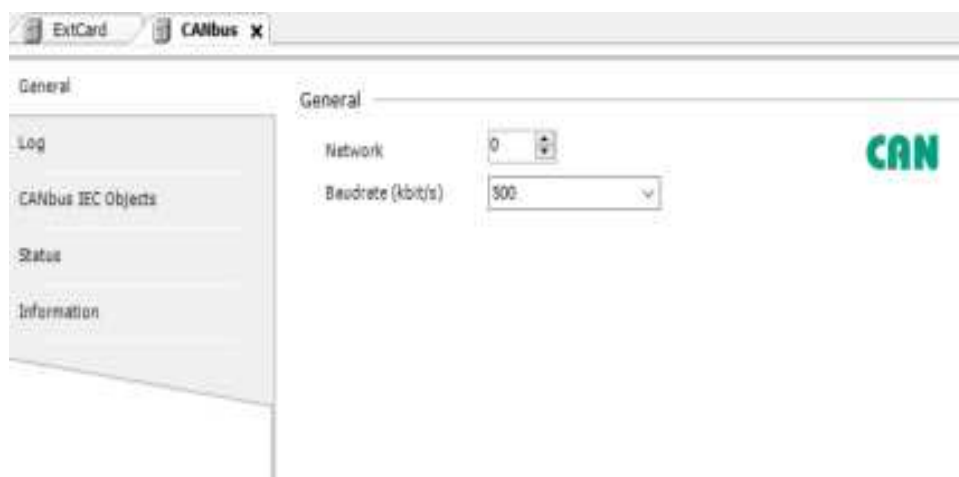
### 2.5.2.4 Parameter configuration of CANOpen master

Step 1 Configure **Network** and **Baud Rate** of the CANbus.

Network: The number of CAN networks connected via the CANbus, range: 0–100.

Baud rate: The baud rate used for transmission on the bus (The following baud rates can be set: 10kbits/s, 20kbits/s, 50kbits/s, 100kbits/s, 125kbits/s, 250kbits/s, 500kbits/s, 800kbits/s, and 1000kbits/s).

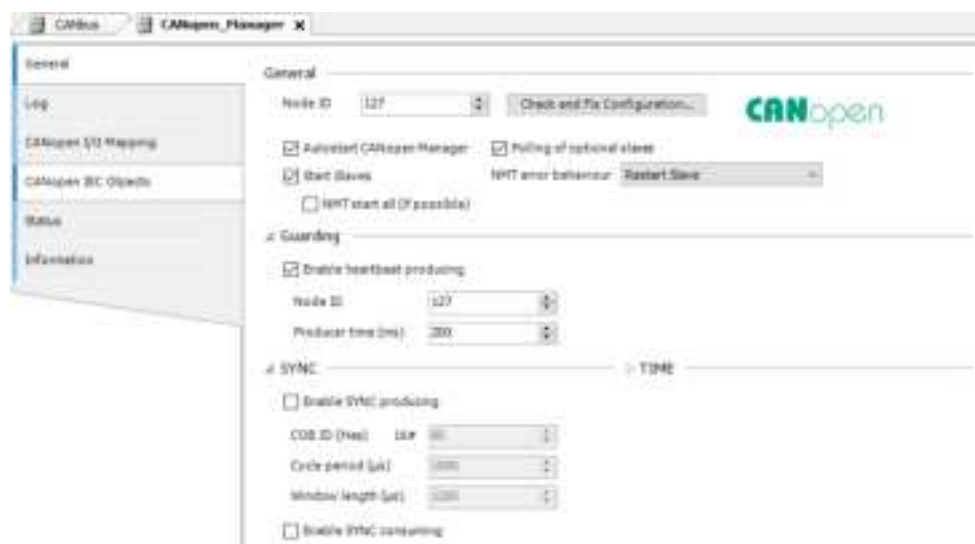
Figure 2-2 Parameter configuration of CANbus



Step 2 Configure **CAN\_Manager**.

CANopen\_Management: A node under the CANbus node that supports CANbus configuration through internal functions. It is generally used as the CANbus master. The configuration page is shown in the following figure.

Figure 2-3 Parameter configuration of CANOpen master



| Master parameter | Description                                                                                                                      |
|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Node ID          | The Node ID parameter allows the CANopen Manager to establish a one-to-one correspondence with up to 127 modules, with ID values |

| Master parameter           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | ranging from 1 to 127, and the ID must be entered as a decimal integer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Guarding                   | Heartbeat mode is a traditional protection mechanism that can be handled by the master station and the slave station modules, different from node protection. Normally the master is configured to send a heartbeat to the slave.                                                                                                                                                                                                                                                                                                                   |
| Enable heartbeat producing | If this option is enabled, the master will send heartbeats continuously according to an internally defined heartbeat time. If a new slave heartbeat function is added, their heartbeat actions will be automatically activated and configured. That means the node ID is automatically set in the management configuration and the heartbeat interval is automatically multiplied by a factor of 1 and 2. If this option is disabled, the node protection (with a life time factor of 10 and a protection time of 100ms) is activated in the slave. |
| Node ID                    | Unique identifier of heartbeat generation (1-127) on the bus.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Producer time (ms)         | Defines the internal heartbeat time in milliseconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

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