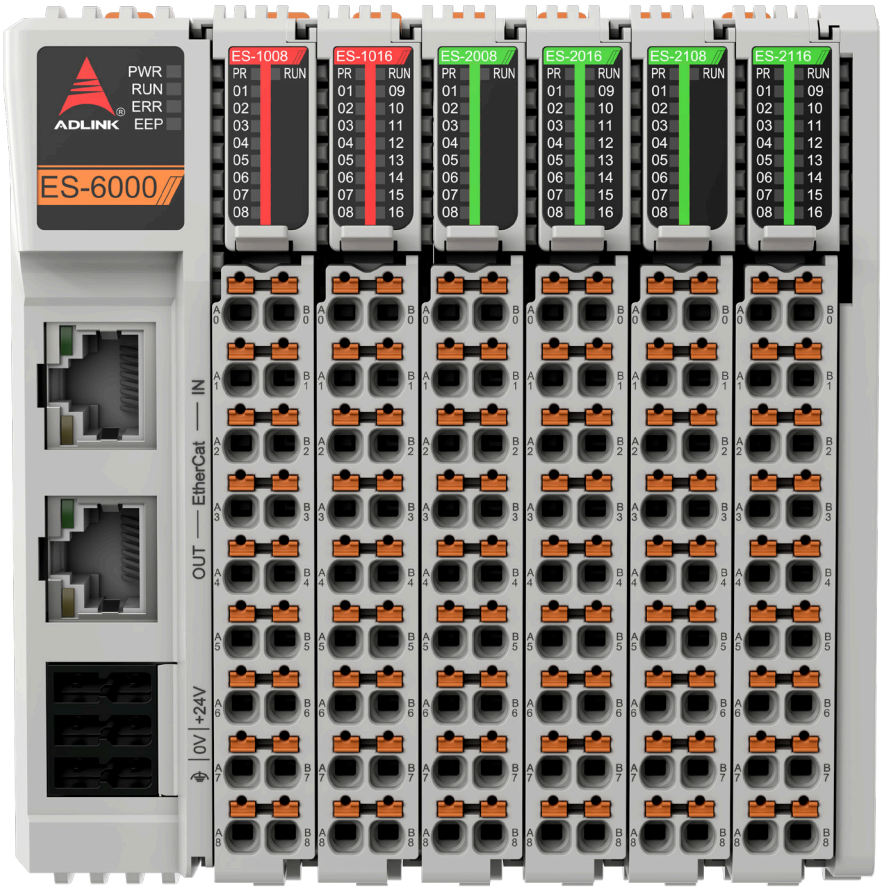
ES Series

User's Manual

EtherCAT Slice I/O Module



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Leading **EDGE COMPUTING**

Revision History

Revision	Description	Date	By
1.0	Initial release	2025-01-14	AL
1.1	Connector pinouts updated	2025-01-23	AL
1.2	Parameter description, appendix A, appendix C updated	2025-03-07	AL
1.3	Specifications updated	2025-08-08	AL

Preface

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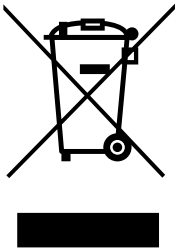
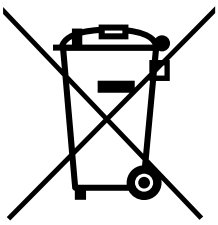
Environmental Responsibility

ADLINK is committed to fulfill its social responsibility to global environmental preservation through compliance with the European Union's Restriction of Hazardous Substances (RoHS) directive and Waste Electrical and Electronic Equipment (WEEE) directive. Environmental protection is a top priority for ADLINK. We have enforced measures to ensure that our products, manufacturing processes, components, and raw materials have as little impact on the environment as possible. When products are at their end of life, our customers are encouraged to dispose of them in accordance with the product disposal and/or recovery programs prescribed by their nation or company.



Battery Labels (for products with battery)



California Proposition 65 Warning

WARNING: This product can expose you to chemicals including acrylamide, arsenic, benzene, cadmium, Tris(1,3-dichloro-2-propyl)phosphate (TDCPP), 1,4-Dioxane, formaldehyde, lead, DEHP, styrene, DINP, BBP, PVC, and vinyl materials, which are known to the State of California to cause cancer, and acrylamide, benzene, cadmium, lead, mercury, phthalates, toluene, DEHP, DIDP, DnHP, DBP, BBP, PVC, and vinyl materials, which are known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Trademarks

Product names mentioned herein are used for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.

Additional information, aids, and tips that help users perform tasks.

Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.

Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

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1 Introduction

1.1 Overview

ADLINK's complete EtherCAT solution, with every element from hardware to middleware to software tailored for dedicated EtherCAT functionality, includes PCIe-833x and SuperCAT master controllers, ES & ECAT-IO slave systems, and remote monitoring and control providers. Additionally, ADLINK's Softmotion one-stop control kernel delivers flexible and easy-to-use intelligent platforms for driving next-generation modern Smart Factories.

ADLINK's ES series I/O modules adopt a structure that combines coupler and I/O modules. The coupler connects the scalable I/O modules to the real-time industrial EtherCAT system, with the backplane using the S-Link bus. The coupler module is responsible for field bus communication, thus enabling real-time data exchange between various I/O modules and the coupler/controller.

The ES slave system is uniquely designed for full operability in conditions ranging from -20°C to 60°C. It also fully complies with EN 61000-6 standards for heavy industrial EMC protection and carries an emission certificate.

1.2 Features

- Compliance with EtherCAT standard.
- Optimization with ADLINK EtherCAT MainDevice (250 µs cycle time).
- Comprehensive SubDevice modules, including bus coupler, digital I/O, analog I/O, power supply, serial communication, switch hub, and terminal shield.
- DO/AO options to maintain the output state when disconnected.
- Compliance with industrial IEC standards.
- Excellent scalability, powered by a modular and slice-type design.
- Spring clamp-type pluggable terminal block.

1.3 Supported Software

1.3.1 OS Support and Software Compatibility

OS Support

- Windows 7/10/11 (x86/x64)

Software Compatibility

- Visual Studio VB.NET, C#, VC.NET
- APS Function Library Support

1.3.2 APS Functions

The ES Series is fully compliant with the APS (Automation Product Software) function library, independent of programming languages and operating systems (OS). A complete and detailed list of functions can be found in the APS Function Library User Manual.

1.3.3 MotionCreatorPro 2 (MCP2)

MotionCreatorPro2™ is a user interface exclusively developed for ADLINK motion control products in a standard Windows environment, designed to set up cards and axis parameters easily. A Setup Wizard guides users through hardware installation, wiring, and I/O manipulation in minutes.

MotionCreatorPro2™ not only effectively reduces development time but also enables concurrent validation of overall mechanisms and electric designs with all DIO and AIO operation pages.

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2 Getting Started

The ES system incorporates one or more couplers with functional modules connected to the right thereof, performing certain tasks and instructions properly.

Diagrams and illustrated equipment are for reference only. Actual system configuration and specifications may vary.

ES modules are NOT hot-swappable, the system must be powered down before module removal or installation.

2.1 Unpacking Checklist

Before unpacking, check the shipping carton for any damage. If the shipping carton and/or contents are damaged, inform your dealer immediately. Retain the shipping carton and packing materials for inspection. Obtain authorization from your dealer before returning any product to ADLINK.

Please ensure that the ES module is included in the package. If any items are missing or damaged, contact the dealer from whom you purchased the product. Keep the shipping materials and cartons in case you want to ship or store the product in the future.

The internal thermal status is monitored by onboard thermal sensors and reported to the host automatically to ensure prompt action in the event of temperature overages.

Do not install or apply power to equipment that is damaged or missing components. Retain the shipping carton and packing materials for inspection. Please contact your ADLINK dealer/vendor immediately for assistance and obtain authorization before returning any product.

2.2 Hardware Installation and Mounting

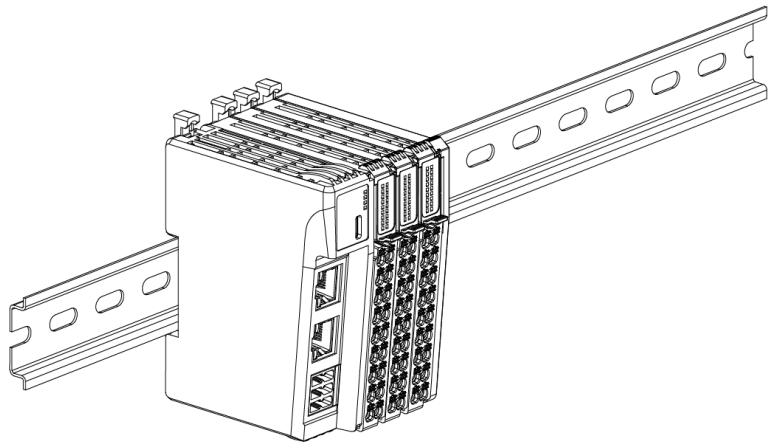
1. The protection level of the module is IP20. The module needs to be installed in the cabinet and used indoors.
2. Ensure that the cabinet has good ventilation (e.g., installing an exhaust fan).
3. Do not install this device next to or above equipment that may cause overheating.
4. Be sure to install the module vertically on the fixed guide rail and maintain surrounding air circulation (with at least 50 mm of space above and below the module).
5. Installation/disassembly must be performed with the power supply turned off.
6. After the module is installed, it is recommended to wire it according to the specified up-and-down wiring method.

If the product is not used in accordance with the user manual, the protection provided by the device may be compromised.

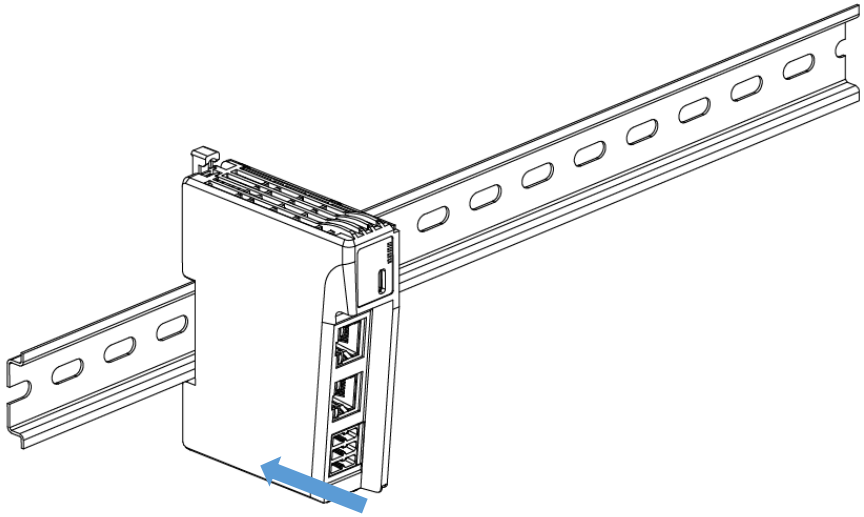
2.2.1 Mounting on the DIN Rail

Make sure all of the module is installed vertically on the DIN rail.

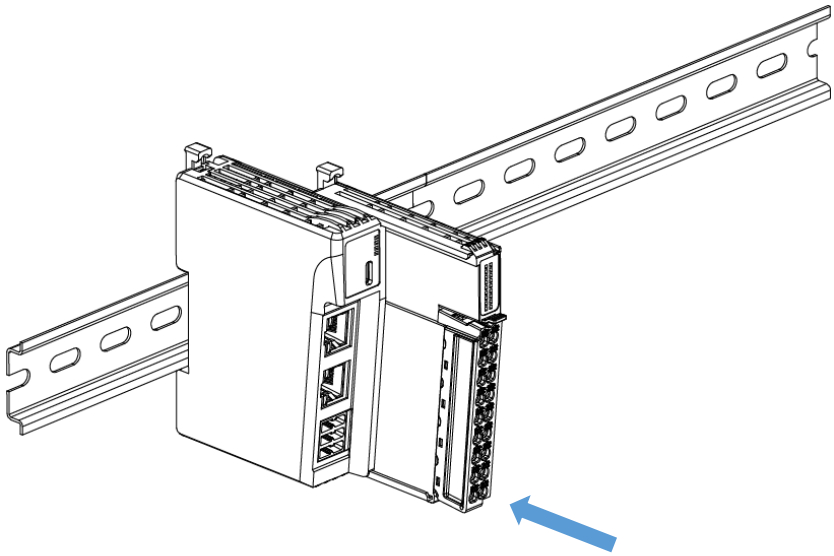
The installation steps are as follows:



1. Mount the bus coupler to the mounting rail (not shown) by applying rearward pressure until it is firmly seated.



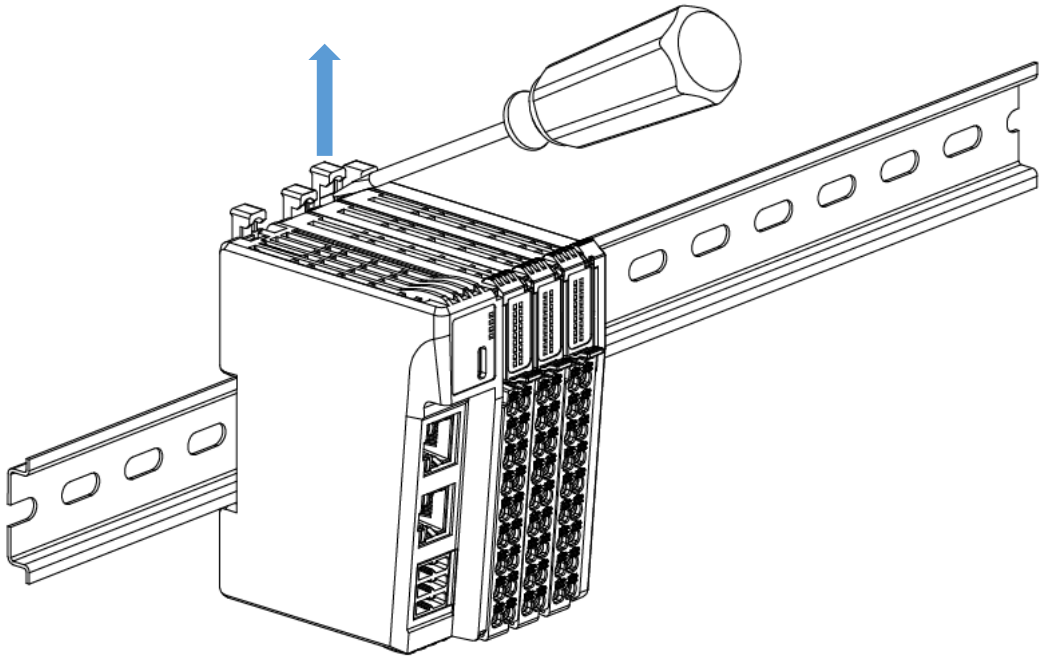
2. Mount additional modules to the right by aligning the module's groove runner (along the top left edge) with the previously mounted terminal's tongue runner (along the top right edge). Slide the module rearward until it clicks into place, indicating it has made contact with the rail.



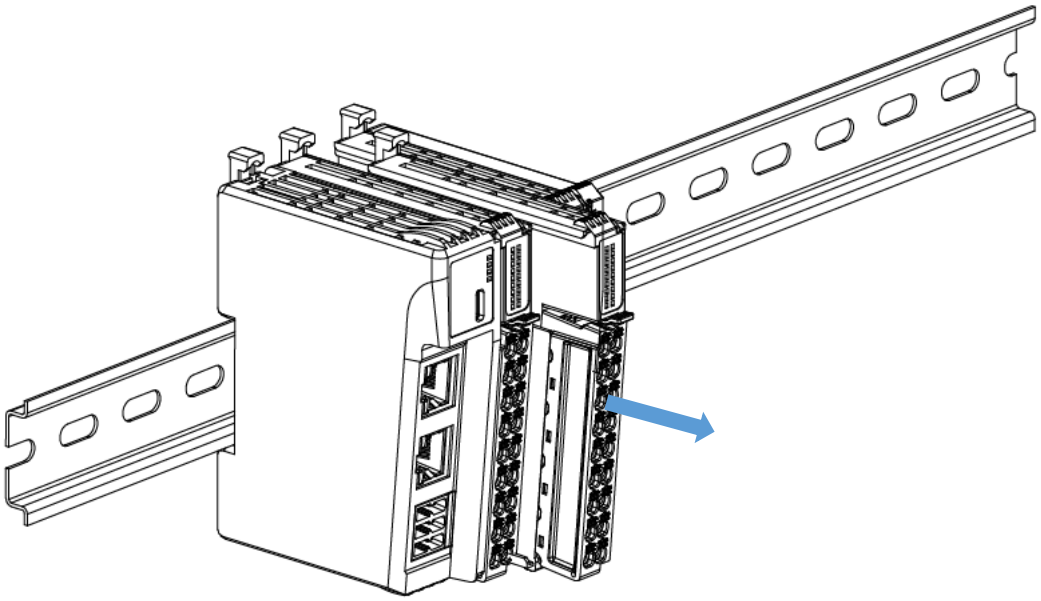
3. If mounted correctly, no significant gap should be visible between the housings.

2.2.2 Dismounting from the DIN Rail

1. Pull the orange tab upward by approximately 1 cm until it clicks. The module will be released from the mounting rail lock and can be pulled out of the bus terminal block easily without using excessive force.

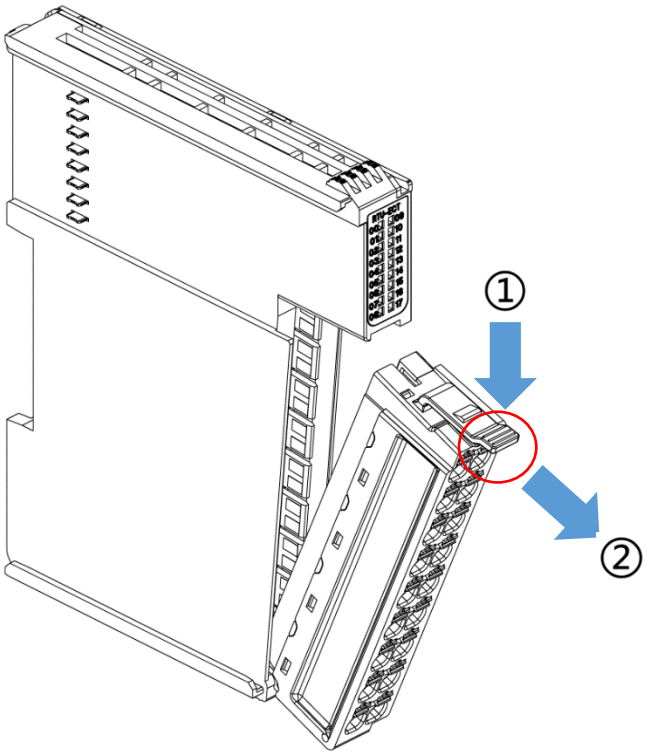


2. To remove a module, grasp it at both top and bottom groove runners, and pull outward until it is free of the terminal block.



2.2.3 Disassembly of Terminal Blocks

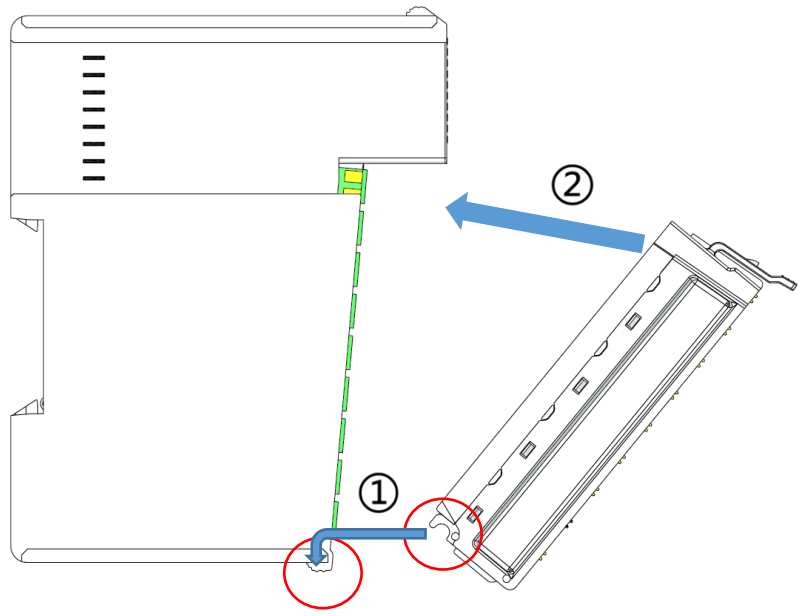
The ES system allows for module changes without the need to remove the cable. As shown in the figure below, press down on the latch of the terminal block, then pull outward to remove the terminal block, allowing the module to be replaced.



Note: Be sure to turn off the power before replacing the module.

2.2.4 Assembly of Terminal Blocks

When installing, first position the half-moon mechanism under the terminal block at a 45-degree angle, and then push it forward into the IO body. When you hear a click, the installation is successful.



2.3 Terminal and Wiring

2.3.1 ES-6000 Terminal and Wiring

2.3.1.1 Terminal Specification

Terminal		
Power terminal	Rated voltage	300V
	Rated current	8A
	Poles	6P
	Wire sizes	24-16 AWG 0.2-1.5 mm²
I/O module terminals (i.e., input and output terminals)	Rated voltage	63V
	Rated current	8A
	Poles	18P
	Wire Sizes	24-16 AWG 0.2-1.5 mm²
EtherCAT interface	2×RJ45	UTP or STP (STP recommended) of Cat.5 or above

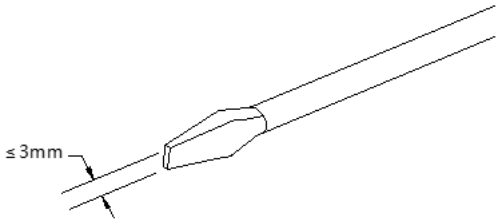
2.3.1.2 Wiring Instructions and Requirements

Power wiring precautions

- The module system-side power supply and field-side power supply should be configured and used separately. Do not mix them.
- PE must be reliably grounded.

Wiring tool requirements

- The power terminals and signal cable terminals adopt a screw-free design, allowing cables to be installed and removed using a flat-blade screwdriver (specification: ≤3mm).



Stripping length requirement

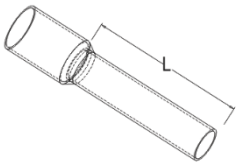
- The recommended cable stripping length for power and signal wire terminals is 10 mm.

Wiring method

- For single-strand hard wires, after stripping the appropriate length of wire, press the button and insert the single-strand wire directly into the corresponding port.
- For multi-stranded flexible wires, after stripping the appropriate length, they can be directly connected or used with cold-pressed terminals (tubular insulated terminals, reference specifications are shown in the table below). Press the button and insert the insulated terminal directly into the corresponding port.

The specifications of power terminals and signal wire terminals are shown in the table below:

- Use only copper conductors for wiring conductors.
- Cable temperature: 80℃.

Tubular Insulating Terminal Specification		
Specification requirements	Model	Wire cross-sectional area mm²
 The length of the tubular insulated terminal L is 10 mm	E0310	0.3
	E0510	0.5
	E7510	0.75
	E1010	1.0
	E1510	1.5

2.3.2 ES-0040 Terminal and Wiring

2.3.2.1 Terminal Specification

Terminal		
Power terminal	Poles	3P
	Wire sizes	22-16 AWG 0.3-1.5 mm²
EtherCAT interface	4×RJ45	UTP or STP (STP recommended) of Cat.5 or above

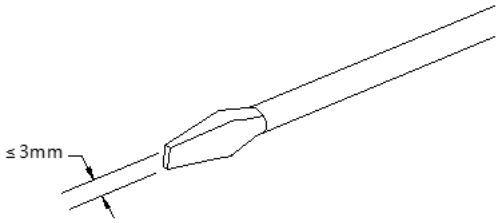
2.3.2.2 Wiring instructions and requirements

Power wiring precautions

- The module system-side power supply and field-side power supply should be configured and used separately, do not mix them.
- PE needs must be reliably grounded.

Wiring tool requirements

- The power terminals and signal cable terminals adopt a screw-free design, allowing cables to be installed and removed using a flat-blade screwdriver (specification: ≤3mm).



Stripping length requirement

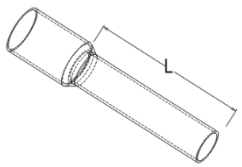
- The recommended cable stripping length for power and signal wire terminals is 10 mm.

Wiring method

- For single-strand hard wires, after stripping the corresponding length of wire, press the button and insert the single-strand wire directly into the corresponding port.
- Multi-stranded flexible wires, after stripping the corresponding length, they can be directly connected or used with cold-pressed terminals (tubular insulated terminals, reference specifications are shown in the table below). Press the button and insert the insulated terminal directly into the corresponding port.

The specifications of power terminals and signal wire terminals are shown in the table below:

- Use only copper conductors for wiring.
- Cable temperature: 80℃.

Tubular Insulating Terminal Specification		
Specification requirements	Model	Wire cross-sectional area mm²
 The length of the tubular insulated terminal L is ≥ 10 mm	E0510	0.5
	E7510	0.75
	E1010	1.0
	E1510	1.5

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3 Specifications

The ES Series provides software-configurable trigger bus bridges, allowing the user to set the status of each trigger bus line, while offering remarkable flexibility and expandability to address diverse application requirements.

Module	Description
ES-6000	EtherCAT bus coupler (Includes terminal cover)
ES-1008	8-ch, sourcing/sinking, digital input
ES-1016	16-ch, sourcing/sinking, digital input
ES-2108	8-ch, sinking, digital output
ES-2116	16-ch, sinking, digital output
ES-3104	4-ch, -10~10V, 16-bit, analog input
ES-4104	4-ch, -10~10V, 16-bit, analog output
ES-3504	4-ch, TC/RTD temperature acquisition
ES-5003	1-ch, Modbus RTU communication module (via RS232/485/422)
ES-0012	5VDC/2A, Extended Power module
ES-0040	1 input & 3 output, EtherCAT switch hub

Compatibility with 3rd party EtherCAT master controllers:

To use ES Series modules with a non-ADLINK EtherCAT master controller, please download the ESI file from the ES Series product page at www.adlinktech.com/products/motion_control/ethercatsolution/es_series?lang=en#tab-ordering.

3.1 Product Specifications

3.1.1 ES-6000 Bus Coupler Module Specifications

The ES-6000 EtherCAT bus coupler module supports not only EtherCAT transmission but also ES peripheral module control and measurement. The ES-6000 fully operable in environments from -20°C to 60°C.

Model Name	ES-6000
Type	EtherCAT bus coupler
System input voltage	SELV input, 24VDC (18V to 36V)
System input current	Max: 600mA @ 24VDC
Bus protocol	S-Link
Bus power output	5VDC / Max: 2A
SubDevice supported	Max: 32
Device supported	Depends on master support
Data transmission cable	Ethernet/EtherCAT CAT5 Cable
Transmission rate	100Mbps
EtherCAT cycle time	Min: 250 μs
Transmission distance	≤ 100m
Bus interface	2×RJ45
LED Indicator	PWR, RUN, ERR, EEP
Operating temperature	-20℃ to 60℃

Storage temperature	-40℃ to 80℃
Humidity	95% none-condensing
Certification	CE, RoHS
Dimension (WxHxD)	25.55 x 107 x 80 mm
Weight	100g

Note: The ES-6000 bus coupler supports a maximum of 32 modules and has a maximum current output of 2A. If the total current drawn by the connected modules exceeds 2A, an ES-0012 power module must be installed in the terminal block at a location that ensures the current draw from the ES-6000 does not exceed 2A.

3.1.2 ES-1008 and ES-1016 Digital Input Specifications

The ES-1008 8-channel and ES-1016 16-channel source/sink type digital input modules operate from -20°C to 60°C and provide high isolation protection.

Model Name	ES-1008	ES-1016
Type	Digital input	
Bus input voltage	5VDC (4.5V to 5.5V)	
Bus input current	≤ 40mA	≤ 50mA
Input voltage	24VDC (20.4V to 28.8V)	
Input current	5mA @ 24VDC	
Channel	8	16
Input type	Souring (PNP) / Sinking (NPN)	
Logic0 voltage (PNP)	-3V to 5V / <0.9mA	
Logic1 voltage (PNP)	11V to 30V / >2.1mA	
Logic0 voltage (NPN)	11V to 30V / >2.1mA	
Logic1 voltage (NPN)	-3V to 5V / <0.9mA	
Response time	< 50μs	
Digital filter	No filter/0.1ms/0.2ms/0.5ms/1ms/2ms/3ms(Default) /4ms…20ms(Interval 1ms)	
Max input frequency	150Hz @ filter 3ms	
Input resistance	5.4KΩ	
Isolation type	Optocoupler	
Isolation voltage	500VAC	
Rated current consumption	40mA	50mA
Power consumption	0.2W	0.25W
LED indicator	PR, RUN, DI status	
Operating temperature	-20℃ to 60℃	
Storage temperature	-40℃ to 80℃	
Humidity	95% none-condensing	
Certification	CE, RoHS	
Dimension (WxHxD: mm)	15.7x107x80.7	
Weight	Approx. 85g	

Note: The NPN type connects to 24V, and the PNP type connects to 0V.

3.1.3 ES-2108 and ES-2116 Sink Digital Output Module Specifications

The ES-2108 8-channel and ES-2116 16-channel sink type digital output module operates from -20°C to 60°C and provides high isolation protection, and supports disconnection retention.

Model Name	ES-2108	ES-2116
Type	Digital Output	
Bus input voltage	5VDC (4.5V-5.5V)	
Bus input current	≤ 65mA	≤ 75mA
Input voltage	24VDC (20.4V-28.8V)	
Channel	8	16
Output type	Sinking (NPN)	
Output voltage drop	< 1V	
Rated current output	500mA per channel	
Leakage Current	< 10μA	
Response time	< 150μs	
Channel protection	Short circuit protection (automatic recovery)	
Module protection	Reverse and surge protection	
Isolation type	Optocoupler	
Isolation voltage	500VAC	
Rated current consumption	65mA	75mA
Power consumption	0.325W	0.375W
LED indicator	PR, RUN, DO status	
Operating temperature	-20℃ to 60℃	
Storage temperature	-40℃ to 80℃	
Humidity	95% none-condensing	
Certification	CE, RoHS	
Dimension (WxHxD: mm)	15.7x107x80.7	
Weight	Approx. 85g	

3.1.4 ES-3104 Analog Input Module Specifications

The ES-3104 is a 4-channel, single-ended voltage input module with a range of -10V to 10V at 16-bit resolution, an operating temperature range of -20°C to 60°C, and high isolation protection.

Model Name	ES-3104
Type	Analog input
Bus input voltage	5VDC (4.5V-5.5V)
Bus input current	≤ 145mA
Channel	4
Input type	Voltage
Input Range	-10V to 10V
Interface	Single-ended
Conversion time	230μs/ch, 380μs/4 ch
Resolution	16 bits

Sampling rate (All channel)	1k sample/s
Accuracy	±0.1% FSR accuracy @25°C
Input impedance	≥ 400kΩ
Analog input voltage	Max: 30V
Over-voltage protection	±30V
Isolation voltage	500VAC
Rated current consumption	145mA
Power consumption	0.725W
LED Indicator	PR, RUN
Operating temperature	-20℃ to 60℃
Storage temperature	-40℃ to 80℃
Humidity	95% none-condensing
Certification	CE, RoHS
Dimension (WxHxD: mm)	15.7x107x80.7
Weight	Approx. 85g

Voltage input value

Voltage	Digital Value
-10	-32768
-9	-29491
-8	-26214
-7	-22937
-6	-19661
-5	-16384
-4	-13107
-3	-9830
-2	-6554
-1	-3277
-0.13	-426
-0.06	-197
0	0
1	3277
2	6554
3	9830
4	13107
5	16384
6	19661
7	22937
8	26214
9	29491
10	32767

* Digital value formula: Digital value = (65535/20) * voltage

* Voltage formula: Voltage = (digital value*20) / 65535

Note: The voltage input module supports overflow and underflow functions when the range is -10V to 10V (-32768 to 32767). That is, when the channel input is greater than 10V, the maximum digital value displayed is 32767. When the channel input is less than -10V, the minimum digital value displayed is -32768.

3.1.5 ES-4104 Analog Output Module Specifications

The ES-4104 is a 4-channel, -10V to 10V, 16-bit voltage output module that supports disconnection retention.

Model Name	ES-4104
Type	Analog output
Bus input voltage	5VDC (4.5V-5.5V)
Bus input current	≤ 30mA
Channel	4
Input voltage	24VDC (20.4V-28.8V)
Input type	Voltage
Voltage range	-10V to 10V
Conversion time	200μs/ch, 200μs/4 ch
Resolution	16 bits
Accuracy	±0.1% FSR accuracy @25°C
Load impedance	≥ 2kΩ
Isolation voltage	500VAC
Rated current consumption	30mA
Power consumption	0.15W
LED Indicator	PR, RUN
Operating temperature	-20℃ to 60℃
Storage temperature	-40℃ to 80℃
Humidity	95% none-condensing
Certification	CE, RoHS
Dimension (WxHxD: mm)	15.7x107x80.7
Weight	Approx. 85g

Voltage output value

Voltage	Digital Value
-10	-32768
-9	-29491
-8	-26214
-7	-22937
-6	-19661
-5	-16384
-4	-13107
-3	-9830

-2	-6554
-1	-3277
0	0
1	3277
2	6554
3	9830
4	13107
5	16384
6	19661
7	22937
8	26214
9	29491
10	32767

* Digital value formula: Digital value = (65535/20) * voltage

*Voltage formula: Voltage = (digital value*20) / 65535

3.1.6 ES-3504 Temperature Aquisition Module Specifications

ES-3504 is a 4-channel temperature acquisition module that supports thermal resistors and thermocouples sensors. By adopting the S-Link bus and using the ES coupler, the module takes up little space and is highly practical, providing users with high-speed data collection, optimized system configuration, simplified field wiring, and improved system reliability.

Model Name	**ES-3504**		
Type	Temperature acquisition		
Bus input voltage	5VDC (4.5V-5.5V)		
Channel	4		
Sensor type	TC	RTD	R
Connection method	2-wire	2-wire, 3-wire	2-wire
Sensor code and range	B: 50 to 1800°C E: -20 to 1000°C J: -200 to 1200°C K: -200 to 1370°C S: -50 to 1690°C	Pt100: −200 to 850°C Pt200: −200 to 850°C Pt500: −200 to 850°C Pt1000: −200 to 850°C Ni100: -60 to 250°C Ni1000: -60 to 250°C	15Ω~3kΩ
Accuracy	±0.3% @25°C (F.S.) ±0.5% @-20 to 60°C (F.S.)	±0.1% @25°C (F.S.) ±0.3% @-20 to 60°C (F.S.)	
Sensitivity	0.1°C		±0.1Ω
Resolution	16 bits		
Conversion time	20ms/ch, 110ms/4-ch	80ms/ch, 330ms/4 ch	
Input filter	Single channel filtering, configurable (number of stages 0 to 10)		
Open circuit diagnosis	YES		
Open circuit diagnosis time	2ms		
Maximum input voltage	±30V		
Noise suppression	50Hz, 60Hz, 10Hz, None		

Excitation current	<2mA
Input impedance	≥10KΩ
Isolation method	Digital isolation
Electrical isolation	500VAC
Rated current consumption	75mA
Power consumption	0.375W
LED Indicator	PR, RUN
Operating temperature	-20℃ to 60℃
Storage temperature	-40℃ to 80℃
Humidity	95% none-condensing
Certification	CE, RoHS
Dimension (WxHxD: mm)	15.7x107x80.7
Weight	Approx. 65g

3.1.7 ES-5003 Modbus RTU Communication Module Specifications (Via RS232/485/422)

The ES-5003 is a plug-in, 1-channel serial communication module that supports Modbus master-slave station and Freeport serial communication functions.

- Supports multiple communication modes, including eight modes: MRM/MRS/MAM/MAS.
- Please refer to the ES-5003 Configuration Parameter Definition.
- Supports three communication interfaces: RS485/RS422/RS232 three interfaces [1].
- Supports three communication protocols: Modbus RTU/ Modbus ASCII/Freeport.

Note [1]: Only one of the RS232, RS485, and RS422 interfaces can be used at a time.

Model Name	ES-5003
Type	Communication module
Bus input voltage	5VDC (4.5V-5.5V)
Channel	1
Interface type [1]	RS232/RS485/RS422
Communication protocol	Modbus RTU / Modbus ASCII / Freeport
Baud rate	1200bps to 115200bps
Isolation Voltage	500VAC
Rated current consumption	170mA
Power consumption	0.85W
LED Indicator	PR, RUN, TX, RX
Operating temperature	-20℃ to 60℃
Storage temperature	-40℃ to 80℃
Humidity	95% none-condensing
Certification	CE, RoHS
Dimension (WxHxD: mm)	15.7x107x80.7
Weight	Approx. 65g

Note[1]: Only one of the RS232, RS485, and RS422 interfaces can be used at a time.

3.1.8 ES-0012 Extended Power Module Specifications

Model Name	ES-0012
Type	Extended power
Bus input voltage	SELV Input, 24VDC (18V-36V)
Bus input current	Max: 500mA @ 24VDC
Backplane power supply current	Max: 2A
Backplane power supply voltage	5VDC
Isolation voltage	500VAC
Rated current consumption	500mA
Power consumption	10W
LED indicator	PR
Operating temperature	-20℃ to 60℃
Storage temperature	-40℃ to 80℃
Humidity	95% none-condensing
Certification	CE, RoHS
Dimension (WxHxD: mm)	15.7x107x80.7
Weight	Approx. 70g

3.1.9 ES-0200 Terminal Cover

The Terminal cover protects ES terminals.

Model Name	ES-0200
Type	Terminal cover
Certification	CE, RoHS
Dimension (WxHxD: mm)	5x100.5x80.5
Weight	Approx. 65g

3.1.10 ES-0040 EtherCAT Switch Module Specifications

The ES-0040 is a 4-port EtherCAT switch module that adopts the EtherCAT industrial Ethernet bus interface and is compatible with EtherCAT networks from multiple manufacturers. It supports cascading functions and can be flexibly combined into a variety of topologies. It is widely used in various industries and systems.

Model Name	ES-0040
Type	EtherCAT switch hub
Bus protocol	EtherCAT
Bus interface	4 x RJ45 (1 in 3 out)
Data transmission cable	Ethernet/EtherCAT CAT5 Cable
Network port hot-swappable	Supported
Transmission distance	≤ 100m
Transmission rate	100Mbps
Configuration method	Via EtherCAT Master site
System Input voltage	24VDC (18V~36V)
Isolation voltage	500VAC
Rated current consumption	80mA
Power consumption	1.92W
LED Indicator	PWR, IN1, OUT2, OUT3, OUT4
Operating temperature	-10℃ to 60℃
Storage temperature	-20℃ to 75℃
Humidity	95% none-condensing
Certification	CE, RoHS
Dimension (WxHxD: mm)	28 x 112 x 76
Weight	Approx. 110g

3.1.10.1 Terminal Specification

Terminal		
Power terminal	Poles	3P
	Wire Sizes	22 to 16 AWG 0.3 to 1.5 mm²
EtherCAT interface	4×RJ45	UTP or STP (STP recommended) of Cat.5 or above

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4 Mechanical Layout

NOTE: All dimensions shown are in millimeters.

4.1 Mechanical Dimensions

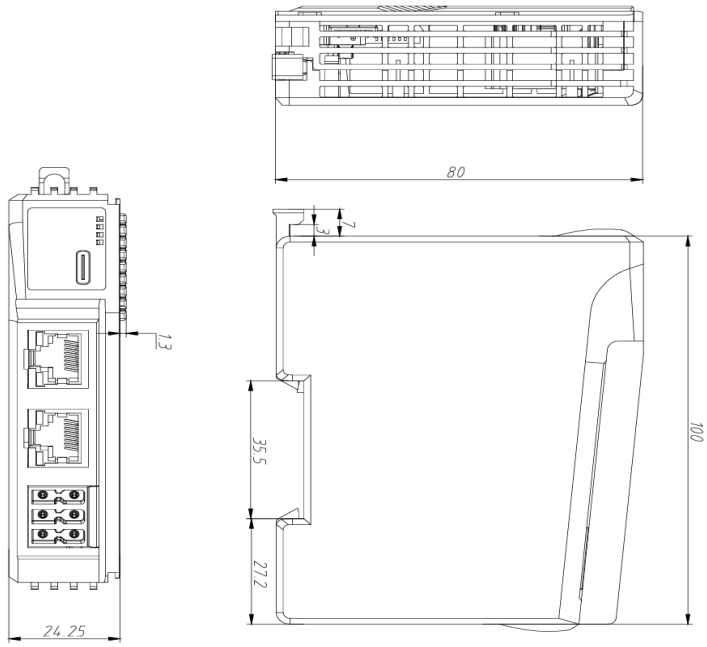


Figure 1: ES-6000 dimensions

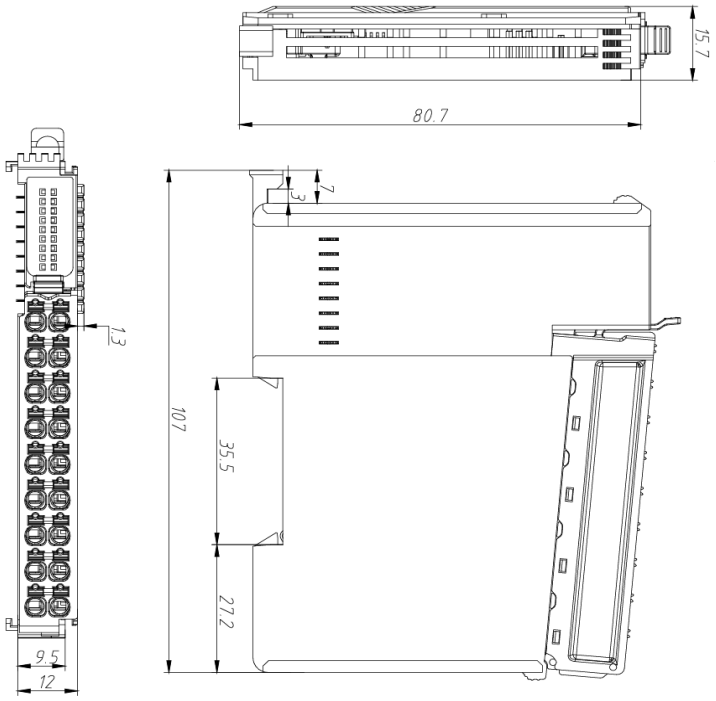
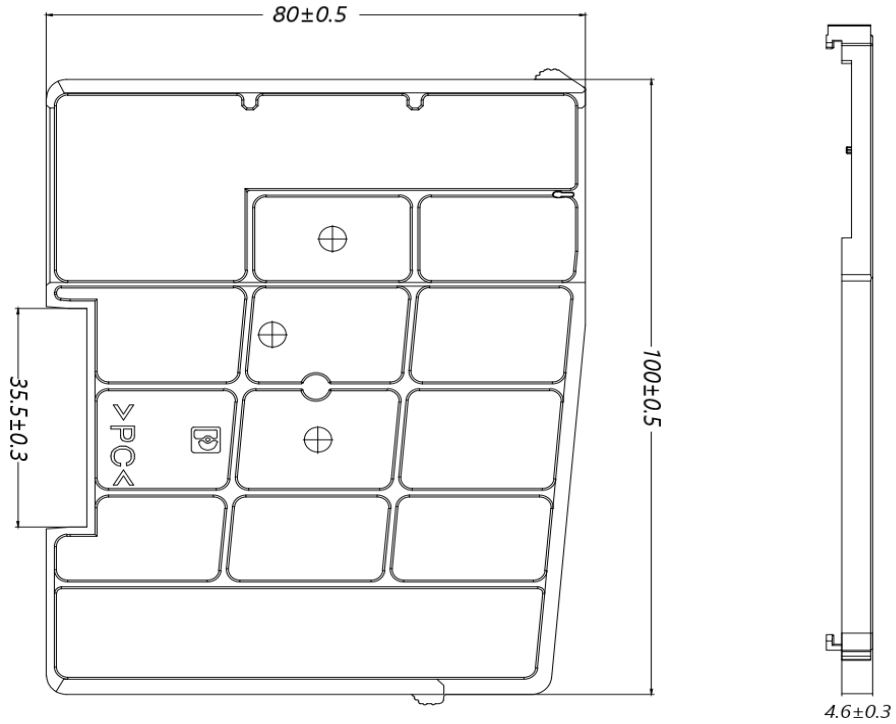


Figure 2: ES-1008/1016/2108/2116/3104/4104/3504/5003/0012 dimensions

4.2 ES-0200 Dimensions



Note: They are all installed using DIN 35 mm standard rails. The DIN rail specifications are 35x7.5x1.0 and 35x15x1.0 (unit: mm).

