COTRUST

CTH300-C series SP18 programmable logic controller manual

◎V1.00

COTRUST TECHNOLOGIES CO., LTD.

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Preface

Thank you for purchasing the CTH300 C57-103S2 and CTH3 C35-003S2 products of COTRUST Technology Co., Ltd.!

Before using CTH300 C57-103S2 and CTH3 C35-003S2, please read this manual carefully so that you can grasp the product's characteristics more clearly, apply it more safely, and make full use of the rich functions of this product.

Product Features

The CTH300 C57-103S2 and CTH3 C35-003S2 motion controllers can cooperate with a variety of expansion modules or units to form a powerful programmable logic controller system. The system meets the control needs of high-end OEM equipment and small and medium-sized engineering projects. Features such as precision, intelligence and ease of use, strong communication interconnection capabilities, and medium I/O scale. Compared with the previous CTH300-H PLCs, CTH300 C57-103S2 and CTH3 C35-003S2 motion controllers inherited their advantages while adding digital input, high-speed counters and other functions, greatly improving the performance of COTRUST's medium-sized PLCs.

Suitable

This manual is designed for engineers, installers, maintenance personnel and electricians with common sense of automation. Provide installation and debugging information about CTH300 C57-103S2 and CTH3 C35-003S2 motion controllers.

Service support

COTRUST Technology Co., Ltd. has established an after-sales maintenance service center and provides telephone hotline services. When customers encounter problems during the use of the product, they can contact the service support at any time. Please go to https://www.co-trust.com/Company/Contact/index.html to obtain the service support hotlines in various regions. In addition, customers can also keep up to date with the latest product developments and download required technical documents through the website of Technology https://www.co-trust.com or official WeChat.

Version History

Release date	Versions	Revision
Jan. 2024	V1.00	• First Release

Contents

Product Overview

1

1.1 Introduction to PLC

CTH3 C35-003S2: CODESYS-SP18 version programming environment, EtherNET × 1. EtherNET/EtherCAT × 1. CANopen × 1. RS485 × 2. USB × 1. 32MB program data space, supporting visual WebVisu, EtherNet/IP master station, Modbus (RTU/TCP) master-slave official authorization, cascading, and dual independent IP, supports OPC UA slaves.

CTH3 C57-103S2: CODESYS-SP18 version programming environment, PLC native comes with 10 channels of DI, 6 channels of high-speed counters, EtherNET × 1. EtherCAT × 1. CANopen/RS485 × 1. USB × 1. 32MB program data space, supporting visual WebVisu, EtherNet/IP master station, Modbus (RTU/TCP) master-slave official authorization, and dual independent IP. Supports OPC UA slaves, Supports softmotion and CNC.

1.1.1 PLC appearance

The appearance of CTH3 C35-003S2 is shown as follows.

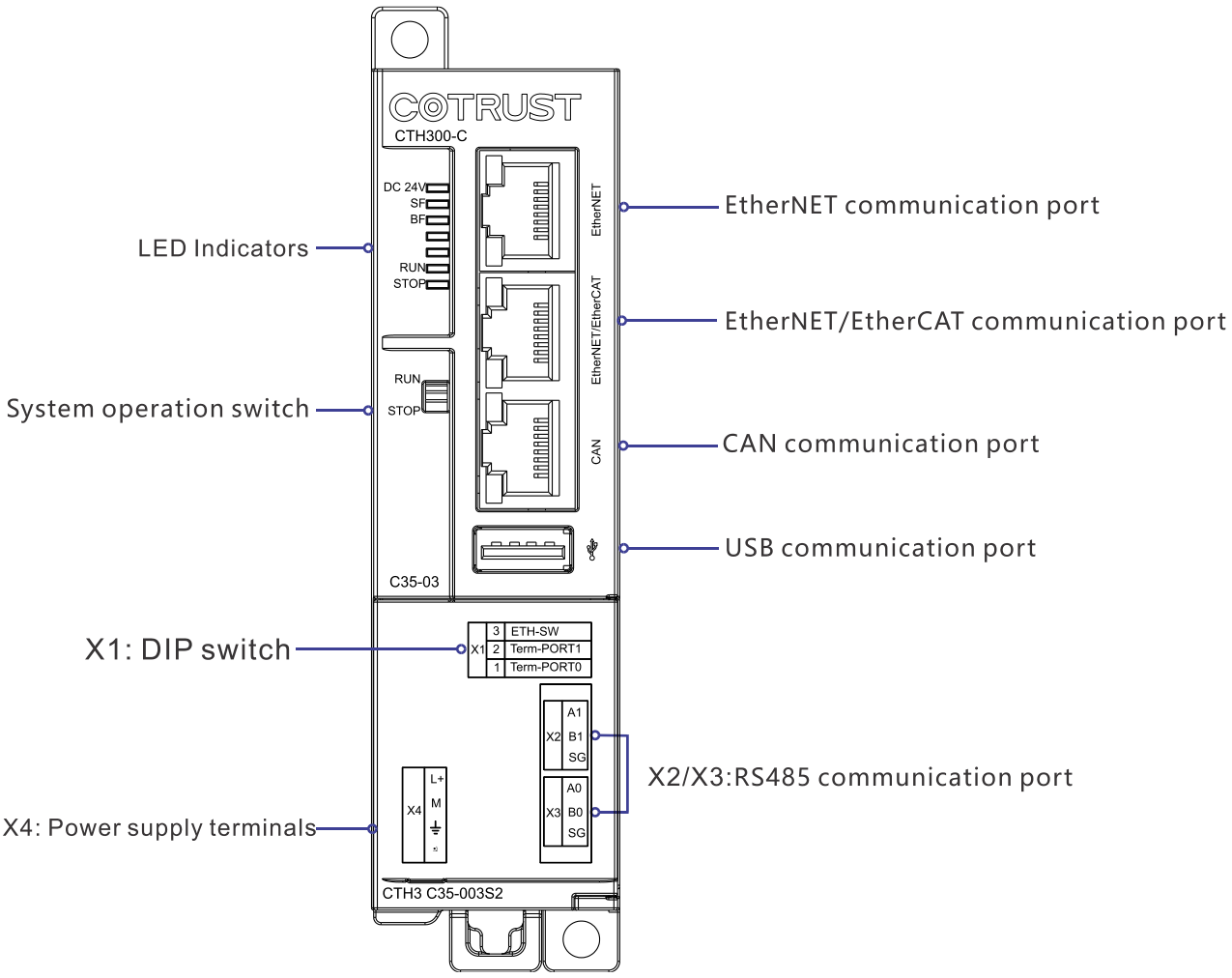


Figure 1-1 CTH3 C35-003S2 Appearance Interface Diagram

The appearance of CTH3 C57-103S2 is shown as follows.

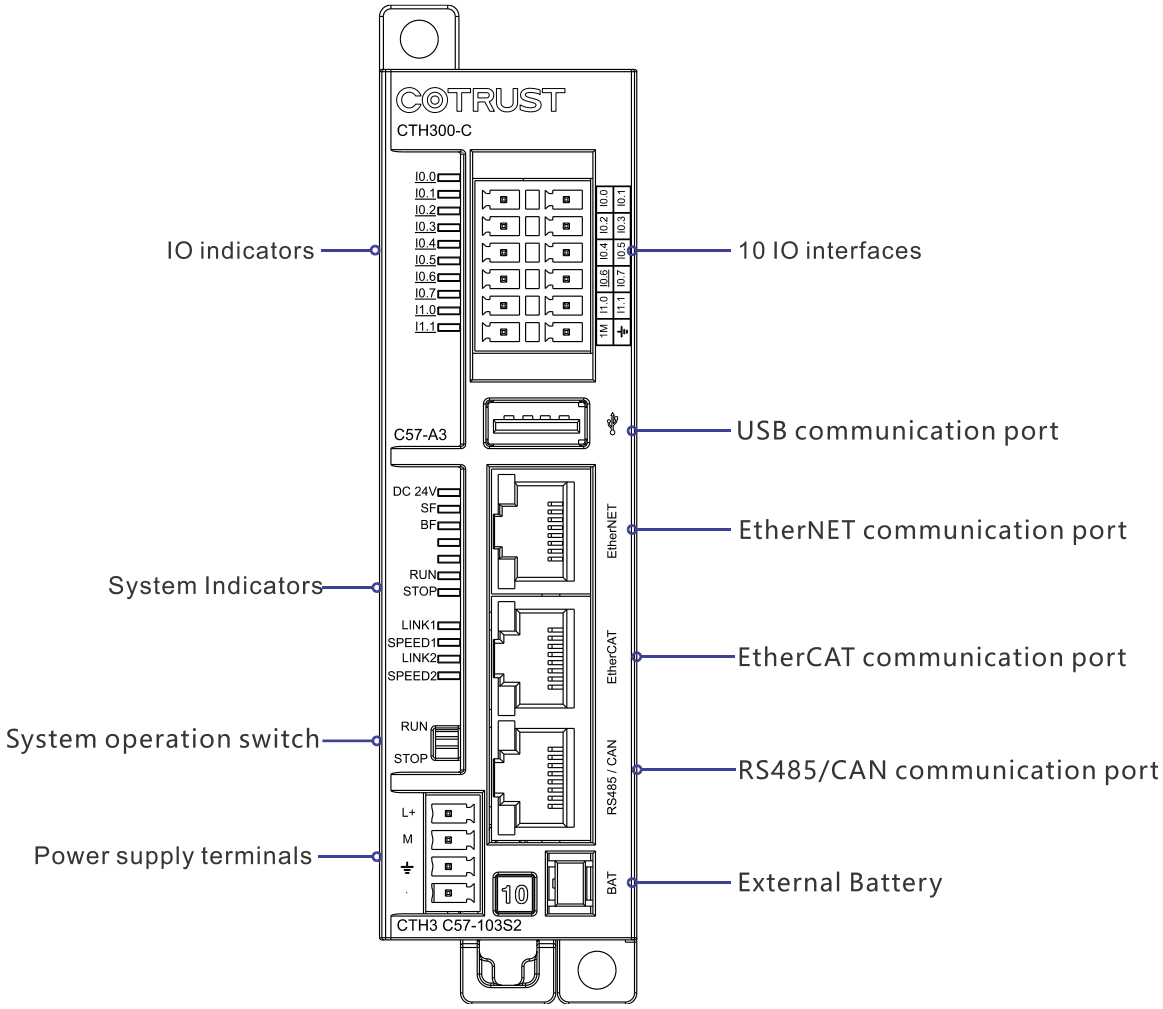


Figure 1-2 CTH3 C57-103S2 External Interface Diagram

1.1.2 PLC specification parameters

Table 1-1 General Specifications

Product Model	**CTH3 C35-003S2**	**CTH3 C57-103S2**
Dimension(W×H×D)	34×115×101.6 mm	
Consumption	19.2W	
Memory		
User Program Space	32MB	
Power Down Hold		
Holding space for power down	Total 64KB, divided into. Memory 1 (32KB): RETAIN (reserved variables) inside GVL global variables. Memory 2 (32KB): PersistentVars	
System Clock	Power-down retention time is about 112 hours (typical) with a monthly deviation of <60s, the CTH3 C57-103S2 can be connected to an external battery, and the power-down retention time is more than 2 years after the external battery is connected to the CTH3 C57-103S2 (typical).	

Product Model		CTH3 C35-003S2	CTH3 C57-103S2
Power characteristics			
Rated input voltage		24V DC	
Input voltage range		20.4V~28.8V DC	
Input Current		0.8A	
Reverse polarity protection		YES	
Bus power supply voltage		+5V DC	
Bus power current		1.6A	
Isolation		Isolation between external power supply and system power supply	
LED indicator characteristics			
24V power	Green	ON: with 24VDC. OFF: without 24VDC	
SF	Red	ON: system error. OFF: No error	
BF	Red	ON: BUS error. OFF: No error	
RUN	Green	ON: system running. OFF: The system stops running	
STOP	Orange	ON: The system stops running. OFF: system running	
RJ45	Green	ON: connect. OFF: not connect	
	Yellow	ON: 100Mbps. OFF: 10Mbps	
CAN	Green	Data Receive indicator	
	Yellow	Data transmission indicator	
Network port communication indicator(Supported by CTH3 C57-103S2 only)			
Link1	Green	ON: connect. OFF: not connect	
SPEED1	Yellow	ON: 100Mbps. OFF: 10Mbps	
Link2	Green	ON: connect. OFF: not connect	
SPEED2	Yellow	ON: 100Mbps. OFF: 10Mbps	
I0.0~I1.1	Green	ON: Signal input. OFF: No signal input	
Protective function			
Power protection		Reverse connection protection and surge absorption on power supply side	
Interface protection		Lightning protection for communication ports	
Extended I/O capability			
Number of INT-00 racks supported by 1 CPU		4	
Maximum number of modules per rack		Master Racks: 11 (Power Modules, CPUs, Intermediate expansion module 8 Signal Modules),	

Product Model	CTH3 C35-003S2	CTH3 C57-103S2
	Slave Racks: 10 (Power Modules, Intermediate expansion module, 8 Signal Modules)	
Number of EtherCAT slaves supported by 1 CPU	Maximum 128	
Number of modules supported per EtherCAT slave	Supports up to 8 modules	
Isolation		
Power Isolation	Isolation between external power supply and system power supply	
Communication Isolation	Ethernet, RS485 Isolation, CAN Isolation	
Programming software		
Programming software package	CODESYS V3.5 SP18 Path5	
Programming language	Programming language according to IEC 61131-3: CFC, FBD, LD, IL, ST, SFC	
Bit instruction execution speed	0.015us	
Motion Controller Functions		
Motion controller functions	--	Softmotion and CNC

Table 1-2 Communication port specifications

Product Model	CTH3 C35-003S2	CTH3 C57-103S2
EtherNET communication port		
Communication interface	2 Ethernet ports, one of which is common to EtherNET/EtherCAT	1 Ethernet ports
Protocol type	Support 1 EtherNet/IP master. Support 1 Modbus TCP communication, can do Modbus TCP master and slave at the same time, socket, visualisation WebVisu.	
Maximum cable length per section	100m	
Maximum number of connections to a station	EtherNet/IP master supports up to 64 slave connections. When Modbus TCP is used as master, it supports up to 32 slaves. When Modbus TCP is used as slave, it supports up to 32 masters, and the maximum number of socket connections is 1000.	
User data	The EtherNet/IP master supports up to 1400 bytes of data read/write per connection with a minimum cycle time (RPI) of 5ms. Modbus TCP master supports up to 240 bytes of data read/write for a single connection, with a minimum cycle time (RPI) of 1ms. Socket single frame data 512 bytes, can be sent in multiple frames, the minimum cyclic communication cycle according to the programme scanning planning.	
Baud	10/100Mbps Adaptive	
Isolation	Communication port isolation	

Product Model	CTH3 C35-003S2	CTH3 C57-103S2
EtherCAT communication port (CTH3 C35-003S2 as an Ethernet port can be set IP. To achieve cascade (switch function), need to dial code 3 to 1. CTH3 C57-103S2 can configure IP by command or software)		
Communication Interface	1 EtherCAT interface	
Maximum number of stations	Each master supports up to 128 slaves.	
Protocol type	EtherCAT interface protocol	
Supported Functions	Supports distributed clock configuration, startup parameter configuration, configuration of PDO parameters and mapping, configuration of bus cycle times	
Maximum cable length per section	100m	
Baud rate	10/100Mbps Adaptive	
Isolation	Communication port isolation	
RS485 communications port		
Communication Interface	2 RS485 communication ports	1 RS485 communication ports
Maximum number of stations	Each master supports up to 32 Modbus RTU slaves	
Protocol type	Modbus master/slave protocol	
Modbus baud rate	1200, 4800, 9600, 19200, 38400, 57600, 115200bps	
Isolation	Communication port isolation	
CANopen communications port		
Communication Interface	1 CAN communication master interface	
Maximum number of slaves	Up to 32 slaves can be connected to the back of a master station	
Protocol type	CANopen DS301 standard protocol	
Supported Functions	Automatic startup of CANopen Manager	
	Optional slave polling	
	Start slave	
	NMT	
	Synchronised production	
	Synchronised consumption	
	Heartbeat generation	
	Activation Time Creation	

transmission rate （Kbit/s）	1000	800	500	250	125	50	20

Product Model	**CTH3 C35-003S2**				**CTH3 C57-103S2**		
Maximum length（m）	25	50	100	250	500	1000	2500
Isolation	Communication port isolation						
USB interface	USB main device interface, update firmware, download program						

1.1.3 CTH3 C57-103S2 CPU Input Functions

The CTH3 C57-103S2 comes with 10 digital inputs, and its input characteristics are shown in the table below.

Table 1-3 CTH3 C57-103S2 Digital Input Characteristics

Digital Input Characteristics		
Native integrated IO number		10
Input type		Drain/source
Rated voltage		24V DC
Input voltage range		20.4~28.8V DC
Surge voltage		35V DC, continue 0.5s
Logic 1 signal (minimum) Logic 0 signal (maximum)		15 VDC, 2.5mA 5 VDC, 1mA
Connect 2-wire proximity switch sensor (BERO)		1mA (Maximum allowable leakage current)
Input filter		Configurable, support.2us, 0.4us, 0.8us, 1.6us, 3.2us, 6.4us, 12.8us, 0.2ms, 0.4ms, 0.8ms, 1.6ms, 3.2ms, 6.4ms, 12.8ms, default 6.4ms.
Isolation (field and logic) Isolation group		500V AC, 1 minute See wiring diagram
Simultaneously connected inputs		10
Maximum cable length Shield Unshielded		500m(Standard input) 50m(High speed counter input) 300m(Standard input)
High speed counter input characteristics		
Pulse capture input		10
High speed counter	total	6
	single phase	6×500kHz
	double-phase	4×250kHz

Table 1-4 When the CTH3 C57-103S2 local input is used as a high-speed counter, the input points and counting modes of the high-speed counter are as follows

Mode	**High speed counter**	**Description**		
	HSC0	I0.0	I0.1	I0.2

	HSC1	I0.3	I0.4	I0.5
	HSC2	I0.6	I0.7	--
	HSC3	I1.0	I1.1	--
	HSC4	I0.2	--	--
	HSC5	I0.5	--	--
0	Single phase counter with internal directional control	clock	--	--
1		clock	--	reset
2		The counting mode is not supported		
3	Single phase counter with external directional control	clock	direction	--
4		clock	direction	reset
5		The counting mode is not supported		
6	Two phase counter with increase/decrease counting clock	up clock	down clock	--
7		up clock	down clock	reset
8		The counting mode is not supported		
9	A/B phase orthogonal counter	clock A	clock B	--
10		clock A	clock B	reset
11		The counting mode is not supported		

For specific usage of CTH3 C57-103S2 local IO, please refer to Native IO used as normal input in section 4.1.

1.1.4 PLC interface definition

The local IO input wiring of CTH3 C57-103S2 is as follows:

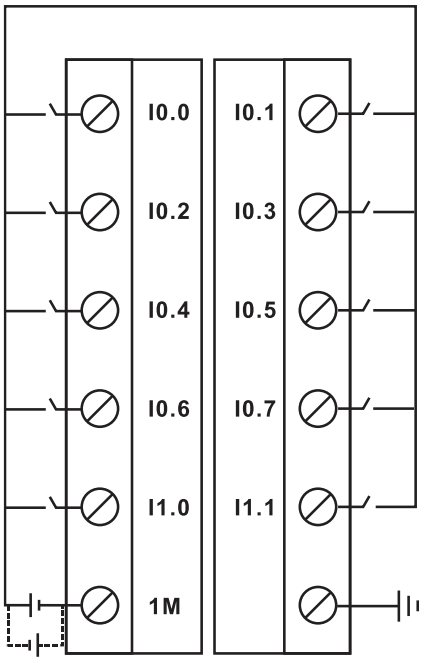


Table 1-5 Definition of power interface

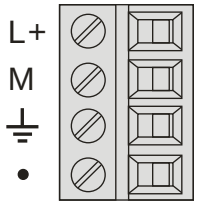
Removable terminals	Symbol	Description
	L+	24V +
	M	24V -
	⏚	ground
	--	--

Table1-6 EtherNET/EtherCAT interface definition

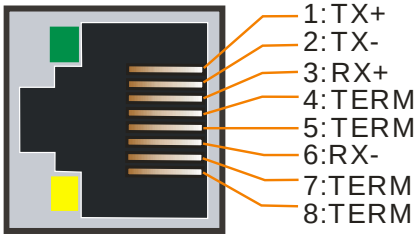
Dual network port interface	NO.	Symbol	Description
	1	TX+	Data send+
	2	TX-	Data send -
	3	RX+	Data receive+
	4	TERM	--
	5	TERM	--
	6	RX-	Data receive-
	7	TERM	-
	8	TERM	-
	shell	PE	shell ground
Green Indicator	As EtherNET/EtherCAT connection status indication		
Yellow Indicator	as EtherNET/EtherCAT speed status indication		

Table 1-7 RS485/CAN communication interface definition

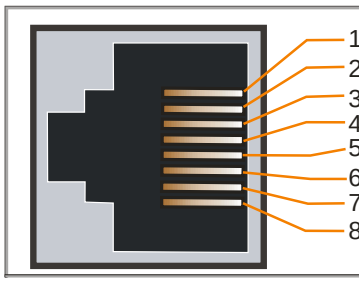
Interface	NO.	Symbol	Description
	1	CAN_H	Data send+
	2	CAN_L	Data send -
	3	--	--
	4	A0	RS485 Signal A
	5	B0	RS485 Signal B
	6	--	--
	7	CAN_GND	CAN/RS485 signal ground
	8	--	--
	connector shell	PE	shell ground

Table 1-8 RS485 terminal definitions

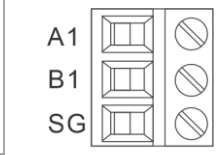
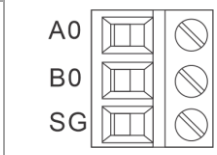
Removable terminals		signal	Description
X2		A1	PORT1 interface RS485 signal B
		B1	PORT1 interface RS485 signal A
		SG	PORT1 interface RS485 signal ground
X3		A0	PORT0 interface RS485 signal B
		B0	PORT0 interface RS485 signal A
		SG	PORT0 interface RS485 signal ground

Table 1-9 System Operation Switch Dial Definitions

System operation switch	Symbol	Direction	Condition
	RUN	UP	system running
	STOP	DOWN	system stop

Table 1-10 DIP Switch (X1) Dial Code Definitions

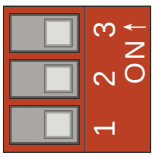
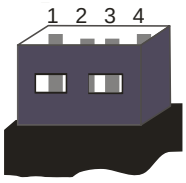
DIP switch (X1)	NO.	Symbol	Description
	3	ETH-SW	EtherNET switch ON: Switch function. OFF: EtherCAT function
	2	Term-PORT1	Terminating Resistor Switch 2 (PORT1) ON: With terminating resistor OFF: Without terminating resistor
	1	Term-PORT0	Terminating resistor switch 1 (PORT0) ON: With terminating resistor. OFF: Without terminating resistor

Table 1-11 USB interface definition

USB interface	NO.	Symbol	Description
	1	V_BUS	+5V power supply
	2	Data-	-
	3	Data+	-
	4	GND	Ground

1.1.5 System architecture

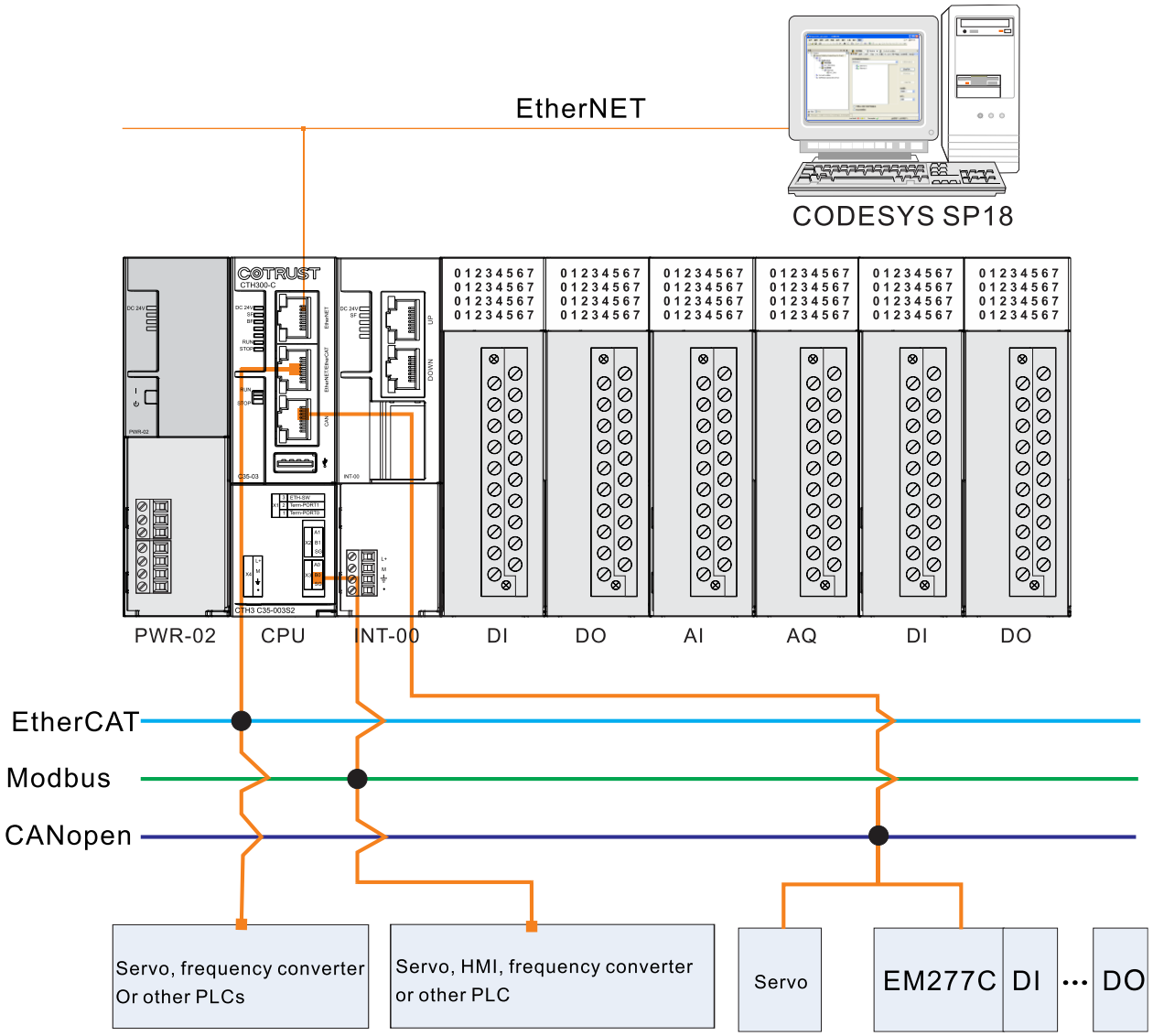


Figure 1-3 CTH3 C35-003S2 Network Architecture Diagram

1.1.6 Data memory

Table 1-12 Memory Regions

Area	Description	Size	Addressing Example
I	Input zones (physical inputs driven through inputs)	32KB	%QX3.5 and %Q3.5: address 3 of the input area, bit 5
Q	Output area (physical outputs driven through outputs)	32KB	%QB2: Address 2 of the output area, 1 byte
M	Memory area	512KB	%MD30: Address 30 in the memory area, double word

Syntax: %<range prefix><length prefix><number|. Number|. Numbers .... >

1.2 Installation

The PLC can be fixed through mounting holes or DIN clips.

1.2.1 Installation considerations

The PLC must be installed with the following precautions.

❒ Separate the CTH3 C35-003S2 from heating devices, high voltage and electrical noise.

When installing equipment, always separate equipment that generates high voltage and electrical noise from low-voltage electronic equipment such as the CTH3 C35-003S2.

When arranging the CTH3 C35-003S2 on the back panel of the control cabinet, consideration should be given to placing the electronics in a lower temperature area of the control cabinet. Prolonged exposure of the electronics to high temperatures will shorten their failure time.

Consider the backplane wiring of the control cabinet, and avoid designing AC power supply lines, high-energy DC signal lines with high switching frequency, low-voltage signal lines, and communication cables in the same raceway as much as possible.

❒ Appropriate space for heat dissipation and wiring

The CTH3 C35-003S2 is designed for natural convection cooling, and at least 80mm of space must be left on the top and bottom of the module for proper heat dissipation.

Attention
The maximum permissible ambient temperature is 10°C lower in vertical mounting than in horizontal mounting, and the CPU should be mounted underneath all expansion modules.

When installing the CTH3 C35-003S2, allow sufficient space for wiring and connecting communication cables.

The figure below shows the CTH3 C35-003S2 mounted in several racks, showing the spacing between the racks and neighbouring components, cable ducts and cabinets. The minimum distance between the bottom of the shielded connecting elements and the cable duct is 40 mm when wiring the module via the cable duct.

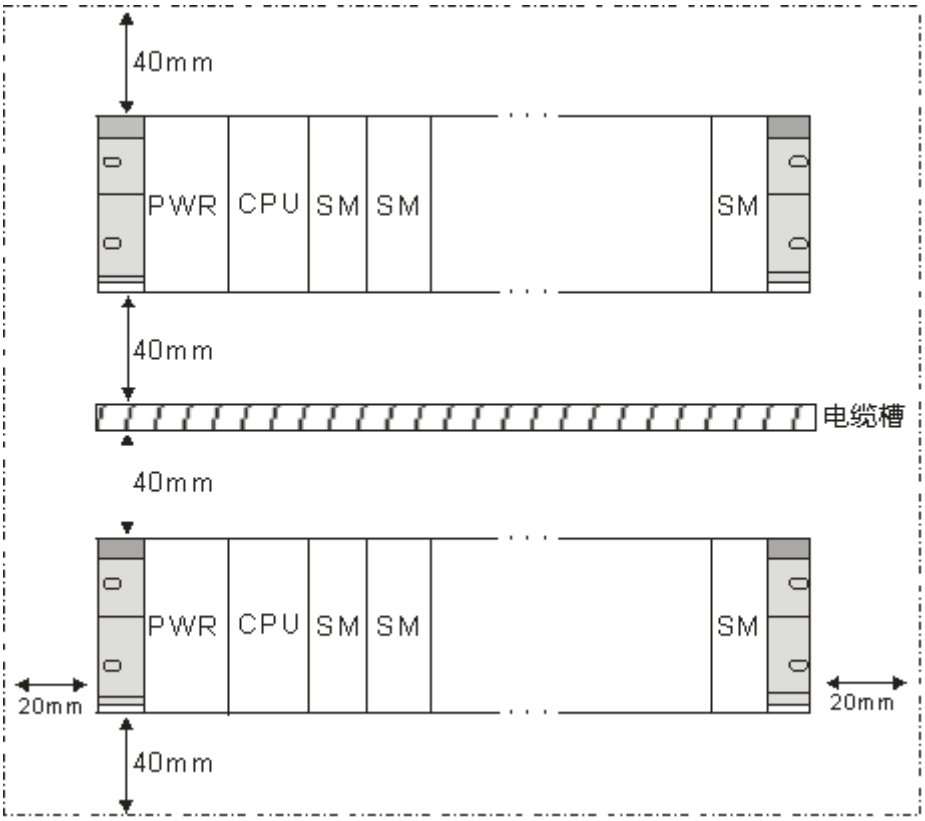


Figure 1-4 Installation Schematic

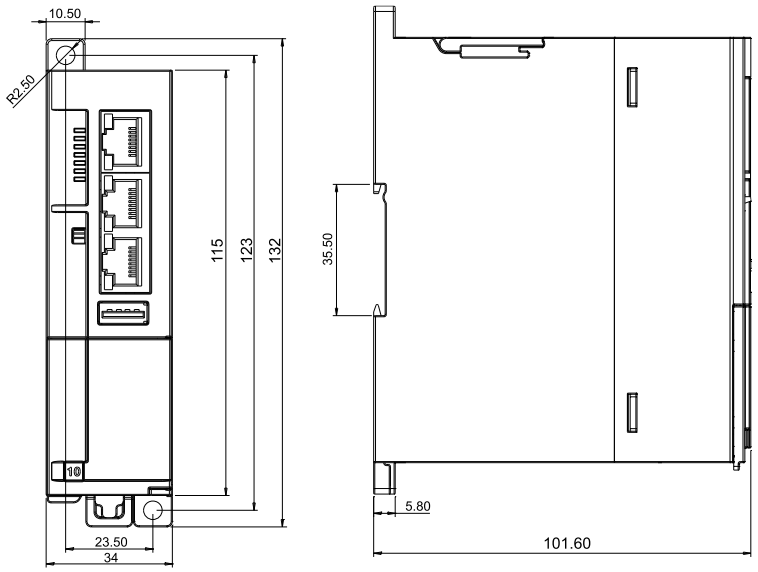
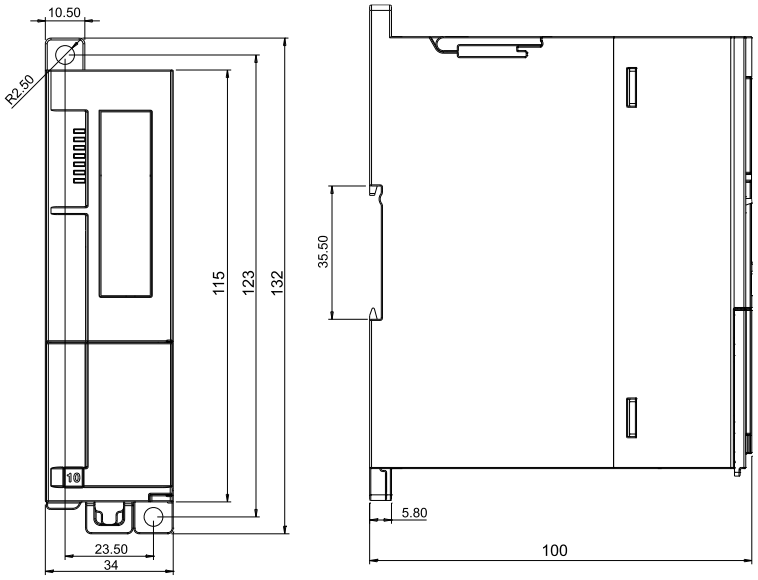
❒ Power Budget

Internal bus voltage is 5VDC, and current is supplied by the CPU (when no intermediate expansion module is present) or by the intermediate expansion module. The sum of the expansion module bus current consumption in each rack must not exceed the maximum bus current allowed by the CPU or intermediate expansion Module.

1.2.2 Installation dimensions

The CTH3 C35-003S2 and its expansion modules have mounting holes for easy installation on the backplane, and the mounting dimensions of each module are shown in the table below.

Table 1-13 Module Mounting Dimensions

Model	Dimensions (Unit: mm)
CTH3 C35-003S2, CTH3 C57-103S2, CTH3 ECT-000S1, CTH3 INT-000S1 CTH3 PWR-020S1, CTH3 HSP-040S1, CTH3 HSP-040S2	
CTH3 HSC-020S1, CTH3 DIT-080S1 CTH3 DIT-160S1, CTH3 DIT-320S1 CTH3 DIT-320S2, CTH3 DQT-080S1 CTH3 DQT-160S1, CTH3 DQT-320S1 CTH3 DQT-320S2, CTH3 DQR-080S1 CTH3 DQR-160S1, CTH3 AIS-040S1 CTH3 AMS-060S1, CTH3 AIV-080S1 CTH3 AIC-080S1, CTH3 AQS-040S1 CTH3 AQS-080S1, CTH3 AQS-080S2 CTH3 AIT-040S1, CTH3 AIT-080S1 CTH3 AIR-040S1, CTH3 AIR-080S1 CTH3 AIR-080S2	

1.2.3 Using racks

When expanding more modules, you can add one intermediate expansion module behind the PLC, connect to the next intermediate expansion module through the network cable, each intermediate expansion module can be configured with a power supply module, 8 expansion modules.

The complete assembly of the four racks is shown below.

If you want to arrange the modules in more than one rack, please note the following.

• The intermediate expansion module always uses slot 3 (slot 1: PWR power supply. slot 2: CPU. slot 3: intermediate expansion module)

• It is always located on the left side until the first signalling module is inserted.

• The number of modules installed in each rack is limited to eight.

• The number of modules is limited by the permissible current consumption on the CTH3 C35-003S2 bus. The cumulative power consumption per rack must not exceed 1.6A.

1.2.4 Grounding and wiring

CTH3 C35-003S2 PLC Grounding and Wiring Guide

Proper grounding and wiring of all electrical equipment is essential to ensure that your system has optimum operating characteristics and provides better protection against electrical noise.

Before grounding and wiring, it is important to ensure that the power to the equipment is disconnected, as well as the power to the equipment associated with the equipment.

When wiring the PLC and its associated equipment, ensure that all valid electrical coding rules are followed. Install and operate all equipment in accordance with all valid national or regional standards. Contact your local authorities to determine which standards meet your particular needs.

Warning

Attempting to ground or wire while energised may result in death or serious personal injury and equipment damage.

When designing the grounding and wiring of PLC systems, safety factors must be considered, otherwise it may cause equipment malfunction. You should comply with all safety regulations to avoid personal injury and equipment damage.

Warning

Controlling the device may cause misoperation of the device it controls. This kind of misoperation may lead to death or serious personal injury and equipment damage. Therefore, the system must have independent emergency stop functions, electromechanical interlocks, or other redundant safety facilities from the PLC.

1.2.5 Installation

❒ Prerequisite

When installing and disassembling PLC and its related equipment, appropriate safety measures must be taken in advance and the power supply must be confirmed to be cut off.

When replacing or installing a PLC, it is important to ensure that the correct or equivalent module is used. In addition to using the same module, it is also important to ensure that the installation direction and position are correct.