Figure 3: ES-0200 dimensions

4.3 ES-0040 Dimensions

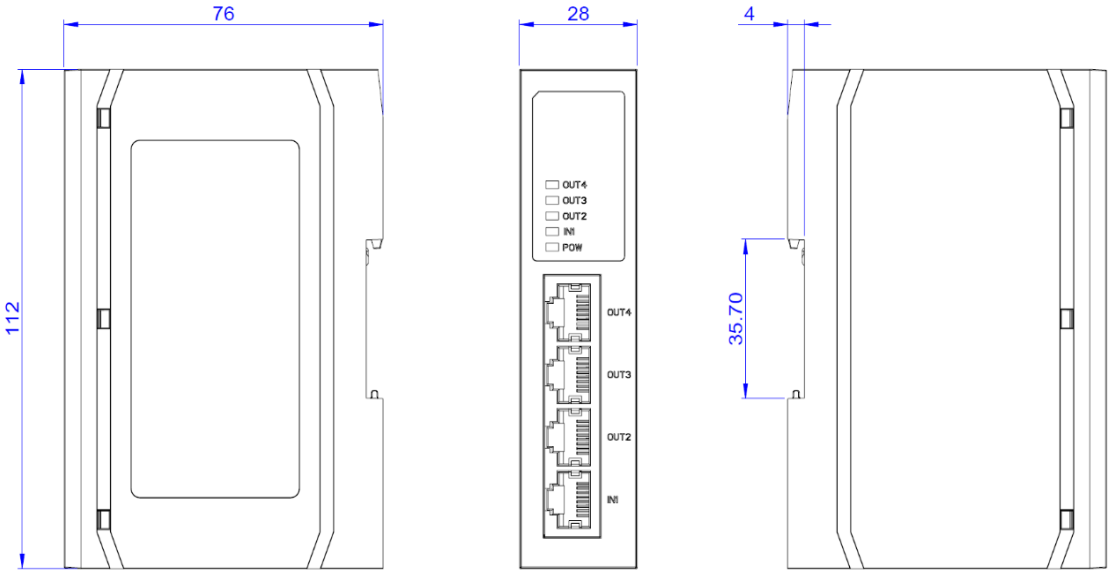
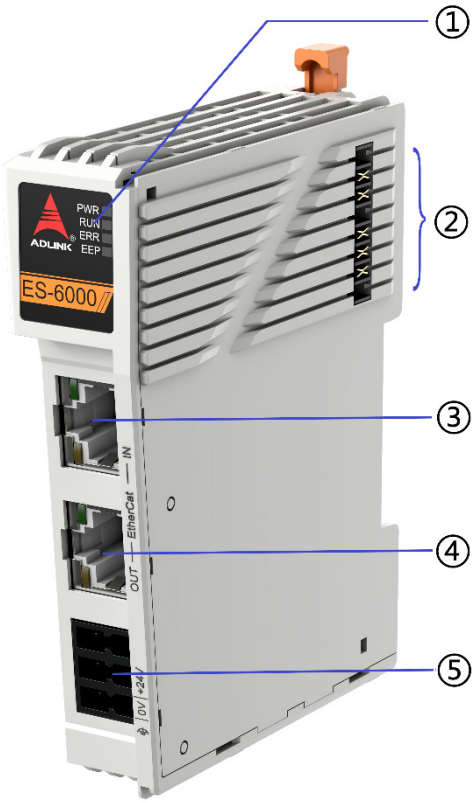


Figure 4: ES-0040 dimensions

4.4 Panel Structure



Number	Definition	Description
①	Module Indicator Light and Indicator Light Identification	Indicates Coupler Power Status, System Operation Status
②	Bus Connector	Communication Signal
③	EtherCAT Connector IN	RJ45 Interface
④	EtherCAT Connector OUT	RJ45 Interface
⑤	24V Power Connector	6P Spring-Loaded Terminal Block

Figure 5: ES-6000 panel structure

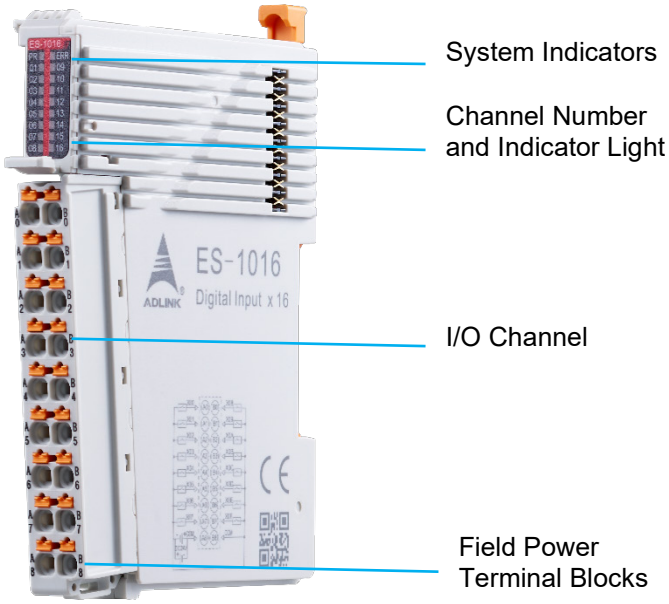


Figure 6: ES-1008 and ES-1016 panel structure

Figure 7: ES-3104 panel structure

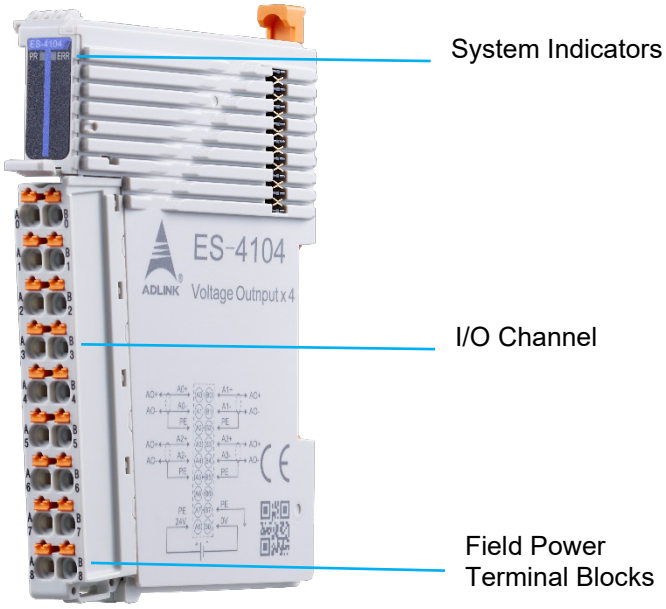


Figure 8: ES-4104 panel structure

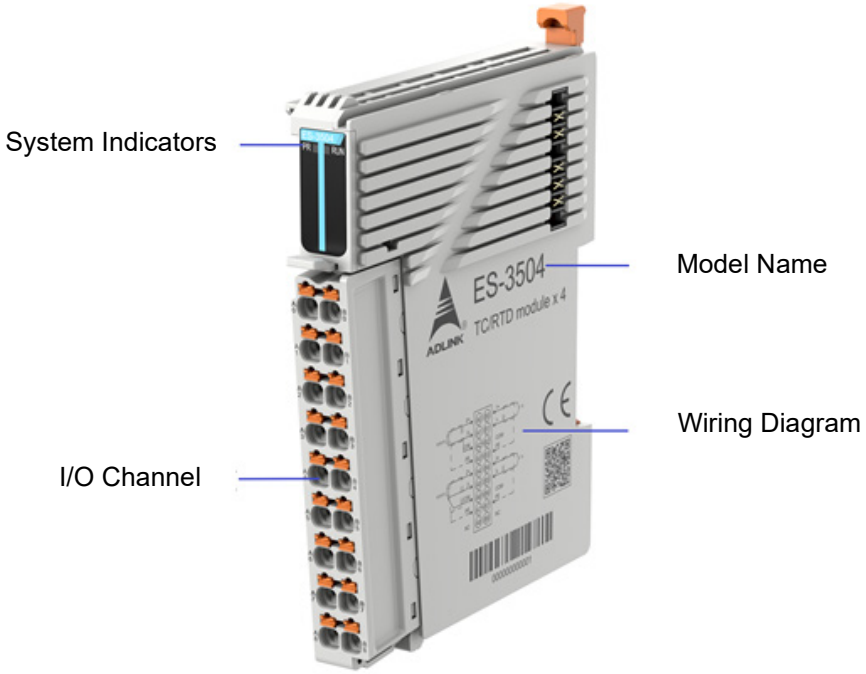


Figure 9: ES-3504 panel structure

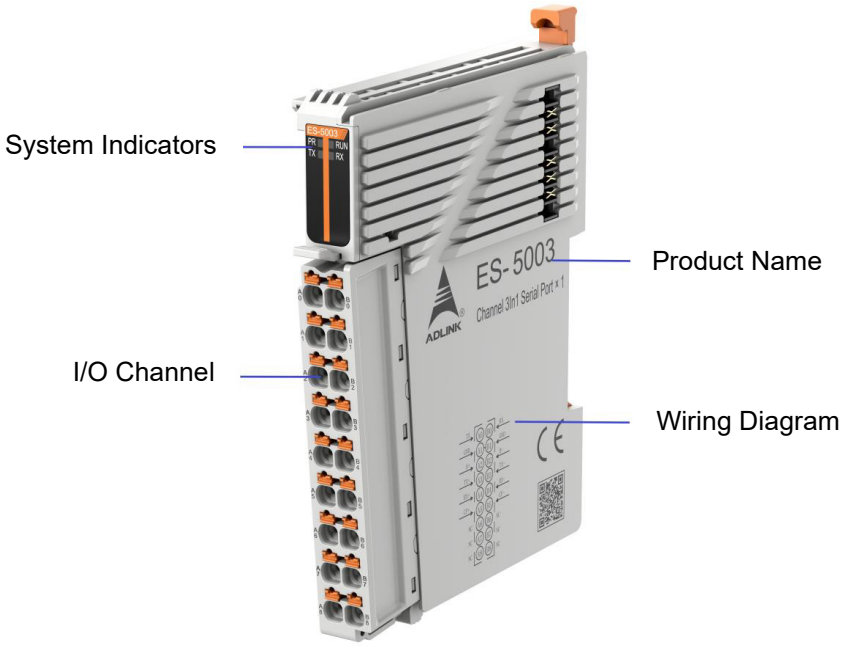


Figure 10: ES-5003 panel structure

Figure 11: ES-0012 panel structure

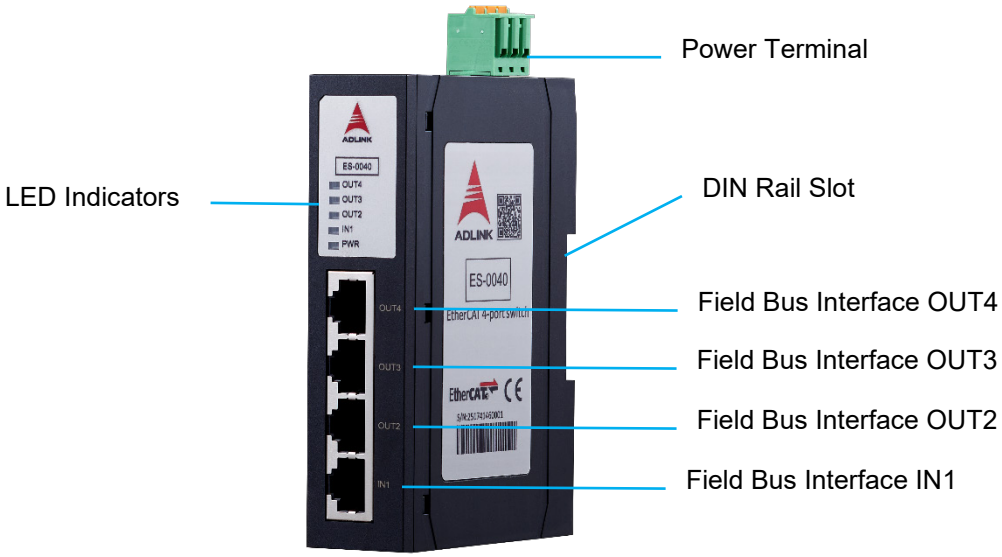


Figure 12: ES-0040 panel structure

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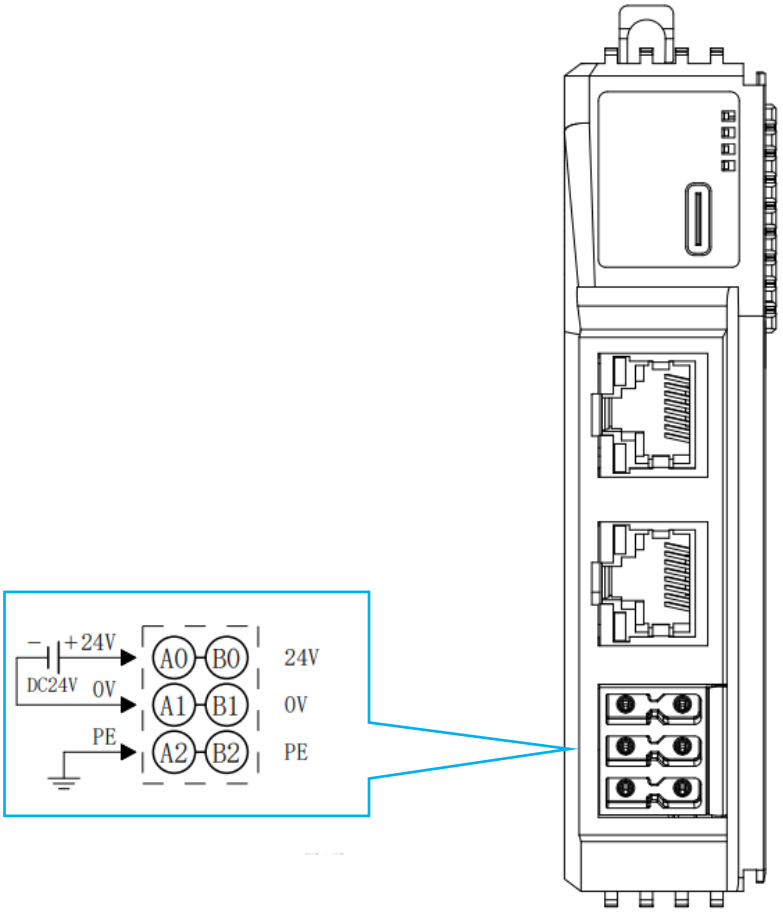
5 Connector Pinouts

5.1 ES-6000 Connector Pinouts

5.1.1 I/O Pin Assignment

Use a 24VDC power supply. Refer to the wiring method and connect the power supply according to the circuit shown in the diagram below. Ensure the PE (Protective Earth) is reliably grounded. It is recommended to use twisted-pair wires for the power lines.



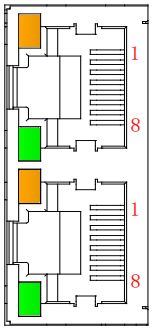
5.1.2 LED Indicators

Function	Color	Status
PWR	Green	Off: Power off On: Power on
RUN	Green	Off: Initialization Blinking (2.5Hz): Pre-operational Single flash (on 200ms/ off 1s): Safe operational Flashing (10Hz): Bootstrap On: Operational
ERR	Red	Off: No Error Blinking (2.5Hz): Invalid Configuration Single Flash (On 200ms/ Off 1s): Local Module Error Double Flash: Watchdog Timeout Note: A double flash refers to a pattern where the light stays on for 200ms, turns off for 200ms, stays on for another 200ms, then turns off for 1000ms, and repeats the cycle.
EEP	Green	Blinking (1Hz): No data interaction

		Flashing (10Hz): The coupler firmware is upgrading On: I/O process data has been established
IN / OUT (on RJ45)	Orange	Off: No data interaction or exception Blinking: Link and TX/RX activity
	Green	Off: No link or exception On: Good link

5.1.3 RJ45 Network Wiring

Using a standard RJ45 network interface connector, the pin assignment is shown in the table below.



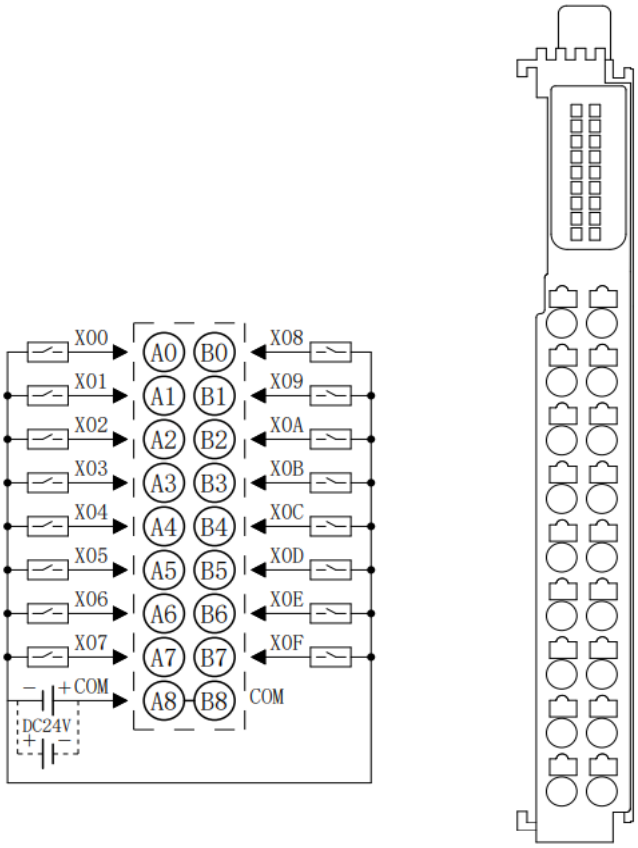
Pin	Signal
1	TD+
2	TD-
3	RD+
4	—
5	—
6	RD-
7	—
8	—

Note:

- It is recommended to use a Cat 5 or higher double-shielded (braided mesh + aluminum foil) STP cable for communication.
- The length of the cables between devices should not exceed 100m.

5.2 ES-1008 and ES-1016 Connector Pinouts

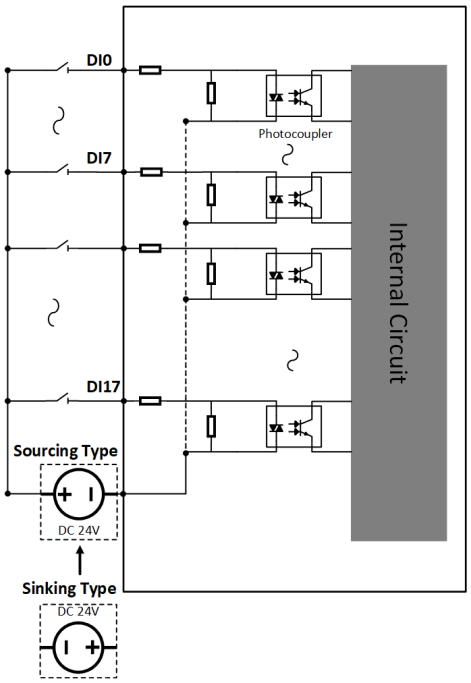
5.2.1 I/O Pin Assignment



*COM internal conduction; NPN/PNP compatible

Note: For 8-channel model, only A0 to A8 are functional, and B0 to B8 do not require wiring.

Signal connection

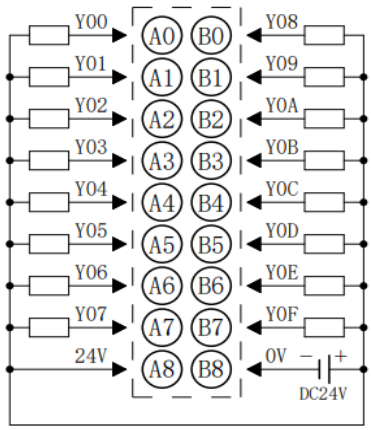


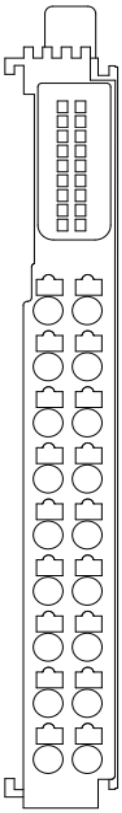
5.2.2 LED Indicators

Function	Color	Status
PR	Green	Off: Power off/ exceptional On: Power on
RUN	Green	Off: System is not working Blinking (1Hz): No data interaction Flashing (10Hz): Firmware is upgrading On: System is running normally
Channel 01~08/16	Green	Off: Inactive On: Active

5.3 ES-2108 and ES-2116 Connector Pinouts

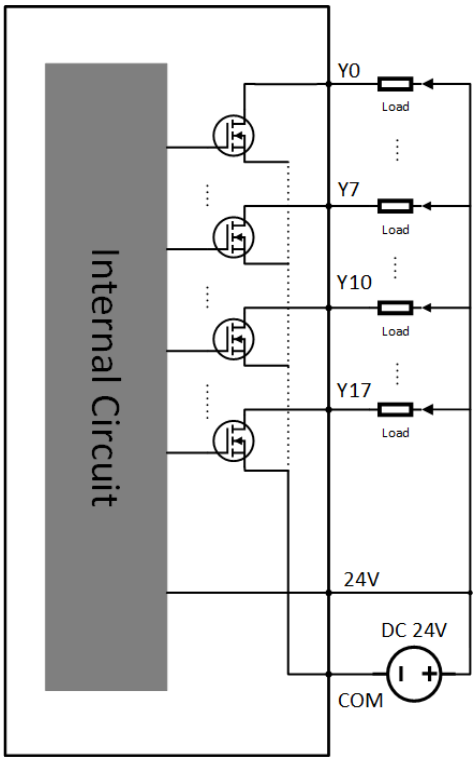
5.3.1 I/O Pin Assignment





Note: For 8-channel model, only A0 to A8 and B8 are functional, B0 to B7 do not require wiring.

Signal connection

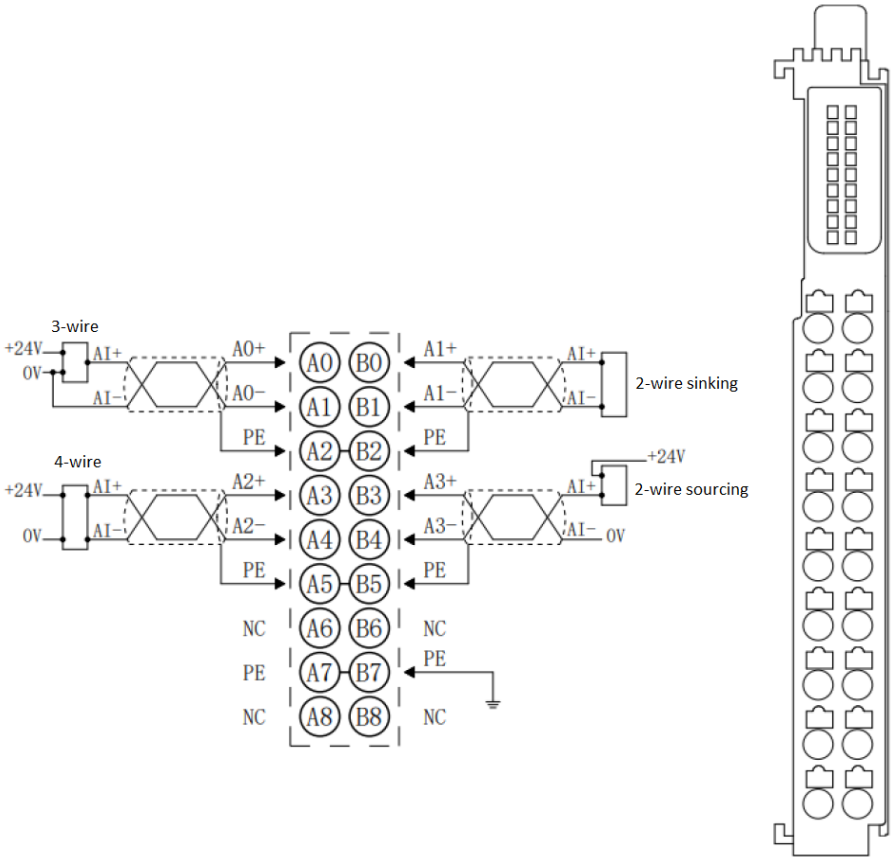


5.3.2 LED Indicators

Function	Color	Status
PR	Green	Off: Power off/ exceptional On: Power on
RUN	Green	Off: System is not working Blinking (1Hz): No data interaction Flashing (10Hz): Firmware is upgrading On: System is running normally
Channel 01~08/16	Green	Off: Inactive On: Active

5.4 ES-3104 Connector Pinouts

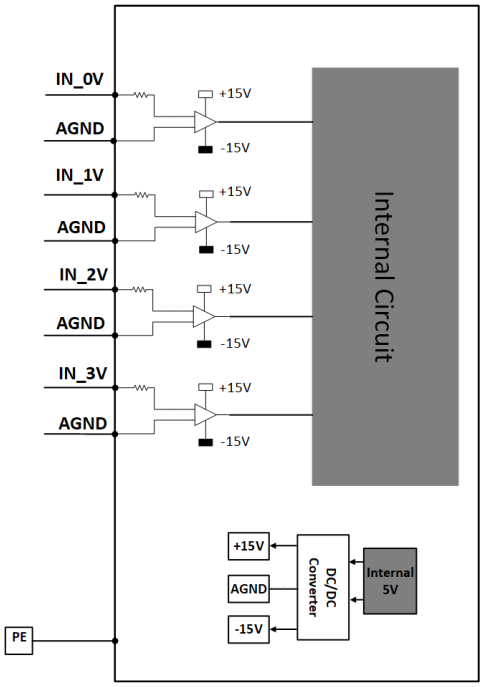
5.4.1 I/O Pin Assignment



*PE internal conduction

*Signal cables are recommended to use shielded twisted pairs

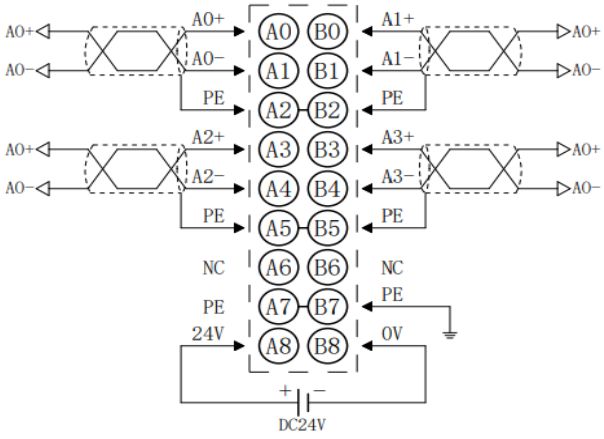
Signal connection

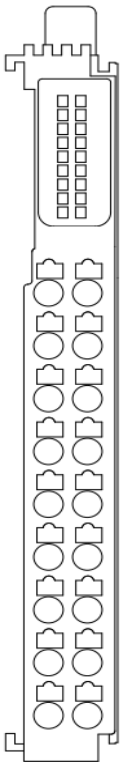


5.4.2 LED Indicators

Function	Color	Status
PR	Green	Off: Power off/ exceptional On: Power on
RUN	Green	Off: System is not working Blinking (1Hz): No data interaction Flashing (10Hz): Firmware is upgrading On: System is running normally

5.5 ES-4104 Connector Pinouts

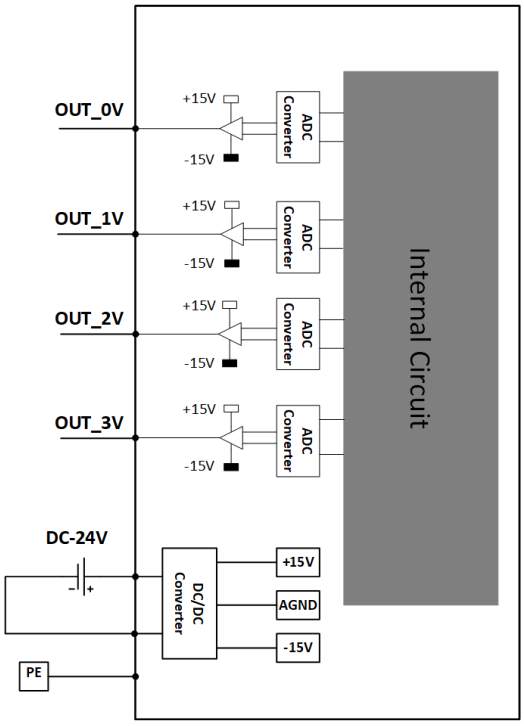




*PE internal conduction

*Signal cables are recommended to use shielded twisted pairs

Signal connection

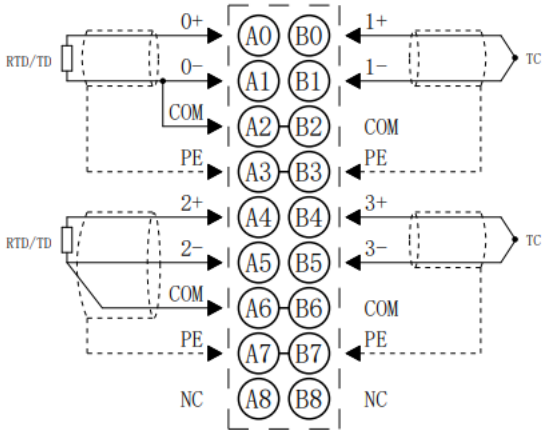


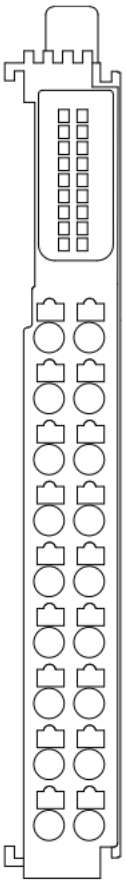
5.5.1 LED Indicators

Function	Color	Status
PR	Green	Off: Power off/ exceptional On: Power on
RUN	Green	Off: System is not working Blinking (1Hz): No data interaction Flashing (10Hz): Firmware is upgrading On: System is running normally

5.6 ES-3504 Connector Pinouts

5.6.1 I/O Pin Assignment





*COM and PE are internally conductive.

Pin assignment

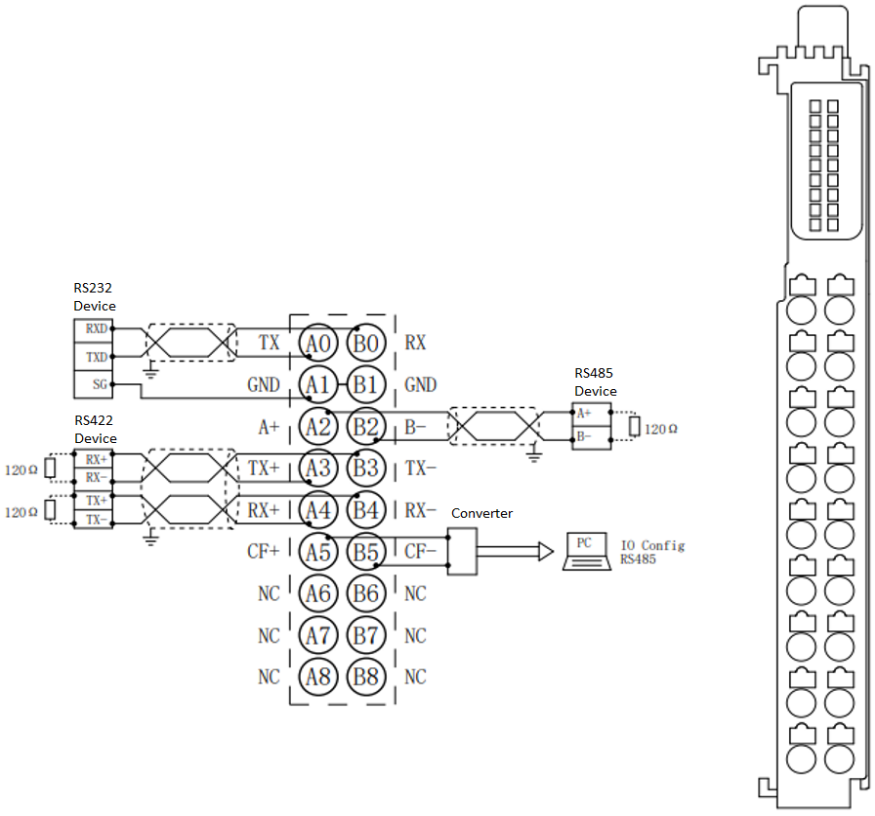
Pin No.	Definition	Description	Pin No.	Definition	Description
A0	0+	CH0 Temperature input	B0	1+	CH1 Temperature input
A1	0-		B1	1-	
A2	COM		B2	COM	
A3	PE		B3	PE	
A4	2+	CH2 Temperature input	B4	3+	CH3 Temperature input
A5	2-		B5	3-	
A6	COM		B6	COM	
A7	PE		B7	PE	
A8	NC	Empty	B8	NC	Empty

5.6.2 LED Indicators

Function	Color	Status
PR	Green	Off: Power off/ exceptional On: Power on
RUN	Green	Off: System is not working Blinking (1Hz): No data interaction Flashing (10Hz): Firmware is upgrading On: System is running normally

5.7 ES-5003 Connector Pinouts

5.7.1 I/O Pin Assignment



*GND is the RS232 signal ground, which is internally conductive.

*Cables should be shielded twisted-pairs and reliably grounded.

*CF+/CF- reserve the debugging interface for the module and are not yet enabled.

Pin assignment

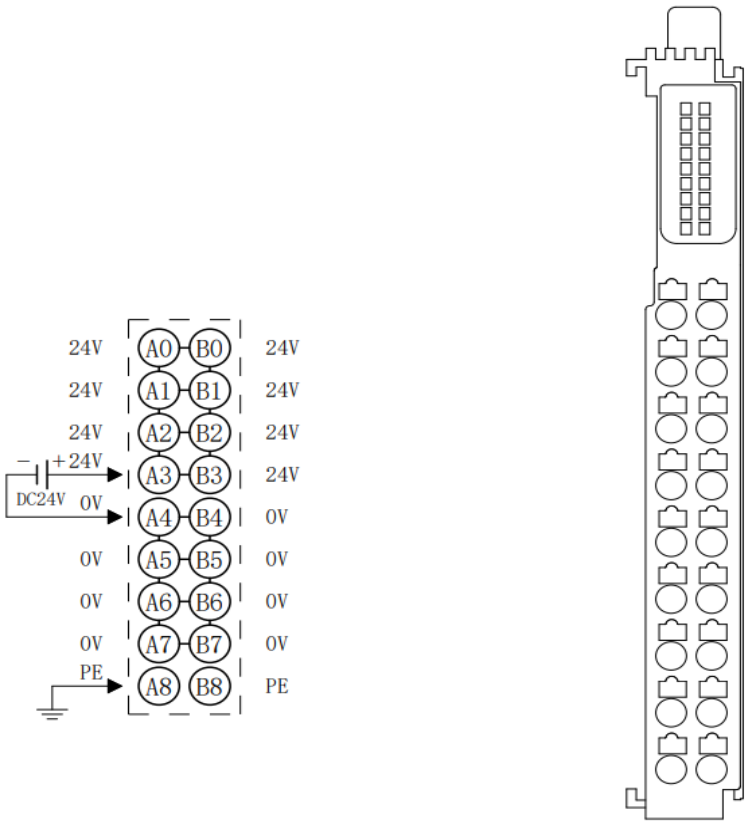
No.	Definition	Description	No.	Definition	Description
A0	TX	RS232 sender	A0	Rx	RS232 receiving
A1	GND	RS232 ground	A1	GND	RS232 ground
A2	A+	RS485 send+	A2	B-	RS485 send-
A3	TX+	RS422 send+	A3	TX-	RS422 send-
A4	RX+	RS422 receive+	A4	RX-	RS422 receive-
A5	CF+	reserved	A5	CF-	reserved
A6	NC	Empty terminal	A6	NC	Empty terminal
A7	NC	Empty terminal	A7	NC	Empty terminal
A8	NC	Empty terminal	A8	NC	Empty terminal

5.7.2 LED Indicators

Function	Color	Status
PR	Green	Off: Power off/ exceptional On: Power on
RUN	Green	Off: System is not working Blinking (1Hz): No data interaction Flashing (10Hz): Firmware is upgrading On: System is running normally
TX	Green	Off: No data is sent on the channel Flashing: The channel has data to send
RX	Green	Off: No data reception on the channel Flashing: The channel has data reception

5.8 ES-0012 Connector Pinouts

5.8.1 I/O Pin Assignment



*24V and 0V are internally conductive.

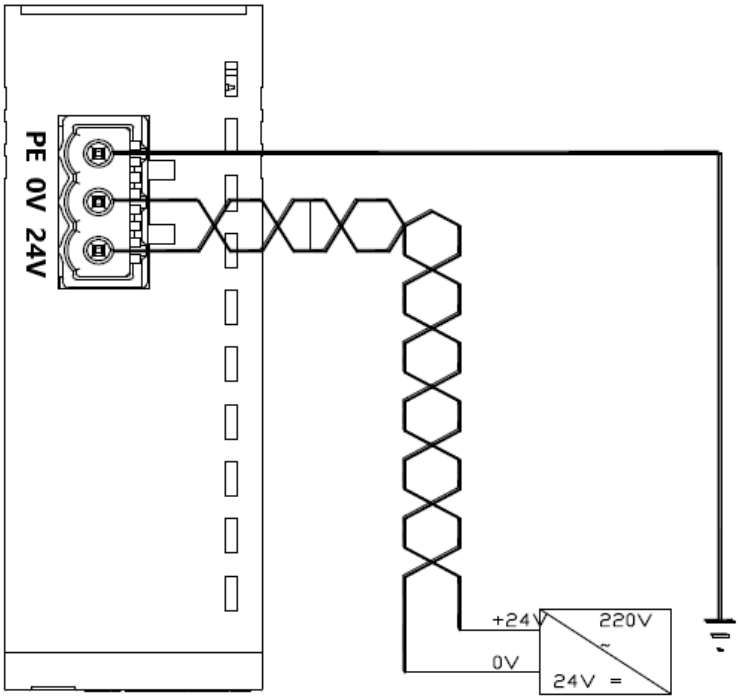
5.8.2 LED Indicators

Function	Color	Status
PR	Green	Off: Power off/ exceptional On: Power on

5.9 ES-0040 Connector Pinouts

5.9.1 I/O Pin Assignment

Use a 24VDC power supply. Refer to the wiring diagram below and connect the power supply according to the circuit shown. Ensure that the PE (Protective Earth) is reliably grounded. It is recommended to use twisted-pair wires for the power lines.



5.9.2 LED Indicators

Function	Color	Status
PWR	Green	Off: Power off On: Power on
IN1	Green	Off: No data interaction or exception Blinking: Link and TX/RX activity On: Establish a network connection
OUT2~4	Green	Off: No data interaction or exception Blinking: Link and TX/RX activity On: Establish a network connection

5.9.3 RJ45 Network Wiring

Using a standard RJ45 network interface connector, the pin assignment is shown in the table below.

Pin	Signal
1	TD+
2	TD-
3	RD+
4	—
5	—
6	RD-
7	—
8	—

Note:

- It is recommended to use Cat 5 or higher double-shielded (braided mesh + aluminum foil) STP cable for communication.
- The length of the cables in between should not exceed 100m.

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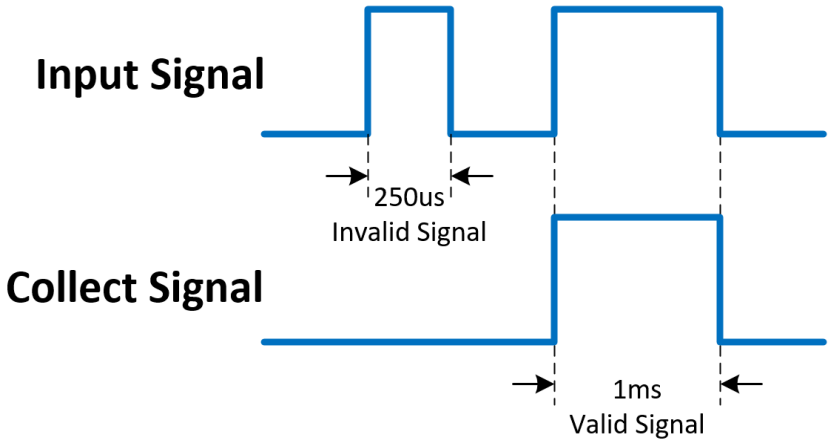
6 Parameter Description

6.1 Digital and Input Filtering

Digital input filtering prevents the program from responding to unexpected rapid changes in the input signal, which may be caused by switch contact bounce or electrical noise. Digital input filter supports single-module settings, allowing each module to be configured individually, but channels cannot be configured separately.

The default configuration for the digital input filter time (FilterTime) is 3 ms, with a configurable range of 0 to 20ms. When set to 3 ms, noise within 3 ms can be filtered out. A 3 ms input filter time means that a signal must remain at "0" to "1" or "1" to "0" for 3 ms to be detected; any high or low pulse shorter than 3 ms will not be detected.

Function Description: When the input filter is configured to 1 ms, noise within 1ms can be filtered out. If a signal input of 250μs is received, it will be considered an invalid signal. Any high or low pulse shorter than 1 ms will not be detected, while signals of 1 ms or longer will be captured.



6.2 Digital Output Signal Clear/Hold

The clear/hold function applies to modules with output channels. This function allows the configuration of the output mode for the output channels when the module is not in the OP state (i.e., stopped operation or network cable disconnected from the coupler). The parameter supports the following output states:

- **Clear Output:** When communication is disconnected, the module's output channel automatically clears the output, i.e., output 0.
- **Output Valid Value:** When communication is disconnected, the module's output channel continuously outputs a valid value, i.e., output 1.
- **Hold Last Output Value:** When communication is disconnected, the module's output channel holds the last output value.

The digital clear/hold function supports both module settings (template mode) and single-channel settings (single-channel mode). Any channel can be configured using either single-channel mode or template mode, with single-channel mode taking priority over template mode. The specific configuration methods are shown in the table below, with the default setting being module-wide clear output.

Digital output module clears and holds parameters				
Name	**Mode**	**Value**	**Value Description**	**Default**
TemplateMode	Template mode	1	PresetLow: Clears the output to "0"	1
		2	PresetHigh: Outputs valid value to "1"	
		3	KeepMode: Keeps the last output value	
Channel x	Single-channel mode	0	TemplateValue: Applies to all channels of this module (disable single channel mode)	0
		1	PresetLow: Clears output "0"	
		2	PresetHigh: Outputs valid value "1"	
		3	KeepMode: Keeps the last output value	

6.3 Analog Input Filtering

Analog Input Filtering Function: The analog input filtering function (Filter) averages the data after A/D conversion internally to reduce fluctuations caused by noise or other disturbances in the input signal.

The analog input is processed using a moving average based on the specified number of A/D conversions.

Filtering Function Configuration: Each channel can be configured individually, with a configuration range from 1 to 200, and the default is 10 times.

The sampling rate for the 4-channel module is: 2.5KHz/4 channels (400μs/4 channels).

6.4 Analog Output Signal Clear/Hold

The clear/hold function applies to modules with output channels. This function allows the configuration of the output mode for the output channels when the module is not in the OP state (i.e., stopped operation or network cable disconnected from the coupler). The parameter supports the following output states:

- **Clear Output:** When communication is disconnected, the module's output channel automatically clears the output.
- **Hold Output:** When communication is disconnected, the module's output channel continuously holds the output.
- **Output Preset Value:** When communication is disconnected, the module's output channel outputs the preset value.

The analog clear/hold function supports both module-wide settings (template mode) and single-channel settings (single-channel mode). Any channel can be configured using single-channel mode or template mode, with single-channel mode taking priority over template mode. The specific configuration methods are shown in the table below, with the default setting being module-wide clear output.

Digital output module clears and holds parameters				
Name	**Mode**	**Value**	**Value Description**	**Default**
TemplateMode	Template mode	0	Clear: Clear the output of all channels.	0
		1	Hold: Hold the output of all channels.	
		2	Preset: Output the preset value on all channels.	
TemplateValue Chx	Single channel clear/keep configuration	0	TemplateValue: Template mode value, meaning single-channel mode is not enabled.	0
		1	Clear (Single Channel): Clear the output of the single channel.	
		2	Hold (Single Channel): Hold the output of the single channel.	
		3	Preset (Single Channel): Output the preset value on the single channel.	
Preset Value Chx	Single channel preset	Value range	Output code value corresponding to current/voltage value. (Corresponding to the range code value table)	0

6.5 Analog Power-Off Memory

The analog parameter supports the function of saving all configuration parameters in the event of an abnormal power-off or communication disconnection. By default, all analog modules support power-off memory.

6.6 ES-3504 Configuration Parameter Definition

Function	Parameter	Value Range	Default
Sensor type selection	Sensor Type	0：PT100	0
		1：PT200	
		2：PT500	
		3：PT1000	
		5：THERMOCOUPLE_K	
		6：THERMOCOUPLE_J	
		8：THERMOCOUPLE_E	
		10：THERMOCOUPLE_S	
		12：THERMOCOUPLE_B	
		16：Ni 100	
		17：Ni 1000	
		24：RESISTANCE_15:3000	
Filter function	Filter Type	0：Default	0
		50hz	
		60hz	
		10hz	
Cold junction compensation	Cold Compensation	0~65535	0 (Enable)
Temperature unit	Temp Mode	Centigrade	0
		Fahrenheit	
		Thermodynamic	
Channel filter time	Filter Time CH00	0~10	0
Channel usage setting	Enable CH00	Disable	1
		Enable	
Temperature compensation	Cmp CH00		0

Sensor Type Selection: The module supports sensor type configuration (for sensor type, please refer to Sensor Type selection of the ES-3504 Configuration Parameter Definition).

The same module only supports the same type of sensors, and a single channel cannot be configured.

Note: The default sensor type is PT100.

Filter Function: The module provides filtering options for no filtering, 50Hz, 60Hz, and 10Hz hardware configurations, utilizing a Sigma-Delta ADC for precise signal processing.

Each channel can apply filtering to its measurement value, performing a sliding average processing on the first N collected data to reduce measurement jitter and improve stability and accuracy.

Filtering time = Number of module cycles (N) × module cycle time

Module cycle time = Conversion time + Disconnection detection time

Note: N configuration range is 0 to 10.

Cold Junction Compensation: The module supports enabling/disabling the thermocouple cold junction compensation. It is all turned on by default. It supports single-channel configuration. There are 4 channels with a total of 8 bits. Each channel occupies 2 bits.

If set to 00, the cold junction compensation function will be enabled for the channel.

If set to 01, the channel will disable this function.

Temperature Unit: The module supports configuration conversion of temperature measurement units between degrees Celsius (Centigrade), Fahrenheit (Fahrenheit), and thermodynamic temperature scale (Thermodynamic).

Note: The default sensor type is Celsius (Centigrade).

Channel Usage Setting: The module determines whether a channel is used through the "enable/disable" parameter setting. If a channel is set to disable, it will be disabled, and a value of -9999 will not be displayed regardless of whether the sensor is connected.

Note: The default is enabled.

Temperature Compensation: The module supports manual cold junction compensation for each channel data in thermocouple and thermal resistance modes. The data compensation value can be entered according to actual needs.

After setting the compensation value, the compensated temperature will be automatically calculated in the uploaded data (Input). This means that the uploaded data is the final compensated temperature.

Divide the read data by 10 to get the compensated temperature in °C.

6.6.1 ES-3504 Process Data

Upload data 8 bytes (2 bytes per channel, channel n ranges from 0 to 3)				
Name	**Description**	**Value Range**	**Data type**	**Length**
Channel n	Channel n Temperature/resistance data acquisition	-32768~32767	Int16	2 Byte

Data Description

1. **Temperature/resistance data acquisition Channel [n]**
   The uploaded data (Input) from the temperature module represents the temperature or resistance data collected by each channel. The data of each channel is a 2-byte signed integer. The collected data is 10 times the actual value. Divide the read data by 10 to get the real temperature or resistance value in °C or Ω.

6.7 ES-5003 Configuration Parameter Definition

Model Name	Range	Description
Communication Mode	0	“NoSelect” means no select
	1	“Modbus RTU Master” means RTU master mode
	2	“Modbus RTU Slave” means RTU slave mode
	3	“Modbus ASCII Master” means ASCII master mode
	4	“Modbus ASCII Slave” means ASCII slave mode
	5	"FP_Request" means free port request mode
	6	"FP_Input_Output" means free port input and output mode
	7	"FP_Input" means free port input mode
	8	"FP_Output" means free port output mode
Baud Rate	0	1200 bps
	1	2400 bps
	2	4800 bps
	3	9600 bps
	4	19200 bps
	5	38400 bps
	6	57600 bps
	7	115200 bps
Stop Bit	0	1 Bit
	1	2 Bits
Word Format	0	8 Bits
	1	7 Bits
Parity	0	Parity None
	1	Parity Odd
	2	Parity Even
Control Mode	0	Disable
	1	Level
	2	Rising Edge
Node Output Mode	0	Poll
	1	Change Trigger
Communication Error Behavior	0	Clear
	1	Hold
Respond Timeout	5~3000	Unit: ms, default 50ms
Poll Delay	5~3000	Unit: ms, default 10ms
Slave ID	1~247	Valid in slave mode, default 1
Slave Respond Delay	0~3000	Unit: ms, default 50ms
Frame Interval	0	1.5T
	1	3.5T
	2	5T
	3	10T
	4	20T
	5	50T
	6	100T
	7	200T
Node_1_Param_1	0~FFFFFFFF	Default 0, see ES-5003 Node Code Parameters for details
Node_1_Param_2	0~FFFFFFFF	
⋮	⋮	
Node_16_Param_1	0~FFFFFFFF	

Node_16_Param_2	0~FFFFFFFF	

6.7.1 ES-5003 Node Code Parameters

6.7.1.1 Modbus Master Function

In Modbus master mode, parameter 1 (Param_1) is composed of a 2-byte start address parameter and a 2-byte node code parameter. Parameter 2 (Param_2) is composed of a 2-bit byte exchange parameter and a 1-byte slave station.

Station number parameter composition.

Param_1			
BIT31~BIT16	BIT15~BIT0		
Start Address	Please refer to the Modbus Master Function Node code for the Node Code.		
Param_2			
BIT31~BIT16	BIT15~BIT10	BIT9~BIT8	BIT7~BIT0
Reserve		Refer to ExByte Flag	Slave Station Number

Note: The starting address parameter range is 0000~FFFFH, and the slave station number parameter range is 1 to 247.

6.7.1.2 Modbus Master Function Node Code

SubModule Group	SubModule	SubModule ID (16#)
Modbus Master Read Coils	Read 8 bits	0x0101
	Read 16 bits	0x0102
	Read 24 bits	0x0103
	Read 32 bits	0x0104
	Read 40 bits	0x0105
	Read 48 bits	0x0106
	Read 56 bits	0x0107
	Read 64 bits	0x0108
	Read 72 bits	0x0109
	Read 80 bits	0x010A
	Read 88 bits	0x010B
	Read 96 bits	0x010C
	Read 104 bits	0x010D
	Read 112 bits	0x010E
	Read 120 bits	0x010F
	Read 128 bits	0x0110
Modbus Master Read Discrete	Read 8 bits	0x0201
	Read 16 bits	0x0202
	Read 24 bits	0x0203
	Read 32 bits	0x0204
	Read 40 bits	0x0205
	Read 48 bits	0x0206
	Read 56 bits	0x0207
	Read 64 bits	0x0208
	Read 72 bits	0x0209
	Read 80 bits	0x020A
	Read 88 bits	0x020B
	Read 96 bits	0x020C
	Read 104 bits	0x020D
	Read 112 bits	0x020E
	Read 120 bits	0x020F
	Read 128 bits	0x0210
Modbus Master Read Hold	Read 1 Reg	0x0301
	Read 2 Regs	0x0302
	Read 3 Regs	0x0303

	Read 4 Regs	0x0304
	Read 5 Regs	0x0305
	Read 6 Regs	0x0306
	Read 7 Regs	0x0307
	Read 8 Regs	0x0308
	Read 9 Regs	0x0309
	Read 10 Regs	0x030A
	Read 11 Regs	0x030B
	Read 12 Regs	0x030C
	Read 13 Regs	0x030D
	Read 14 Regs	0x030E
	Read 15 Regs	0x030F
	Read 16 Regs	0x0310
Modbus Master Read Input	Read 1 Reg	0x0401
	Read 2 Regs	0x0402
	Read 3 Regs	0x0403
	Read 4 Regs	0x0404
	Read 5 Regs	0x0405
	Read 6 Regs	0x0406
	Read 7 Regs	0x0407
	Read 8 Regs	0x0408
	Read 9 Regs	0x0409
	Read 10 Regs	0x040A
	Read 11 Regs	0x040B
	Read 12 Regs	0x040C
	Read 13 Regs	0x040D
	Read 14 Regs	0x040E
	Read 15 Regs	0x040F
	Read 16 Regs	0x0410
Modbus Master Write Coils	Write 8 bits	0x0501
	Write 16 bits	0x0502
	Write 24 bits	0x0503
	Write 32 bits	0x0504
	Write 40 bits	0x0505
	Write 48 bits	0x0506
	Write 56 bits	0x0507
	Write 64 bits	0x0508
	Write 72 bits	0x0509
	Write 80 bits	0x050A
	Write 88 bits	0x050B
	Write 96 bits	0x050C
	Write 104 bits	0x050D
	Write 112 bits	0x050E
	Write 120 bits	0x050F
	Write 128 bits	0x0510
	Write Single bit	0x05FF
Modbus Master Write Hold	Write 1 Reg	0x0601
	Write 2 Regs	0x0602
	Write 3 Regs	0x0603
	Write 4 Regs	0x0604
	Write 5 Regs	0x0605
	Write 6 Regs	0x0606
	Write 7 Regs	0x0607
	Write 8 Regs	0x0608
	Write 9 Regs	0x0609
	Write 10 Regs	0x060A
	Write 11 Regs	0x060B
	Write 12 Regs	0x060C
	Write 13 Regs	0x060D
	Write 14 Regs	0x060E
	Write 15 Regs	0x060F
	Write 16 Regs	0x0610
	Write Single Reg	0x06FF

6.7.1.3 Modbus Slave Function

In Modbus slave mode, parameter 1 (Param_1) is composed of a 2-byte start address parameter and a 2-byte node code parameter. Parameter 2 (Param_2) is composed of a 2-bit byte exchange parameter.

Param_1		
BIT31~BIT16	BIT15~BIT0	
Start Address	Please refer to the Modbus Slave Function Node Code.	
Param_2		
BIT31~BIT16	BIT15~BIT2	BIT1~BIT0
Reserve		Refer to ExByte Flag

Note: The starting address parameter range is 0000~FFFFH.

6.7.1.4 Modbus Slave Function Node Code

SubModule Group	SubModule	SubModule ID (16#)
Modbus Slave Read Coils	Read 8 bits	0x0701
	Read 16 bits	0x0702
	Read 24 bits	0x0703
	Read 32 bits	0x0704
	Read 40 bits	0x0705
	Read 48 bits	0x0706
	Read 56 bits	0x0707
	Read 64 bits	0x0708
	Read 72 bits	0x0709
	Read 80 bits	0x070A
	Read 88 bits	0x070B
	Read 96 bits	0x070C
	Read 104 bits	0x070D
	Read 112 bits	0x070E
	Read 120 bits	0x070F
	Read 128 bits	0x0710
Modbus Slave Read Hold	Read 1 Reg	0x0801
	Read 2 Regs	0x0802
	Read 3 Regs	0x0803
	Read 4 Regs	0x0804
	Read 5 Regs	0x0805
	Read 6 Regs	0x0806
	Read 7 Regs	0x0807
	Read 8 Regs	0x0808
	Read 9 Regs	0x0809
	Read 10 Regs	0x080A
	Read 11 Regs	0x080B
	Read 12 Regs	0x080C
	Read 13 Regs	0x080D
	Read 14 Regs	0x080E
	Read 15 Regs	0x080F
Modbus Slave Write Coils	Write 8 bits	0x0901
	Write 16 bits	0x0902
	Write 24 bits	0x0903
	Write 32 bits	0x0904
	Write 40 bits	0x0905
	Write 48 bits	0x0906
	Write 56 bits	0x0907
	Write 64 bits	0x0908
	Write 72 bits	0x0909
	Write 80 bits	0x090A
	Write 88 bits	0x090B
	Write 96 bits	0x090C
	Write 104 bits	0x090D
	Write 112 bits	0x090E
	Write 120 bits	0x090F
	Write 128 bits	0x0910

Modbus Slave Write Discrete	Write 8 bits	0x0A01
	Write 16 bits	0x0A02
	Write 24 bits	0x0A03
	Write 32 bits	0x0A04
	Write 40 bits	0x0A05
	Write 48 bits	0x0A06
	Write 56 bits	0x0A07
	Write 64 bits	0x0A08
	Write 72 bits	0x0A09
	Write 80 bits	0x0A0A
	Write 88 bits	0x0A0B
	Write 96 bits	0x0A0C
	Write 104 bits	0x0A0D
	Write 112 bits	0x0A0E
	Write 120 bits	0x0A0F
	Write 128 bits	0x0A10
Modbus Slave Write Hold	Write 1 Reg	0x0B01
	Write 2 Regs	0x0B02
	Write 3 Regs	0x0B03
	Write 4 Regs	0x0B04
	Write 5 Regs	0x0B05
	Write 6 Regs	0x0B06
	Write 7 Regs	0x0B07
	Write 8 Regs	0x0B08
	Write 9 Regs	0x0B09
	Write 10 Regs	0x0B0A
	Write 11 Regs	0x0B0B
	Write 12 Regs	0x0B0C
	Write 13 Regs	0x0B0D
	Write 14 Regs	0x0B0E
	Write 15 Regs	0x0B0F
Modbus Slave Write Input	Write 1 Reg	0x0C01
	Write 2 Regs	0x0C02
	Write 3 Regs	0x0C03
	Write 4 Regs	0x0C04
	Write 5 Regs	0x0C05
	Write 6 Regs	0x0C06
	Write 7 Regs	0x0C07
	Write 8 Regs	0x0C08
	Write 9 Regs	0x0C09
	Write 10 Regs	0x0C0A
	Write 11 Regs	0x0C0B
	Write 12 Regs	0x0C0C
	Write 13 Regs	0x0C0D
	Write 14 Regs	0x0C0E
	Write 15 Regs	0x0C0F

6.7.2 ExByte Flag

Byte Number	Function	Length
0	No Exchange	2 Bits
1	2Bytes Exchange	2 Bits
2	4Bytes Register Exchange	2 Bits
3	4Bytes Big-Little-Endian Exchange	2 Bits

6.7.3 Freeport Function

In Freeport mode, parameter 1 (Param_1) is a 2-byte node code parameter.

Param_1	
BIT31~BIT16	BIT15~BIT0
Reserve	Please refer to the Freeport Function Node Code.
Param_2	
BIT31~BIT0	
Reserve	

6.7.3.1 Freeport Function Node Code

SubModule Group	SubModule	SubModule ID (16#)
Freeport Input	Input 1 byte	0x0D01
	Input 2 bytes	0x0D02
	Input 4 bytes	0x0D03
	Input 8 bytes	0x0D04
	Input 16 bytes	0x0D05
	Input 32 bytes	0x0D06
	Input 64 bytes	0x0D07
	Input 128 bytes	0x0D08
	Input 160 bytes	0x0D09
	Input 192 bytes	0x0D0A
	Input 224 bytes	0x0D0B
	Input 255 bytes	0x0D0C
Freeport Output	Output 1 byte	0x0E01
	Output 2 bytes	0x0E02
	Output 4 bytes	0x0E03
	Output 8 bytes	0x0E04
	Output 16 bytes	0x0E05
	Output 32 bytes	0x0E06
	Output 64 bytes	0x0E07
	Output 128 bytes	0x0E08
	Output 160 bytes	0x0E09
	Output 192 bytes	0x0E0A
	Output 224 bytes	0x0E0B
	Output 255 bytes	0x0E0C
Freeport Parity	CRC8	0x0F01
	CRC16	0x0F02
	XOR	0x0F03
	SUM8	0x0F04
	LRC	0x0F05

6.7.4 Control and Status Node Code

When the configuration parameter Control Mode is set to ‘disable’ for the control and status mode, there is no need to configure the control and status node code. However, when the Control Mode parameter Control Mode for control and status mode is set to Level or Rising Edge, the node code must be configured first in Node 1 parameter 1 (Node_1_Param_1).

The node code is shown in the table below:

SubModule Group	SubModule	SubModule ID (16#)	Remarks
Control & Status	1 Node	0x0001	Configuration in Master Mode
	2 Node	0x0002	
	3 Node	0x0003	
	4 Node	0x0004	
	5 Node	0x0005	
	6 Node	0x0006	
	7 Node	0x0007	
	8 Node	0x0008	
	9 Node	0x0009	
	10 Node	0x000A	
	11 Node	0x000B	
	12 Node	0x000C	
	13 Node	0x000D	
	14 Node	0x000E	
	15 Node	0x000F	
	Freeport Req	0x0020	Configuration in freeport mode
	Freeport Input_Output	0x0021	
	Freeport Input	0x0022	
	Freeport Output	0x0023	
	Modbus Slave	0x0030	Configuration in Slave Mode

6.7.5 Process Data

The upload and download data lengths of the ES-5003 are 32Bytes each as shown in the table below. When the amount of PDO data generated by the module's communication node parameter configuration exceeds a certain threshold (either the upload data amount or the download data amount reaches the limit), the coupler module will trigger alarm 0x5002.

PDO length range and model matching table		
Module	Upload data length (Byte)	Download data length (Byte)
ES-5003-32Byte	0~32	0~32

The following example uses the model ES-5003-32Bytes model to introduce the configuration parameters.

When the configuration parameter Control Mode for control and status mode is set to disable, the upload and download process data are shown in the table below.

Upload Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Input Data	Serial communication module input data	32 Byte
2	Input Data		
…	…		
32	Input Data		
Download Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Output Data	Serial communication module output data	32 Byte

2	Output Data		
…	…		
32	Output Data		

6.7.5.1 Modbus Master Process Data

Upload Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Status word	Bit0: idle state Bit1: busy state, transmitting data Bit2: Completion status, transmission of data is completed	1 Byte
2	Alarm code	Refer to Modbus Alarm Code	1 Byte
3	Input Data	Serial communication module input data	last 30 bytes
4	Input Data		
…	…		
32	Input Data		
Download Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Control word	When the configuration parameter Control Mode is Level, set it to 1 to send data When the configuration parameter Control Mode is Rising Edge, 0 >1 sends data	1 Byte
2	Output Data	Serial communication module output data	last 31 bytes
3	Output Data		
...	...		
32	Output Data		

Note: The process data in the above table is for configuring one node in Level or Rising Edge mode; if two nodes are configured, byte numbers 1 and 2 of the upload data represent the "Status word" and "Alarm code" of node 1, and byte numbers 3 and 4 represent the "Status word" and "Alarm code" of node 2, the remaining bytes are data bytes.

Byte number 1 of the downloaded data is the "Control word" of node 1, byte number 2 is the "Control word" of node 2, the remaining bytes are data byte and up to 15 nodes can be configured.

6.7.5.2 Modbus Slave Process Data

Upload Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Status word	Bit0: idle state Bit1: busy state, transmitting data Bit2: Completion status, transmission of data is completed	1 Byte
2	Alarm code	Refer to Modbus Alarm Code	1 Byte
3	Input Data	Serial communication module input data	last 30 bytes
4	Input Data		
…	…		
32	Input Data		
Download Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Control word	Bit0: Clear alarm code	1 Byte
2	Output Data	Serial communication module output data	
3	Output Data		
…	…		
32	Output Data		

6.7.5.3 Freeport_Request Process Data

Upload Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Status word	Bit0: Idle state Bit1: Busy state, that is, data is being transmitted Bit2: Completion status, that is, the transmission of data is completed	1 byte
2	Alarm code	Bit0: Received data length error Bit1: Verification error Bit2: Timeout error	1 byte
3	Receive data length	0~255	1 byte
4~5	Receive exception count	0~65535	2 bytes
6~7	Receive data count	0~65535	2 bytes
8	Input Data	Serial communication module input data	last 25 bytes
9	Input Data		
…	…		
32	Input Data		
Download Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Control word	Bit0: Enable Bit1: Status word cleared Bit2: Clear receiving data	1 byte

2	Send data length	0~255	1 byte
3	Count cleared	Bit0: Clear reception exception count	1 byte
		Bit1: Clear received data count	
		Bit2: Clear the received data length to zero	
4	Clear error code	Bit0: Length exception cleared	1 byte
		Bit1: Verification error cleared	
		Bit2: Timeout error clear	
5	Output data	Serial communication module output data	last 28 bytes
6	Output data		
…	…		
32	Output data		

6.7.5.4 Freeport_Input Process Data

Upload Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Alarm code	Bit0: Received data length error	1 byte
		Bit1: Verification error	
2	Receive data length	0~255	1 byte
3~4	Receive exception count	0~65535	2 bytes
5~6	Receive data count	0~65535	2 bytes
7	Enter data	Serial communication module input data	last 26 bytes
8	Enter data		
…	…		
32	Enter data		
Download Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Control word	Bit0: enable	1 byte
		Bit1: Status word cleared	
		Bit2: Clear receiving data	
2	Count cleared	Bit0: Clear reception exception count	1 byte
		Bit1: Clear received data count	
		Bit2: Clear the received data length to zero	
3	Clear error code	Bit0: Receive length error cleared	1 byte
		Bit1: Verification error cleared	
4	Output data	Serial communication module output data	last 29 bytes
5	Output data		
…	…		
32	Output data		

6.7.5.5 Freeport_Output Process Data

Download Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Control word	Bit0：Enable	1 byte
2	Send data length	0~255	1 byte
3	Output data	Serial communication module output data	last 30 bytes
4	Output data		
…	…		
32	Output data		

6.7.5.6 Freeport_Input_Output Process Data

Upload Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Alarm code	Bit0: Received data length error	1 byte
		Bit1: Verification error	
2	Receive data length	0~255	1 byte
3~4	Receive exception count	0~65535	2 bytes
5~6	Receive data count	0~65535	2 bytes
7	Enter data	Serial communication module input data	last 26 bytes
8	Enter data		
…	…		
32	Enter data		
Download Data (32 byte)			
Byte No.	**Function**	**Definition**	**Address Range**
1	Control word	Bit0: enable	1 byte
		Bit1: Status word cleared	
		Bit2: Clear receiving data	
2	Send data length	0~255	1 byte
3	Count cleared	Bit0: Clear reception exception count	1 byte
		Bit1: Clear received data count	
		Bit2: Clear the received data length to zero	
4	Clear error code	Bit0: Receive length error cleared	1 byte
		Bit1: Verification error cleared	
5	Output data	Serial communication module output data	last 28 bytes
6	Output data		
…	…		
32	Output data		

6.8 Modbus Alarm Code

Alarm Code	Comment
0x00	No errors
0x01	Slave device address error
0x02	Function code error
0x03	CRC check error
0x04	Response byte count error
0x05	Coil register data error
0x06	Holding register data error
0x07	Illegal data address
0x08	Slave device failure
0x09	LRC check error
0x0C	Data length error
0x0D	Data conversion error
0x0E	ASCII frame error
0x0F	Response timeout

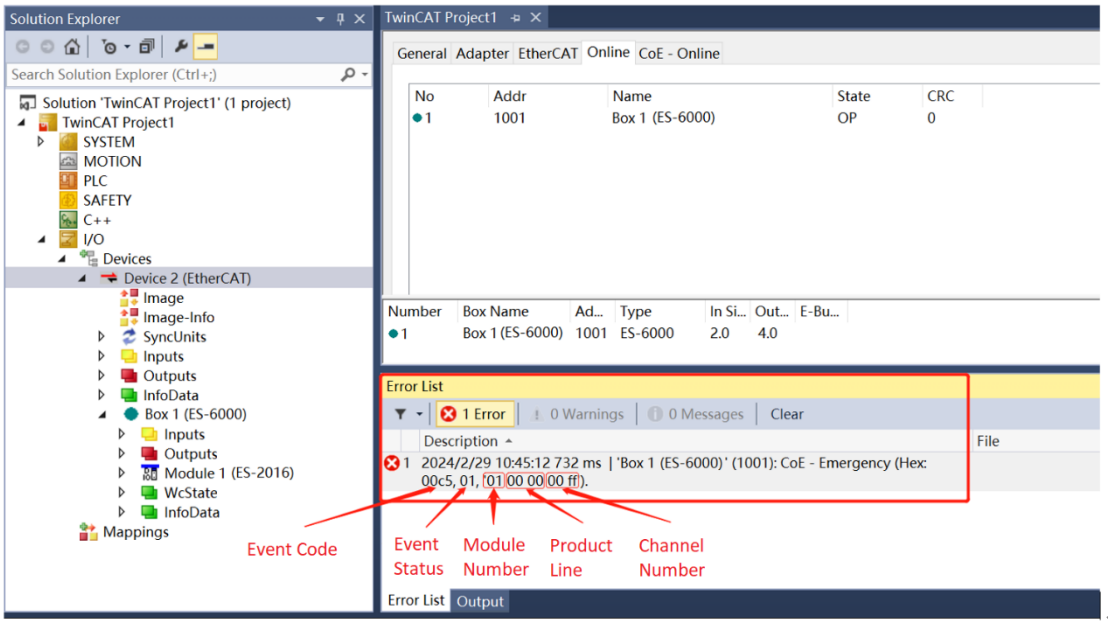
6.8.1 Bus Coupler General Error Codes

Number	Error Type	Error Code	Event Name	Event Code (16#)	Processing Method
2	Online upgrade error	1	Firmware upgrade abnormality	0x0081	Try to upgrade again, check whether there is any interference in the environment, whether the firmware is too large, etc.
		2	The firmware does not match the current module model	0x0082	Check whether the file is correct, whether there are any abnormalities or interference in the module, etc.
3	Voltage error	5	Load side voltage is not connected	0x00C5	Check whether the on-site power supply is connected
6	Channel error	4	Channel overflow and underflow	0x0184	Check whether the input signal of the corresponding channel exceeds the measurement range and whether the output signal exceeds the configurable range.
7	Parameter error	0	Abnormal parameter setting	0x01C0	Check module parameter settings
63	S-Link communication error	1	S-Link initialization failed	0x0FC1	Check whether the module connection is normal
		2	S-Link token timeout	0x0FC2	Check the module for abnormalities or interference, etc.
		3	S-Link module runs offline	0x0FC3	Check whether the module is online or there is interference, etc.
		4	Parsing data CRC error	0x0FC4	Check the module for abnormalities or interference, etc.
1	ES-3504	0	Disconnect	0x2040	Check whether the corresponding channel wiring is normal
0	ES-5003	0	General parameter error	0x5000	Check whether the common parameter exists and exceeds the parameter limit
		1	Communication node parameter error	0x5001	Check whether the communication node format and node settings are consistent with the communication mode and control mode

		2	Process data error	0x5002	After the parameter configuration is completed and there are no other alarms, power off and on again to scan the module again.
		3	Modbus register map conflict	0x5003	Compare the starting address and length setting of each Modbus write command of communication node parameter 1 to see if there is any overlap in the range.
		4	Modbus node ID setting error	0x5004	Check whether the slave ID range of communication node parameter 2 is in the range of 1~247

6.8.2 Check Error Codes

Taking TwinCAT3 software as an example, check the alarm information under Error in the Error List window. As shown in the figure below, the alarm code is Hex: 00c5, which means a voltage error. The load side voltage is not connected. You can check whether the on-site side power supply is connected.



The method of viewing event information is shown in the table below:

The structure of event information							
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7
Event Code		Event Status	Module Number	Product Line		Channel Number	
		For example: 0x01: event occurs 0x00: event disappears				For example: 0xFF: Channel level event 0x00: Channel 0	

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7 Process Data Objects

7.1 ES-6000 PDO

Index	Sub Index	Name/ Description	PDO Mapping	Range	Data Type	Access	Description
0xF100	1	CouplerState	TxPDO	0~FFFF	UINT	RO	Coupler State Word
0xF200	1	CouplerCtr	RxPDO	0~FFFF	UINT	RW	Coupler Control Word

7.2 ES-1008/ES-1016 PDO

Index	Sub Index	Name/ Description	PDO Mapping	Range	Data Type	Access	Description
0x6nn0	1	Channel 0	TxPDO	0~1	BIT	RO	Digital input channel 0 data
0x6nn0	2	Channel 1	TxPDO	0~1	BIT	RO	Digital input channel 1 data
0x6nn0	3	Channel 2	TxPDO	0~1	BIT	RO	Digital input channel 2 data
0x6nn0	4	Channel 3	TxPDO	0~1	BIT	RO	Digital input channel 3 data
0x6nn0	5	Channel 4	TxPDO	0~1	BIT	RO	Digital input channel 4 data
0x6nn0	6	Channel 5	TxPDO	0~1	BIT	RO	Digital input channel 5 data
0x6nn0	7	Channel 6	TxPDO	0~1	BIT	RO	Digital input channel 6 data
0x6nn0	8	Channel 7	TxPDO	0~1	BIT	RO	Digital input channel 7 data
0x6nn0	9	Channel 8	TxPDO	0~1	BIT	RO	Digital input channel 8 data
0x6nn0	A	Channel 9	TxPDO	0~1	BIT	RO	Digital input channel 9 data
0x6nn0	B	Channel 10	TxPDO	0~1	BIT	RO	Digital input channel 10 data
0x6nn0	C	Channel 11	TxPDO	0~1	BIT	RO	Digital input channel 11 data
0x6nn0	D	Channel 12	TxPDO	0~1	BIT	RO	Digital input channel 12 data
0x6nn0	E	Channel 13	TxPDO	0~1	BIT	RO	Digital input channel 13 data
0x6nn0	F	Channel 14	TxPDO	0~1	BIT	RO	Digital input channel 14 data
0x6nn0	10	Channel 15	TxPDO	0~1	BIT	RO	Digital input channel 15 data

Remark: "nn" means the slot number and starting from 00 to 31, corresponding to the expansion IO module in sequence.

7.3 ES-2108/2116 PDO

Index	Sub Index	Name /Description	PDO Mapping	Range	Data Type	Access	Description
0x7nn0	1	Channel 0	RxPDO	0~1	BIT	RW	Digital output channel 0 data
0x7nn0	2	Channel 1	RxPDO	0~1	BIT	RW	Digital output channel 1 data
0x7nn0	3	Channel 2	RxPDO	0~1	BIT	RW	Digital output channel 2 data
0x7nn0	4	Channel 3	RxPDO	0~1	BIT	RW	Digital output channel 3 data
0x7nn0	5	Channel 4	RxPDO	0~1	BIT	RW	Digital output channel 4 data
0x7nn0	6	Channel 5	RxPDO	0~1	BIT	RW	Digital output channel 5 data
0x7nn0	7	Channel 6	RxPDO	0~1	BIT	RW	Digital output channel 6 data
0x7nn0	8	Channel 7	RxPDO	0~1	BIT	RW	Digital output channel 7 data
0x7nn0	9	Channel 8	RxPDO	0~1	BIT	RW	Digital output channel 8 data
0x7nn0	A	Channel 9	RxPDO	0~1	BIT	RW	Digital output channel 9 data
0x7nn0	B	Channel 10	RxPDO	0~1	BIT	RW	Digital output channel 10 data
0x7nn0	C	Channel 11	RxPDO	0~1	BIT	RW	Digital output channel 11 data
0x7nn0	D	Channel 12	RxPDO	0~1	BIT	RW	Digital output channel 12 data
0x7nn0	E	Channel 13	RxPDO	0~1	BIT	RW	Digital output channel 13 data
0x7nn0	F	Channel 14	RxPDO	0~1	BIT	RW	Digital output channel 14 data
0x7nn0	10	Channel 15	RxPDO	0~1	BIT	RW	Digital output channel 15 data

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

7.4 ES-3104 PDO

Index	Sub Index	Name /Description	PDO Mapping	Range	Data Type	Access	Description
0x6nn1	1	Channel 0	TxPDO	-32768 to 32767	INT	RO	Analog input channel 0 data
0x6nn1	2	Channel 1	TxPDO	-32768 to 32767	INT	RO	Analog input channel 1 data
0x6nn1	3	Channel 2	TxPDO	-32768 to 32767	INT	RO	Analog input channel 2 data
0x6nn1	4	Channel 3	TxPDO	-32768 to 32767	INT	RO	Analog input channel 3 data

Remark: "nn" means the slot number and starting from 00 to 31, corresponding to the expansion IO module in sequence.

7.5 ES-3504 PDO

Index	Sub Index	Name /Description	PDO Mapping	Range	Data Type	Access	Description
0x6nn1	1	Channel 0	TxPDO	-32768 to 32767	INT	RO	Analog input channel 0 data
0x6nn1	2	Channel 1	TxPDO	-32768 to 32767	INT	RO	Analog input channel 1 data
0x6nn1	3	Channel 2	TxPDO	-32768 to 32767	INT	RO	Analog input channel 2 data
0x6nn1	4	Channel 3	TxPDO	-32768 to 32767	INT	RO	Analog input channel 3 data

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

7.6 ES-4104 PDO

Index	Sub Index	Name /Description	PDO Mapping	Range	Data Type	Access	Description
0x7nn1	1	Channel 0	RxPDO	-32768 to 32767	INT	RW	Analog output channel 0 data
0x7nn1	2	Channel 1	RxPDO	-32768 to 32767	INT	RW	Analog output channel 1 data
0x7nn1	3	Channel 2	RxPDO	-32768 to 32767	INT	RW	Analog output channel 2 data
0x7nn1	4	Channel 3	RxPDO	-32768 to 32767	INT	RW	Analog output channel 3 data

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

7.7 ES-5003 32-Byte PDO

Index	Sub Index	Name /Description	PDO Mapping	Range	Data Type	Access	Description
0x7nn1	1	TX 1	RxPDO	0~FF	USINT	RW	Send 1
0x7nn1	2	TX 2	RxPDO	0~FF	USINT	RW	Send 2
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
0x7nn1	1F	TX 31	RxPDO	0~FF	USINT	RW	Send 31
0x7nn1	20	TX 32	RxPDO	0~FF	USINT	RW	Send 32
0x6nn1	1	RX 1	TxPDO	0~FF	USINT	RO	Receive 1
0x6nn1	2	RX 2	TxPDO	0~FF	USINT	RO	Receive 2
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
0x6nn1	1F	RX 31	TxPDO	0~FF	USINT	RO	Receive 31
0x6nn1	20	RX 32	TxPDO	0~FF	USINT	RO	Receive 32

Note: Sub index: Accumulation, hexadecimal.