Take care

If incorrect modules are installed, the PLC program may produce incorrect functions.

If the same module is not used to replace the PLC in the same direction and order, it may lead to death or serious personal injury and equipment damage.

❒ Installation method

PLC can be installed on the back panel of the control cabinet or on standard DIN rails, either horizontally or vertically. The CPU and power module should always be installed on the left or bottom during installation.

❒ Installation and Removal

Install or remove the PLC as follows.

● Mounting the panel.

1) Position and punch the holes according to the size requirements.

2) Secure the module to the back panel with suitable screws.

3) If an expansion module is used, connect the flat cable of the expansion module to the expansion port under the front cover.

● Mounting the DIN rail

1) Fix the DIN rail on the back plate, keeping the distance 80mm.

2) Open the DIN clamp on the bottom of the module and snap the back of the module onto the DIN rail.

3) If using an expansion module, connect the flat cable of the expansion module to the expansion port under the front cover.

4) Rotate the module close to the DIN rail and close the DIN clamp.

5) Double check that the DIN clips on the module are tightly secured to the DIN rail.

6) To avoid damage to the module, do not press directly on the front of the module, but press on the part of the mounting holes.

Take care
When the PLC is used in environments with high vibrations or when installed vertically, DIN rail stops should be used. If the system is in a high vibration environment, using a backboard installation method can achieve a higher level of vibration protection.

● Removing the CPU or expansion module

1) Remove the power supply of the PLC.

2) Remove all wires and cables from the module.

3) If there are other expansion modules connected to the module you are removing, open the top cover and unplug the expansion flat cable from the adjacent module.

4) Remove the mounting screws or open the DIN clips.

5) Remove the module and terminal block.

● Removing the terminal block

1) Open the top cover of the terminal block mounting position.

2) Turn the mounting screw counterclockwise with a screwdriver.

3) Remove the terminal block.

● Terminal block installation

1) Open the top cover of the terminal block mounting position.

2) Make sure that the pins on the module are aligned with the holes on the edge of the terminal block.

3) Press the terminal strip down into the module and screw the screwdriver clockwise to tighten the screws.

1.2.6 Suppression circuit

When using inductive loads, a suppression circuit should be added to limit the voltage increase when the output is turned off. The suppression circuit can protect the output from premature damage due to high inductive switching current. In addition, the suppression circuit can also limit the electronic noise generated during the switching of inductive loads.

Note:
The effectiveness of the suppression circuitry depends on the application and you should adjust its parameters to suit your particular application. Be sure that all device parameters match the actual application.

❒ Transistor outputs and relay outputs for controlling DC loads

The transistor outputs are internally protected and can be adapted to a wide range of applications. Since relay-type outputs can be connected to both DC and AC loads, there is no internal protection.

Figure 1-5 gives an example of a DC load suppression circuit. In most applications, the additional diode A is sufficient, but if your application requires faster turn-off, it is recommended that you add the Zener diode B. Make sure that the Zener diode meets the current requirements of the output circuit.

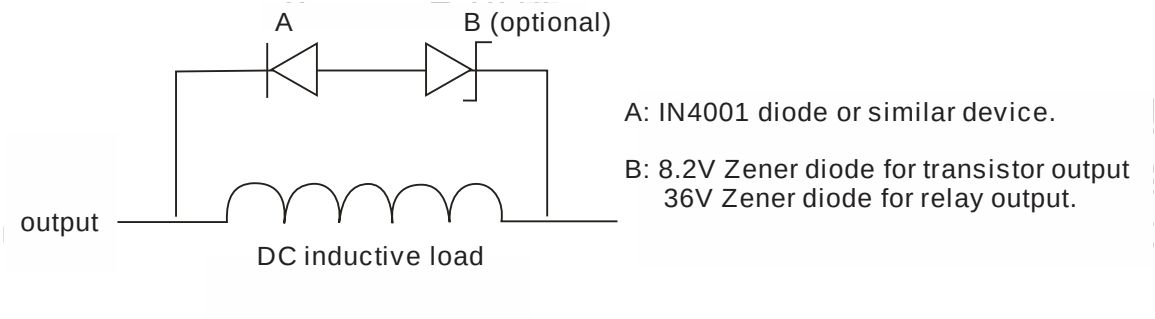


Figure 1-5 DC Load Suppression Circuit

❒ AC outputs and relay outputs for controlling AC loads

AC output provides internal protection for most applications, as relays can be used for DC or AC loads and therefore do not provide internal protection.

Figure 1-6 shows an example of an AC load suppression circuit. In most applications, additional metal oxide variable resistors (MOVs) can limit peak voltage and protect the internal circuits of PLCs. Ensure that the operating voltage of the MOV is at least 20% higher than the normal line voltage.

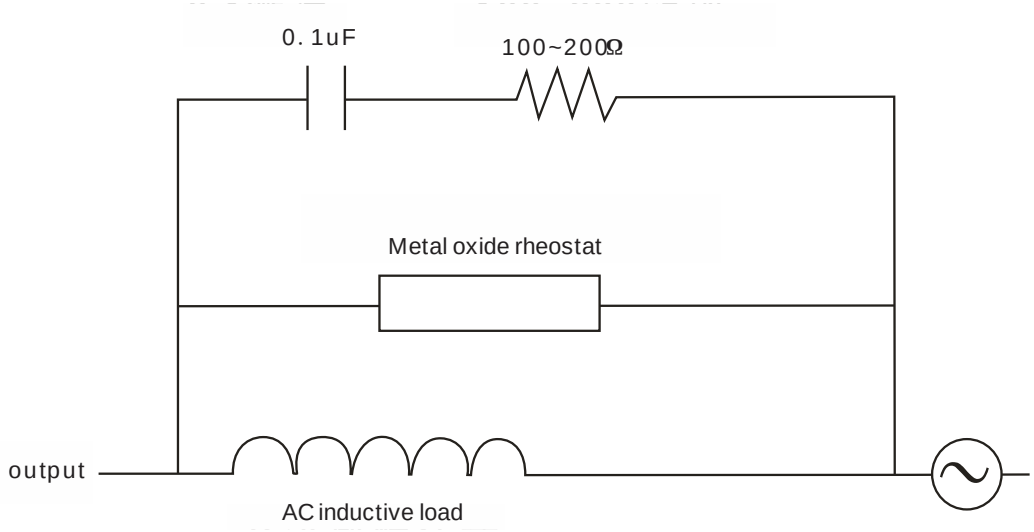


Figure 1-6 AC Load Suppression Circuit

Expansion Module Specifications

2

Table 2-1 Extension Module Information Table

Power supply module	
CTH3 PWR-020S1	Power module, input 85～264V AC, output 24V DC/2A
Intermediate expansion module	
CTH3 INT-000S1	INT-00 intermediate expansion module
High-speed counting module	
CTH3 HSC-020S1	HSC-02 high-speed counting module, 2-channel differential/single-ended signal input
High-Pulse output module	
CTH3 HSP-040S1	HSP-04 pulse output module, 4-channel differential/single-ended signal output
CTH3 HSP-040S2	HSP-04 pulse output module, Plug-in Crimp Terminals,4-channel differential /single-ended signal output
EtherCAT Slave Module	
CTH3 ECT-000S1	EtherCAT slave module, up to 8 expansion modules can be attached
Profinet Slave Modules	
CTH3 PNT-000S1	Profinet slave module
Digital module	
CTH3 DIT-080S1	Digital input, 8DI x 24VDC
CTH3 DIT-160S1	Digital input, 16DI x 24VDC
CTH3 DIT-320S1	Digital input, 32DI x 24VDC
CTH3 DIT-320S2	Digital input, Plug-in Crimp Terminals,32 x 24VDC
CTH3 DQT-080S1	Digital output, 8DQ x 24VDC
CTH3 DQT-160S1	Digital output, 16DQ x 24VDC
CTH3 DQT-320S1	Digital output, 32DQ x 24VDC
CTH3 DQT-320S2	Digital output, Plug-in Crimp Terminals, 32 x 24VDC
CTH3 DQR-080S1	Digital output, 8DQ x relay
CTH3 DQR-160S1	Digital output, 16DQ x relay
Analog module	
CTH3 AIS-040S1	Voltage and current input, 4AI x 12bit
CTH3 AMS-060S1	Analog voltage and current input and output, 4AI x 12bit, 2AQ x 12bit
CTH3 AIV-080S1	Voltage input,8AI x 16bit
CTH3 AIC-080S1	Current input,8AI x 16bit
CTH3 AQS-040S1	Voltage and current output, 4AQ x 12bit
CTH3 AQS-080S1	Voltage and current output, 8AQ x 12bit
CTH3 AQS-080S2	Voltage and current output, Plug-in Crimp Terminals, 8AQ x 12bit

Temperature module	
CTH3 AIT-040S1	Thermocouple input module, 4 x TC, isolated 16bit accuracy
CTH3 AIT-080S1	Thermocouple input module, 8 x TC, isolated 16bit accuracy
CTH3 AIR-040S1	Thermal resistance input module, 4 x RTD, isolated 16bit accuracy
CTH3 AIR-080S1	Thermal resistance input module, 8 x RTD, isolated 16bit accuracy
CTH3 AIR-080S2	Thermal resistance input module, Plug-in Crimp Terminals, 8-point* RTD, isolated 16bit accuracy
Accessories	
CTH3 BAT-000S1	PLC lithium battery, voltage 3.6V, capacity 2700mAh

2.1 Power supply module

The power supply module provides 24V DC power supply for CPU and expansion modules (except digital modules). Please select one power supply module for each rack. For digital input/output power supply and sensor power supply, please select other power supply.

Table 2-2 Power Module Basic Specifications

Description	**Order no.**
Input: 85~264V AC　output:24V DC/2A	CTH3 PWR-020S1

Table 2-3 Power Module Technical Parameters

Physical characteristics	
Dimensions(W×H×D)	34×115×101.6 mm
LED indicator	
24V power(green)	ON: with 24V DC output, OFF: without 24V DC output
Switching Characteristics	
Switch	Control 24V DC power output ON: with 24V DC output, OFF: without 24V DC output
Input Voltage Characteristics	
Voltage range	85 to 264V AC, wide voltage input
Rated frequency Frequency Range	50Hz/60Hz 47Hz～63Hz
Efficient	75%
Alternating current	0.9A/110V、0.5A/220V
Surge current(77℉ max)	≤20A/110V、≤35A/220V
Leakage current	≤5mA/220V AC

Output Voltage Characteristics	
DC Voltage/Rated Current	24V DC/2A
rated power	48W
Ripple and noise (max)	150mVp-p
Voltage output range	±5%
Start-up/rise/hold time	≤2.5s/≤50ms/≥20ms
Isolation (power input and output)	Isolation between 110V/220V AC and 24V DC
Protection	
Overload protection	105% to 130% of rated output power, cut off output, and automatically recover after troubleshooting
Overvoltage protection	115% to 135% Ue. Protection method: Hiccup mode, automatic recovery after troubleshooting
Surge protection	The power supply terminal provides surge absorption function
Overcurrent protection	Overcurrent protection is provided at the power supply output
Safety electromagnetic compatibility	
Withstand voltage	Input~Output: 1.5kVDC, Input-PE: 1.5kV DC, Output-PE: 500V DC
Isolation resistance	Input~Output, Input-PE, Output-PE: 100MΩ/500V DC
Standard basis	Safety according to UL60950 and UL1950, Electromagnetic compatibility according to EN55022.

Interface Schematic

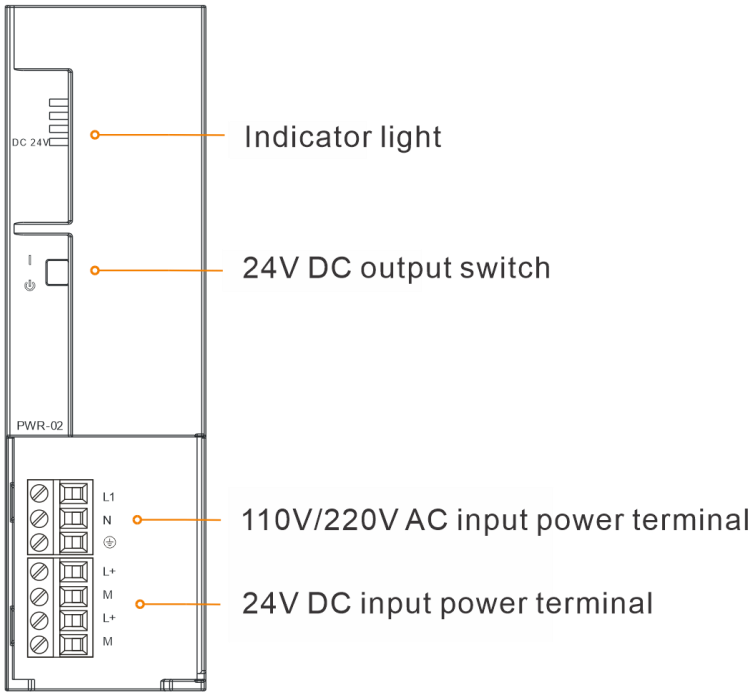


Table 2-4 220V AC Input Power Interface Definitions

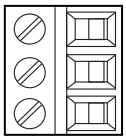
Removable terminal	Signal	Definition
	L	Fire line
	N	Zero line
	⏚	Ground

Table 2-5 24V DC Output Power Interface Definitions

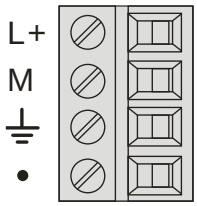
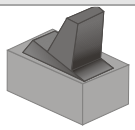
Removable terminal	Signal	Definition
	L+	24V+
	M	24V-
	L+	24V+
	M	24V-

Table 2-6 Definition of Dial Switch

Switch	Status	Direction	Definition
	ON	UP	with 24V DC output
	OFF	DOWN	without 24V DC output

2.2 Intermediate Expansion Module

Table 2-7 Basic Attributes of Intermediate expansion module

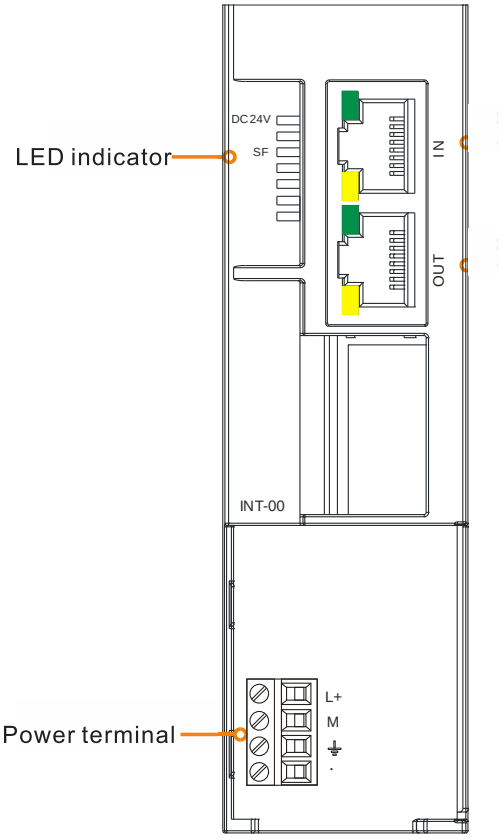
Corresponding name in CODESYS	Description	Order No.
INT_00_8SLOT	Intermediate expansion module	CTH3 INT-000S1

Table 2-8 General Characteristics

Physical characteristics	
Dimension(W×H×D)	34×115×101.6 mm
Power consumption	19.5W
Power characteristics	
Rated input voltage	24V DC
Input voltage range	20.4V~28.8V DC
Input Current	0.8A
Reverse polarity protection	YES
Bus power supply voltage	+5V DC

Bus power current	1.6A
LED indicator	
DC 24V	ON: with 24VDC, OFF: without 24VDC
SF	ON: The module is faulty. OFF: No error
Functions and Features	
Extensions	Provide bus expansion function
Communication function	Provide communication interface between Intermediate extension modules
Extensions	Provides 8 I / O modules that allow expansion
Isolation function	Isolation between external power supply and system power supply
Protective function	The power supply terminal provides reverse connection protection function and surge absorption function

Interface Schematic



Please follow the instructions below to connect the Intermediate expansion module, if it is connected incorrectly, the communication will fail.

Intermediate expansion Interface 1 (IN): Interface for connecting to the previous repeater module (if it is the first repeater module, this port is not connected).

Intermediate expansion Interface 2 (OUT): Interface for the next Intermediate expansion module (if it is the last Intermediate expansion module, this port is not connected).

< Note > The first intermediate expansion module should be hooked up to the back of the CPU and plugged into the bus, the second Intermediate expansion module bus is left dangling.

Table 2-9 Power Interface Definitions

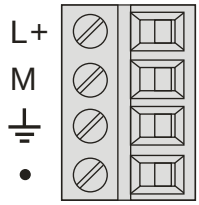
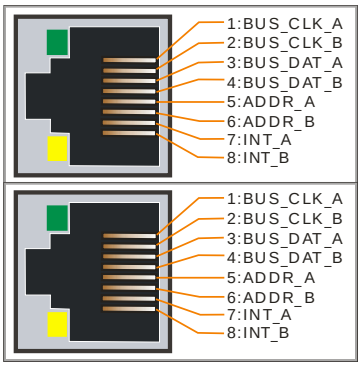
Removable Terminals	No.	Signal	Signal definition
	1	L+	24V+ power supply
	2	M	24V - power supply
	3	⏚	ground
	4	--	--

Table 2-10 Definition of Dual RJ45 Interface

	No.	Signal	Signal definition
	1	BUS_CLK_A	bus clock
	2	BUS_CLK_B	bus clock
	3	BUS_DAT_A	bus data
	4	BUS_DAT_B	bus data
	5	ADDR_A	configure address
	6	ADDR_B	configure address
	7	INT_A	interrupt
	8	INT_B	interrupt
	connector shell	PE	chassis ground

2.3 High-Speed Counting Module

Table 2-11 Basic Attributes of High-Speed Counter Module

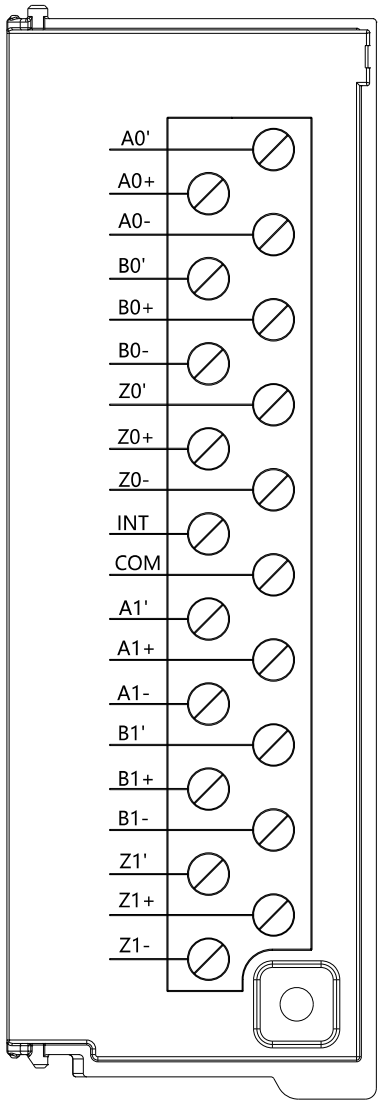
Corresponding name in CODESYS	Specification	Order No
HSC-02	2 differential/single-ended signal inputs	CTH3 HSC-020S1

Table 2-12 General Characteristics of the CTH3 HSC-020S1

Physical characteristics	
Dimension（W×H×D）	34×115×100 mm
Power characteristics	
Bus supply voltage	+5V DC
Bus supply current	130mA
LED indicator characteristics	
Signal indicator	ON: with input signal, OFF: without input signal

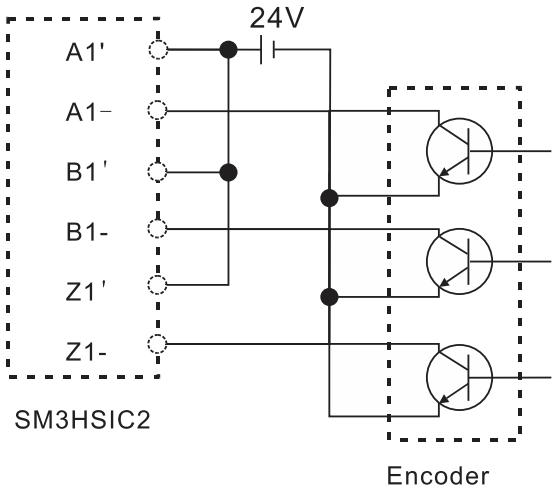
Sensor connection		
Number of input channels		2
Signal type	Differential Input	Signal voltage: 5VDC Maximum input frequency: 2MHz
	Single-ended inputs	Signal voltage: 24VDC Maximum input frequency: 500KHz Allowable range of signal duty cycle: 40% - 60%
Maximum protection voltage of signal input		30VDC
Input filter		Configurable, 125kHz, 250kHz, 500kHz, 1MHz, 2MHz
Orthogonal frequency multiplication		1, 2, 4 times frequency
Counter format		32bit
Counter reset function		Support, Z signal
Counter capture function		Support, Z signal
Multi counter synchronous counting function		Support, INT signal
INT signal voltage		24VDC
Maximum input frequency of INT signal		500kHz
INT signal input filter		Configurable, 125kHz, 250kHz, 500kHz
Photoelectric isolation		500VAC, 1min

Wiring diagram

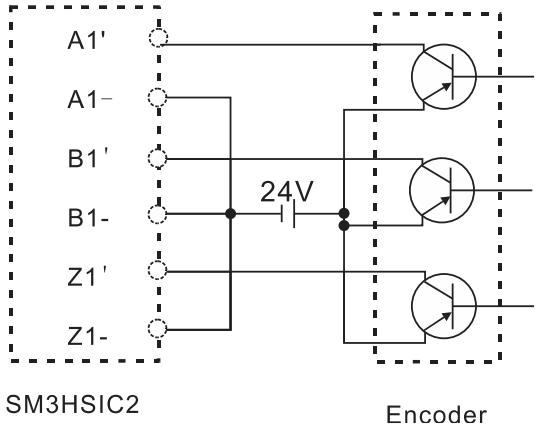


Single-ended wiring

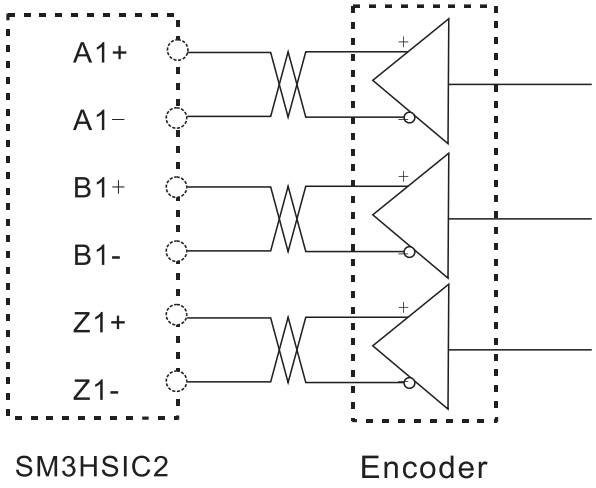
• Connection of encoder outputs of drain type (NPN)



• Connection of encoder output as source type output (PNP)



Differential connection



2.4 High speed pulse output module

High speed pulse output module are used for multi-axis motion control and support bus expansion. Up to 8 HSP modules can be hung behind each CPU or EtherCAT slave (4 racks can be hung behind a CPU, and a total of 8 HSP modules can be hung in the 4 racks).

Table 2-13 Basic properties of pulse output module

Name in CODESYS	Specification Description	Order no.
HSP_04	Supports four 5~24VDC single-ended 500kHz or 5VDC differential 4MHz signal outputs	CTH3 HSP-040S1
HSP_04	Plug-in Crimp Terminals, Supports four 5~24VDC single-ended 500kHz or 5VDC differential 4MHz signal outputs	CTH3 HSP-040S2

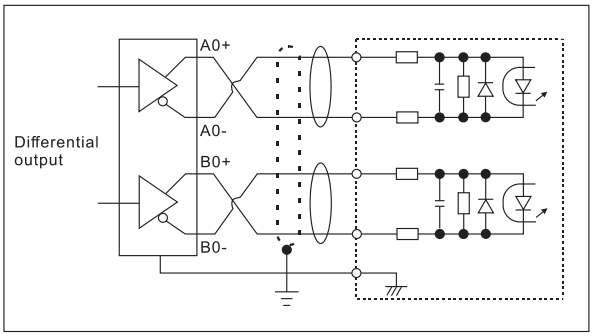
Table 2-14 General properties of CTH3 HSP-040S1

Physical properties	
Dimension（W×H×D）	34×115×101.6 mm
Power characteristics	

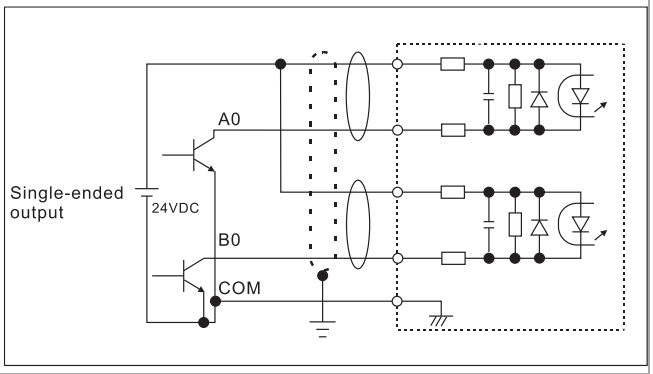
Rated input voltage	24V DC	
Input voltage range	20.4V~28.8V DC	
Input Current	100mA	
Reverse polarity protection	YES	
bus supply voltage	+5V DC	
Bus supply current	100mA	
LED Indicator		
Signal indicator	ON: with input signal. OFF: without input signal	
Output		
Number of output channels	4	
Output type	differential signal	Single-ended (NPN) signal
Maximum output frequency	4MHz	500kHz
Output signal duty cycle	-	50%
Rated output voltage	5VDC	5~24VDC
Output voltage range	0~5.5VDC	5~28.8VDC
Output signal logic "1"	3.8V(Min)	0.5V(Max)
Output signal logic "0"	0.3V(Max)	Vcc~0.5V(Min)
Inrush current	8A, continue 100ms	
Current per point (max)	20mA	20mA
Maximum current per common	NO	160mA
Leakage current (max)	10μA	
Isolate	500VAC, 1min	

External wiring diagram

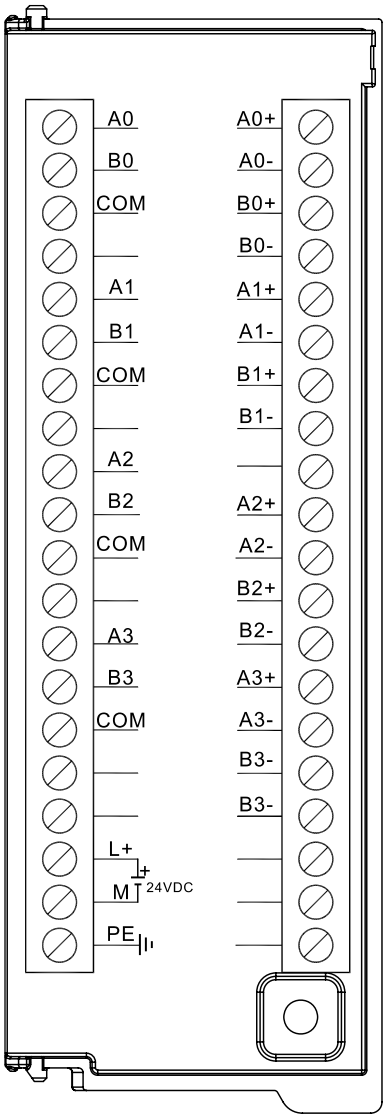
1. The following figure for the differential output, a total of 4 axes, each axis has two pairs of differential outputs, respectively, for the pulse and direction (such as A0 +, A0 - for the pulse, B0 +, B0 - for the direction), the output frequency up to 4MHz.



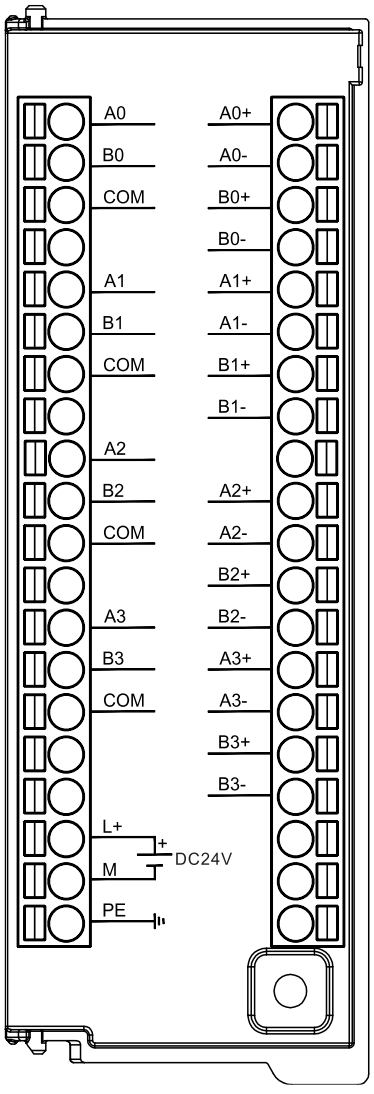
2. The following figure for the single-ended output and 24VDC power supply, single-ended output of a total of 4 axes, each axis has two sets of outputs, respectively, for the pulse and the direction (such as A0 for the pulse, B0 for the direction, COM for the common terminal), the output frequency of up to 500kHz.



Internal wiring diagram



CTH3 HSP-040S1



CTH3 HSP-040S2

The upper two rows of the module panel for the module LED indicators, the lower two rows are not used: high-speed pulse output module has 4 indicators for each output, 4 output a total of 16 LED indicators. Among them, the first output indicators are 0.0, 0.1, 1.0, 1.1 .

0.0, 0.1 represents differential output pulse, direction; 1.0, 1.1 represents single-ended output pulse, direction. The 2nd, 3rd and 4th outputs are the same. Indicator lamps are shown as follows.

	Output 1		**Output 2**		**Output 3**		**Output 4**	
	pulse	direction	pulse	direction	pulse	direction	pulse	direction
differential output	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
single-ended output	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7

2.5 EtherCAT Slave Module

Table 2-15 Basic Attributes of EtherCAT Slave Modules

Corresponding name in CODESYS	**Description**	**Order No.**
ECT-00	EtherCAT slave module, up to 8 IO modules can be expanded, supporting third-party EtherCAT master	CTH3 ECT-000S1

Table 2-16 general characteristics

Physical characteristics	
Dimension(W×H×D)	34×115×100 mm
Power consumption	2.5W
Power characteristics	
Rated input voltage	24V DC
Input voltage range	20.4V~28.8V DC
Input Current	0.8A
Reverse polarity protection	YES
Bus power supply voltage	+5V DC
Bus power current	1.6A
LED indicator	
DC 24V (green)	ON: with 24VDC, OFF: without 24VDC
SF (red)	ON: EtherCAT slave module failure, OFF: no error
BF (red)	ON: Expansion bus failure, OFF: No error

LINK (green) (Slave status indicator)	ON: normal operation (8), flashing: pre-operation (2), safe operation (4) (see note 1), OFF: no connection (0), initialization (1)
RJ45 (green)	ON: Connect with other EtherCAT interface OFF: No connection with other EtherCAT interfaces Flashing: communicating with other EtherCAT interfaces
Function	
Hardware configuration	The ECT-00 module supports the expansion of 8 slots
Extensions	Allows to expand 8 I/O modules, supports expanded digital quantity module, analog quantity module, temperature module, HSC module, HSP module, does not support expanded CAN module.
Communication function	Provide expansion module interface, support CTH300 PLC custom 55MHz bus protocol
	EtherCAT interface supports CANopen over EtherCAT (CoE)
Isolation function	Isolate the external power supply from the system power supply
Protective function	The power supply terminal provides reverse connection protection and surge absorption

Note 1: When the slave expansion bus has no output, the communication between the slave and the master is disconnected, and the slave will not switch to safe operation.

Table 2-17 Communication port specifications

EtherCAT communication	
Communication interface	1 double RJ45 port
Baud rate	100Mbps
Protocol type	CANopen over EtherCAT (CoE)
	Supports the PDO service
	Support for SDO services
	Supports the EtherCAT state machine command
	Support for third-party EtherCAT master
The communication distance between slave is the longest	100m (100BASE-TX)
Isolation	Communication port isolation

The EtherCAT communication port uses a shielded network cable as the communication cable. The available network cable types are 22AWG~25AWG. The specifications and standards are as follows. The resistance value is the DC resistance value of a single wire. It is recommended to use fully shielded Category 5 cable or fully shielded Category 5e cable, 24AWG.

Table 2-18 Communication port wire specifications

AWG	Outside diameter mm	Outside diameter inch	Cross-sectional area/mm^2	Resistance Ω/km

22	0.643	0.0253	0.3247	48.5
23	0.574	0.0226	0.2588	54.3
24	0.511	0.0201	0.2047	79.6
25	0.44	0.0179	0.1624	89.4

It is recommended to use the super five types of shielded crystal head, as shown in the figure below:

Interface Schematic

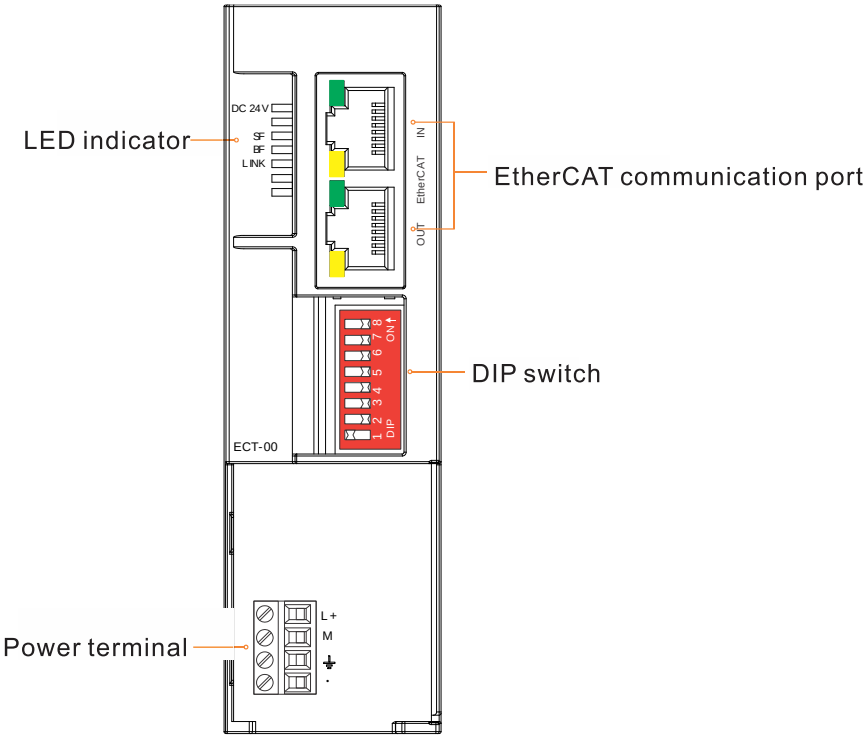


Table 2-19 Power port definitions

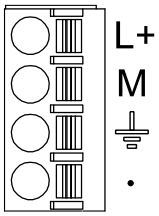
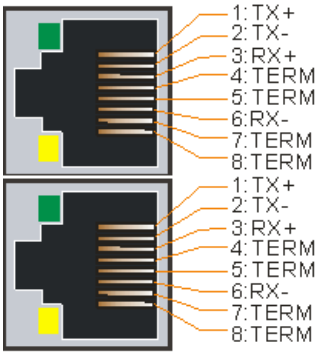
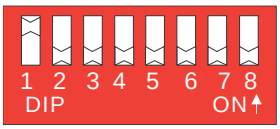
Removable Terminals	No.	Signal	Signal definition
	1	L+	24V power supply+
	2	M	24V power supply -
	3	⏚	ground
	4	--	--

Table 2-20 Definitions of dual RJ45 ports

Dual RJ45 network ports	No.	Signal	Signal definition
	1	TX+	Data send+
	2	TX-	Data send-
	3	RX+	Data receive+
	4	--	--
	5	--	--
	6	RX-	Data receive-
	7	--	--
	8	--	--
	Connector shell	PE	Chassis ground

DIP switch definition: EtherCAT slave module address, dial to the top is ON, and the bottom is OFF.



DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7	DIP8	address value
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
0	1	0	0	0	0	0	0	2
1	1	0	0	0	0	0	0	3
0	0	1	0	0	0	0	0	4
1	0	1	0	0	0	0	0	5
….								….
1	1	1	1	1	1	1	1	255

Remarks: When communicating with Omron CPU, the configured device node address needs to be consistent with the actual device address (DIP switch address) in order to successfully communicate.

2.6 Profinet Slave Module

Profinet slave module is an important part of PLC system, each slave module allows to expand 8 I/O modules (digital module, analog module, temperature module and HSC/HSP module), together with the Siemens Profinet master to form a network to realize the Profinet remote IO expansion communication function.