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

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8 Appendix A – Object Dictionary

8.1 ES-6000 Object Dictionary

Index	Sub Index	Name / Description	Access	Default Value	Description
0x1000	0	Device type	RO	0x00001389	Slave Device Type
0x1001	0	Error	RO	0x00	
0x1008	0	Device Name	RO	ES-6000	Device Name
0x1009	0	Hardware version	RO	X.X.X.XX	Coupler Hardware Version Number
0x100A	0	Software version	RO	X.X.X.XX	Coupler Firmware Version Number
0x1018	0	Identify	RO	4	Coupler Basic Information
0x1018	1	Vender ID	RO	0x0000144A	Vendor ID
0x1018	2	Product Code	RO	0x00000200	Product ID
0x1018	3	Revision Name	RO	0x00000001	Version
0x1018	4	Serial Number	RO	0x00000000	Series
0x10F3	0	Diagnosis History	RO	5	Historical Diagnostics
0x10F3	1	Maximum Messages	RO	0x40	
0x10F3	2	Newest Message	RO	0x00	
0x10F3	3	Newest Acknowledged Message	RO	0x00	
0x10F3	4	New Messages Available	RO	FALSE	
0x10F3	5	Flags	RW	0x0001	
0x10F3	6	Diagnosis Message	RO		First Diagnostic Information, Incrementing Index
0x4F00	0	Coupler Produce Information	RO	7	
0x4F00	1	ProduceInfo1	RW	0xFFFFFFFF	Material Code
0x4F00	2	ProduceInfo2	RW	0xFFFFFFFF	Manufacture Date
0x4F00	3	ProduceInfo3	RW	0xFFFFFFFF	Production Serial Number
0x4F00	4	ProduceInfo4	RW	0xFFFFFFFF	Production Test Completion Flag
0x4F00	5	ProduceInfo5	RW	0xFFFFFFFF	Write Switch + Machine Test Completion Flag
0x4F00	6	ProduceInfo6	RW	0xFFFFFFFF	Last 8 of SN Code
0x4F00	7	ProduceInfo7	RW	0xFFFFFFFF	
0x5F00	0	Bus Feature	RO	4	
0x5F00	1	BusFault Communication Configuration	RW	0	Default Bus Communication Configuration
0x5F00	2	Bus Communication CycleTime Min	RO	0	Bus Communication Minimum Cycle Time
0x5F00	3	Bus Communication CycleTime Max	RO	0	Bus Communication Maximum Cycle Time
0x5F00	4	Bus Communication CycleTime Current	RO	0	Bus Communication Current Cycle Time
0x5F01	0	Coupler Feature	RO	1	
0x5F01	1	Coupler RunTimeAccumulation	RO	0	Coupler Accumulated Runtime

8.2 ES-1008/1016 Object Dictionary

Index	Sub Index	Name / Description	Access	Default Value	Description
0x2nn0	0	ES-1016 Config	RO	1	
0x2nn0	1	FilterTime	RW	3	Enter filter parameters (0ms-20ms optional)
0x4nn0	0	Produce Information	RO	7	
0x4nn0	1	ProduceInfo1	RW	0xFFFFFFFF	Material Code
0x4nn0	2	ProduceInfo2	RW	0xFFFFFFFF	Manufacture Date
0x4nn0	3	ProduceInfo3	RW	0xFFFFFFFF	Production Serial Number
0x4nn0	4	ProduceInfo4	RW	0xFFFFFFFF	Production Test Completion Flag
0x4nn0	5	ProduceInfo5	RW	0xFFFFFFFF	Write Switch + Machine Test Completion Flag
0x4nn0	6	ProduceInfo6	RW	0xFFFFFFFF	Last 8 of SN Code
0x4nn0	7	ProduceInfo7	RW	0xFFFFFFFF	
0x5nn0	0	ES-1016 Diag	RO	2	
0x5nn0	1	RunningTime	RO	0	I/O module cumulative run time
0x5nn0	2	Software Version	RO	X.X.X.XX	I/O module firmware version number

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

8.3 ES-2108/ES-2116 Object Dictionary

Index	Sub Index	Name / Description	Access	Default Value	Description
0x2nn0	0	ES-2116 Config	RO	17	
0x2nn0	1	TemplateMode	RW	1	The output action when the bus is abnormal, follow this setting when the ChannelMode n value below is 0: 1: PresetLow output is low 2: PresetHigh output is high 3:KeepMode maintains the current output
0x2nn0	2	Channel 00	RW	0	The output action when the bus is abnormal. When the value is 0, it follows the "TemplateMode" setting. When the value is non-0, it does not follow the "TemplateMode" setting. The action is performed according to the corresponding state: 0:TemplateValue 1: PresetLow output is low 2: PresetHigh output is high 3:KeepMode maintains the current output
0x2nn0	3	Channel 01	RW	0	
0x2nn0	4	Channel 02	RW	0	
0x2nn0	5	Channel 03	RW	0	
0x2nn0	6	Channel 04	RW	0	
0x2nn0	7	Channel 05	RW	0	
0x2nn0	8	Channel 06	RW	0	
0x2nn0	9	Channel 07	RW	0	
0x2nn0	A	Channel 08	RW	0	
0x2nn0	B	Channel 09	RW	0	
0x2nn0	C	Channel 10	RW	0	
0x2nn0	D	Channel 11	RW	0	
0x2nn0	E	Channel 12	RW	0	
0x2nn0	F	Channel 13	RW	0	
0x2nn0	10	Channel 14	RW	0	
0x2nn0	11	Channel 15	RW	0	
0x4nn0	0	Produce Information	RO	7	
0x4nn0	1	ProduceInfo1	RW	0xFFFFFFFF	Material Code
0x4nn0	2	ProduceInfo2	RW	0xFFFFFFFF	Manufacture Date
0x4nn0	3	ProduceInfo3	RW	0xFFFFFFFF	Production Serial Number
0x4nn0	4	ProduceInfo4	RW	0xFFFFFFFF	Production Test Completion Flag
0x4nn0	5	ProduceInfo5	RW	0xFFFFFFFF	Write Switch + Machine Test Completion Flag
0x4nn0	6	ProduceInfo6	RW	0xFFFFFFFF	Last 8 of SN Code
0x4nn0	7	ProduceInfo7	RW	0xFFFFFFFF	
0x5nn0	0	ES-2116 Diag	RO	2	
0x5nn0	1	RunningTime	RO	0	I/O module cumulative run time
0x5nn0	2	Software Version	RO	X.X.X.XX	I/O module firmware version

					number

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

8.4 ES-3104 Object Dictionary

Index	Sub Index	Name / Description	Access	Default Value	Description
0x2nn0	0	ES-3104 Config	RO	8	
0x2nn0	1	Range Select Ch00	RW	1	Channel 0-3 range selection: 0: Disable 1: -10V~10V(-32768~32767)(default)
0x2nn0	2	Range Select Ch01	RW	1	
0x2nn0	3	Range Select Ch02	RW	1	
0x2nn0	4	Range Select Ch03	RW	1	
0x2nn0	5	Filter Ch00	RW	10	Filter parameter, optional value 1~200, default 10
0x2nn0	6	Filter Ch01	RW	10	
0x2nn0	7	Filter Ch02	RW	10	
0x2nn0	8	Filter Ch03	RW	10	
0x4nn0	0	Produce Information	RO	7	
0x4nn0	1	ProduceInfo1	RW	0xFFFFFFFF	Material Code
0x4nn0	2	ProduceInfo2	RW	0xFFFFFFFF	Manufacture Date
0x4nn0	3	ProduceInfo3	RW	0xFFFFFFFF	Production Serial Number
0x4nn0	4	ProduceInfo4	RW	0xFFFFFFFF	Production Test Completion Flag
0x4nn0	5	ProduceInfo5	RW	0xFFFFFFFF	Write Switch + Machine Test Completion Flag
0x4nn0	6	ProduceInfo6	RW	0xFFFFFFFF	Last 8 of SN Code
0x4nn0	7	ProduceInfo7	RW	0xFFFFFFFF	
0x5nn0	0	ES-3104 Diag	RO	2	
0x5nn0	1	RunningTime	RO	0	I/O module cumulative run time
0x5nn1	2	Software Version	RO	X.X.X.XX	I/O module firmware version number

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

8.5 ES-3504 Object Dictionary

Index	Sub Index	Name / Description	Access	Default Value	Description
0x2nn0	0	ES-3504 Config	RO	16	
0x2nn0	1	Sensor Type	RW	0	Sensor type
0x2nn0	2	Filter Type	RW	0	Filter type (0~3 optional)
0x2nn0	3	Cold Compensation	RW	0	Cold junction compensation function (0~65535 optional)
0x2nn0	4	Temp Mode	RW	0	Temperature measurement unit switching (0~2 optional)
0x2nn0	5	Filter Time CH00	RW	0	Channel 0 filter time (0-10)
0x2nn0	6	Filter Time CH01	RW	0	Channel 1 filter time (0-10)
0x2nn0	7	Filter Time CH02	RW	0	Channel 2 filter time (0-10)
0x2nn0	8	Filter Time CH03	RW	0	Channel 3 filter time (0-10)
0x2nn0	9	Enable CH00	RW	1	Channel 0 enable switch (0, 1 optional)
0x2nn0	A	Enable CH01	RW	1	Channel 1 enable switch (0, 1 optional)
0x2nn0	B	Enable CH02	RW	1	Channel 2 enable switch (0, 1 optional)
0x2nn0	C	Enable CH03	RW	1	Channel 3 enable switch (0, 1 optional)
0x2nn0	D	Cmp CH00	RW	0	Channel 0 temperature compensation (-2147483648 ~ 2147483647)
0x2nn0	E	Cmp CH01	RW	0	Channel 1 temperature

					compensation (-2147483648 ~ 2147483647)
0x2nn0	F	Cmp CH02	RW	0	Channel 2 temperature compensation (-2147483648 ~ 2147483647)
0x2nn0	10	Cmp CH03	RW	0	Channel 3 temperature compensation (-2147483648 ~ 2147483647)
0x4nn0	0	ES-3504 Produce Information	RO	7	
0x4nn0	1	ProduceInfo1	RW	0xFFFFFFFF	Material Code
0x4nn0	2	ProduceInfo2	RW	0xFFFFFFFF	Manufacture Date
0x4nn0	3	ProduceInfo3	RW	0xFFFFFFFF	Production Serial Number
0x4nn0	4	ProduceInfo4	RW	0xFFFFFFFF	Production Test Completion Flag
0x4nn0	5	ProduceInfo5	RW	0xFFFFFFFF	Write Switch + Machine Test Completion Flag
0x4nn0	6	ProduceInfo6	RW	0xFFFFFFFF	Last 8 of SN Code
0x4nn0	7	ProduceInfo7	RW	0xFFFFFFFF	
0x5nn0	0	ES-3504 Diag	RO	2	
0x5nn0	1	RunningTime	RO	0	I/O module cumulative run time
0x5nn1	2	Software Version	RO	0	I/O module firmware version number

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

8.6 ES-4104 Object Dictionary

Index	Sub Index	Name / Description	Access	Default Value	Description
0x2nn0	0	ES-4104 Config	RO	8	
0x2nn0	1	Range Select Ch00	RW	1	Channel 0-3 range selection: 0: Disable 1: -10V~10V(-32768~32767)(default)
0x2nn0	2	Range Select Ch01	RW	1	
0x2nn0	3	Range Select Ch02	RW	1	
0x2nn0	4	Range Select Ch03	RW	1	
0x2nn0	5	TemplateMode	RW	0	All channel clearing, holding, and default value effective flags: 0: All channels are configured to be cleared (default) 1: All channels are configured to hold 2: All channels are configured as preset value output
0x2nn0	6	TemplateValue Ch00	RW	0	Single channel clearing, holding, and default value effective flags: 0: TemplateValue 1:Clear 2:Hold 3:Preset
0x2nn0	7	TemplateValue Ch01	RW	0	
0x2nn0	8	TemplateValue Ch02	RW	0	
0x2nn0	9	TemplateValue Ch03	RW	0	
0x2nn0	A	Preset Value Ch00	RW	0	
0x2nn0	B	Preset Value Ch01	RW	0	
0x2nn0	C	Preset Value Ch02	RW	0	
0x2nn0	D	Preset Value Ch03	RW	0	
0x4nn0	0	Produce Information	RO	7	

0x4nn0	1	ProduceInfo1	RW	0xFFFFFFFF	Material Code
0x4nn0	2	ProduceInfo2	RW	0xFFFFFFFF	Manufacture Date
0x4nn0	3	ProduceInfo3	RW	0xFFFFFFFF	Production Serial Number
0x4nn0	4	ProduceInfo4	RW	0xFFFFFFFF	Production Test Completion Flag
0x4nn0	5	ProduceInfo5	RW	0xFFFFFFFF	Write Switch + Machine Test Completion Flag
0x4nn0	6	ProduceInfo6	RW	0xFFFFFFFF	Last 8 of SN Code
0x4nn0	7	ProduceInfo7	RW	0xFFFFFFFF	
0x5nn0	0	ES-4104 Diag	RO	2	
0x5nn0	1	RunningTime	RO	0	I/O module cumulative run time
0x5nn1	2	Software Version	RO	X.X.X.XX	I/O module firmware version number

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

8.7 ES-5003 Object Dictionary

Index	Sub Index	Name / Description	Access	Default Value	Description
0x2nn0	0	ES-5003 Config	RO	46	
0x2nn0	1	Communication Mode	RW	0	Communication mode selection: 0:NoSelect 1:ModbusRTUMaster 2:ModbusRTUSlave 3:ModbusAsciiMaster 4:ModbusAsciiSlave 5:FP_Request 6:FP_Input_Output 7:FP_Input 8:FP_Output 9: SetPDOLength32Bytes
0x2nn0	2	Baud Rate	RW	7	Baud rate selection: 0:1200 1:2400 2:4800 3:9600 4:19200 5:38400 6:57600 7:115200
0x2nn0	3	Stop Bit	RW	0	Stop bit selection: 0:StopBit 1 1:StopBit 2
0x2nn0	4	Word Format	RW	0	Character format selection: 0:8Bits 1:7Bits
0x2nn0	5	Parity	RW	0	Check sum selection: 0:Parity None 1:Parity Odd 2:Parity Even
0x2nn0	6	Control Mode	RW	0	Control mode selection: 0:Disable 1:Level 2:Rising Edge
0x2nn0	7	Node Output Mode	RW	0	Node output mode selection: 0:Poll 1:Change Trigger
0x2nn0	8	Communication Error Behavior	RW	0	Abnormal communication behavior selection: 0:Clear

					1:Hold
0x2nn0	9	Respond Timeout	RW	50	5~3000 ms
0x2nn0	A	Poll Delay	RW	10	5~3000 ms
0x2nn0	B	Slave ID	RW	1	ID 1-247
0x2nn0	C	Slave Respond Delay	RW	50	Delay 0~3000 ms
0x2nn0	D	Frame Interval	RW	0	0:1.5T 1:3.5T 2:5T 3:10T 4:20T 5:50T 6:100T 7:200T
0x2nn0	E	Node_1_Param1	RW	0	Refer to ES-5003 Node Code Parameters
0x2nn0	F	Node_1_Param2	RW	0	
0x2nn0	10	Node_2_Param1	RW	0	
0x2nn0	11	Node_2_Param2	RW	0	
0x2nn0	12	Node_3_Param1	RW	0	
0x2nn0	13	Node_3_Param2	RW	0	
0x2nn0	14	Node_4_Param1	RW	0	
0x2nn0	15	Node_4_Param2	RW	0	
0x2nn0	16	Node_5_Param1	RW	0	
0x2nn0	17	Node_5_Param2	RW	0	
0x2nn0	18	Node_6_Param1	RW	0	
0x2nn0	19	Node_6_Param2	RW	0	
0x2nn0	1A	Node_7_Param1	RW	0	
0x2nn0	1B	Node_7_Param2	RW	0	
0x2nn0	1C	Node_8_Param1	RW	0	
0x2nn0	1D	Node_8_Param2	RW	0	
0x2nn0	1E	Node_9_Param1	RW	0	
0x2nn0	1F	Node_9_Param2	RW	0	
0x2nn0	20	Node_10_Param1	RW	0	
0x2nn0	21	Node_10_Param2	RW	0	
0x2nn0	22	Node_11_Param1	RW	0	
0x2nn0	23	Node_11_Param2	RW	0	
0x2nn0	24	Node_12_Param1	RW	0	
0x2nn0	25	Node_12_Param2	RW	0	
0x2nn0	26	Node_13_Param1	RW	0	
0x2nn0	27	Node_13_Param2	RW	0	
0x2nn0	28	Node_14_Param1	RW	0	
0x2nn0	29	Node_14_Param2	RW	0	
0x2nn0	2A	Node_15_Param1	RW	0	
0x2nn0	2B	Node_15_Param2	RW	0	
0x2nn0	2C	Node_16_Param1	RW	0	
0x2nn0	2D	Node_16_Param2	RW	0	
0x4nn0	0	Produce Information	RO	7	
0x4nn0	1	ProduceInfo1	RW	0xFFFFFFFF	Material Code
0x4nn0	2	ProduceInfo2	RW	0xFFFFFFFF	Manufacture Date
0x4nn0	3	ProduceInfo3	RW	0xFFFFFFFF	Production Serial Number
0x4nn0	4	ProduceInfo4	RW	0xFFFFFFFF	Production Test Completion Flag
0x4nn0	5	ProduceInfo5	RW	0xFFFFFFFF	Write Switch + Machine Test Completion Flag
0x4nn0	6	ProduceInfo6	RW	0xFFFFFFFF	Last 8 of SN Code
0x4nn0	7	ProduceInfo7	RW	0xFFFFFFFF	
0x5nn0	0	ES-5003 Diag	RO	2	
0x5nn0	1	RunningTime	RO	0	I/O module cumulative run time
0x5nn0	2	Software Version	RO	X.X.X.XX	I/O module firmware version number

Remark: "nn" means the slot number, ranging from 00 to 31, corresponding to the expansion IO module in sequence.

9 Appendix B - TwinCAT® Operation Example

TwinCAT is a software system from Beckhoff that provides an integrated development environment (IDE) for programming and configuring industrial automation and control systems.

In this case, we will show how to connect the ES to TwinCAT and operate the I/O functions.

9.1 Import EtherCAT Slave Information (ESI) Files

The ESI file is typically provided in XML format and can be accessed and read by EtherCAT configuration and programming tools that support the EtherCAT communication protocol. The ESI file is an essential component of an EtherCAT system, as it enables the EtherCAT master device to communicate with and control EtherCAT slave devices on the network.

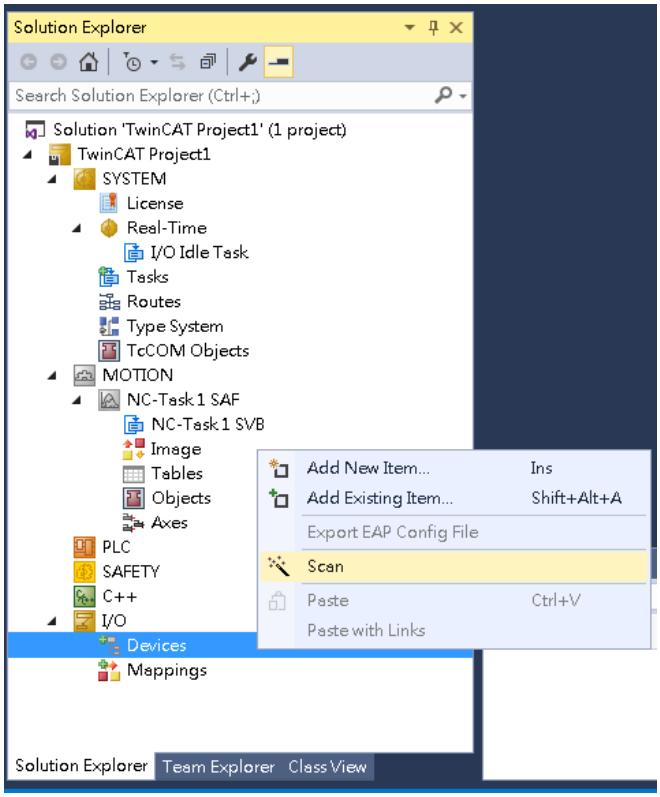
ESI files must be imported into the TwinCAT I/O EtherCAT installation folder before initiating TwinCAT.

Taking Twincat version 3.1 as an example, the default path is C:\TwinCAT\3.1\Config\Io\EtherCAT

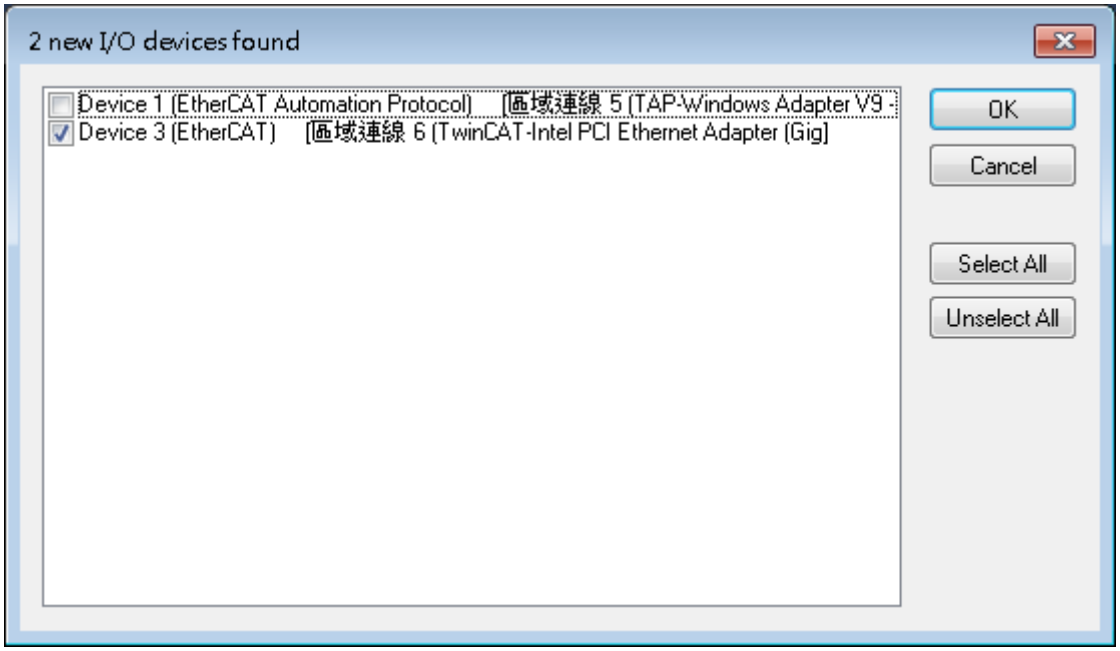
After importing the ESI file, reopen TwinCAT and wait for the utility to rebuild the EtherCAT device description cache.

9.2 Activate for ES Devices

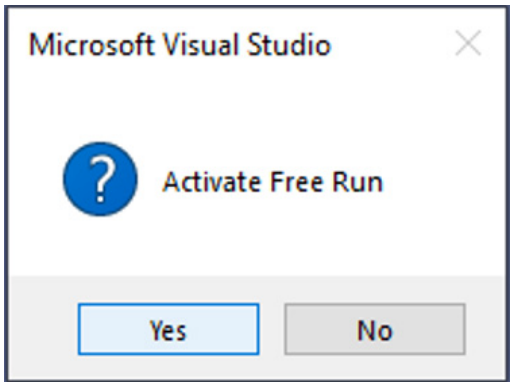
1. Create a project and right click **I/O Devices**, then select **Scan** to initiate a scan for EtherCAT devices.



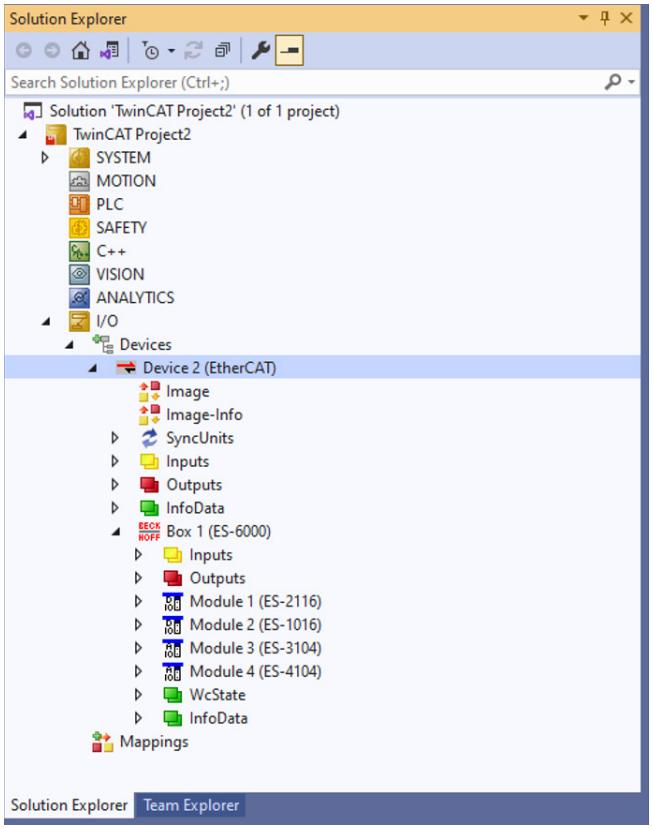
All network interface cards will be listed in the popup window. If slaves are connected to the network interface card and have been identified by TwinCAT, the device checkbox will be checked.



2. Click **Yes** to activate the slaves.



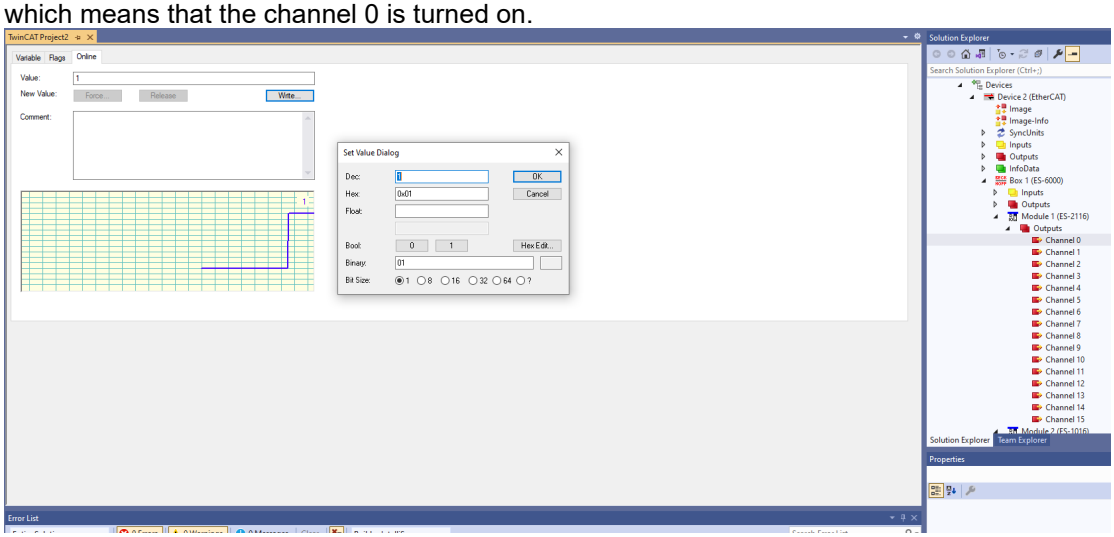
The ES I/O will be listed as a slave device of the EtherCAT master, and the “**Run**” status LED will emit a green light. This indicates that the user can begin operating the device.



9.3 Operation

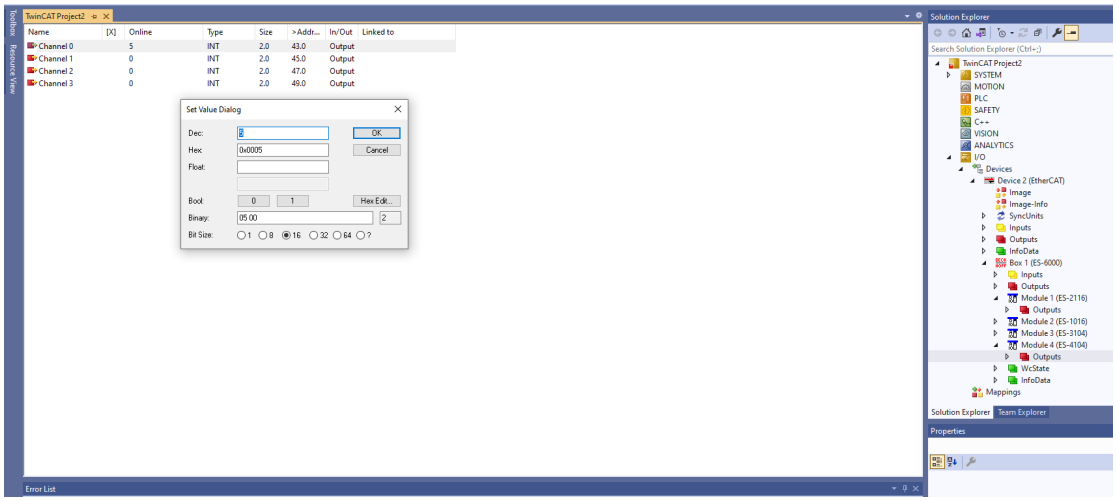
In this example, there is an ES-2116 module in the topology, which has 16 digital output channels which are respectively controlled by subindex 0 to 15.

The value "0" of each bit means turn off, and "1" means turn on. The setting in the picture is a decimal value "1", which means that the channel 0 is turned on.



The ES-4104 module in the topology and has 4 analog output channels, which are respectively controlled by subindex 1 to 4.

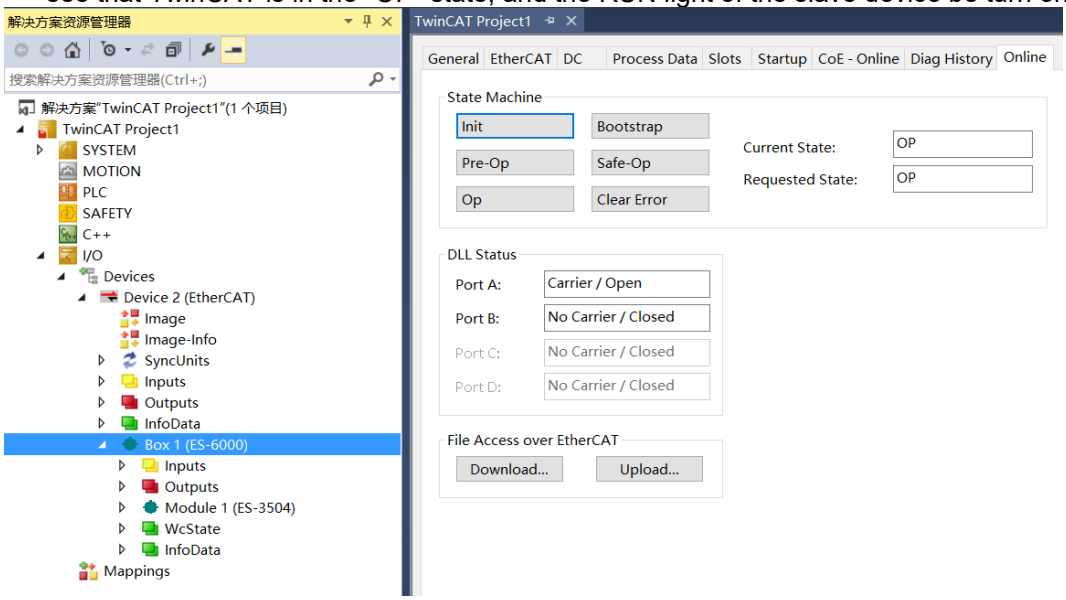
For the value corresponding to the voltage output, please refer to **Voltage Output Value** table.



10 Appendix C - TwinCAT® with ES-3504

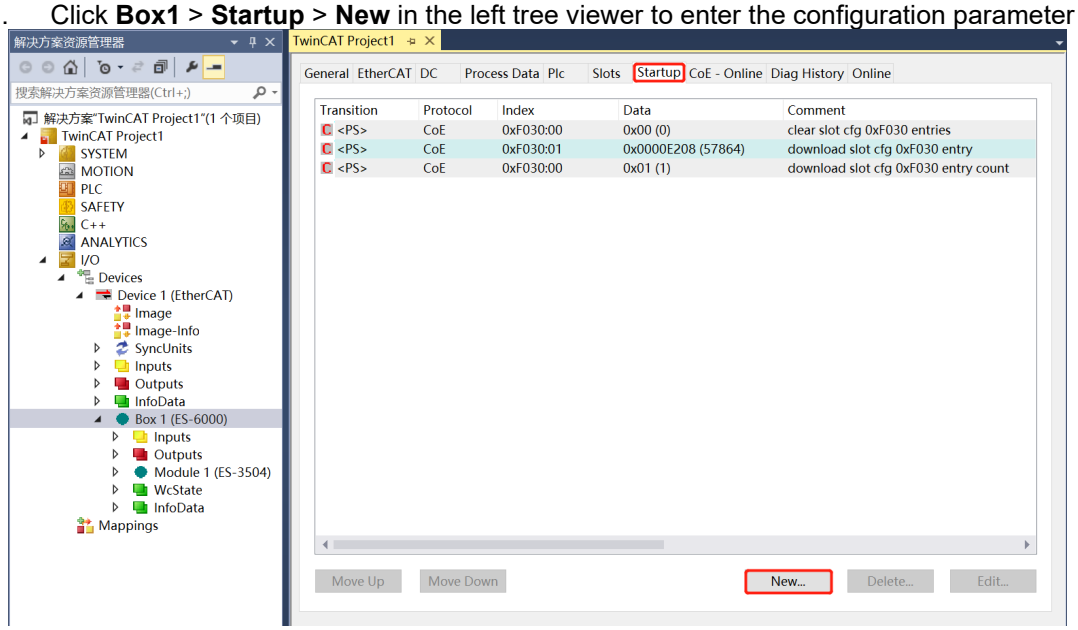
Please refer to the steps below for the process of connecting the ES-3504 to TwinCAT and operating its I/O functions.

1. After scanning the device, you will see **Box1 (ES-6000)** and **Module1 (ES-3504)**. In “**Online**” sheet, you can see that TwinCAT is in the "OP" state, and the RUN light of the slave device be turn on.

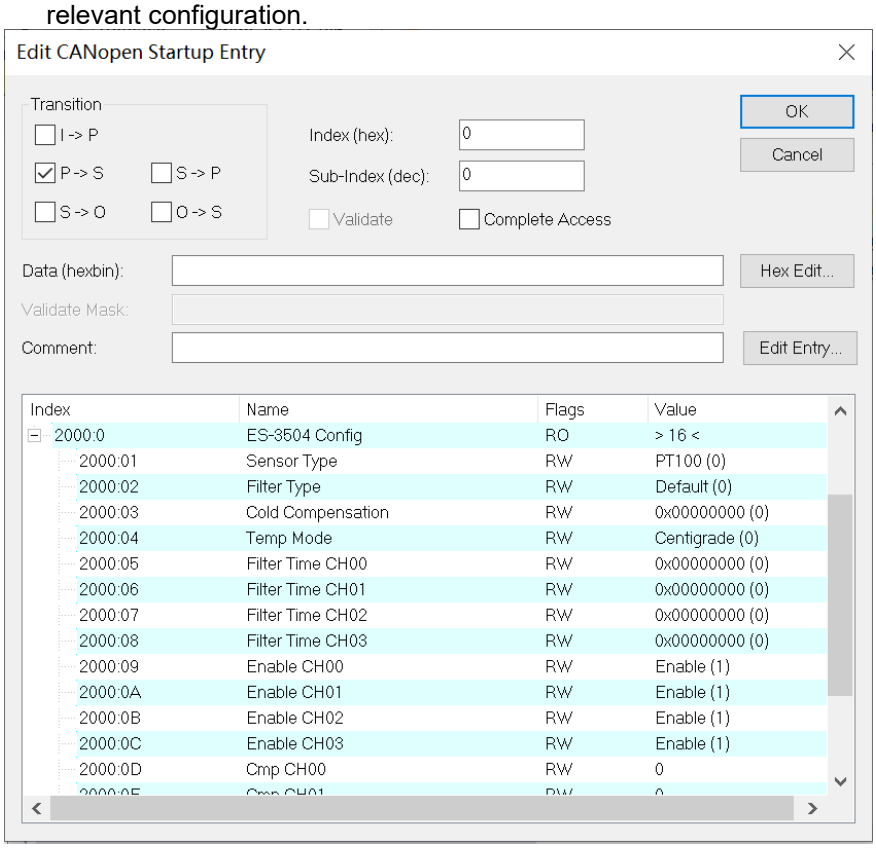


10.1 Parameter Configuration

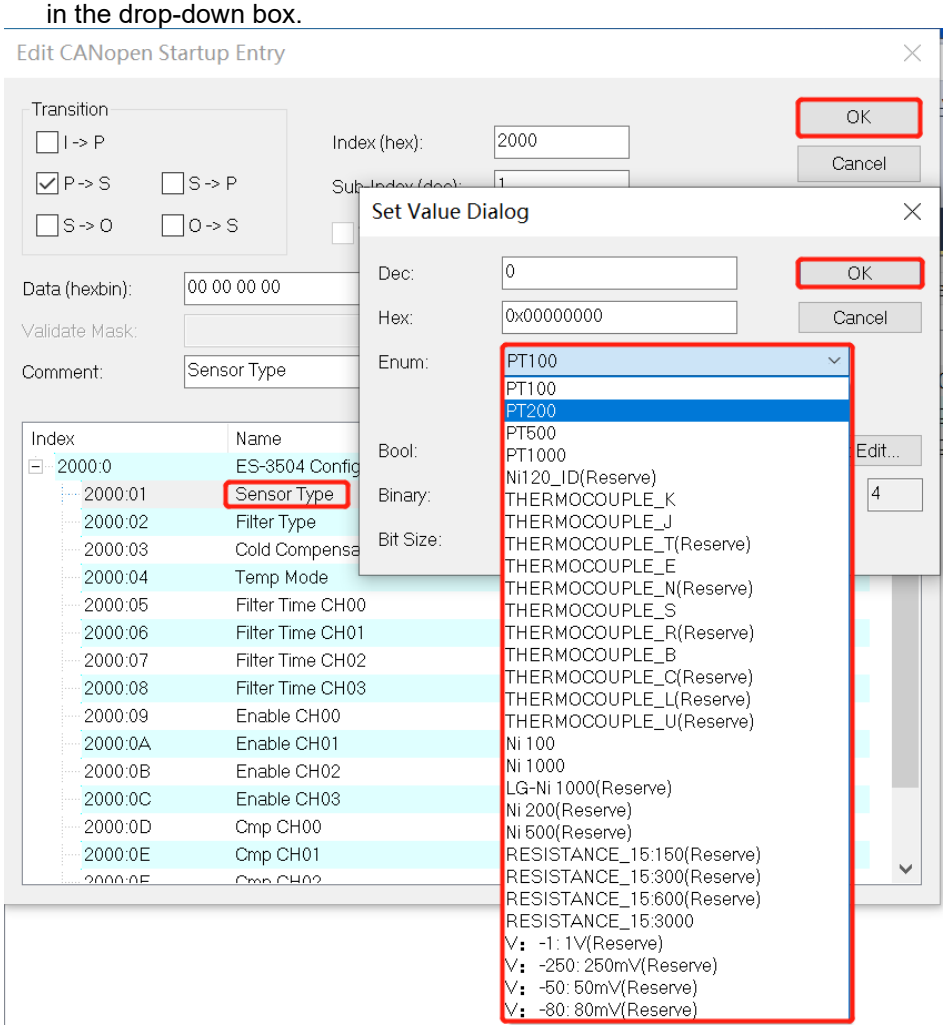
1. Click **Box1** > **Startup** > **New** in the left tree viewer to enter the configuration parameter editing page.



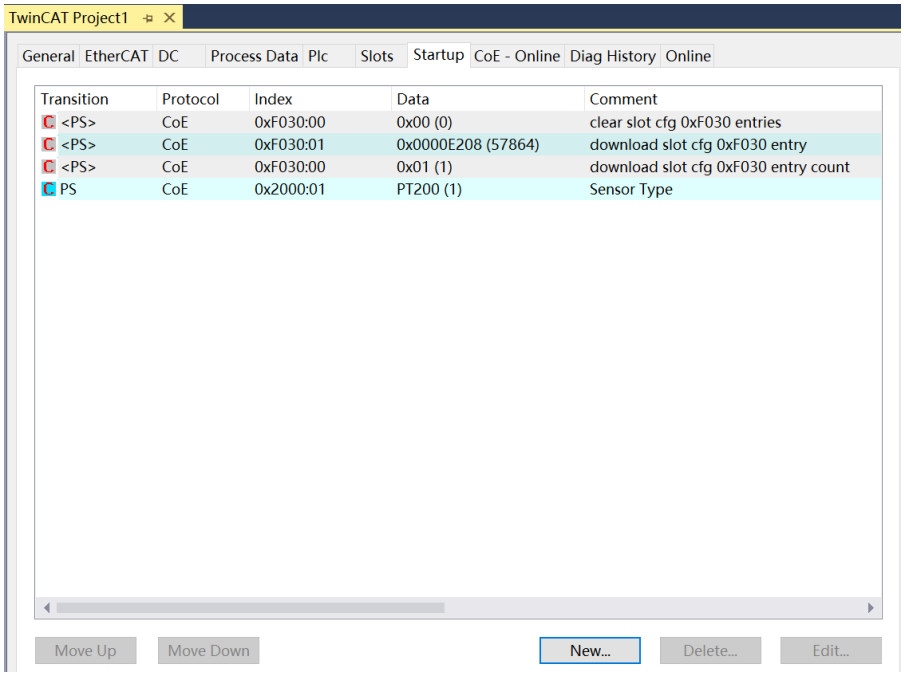
2. In the **Edit CANopen Startup Entry** pop-up window, click "**+**" in front of Index 2000:0 to expand the configuration parameter menu. You can see 16 configuration parameters. Click on the parameter to set the relevant configuration.



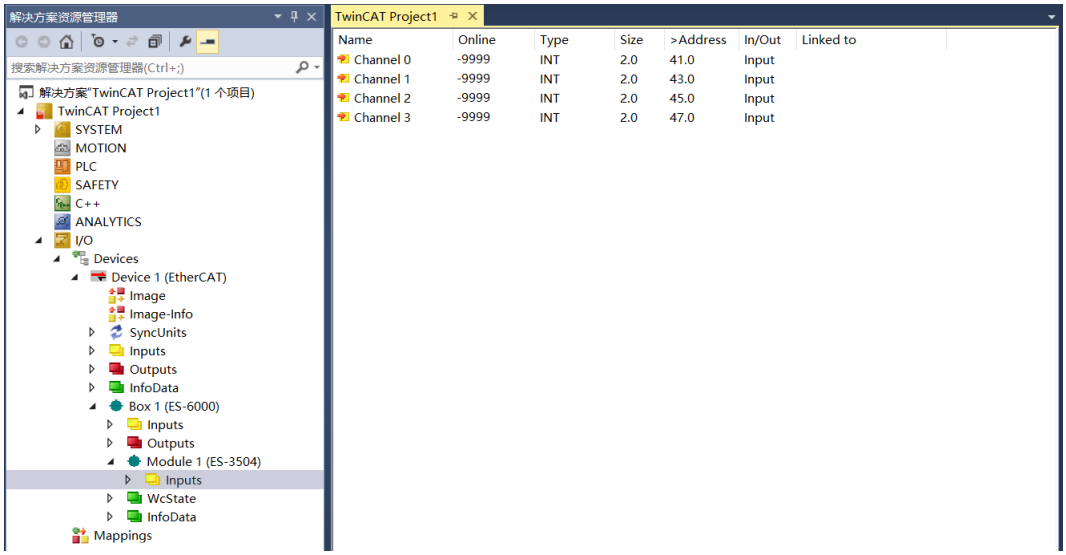
3. For example, to modify the sensor type selection, double-click **Sensor Type** and modify the parameter value in the drop-down box.



4. After the parameter modification is complete, you will see the modified parameter items and parameter values under Startup, as shown in the figure below. Once the parameter setting is complete, the Reload operation and the module needs to be powered on again to enable the automatic delivery of parameter settings by the master station.