Table 2-21 Basic attributes of the Profinet master module

Specification Description	Order no.
Profinet slave module	CTH3 PNT-000S1

Table 2-22 General Characteristics

Physical properties	
Dimensions (W×H×D)	34×115×100 mm
Power consumption	
Rated input voltage	24V DC
Input voltage range	20.4V~28.8V DC
Input current	0.8A
Reverse polarity protection	YES
Bus supply voltage	+5V DC
Bus supply current	1.6A
LED Indicator	
DC 24V(green)	ON = 24VDC power supply is normal. OFF = no 24VDC power supply
SF (red)	ON = Expansion I/O bus failure or PROFINET module failure OFF = no error
BF(red)	ON = PROFINET bus communication failure (no switch connected, no network detected) Flashing = configuration configuration is inconsistent. OFF = no error
MT(yellow) (maintenance indicator)	reserve
RJ45 port indicator (green)	ON = there is a connection to the switch/PN master
	OFF = no connection to switch/PN master
RJ45 port indicator (yellow)	ON = there is data transceiving to the switch/PN master
	OFF = No data transmission/reception to switch/PN master

Expanded I/O	
Maximum number of supported modules per slave	8 (digital module, analog module, temperature module, HSP module, HSC module)
Protocol type	CTH300 PLC custom 55MHZ bus protocol
Maximum configuration of IO per slave	The maximum configuration of analog IO can reach 64AI/64AQ The maximum configuration of digital IO can reach 256DI/256DQ
PROFINET communication port	
Communication Interface	1 dual RJ45 port
Data transfer rate	Transmission rate for Ethernet services: 10 Mbps
	Transmission rate for PROFINET: 100 Mbps, full duplex
Supported Ethernet Services	ping, arp, network diagnostics (SNMP)/MIB-2, LLDP
Send cycle	250us~4ms
Third-party PN master	Support S7-300/400, SMART CPU, S7-1200/1500
The longest communication distance between slave	100m (100BASE-TX)
Topology	Support star, tree, line topology
Isolation	Communication port isolation
Hardware configuration function	
File to import	PROFINET GSD file XML format
PN slave	The added CTH3 PNT-000S1 module supports 8-slot expansion
	Expansion modules can add digital modules, analog modules, temperature modules, HSP modules, HSC modules
Isolation and Protection	
Power isolation	Isolation between external power and system power
Interface isolation	PROFINET communication interface isolation
Power protection	The power supply end provides reverse polarity protection and surge absorption

Interface Schematic

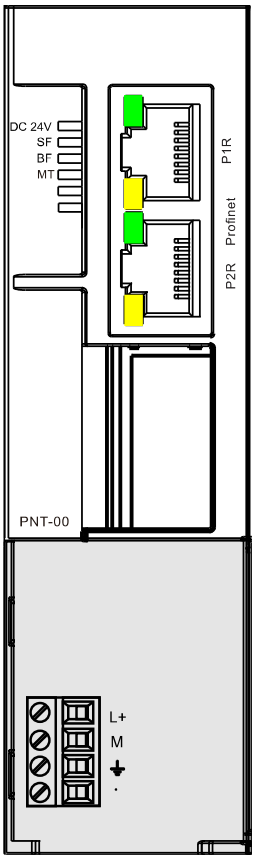


Table 2-23 PROFINET communication port definition

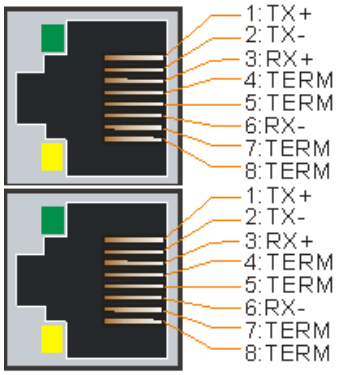
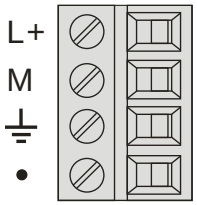
Dual RJ45 network ports (P1R/P2R)	NO.	Signal	Signal definition
	1	TX+	Data sending +
	2	TX-	Data sending -
	3	RX+	Data receiving +
	4	--	--
	5	--	--
	6	RX-	Data receiving -
	7	--	--
	8	--	--
	connector shell	PE	Chassis ground

Table 2-24 Definition of external power interface

Terminal	symbol	Signal definition
	L+	24V power supply +
	M	24V power supply -
	⏚	the earth
	--	--

2.7 Digital module

The digital quantity module is used to output digital signals to field devices or to receive digital signals input by field devices.

Table 2-25 Basic Specifications of Digital Quantity Module

Specification Description	Name in CODESYS	Order no.
Digital input, 8DI x 24VDC	DIT_08_8DI	CTH3 DIT-080S1
Digital input, 16DI x 24VDC	DIT_16_16DI	CTH3 DIT-160S1
Digital input, 32DI x 24VDC	DIT_32_32DI	CTH3 DIT-320S1
Digital input, Plug-in Crimp Terminals, 32DI x 24VDC		CTH3 DIT-320S2
Digital output, 8DQ x 24VDC	DQT_08_8DQ	CTH3 DQT-080S1
Digital output, 16DQ x 24VDC	DQT_16_16DQ	CTH3 DQT-160S1
Digital output, 32DQ x 24VDC	DQT_32_32DQ	CTH3 DQT-320S1
Digital output, Plug-in Crimp Terminals, 32DQ x 24VDC		CTH3 DQT-320S2
Digital output, 8DQ x relay	DQT_08_8DQ(PNP)	CTH3 DQR-080S1
Digital output, 16DQ x relay	DQT_16_16DQ(PNP)	CTH3 DQR-160S1

2.7.1 Digital Input Modules

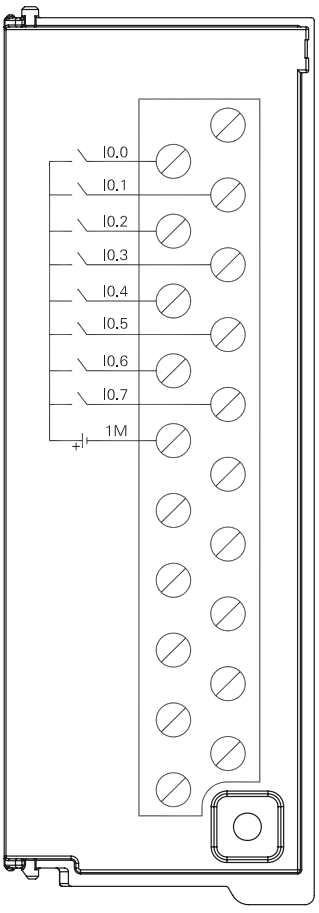
Table 2-26 Specifications of Digital Input Module

Item		CTH3 DIT-080S1	CTH3 DIT-160S1	CTH3 DIT-320S1 CTH3 DIT-320S2
Dimension（W×H×D）		34×115×100 mm		
Input		8	16	32
Current consumption	24V DC	4mA/ channel	4mA/ channel	4mA/ channel
	+5VBus	60mA	80mA	130mA
Input type		Drain/Source （IEC 1 Drain）		
Input rated voltage		24V DC, 6mA		
Input voltage range		20.4~28.8V DC		
Surge voltage		35V DC, continue 0.5s		
Logic 1 (minimum)		15V DC, 2.5mA, Flip level: 10.5V DC±15%		
Logic 0 (maximum)		5V DC, 1mA		
Connect 2-wire proximity switch sensor (BERO) Allowable leakage current (maximum)		1mA		

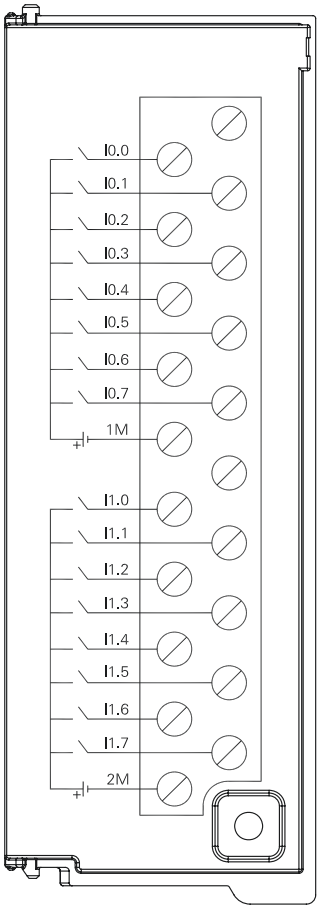
Input filter		Configurable, supports 0.2ms, 0.4ms, 0.8ms, 1.6ms, 3.2ms, 6.4ms (default), 12.8ms		
Input frequency		1.5kHz, 50% duty cycle		
input resistance		6.6kΩ		
isolation		500V AC for 1 minute		
Number of isolation points per group		8	8	8
Simultaneous ON input		8	16	32
Cable length	Shield	500m		
	Unshielded	300m		

Wiring

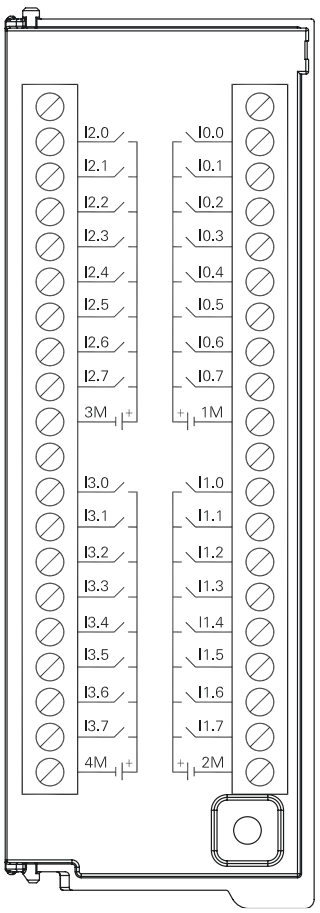
CTH3 DIT-080S1



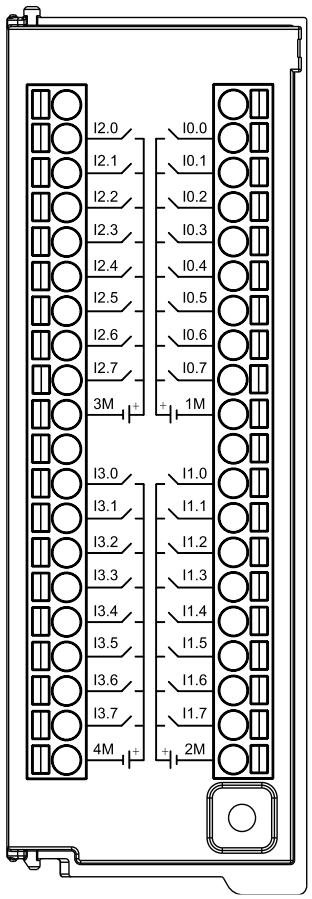
CTH3 DIT-160S1



CTH3 DIT-320S1



CTH 3DIT-320S2



Digital Input Module Channel Configuration

The format of the configuration parameters for each group (8 channels) is:

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
reserve	Channel 4-7 Filter Time			reserve	Channel 0-3 Filter Time		

Filter time:

0: 0.20ms, 1: 0.40ms, 2: 0.80ms, 3: 1.60ms, 5: 3.20ms, 6: 6.40ms (default), 7: 12.8ms.

2.7.2 Digital Output Module

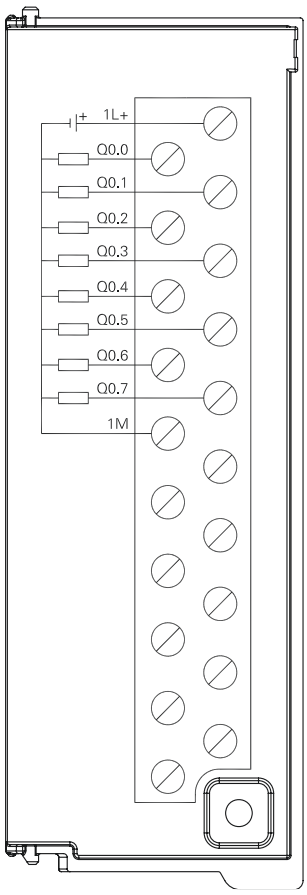
Table 2-27 Specifications of Digital Output Module

Item		CTH3 DQT-080S1	CTH3 DQT-160S1	CTH3 DQT-320S1, CTH3 DQT-320S2	CTH3 DQR-080S1	CTH3 DQR-160S1
Dimension（W×H×D）		34×115×100 mm				
Output		8	16	32	8	16
Current consumption	24V DC	50mA	95mA	180mA	64mA	130mA
	+5VBus	70mA	120mA	210mA	45mA	60mA
Output type		Solid state-MOSFET, source type			Relay-dry contact	
Output rated voltage		24V DC			DC: 24V, AC: 110V/220V	

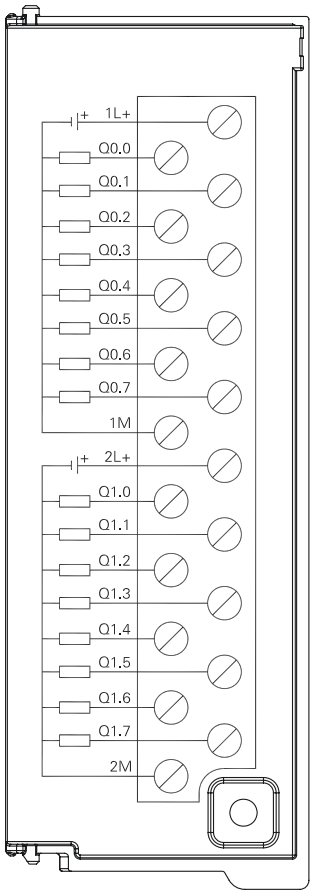
Output voltage range		20.4~28.8V DC			DC: 5～30V, AC: 5～250V	
Logic 1 (min)		20V DC			-	
Logical 0 (max)		0.1V DC,10kΩ load			-	
Maximum output current		0.5A			2A	
Current at each common terminal		Maximum 4A			Maximum 16A	
Maximum output sink current		15uA			-	
Surge current		8A, 100ms			5A, 4s@10% duty cycle	
Lamp load		5W			DC: 30W /AC: 200W	
Contact resistance		0.3Ω, Maximum 0.6Ω			The maximum for new devices is 0.2Ω	
Output delay		OFF to ON (Maximum): 50uS ON to OFF (Maximum): 200us			Maximum 10ms	
Maximum output frequency		1kHz			Resistive load: 10Hz Lamp load: 1Hz Inductive load: 0.5Hz	
Mechanical life (no load)）		-			10, 000, 000	
Contact life (rated load)		-			100, 000	
Quarantine Field to logic Coil to contact		500V AC, 1min continuous-			500V AC, 1min continuous 500V AC, 1min continuous	
Number of isolation points per group		8	8	8	8	8
Number of simultaneous ON outputs		8	16	32	8	16
Two outputs in parallel		Supports parallel connection of two outputs within the same group			-	
Cable length	Shield	500m				
	Unshielded	150m				

Wiring

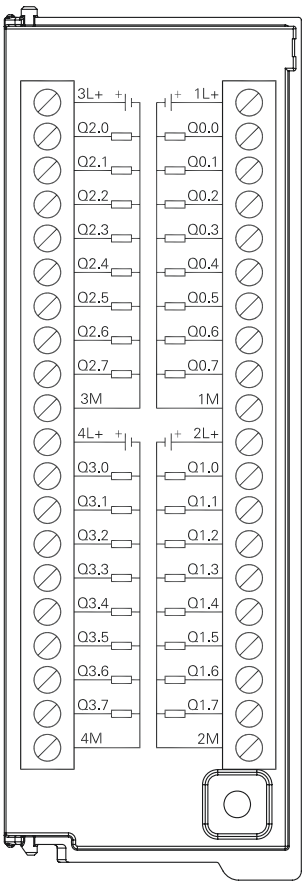
CTH3 DQT-080S1



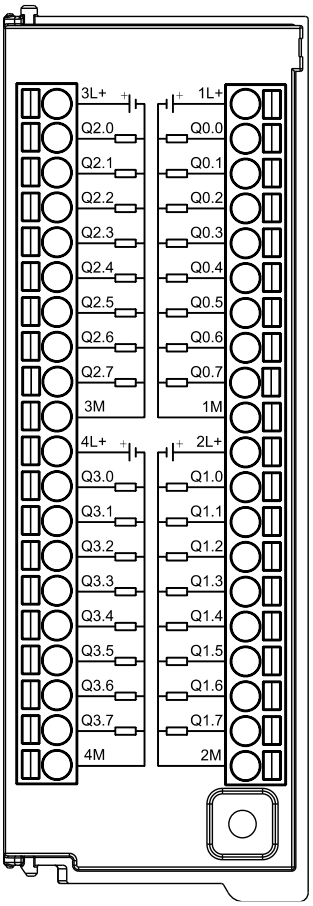
CTH3 DQT-160S1



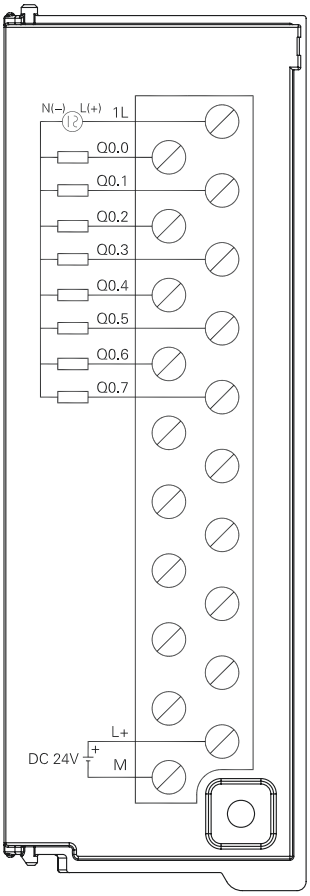
CTH3 DQT-320S1



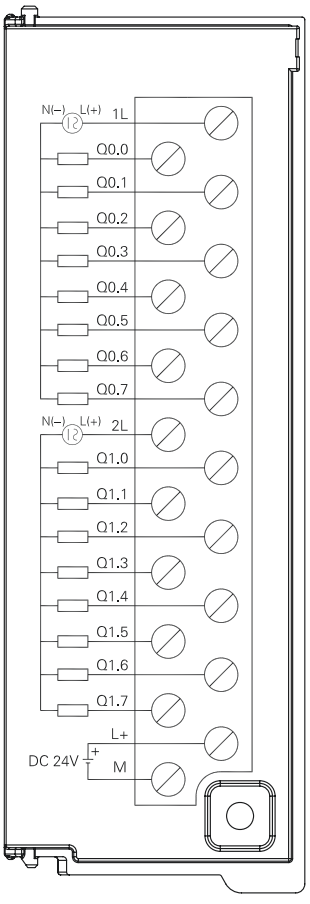
CTH3 DQT-320S2



CTH3 DQR-080S1



CTH3 DQR-160S1



Digital output module channel configuration

The format of the configuration parameters for each group (8 channels) is.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
reserve	reserve	reserve	reserve	reserve	reserve	reserve	reserve

2.8 Analog Module

Analogue input modules, analogue input and output module models, corresponding models and specifications are as follows.

Table 2-28 Product Model Specifications

Name	Specification Description	Order number
AIS-04	Analog voltage and current input, 4AI x 12 bits	CTH3 AIS-040S1
AMS-06	Analog voltage and current input and output, 4AIx12 bits, 2AQx12 bits	CTH3 AMS-060S1
AIV-08	Analog voltage input, 8AI x 16 bits	CTH3 AIV-080S1
AIC-08	Analog current input, 8AI x 16 bits	CTH3 AIC-080S1
AQS-04	Analog voltage and current output, 4AQ x 12 bits	CTH3 AQS-040S1
AQS-08	Analog voltage and current output, 8AQ x 12 bits	CTH3 AQS-080S1
	Analog voltage and current output, Plug-in Crimp Terminals, 8AQ x 12 bits	CTH3 AQS-080S2

Table 2-29 General characteristics of analogue modules

Item	CTH3 AIS-040S1	CTH3 AMS-060S1	CTH3 AIV-080S1/ CTH3 AIC-080S1	CTH3 AQS-040S1	CTH3 AQS-080S1 CTH3 AQS-080S2
Physical					
Dimension（W×H×D）	34×115×100 mm				
Power					
Rated input voltage	24V DC				
Input voltage range	20.4V~28.8V DC				
Input Current	65mA	110mA	50mA	110mA	200mA
Reverse polarity protection	YES				
Bus power supply voltage	+5V DC				
Bus power current	50mA	50mA	30mA	40mA	40mA

LED Indicator Characteristics	
24V DC	ON: 24VDC power supply. OFF: No 24VDC power supply
SF	ON: Module failure. OFF: No error Flashing: Input current signal exceeds limit alarm (only for 4-20mA)
Functional characteristics	
Extensions	Provide Bus expansion function
Signal isolation	Isolation between field and Bus
Power protection	The power supply terminal provides reverse connection protection and surge absorption
Filter function	Using a combination of hardware filtering and software filtering
Power function	The module uses 24V DC power supply

2.8.1 Analogue input modules

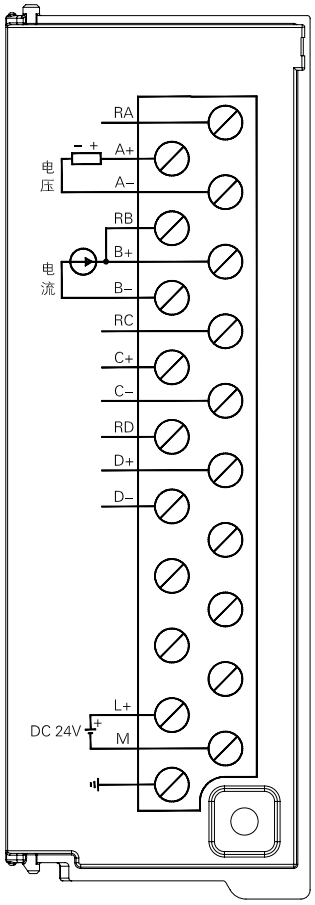
Table 2-30 Analogue Input Module Specifications

Item		**CTH3 AIS-040S1**	**CTH3 AIV-080S1**	**CTH3 AIC-080S1**
Input type		Voltage or current (differential input)	Voltage input	Current input
Input		4	8	
Input range	Voltage	Unipolar: 0 ~ 5V, 0 ~ 10V, bipolar: ± 2.5V, ± 5V		
	Current	0~20mA, 4~20mA		
Maximum input	Voltage	30V DC		
	Current	40mA		
input resistance	Voltage	≥2MΩ		
	Current	250Ω		
Data Format	Voltage	0~+32000(unipolar), -32000~+32000(bipolar)		
	Current	0~+32000		
Input step response		4 channels 5ms (fastest)	8 channels 50ms (fastest)	
Module update frequency (all channels)		4 channels support 200Hz, 100Hz, 50Hz, 20Hz and 10Hz configurations Default: 50Hz all channels	8 channels support 50Hz, 20Hz, 10Hz, 5Hz and 2Hz configurations Default: 10Hz all channels (50Hz only meets 4 channels)	
Common mode suppression		>40dB		
Channel crosstalk		>60dB		
Common mode voltage		-12V≤signal voltage+common mode voltage≤+12V		
Resolution	Unipolar	12 bits	16 bits	

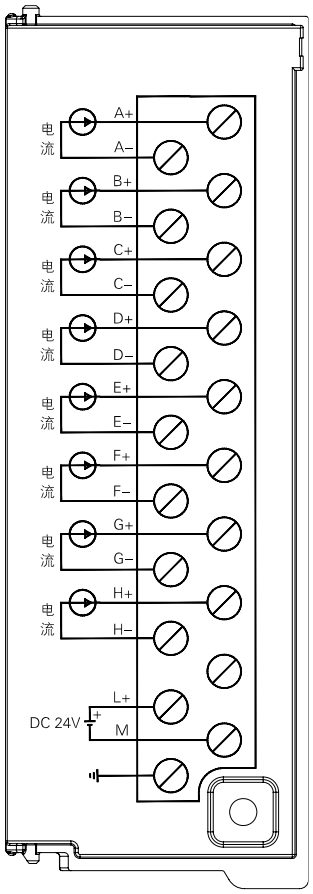
	Bipolar	11 bits + Sign bit	15 bits + Sign bit
Measuring principle		Successive approximation	Sigma-delta（Σ-△）
Measurement error		0.5%(maximum)	0.1%(maximum)
Wire break detection (only for 4~20mA)		Broken wire calibration: -32768, 32767 two values are optional	
Isolation	Field to logic	500V AC	
	24VDC to logic		
Diagnosis	Ultra-negative range	Unipolar: 0, bipolar: -32768	Unipolar: 0, bipolar: -32768
	Over positive range	Unipolar: 32760, bipolar: 32752	Unipolar: 32767, Bipolar: 32767
	No power	32736	32766

Wiring

CTH3 AIS-040S1



CTH3 AIC-080S1



CTH3 AIV-080S1

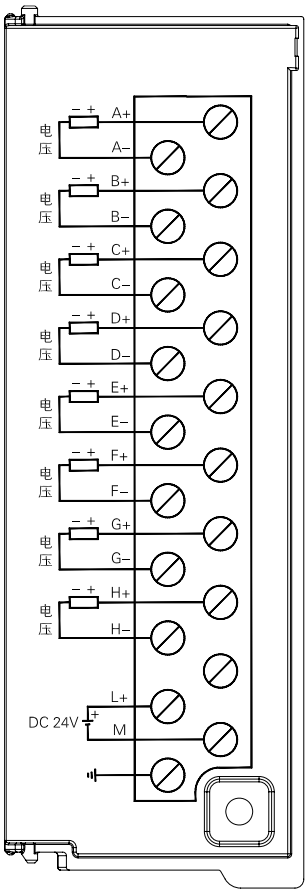


Table 2-31 Analogue input parameter configuration format.

<table>
<tr><th>bit 7</th><th>bit 6</th><th>bit 5</th><th>bit 4</th><th>bit 3</th><th>bit 2</th><th>bit 1</th><th>bit 0</th></tr>
<tr><td colspan="3">Sampling period
<table><tr><th>Module Type</th><th>Update frequency (sampling period)</th><th>Sampling period code (bit7~5)</th></tr><tr><td rowspan="5">AI module 4 channels</td><td>200 Hz</td><td>000</td></tr><tr><td>100 Hz</td><td>001</td></tr><tr><td>50 Hz(default)</td><td>010</td></tr><tr><td>20 Hz</td><td>011</td></tr><tr><td>10 Hz</td><td>100</td></tr><tr><td rowspan="5">AI module 8 channels</td><td>50 Hz</td><td>000</td></tr><tr><td>20 Hz</td><td>001</td></tr><tr><td>10 Hz(default)</td><td>010</td></tr><tr><td>5 Hz</td><td>011</td></tr><tr><td>2 Hz</td><td>100</td></tr></table></td><td colspan="5">Input type and range (unipolar and bipolar differentiated by bit4, bit4 1 for bipolar, 0 for unipolar)
<table><tr><th>Input Type</th><th>Input range</th><th>range code (bit4~0)）</th></tr><tr><td rowspan="4">voltage</td><td>0~5V</td><td>00000</td></tr><tr><td>0~10V(default)</td><td>00001</td></tr><tr><td>±2.5V</td><td>10000</td></tr><tr><td>±5V</td><td>10001</td></tr><tr><td rowspan="2">current</td><td>0~20mA(default)</td><td>00010</td></tr><tr><td>4~20mA</td><td>00011</td></tr></table></td></tr>
<tr><th>bit 15</th><th>bit 14</th><th>bit 13</th><th>bit 12</th><th>bit 11</th><th>bit 10</th><th>bit 9</th><th>bit 8</th></tr>
<tr><td>reserve</td><td>Must be 1</td><td>reserve</td><td>Disconnection direction calibration
0: Positive direction
1: Negative direction</td><td colspan="4">reserve</td></tr>
</table>

2.8.2 **Analog Output Module**

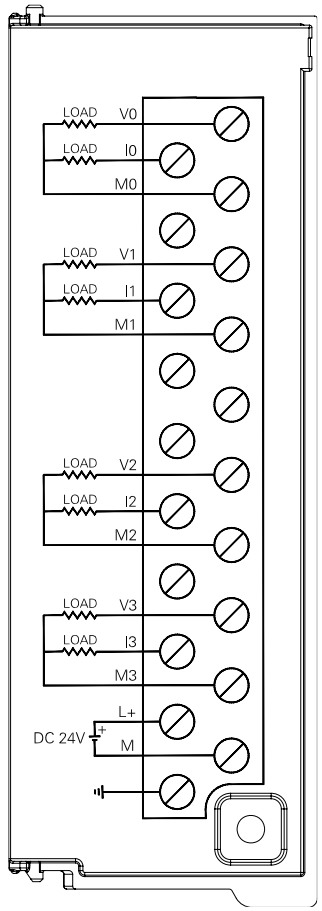
Table 2-32 Analogue output module specifications

Item	CTH3 AQS-040S1	CTH3 AQS-080S1
Output type	Voltage or current	
Number of outputs	4	8
Output range	voltage: ±10V currents: 0~20mA, 4mA~20mA	
Protection	Output misconnection voltage: 30V DC max. Voltage short circuit protection: Yes	
Data format	At full scale voltage: -32000~+32000 currents: 0~+32000	
Setup time	Voltage output: 100us Currents output: 2ms	
Load Impedance	Voltage output: 5000Ω (min) Currents output: 500Ω (max)	

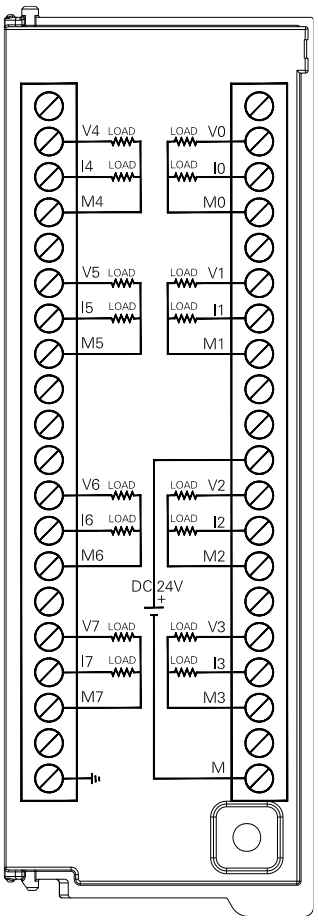
Resolution		unipolar: 12bit bipolar: 11bit+sign bit
Accuracy	Voltage	Typical: ±0.5% of full scale, worst case: ±2% of full scale
	Currents	Typical: ±0.6% of full scale, Worst case: ±2% of full scale
Isolation	Power Isolation	500V AC
	Field to Logic	500V AC

Wiring

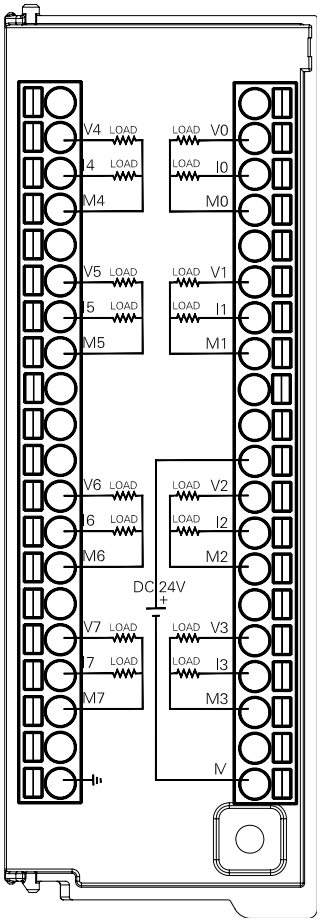
CTH3 AQS-040S1



CTH3 AQS-080S1



CTH3 AQS-080S2



2.8.3 Analog Input and Output Module

Table 2-33 Analogue input and output module specifications

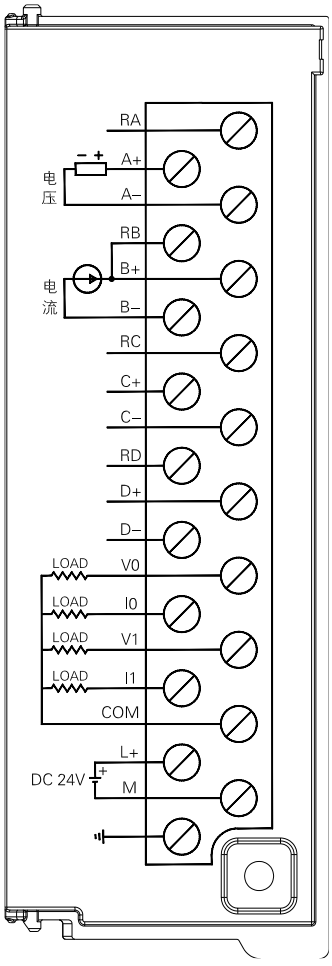
Input characteristics		**CTH3 AMS-060S1**
Input type		Voltage or current (differential input)
Input		4
Input range	Voltage	Unipolar: 0~5V, 0~10V. Bipolar: ±2.5V, ±5V
	Current	0~20mA,4~20mA
Maximum input	Voltage	30VDC

	Current	40mA	
Input resistance	Voltage	≥2MΩ	
	Current	250Ω	
Data Format	Voltage	0~+32000(Unipolar), -32000~+32000(Bipolar)	
	Current	0~+32000	
Input step response 4 channels 5ms (fastest)		Input step response 4 channels 5ms (fastest)	
Module update frequency (all channels)		4 channels support 200Hz, 100Hz, 50Hz, 20Hz, 10Hz configuration Default: 50Hz all channels	8 channels support 50Hz, 20Hz, 10Hz, 5Hz, 2Hz configuration Default: 10Hz all channels
Common mode		>40dB	
Channel crosstalk >60dB		>60dB	
Common mode voltage		-12V≤signal voltage+common mode voltage≤+12V	
Resolution	Unipolar	12 bits	
	Bipolar	11 bits+sign bit	
Measuring principle		Successive approximation	
Measurement error		0.5%(max.)	
Disconnection detection (only for 4 ~ 20mA)		Disconnection calibration: -32768,32767 two values are optional,	
Isolation (field to logic) /24VDC to logic)		500V AC	
Diagnosis	Over negative range	Unipolar: 0, bipolar: - 32768	
	Over positive range	Unipolar: 32760, bipolar: 32752	
	No power supply	32736	
Output characteristics		AMS-060S1	
Output type		Voltage or current	
Output points		2	
Output range	Voltage	±10V	
	Current	0~20mA, 4mA~20mA	
Protect	Output misconnection voltage	Max. 30V DC	
	Voltage short circuit protection	YES	

Data Format	Voltage	-32000~+32000(at full scale)
	Current	0~+32000(at full scale)
Establish time	Voltage output	100us
	Current output	2ms
Load impedance	Voltage output	5000Ω(min)
	Current output	500Ω(max)
Resolution	Unipolar	12bit
	Bipolar	11bit + sign bit
Precision	Voltage	Typical value: ± 0.5% of full scale. worst case: ± 2% of full scale
	Current	Typical value: ± 0.6% of full scale. worst case: ± 2% of full scale
Isolate	Power isolation	500V AC
	Field to logic	

Wiring

CTH3 AMS-060S1



2.8.4 Channel configuration

Table 2-34 Analogue Input Parameter Configuration Format.

<table>
<tr><th>bit 7</th><th>bit 6</th><th>bit 5</th><th>bit 4</th><th>bit 3</th><th>bit 2</th><th>bit 1</th><th>bit 0</th></tr>
<tr><td colspan="3">Sampling period
<table>
<tr><th>Module Type</th><th>Update frequency (sampling period)</th><th>Sampling period code (bit7~5)</th></tr>
<tr><td rowspan="5">AI module 4 channels</td><td>200 Hz</td><td>000</td></tr>
<tr><td>100 Hz</td><td>001</td></tr>
<tr><td>50 Hz(default)</td><td>010</td></tr>
<tr><td>20 Hz</td><td>011</td></tr>
<tr><td>10 Hz</td><td>100</td></tr>
<tr><td rowspan="5">AI module 8 channels</td><td>50 Hz</td><td>000</td></tr>
<tr><td>20 Hz</td><td>001</td></tr>
<tr><td>10 Hz(default)</td><td>010</td></tr>
<tr><td>5 Hz</td><td>011</td></tr>
<tr><td>2 Hz</td><td>100</td></tr>
</table></td><td colspan="5">Input type and range (unipolar and bipolar differentiated by bit4, bit4 1 for bipolar, 0 for unipolar)
<table>
<tr><th>Input Type</th><th>Input range</th><th>range code (bit4~0)）</th></tr>
<tr><td rowspan="4">voltage</td><td>0~5V</td><td>00000</td></tr>
<tr><td>0~10V(default)</td><td>00001</td></tr>
<tr><td>±2.5V</td><td>10000</td></tr>
<tr><td>±5V</td><td>10001</td></tr>
<tr><td rowspan="2">current</td><td>0~20mA(default)</td><td>00010</td></tr>
<tr><td>4~20mA</td><td>00011</td></tr>
</table></td></tr>
<tr><th>bit 15</th><th>bit 14</th><th>bit 13</th><th>bit 12</th><th>bit 11</th><th>bit 10</th><th>bit 9</th><th>bit 8</th></tr>
<tr><td>reserve</td><td>Must be 1</td><td>reserve</td><td>Disconnection direction calibration
0: Positive direction
1: Negative direction</td><td colspan="4">reserve</td></tr>
</table>

Table 2-35 Analogue output type configuration format.