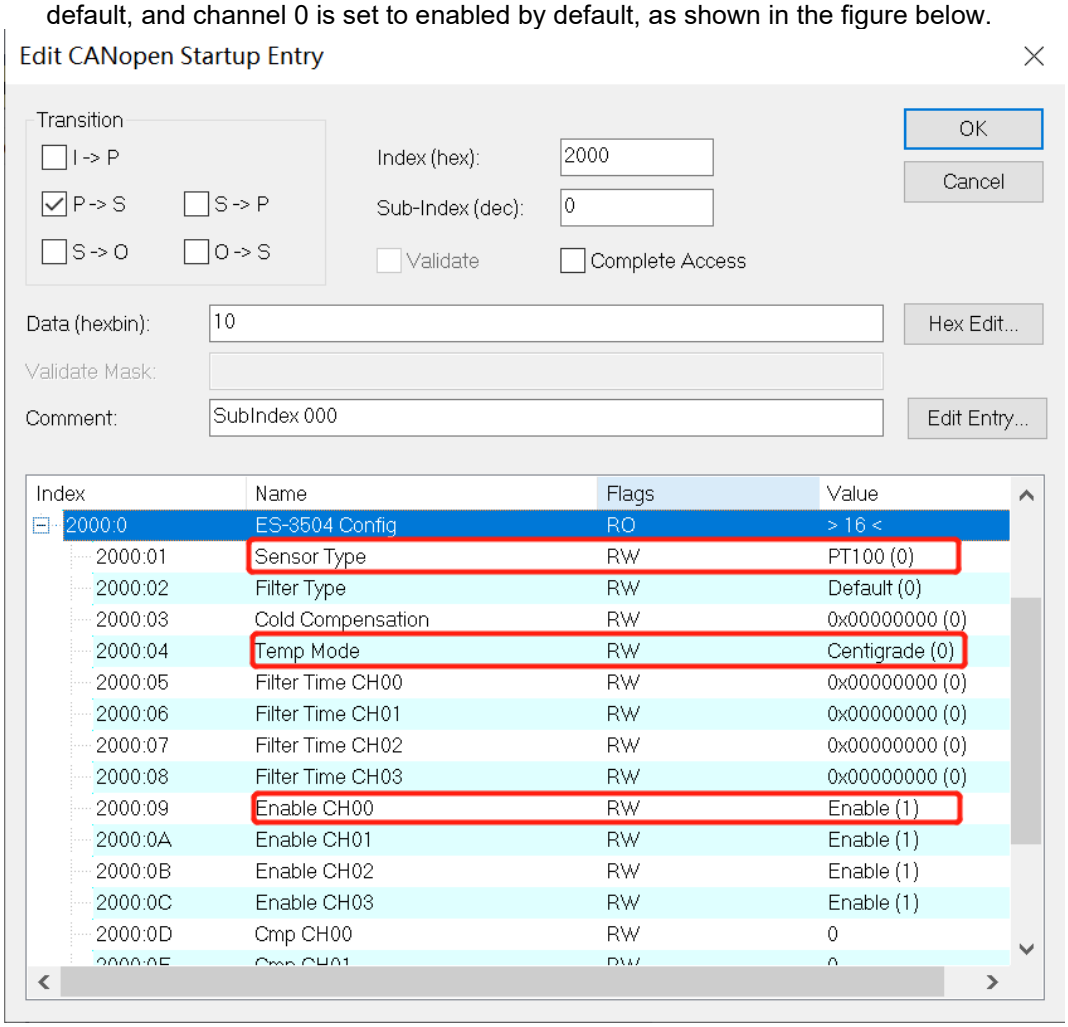


5. The left tree viewer **Module 1** > **Inputs** displays the upload data of the module and is used to monitor the status of the module.

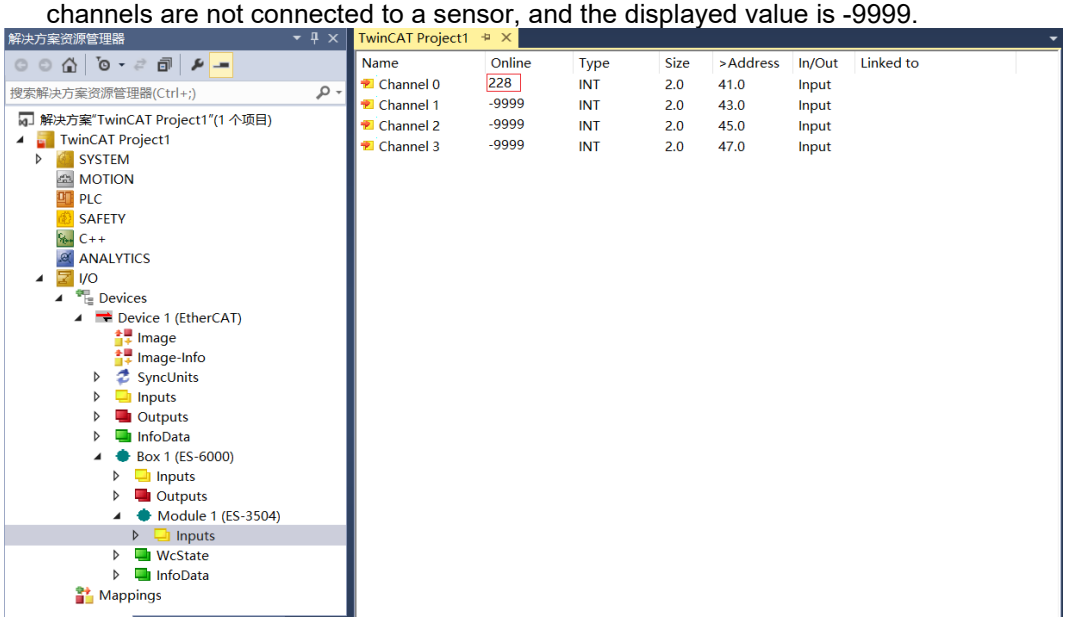


10.2 Temperature Input Channel Data Monitoring

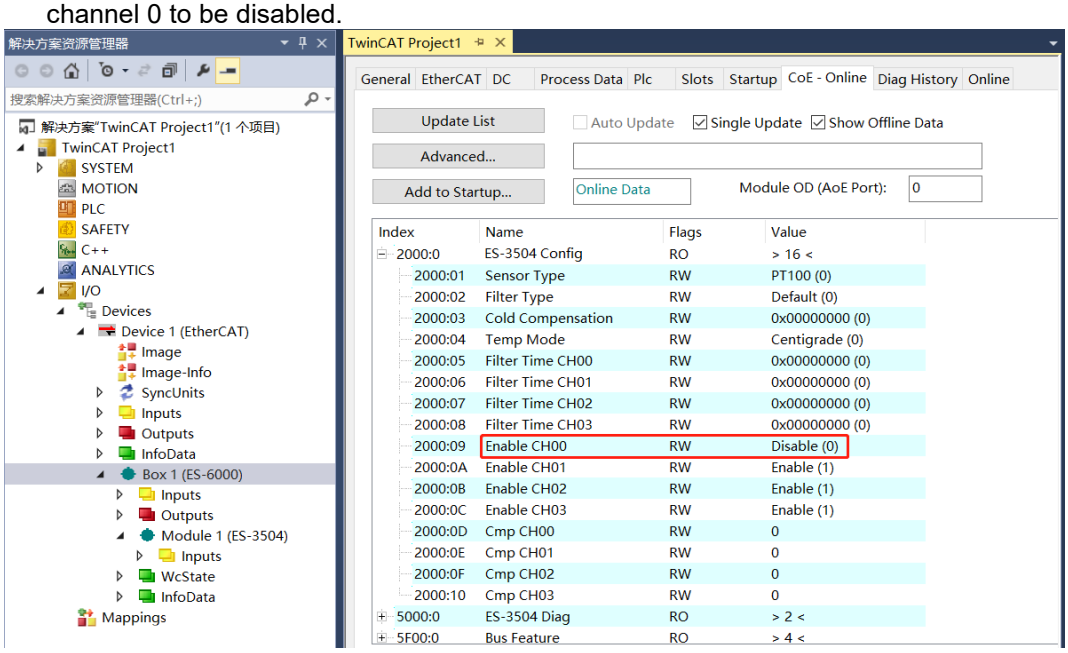
1. Channel 0 is connected to the thermal resistance sensor. Configure the configuration parameters as needed, select PT100 as the sensor type, the temperature measurement unit switch is set to degrees Celsius by default, and channel 0 is set to enabled by default, as shown in the figure below.



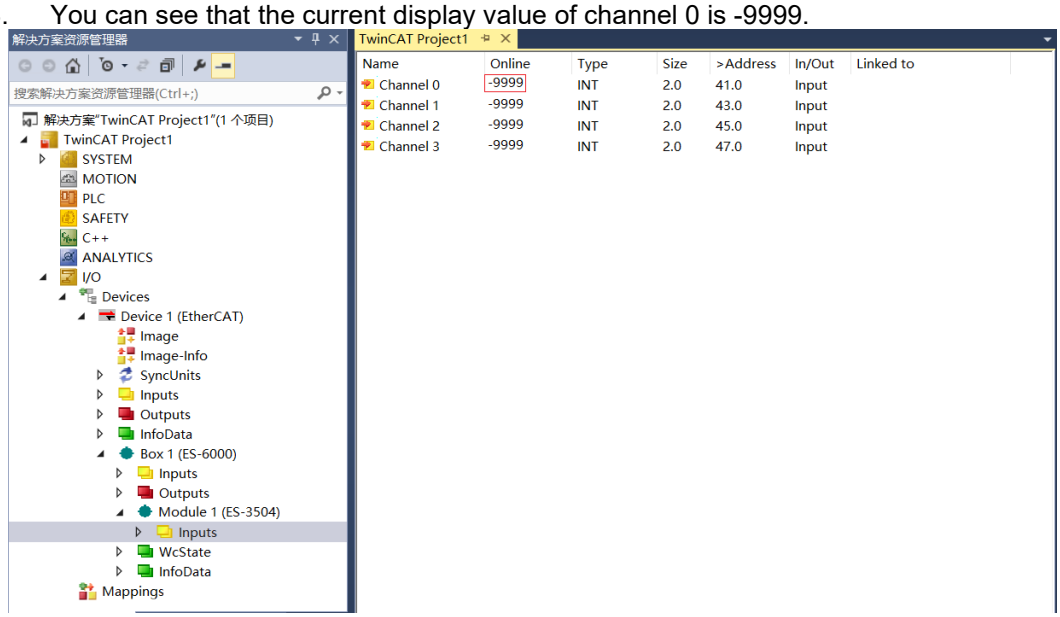
2. You can see that the current temperature value of channel 0 is 228, which corresponds to 22.8°C. The other channels are not connected to a sensor, and the displayed value is -9999.



3. Click **Box1** > **CoE-Online** in the left tree viewer to enter the configuration parameter editing page and set channel 0 to be disabled.

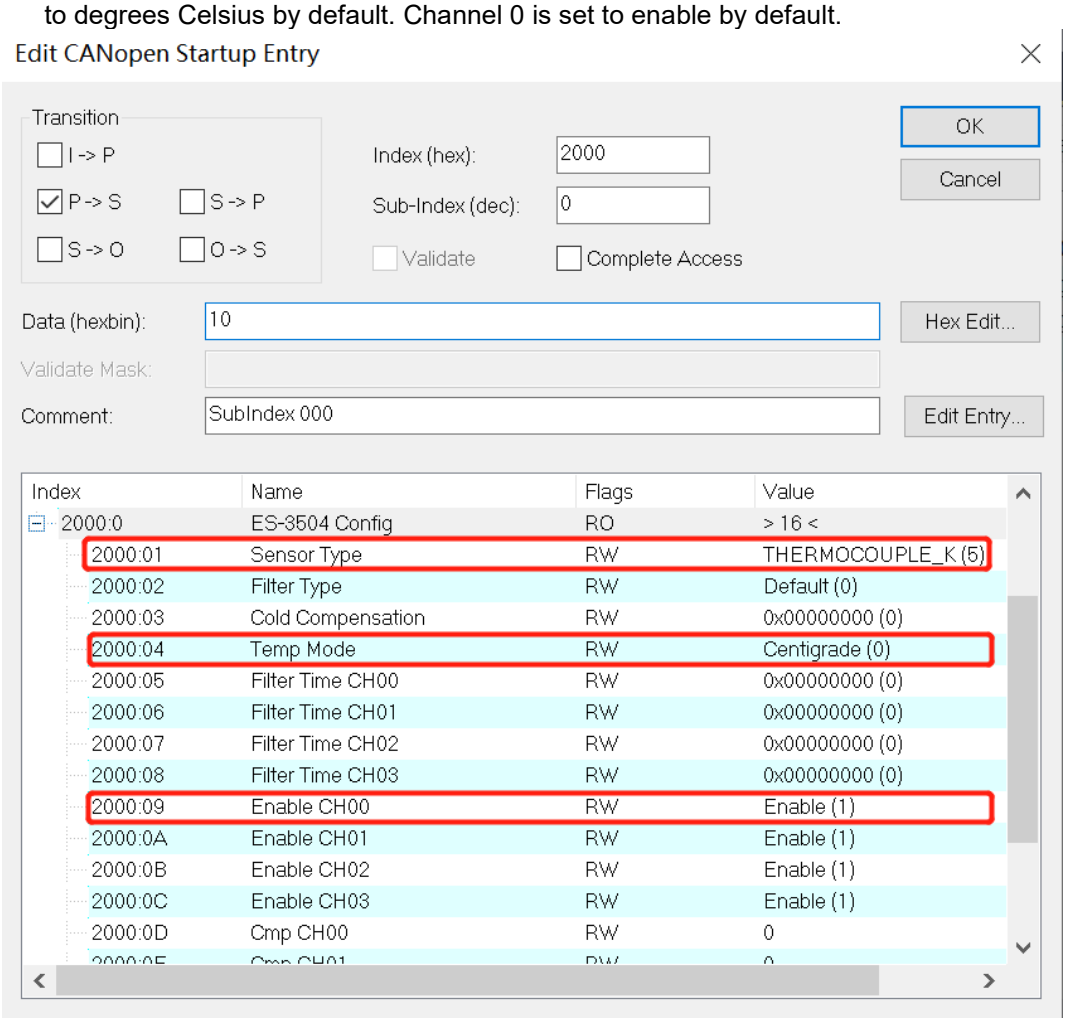


4. You can see that the current display value of channel 0 is -9999.

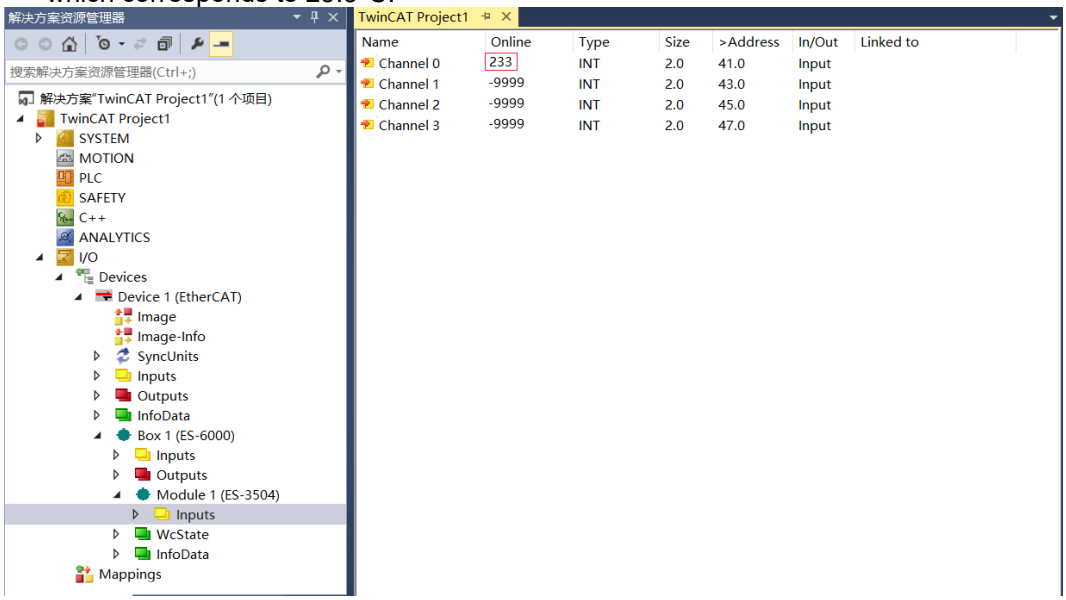


10.3 Temperature Compensation Function

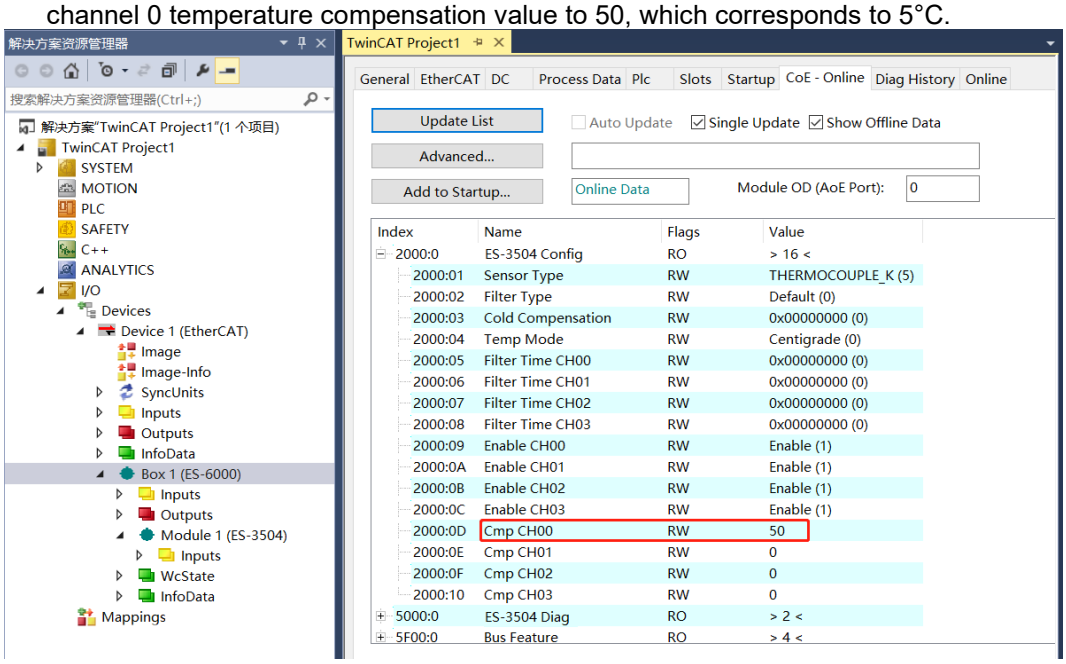
1. Channel 0 is connected to the thermocouple sensor. Configure the configuration parameters as needed. For example, select the K-type thermocouple as the sensor type. The temperature measurement unit switch is set to degrees Celsius by default. Channel 0 is set to enable by default.



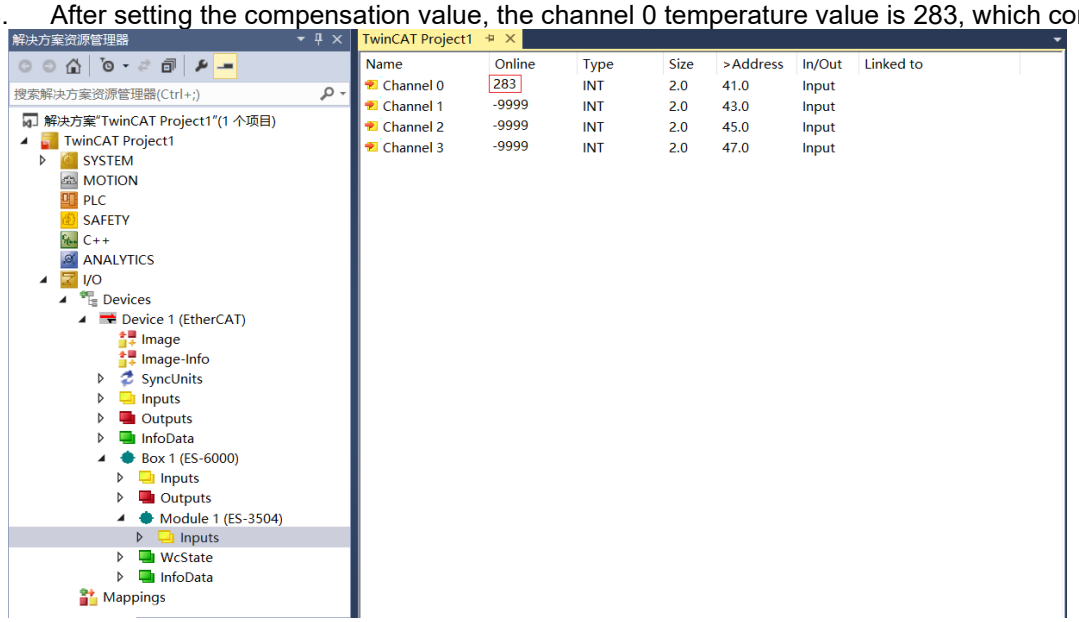
2. Taking channel 0 as an example, you can see that the measured temperature value of channel 0 is 233, which corresponds to 23.3°C.



3. Click **Box1** > **CoE-Online** in the left tree viewer to enter the configuration parameter editing page and set the channel 0 temperature compensation value to 50, which corresponds to 5°C.

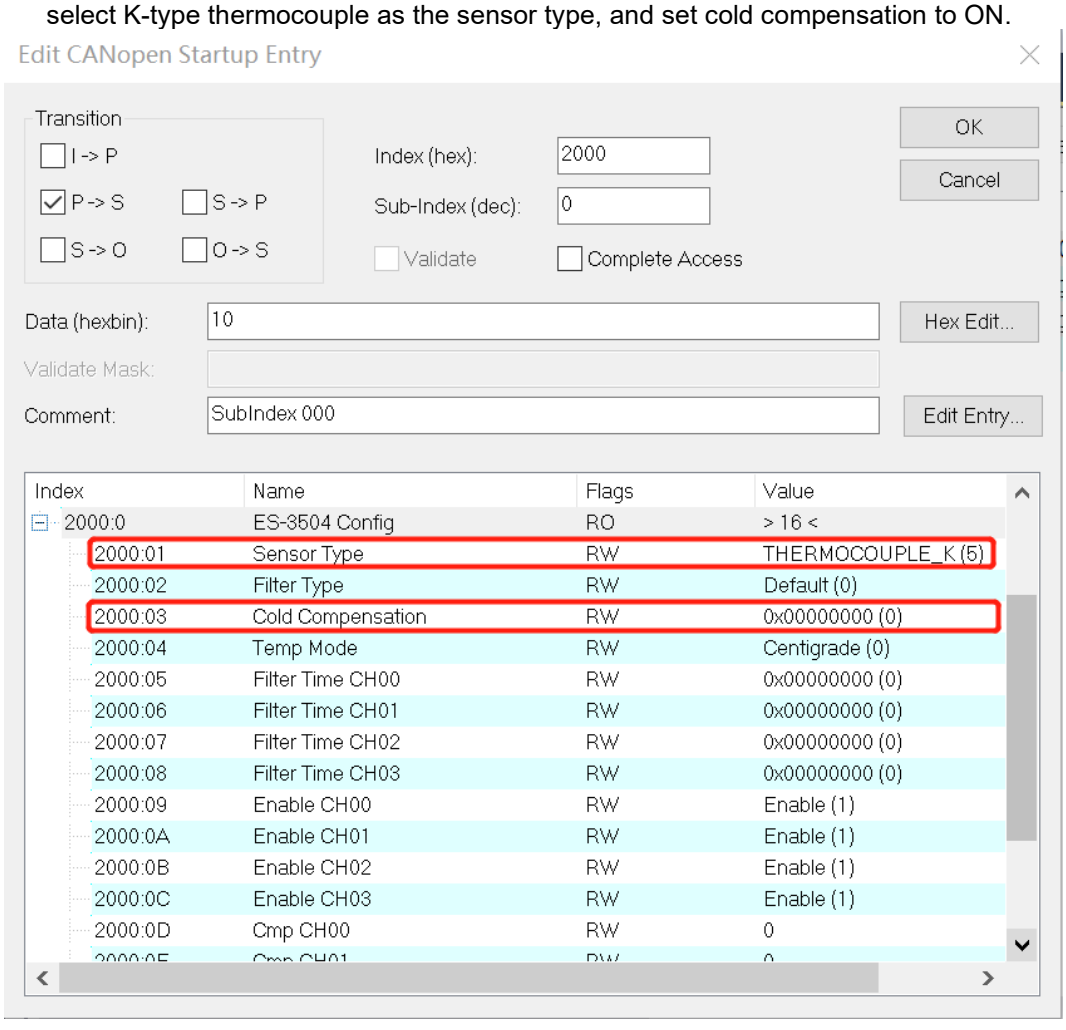


4. After setting the compensation value, the channel 0 temperature value is 283, which corresponds to 28.3°C.

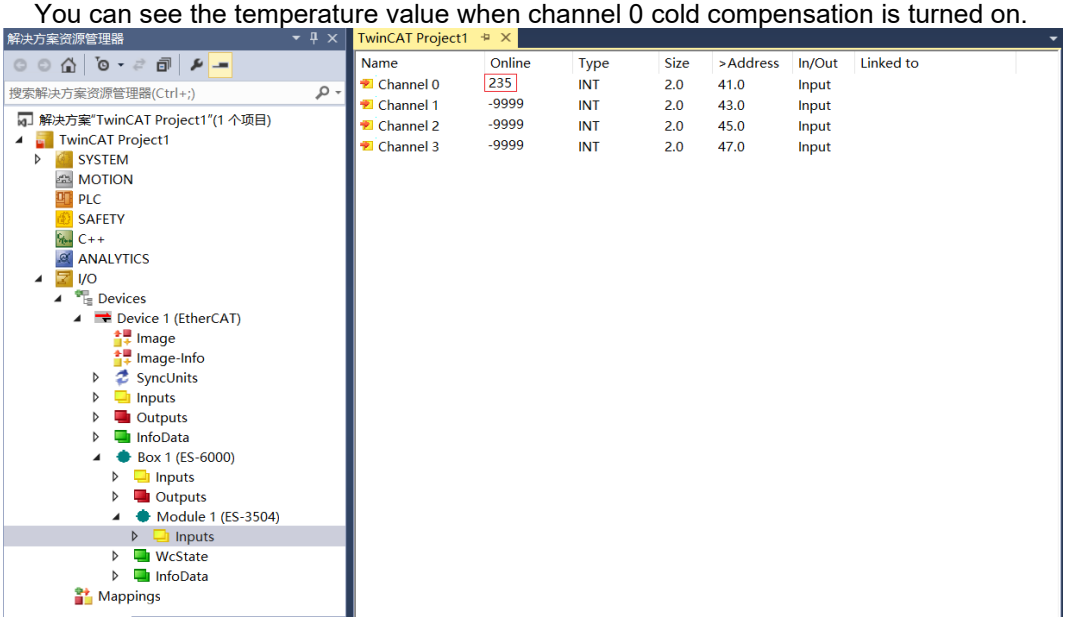


10.4 Temperature Cold Junction Compensation Function

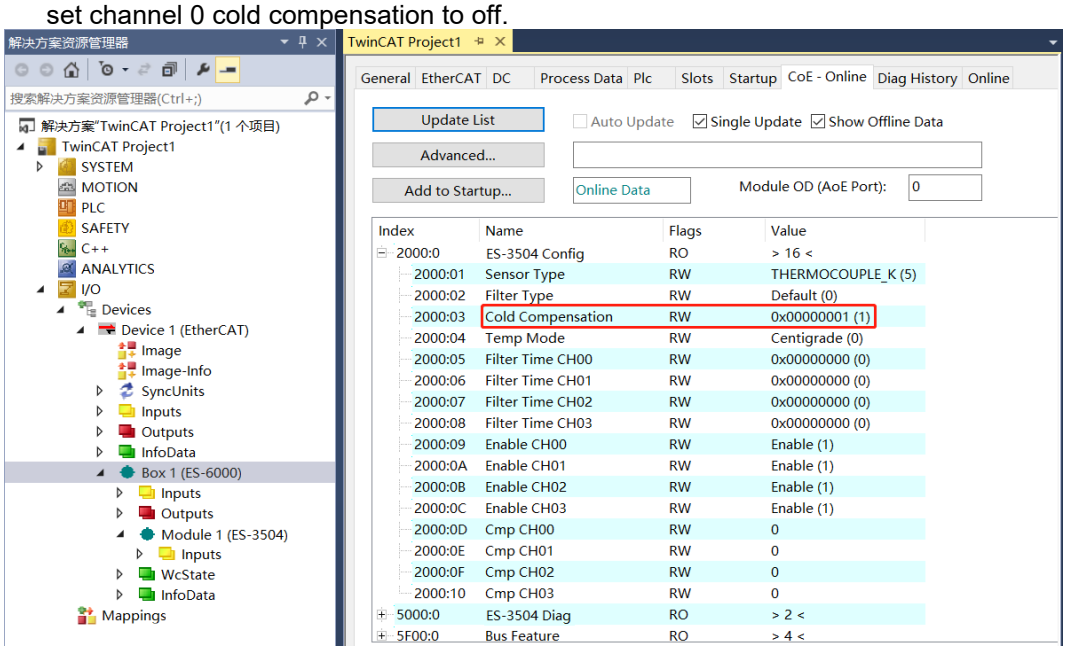
1. Channel 0 is connected to the thermocouple sensor. Configure the configuration parameters as needed, select K-type thermocouple as the sensor type, and set cold compensation to ON.



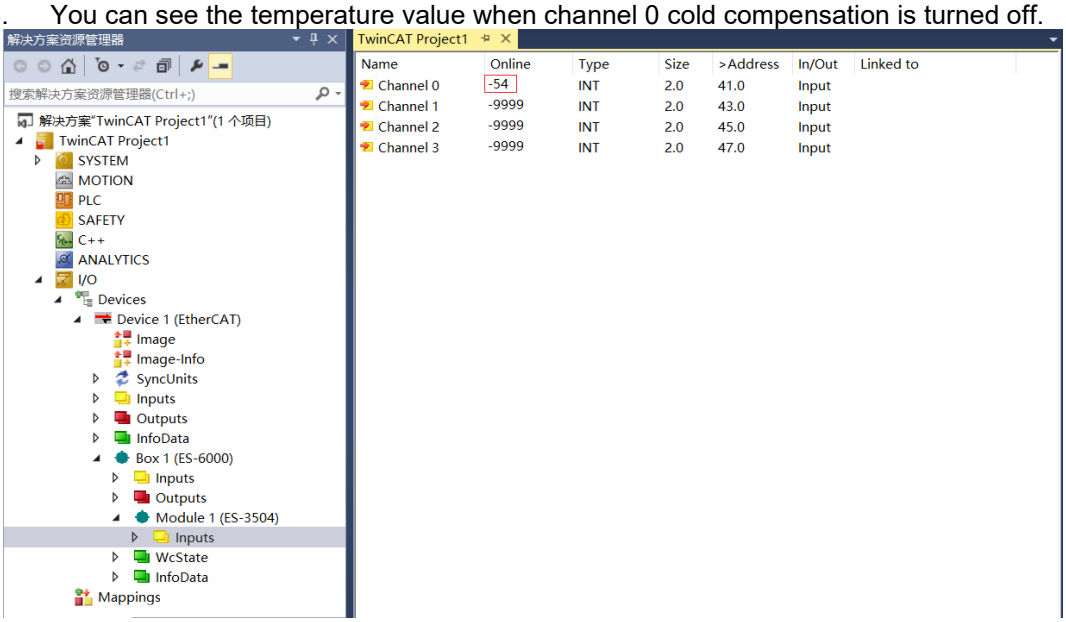
2. You can see the temperature value when channel 0 cold compensation is turned on.



3. Click **Box1** > **CoE-Online** in the tree viewer on the left to enter the configuration parameter editing page and set channel 0 cold compensation to off.



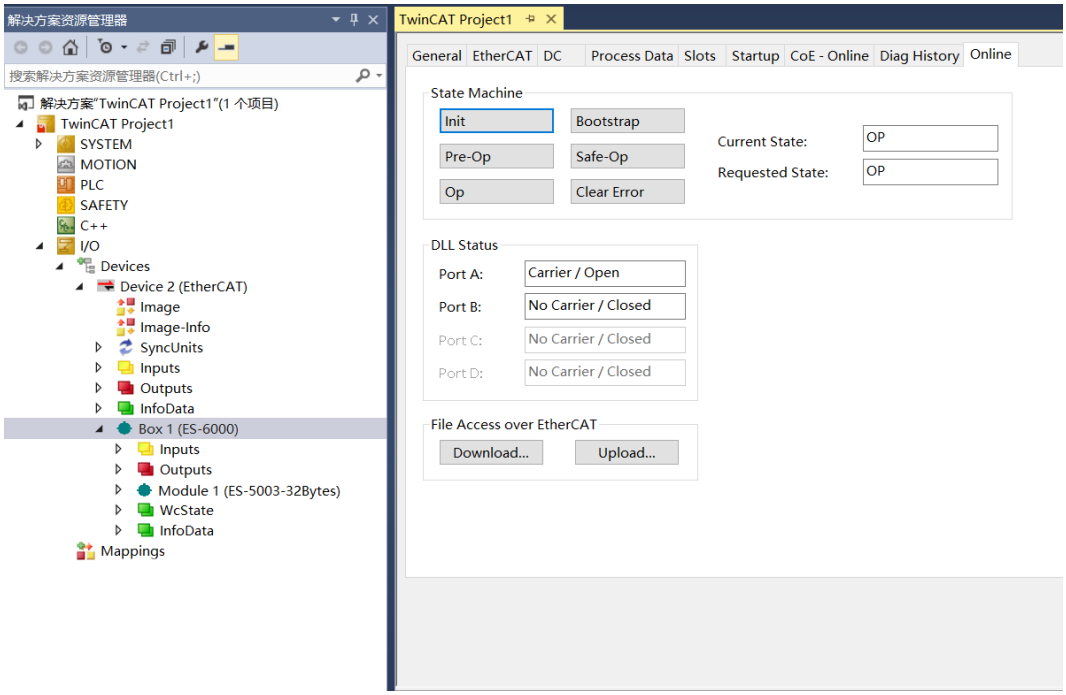
4. You can see the temperature value when channel 0 cold compensation is turned off.



11 Appendix C - TwinCAT® with ES-5003

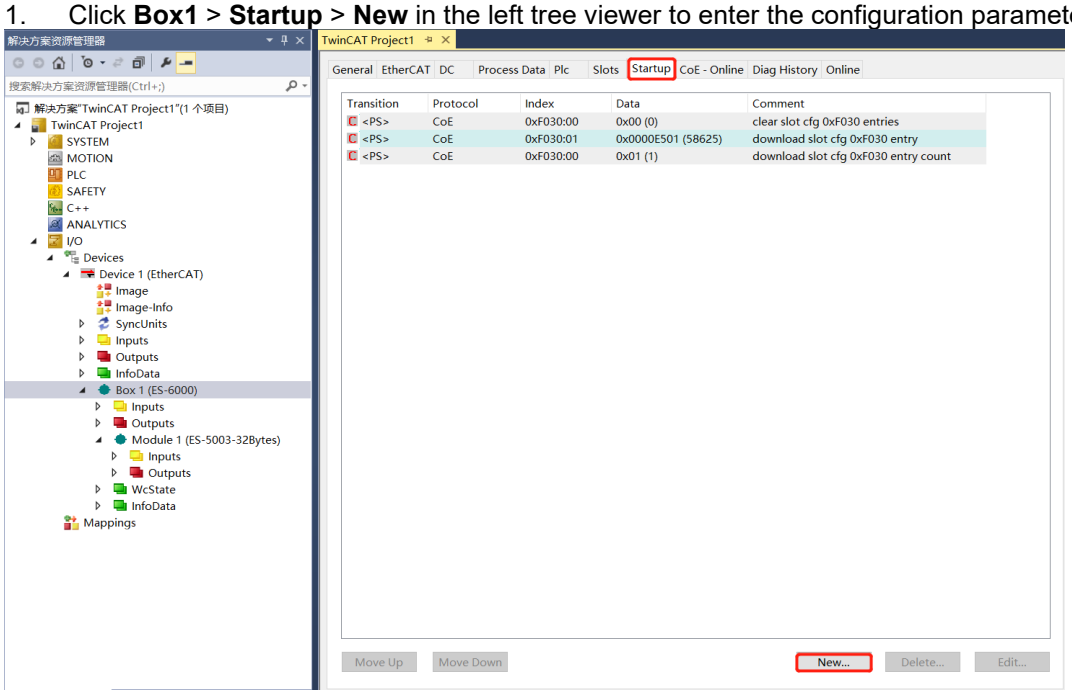
Please refer to the steps below for the process of connecting the ES-5003 to TwinCAT and operating its I/O functions.

After scanning the device, you will see **Box1 (ES-6000)** and **Module1 (ES-5003-32Bytes)** in the left tree viewer. You will also see that TwinCAT is in the "OP" state at "Online", and you can observe the slave station. The device RUN light is always on.

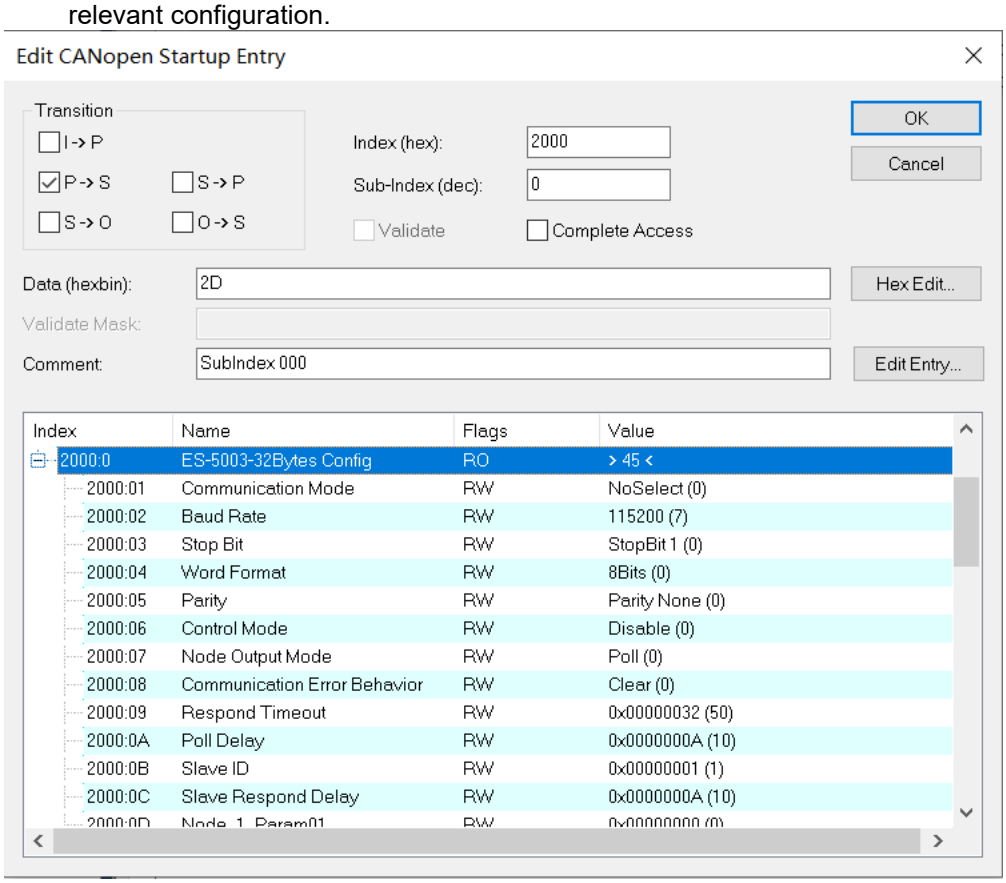


11.1 Verify Basic Function

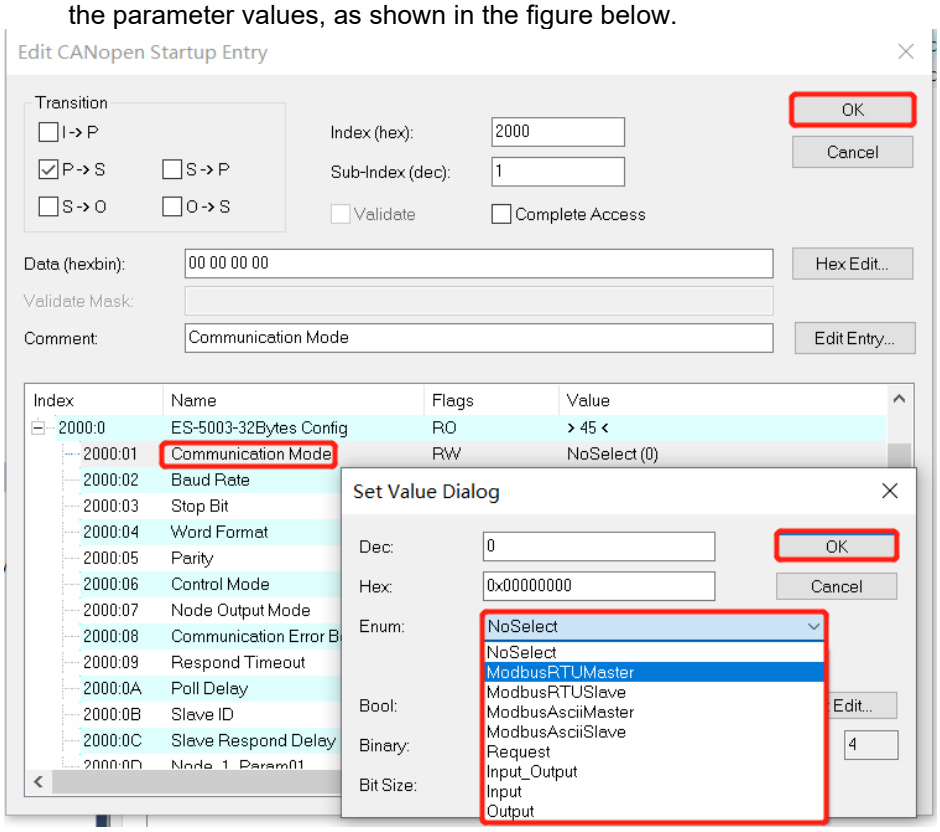
1. Click **Box1** > **Startup** > **New** in the left tree viewer to enter the configuration parameter editing page.



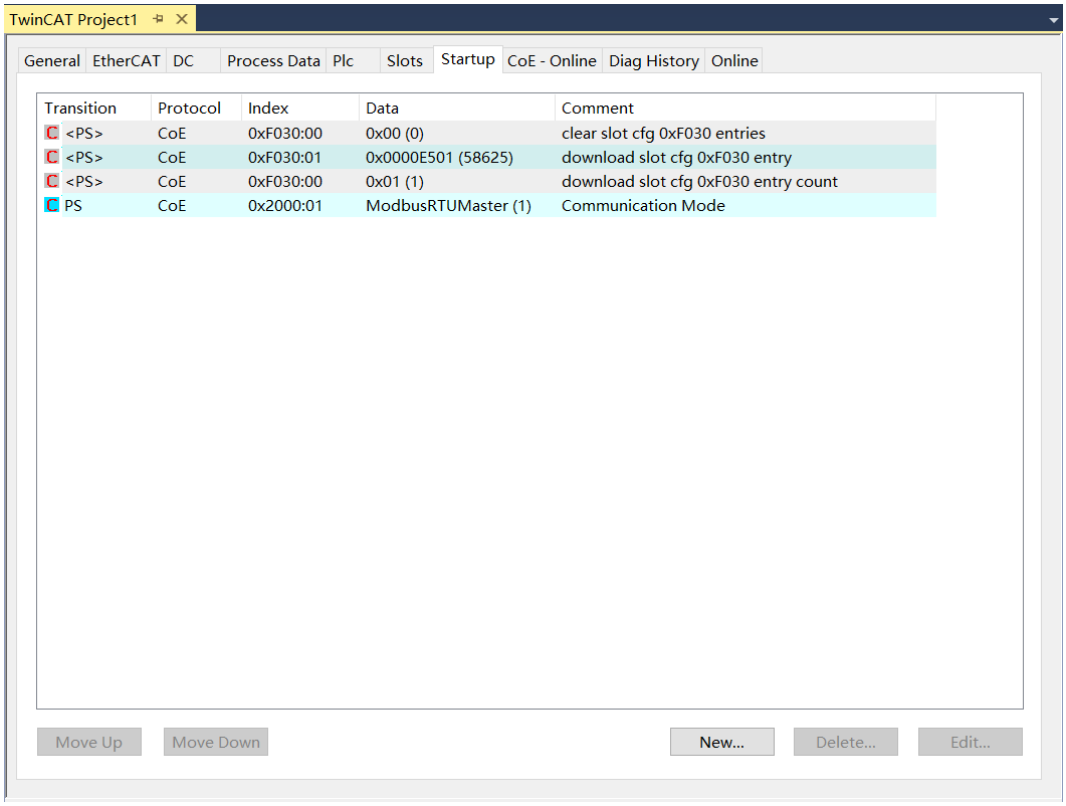
2. In the **Edit CANopen Startup Entry** window, click the "**+**" in front of Index 2000:0 to expand the configuration parameter menu. You will see a number of configuration parameters. Click on any parameter to set the relevant configuration.



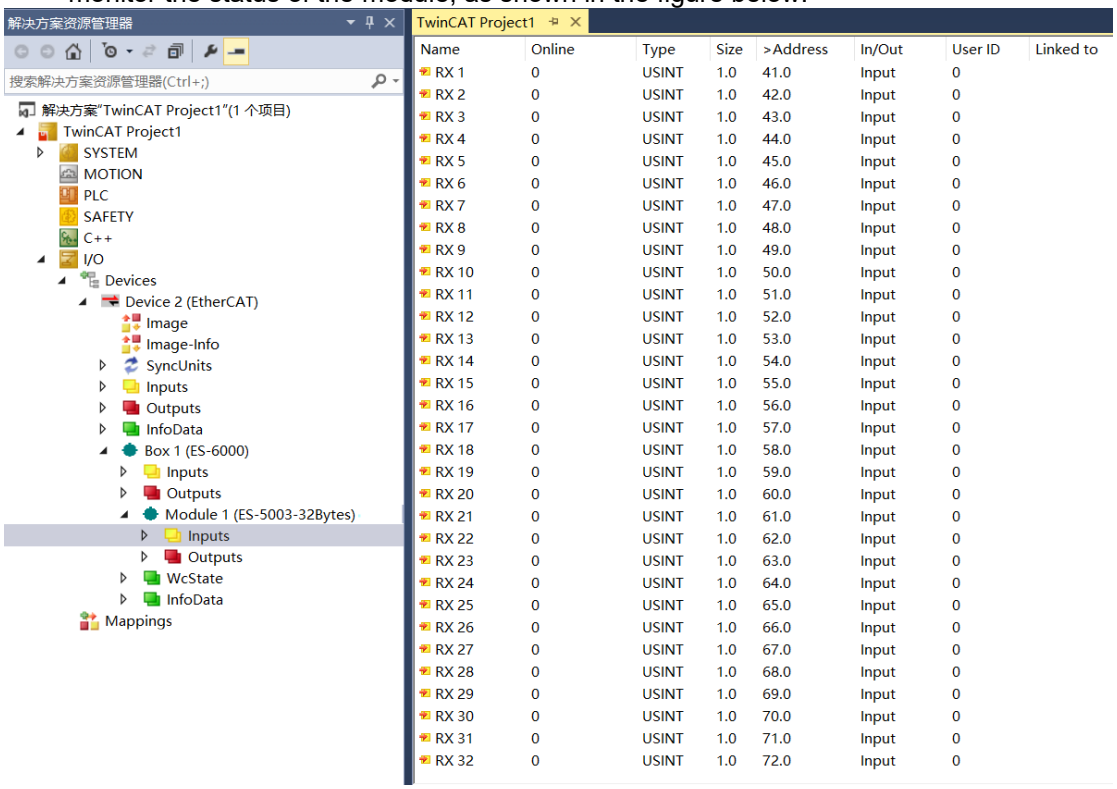
3. For example, to modify the communication mode parameters, double-click **Communication Mode** to modify the parameter values, as shown in the figure below.



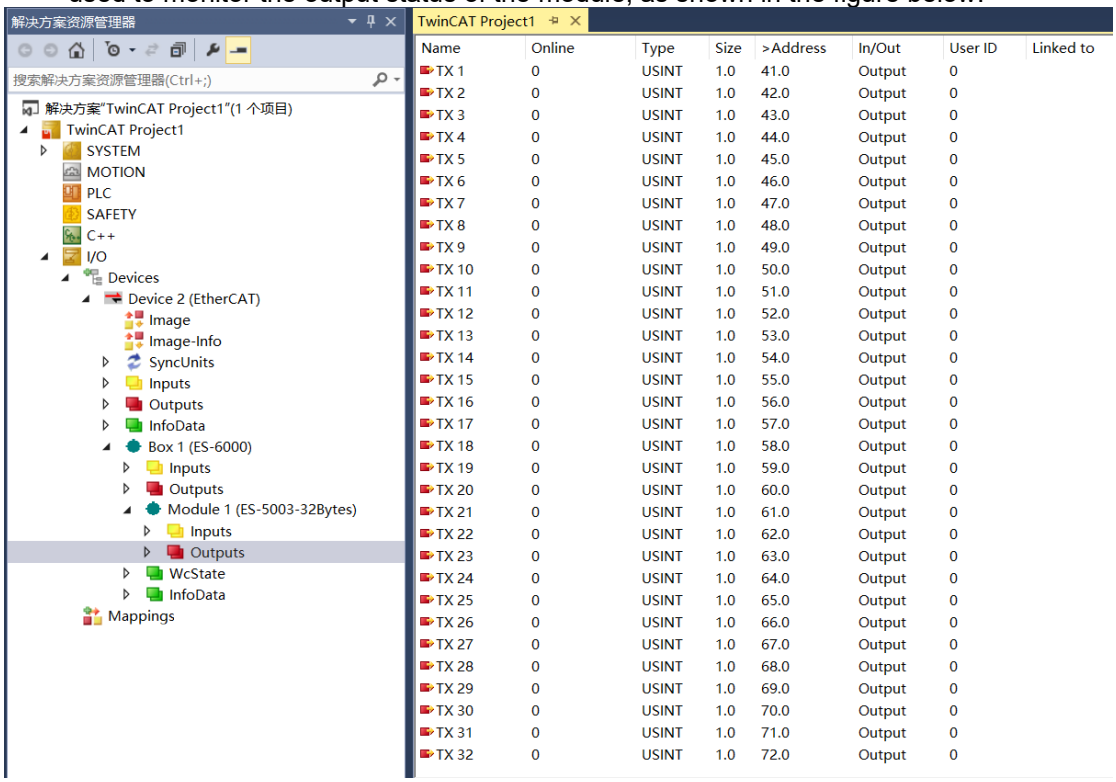
4. After the parameter modification is complete, you will see the modified parameter items and parameter values under Startup, as shown in the figure below. After the parameter setting is complete, the Reload operation and the module need to be powered on again to enable the automatic delivery of parameter settings by the master station.



5. The left tree viewer **Module 1** > **Inputs** displays the upload data of the communication module and is used to monitor the status of the module, as shown in the figure below.



6. The left tree viewer **Module 1** > **Outputs** displays the download data of the communication module and is used to monitor the output status of the module, as shown in the figure below.



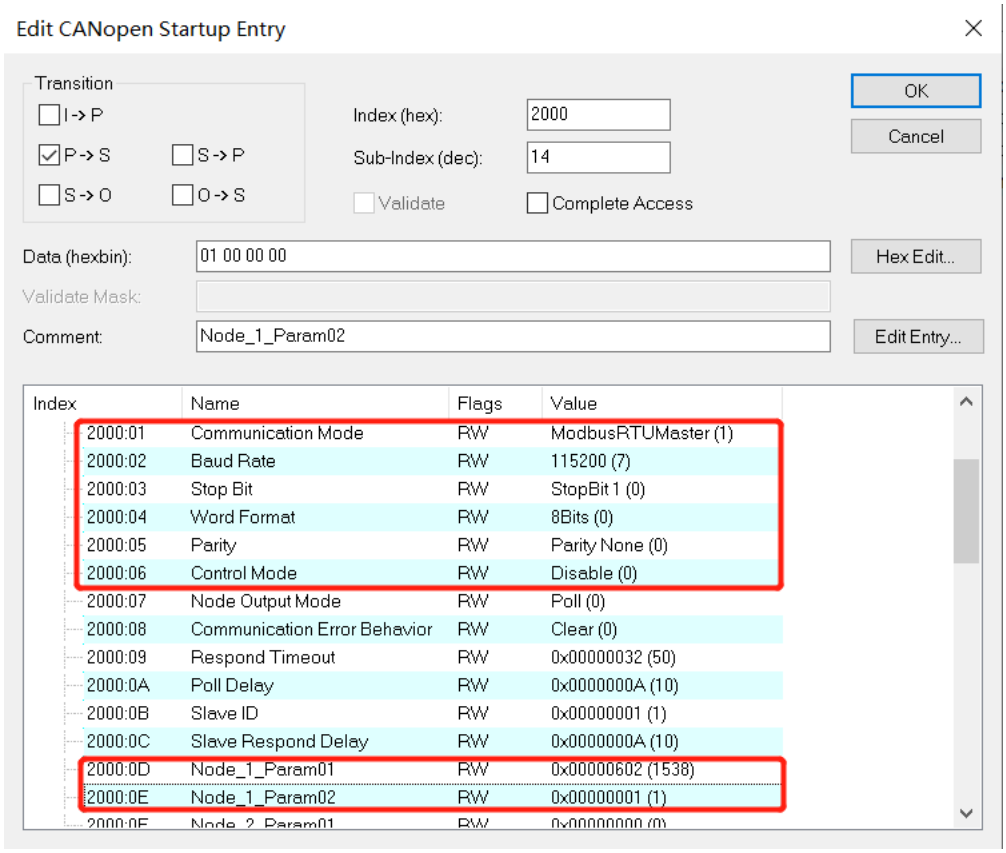
Name	Online	Type	Size	>Address	In/Out	User ID	Linked to
TX 1	0	USINT	1.0	41.0	Output	0	
TX 2	0	USINT	1.0	42.0	Output	0	
TX 3	0	USINT	1.0	43.0	Output	0	
TX 4	0	USINT	1.0	44.0	Output	0	
TX 5	0	USINT	1.0	45.0	Output	0	
TX 6	0	USINT	1.0	46.0	Output	0	
TX 7	0	USINT	1.0	47.0	Output	0	
TX 8	0	USINT	1.0	48.0	Output	0	
TX 9	0	USINT	1.0	49.0	Output	0	
TX 10	0	USINT	1.0	50.0	Output	0	
TX 11	0	USINT	1.0	51.0	Output	0	
TX 12	0	USINT	1.0	52.0	Output	0	
TX 13	0	USINT	1.0	53.0	Output	0	
TX 14	0	USINT	1.0	54.0	Output	0	
TX 15	0	USINT	1.0	55.0	Output	0	
TX 16	0	USINT	1.0	56.0	Output	0	
TX 17	0	USINT	1.0	57.0	Output	0	
TX 18	0	USINT	1.0	58.0	Output	0	
TX 19	0	USINT	1.0	59.0	Output	0	
TX 20	0	USINT	1.0	60.0	Output	0	
TX 21	0	USINT	1.0	61.0	Output	0	
TX 22	0	USINT	1.0	62.0	Output	0	
TX 23	0	USINT	1.0	63.0	Output	0	
TX 24	0	USINT	1.0	64.0	Output	0	
TX 25	0	USINT	1.0	65.0	Output	0	
TX 26	0	USINT	1.0	66.0	Output	0	
TX 27	0	USINT	1.0	67.0	Output	0	
TX 28	0	USINT	1.0	68.0	Output	0	
TX 29	0	USINT	1.0	69.0	Output	0	
TX 30	0	USINT	1.0	70.0	Output	0	
TX 31	0	USINT	1.0	71.0	Output	0	
TX 32	0	USINT	1.0	72.0	Output	0	

11.2 RTU Master Mode Function Example

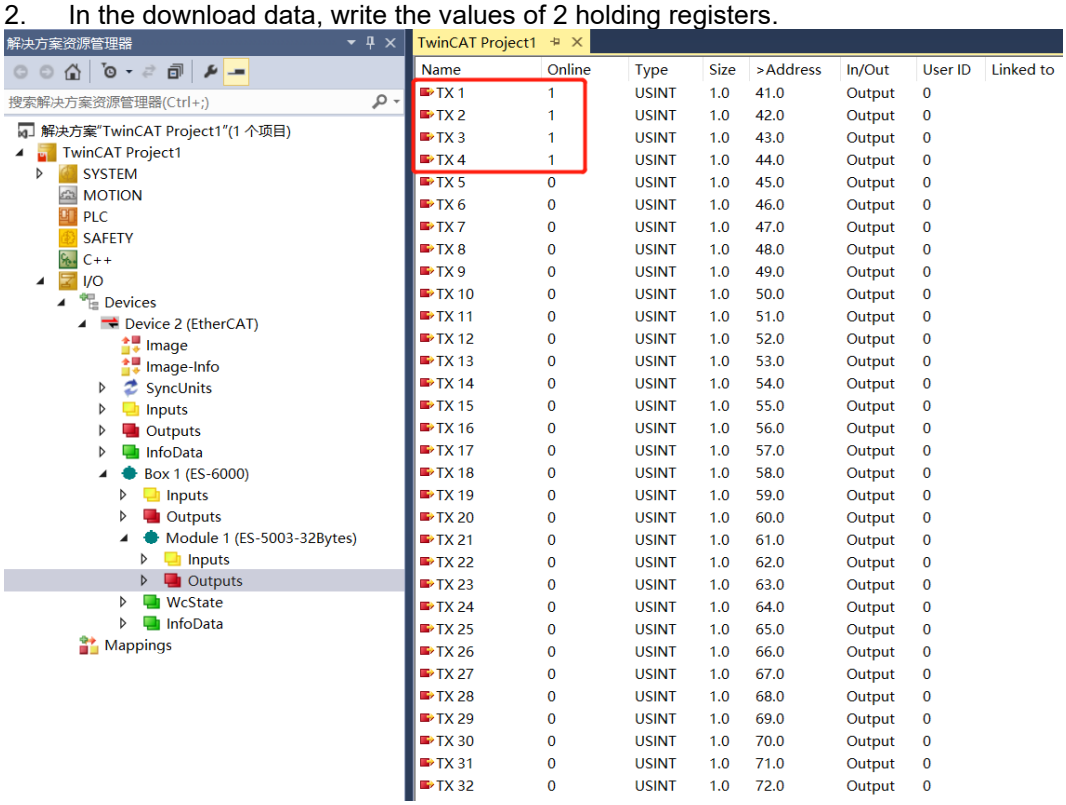
Example 1: Use tools such as Modbus Slave debugging software or device verification module RTU master station to write the values of 2 holding registers in disable mode.

1. Configure the parameters and select 1 as the communication mode, which is the RTU master mode.

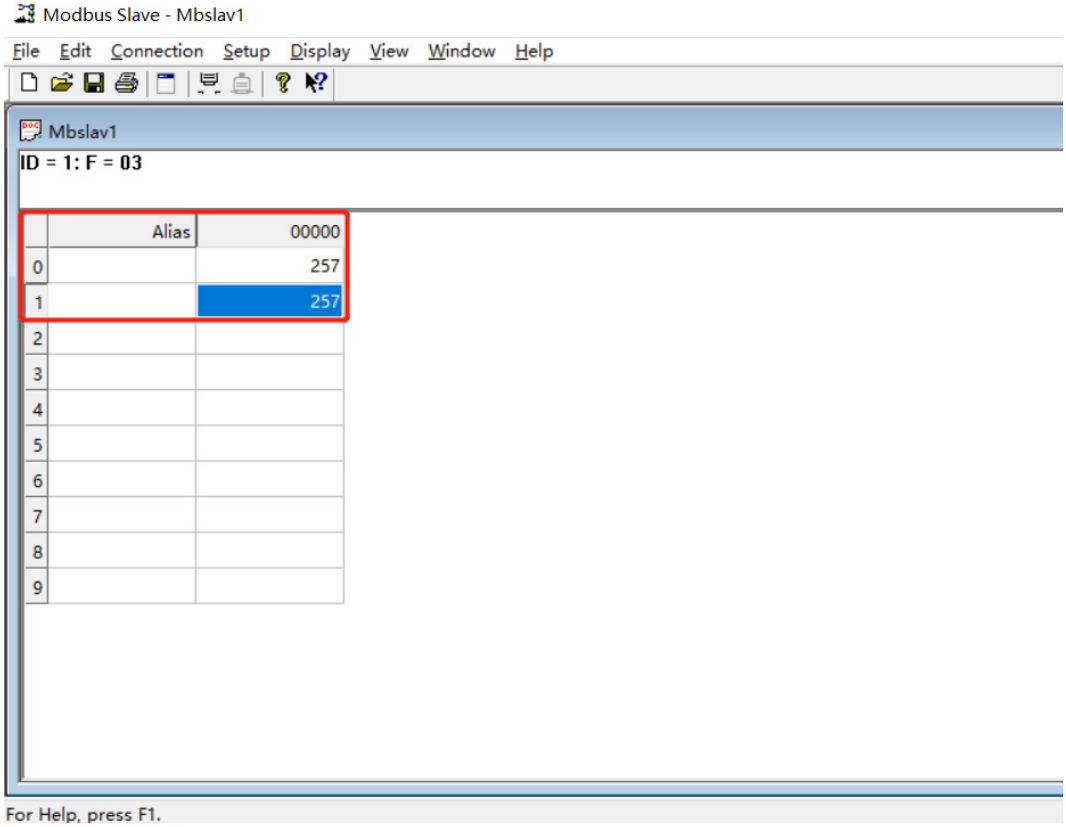
   - **Communication Mode**: Select **ModbusRTUMester**.
   - **Control Mode**: Select **Disable**.
   - **Node_1_Param_1**: Configure to 0x00000602, please refer to Modbus Master Function Node code for configuration parameters.
   - **Node_1_Param_2**: Configure to 0x00000001, please refer to Modbus Master Function Node code for configuration parameters.



2. In the download data, write the values of 2 holding registers.

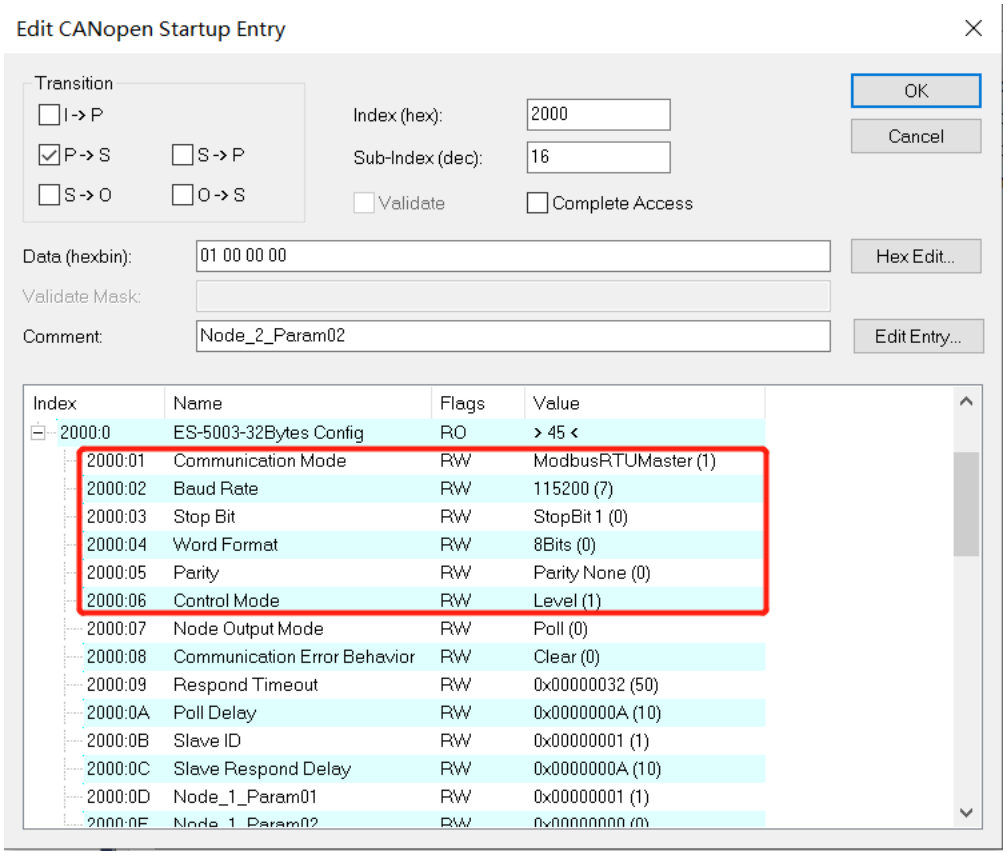


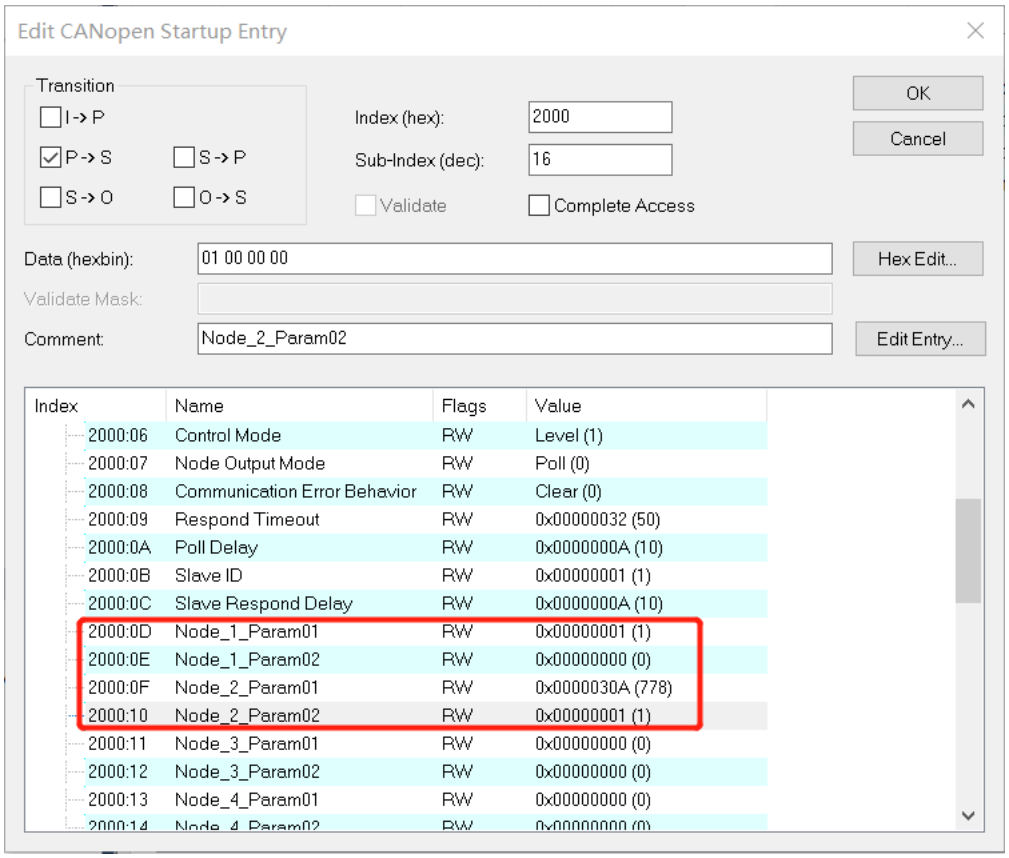
3. You can see the values of the two received registers through the debugging software.



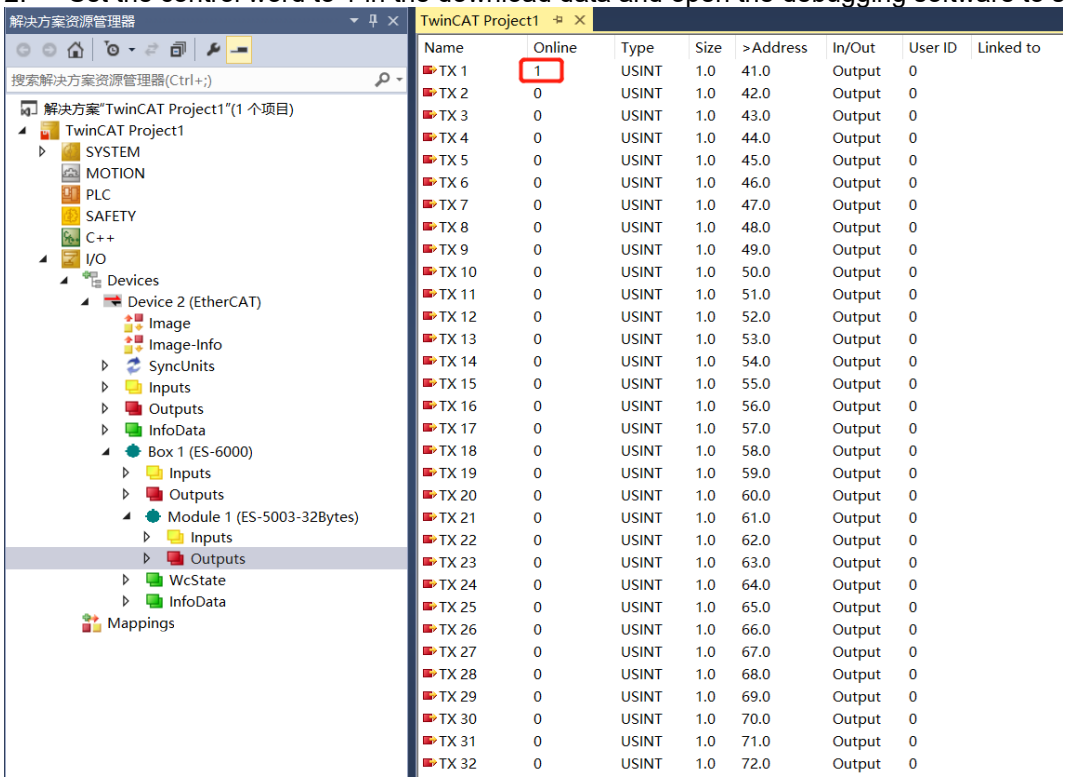
Example 2: Read 10 holding registers in Level mode through tools such as Modbus Slave debugging software or device verification module RTU master station.

1. Configure the parameters and select the communication mode 1, which is the RTU master mode.
   - **Communication Mode**: Select **ModbusRTUMester**.
   - **Control Mode**: Select **Level**.
   - **Node_1_Param_1**: Configure to 0x00000001. For details of configuration parameters, see Control and status node code.
   - **Node_2_Param_1**: Configure to 0x0000030A. For details of configuration parameters, see Modbus Master Function Node code.
   - **Node_2_Param_2**: Configure to 0x00000001. For details on configuration parameters, see Modbus Master Function Node code.

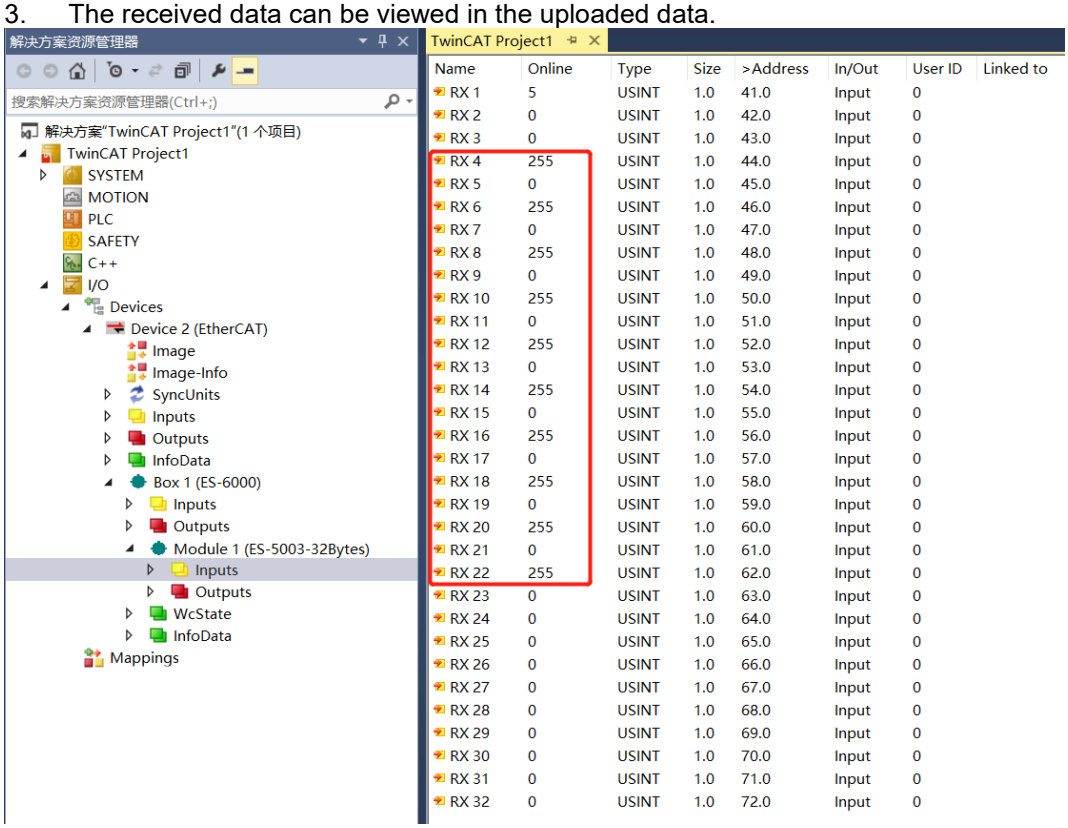




2. Set the control word to 1 in the download data and open the debugging software to send the data.



3. The received data can be viewed in the uploaded data.

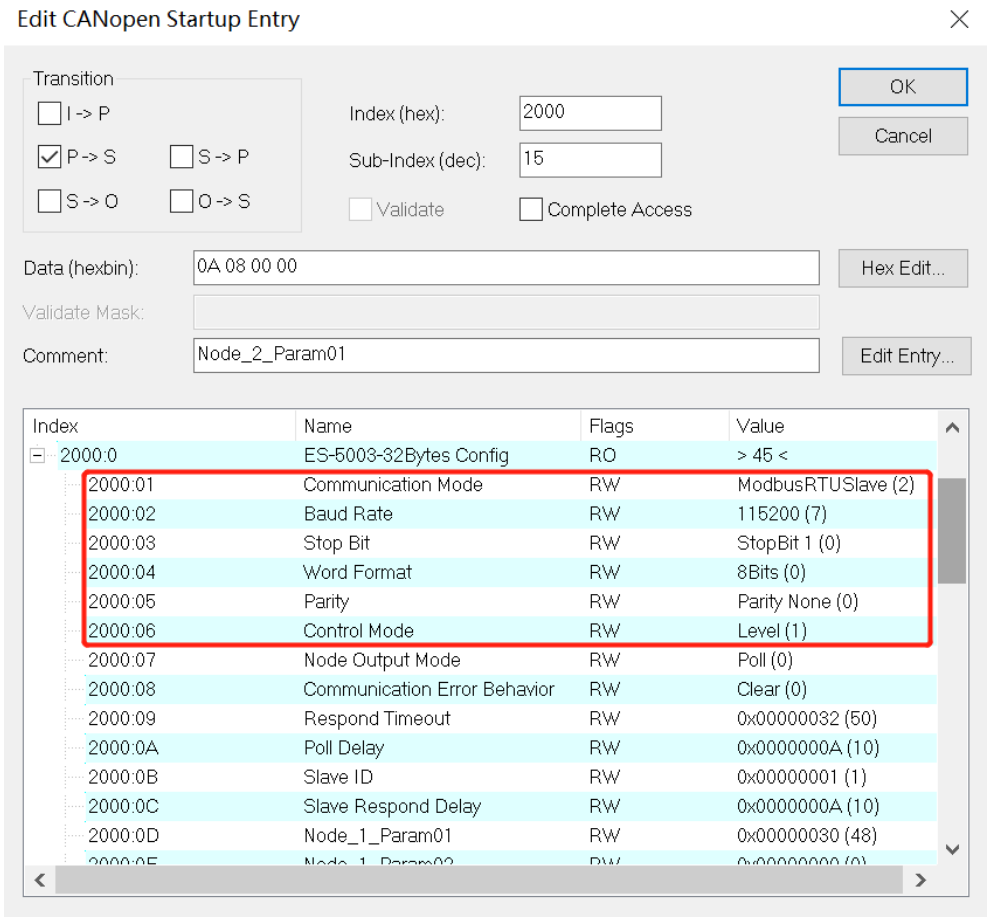


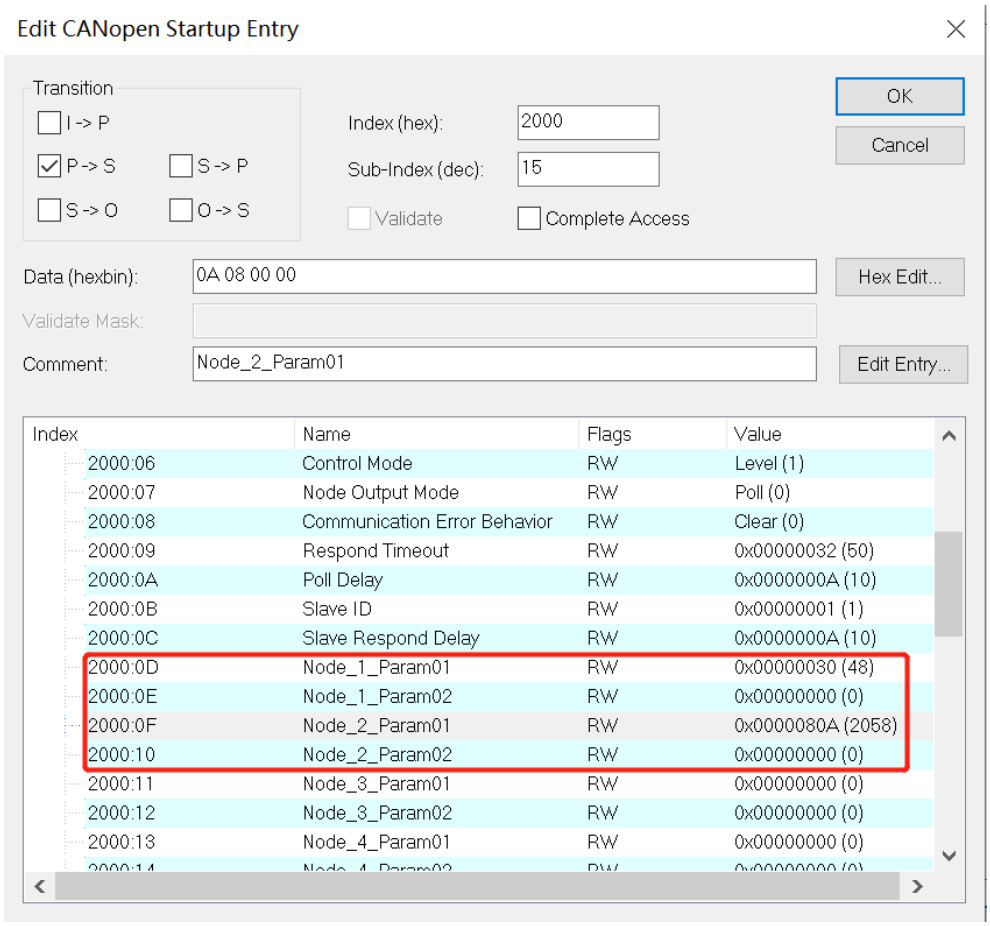
Name	Online	Type	Size	>Address	In/Out	User ID	Linked to
RX 1	5	USINT	1.0	41.0	Input	0	
RX 2	0	USINT	1.0	42.0	Input	0	
RX 3	0	USINT	1.0	43.0	Input	0	
RX 4	255	USINT	1.0	44.0	Input	0	
RX 5	0	USINT	1.0	45.0	Input	0	
RX 6	255	USINT	1.0	46.0	Input	0	
RX 7	0	USINT	1.0	47.0	Input	0	
RX 8	255	USINT	1.0	48.0	Input	0	
RX 9	0	USINT	1.0	49.0	Input	0	
RX 10	255	USINT	1.0	50.0	Input	0	
RX 11	0	USINT	1.0	51.0	Input	0	
RX 12	255	USINT	1.0	52.0	Input	0	
RX 13	0	USINT	1.0	53.0	Input	0	
RX 14	255	USINT	1.0	54.0	Input	0	
RX 15	0	USINT	1.0	55.0	Input	0	
RX 16	255	USINT	1.0	56.0	Input	0	
RX 17	0	USINT	1.0	57.0	Input	0	
RX 18	255	USINT	1.0	58.0	Input	0	
RX 19	0	USINT	1.0	59.0	Input	0	
RX 20	255	USINT	1.0	60.0	Input	0	
RX 21	0	USINT	1.0	61.0	Input	0	
RX 22	255	USINT	1.0	62.0	Input	0	
RX 23	0	USINT	1.0	63.0	Input	0	
RX 24	0	USINT	1.0	64.0	Input	0	
RX 25	0	USINT	1.0	65.0	Input	0	
RX 26	0	USINT	1.0	66.0	Input	0	
RX 27	0	USINT	1.0	67.0	Input	0	
RX 28	0	USINT	1.0	68.0	Input	0	
RX 29	0	USINT	1.0	69.0	Input	0	
RX 30	0	USINT	1.0	70.0	Input	0	
RX 31	0	USINT	1.0	71.0	Input	0	
RX 32	0	USINT	1.0	72.0	Input	0	

11.3 RTU Slave Mode Function Example

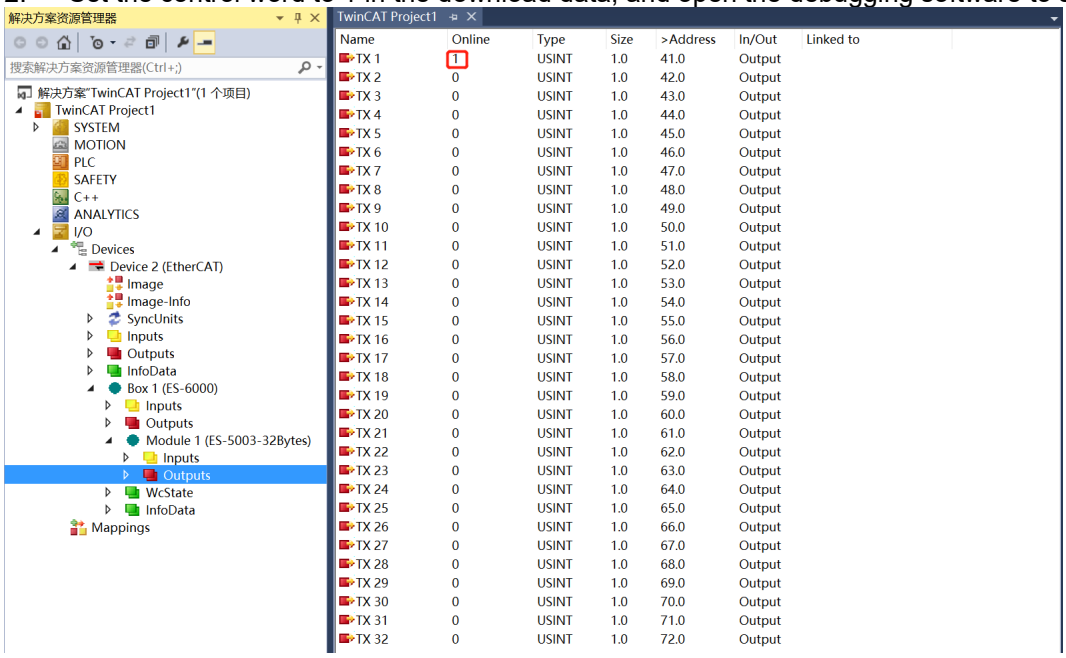
Example: Use tools such as Modbus Poll debugging software or device verification module RTU slave station to read 10 holding registers in Level mode.

1. Configure the parameters and select the communication mode 2, which is the RTU slave mode.
   - **Communication Mode**: Select **ModbusRTUSlave**.
   - **Control Mode**: Select **Level**.
   - **Node_1_Param_1**: Configure to 0x00000030. For details of configuration parameters, see Control and status node code.
   - **Node_2_Param_1**: Configure to 0x0000080A. For details of configuration parameters, see Modbus Slave Function Node code.
   - **Node_2_Param_2**: Configure to 0x00000000. For details on configuration parameters, see Modbus Slave Function Node code.