<table>
<tr><th>bit 7</th><th>bit 6</th><th>bit 5</th><th>bit 4</th><th>bit 3</th><th>bit 2</th><th>bit 1</th><th>bit 0</th></tr>
<tr><td colspan="2">reserve</td><td>reserve</td><td>Voltage/current
0: voltage(default)
1: current</td><td colspan="4">Range
0: ±10V（voltage）
1: 0~20mA（currents）
2: 4~20mA（currents）</td></tr>
<tr><th>bit 15</th><th>bit 14</th><th>bit 13</th><th>bit 12</th><th>bit 11</th><th>bit 10</th><th>bit 9</th><th>bit 8</th></tr>
<tr><td colspan="8">reserve</td></tr>
</table>

2.9 Temperature Module

Table 2-36 Basic Specifications for Temperature Modules

Name in CODESYS	Specification Description	Order no.
AIT_04_4TC	Thermocouple input module, 4 TC, isolated type with 16 bits accuracy	CTH3 AIT-040S1
AIT_08_8TC	Thermocouple input module, 8 TC, isolated type with 16 bits accuracy	CTH3 AIT-080S1
AIR_04_4RTD	Thermal resistance input module, 4 RTD, isolated type with 16 bits accuracy	CTH3 AIR-040S1
AIR_08_8RTD	Thermal resistance input module, 8 RTD, isolated type with 16 bits accuracy	CTH3 AIR-080S1
	Thermal resistance input module, Plug-in Crimp Terminals,8 RTD, isolated type with 16 bits accuracy	CTH3 AIR-080S2

Table 2-37 General Characteristics of Temperature Modules

Item		CTH3 AIT-040S1	CTH3 AIT-080S1	CTH3 AIR-040S1	CTH3 AIR-080S1 CTH3 AIR-080S2
Physical characteristics					
Dimension(W×H×D)		34×115×100 mm			
Power characteristics					
Rated input voltage		24V DC			
Input voltage range		20.4V~28.8V DC			
Input Current		50mA	50mA	60mA	80mA
Reverse polarity protection		YES			
Bus power supply voltage		+5V DC			
Bus power current		50mA	50mA	50mA	50mA
LED indicator					
24V DC		ON: 24VDC power supply is normal, OFF: no 24VDC power supply.			
SF		ON: Module fault, OFF: No error, Flashing: Input signal error			
Functional characteristics					
I/O		Provide 4 channels/8 channels temperature sensor input interface			
Extensions		Provide Bus expansion function			
Isolation		Isolation between field and Bus			
		Isolation between external power supply and system power supply			
Protective	Power	The power supply terminal provides reverse connection protection and surge			

function	protection	absorption
	Broken wire detection	Input provides disconnection detection function
Filter function		Using a combination of hardware filtering and software filtering
Power function		The module uses 24VDC power supply

Table 2-38 Input Characteristics for Temperature Modules

Item		CTH3 AIT-040S1	CTH3 AIT-080S1	CTH3 AIR-040S1	CTH3 AIR-080S1 CTH3 AIR-080S2
Input type		Suspended thermocouple		Module reference ground resistance	
Number of input		4	8	4	8
Wiring		-		Support 2-wire system, 3-wire system and 4-wire system. Default: 3-wire system	
Input range		Thermocouple type (select one):S, T, R, E, N, K, J voltage range: ±80mV default: K		Thermocouple type (select one): Pt-100Ω, 200Ω, 500Ω, 1000Ω（α=3850ppm, 3920ppm, 3850.55ppm, 3916ppm, 3902ppm） Pt-10000Ω（α=3850ppm） Cu-9.035Ω（α=4720ppm） Ni-100Ω, 120Ω, 1000Ω（α=6720ppm, 6178ppm） R-150Ω, 300Ω, 600ΩFS Default: Pt-100Ω（α=3850ppm）	
Isolate	Field to logic	500VAC			
	Field to 24VDC				
	24VDC to logic				
Common mode rejection		＞100dB@120VAC			
Input resolution	Temperature	0.1℃/0.1℉		0.1℃/0.1℉	
	Voltage	15 bits +sign bit		-	
	Resistance	-		15 bits +sign bit	
Measuring principle		Sigma-Delta			
Module update frequency (all channels)		4 channels support 8Hz, 4Hz, 2Hz, 1Hz configuration, default: 2Hz all channels			
		8 channels support 4Hz, 2Hz, 1Hz, 0.5Hz configuration, default: 1Hz all channels			
Length of wire to sensor		Maximum 100m			
Wire loop resistance		100Ω		20Ω, Cu type 2.7Ω	
Noise suppression		85dB@50Hz/60Hz/400Hz			
Data word format		voltage: -27648~+27648		resistances: -27648~+27648	

Input resistance		＞10MΩ	＞10MΩ
Maximum input voltage		The inputs can support misconnections up to 30V DC.	
Resolution		15bits+sign bit	
Input filter attenuation		-3dB@21kHz	-3dB@3.6kHz
Basic error		0.1%Fs（voltage）	0.1%Fs(Resistance)
Repeatability		0.05%Fs	
Cold End Compensation		Configurable, cold end compensation by default	-
Cold End Error		±1.5℃	-
Temperature unit		℃,℉Configurable, Default ℃	
Broken wire detection		Thermocouple: Configurable, broken wire detection by default.	RTD: always broken wire detection, not configurable
		Supports both positive and negative calibration, default is positive calibration.	
Diagnostic	Disconnection	32767 (positive calibration), -32768 (32767 (positive calibration), -32768 (negative calibration) negative calibration)	
	No modular power supply	32766	
PID control function		None	-

TC module channel configuration

Table 2-39 Temperature module parameter configuration format.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Sampling period			Input type and range				
bit 15	**bit 14**	**bit 13**	**bit 12**	**bit 11**	**bit 10**	**bit 9**	**bit 8**
Closed Bit 0 - Enable	Configuration enable bit, must be 1	Temperature Module Cold End Compensation	Temperature module positive and negative calibration	Temperature module disconnection detection	Temperature Module Temperature Units	Wiring Method	

Table 2-40 Input Types and Ranges.

Module type	Input type	Input range	Range code (bit4~0)
TC	TC	S	00000
		T	00001
		R	00010
		E	00011
		N	00100
		K(default)	00101

		J	00110
	voltage	±80mV	10000

Table 2-41 Sampling Period.

Module Type	Update frequency (sampling period)	Sampling period code (bit7~5)
TC 4-channel	8 Hz	000
	4 Hz	001
	2 Hz(default)	010
	1 Hz	011
TC 8-channel	4 Hz	000
	2 Hz	001
	1 Hz(default)	010
	0.5 Hz	011

Wiring Method	0: 3-wire (default) 1: 2-wire 2: 4-wire
Unit of temperature	0: ℃(default) 1: ℉
Detect disconnection	0: To detect disconnection (default) 1: Do not disconnect detection. Temperature module should be configured with this parameter, AI module only needs to be configured with this parameter for 4～20mA range.
Positive and negative calibration	0: Positive calibration (default) 1: Negative calibration Temperature module should be configured with this parameter, AI module only needs to be configured with this parameter for 4-20mA range.
Cold End Compensation	0: Cold end compensation (default) 1: No cold end compensation
Group enable	0: enable (default) 1: Do not enable

RTD Module Channel Configuration

Table 2-42 Temperature Module Input Parameter Configuration Format.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Sampling frequency			Input type and range				
bit 15	**bit 14**	**bit 13**	**bit 12**	**bit 11**	**bit 10**	**bit 9**	**bit 8**
Closed Bit 0 - Enable	Configuration enable bit, must be 1	reserve	Temperature module positive and	Temperature module disconnectio	Temperatur e Module Temperatur	Temperature module wiring method	

			negative calibration	n detection	e Units	

Table 2-43 Input Types and Ranges.

Module type	Input type	Input range	Range code (bit4~0)
RTD	RTD	Pt-100Ω(α=3850ppm) (Default)	00000
		Pt-200Ω(α=3850ppm)	00001
		Pt-500Ω(α=3850ppm)	00010
		Pt-1000Ω(α=3850ppm)	00011
		Pt-100Ω(α=3920ppm)	00100
		Pt-200Ω(α=3920ppm)	00101
		Pt-500Ω(α=3920ppm)	00110
		Pt-1000Ω(α=3920ppm)	00111
		Pt-100Ω(α=3850.55ppm)	01000
		Pt-200Ω(α=3850.55ppm)	01001
		Pt-500Ω(α=3850.55ppm)	01010
		Pt-1000Ω(α=3850.55ppm)	01011
		Pt-100Ω(α=3916ppm)	01100
		Pt-200Ω(α=3916ppm)	01101
		Pt-500Ω(α=3916ppm)	01110
		Pt-1000Ω(α=3916ppm)	01111
		Pt-100Ω(α=3902ppm)	10000
		Pt-200Ω(α=3902ppm)	10001
		Pt-500Ω(α=3902ppm)	10010
		Pt-1000Ω(α=3902ppm)	10011
		Pt-10000Ω(α=3850ppm)	10100
		Cu-9.035Ω(α=4720ppm)	10101
		Ni-10Ω(α=6720ppm)	10110
		Ni-120Ω(α=6720ppm)	10111
		Ni-1000Ω(α=6720ppm)	11000
		Ni-10Ω(α=6178ppm)	11001
		Ni-120Ω(α=6178ppm)	11010
		Ni-1000Ω(α=6178ppm)	11011
	resistors	R-150Ω	11100

		R-300Ω	11101
		R-600ΩFS	11110

Table 2-44 Sampling Frequency.

Module Type	Update frequency (sampling period)	Sampling period code (bit7~5)
RTD 4-channel	8 Hz	000
	4 Hz	001
	2 Hz(default)	010
	1 Hz	011
RTD 8-channel	4 Hz	000
	2 Hz	001
	1 Hz(default)	010
	0.5 Hz	011

Wiring method	0: 3-wire (default) 1: 2-wire 2: 4-wire
Temperature unit	0: ℃(default) 1: ℉
Disconnection detection	0: To disconnect detection (default) 1: Do not disconnect detection Temperature module should be configured with this parameter, AI module only needs to be configured with this parameter for 4～20mA range.
Positive and negative calibration	0: Positive calibration (default) 1: Negative calibration Temperature module should be configured with this parameter, AI module only needs to be configured with this parameter for 4-20mA range.
Enable	0: enable (default) 1: Do not enable

Thermocouple characteristics

Temperature range(℃) and accuracy of various types of thermocouples

System word (1 digit = 0. 1℃)		type of J	type of K	type of T	type of E	type of R,S	type of N	±80mV	
Decimal	Hexadecimal								
32767	7FFF	>1200.0°C	>1372.0°C	>400.0°C	>1000.0°C	>1768.0°C	>1300.0°C	>94.071mV	OF
↑	↑							↑	↑
32511	7EFF							97.071mV	OR
:	:								
27649	6C01							80.0029mV	
27648	6C00							80mV	NR
:	:								
17680	4510								
:	:								
13720	3598								
:	:								
13000	32C8								
:	:								
12000	2EE0								
:	:								
10000	2710								
:	:								
4000	0FA0								
:	:								
1	0001	0.1°C	0.1°C	0.1°C	0.1°C	0.1°C	0.1°C	0.0029mV	
0	0000	0.0°C	0.0°C	0.0°C	0.0°C	0.0°C	0.0°C	0.0mV	
-1	FFFF	-0.1°C	-0.1°C	-0.1°C	-0.1°C	-0.1°C	-0.1°C	-0.0029mV	
:	:								
-500	FE0C								
-1500	FA24								
:	:								
-2000	F830								
:	:								
-2100	F7CC								
:	:								
-2550	F60A								
:	:								
-2700	F574								
:	:								
-27648	9400							-80mV	
-27649	93FF							-80.0029mV	UR
:	:								
-32512	8100							-94.071mV	
#	#							↓	↓
-32768	8000	<-210.0°C	<-270.0°C	<-270.0°C	<-270.0°C	<-50.0°C	<-270.0°C	<-94.07mV	UF
Accuracy of the whole range		S0.1%	S0.3%	S0.6%	S0.1%	S0.6%	S0.1%	S0.1%	
Accuracy (rated range without cold end compensation)		S1.5°C	S1.7°C	S1.4°C	S1.3°C	S3.7°C	S1.6°C	S0.10°C	
Cold end error		S1.5°C	S1.5°C	S1.5°C	S1.5°C	S1.5°C	S1.5°C	NA	
* OF=overflow, OR=out of range, NR=rated range, VR=below range, UF=underflow									
↑ indicates that all analog quantities greater than this value but less than the cutoff threshold are reported as overflow values, 32767 (0x7FFF) ↓ indicates that all analog quantities smaller than this value but greater than the cutoff threshold are reported as underflow values, -32768 (0x8000)									

Thermal resistance characteristics

Temperature range (℃) and accuracy for thermal resistance type

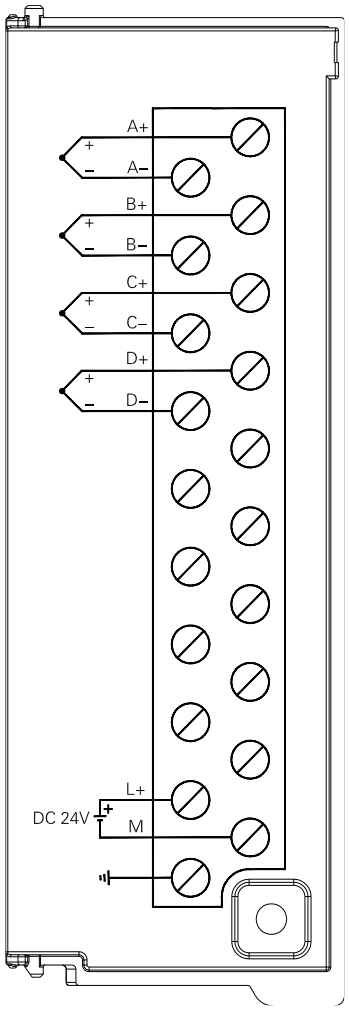
System word (1 digit = 0. 1℃)		Pt10000	Pt100 Pt200 Pt500 Pt1000	Ni100 Ni120 Ni1000	Cu9.035	0-150Ω	0-300Ω	0-600Ω	
Decimal	Hexadecimal								
32767	7FFF								
32766	7FFE					↑	↑	↑	
32511	7EFF					176.383Ω	352.767Ω	705.534Ω	
29649	6C01					150.005Ω	300.011Ω	600.022Ω	
27648	6C00					150.000Ω	300.000Ω	600.000Ω	
25000	61AB								↑
18000	4650								OR
15000	3A98								
13000	32C8	↑	↑						
10000	2710	1000.0°C	1000.0°C						
8500	2134		850.0°C						
6000	1770	600.0°C			↑				
3120	0C30			↑	312.0°C				
2950	0B86			295.0°C					
2600	0A28				260.0°C				
2500	09C4			250.0°C					
1	0001	0.1°C	0.1°C	0.1°C	0.1°C	0.005Ω	0.011Ω	0.022Ω	
0	0000	0.0°C	0.0°C	0.0°C	0.0°C	0.000Ω	0.000Ω	0.000Ω	
-1	FFFF	-0.1°C	-0.1°C	-0.1°C	-0.1°C	(It can't be negative)			
						↓	↓	↓	
-600	FDA8			-60.0°C					
-1050	FBE6			-105.0°C					
				↓					
-2000	F830	-200.0°C	-200.0°C		-200.0°C				
-2400	F6A0				-240.0°C				
-2430	F682	-243.0°C	-243.0°C		↓				
		↓	↓						
-5000	EC78								
-6000	E890								UR
-10500	D6FC								↓
-12000	D120								
-20000	4E20								
-32767	8001								
-32768	8000								
Accuracy of the whole range		±0.4%	±0.1%	±0.2%	±0.5%	±0.1%	±0.1%	±0.1%	
Accuracy (rated range)		±4°C	±1°C	±0.6°C	±2.8°C	±0.15°C	±0.3°C	±0.6°C	

OF=Overflow OR=Out of range NR=Rated range UR=Below range UF=under flow

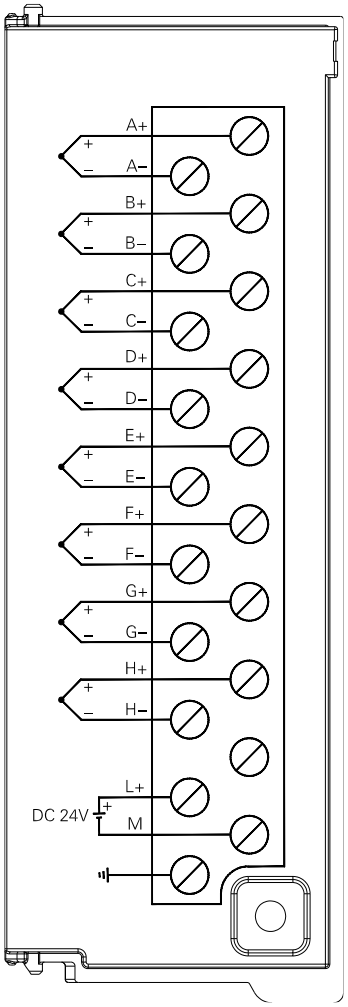
↑ or ↓ means that all analog quantities that exceed or fall below this limit value are reported as the selected fuse value, 32767 (0X7FFF) or -32768 (0X8000)

Thermocouple wiring

CTH3 AIT-040S1

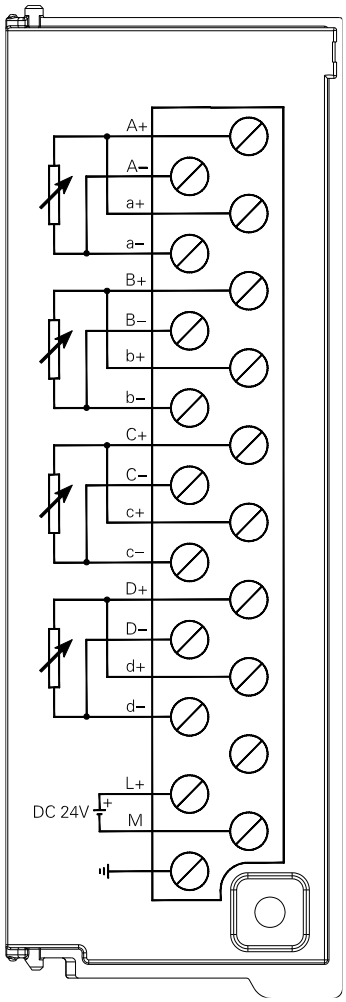


CTH3 AIT-080S1

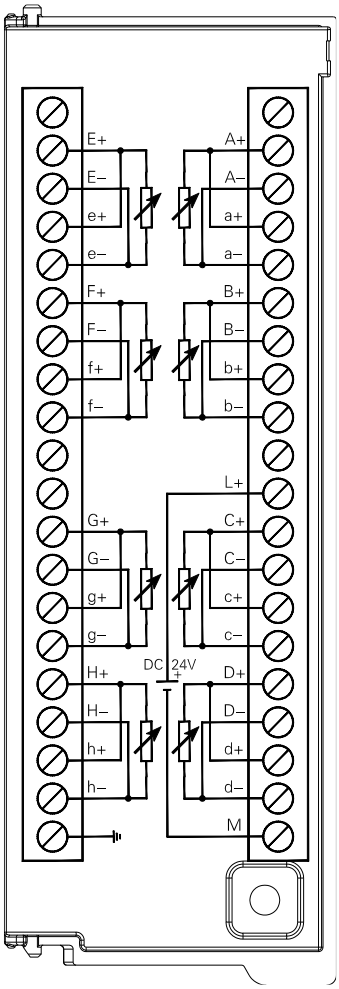


RTD Wiring Specifications

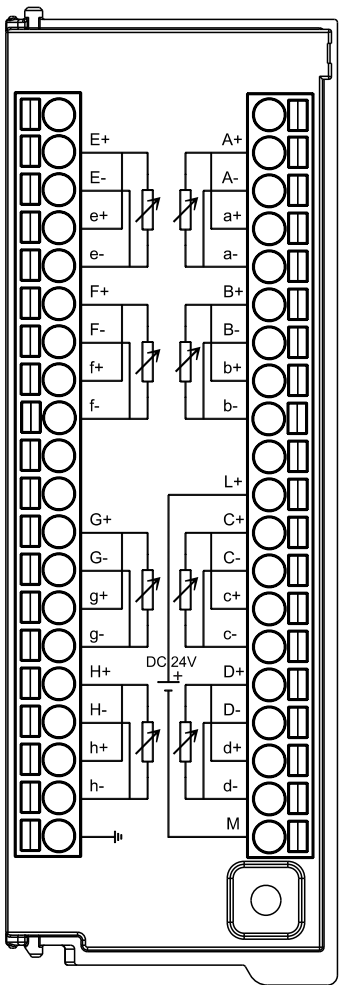
CTH3 AIR-040S1



CTH3 AIR-080S1



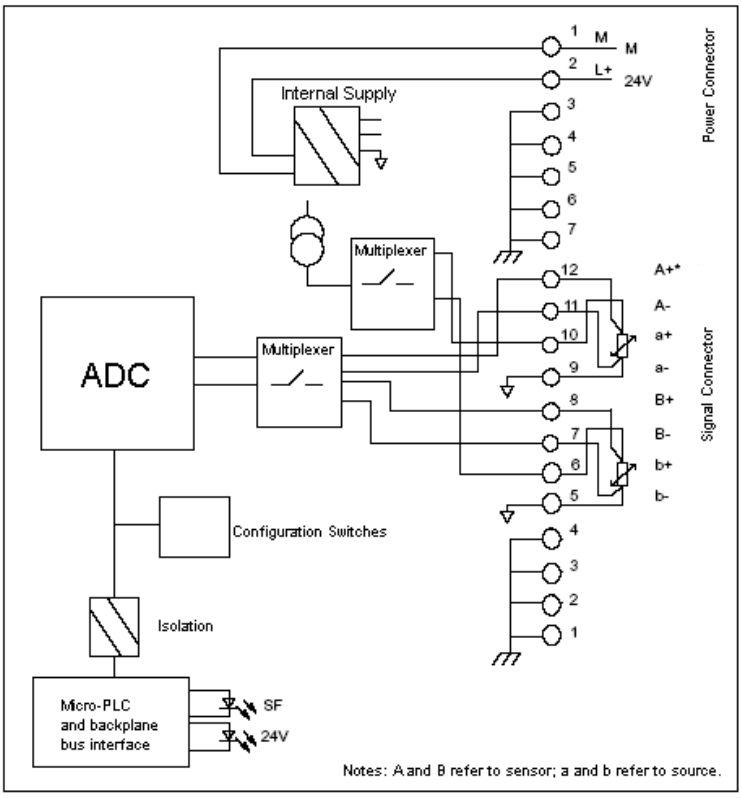
CTH3 AIR-080S2

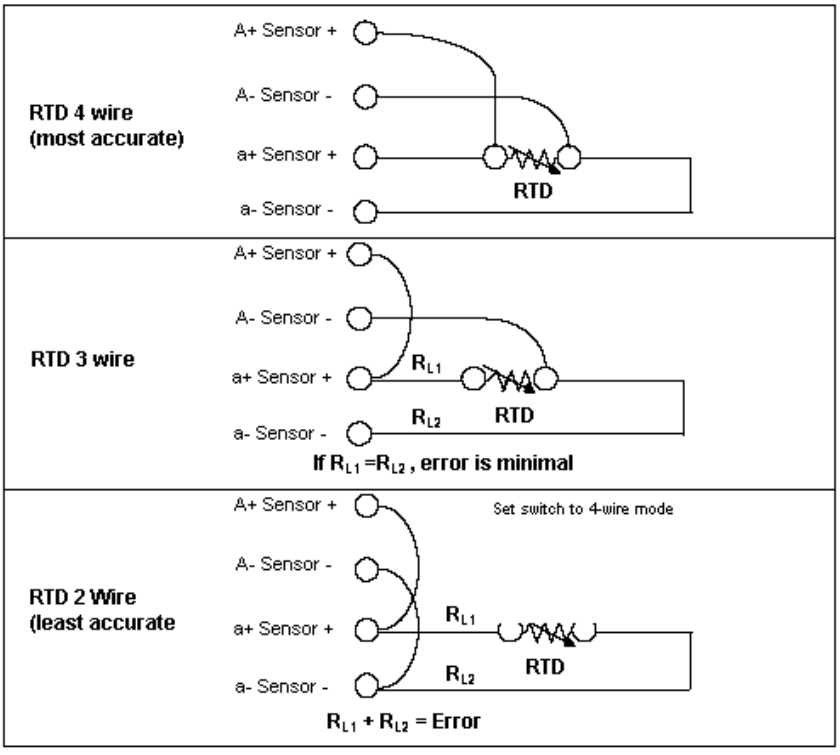


Wiring between RTD and sensor

As shown in the figure below, the user can connect the thermal resistance sensor to the thermal resistance module by direct wiring or expansion line. The best anti irritability can be achieved by using shielded wire. If shielded wire is used, the shielded wire shall be connected to the 1-4 pin grounding point of the signal connector. This ground point is grounded with pins 3 to 7 of the power connector. If some thermal resistance input channels are not used, the user shall connect a resistor with the unused input channel to prevent the error caused by the floating input signal from affecting the false display of the effective channel.

The user needs to connect the power supply to pins 1 and 2 of the power connector, and pin 3 of the power connector must be connected to the nearby chassis ground. One of the following three wiring modes (2-wire system, 3-wire system and 4-wire system) can be selected to connect the thermal resistance module with the sensor. The 4-wire connection method has the highest accuracy and the 2-wire connection method has the lowest accuracy. It is recommended to use the 2-wire connection method only when the conductor error is not concerned in the application.





Notes: A refers to sensor; a refers to source

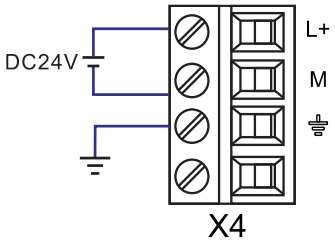
Configuration steps for simple project

3

3.1 CODESYS and PLC hardware connection

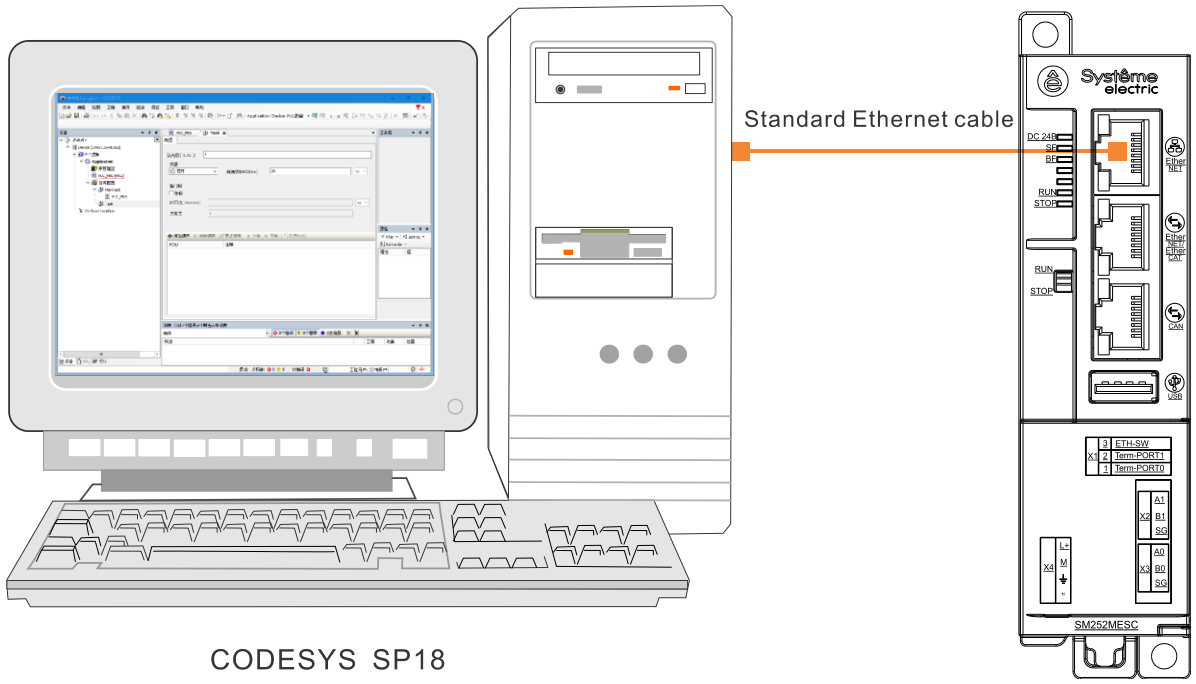
Powering the CTH3 C35-003S2

The following diagram shows the DC power supply wiring of the CTH3 C35-003S2.



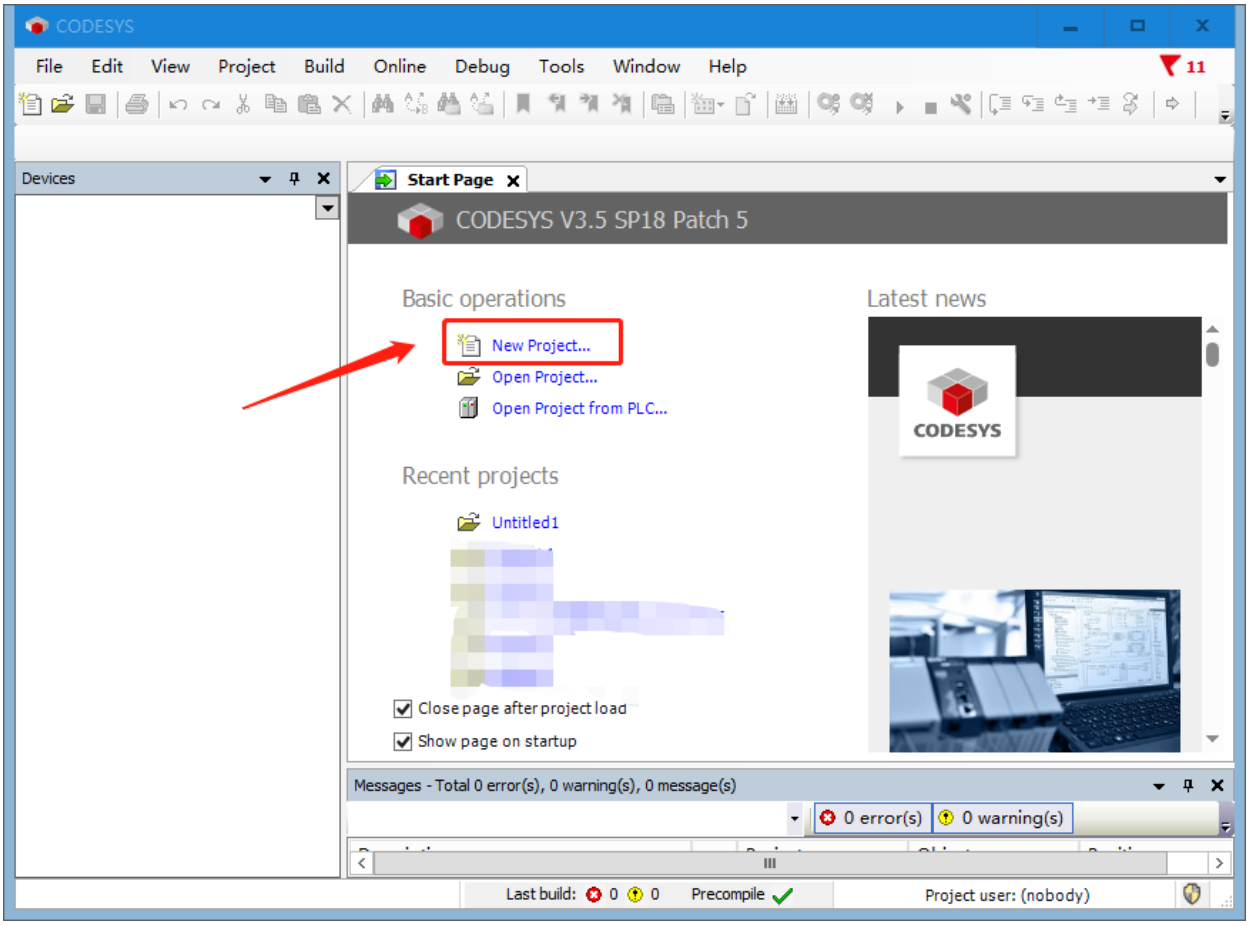
Connected to CTH3 C35-003S2 via Ethernet port

Connection of the programming device PG/PC to the CTH3 C35-003S2 using a standard network cable (EtherNET communication port)

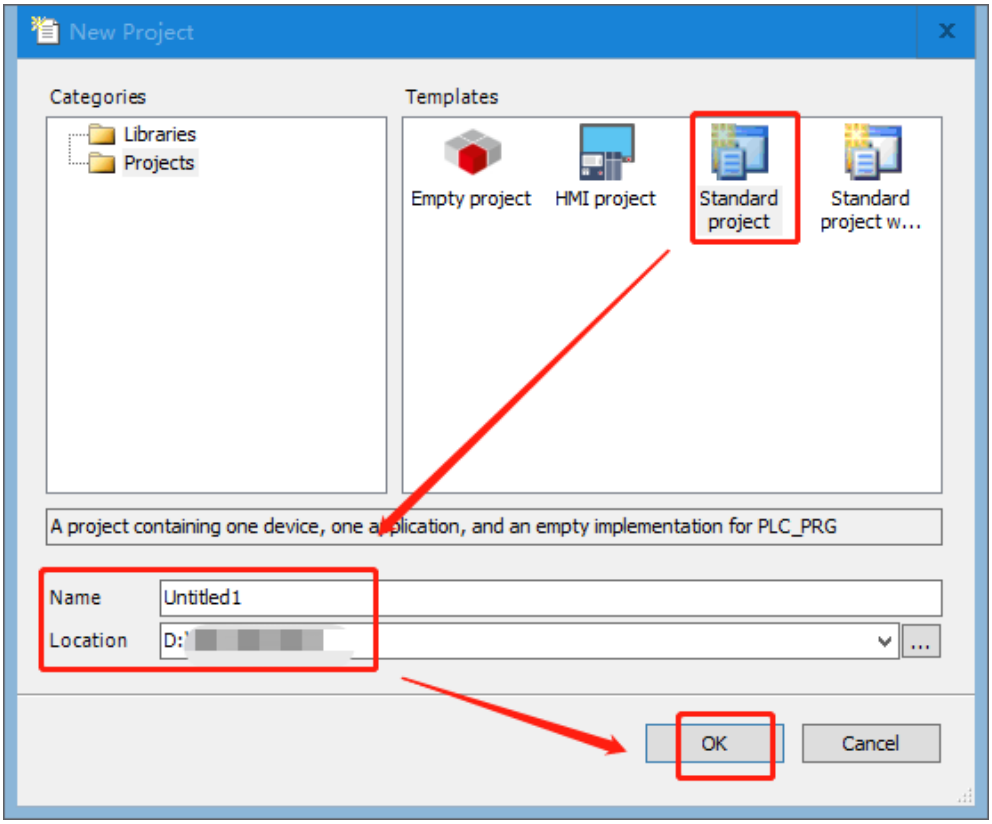


3.2 Create a new project

1. Start CODESYS SP18, the starting interface is as follows, click New Project.

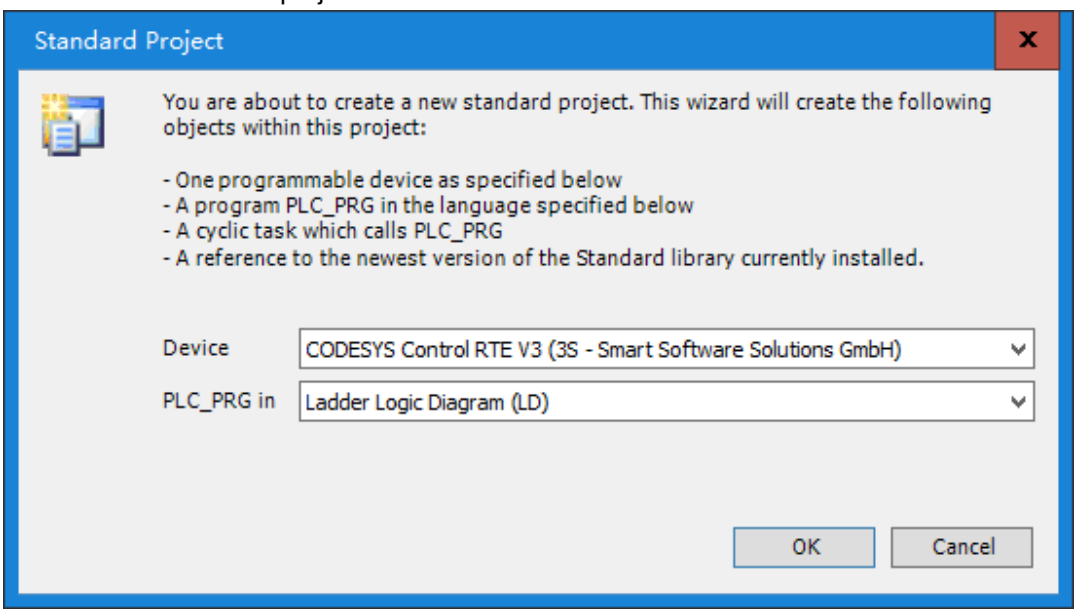


2. Create a new standard project, set the project name and project save path.



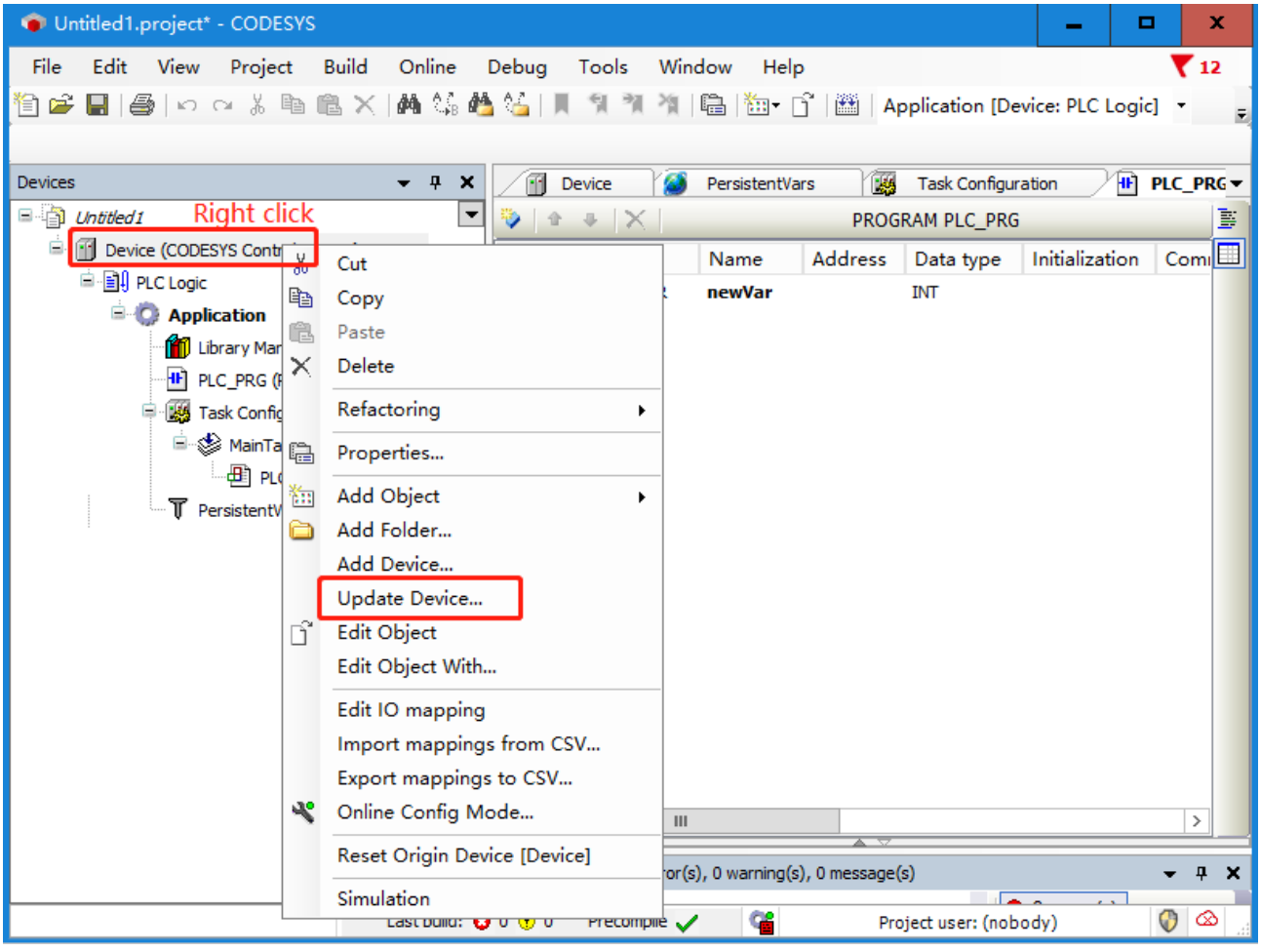
3. Select the device and programming language, if there is no desired device, you can select the default device to create a project, and then install the desired device description file in the project, the installation is completed directly update the project device can be. Specific operations are as follows.