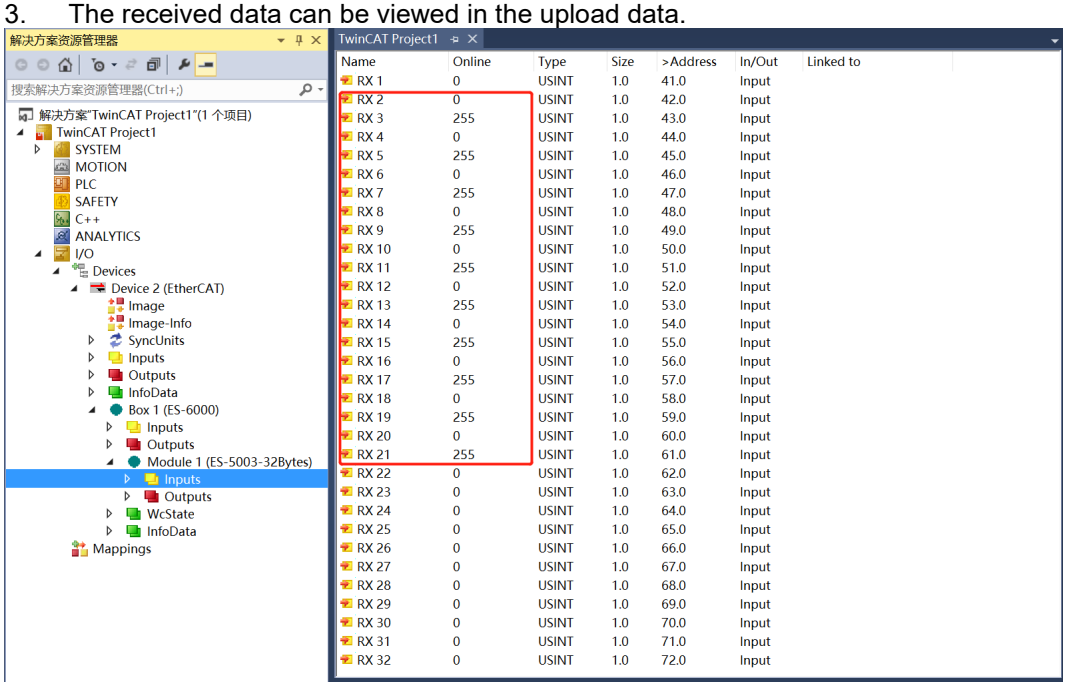




2. Set the control word to 1 in the download data, and open the debugging software to send the data.



3. The received data can be viewed in the upload data.

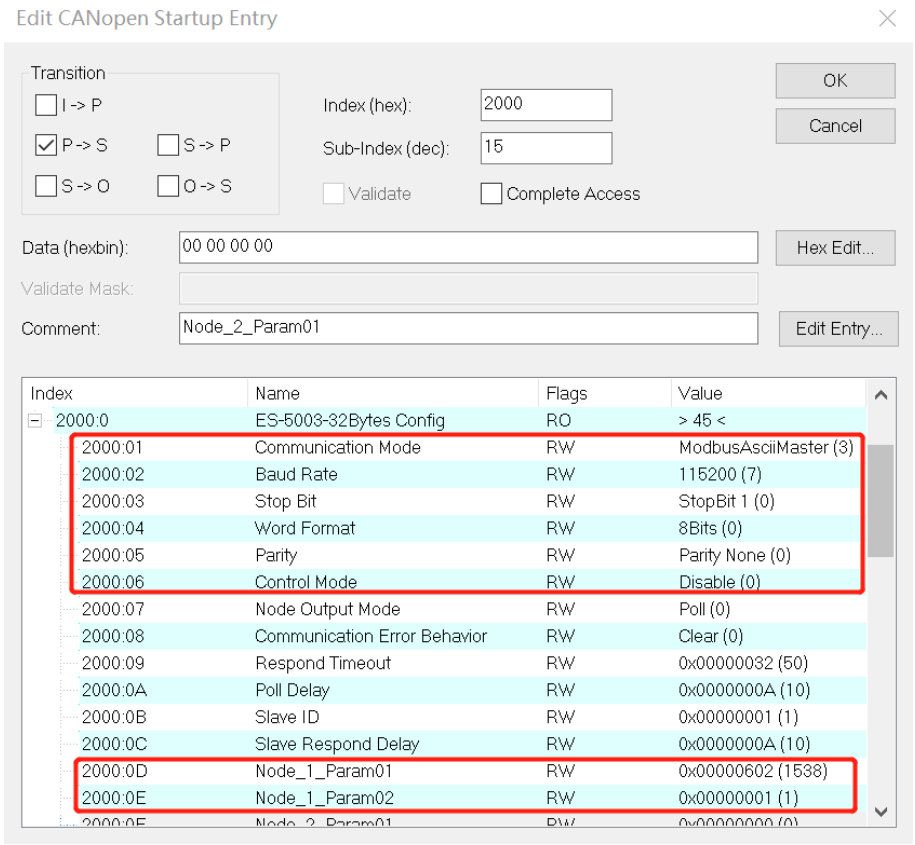


11.4 ASCII Master Mode Function Example

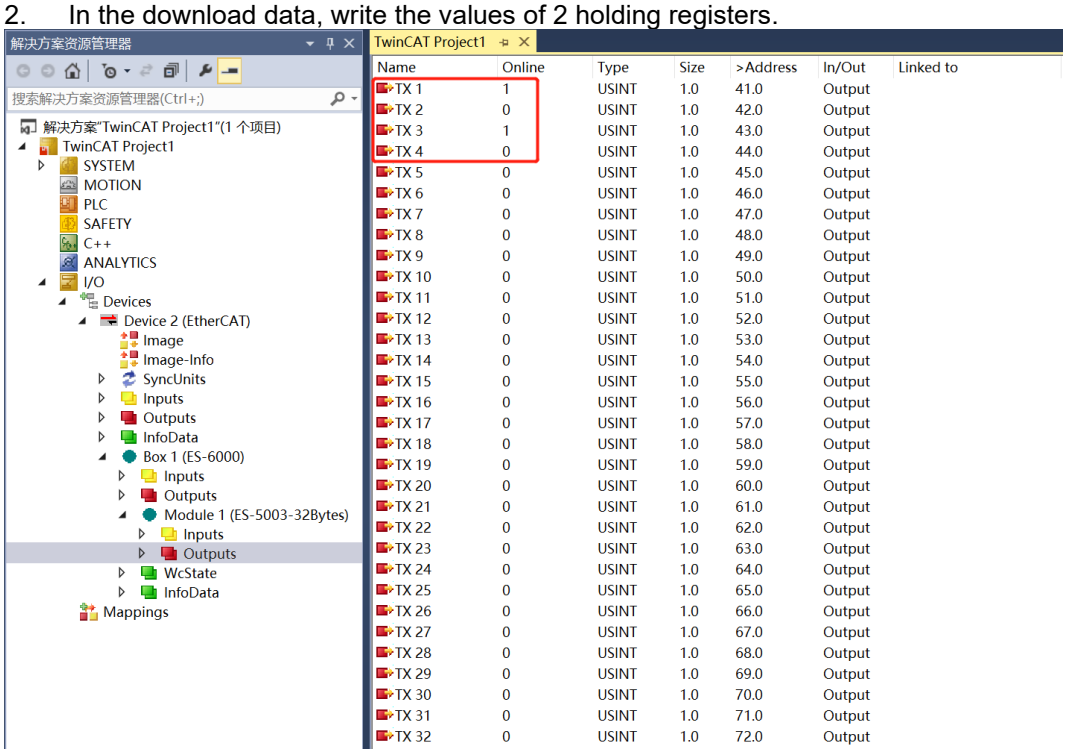
Example: Use tools such as Modbus Slave debugging software or device verification module ASCII master station to write the value of 2 holding registers in disable mode.

1. Configure the parameters and select the communication mode 3, which is the ASCII master mode, as shown in the figure below.

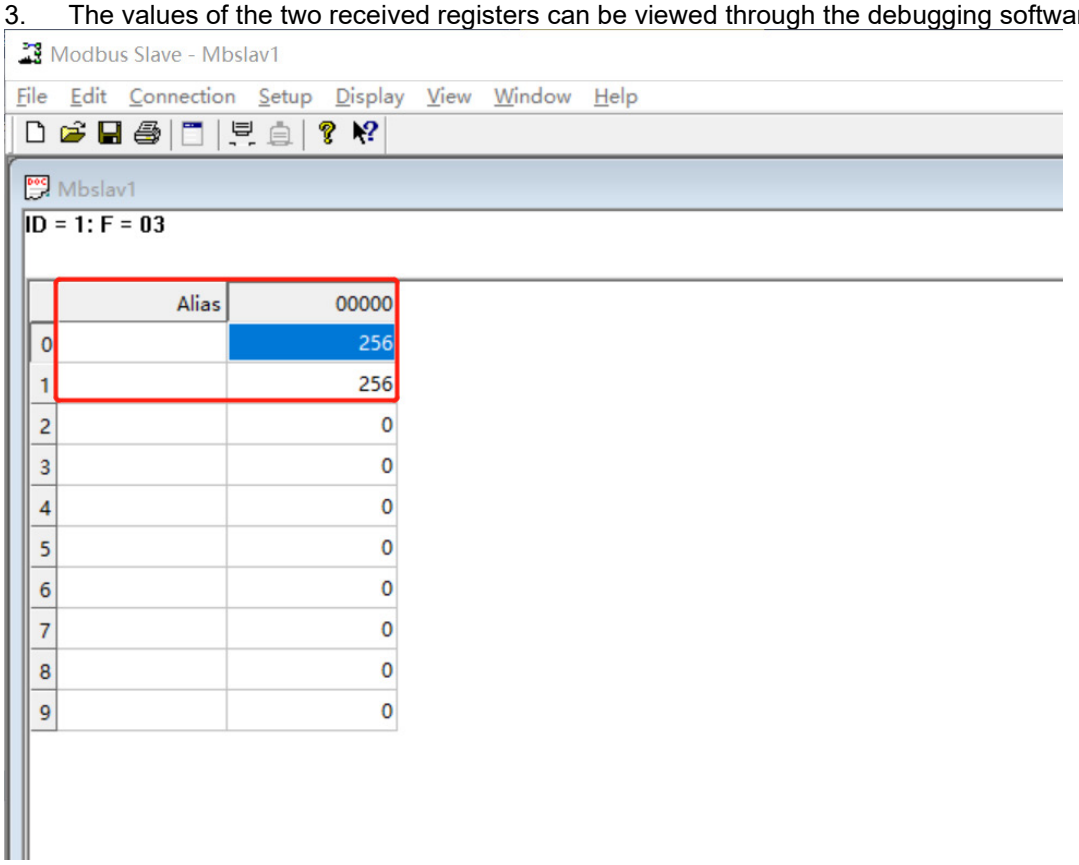
   - **Communication Mode**: Select **ModbusAsciiMaster**.
     Control Mode: Select **Disable**.
   - **Node_1_Param_1**: Configure to 0x00000602, please refer to Modbus Master Function Node code for configuration parameters.
   - **Node_1_Param_2**: Configure to 0x00000001, please refer to Modbus Master Function Node code for configuration parameters.



2. In the download data, write the values of 2 holding registers.



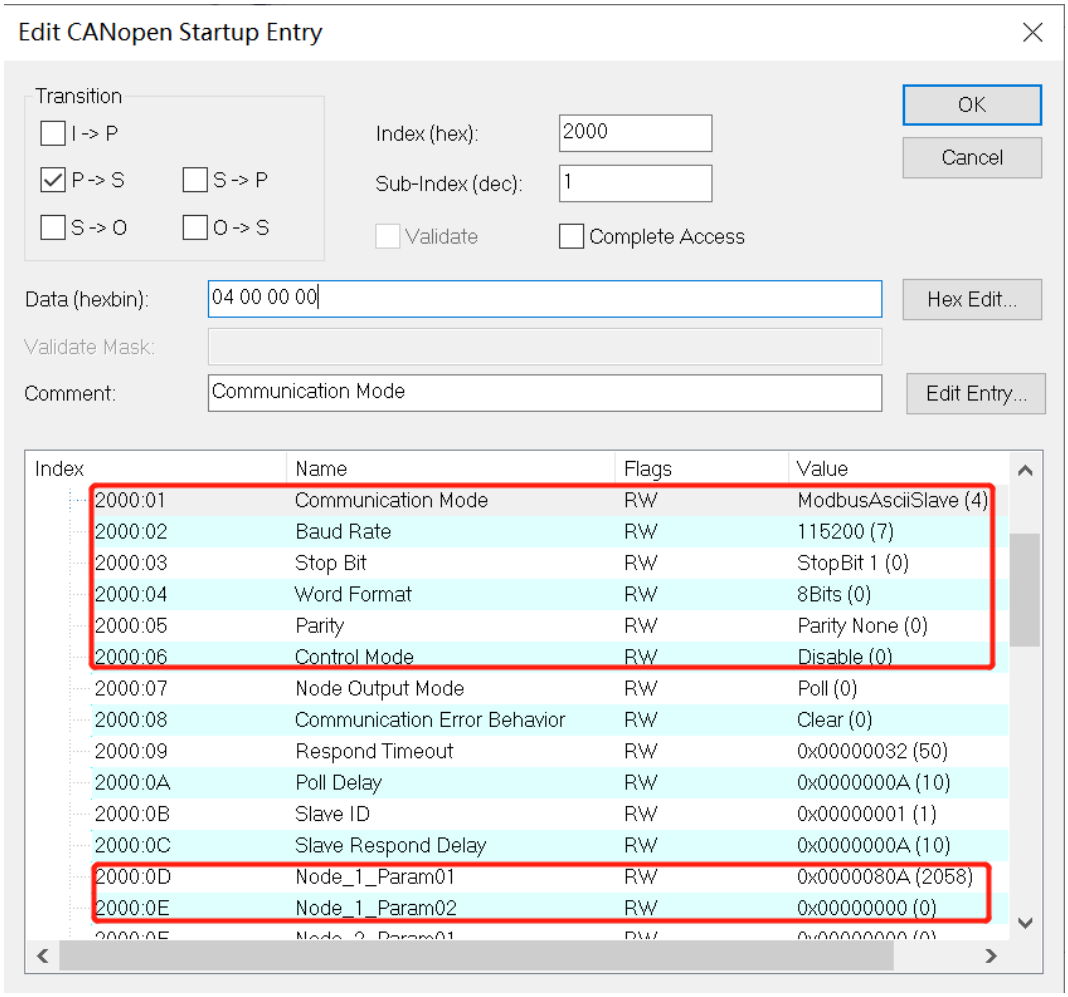
3. The values of the two received registers can be viewed through the debugging software.



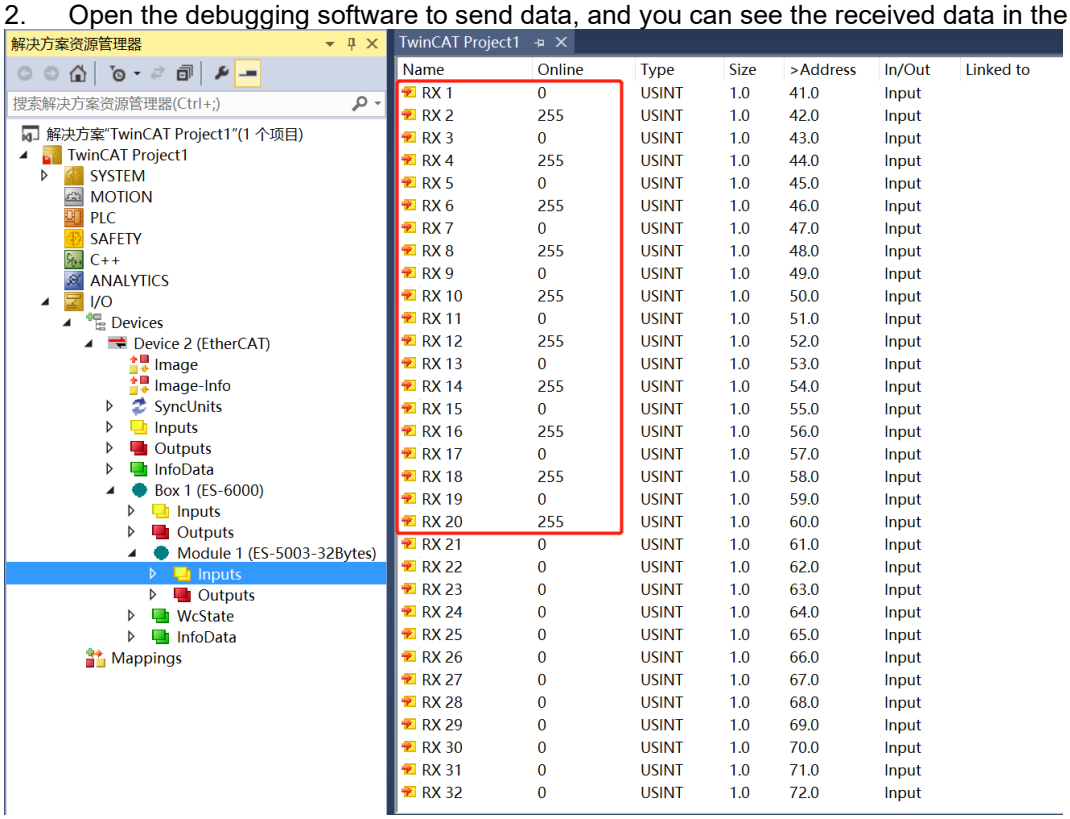
11.5 ASCII Slave Mode Function Example

Example: Use tools such as Modbus Poll debugging software or device verification module ASCII slave to read 10 holding registers in disabled mode.

1. Configure the configuration parameters and select the communication mode 4, which is the ASCII slave mode, as shown in the figure below.
   - **Communication Mode**: Select ModbusAsciiSlave.
   - **Control Mode**: Select **Disable**.
   - **Node_1_Param_1**: Configure to 0x0000080A. For details of configuration parameters, see Modbus Slave Function Node code.
   - **Node_1_Param_2**: Configure to 0x00000000. For details on configuration parameters, see Modbus Slave Function Node code.



2. Open the debugging software to send data, and you can see the received data in the upload data.



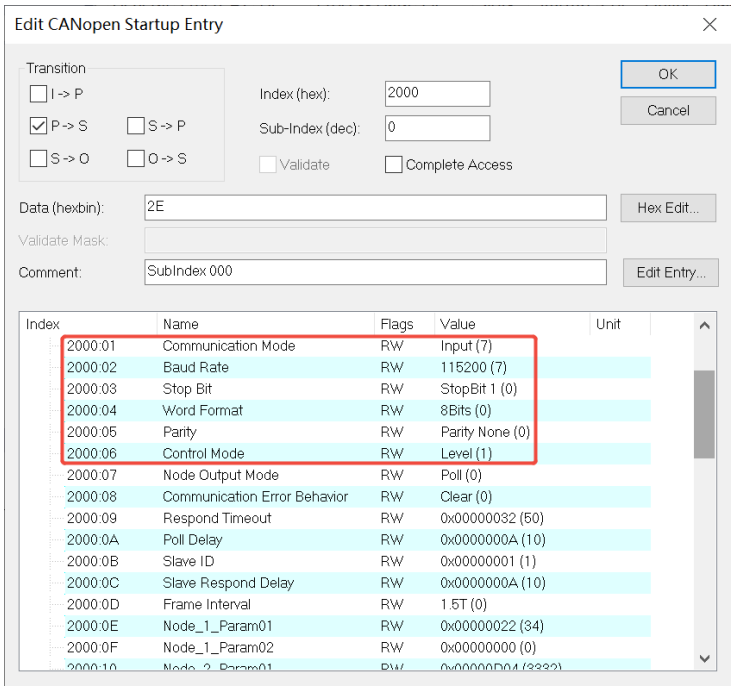
Name	Online	Type	Size	>Address	In/Out	Linked to
RX 1	0	USINT	1.0	41.0	Input	
RX 2	255	USINT	1.0	42.0	Input	
RX 3	0	USINT	1.0	43.0	Input	
RX 4	255	USINT	1.0	44.0	Input	
RX 5	0	USINT	1.0	45.0	Input	
RX 6	255	USINT	1.0	46.0	Input	
RX 7	0	USINT	1.0	47.0	Input	
RX 8	255	USINT	1.0	48.0	Input	
RX 9	0	USINT	1.0	49.0	Input	
RX 10	255	USINT	1.0	50.0	Input	
RX 11	0	USINT	1.0	51.0	Input	
RX 12	255	USINT	1.0	52.0	Input	
RX 13	0	USINT	1.0	53.0	Input	
RX 14	255	USINT	1.0	54.0	Input	
RX 15	0	USINT	1.0	55.0	Input	
RX 16	255	USINT	1.0	56.0	Input	
RX 17	0	USINT	1.0	57.0	Input	
RX 18	255	USINT	1.0	58.0	Input	
RX 19	0	USINT	1.0	59.0	Input	
RX 20	255	USINT	1.0	60.0	Input	
RX 21	0	USINT	1.0	61.0	Input	
RX 22	0	USINT	1.0	62.0	Input	
RX 23	0	USINT	1.0	63.0	Input	
RX 24	0	USINT	1.0	64.0	Input	
RX 25	0	USINT	1.0	65.0	Input	
RX 26	0	USINT	1.0	66.0	Input	
RX 27	0	USINT	1.0	67.0	Input	
RX 28	0	USINT	1.0	68.0	Input	
RX 29	0	USINT	1.0	69.0	Input	
RX 30	0	USINT	1.0	70.0	Input	
RX 31	0	USINT	1.0	71.0	Input	
RX 32	0	USINT	1.0	72.0	Input	

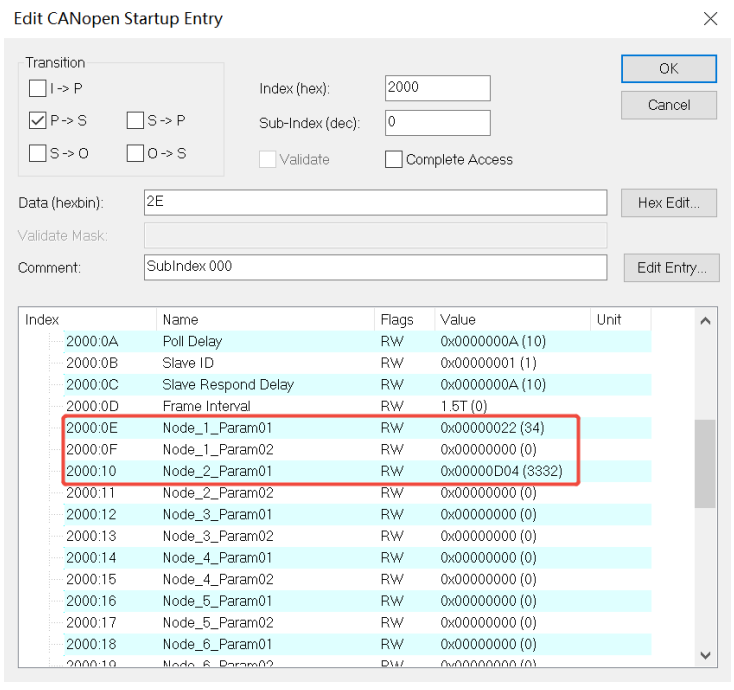
11.6 Freeport_Input Mode Function Example

Example: Use Freeport_Input to receive 8-byte data in Level mode through tools or devices such as the Serial Debug Assistant.

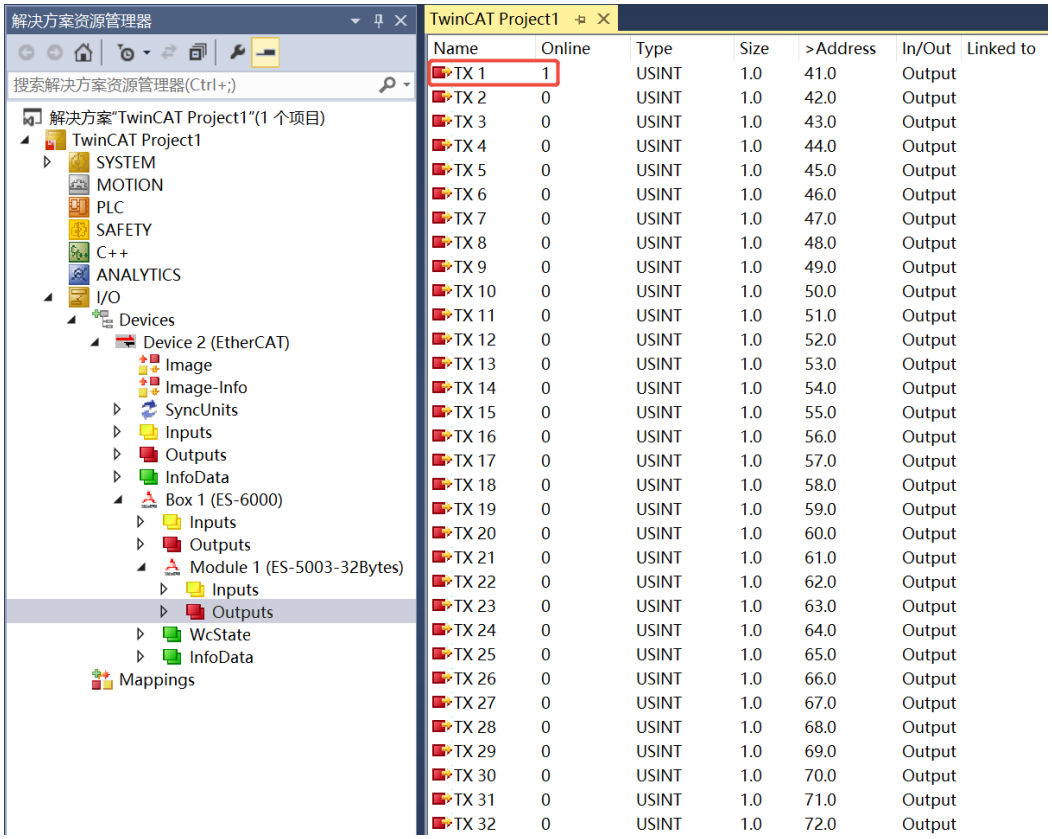
1. Configure the parameters and select the communication mode 7, which is the Freeport_Input mode, as shown in the figure below.

   - **Communication Mode**: Select Input.
   - **Control Mode**: Select **Level**.
   - **Node_1_Param_01**: Configure to 0x00000022. For details of configuration parameters, see Control and Status Node Code.
   - **Node_2_Param_01**: Configure to 0x00000D04. For details on configuration parameters, see Freeport function.

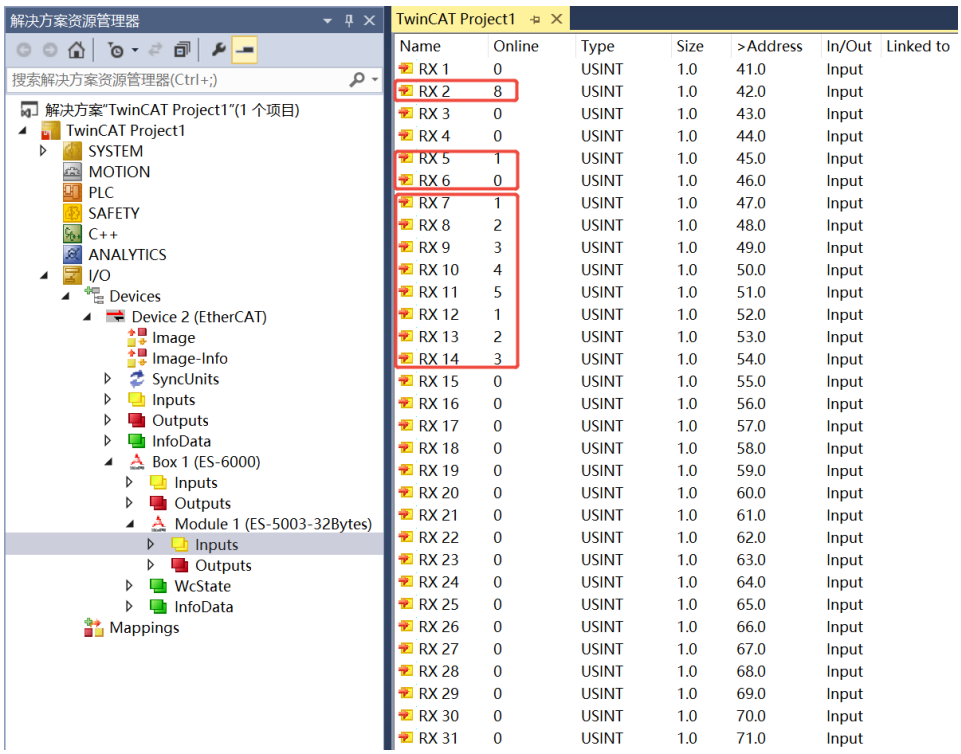




2. Set the control word to 1 in the download data, then open the serial port debugging assistant to send data.



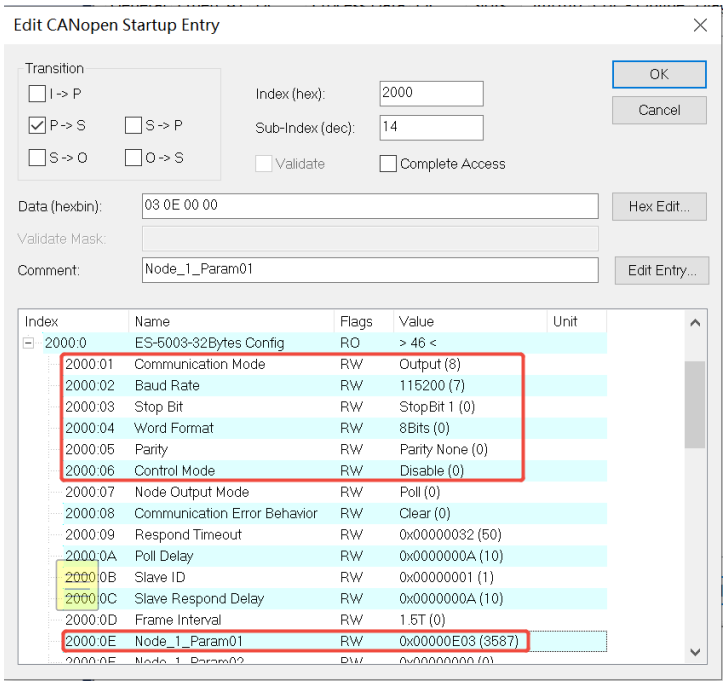
- From the uploaded data, you can see that the received data length is 8, data count is 1, and the 8 bytes of data (RX7 to RX14) are all displayed.



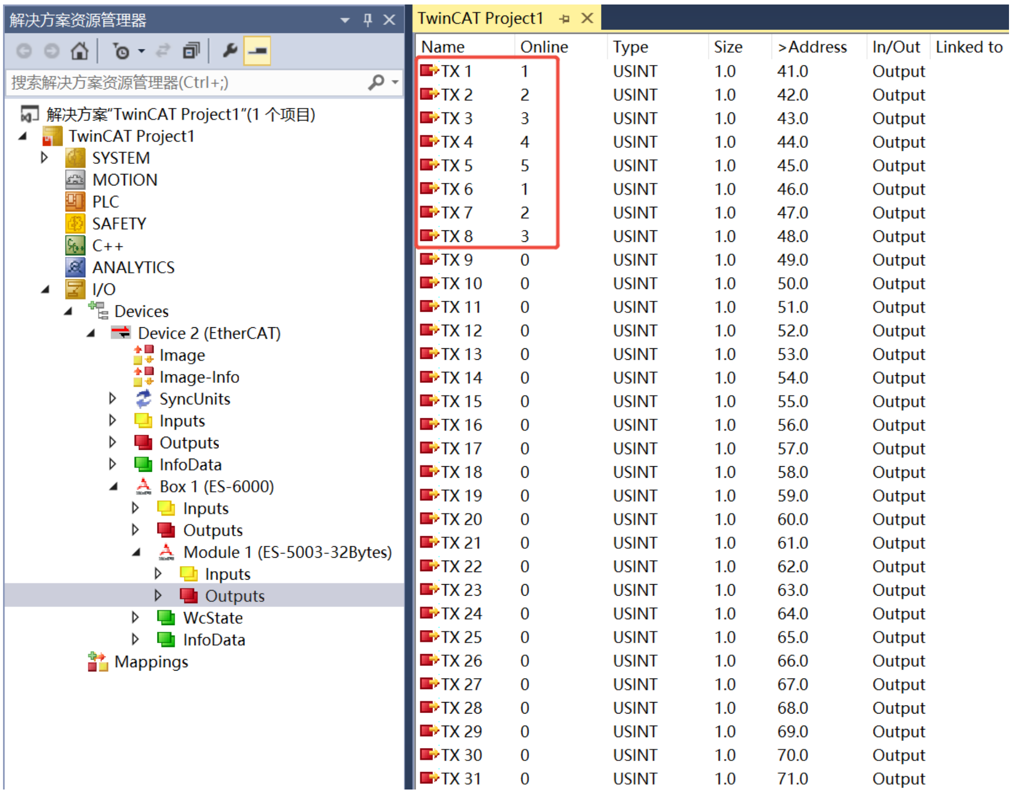
11.7 Freeport_Output Mode Function Example

Example: Use Freeport_Output to send 8 bytes of data in disabled mode through tools or devices such as the Serial Debug Assistant.

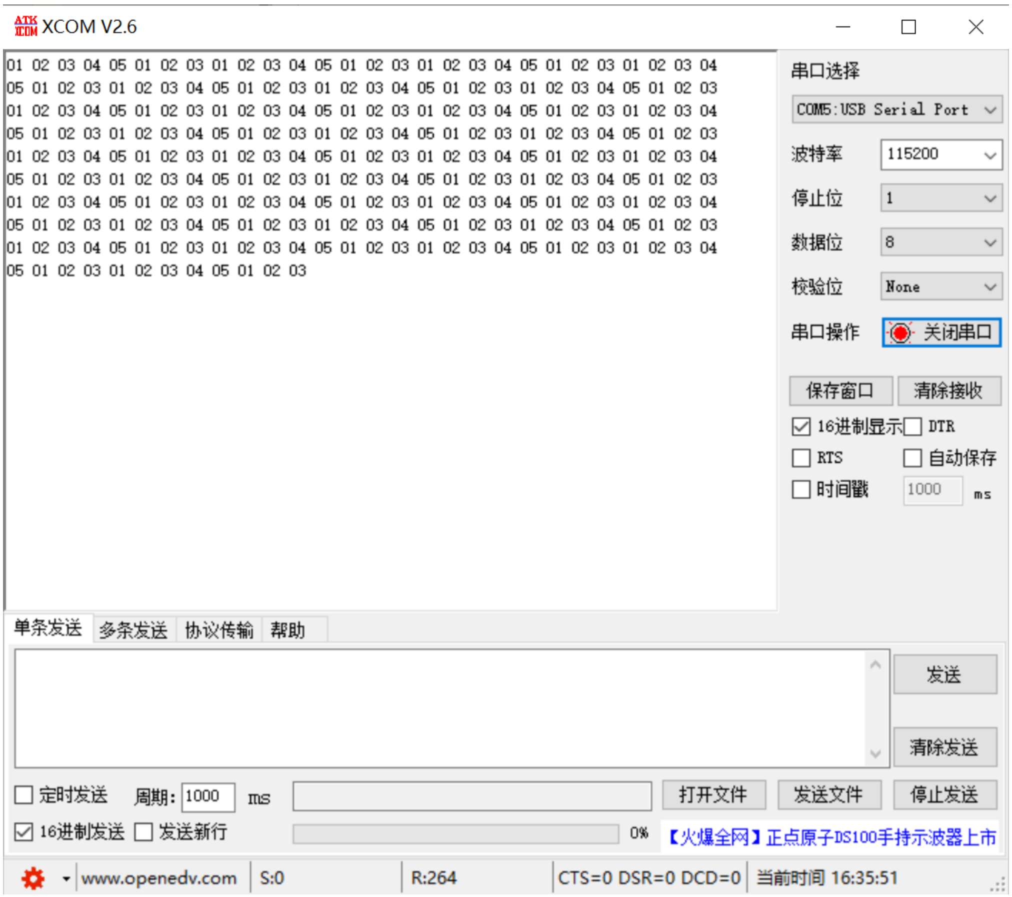
1. Configure the parameters and select the communication mode 8, which is the Freeport_Output mode, as shown in the figure below.
   - **Communication Mode**: Select Output.
   - **Control Mode**: Select **Disable**.
   - **Node_1_Param_01**: Configure to 0x00000E03. For details of configuration parameters, see Freeport function.



2. Configure the data to be sent in the download data.



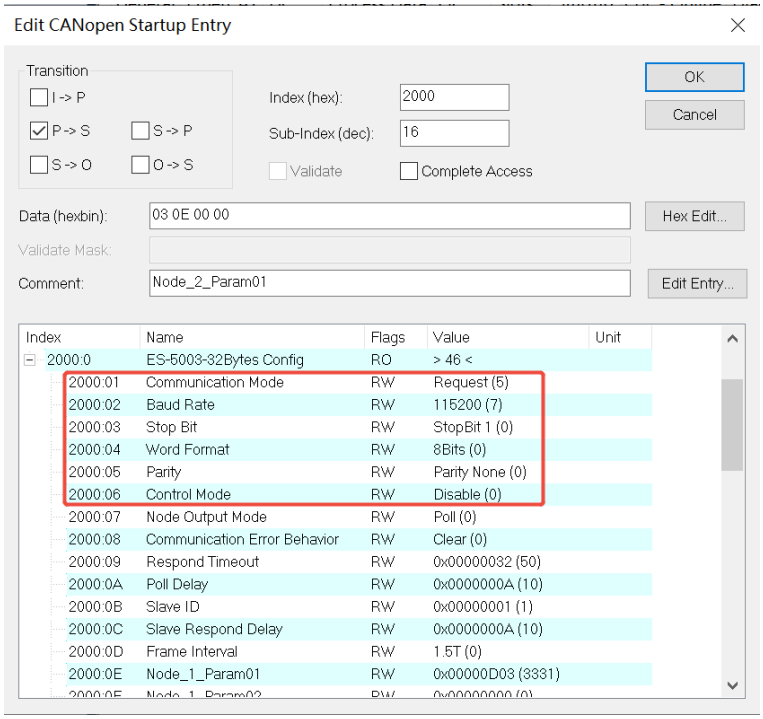
3. View the sent data through the serial port debugging assistant tool.

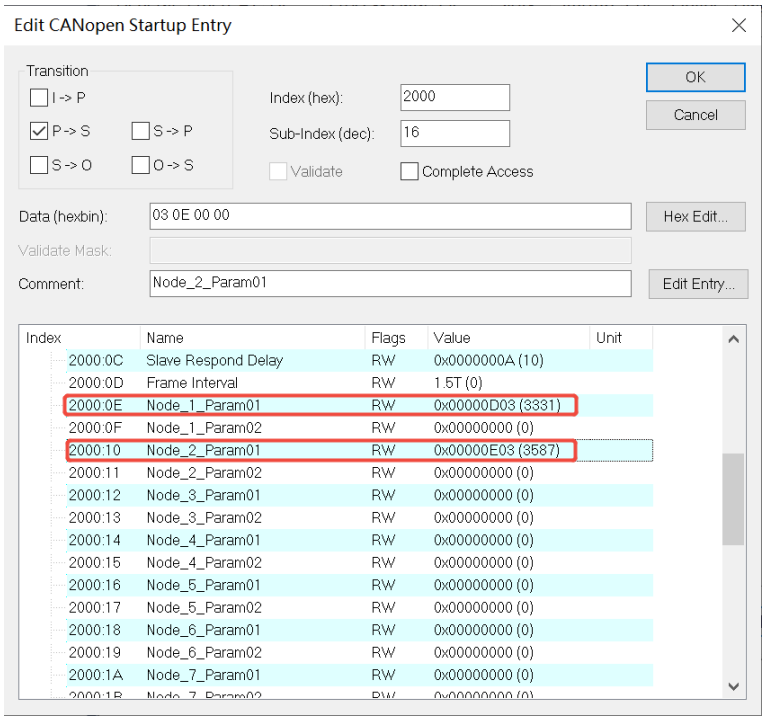


11.8 Freeport_Request Mode Function Example

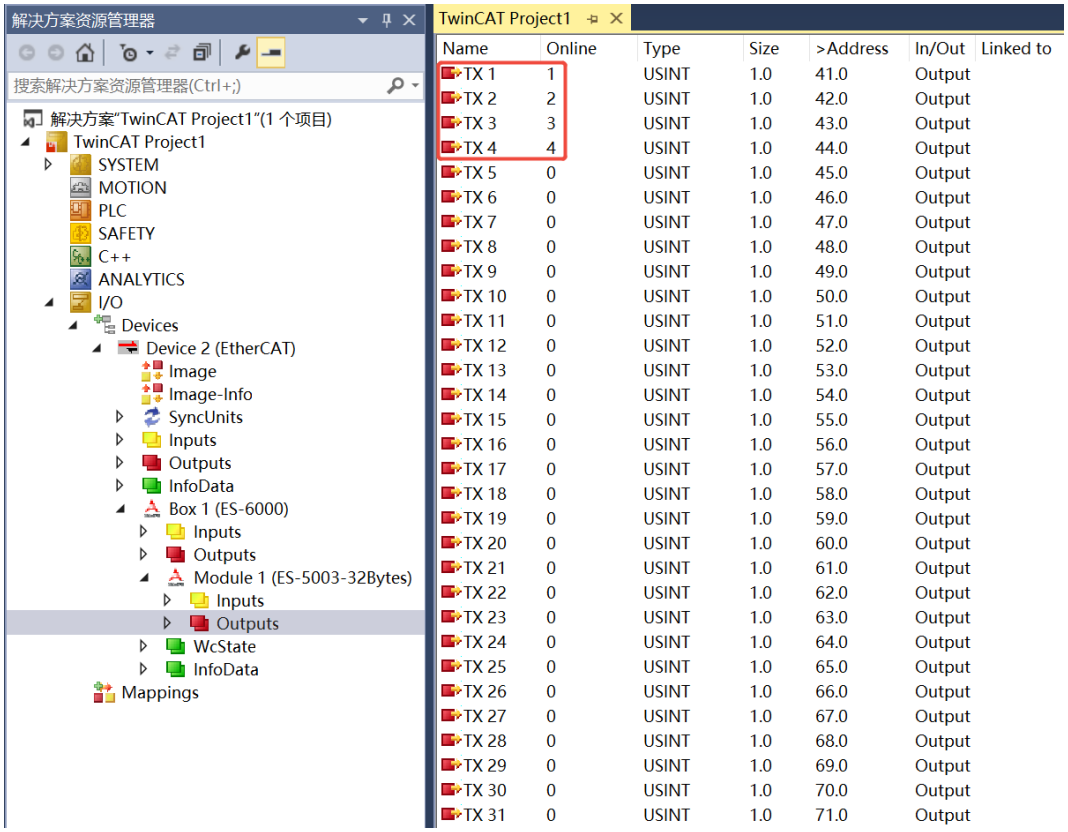
Example: Use Freeport_Request to send and receive 4 bytes of data in disabled mode through tools or devices such as the Serial Debug Assistant.

1. Configure the parameters and select the communication mode 5, which is the Freeport_Request mode, as shown in the figure below.
   - **Communication Mode**: Select Request.
   - **Control Mode**: Select **Disable**.
   - **Node_1_Param_01**: Configure to 0x00000D03. For details of configuration parameters, see Freeport function.
   - **Node_2_Param_01**: Configure to 0x00000E03. For details on configuration parameters, see Freeport function.