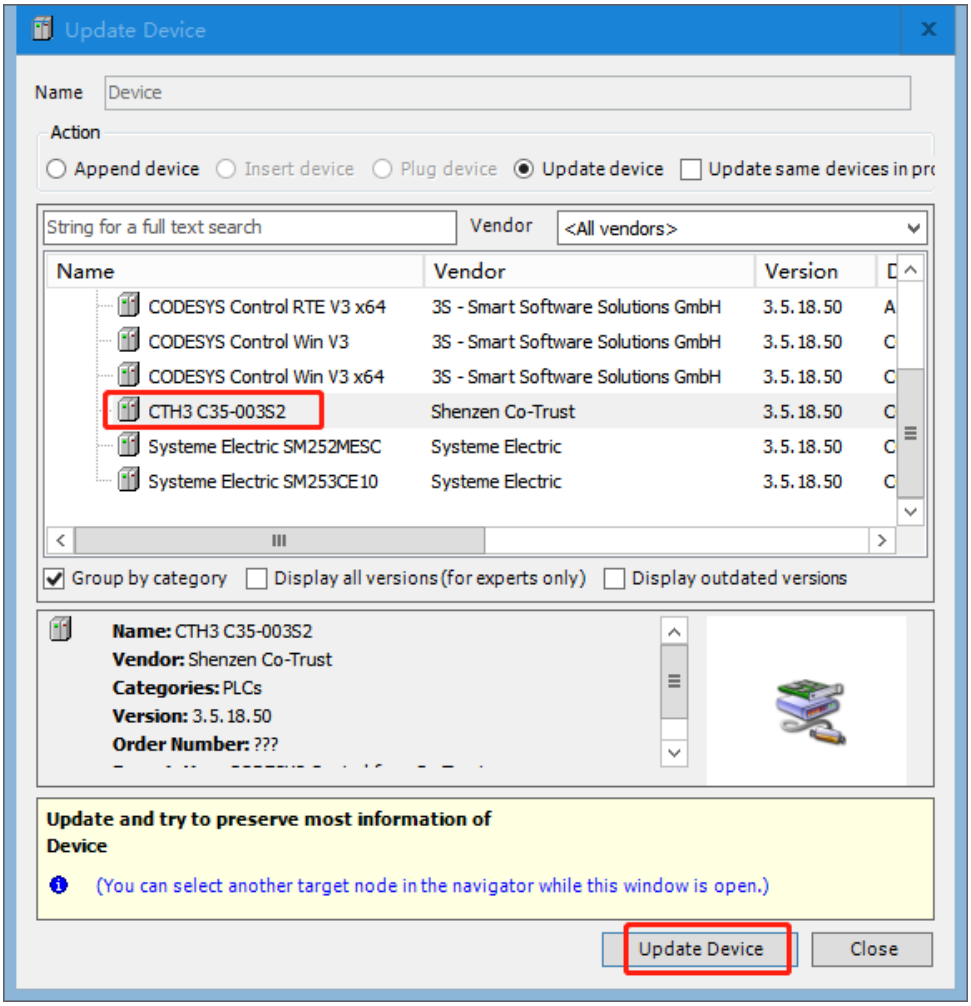
1) Create a project for the CTH3 C35-003S2, but since there is no description file installed for this device, we will create a default project first.



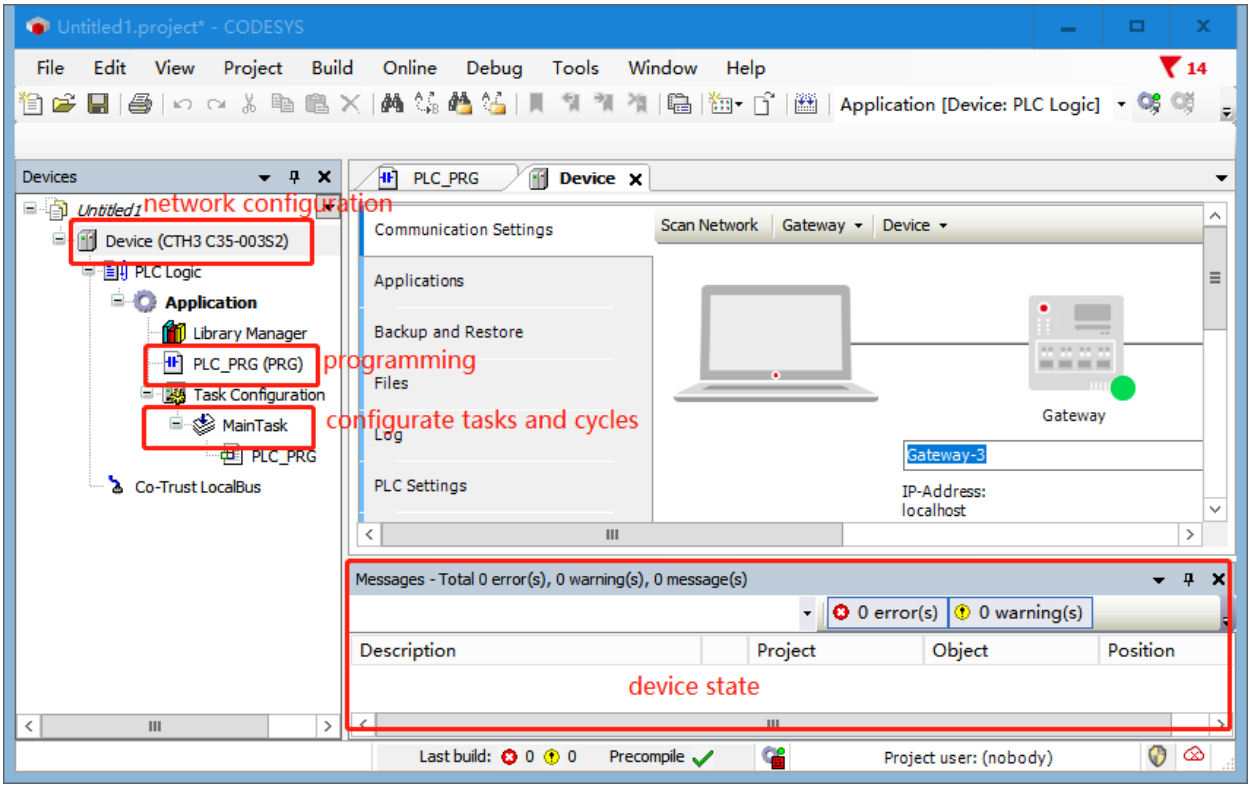
2) Enter the project interface, refer to 3.3.1 Install device description file to install the device description file of CTH3 C35-003S2.

3) Upgrading of project device





4. The basic interface of the project is as follows.

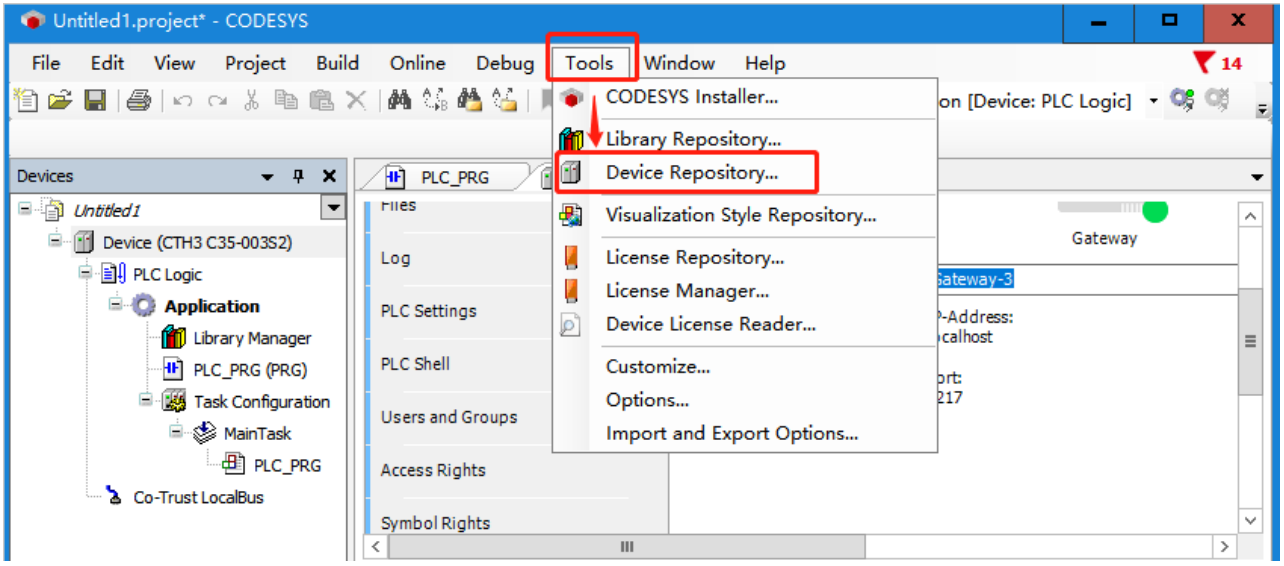


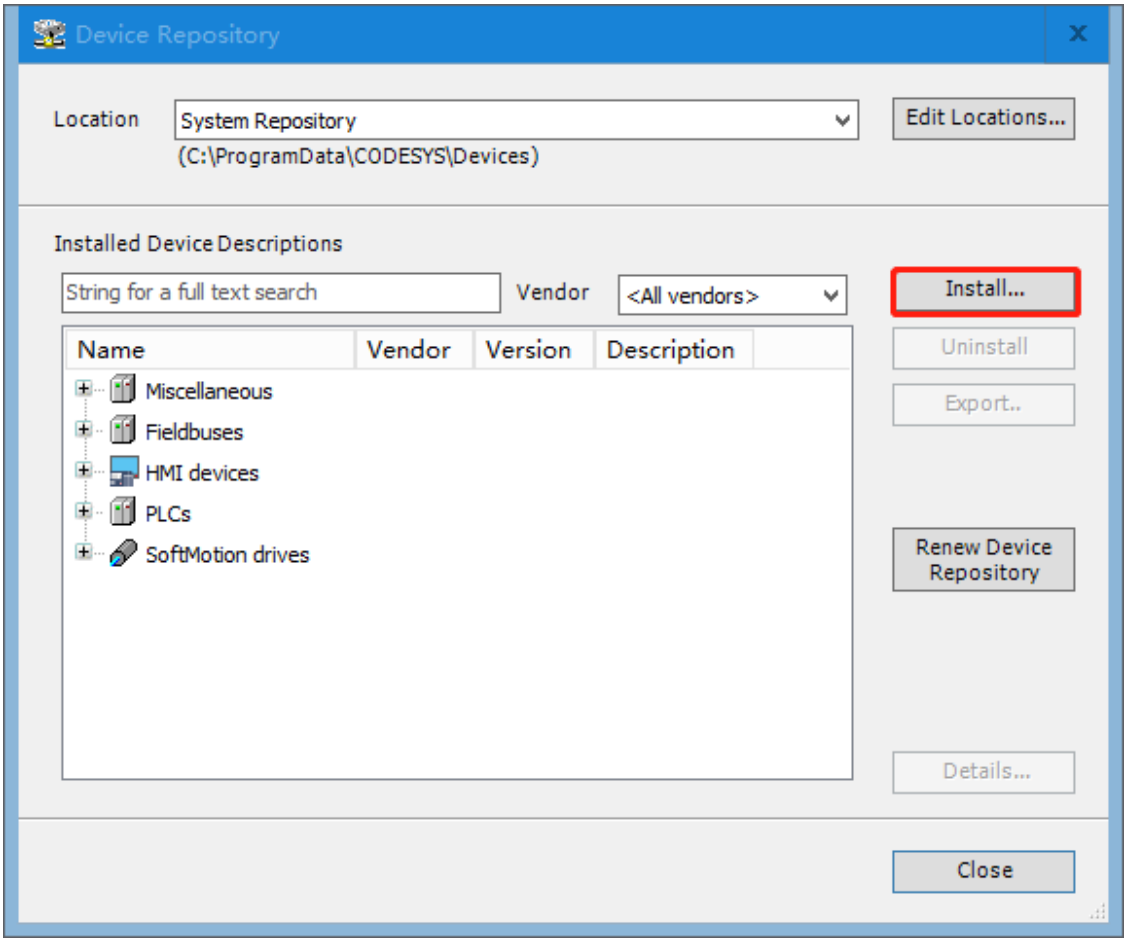
3.3 Install device description files and libraries into CODESYS

3.3.1 Install device description file

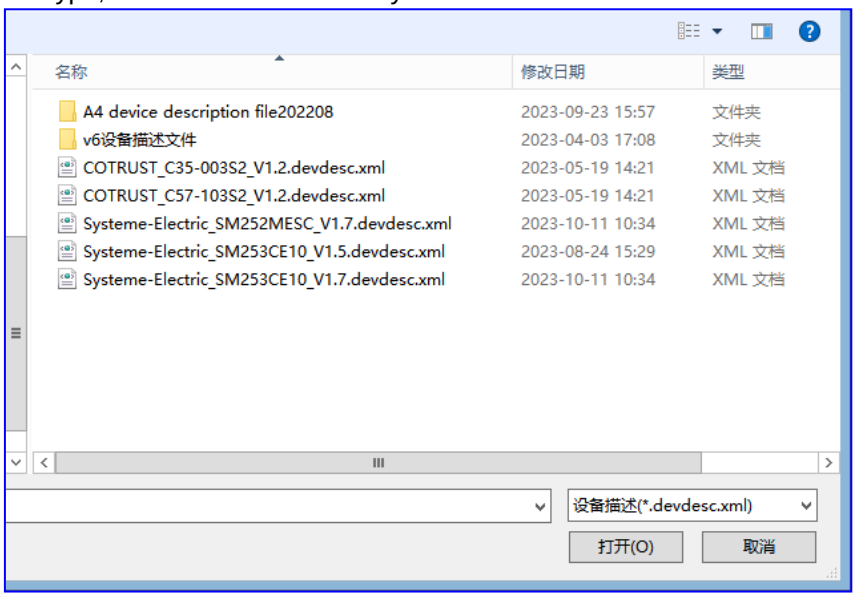
Specific steps to add the following.

1. Select the menu item [Tools] → [Device Repository], and then click [Install].



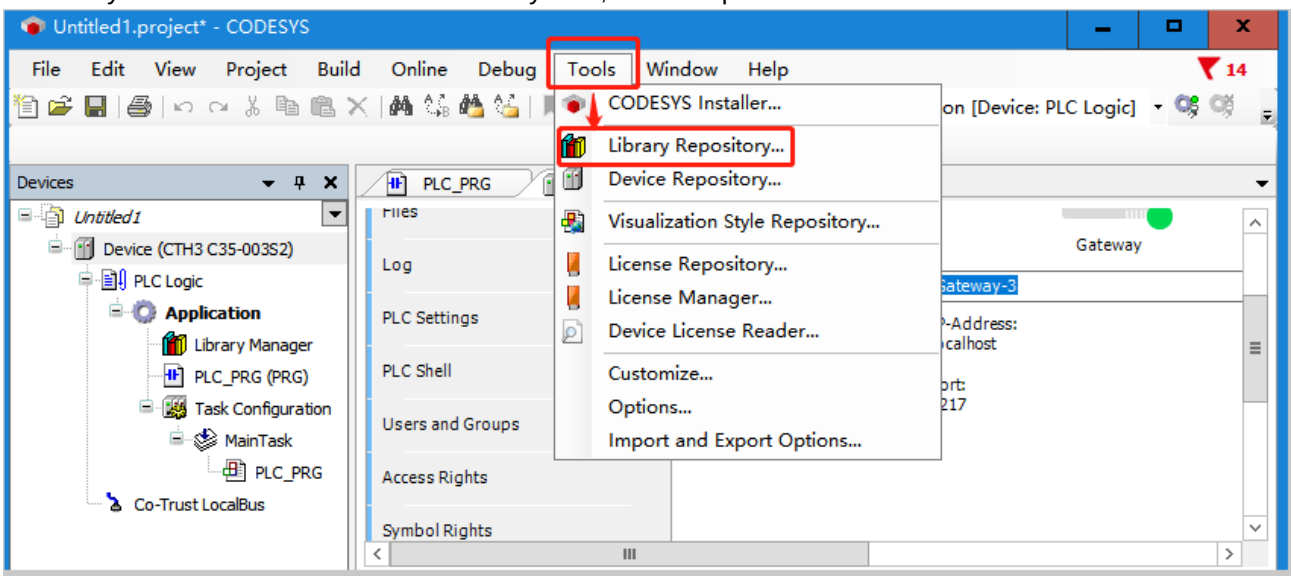


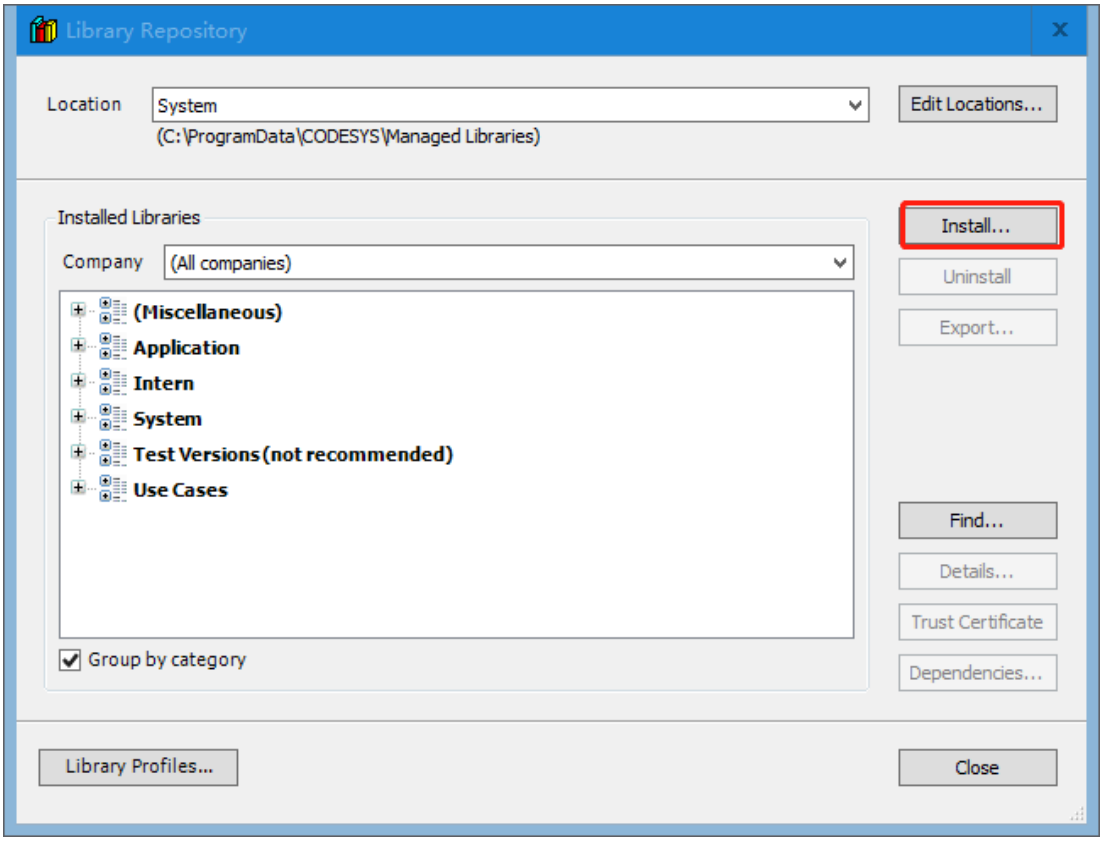
2. Find the path where the description file is located, according to the need to install the device to select the file type, select the device directly after the installation can be.



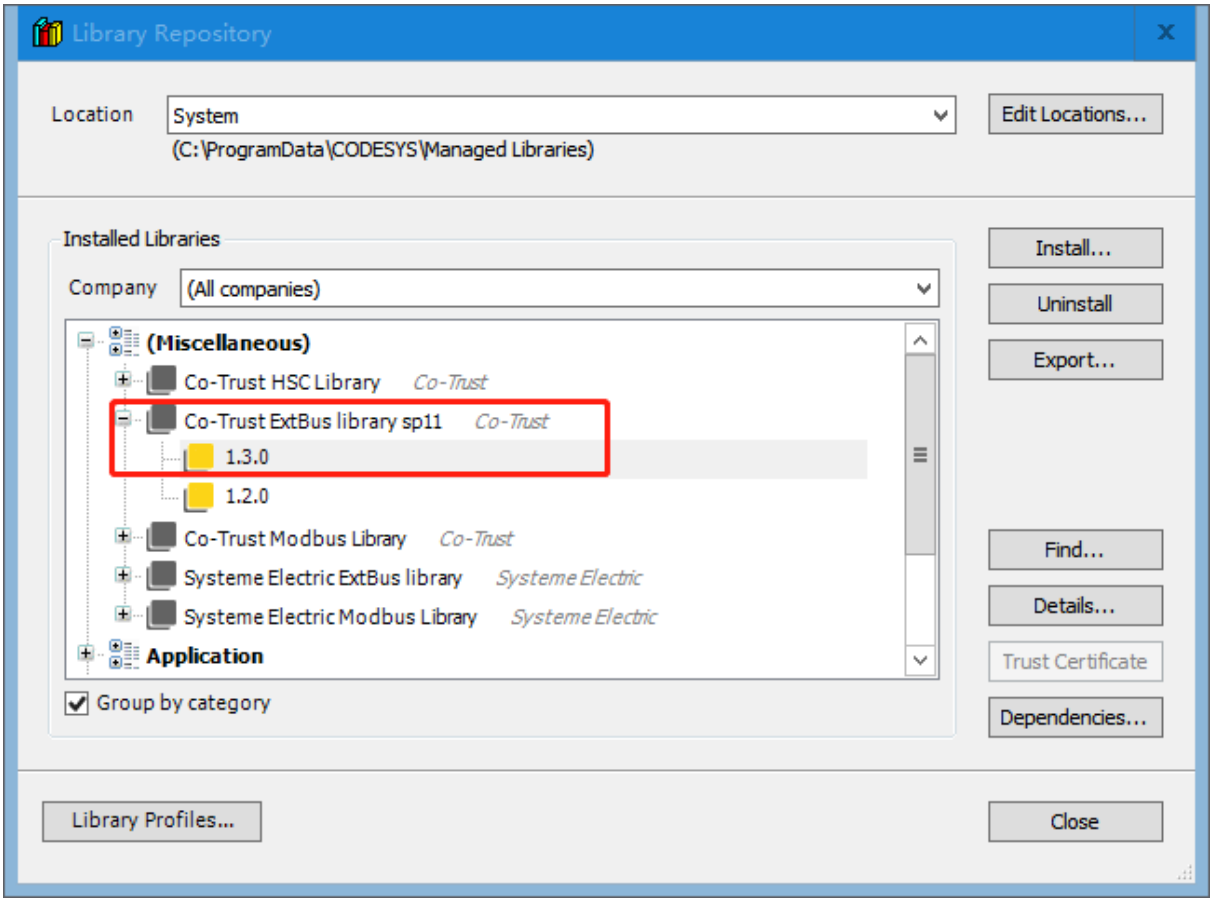
3.3.2 Install Library

1. Select [Tools] → [Library Storage], in the pop-up dialogue box on the right side of the [Installation], select the library files need to be installed into the system, select "Open" for installation.





2. The installation is complete can be seen in the installed library directory of the library.



3.4 Set communication

1. Set the IP of the programming device to the same network segment as the PLC.

Before setting up the communication, it is necessary to set the IP of the programming PC to the same network segment as the PLC (IP: 192.168.0.X).

Setting method:

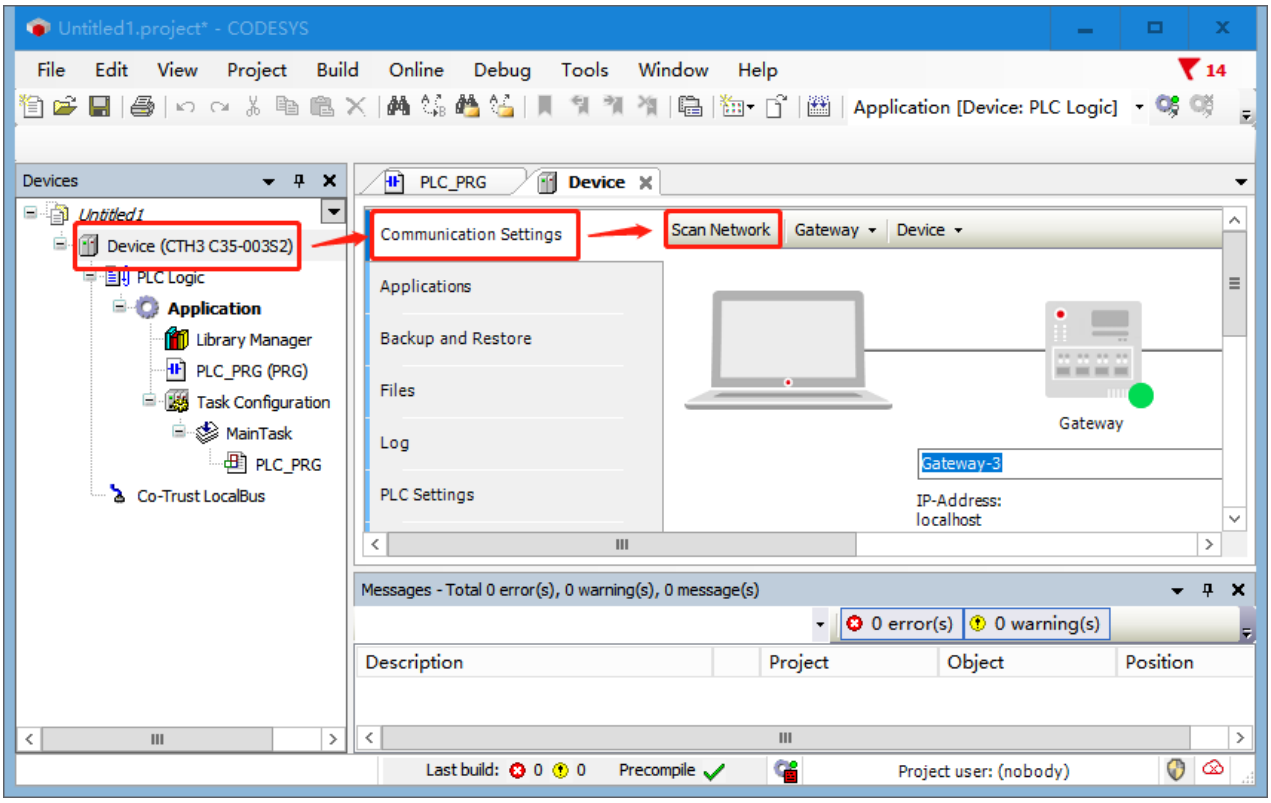
1) Open the PC's Ethernet properties.

(2) Double click on Internet TCP/IP protocol.

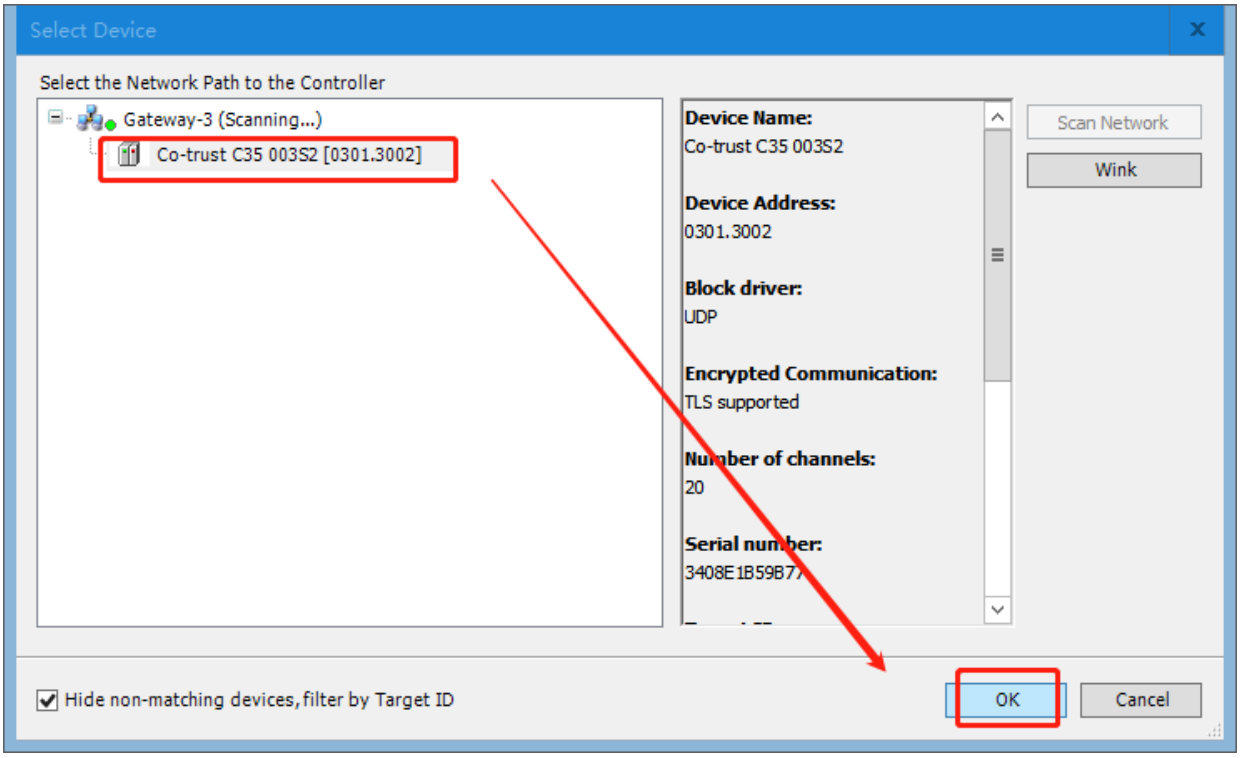
3) Change "Obtain IP address automatically" to "Use the following IP address", and then fill in "192.168.0.X" in the IP address.

2. Perform "Communication Settings" in CODESYS device view.

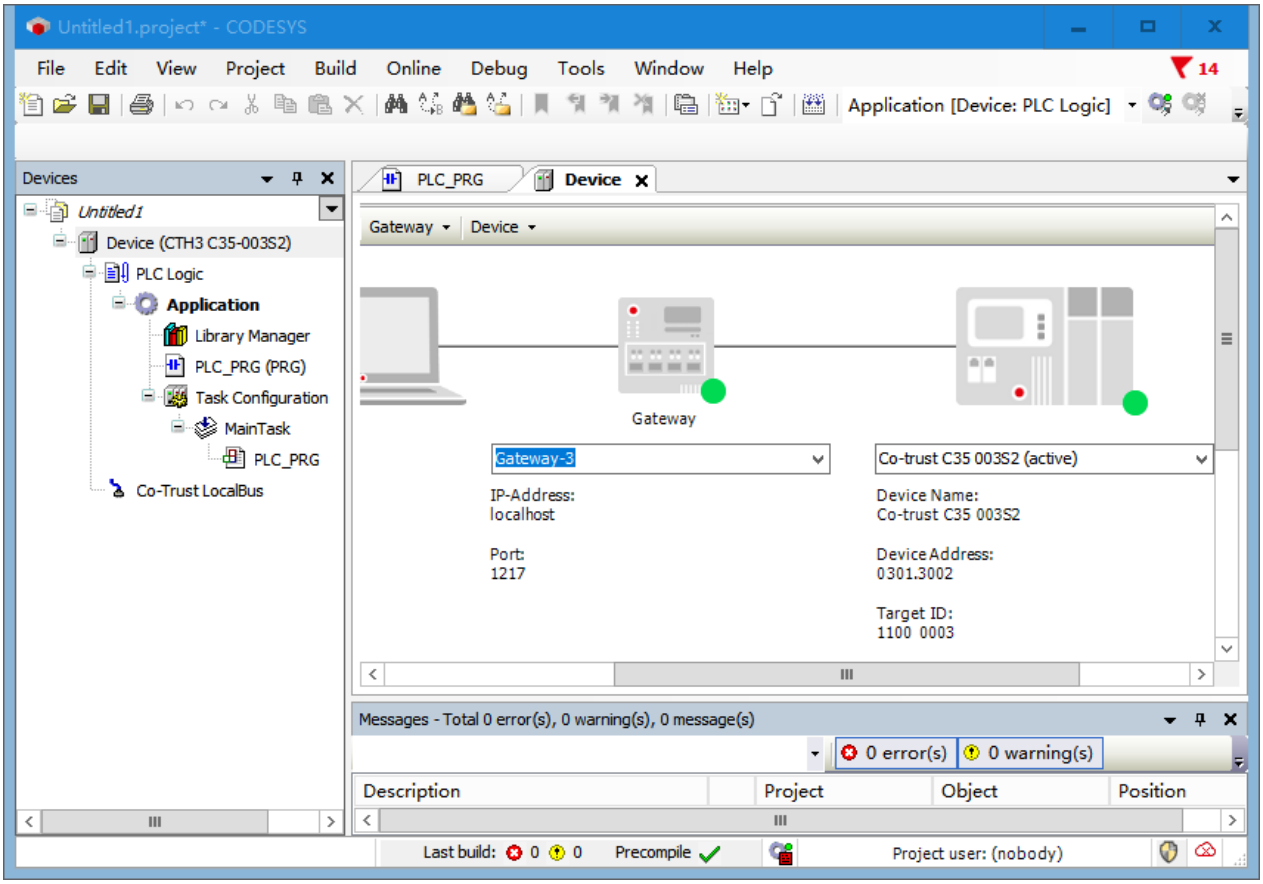
Double click [Device] in the device view, and then click [Scan Network] in the tab [Communication Settings].



Select the scanned device and confirm, with device information displayed on the right.