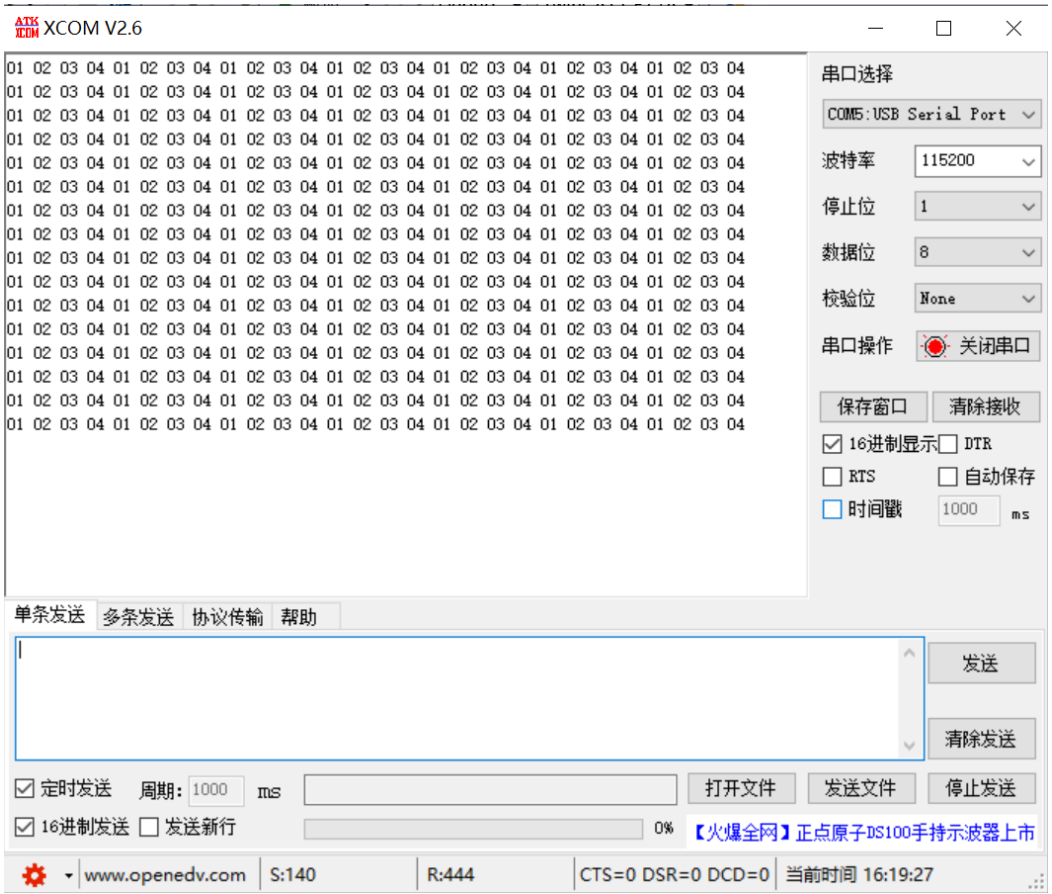




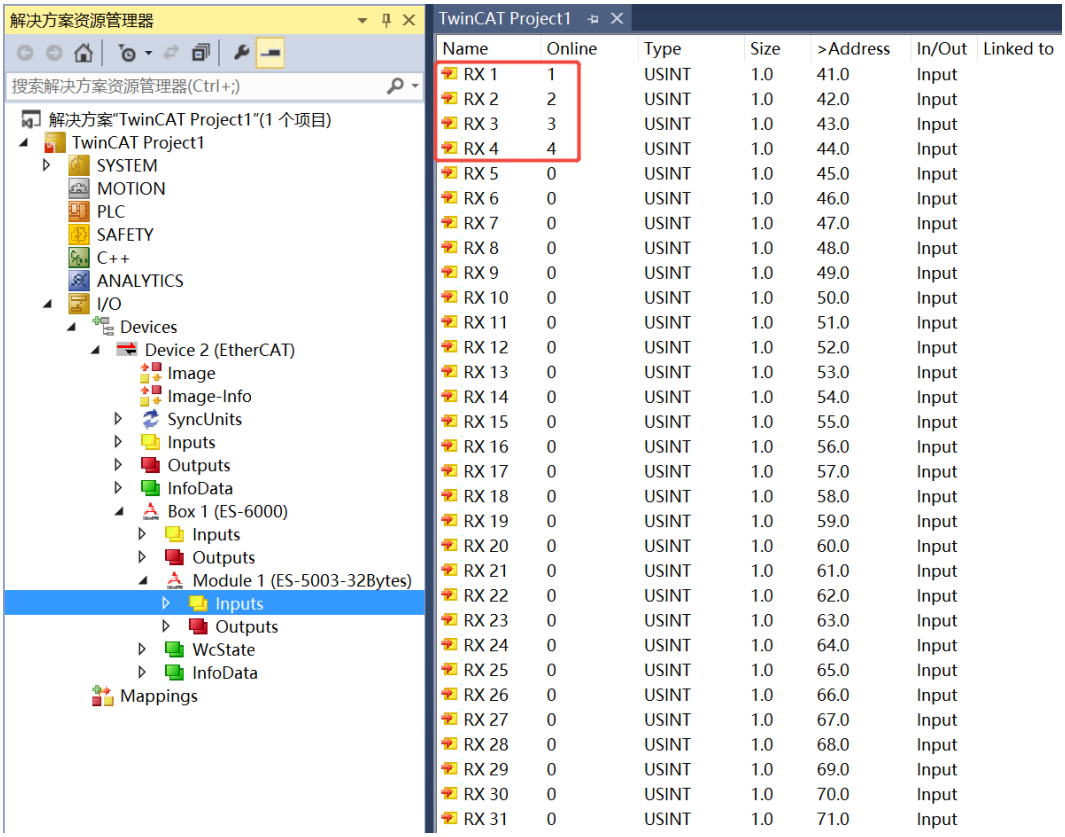
2. Configure the data has been downloaded .



3. View the sent data through the serial port debugging assistant tool.



4. Send 4 bytes of data through the serial port debugging assistant tool, and you can see the received 4 bytes of data (RX1~RX4) in the uploaded data.

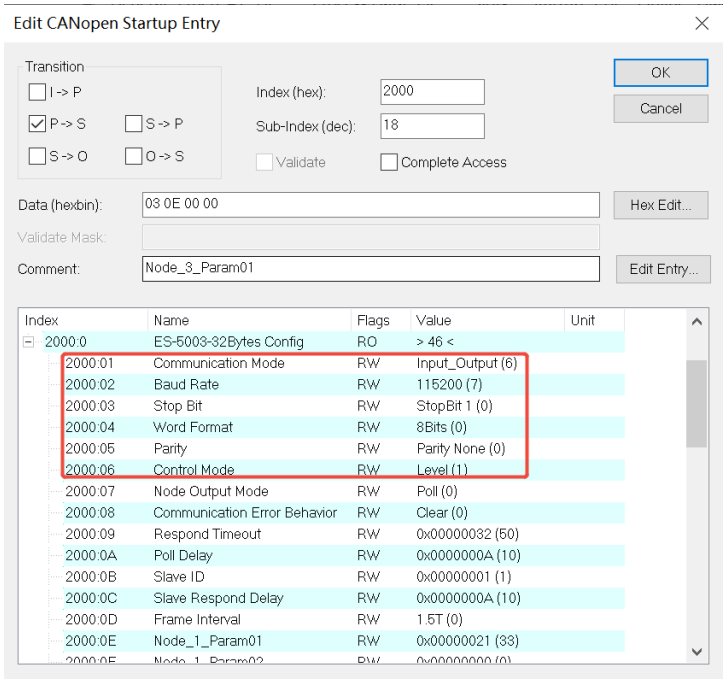


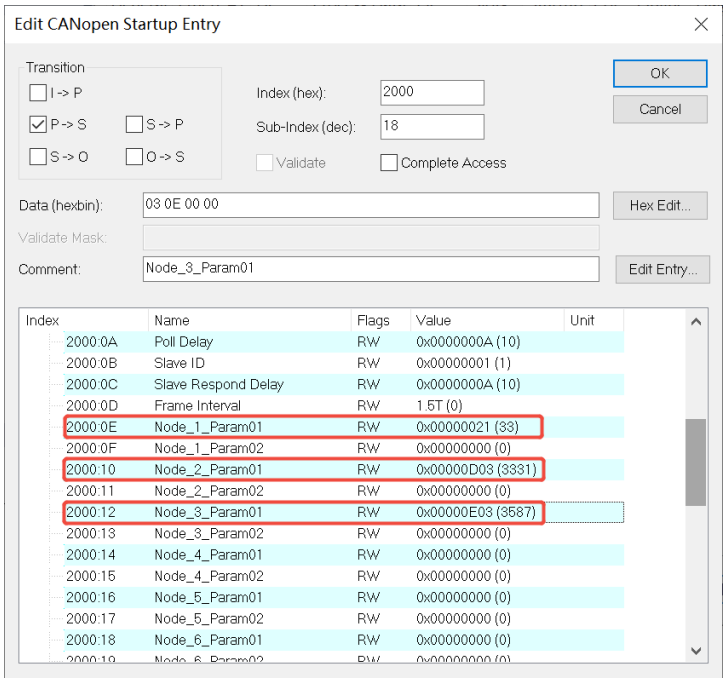
11.9 Freeport_Input_Output Mode Function Example

Example: Use Freeport_Input_Output to send and receive 4 bytes of data in Level mode through tools or devices such as the Serial Debug Assistant.

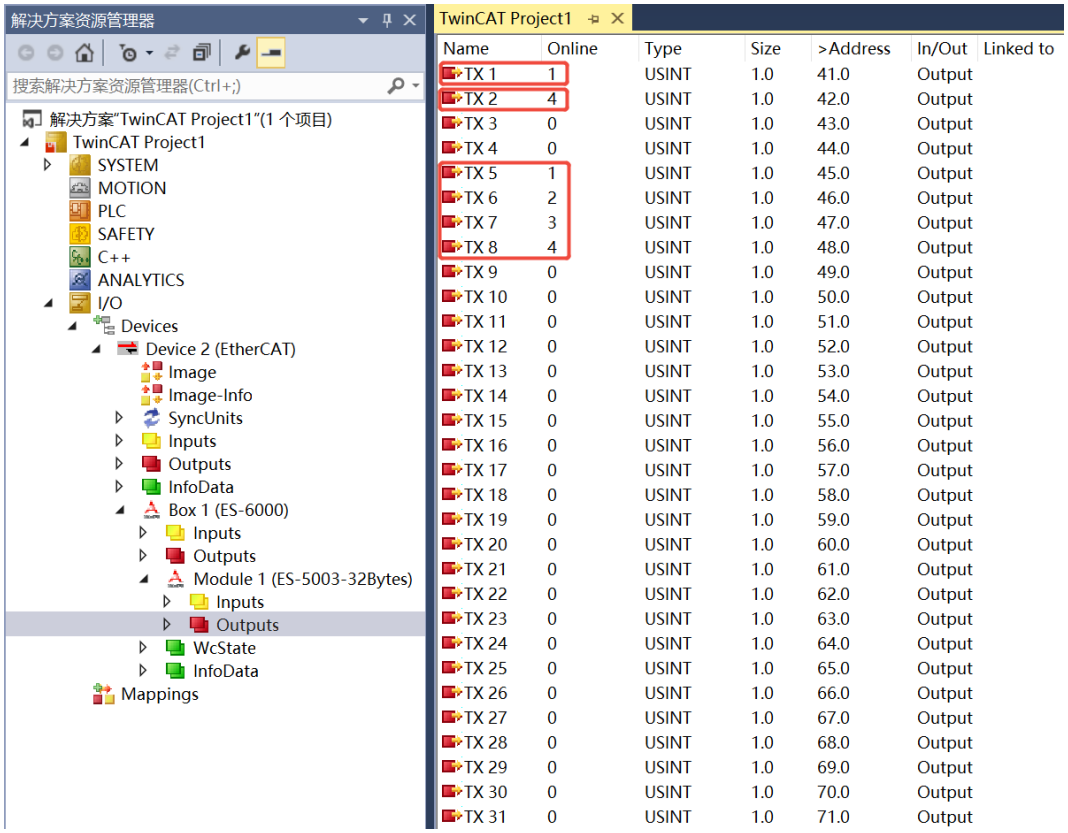
1. Configure the parameters and select the communication mode 6, which is the Freeport_Input_Output mode, as shown in the figure below.

   - **Communication Mode**: Select Input_Output.
   - **Control Mode**: Select **Level**.
   - **Node_1_Param_01**: Configure to 0x00000021. For details of configuration parameters, see Control and Status Node Code.
   - **Node_2_Param_01**: Configure to 0x00000D03. For details on configuration parameters, see Freeport function.
   - **Node_3_Param_01**: Configure to 0x00000E03. For details on configuration parameters, see Freeport function.

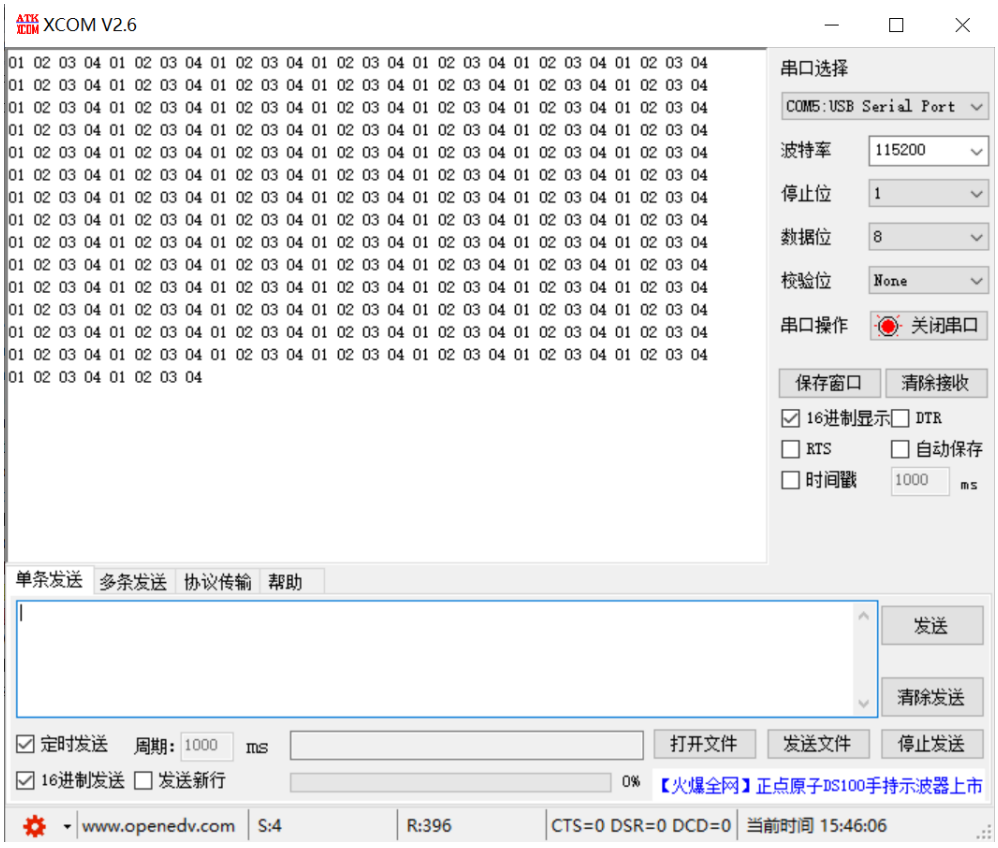




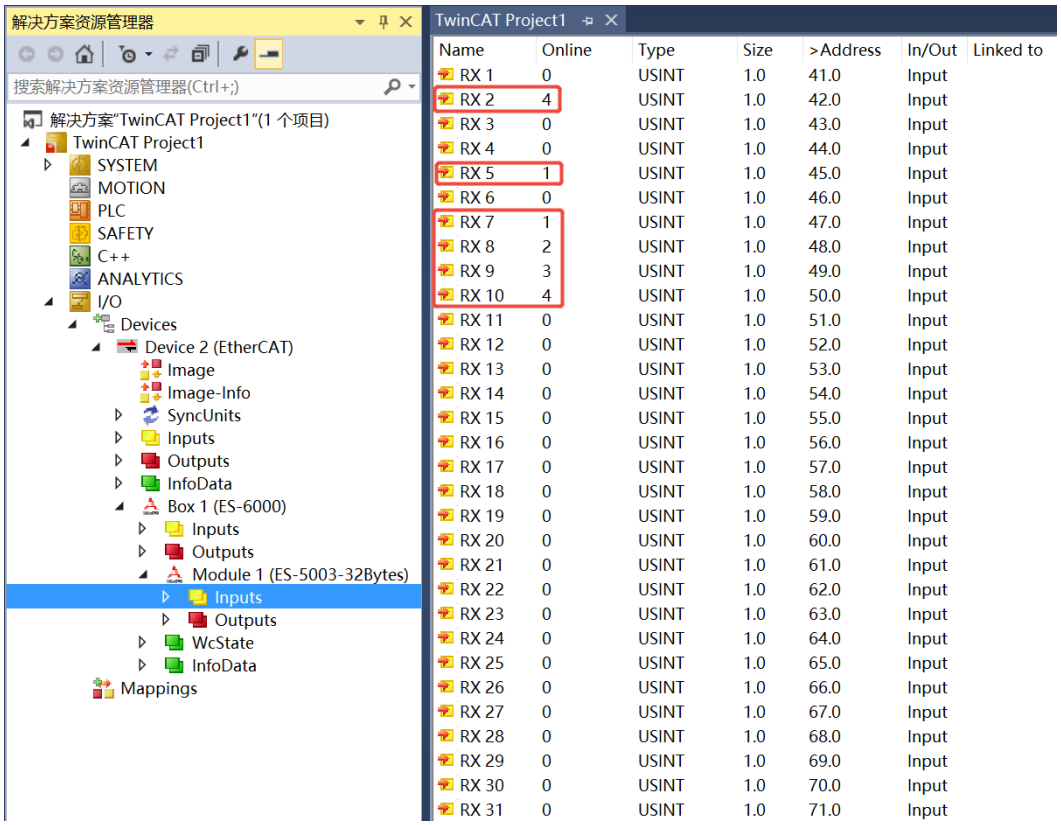
2. Configure the data that has been downloaded. The length of the sent data is 4 and the control word is set to 1.



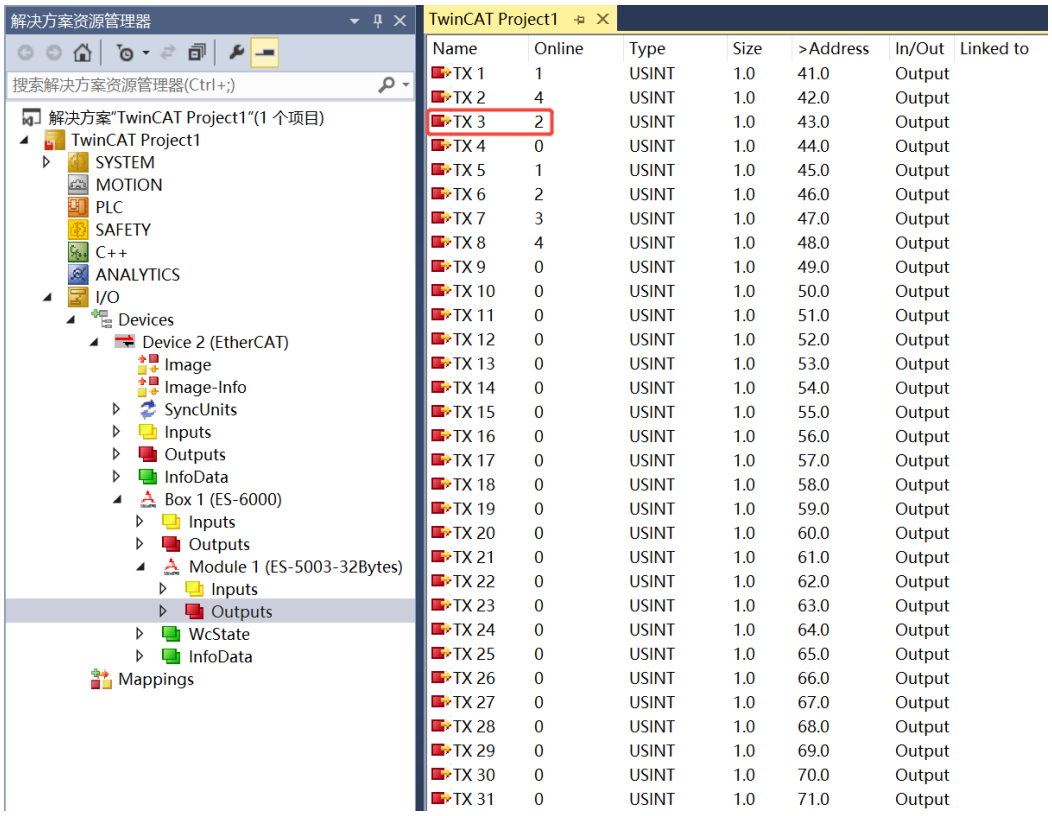
3. View the sent data through the serial port debugging assistant tool.



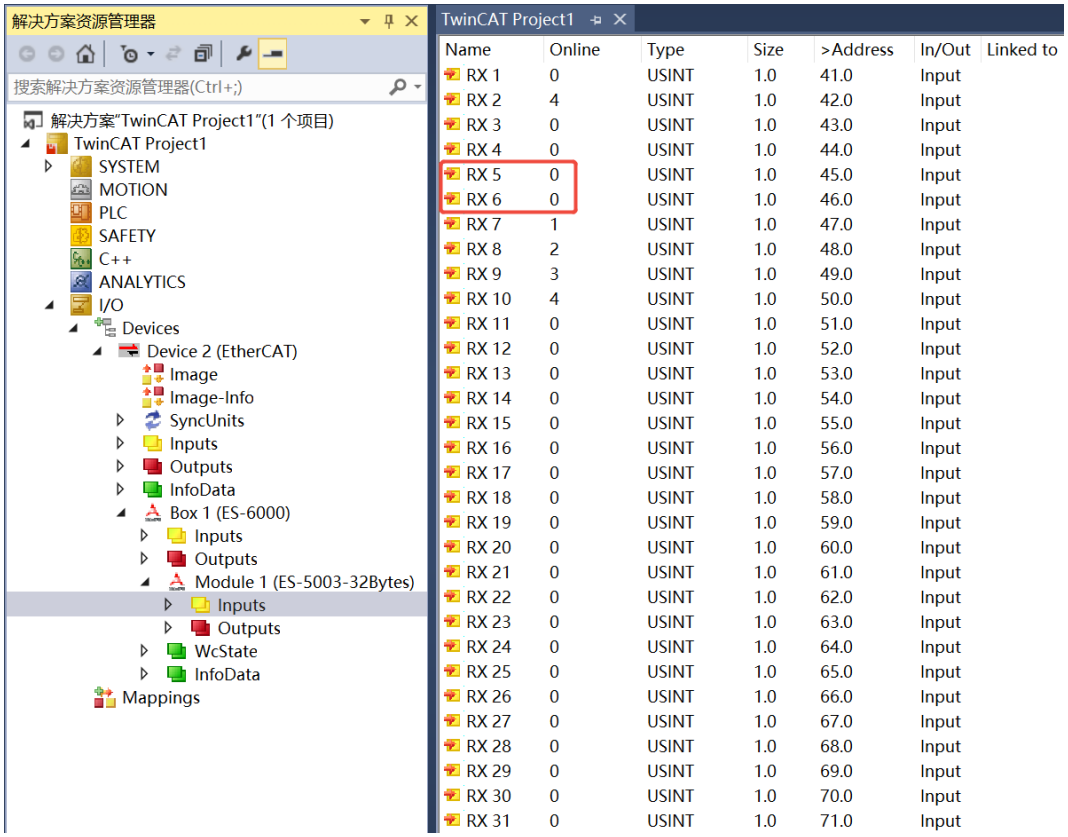
4. Send 4 bytes of data through the serial port debugging assistant tool. In the upload data, you can see that the received data length is 4, the data count (RX5~RX6), and the 4 bytes of data (RX7~RX10).



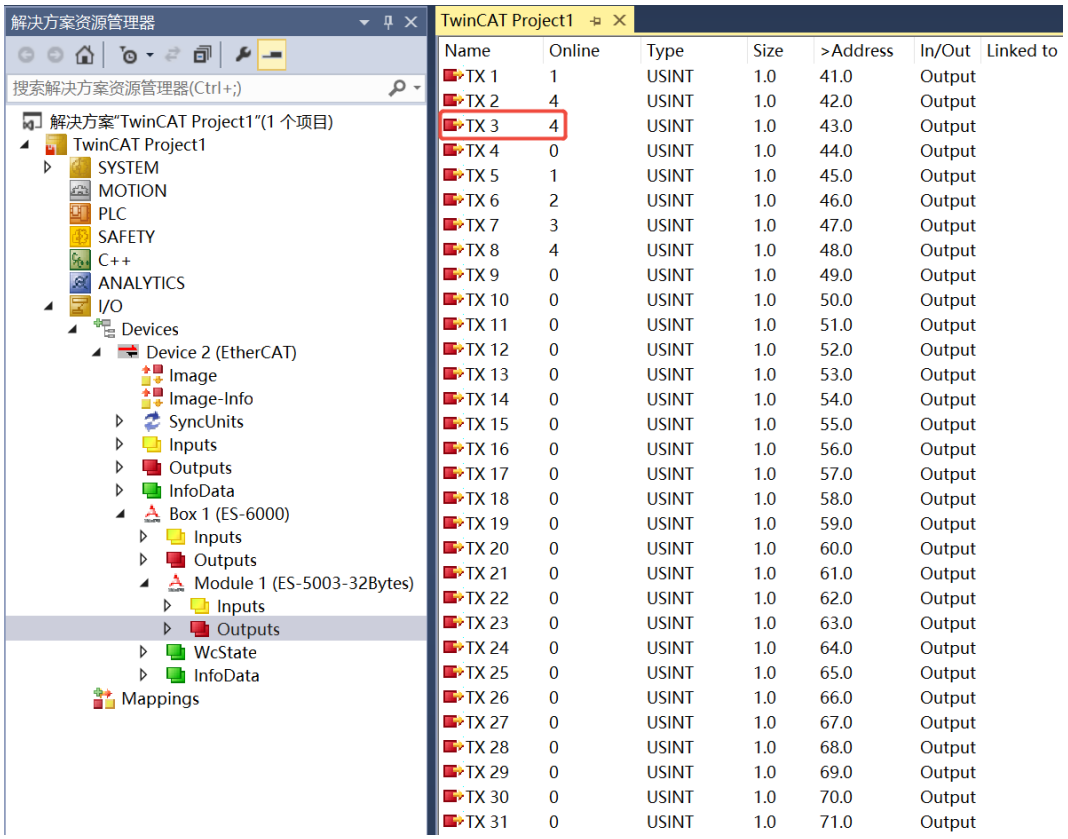
- In the downloaded data, the configuration count is cleared to 2.



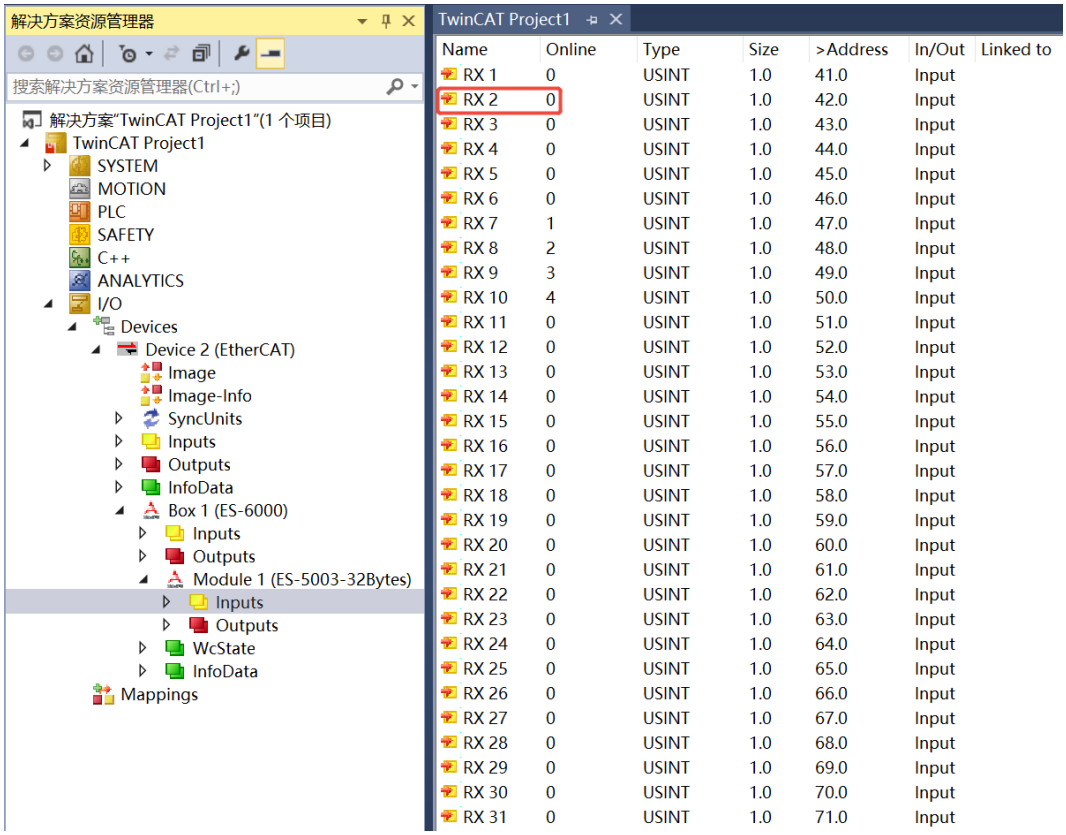
- You can see that the received data count is cleared to zero.



- In the downloaded data, the count is reset to 4.



- You can see that the received data length is cleared to zero.

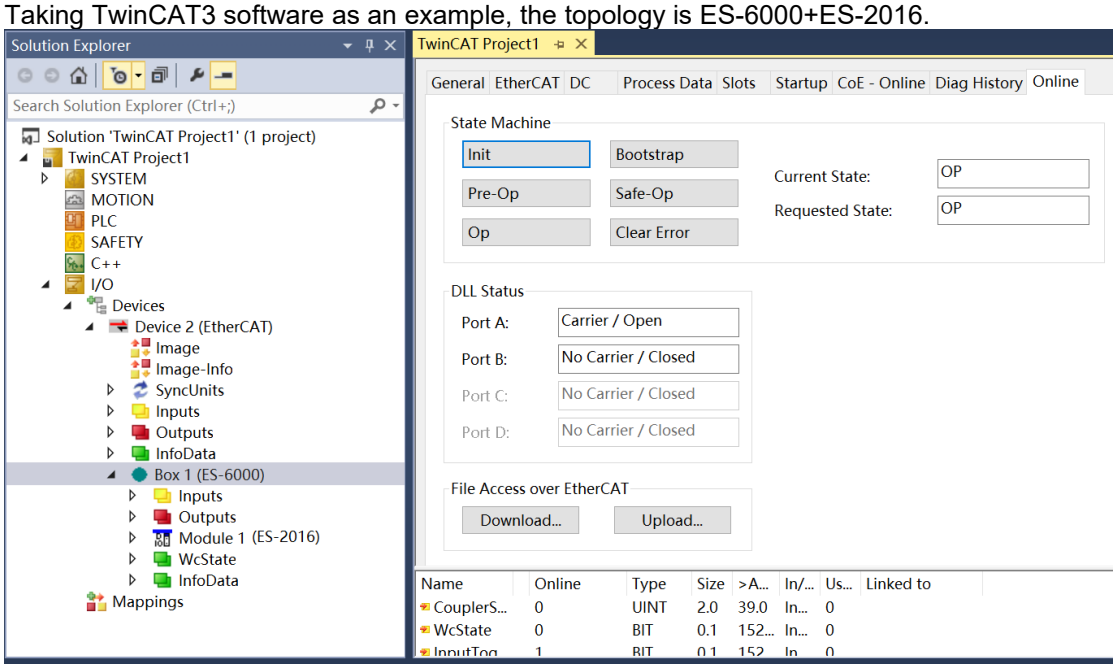


Name	Online	Type	Size	>Address	In/Out	Linked to
RX 1	0	USINT	1.0	41.0	Input	
RX 2	0	USINT	1.0	42.0	Input	
RX 3	0	USINT	1.0	43.0	Input	
RX 4	0	USINT	1.0	44.0	Input	
RX 5	0	USINT	1.0	45.0	Input	
RX 6	0	USINT	1.0	46.0	Input	
RX 7	1	USINT	1.0	47.0	Input	
RX 8	2	USINT	1.0	48.0	Input	
RX 9	3	USINT	1.0	49.0	Input	
RX 10	4	USINT	1.0	50.0	Input	
RX 11	0	USINT	1.0	51.0	Input	
RX 12	0	USINT	1.0	52.0	Input	
RX 13	0	USINT	1.0	53.0	Input	
RX 14	0	USINT	1.0	54.0	Input	
RX 15	0	USINT	1.0	55.0	Input	
RX 16	0	USINT	1.0	56.0	Input	
RX 17	0	USINT	1.0	57.0	Input	
RX 18	0	USINT	1.0	58.0	Input	
RX 19	0	USINT	1.0	59.0	Input	
RX 20	0	USINT	1.0	60.0	Input	
RX 21	0	USINT	1.0	61.0	Input	
RX 22	0	USINT	1.0	62.0	Input	
RX 23	0	USINT	1.0	63.0	Input	
RX 24	0	USINT	1.0	64.0	Input	
RX 25	0	USINT	1.0	65.0	Input	
RX 26	0	USINT	1.0	66.0	Input	
RX 27	0	USINT	1.0	67.0	Input	
RX 28	0	USINT	1.0	68.0	Input	
RX 29	0	USINT	1.0	69.0	Input	
RX 30	0	USINT	1.0	70.0	Input	
RX 31	0	USINT	1.0	71.0	Input	

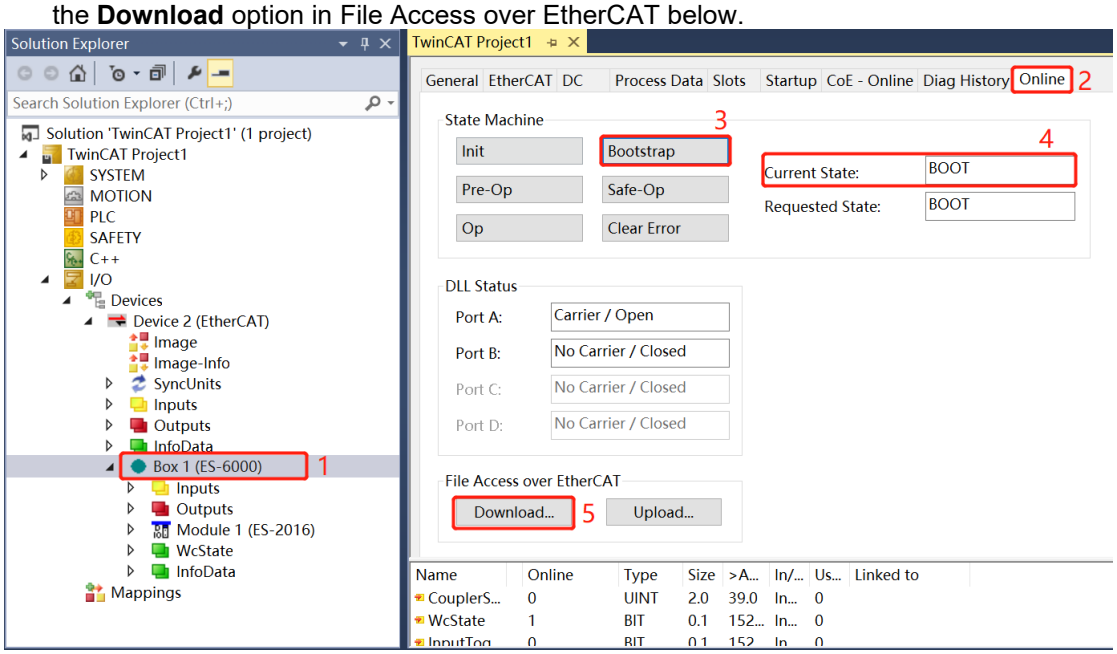
12 Appendix D – Firmware Online Upgrade

The ES system can directly update the firmware through FOE. Please refer to the following update steps.

Taking TwinCAT3 software as an example, the topology is ES-6000+ES-2016.



1. Click the coupler **ES-6000** in the left tree viewer, then click the **Online** option in the right menu. Next, click the **Bootstrap** option in the State Machine, wait until the Current State displays the **BOOT** status, and then click the **Download** option in File Access over EtherCAT below.

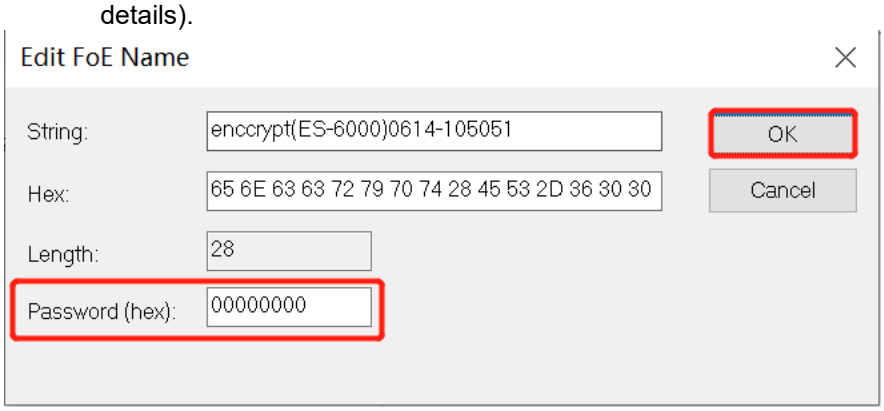


2. The open file window pops up, select the **All Files** option, select the bin file corresponding to the module to be upgraded, and click **Open**.

3. The setting window pops up; enter the password. A Password of “0” means upgrading the bus coupler. Click **OK** to upgrade, as shown in the figure below.

   Note: To upgrade the corresponding slave module, you need to fill in the corresponding station number in the password field.

   - For example, enter 1 when upgrading the ES-2016. After confirming the upgrade, observe the progress bar and module performance below to confirm whether the upgrade is successful (see the next step for details).



4. Successful upgrade process of different modules
   - EtherCAT coupler online upgrade:
     a. After the progress bar is full, the coupler EEP starts to flash at 10Hz (on for 50ms and off for 50ms);
     b. The EEP flashes from 10Hz to 1Hz, indicating a successful upgrade;
     c. After the online upgrade is successful, you need to manually switch to the OP state before the connection can be re-established;
     d. If you want to repeat the upgrade, you need to switch the OP state to BOOT state again.

   - I/O module online upgrade:
     a. After the progress bar is full, the coupler’s EEP and the RUN light of the module being upgraded start flashing at 10Hz (on for 50ms and off for 50ms);
     b. The RUN light of the module being upgraded changes from 10Hz to off, indicating that the upgrade is successful (after the upgrade is complete, it needs to be powered on and off again to connect normally);
     c. You can continue upgrading other modules without the interruption of power supply.

Safety Instructions

For user safety, please read and follow all instructions, Warnings, Cautions, and Notes marked in this manual and on the associated device before handling/operating the device, to avoid injury or damage.

S'il vous plaît prêter attention stricte à tous les avertissements et mises en garde figurant sur l'appareil , pour éviter des blessures ou des dommages.

- Read these safety instructions carefully.
- Keep the User's Manual for future reference.
- Read the Specifications section of this manual for detailed information on the recommended operating environment.
- The device can be operated at an ambient temperature of 50ºC.
- When installing/mounting or uninstalling/removing device; or when removal of a chassis cover is required for user servicing (See "Getting Started" on page 9.):
  - Turn off power and unplug any power cords/cables.
  - Reinstall all chassis covers before restoring power.
- To avoid electrical shock and/or damage to device:
  - Keep device away from water or liquid sources.
  - Keep device away from high heat or humidity.
  - Keep device properly ventilated (do not block or cover ventilation openings).
  - Always use recommended voltage and power source settings.
  - Always install and operate device near an easily accessible electrical outlet.
  - Secure the power cord (do not place any object on/over the power cord).
  - Only install/attach and operate device on stable surfaces and/or recommended mountings.
- If the device will not be used for long periods of time, turn off and unplug from its power source.
- Never attempt to repair the device, which should only be serviced by qualified technical personnel using suitable tools.
- A Lithium-type battery may be provided for uninterrupted backup or emergency power.

Risk of explosion if battery is replaced with one of an incorrect type; please dispose of used batteries appropriately.

Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.

- The device must be serviced by authorized technicians when:
  - The power cord or plug is damaged.
  - Liquid has entered the device interior.
  - The device has been exposed to high humidity and/or moisture.
  - The device is not functioning or does not function according to the User's Manual.
  - The device has been dropped and/or damaged and/or shows obvious signs of breakage.
- Disconnect the power supply cord before loosening the thumbscrews and always fasten the thumbscrews with a screwdriver before starting the system up.
- It is recommended that the device be installed only in a server room or computer room where access is:
  - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefore, and any precautions required.

- Only afforded by the use of a tool or lock and key, or other means of security, and controlled by the authority responsible for the location.

- If PoE (Power over Ethernet) is enabled for the device, the system can ONLY be deployed indoors. Unless otherwise noted, the PoE system is NOT designed to withstand the rigors of outdoor use.

	**BURN HAZARD** Touching this surface could result in bodily injury. To reduce risk, allow the surface to cool before touching. ***RISQUE DE BRÛLURES*** *Ne touchez pas cette surface, cela pourrait entraîner des blessures.*

Getting Services

Ask an Expert: https://www.adlinktech.com/en/Askanexpert

ADLINK Technology, Inc.
Address: No. 66, Huaya 1st Road, Guishan District
Taoyuan City 333, Taiwan
Tel: +886-3-216-5088
Fax: +886-3-328-5723
Email: service@adlinktech.com

Ampro ADLINK Technology, Inc.
Address: 6450 Via Del Oro, San Jose, CA 95119-1208, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-600-1189
Email: info@adlinktech.com

ADLINK Technology (China) Co., Ltd.
Address: 300 Fang Chun Rd., Zhangjiang Hi-Tech Park, Pudong New Area
Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5132-3588
Email: market@adlinktech.com

ADLINK Technology GmbH
Address: Hans-Thoma-Strasse 8-10, 68163 Mannheim, Germany
Tel: +49-621-43214-0
Fax: +49-621 43214-30
Email: emea@adlinktech.com

Please visit the Contact page at www.adlinktech.com for information on how to contact the ADLINK regional office nearest you.