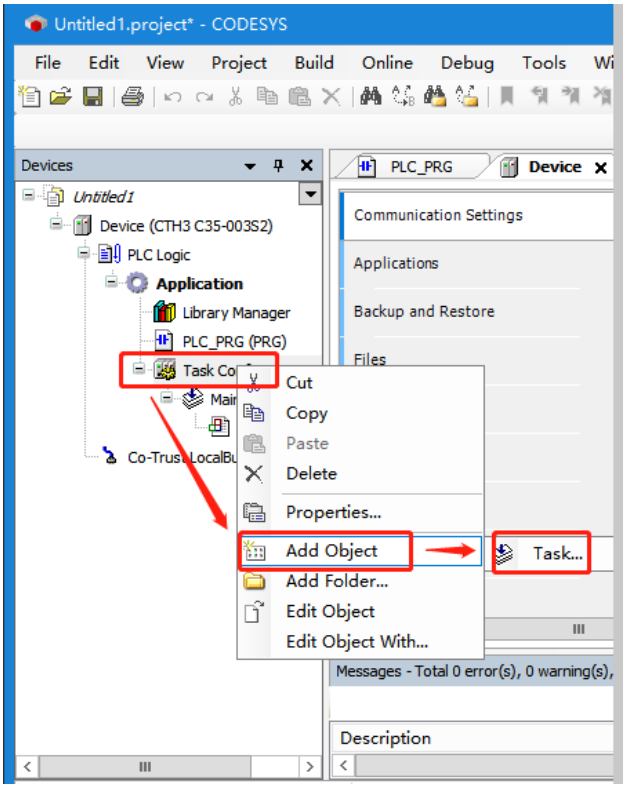


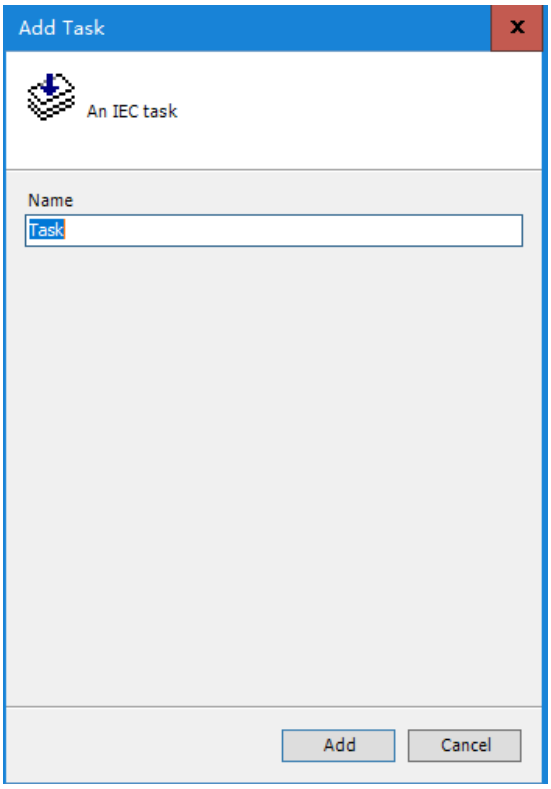
Returning to the communication settings interface, you can see two green indicator lights, indicating that the communication channel is activated, which means that all communication related operations are associated with the channel and the device successfully communicates.



3.5 Task Configuration

In "Task Configuration", tasks can be managed. Creating a standard PLC project will automatically generate a recurring task that is automatically associated with the PLC_ PRG, the default task cycle is 4ms, with a priority of 1. The PLC program will only participate in compilation and actual execution when called by the task. Right click on "Task Configuration ->Add Object ->Task", define the task name, and complete the creation of a new task. A maximum of 100 tasks of different types can be created, executed in the priority order set by the user. The smaller the number, the higher the priority. If the priority is the same, execute from top to bottom according to the order in the task configuration.

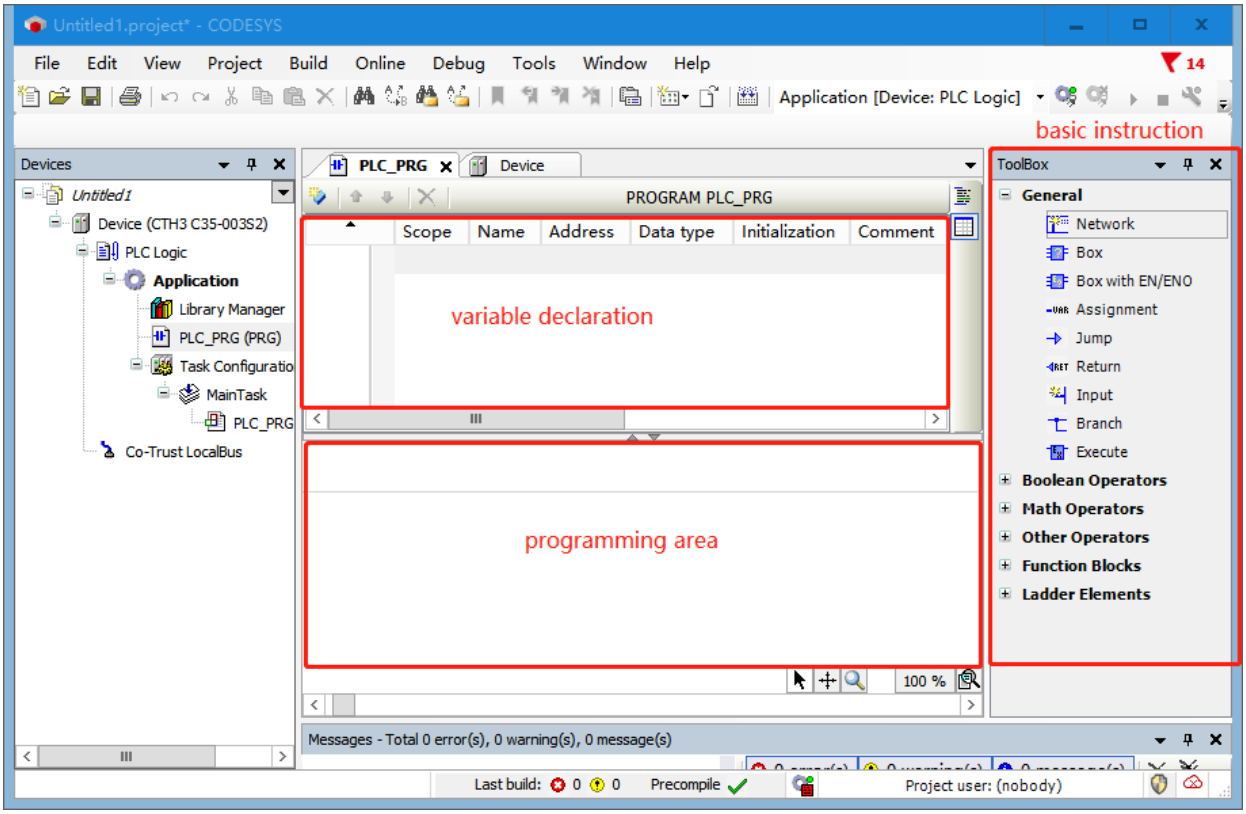




For the new created PLC program, you need to manually configure and call tasks, otherwise the program will not execute. Double click Main Task → Add Object →program call. Click OK to complete the call for the PLC program that needs to be called.

3.6 Programming

In the device window, the default POU is "PLC_PRG", double clicking on "PLC_PRG" in the device view automatically opens the LD language editor in the middle of the CODESYS user interface. the LD language editor contains the declaration section, The LD language editor consists of a declaration section and an implementation section.

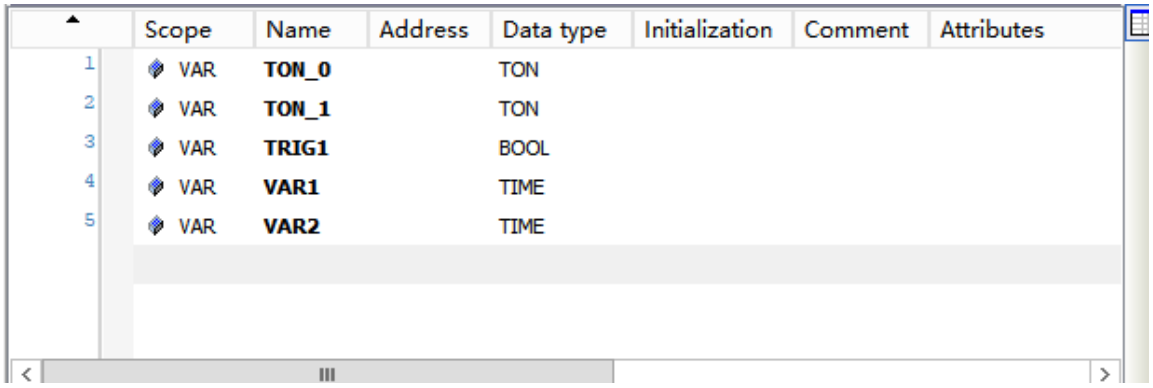


The declaration section includes: line numbers displayed in the left border, POU type and name (such as "Program PLC-PRG"), and variable declarations between the keywords "VAR" and "END_VAR".

The program implementation function of this example is to set and reset timer 1 and timer 2 repeatedly within a 5-second interval.

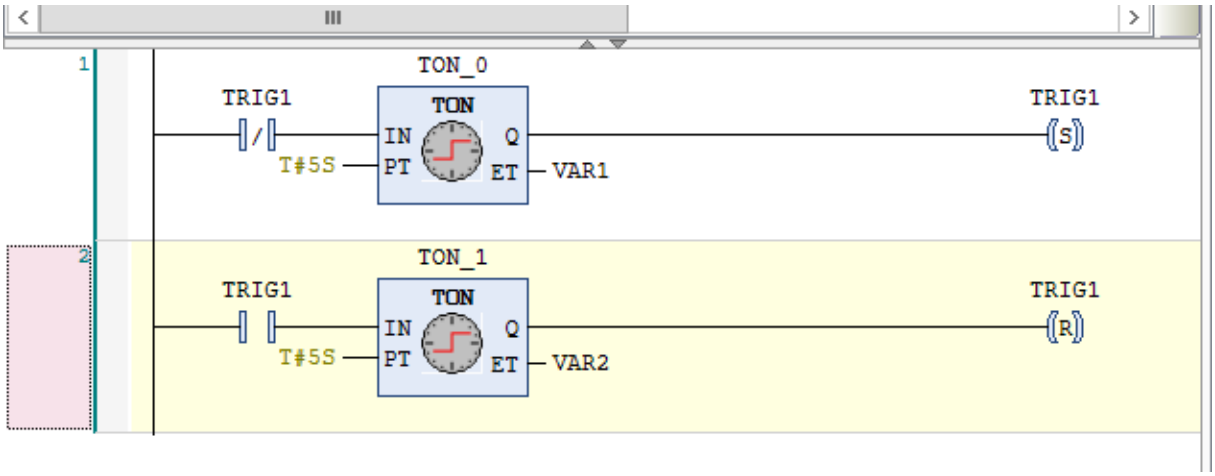
1. Declare variables in PLC_ PRG

In the declaration section of the editor, move the cursor over VAR, click enter, insert a new blank line, and declare the variables that need to be used. Alternatively, in the implementation section of the program, use the automatic declaration function: enter instructions in the implementation section of the program, click enter, and if there are undeclared variables in a new line, the system will open the automatic declaration dialog box, where declaration settings can be made. The declaration section of this example is shown in the following figure:



2. In implementation part of PLC_ PRG input instructions

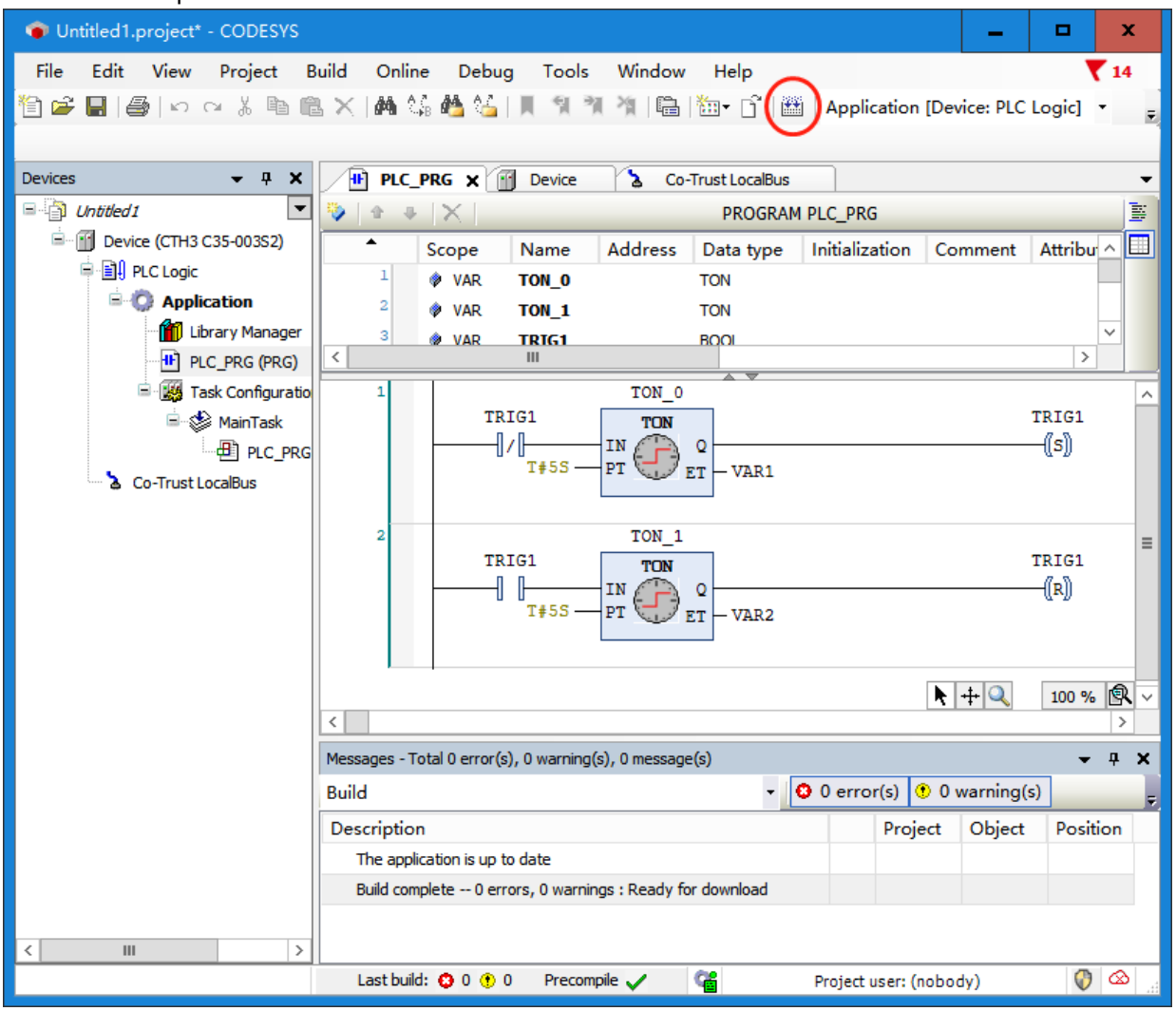
Expand "Ladder Elements" in the toolbox on the right side of the LD language editor, use the mouse to drag "Timer TON" to the implementation section of the language editor, and then drag a reset coil from the "Ladder Elements" in the toolbox to the back of the TON instruction output. Using the same operation, create a TON instruction in network 2.



3.7 Compilation and Download

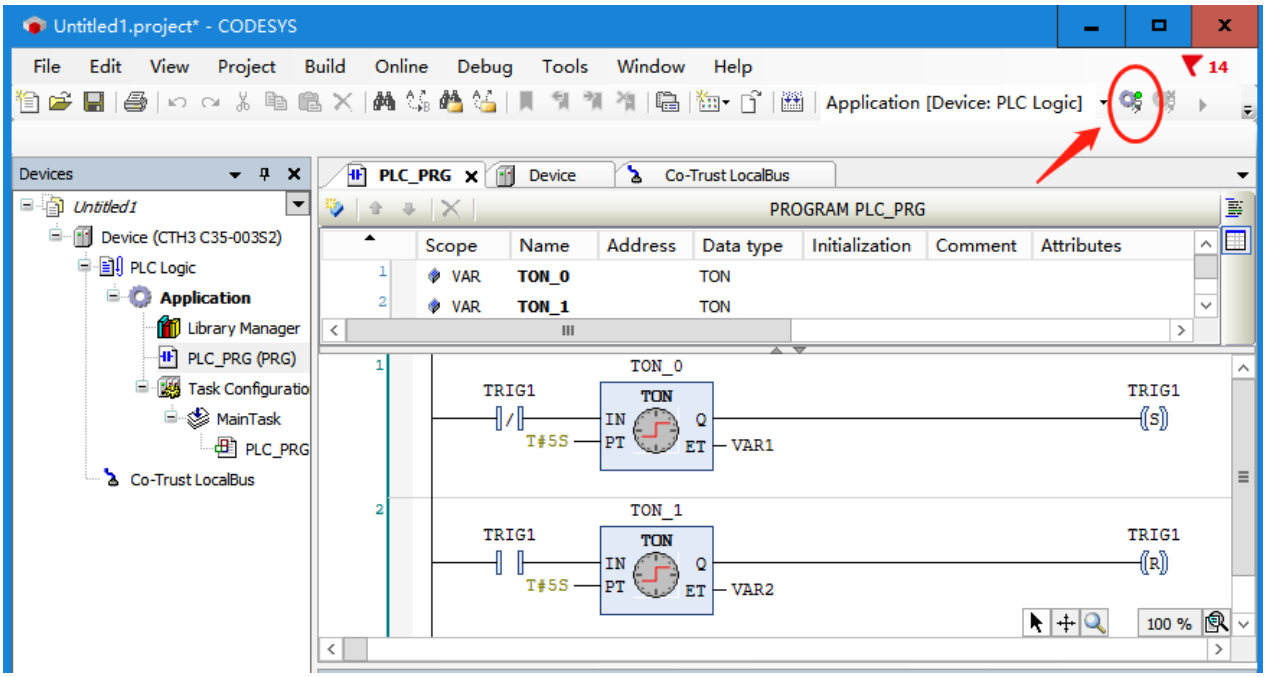
1. Save the current project and compile it

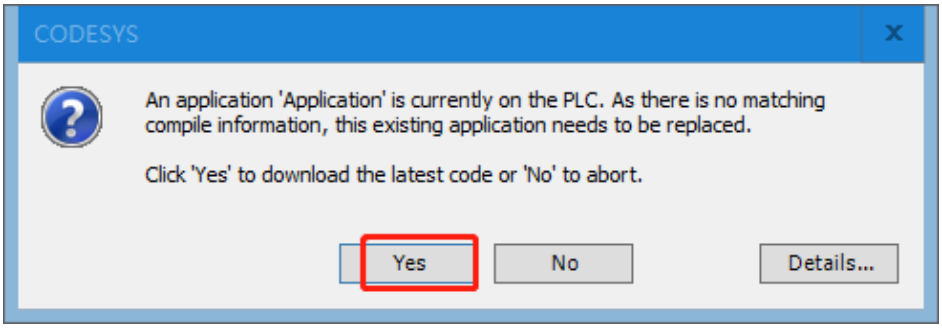
After the program is written, save the current project and select the menu item "Compile" to perform a syntax check on the current object. When the syntax check is completed, any error messages and warnings will be displayed in the message window of the "Compile" class. If there are no errors, it indicates successful compilation.



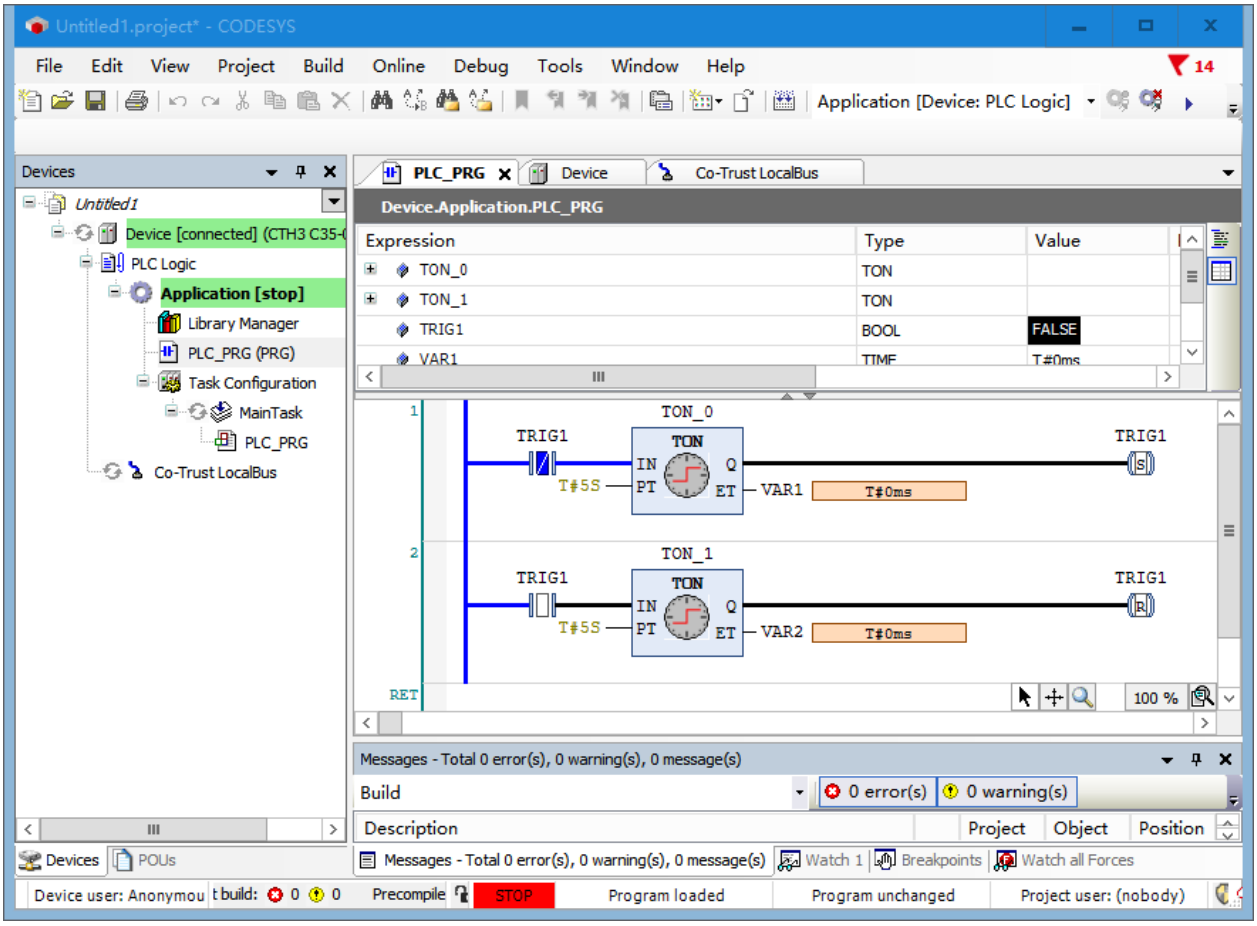
2. Login, Download, and Start Programs

Select the menu item "Online" ->"Login..." or simply click icon to establish a connection between the application and PLC and enter online mode. If communication settings have been made, the following dialog box prompt will pop up:

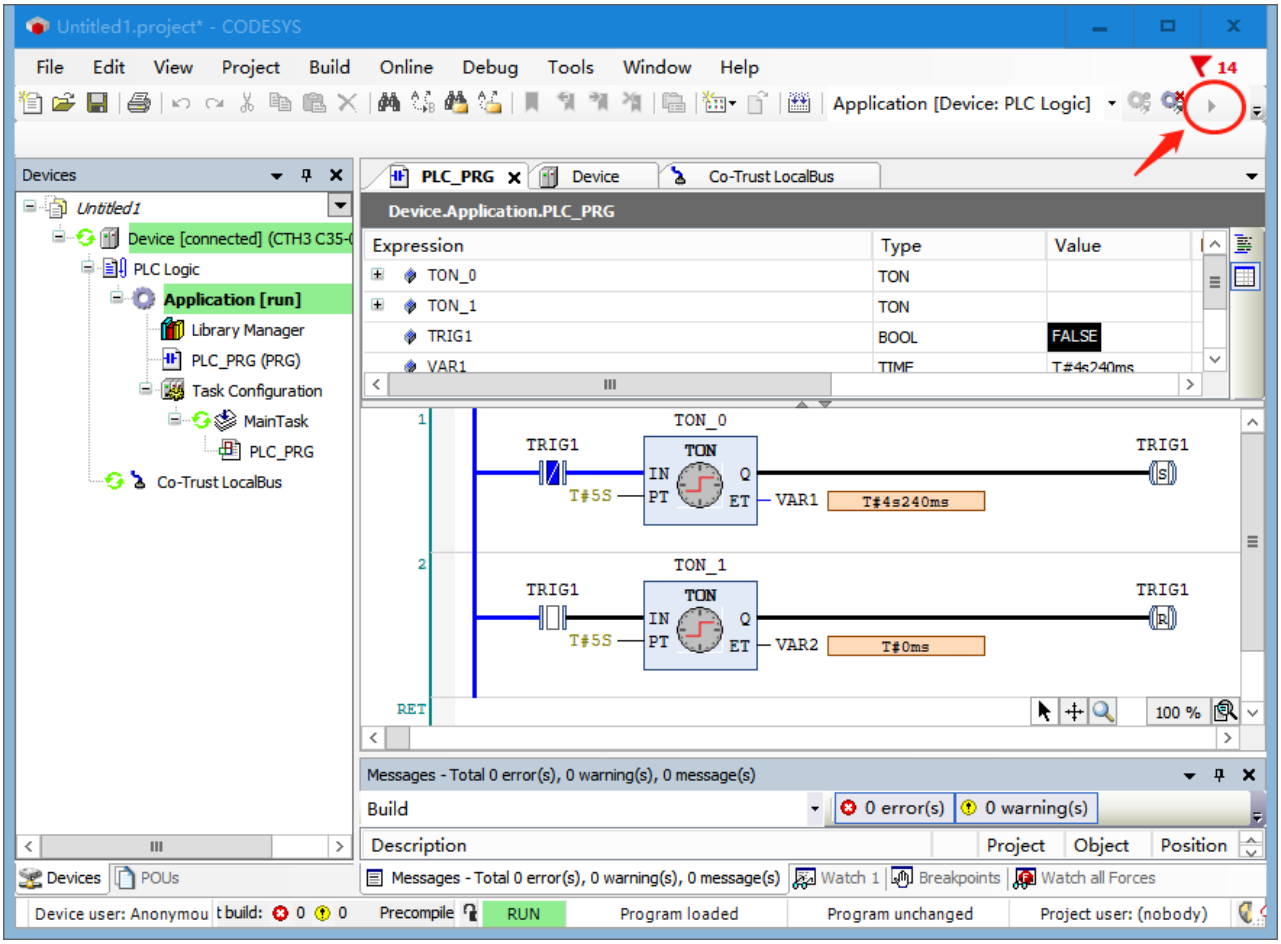




Click "Yes" to start the download of the program. After successful login, the interface is as follows:



After successful login, select the menu item "Debug" ->"Start" or directly click the run icon to run the PLC program. At this time, the current project can be monitored and debugged.



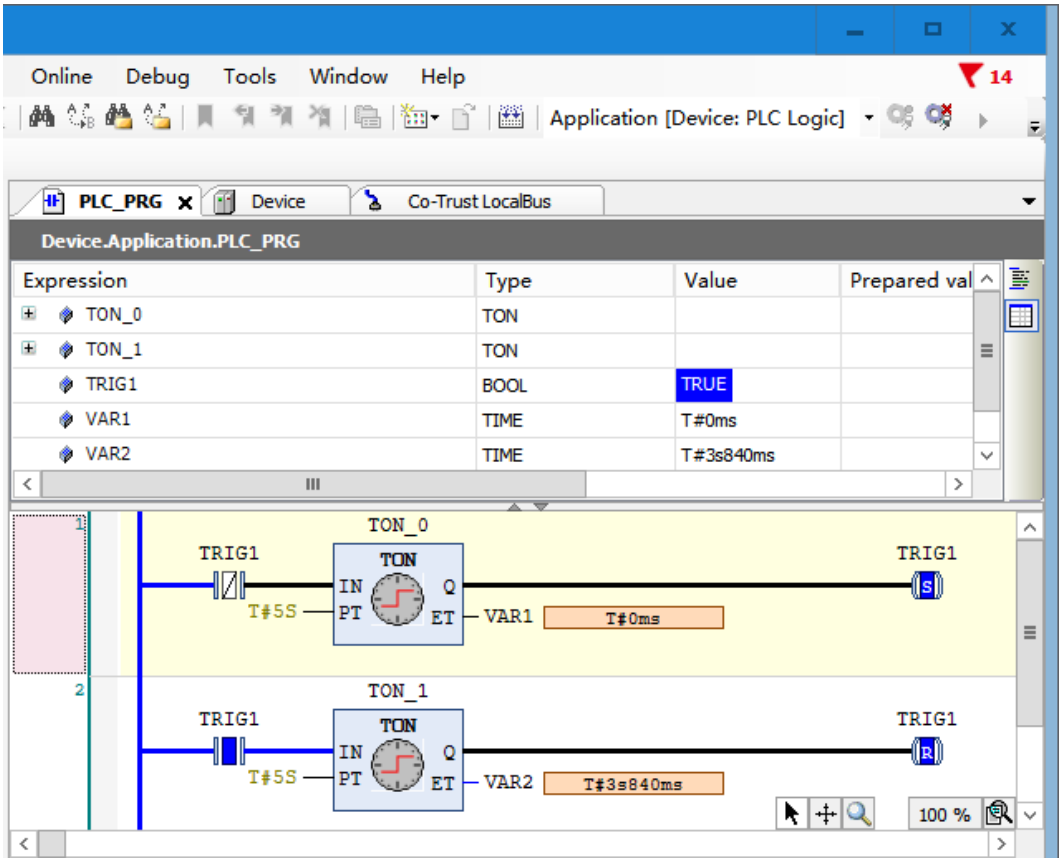
3.8 Monitoring and Commissioning

Variables and addresses in the application can be monitored using the following three methods.

- A watch window with a defined watch list.
- Write and force variables
- Online view of special POUs

1. Open the sample window of the programme

Double click to open PLC_ PRG, the following online view appears: the upper part displays the corresponding PLC_ PRG implements the program body for partial views, and the internal monitoring window for each variable displays the actual value.

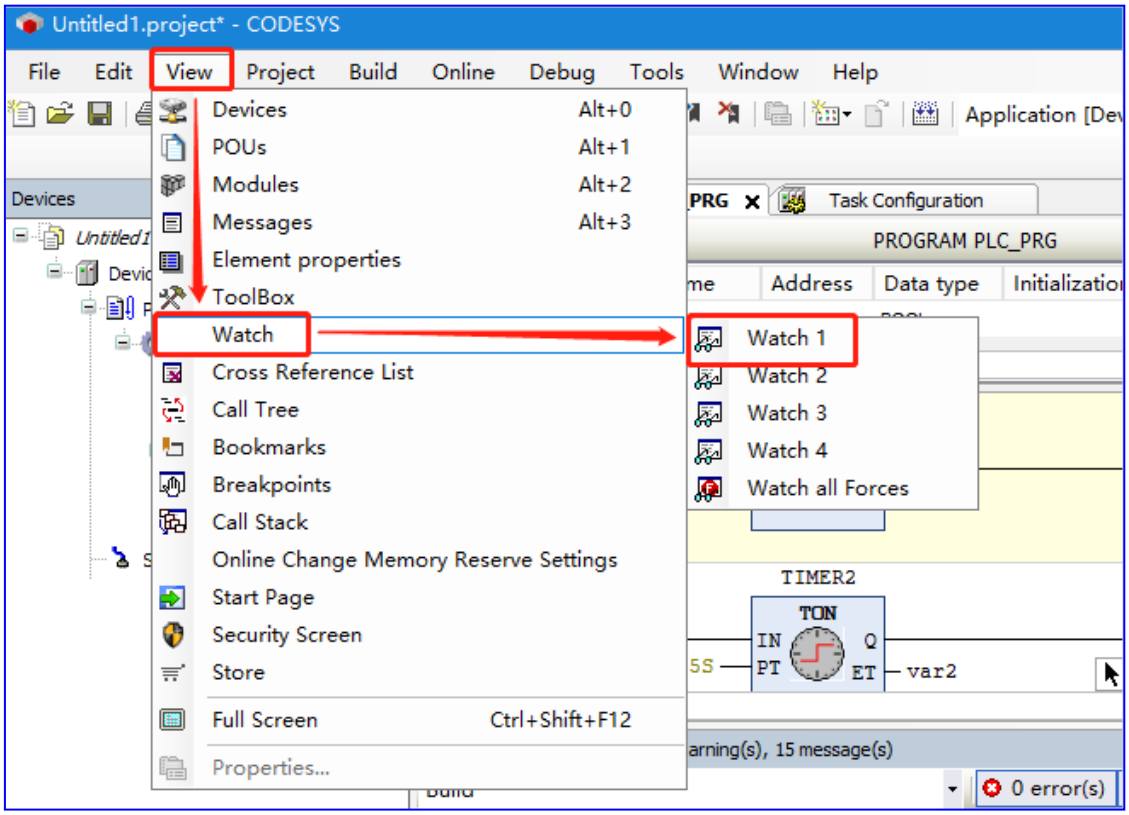


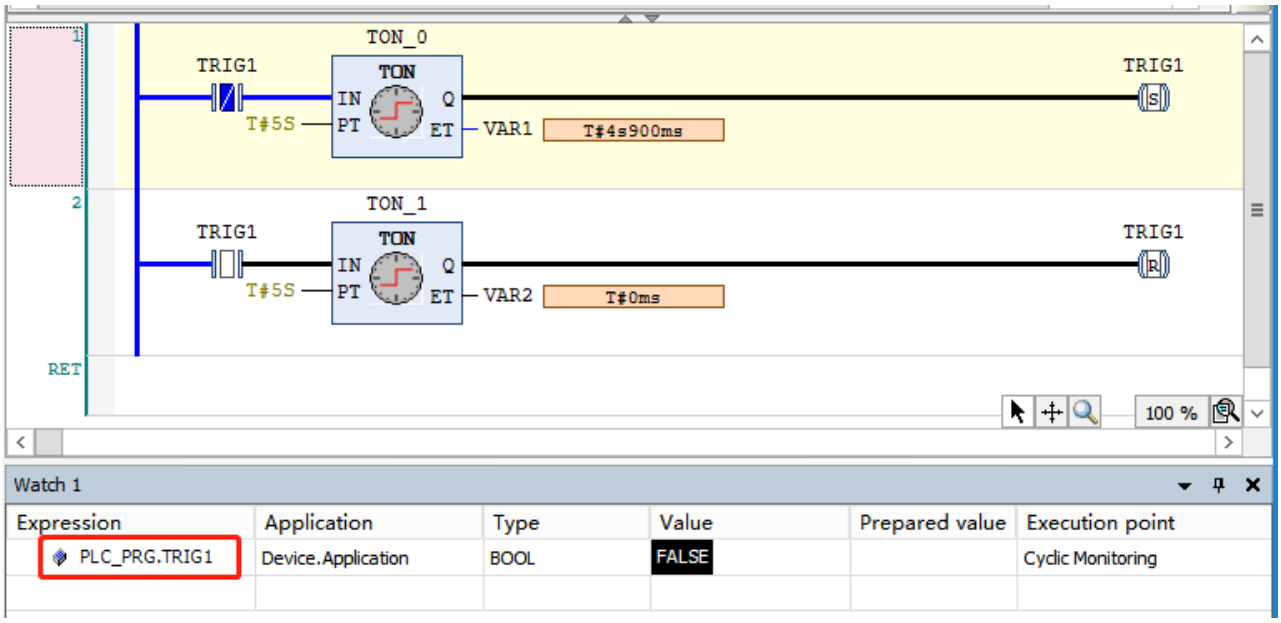
2. Writing and forcing variables

Assign a "prepared value" to variable TRIG1 by writing or forcing it, and at the beginning of the next cycle, the variable will display that value. Enter the "prepare value" (integer), click enter or outside the area, and then execute the command "write value" or "force value" to write or force the value to the PLC.

3. Using the Monitor Window

Select the menu item "View" → "Watch" → " Watch 1" to open the monitor window. Then, mouse click on the first line of the expression column, open the edit box, enter the variable to be monitored TRIG1, after logging in the project can then write and force the value of the variable.


Untitled1.project* - CODESYS
File
Edit
View
Project
Build
Online
Debug
Tools
Window
Help
Devices
Alt+0
POUs
Alt+1
Modules
Alt+2
Messages
Alt+3
Element properties
ToolBox
Watch
Cross Reference List
Call Tree
Bookmarks
Breakpoints
Call Stack
Online Change Memory Reserve Settings
Start Page
Security Screen
Store
Full Screen
Ctrl+Shift+F12
Properties...
Application [Dev
Task Configuration
PROGRAM PLC_PRG
Address
Data type
Watch 1
Watch 2
Watch 3
Watch 4
Watch all Forces
TIMER2
TON
IN
PT
Q
ET
var2
arning(s), 15 message(s)
0 error(s)


TON_0
TRIG1
TON
IN
PT
Q
ET
T#5S
VAR1
T#4s900ms
TRIG1
TON_1
TRIG1
TON
IN
PT
Q
ET
T#5S
VAR2
T#0ms
TRIG1
RET
100 %
Watch 1
Expression
Application
Type
Value
Prepared value
Execution point
PLC_PRG.TRIG1
Device.Application
BOOL
FALSE
Cyclic Monitoring

Module usage and status description

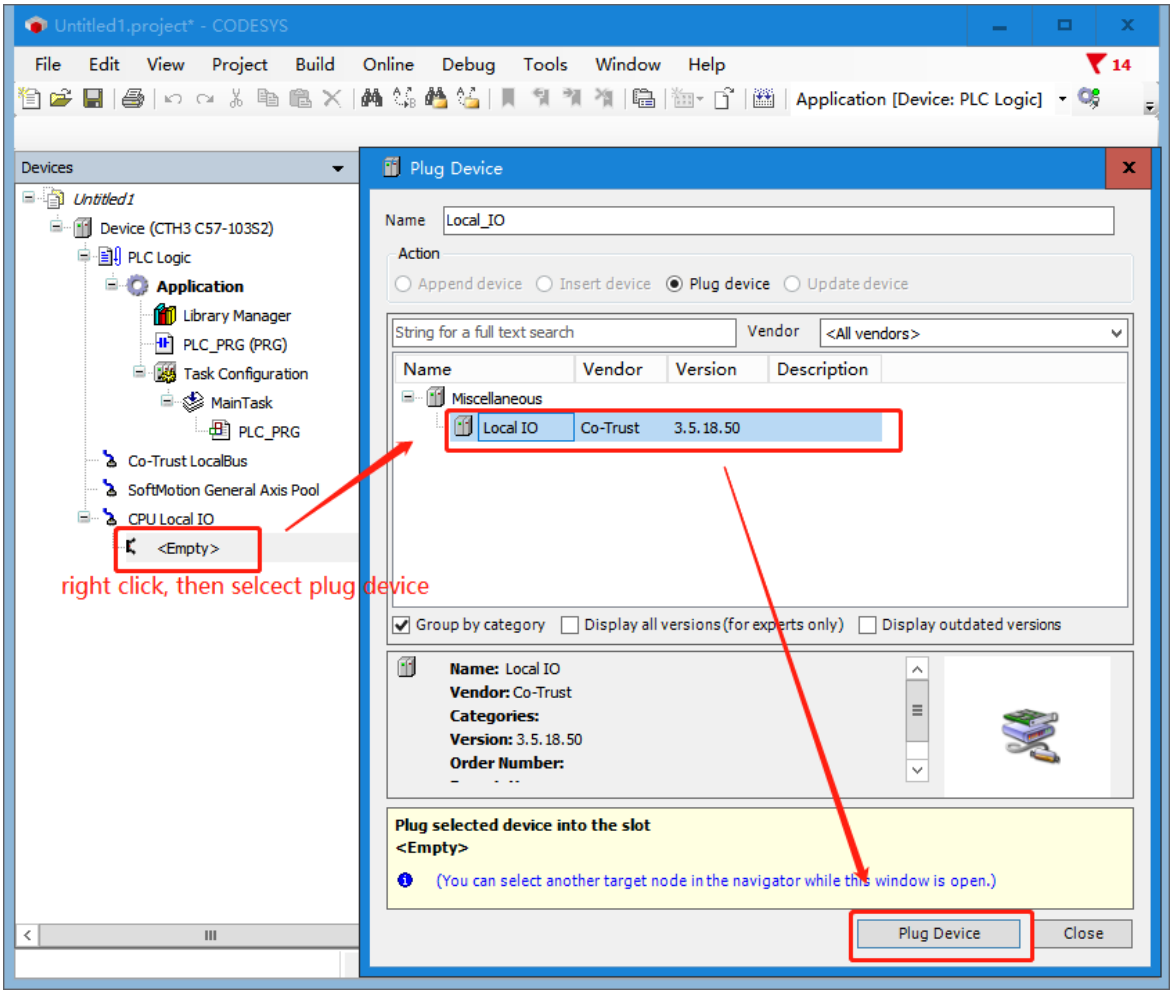
4

4.1 Explanation of PLC native IO usage

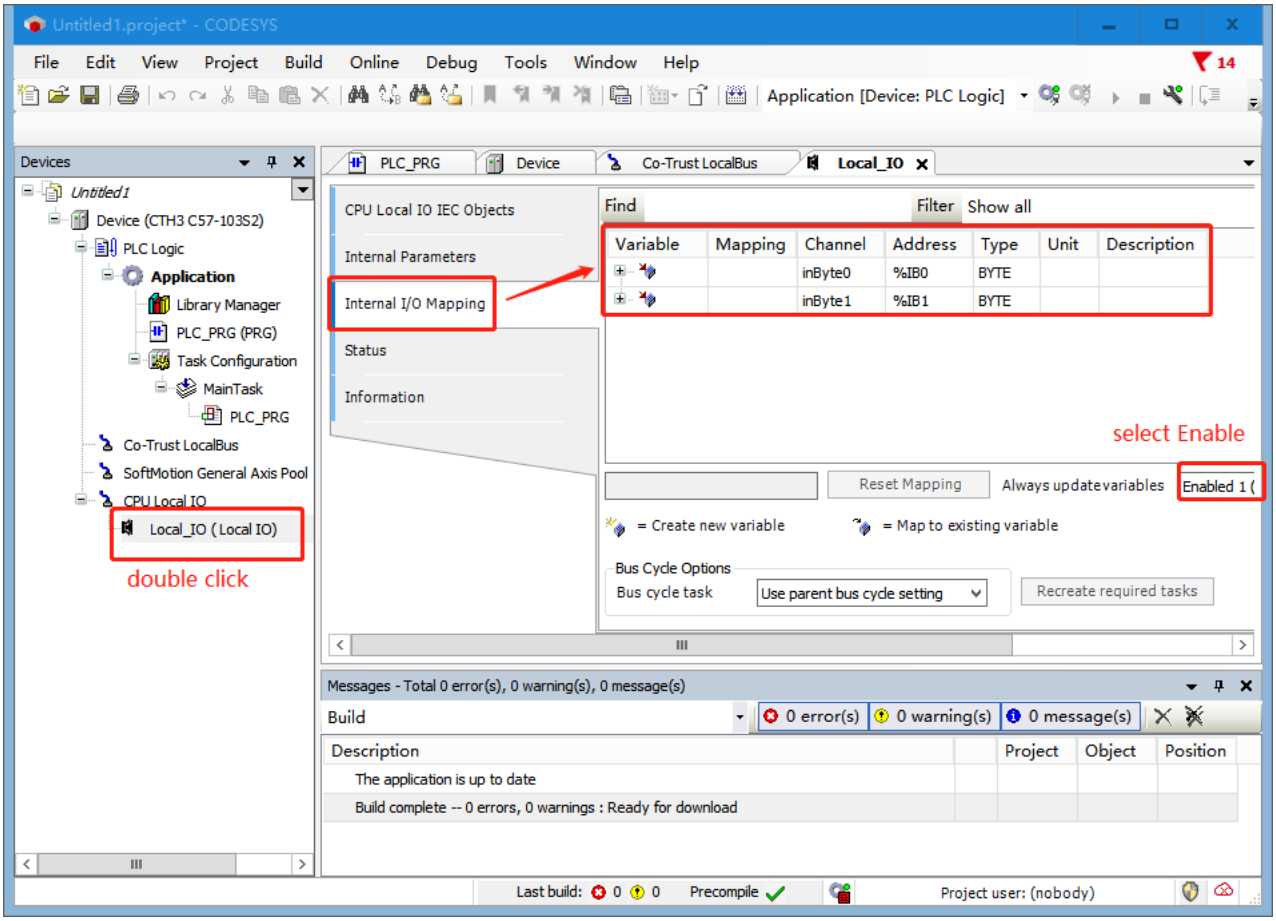
CTH3 C57-103S2 comes with 10-channel IO port, the following will introduce the use of the 10-channel IO.

4.1.1 Native IO used as normal input

The wiring as a normal input IO is the same as that of a digital input module, and the configuration steps in the software are as follows.



2. After adding, you can monitor the current local IO status under General I/O mapping on the right side.



4.1.2 Native IO used as high-speed input

CTH3 C57-103S2 itself integrates 6-channel high-speed counter (HSC0~HSC5), can also be equipped with high-speed counter module, this section introduces the use of the local IO as a high-speed input.

Table 4-1 When the CTH3 C57-103S2 local input is used as a high-speed counter, the high-speed counter input points and counting modes are as follows.

Mode	High speed counter	Description		
	HSC0	I0.0	I0.1	I0.2
	HSC1	I0.3	I0.4	I0.5
	HSC2	I0.6	I0.7	--
	HSC3	I1.0	I1.1	--
	HSC4	I0.2	--	--
	HSC5	I0.5	--	--
0	Single phase counter with internal directional control	clock	--	--
1		clock	--	reset
2		The counting mode is not supported		
3	Single phase counter with external directional control	clock	direction	--
4		clock	direction	reset
5		The counting mode is not supported		

6	Two phase counter with increase/decrease counting clock	up clock	down clock	--
7		up clock	down clock	reset
8		The counting mode is not supported		
9	A/B phase orthogonal counter	clock A	clock B	--
10		clock A	clock B	reset
11		The counting mode is not supported		

I. Description of counting modes

1. CTH3 C57-103S2 itself integrated 6-way high-speed counter, high-speed counter input points can not be freely assigned, you need to follow the above table to configure the input points. The same input point can not be used for more than one high-speed counter, but only for one high-speed counter.

2. HSC0 has three inputs, HSC0 and HSC1 support all the remaining counting modes except for modes 2, 5, 8 and 11 listed in the table above. When HSC0 adopts modes 4, 7, 10, I0.2 is occupied, then HSC4 is not available. Similarly, when HSC1 adopts modes 4, 7, and 10, I0.5 is occupied and HSC5 has no input.

3. The difference between internal direction direction and external direction direction: internal counting direction is through the ctrol word direct counting, do not need to be wired and occupy I points. External counting is initiated by an external input signal.

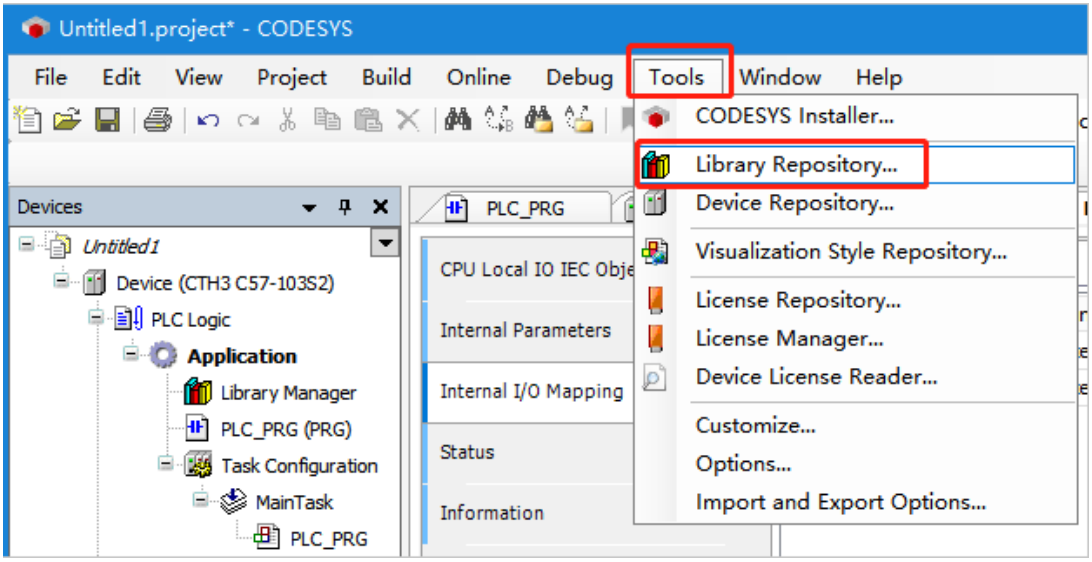
4. With the reset signal mode support capture function, capture is through the external input signal latch the current count value. HSC_SETMODE instruction can be set to falling edge latch or rising edge latch, latch, if the corresponding capture interrupt is turned on, then you can generate an interrupt.

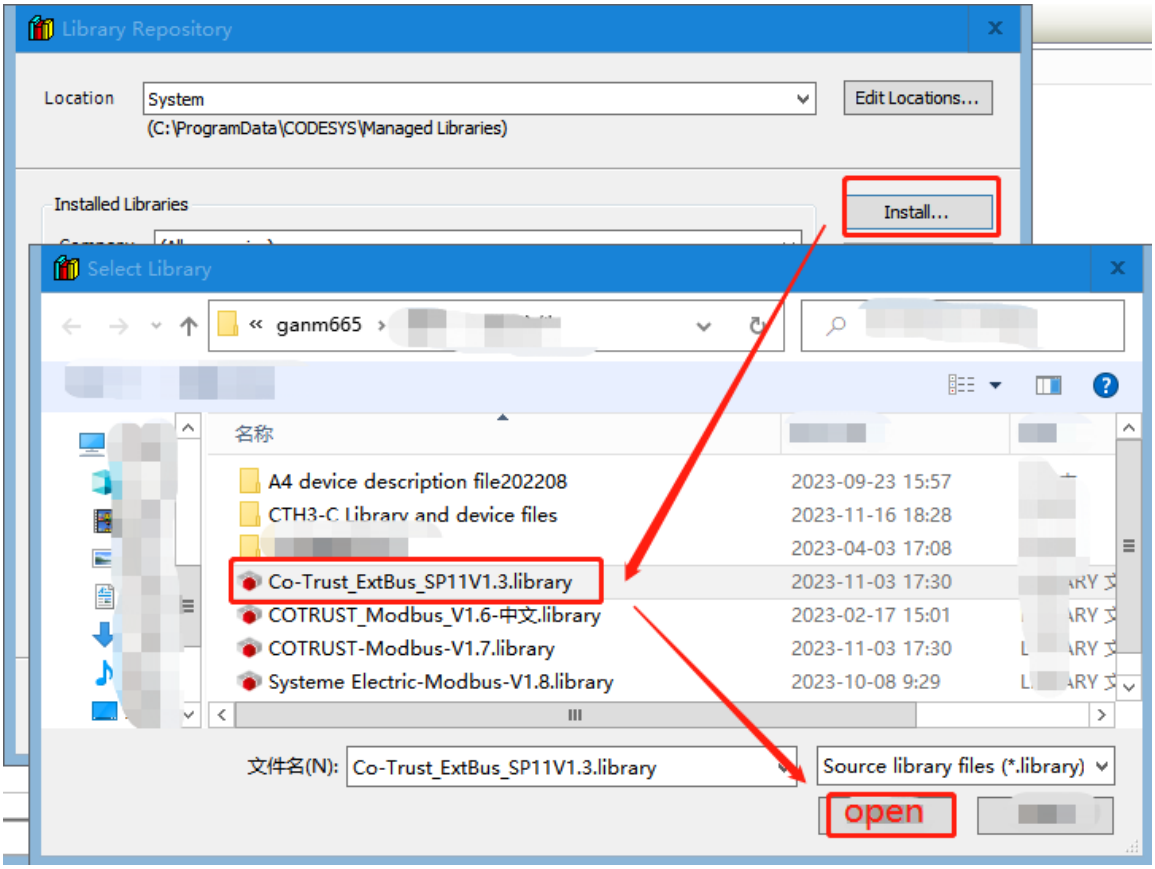
5. Counting unit: number of pulses.

II. Configuring high-speed counters in CODESYS

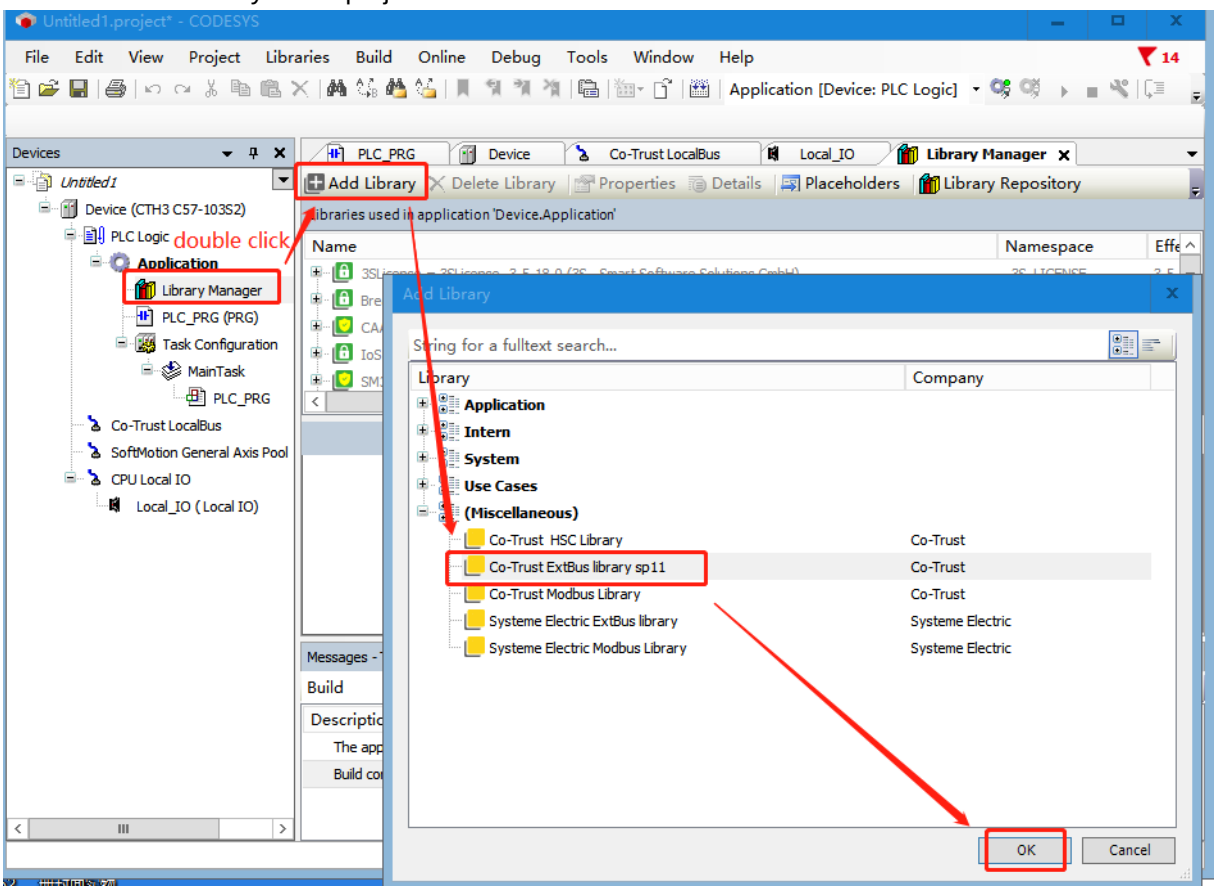
1. Before configuring the high-speed counter, it is necessary to install the Extbus library into CODESYS and then add the library to the project, convenient for project calls.

Add the Extbus library to CODESYS as follows:

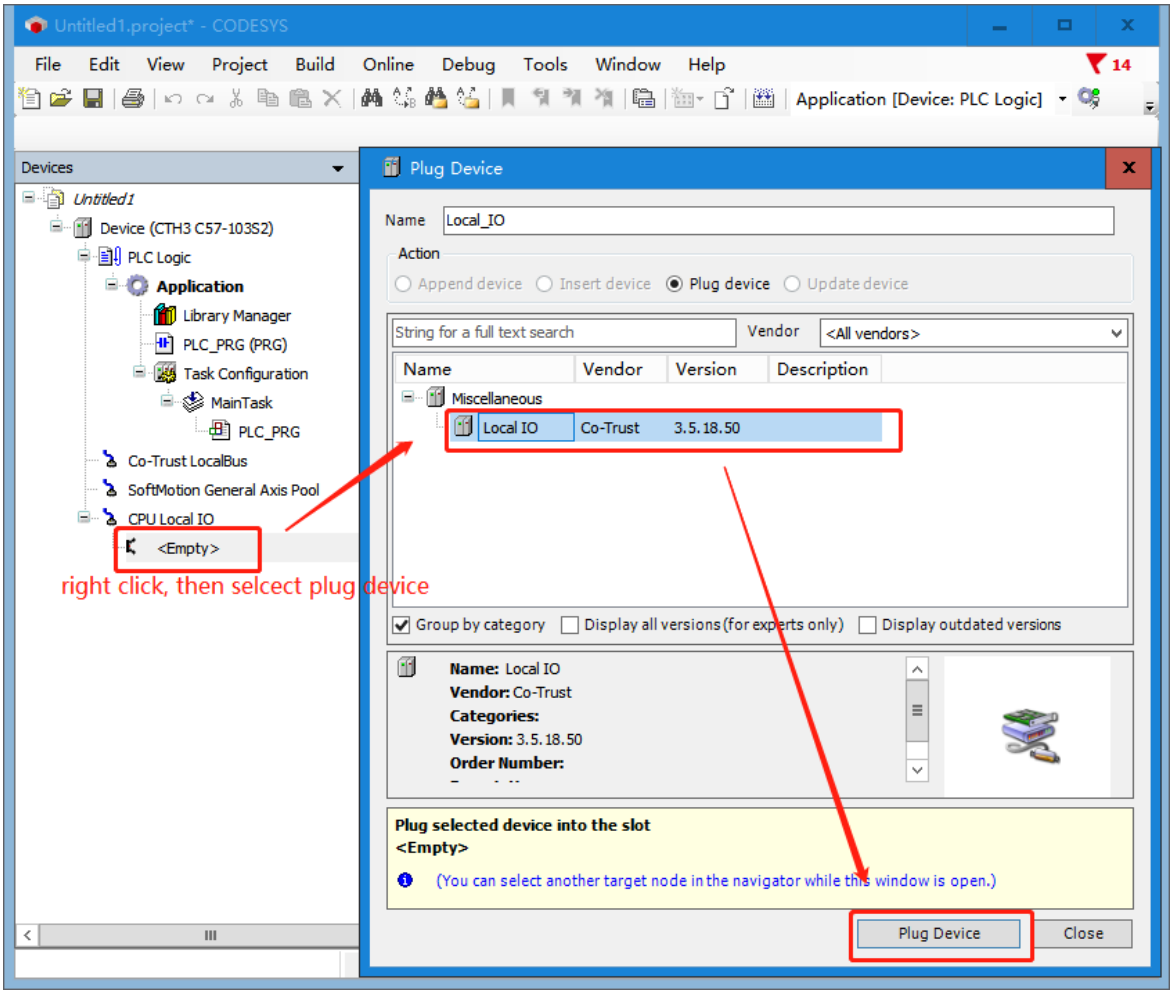




Add the Extbus library to the project as follows:



2. Insert high-speed counting input



3. In the Internal parameters of the high-speed counter, the parameters of the high-speed counter can be configured, including channel filtering, counting mode, control word, etc., as shown in the following figure. If control words, modes, and other parameters are configured in the Internal parameters, there is no need to call HSC_ 300, HSC_ The SETMODE command configures high-speed counter parameters and counting mode.

If the HSC mode and HSC control word are set in the Internal parameter and HSC_300 and HSC_SETMODE are called to set the HSC mode and HSC control word, the HSC_300 and HSC_SETMODE instructions will prevail because the HSC mode and HSC control word in the Internal parameter will be overwritten by the HSC_300 and HSC_SETMODE instructions.

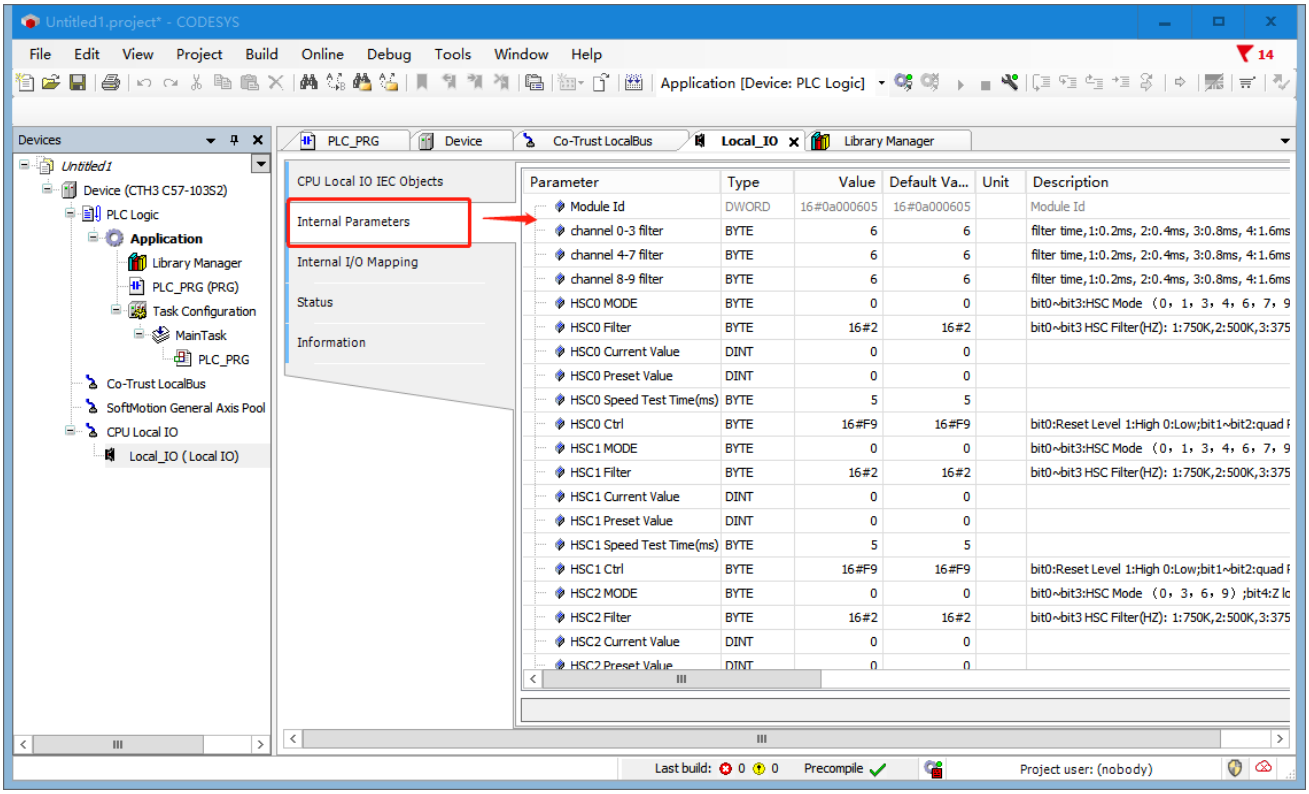


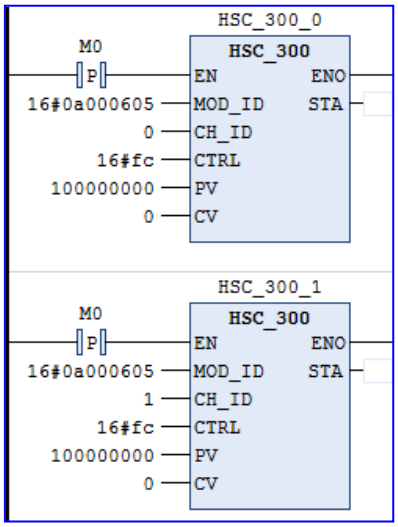
Table 4-2 High-speed Counter Parameters

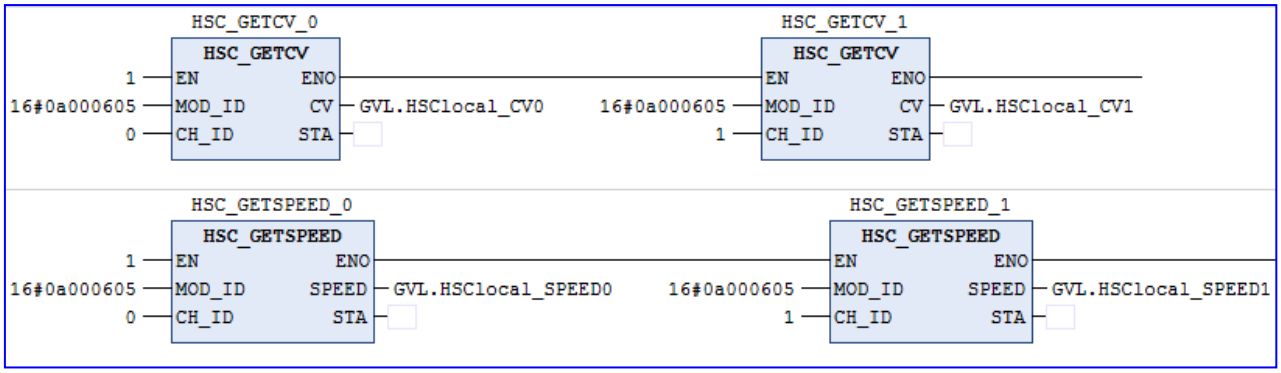
Parameter	Data type	Default value	Description
Module Id	DWORD	16#0a000605	Module Id, when using the native high-speed counter, the Module Id in the Extbus library instruction refers to 16#0a000605.
channel 0-9 filter	BYTE	6	filter time, 1: 0.2ms, 2: 0.4ms, 3: 0.8ms, 4: 1.6ms, 5: 3.2ms 6: 6.4ms, 7: 12.8ms, 8: 0.2us, 9: 0.4us, 10: 0.8us 11: 1.6us, 12: 3.2us, 13: 6.4us, 14: 12.8us
HSC0 MODE	BYTE	0	bit0~bit3: HSC Mode(0,1,3,4,6,7,9,10) bit4: Z lock disable, 0: enable, 1: disable bit5: Z dear disable, 0: enable, 1: disable bit6: reserve bit7: clear lock data 0:clear 1:not clear
HSC 0~5 Filter	BYTE	16#2	Bit0~Bit3: HSC Filter(Hz) 1: 750k, 2: 500k, 3: 375k, 4: 250k 5: 125k, 6: 100k, 7: 75k
HSC0~5 Current Value	DINT	0	
HSC0~5 Preset value	DINT	0	
HSC0~5 Speed Test Time(ms)	BYTE	5	
HSC0~5 Ctrl	BYTE	16#F9	bit0: Reset Level, 0: Low, 1: High。 bit1~bit2: quad Rate, 0: 4x, 1: 2x, 2: 1x。 bit3: Direction, 0: Decrease, 1: Increase。 bit4: Direction Update, 0: Not Update, 1: Update。 bit5: Preset Value Update, 0: Not update, 1: Update。

			bit6: Current Value Update, 0: Not update, 1: Update。 bit7: HSC Enable, 0: Disable, 1: Enable。

4、Call Extbus library instruction for programming

Directly call the instructions HSC_GETCV, HSC_GETSPEED, and HSC_STA to read the count value, count speed, and count status.



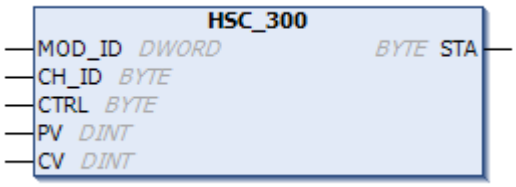


4.1.3 ExtBus Library Instruction Description

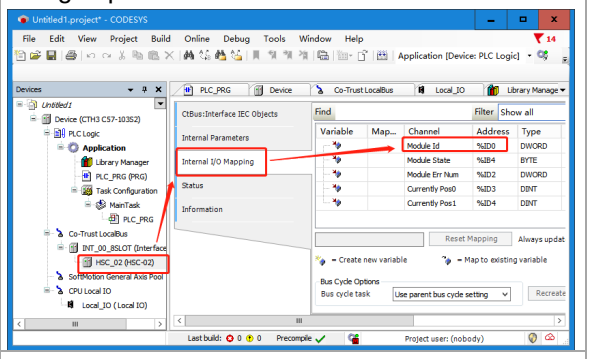
Table 4-3 High-speed Counter Supported Instruction Library (ExtBus), the description of each instruction is as follows.

Command	Name
HSC_300	Set Count Parameter Command
HSC_CLEARLOCK	Clear latch value
HSC_GETLOCK	Get current latch value
HSC_GETCV	Get current count value
HSC_GETSPEED	Get current count speed
HSC_GETSPEED-AVG	Get current speed using average value
HSC_GETSTA	Get current count status
HSC_SETMODE	Set Counter Mode

1、Set counting parameter instruction

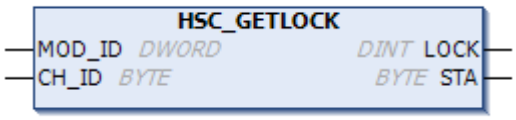


Parameter

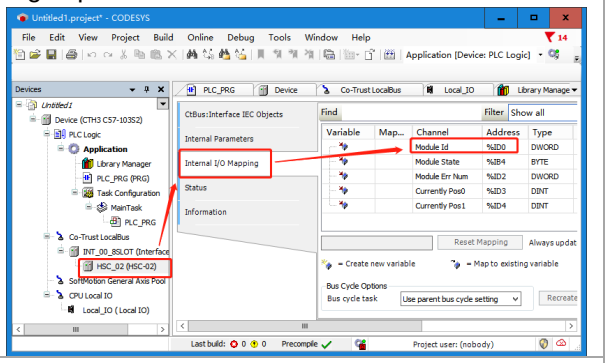
Parameter	Input/ output	Description	Data type	Initialize	Comment
MOD_ID	IN	module address	DWORD	0	• Use PLC local high speed counter, MOD_ID is 16#0a000605. • Use high speed counter module, MOD_ID corresponds to Module Id in internal/O mapping of high speed counter module. 
CH_ID	IN	channel address	BYTE	0	Channel address, PLC takes value 0~5, high-speed counter module takes value 0~1.
CTRL	IN	control word	BYTE	16#F9	**bit0:** reset level, 1-high level reset, 0-low level reset. **bit1~2:** Orthogonal counting selection, 00 means 4 times orthogonal mode, 01 means 2 times orthogonal mode, 10 means 1 times orthogonal mode. **bit3:** Count direction, 0-decrease count, 1-increase count. **bit4:** count direction update, 0-no update, 1-update. **bit5:** Preset value update, 0-no update, 1-update. **bit6:** current value update, 0-no update, 1-update. **bit7:** Count enable, 0-don't enable, 1-enable.
PV	IN	Preset value	DINT	0	
CV	IN	current value	DINT	0	
STA	OUT	Return Status	BYTE	0	Module Status Word 0: OK 5: Module parameter error 7: Module not responding

					8: Module link layer checksum error

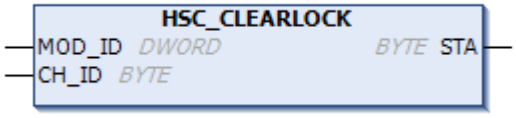
2. Get the current latch value



Parameter

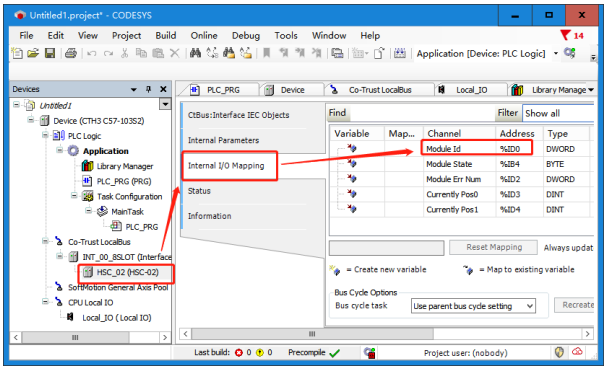
Parameter	Input/ output	Description	Data type	Initialize	Comment
MOD_ID	IN	module address	DWORD	0	• Use PLC local high speed counter, MOD_ID is 16#0a000605. • Use high speed counter module, MOD_ID corresponds to Module Id in internal/O mapping of high speed counter module. 
CH_ID	IN	channel address	BYTE	0	Channel address, PLC takes value 0~5, high-speed counter module takes value 0~1.
LOCK	OUT	latched value	DINT	0	latched value
STA	OUT	module status word	BYTE	0	Module Status Word 0: OK 2: Illegal parameter 5: Module parameter error 7: Module not responding 8: Module link layer check error

3. Clear the latch value

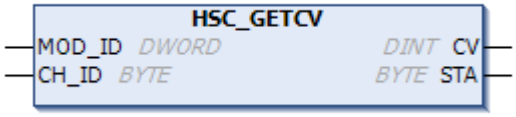


Parameter

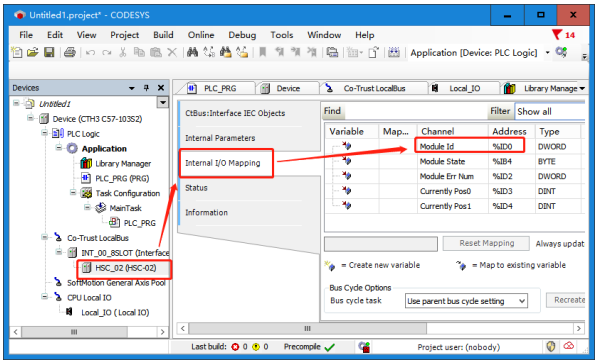
Parameter	Input/ output	Description	Data type	Initialize	Comment
MOD_ID	IN	module address	DWORD	0	• Use PLC local high speed counter, MOD_ID is 16#0a000605.

					• Use high speed counter module, MOD_ID corresponds to Module Id in internal/O mapping of high speed counter module. 
CH_ID	IN	channel address	BYTE	0	Channel address, PLC takes value 0~5, high-speed counter module takes value 0~1.
STA	OUT	Module status words	BYTE	0	Module status words 0: OK 5: Module parameter error 7: Module not responding 8: Module Link Layer Check Error

4. Get the current count value



Parameter

Parameter	Input/ output	Description	Data type	Initialize	Comment
MOD_ID	IN	module address	DWORD	0	• Use PLC local high speed counter, MOD_ID is 16#0a000605. • Use high speed counter module, MOD_ID corresponds to Module Id in internal/O mapping of high speed counter module. 
CH_ID	IN	channel address	BYTE	0	Channel address, PLC takes value 0~5, high-speed counter module takes value 0~1.
CV	OUT	Current count value	DINT	0	Current count value

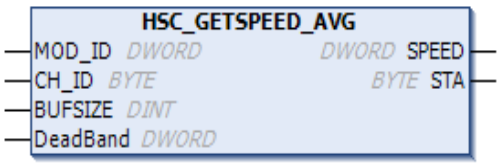
STA	OUT	Module status word	BYTE	0	Module status word 0: OK 2: Illegal parameters 5: Module parameter error 7: Module not responding 8: Module link layer validation error

5. Get the current counting speed

Parameter

Parameter	Input/output	Description	Data type	Initialize	Comment
MOD_ID	IN	module address	DWORD	0	• Use PLC local high speed counter, MOD_ID is 16#0a000605. • Use high speed counter module, MOD_ID corresponds to Module Id in internal/O mapping of high speed counter module.
CH_ID	IN	channel address	BYTE	0	Channel address, PLC takes value 0~5, high-speed counter module takes value 0~1.
SPEED	OUT	Counting speed	DWORD	0	Hz
STA	OUT	Module status word	BYTE	0	Module status word 0: OK 2: Illegal parameters 5: Module parameter error 7: Module not responding 8: Module link layer validation error

6. Use the average value to obtain the current speed



Parameter

Parameter	Input/output	Description	Data type	Initialize	Comment
MOD_ID	IN	module address	DWORD	0	• Use PLC local high speed counter, MOD_ID is 16#0a000605. • Use high speed counter module, MOD_ID corresponds to Module Id in internal/O mapping of high speed counter module.

CH_ID	IN	channel address	BYTE	0	Channel address, PLC takes value 0~5, high-speed counter module takes value 0~1.
BUFSIZE	IN	Average buffer	DINT	16	0<average buffer size<64
DeadBand	IN	deadband	DWORD	20000	If the difference between the average value and the existing value is less than the dead zone value, the average value shall prevail. If it is greater than the dead zone average value, the existing value shall prevail
SPEED	OUT	Counting speed	DWORD	0	Hz
STA	OUT	Module status word	BYTE	0	Module status word 0: OK 2: Illegal parameters 5: Module parameter error 7: Module not responding 8: Module link layer validation error

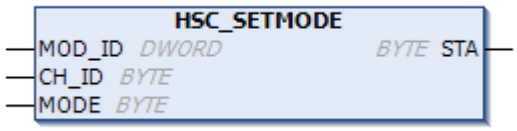
7. Get current count status

Parameter

Parameter	Input/output	Description	Data type	Initialize	Comment
MOD_ID	IN	module address	DWORD	0	• Use PLC local high speed counter, MOD_ID is 16#0a000605. • Use high speed counter module, MOD_ID corresponds to Module Id in internal/O mapping of high speed counter module.
CH_ID	IN	channel address	BYTE	0	Channel address, PLC takes value 0~5, high-speed counter module takes value 0~1.
HSC_STA	OUT	Counting status	BYTE	0	Bit0~bit3: Current mode Bit4: Reserve Bit5: HSC0 current counting direction bit, 1=increase counting, 0: decrease counting Bit6=1: The current value is equal to the preset value bit Bit7=1: The current value is greater than the preset value
STA	OUT	Module status word	BYTE	0	Module status word 0: OK 2: Illegal parameters 5: Module parameter error 7: Module not responding

					8: Module link layer validation error

8. Set counter mode



Parameter

Parameter	Input/output	Description	Data type	Initialize	Comment
MOD_ID	IN	module address	DWORD	0	• Use PLC local high speed counter, MOD_ID is 16#0a000605. • Use high speed counter module, MOD_ID corresponds to Module Id in internal/O mapping of high speed counter module.
CH_ID	IN	channel address	BYTE	0	Channel address, PLC takes value 0~5, high-speed counter module takes value 0~1.
MODE	IN	count mode	BYTE	0	bit0~bit3: HSC counting modes (This unit supports 0, 1, 3, 4, 6, 7, 9, 10. HSC-02 module supports 0~11 modes) Mode 0~2: Single phase counter with internal direction control. Mode 3~5: Single-phase counter with external direction. Mode 6~8: Duplex counter with 2 clock inputs. Mode 9~11: A\B phase quadrature counter. bit4: Z signal latch function, 0: latch, 1: non-latch bit5: Z signal clear function, 0: clear, 1: not clear bit6: Reserved bit7: Clear of latched value, 0: invalid, 1: valid
STA	OUT	Module status word	BYTE	0	Module status word 0: OK 2: Illegal parameters 5: Module parameter error 7: Module not responding 8: Module link layer validation error

4.2 Use of High-Speed Counting Module and High-Speed Pulse Module

In this chapter, CTH3 C57-103S2 is used as the master station, and the high-speed counting module and high-speed pulse output module are connected to the back of the master station, and the high-speed counting module counts the output pulses of the high-speed pulse output module.

Table 4-4 High-speed counter module input and counting modes are as follows.

Mode	Description	Input			Software control
	HSC0	A0	B0	Z0	INT
	HSC1	A1	B1	Z1	
0	Single phase counter with internal directional control	clock	--	--	--
1		clock	--	reset	--
2		clock	--	reset	Startup (external synchronisation)
3	Single phase counter with external directional control	clock	direction	--	--
4		clock	direction	reset	--
5		clock	direction	reset	Startup (external synchronisation)
6	Two phase counter with increase/decrease counting clock	up clock	down clock	--	--
7		up clock	down clock	reset	--
8		up clock	down clock	reset	Startup (external synchronisation)
9	A/B phase orthogonal counter	clock A	clock B	--	--
10		clock A	clock B	reset	--
11		clock A	clock B	reset	Startup (external synchronisation)

Note: If counter mode 2, 5, 8 or 11 is selected, the counting can only be started with the INT control start signal.

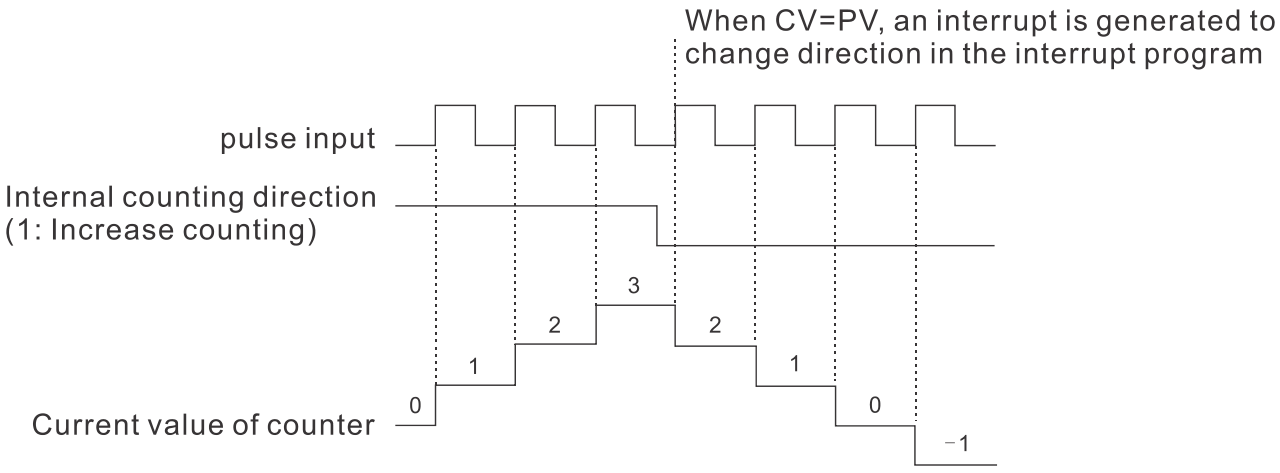
In the same way as the CPU's native high-speed counter, the high-speed counter module can also set the control word and control mode via the Internal parameter or via the HSC_300, HSC_SETMODE of the Extbus library.

Table 4-5 High Speed Count Parameters in Internal Parameters

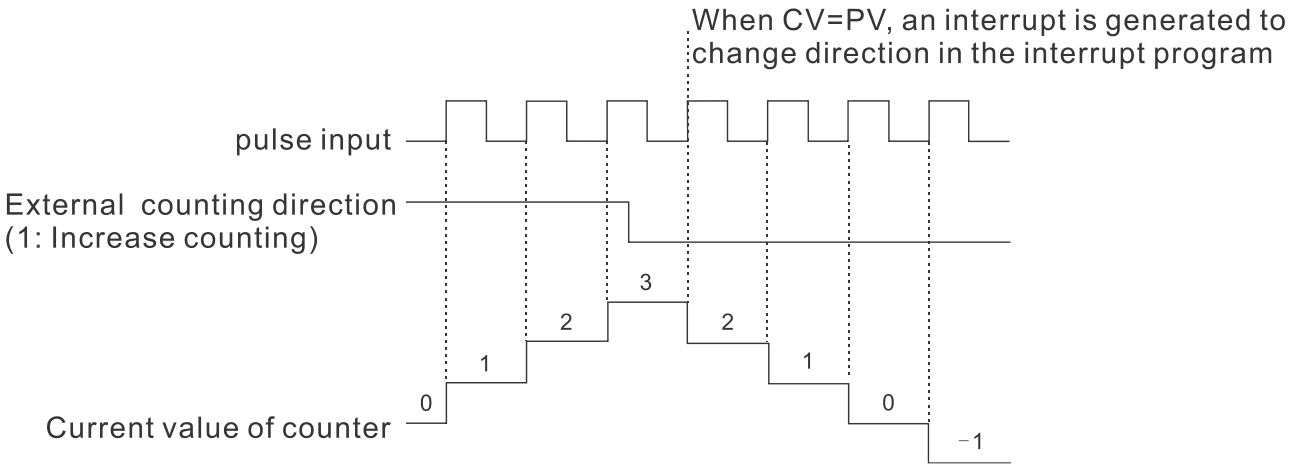
Parameters	Data type	Default value	描述
INT Set	BYTE	16#2	bit0~bit3: Int filter, 0: 25k, 1: 50k, 2: 125k, 3: 200k, 4: 400k. bit4: Act level, 0: Low, 1: High.
HSC 0~1 MODE	BYTE	0	bit0~bit3: HSC Mode bit4: Z lock disable, 0: enable, 1: disable. bit5: Z dear disable, 0: enable, 1: disable.

			bit6: reserve bit7: clear lock data, 0:clear, 1:not clear.
HSC 0~1 Filter	BYTE	16#2	Bit0~Bit3: HSC Filter(Hz) 0: 125k, 1: 250k, 2: 500k, 3: 1M, 4: 2M.
HSC0~1 Current Value	DINT	0	
HSC0~1 Preset value	DINT	0	
HSC0~1 Speed Test Time(ms)	BYTE	5	
HSC0~1 Ctrl	BYTE	16#F9	bit0: Reset Level, 0: Low, 1: High. bit1~bit2: quad Rate, 0: 4x, 1: 2x, 2: 1x. bit3: Direction, 0: Decrease, 1: Increase. bit4: Direction Update, 0: Not Update, 1: Update. bit5: Preset Value Update, 0: Not update, 1: Update. bit6: Current Value Update, 0: Not update, 1: Update. bit7: HSC Enable, 0: Disable, 1: Enable.

HSC Counting Mode Description



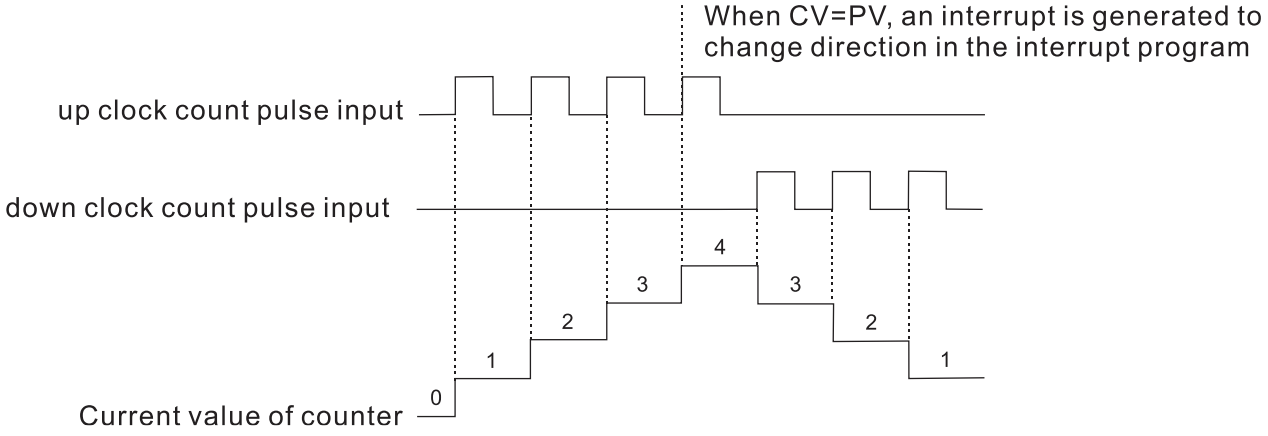
Mode 0/1/2



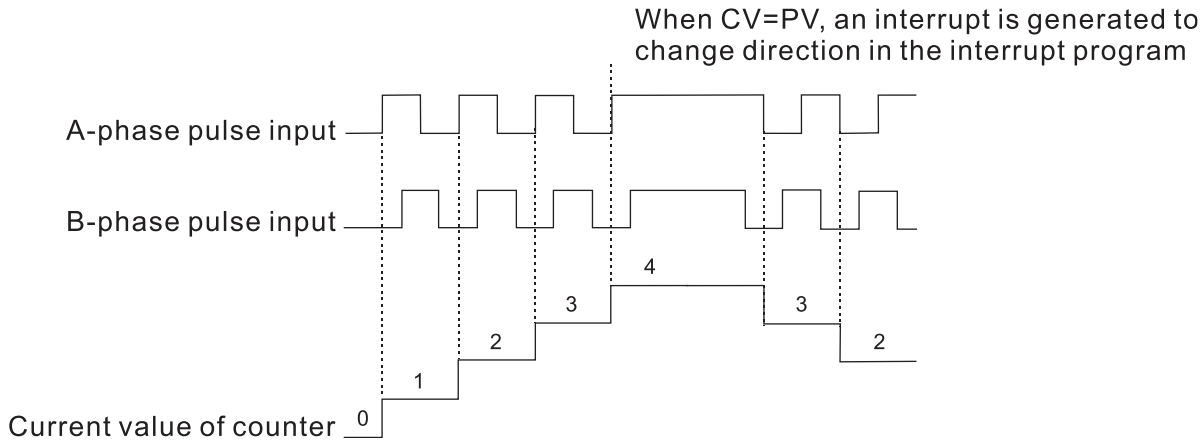
Mode 3/4/5

When using mode 6/7/8, if the time interval between the rising edge of the up clock and the rising edge of

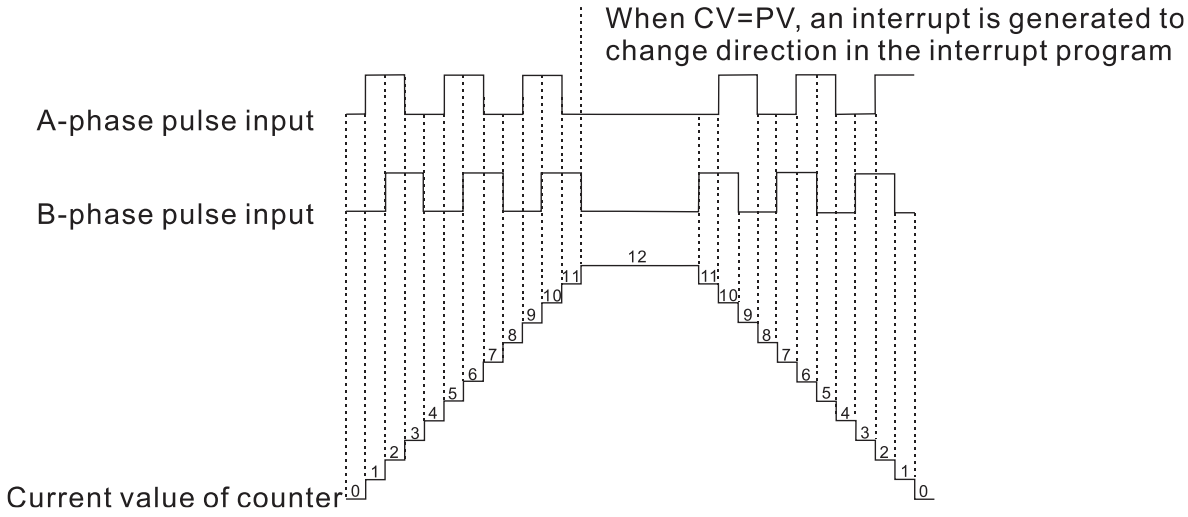
down clock is less than 0.3 microseconds, the high-speed counter will consider these events to occur simultaneously. If this situation occurs, the current value remains unchanged and the counting direction indicator remains unchanged. As long as the time interval between the rising edge of the up clock and the rising edge of the down clock input is greater than 0.3 seconds, the high-speed counter captures each event separately. In both cases, there will be no errors and the counter will remain at the correct current value.



Mode 6/7/8



Mode 9/10/11 (Single orthogonal mode)



Mode 9/10/11 (Quadruple orthogonal mode)

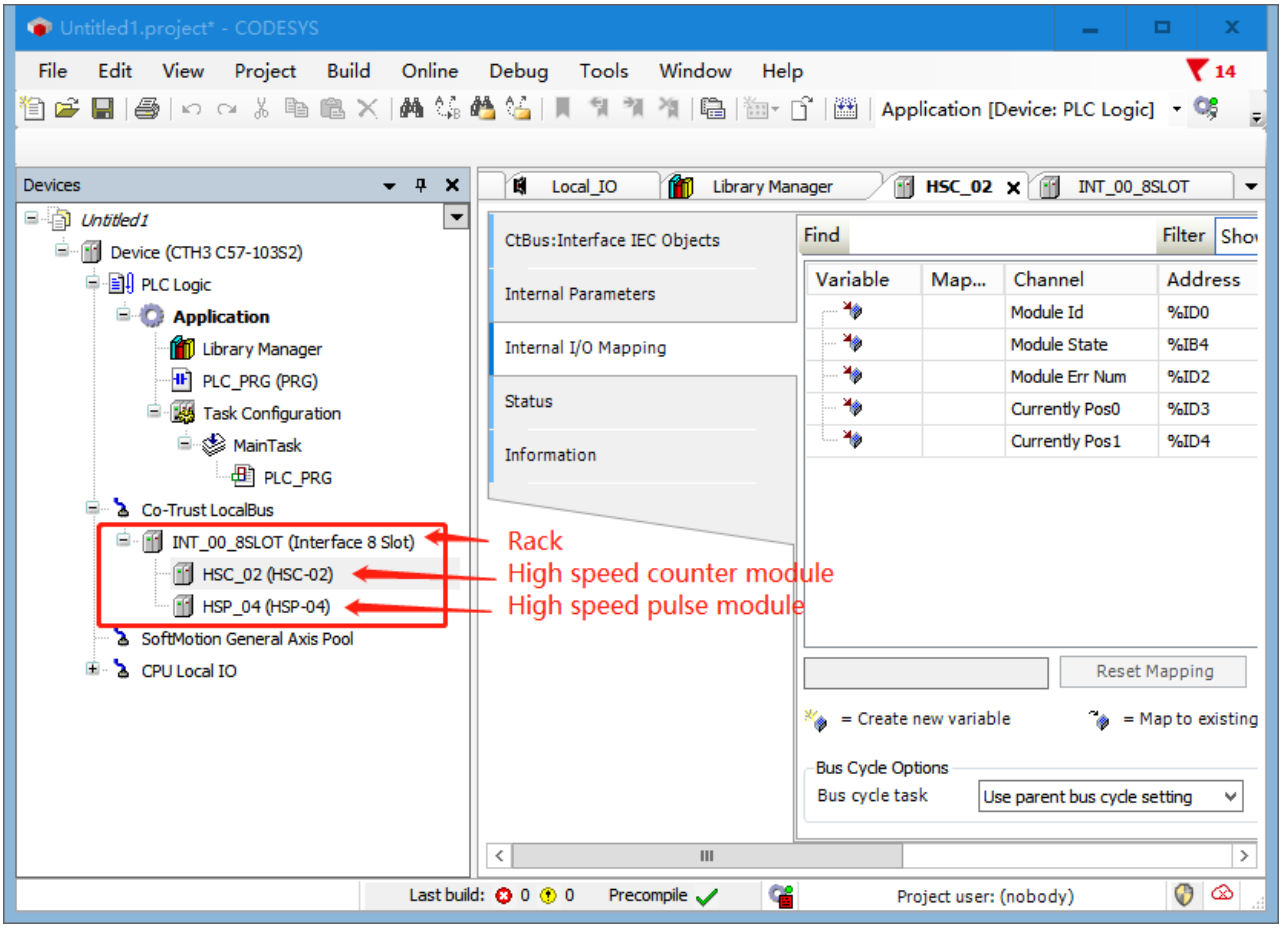
Project configuration

Hardware: High speed pulse output module HSP-04, high-speed counting module HSC-02

Implementation function: The high-speed pulse output module outputs a pulse to the virtual axis, and the high-speed counter counts the output pulse.

Wiring: One high-speed counting input is connected to one high-speed pulse output. Please refer to the wiring diagrams of the two modules for specific wiring.

1. Add high-speed counting module and high-speed pulse output module in CODESYS.



2. Double-click the high-speed pulse output module and high-speed counter module to enter the corresponding module configuration interface. The following is the configuration interface of high-speed pulse output module and high-speed counter module respectively.

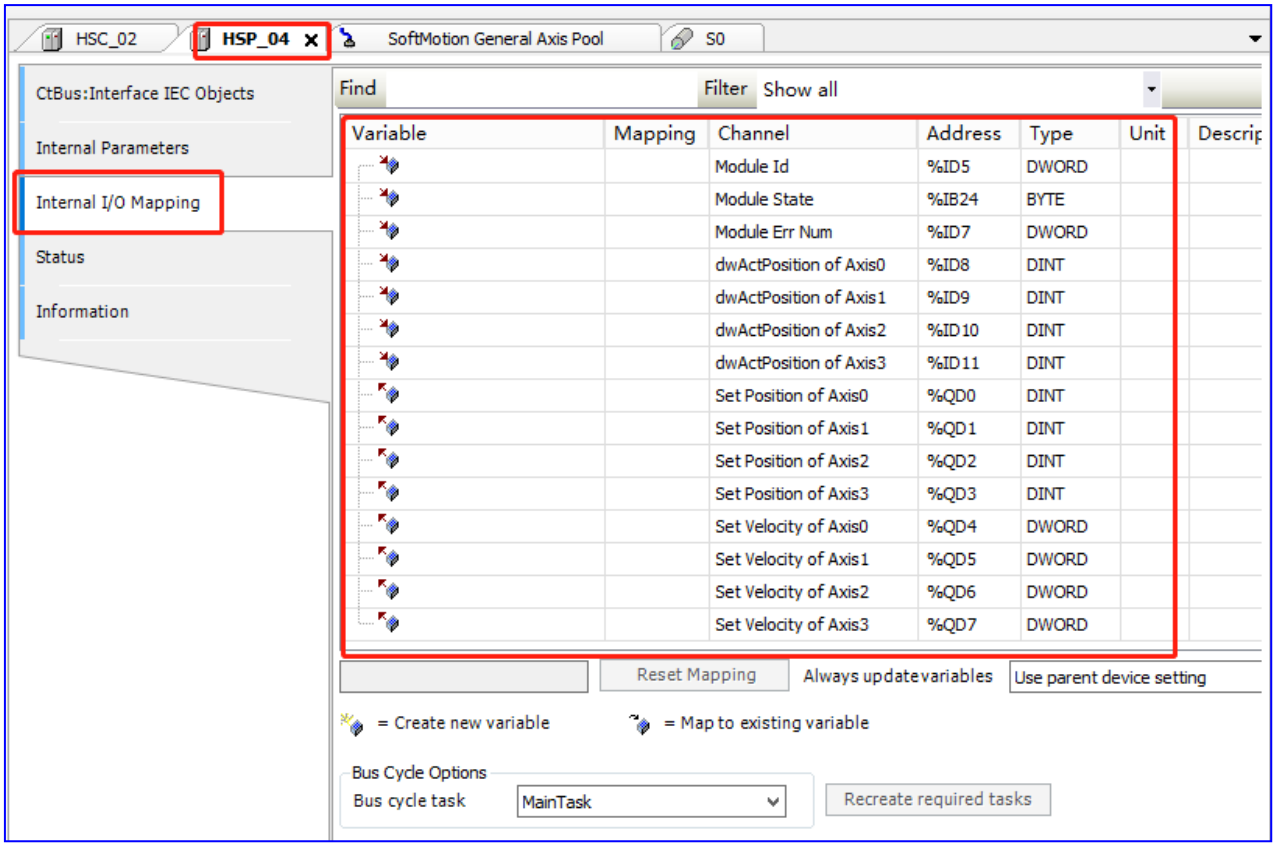


Table 4-6 Parameter Information Involved in I/O Mapping of High Speed Pulse Output Module

Name	Describe
Module ID	--
Module State	Module State 0x00: No error 0x01: Module busy 0x02: Timeout not responding 0x03: Module type match 0x04: Module version mismatch 0x05: Software error 0x06: Wait flag timeout 0x07: Bus answer error 0x08: Bus CRC check error 0x0E: Address not configured 0x10: Memory offset out of range 0x11: Module not ready 0x12: Module configuration error 0x13: Module does not support this instruction 0x15: Module internal diagnostics 0x16: Module not powered 0X17: Check error
Module Err Num	Number of module errors
dwActPosition of Axis0~3	The actual position of axes 0-3 is fed back by the encoder or other position detection devices. In this example, virtual axes are used instead of encoder and other position detection devices.

Set Position of Axis0~3	The set position of axis 0 to 3 is the value we want axis 0 to reach. We can use this value to control the movement of axis 0.
Set Velocity of Axis0~3	The set speed of axis 0~3, that is, the speed we want axis 0 to move. We can use this value to control the speed of axis 0's movement.

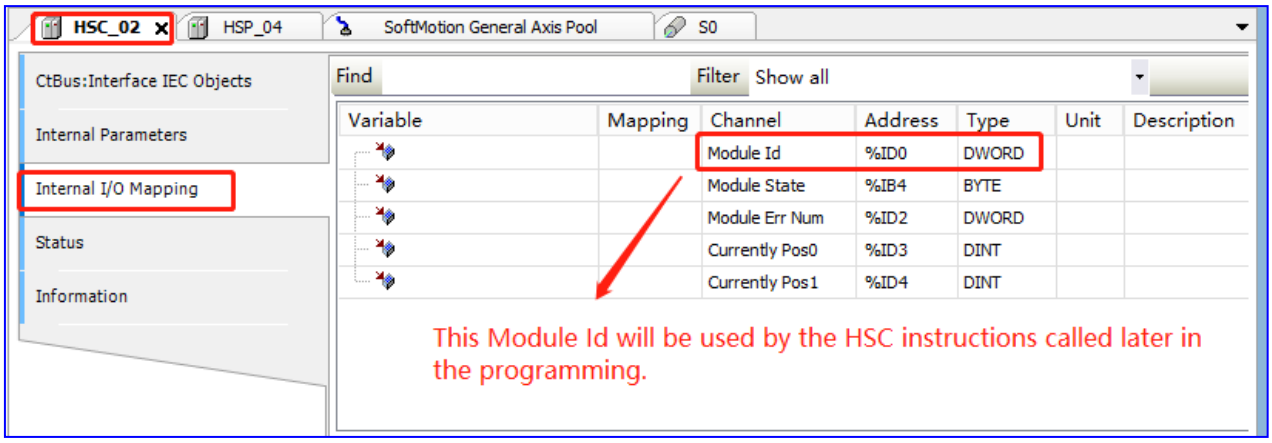
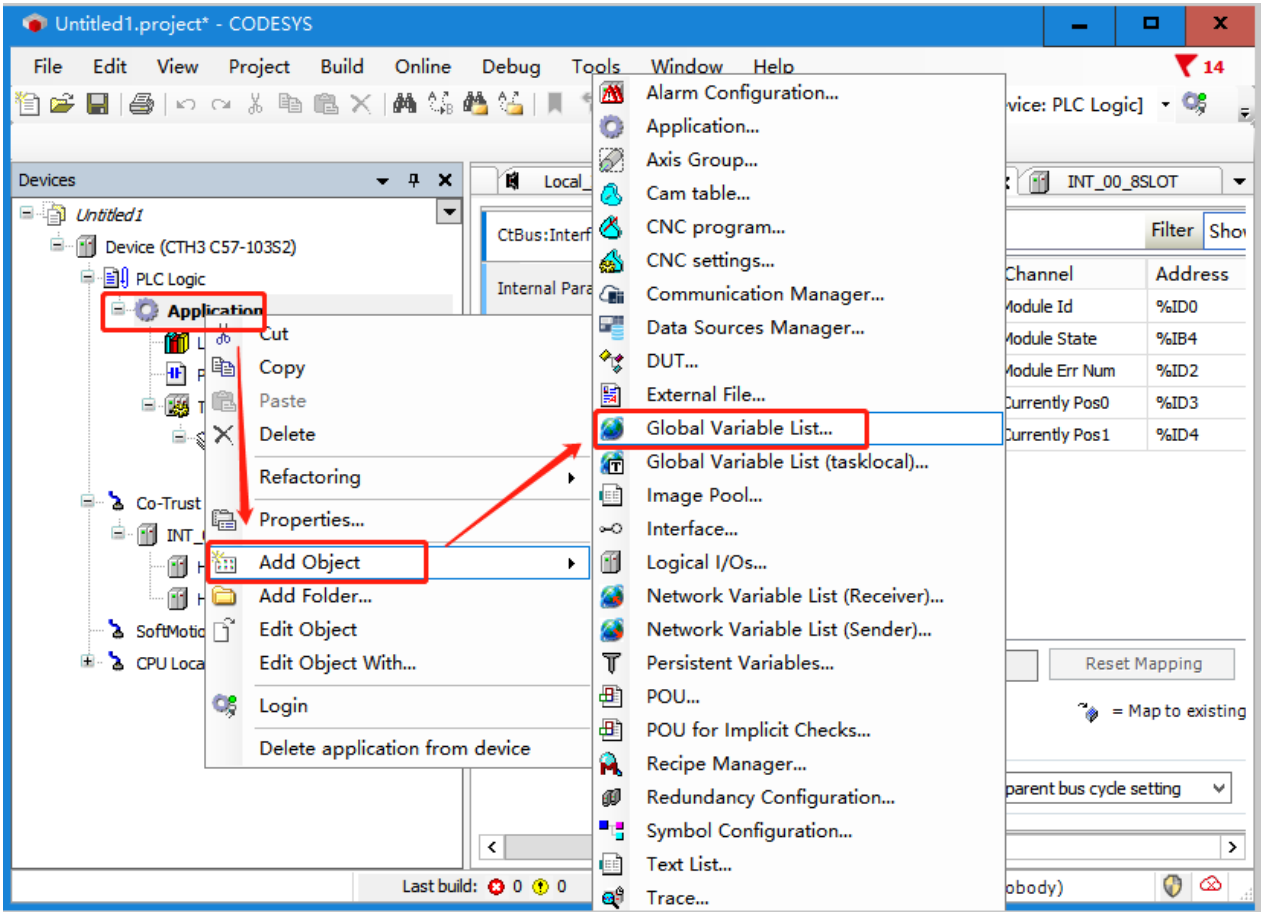


Table 4-7 Parameter Information Involved in High-Speed Counter Module I/O Mapping

Name	Describe
Module ID	--
Module State	Module State 0x00: No error 0x01: Module busy 0x02: Timeout not responding 0x03: Module type match 0x04: Module version mismatch 0x05: Software error 0x06: Wait flag timeout 0x07: Bus answer error 0x08: Bus CRC check error 0x0E: Address not configured 0x10: Memory offset out of range 0x11: Module not ready 0x12: Module configuration error 0x13: Module does not support this instruction 0x15: Module internal diagnostics 0x16: Module not powered 0X17: Check error
Module Err Num	Number of module errors
Currently Pos0~1	Represents the current positions of axis 0 and axis 1. These values are fed back by encoders or other position detection devices for real-time monitoring of the position status of the axis.

3. Add the global variable table

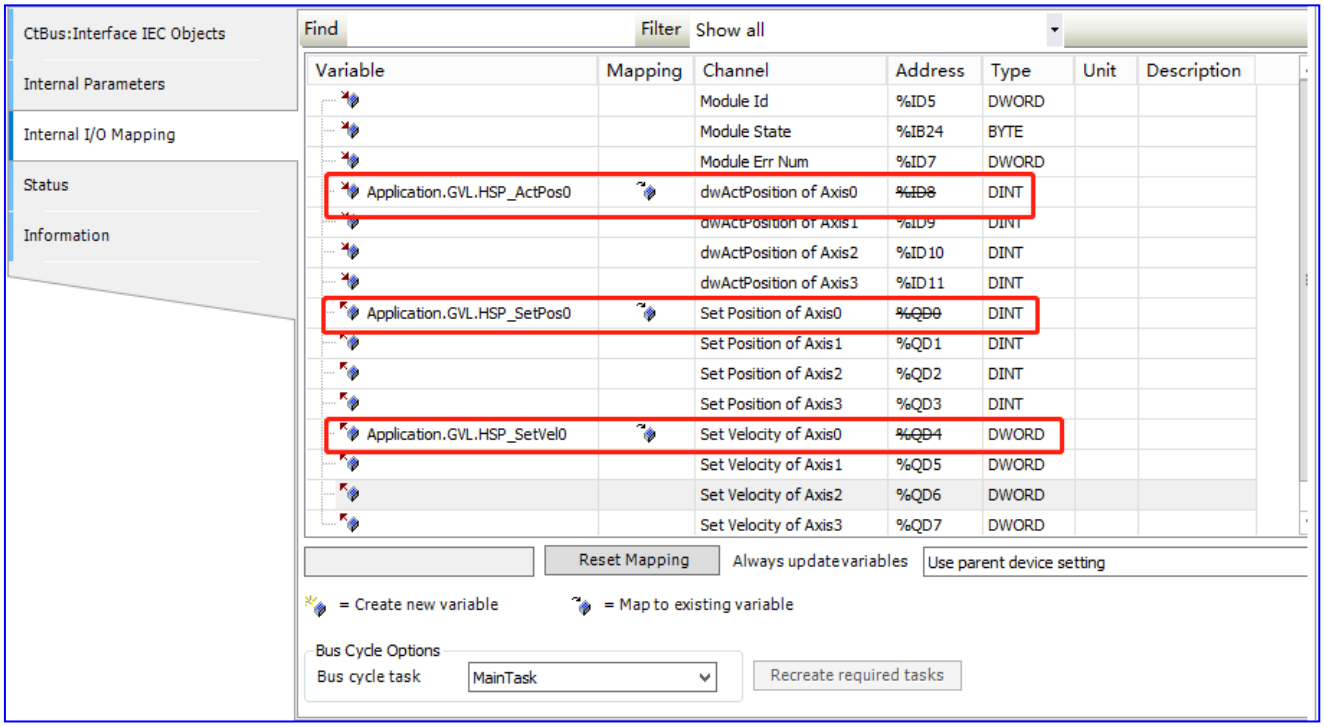


4. Map the three parameters of the HSP axes : action position, set speed and set position into global variables, and then define the mapping relationships in the mapping parameters of the HSP-04 module.

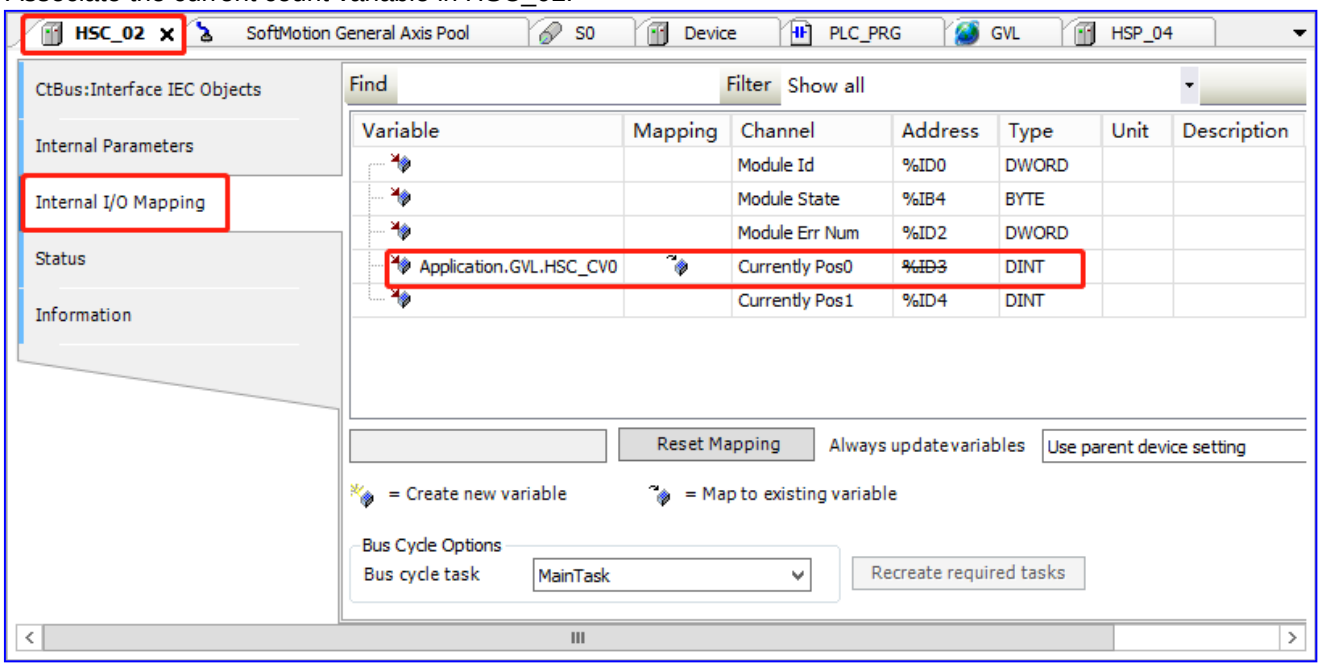
5. Define the CV and SPEED of the HSC as global variables, then associate the mapping relationship in the mapping parameters of the HSC module, and call the variables in the following program.

```
{attribute 'qualified_only'}
VAR_GLOBAL

    HSC_SPEED0: DWORD;
    HSP_SetPos0: DINT;
    HSP_SetVel0: DINT;

    // Number of pulses sent by HSP
    HSP_ActPos0: DINT;

    // Number of pulses received by the HSC, correct result: the number of pulses is equal to the number of pulses sent BY the HS
    HSC_CV0: DINT;

END_VAR
```

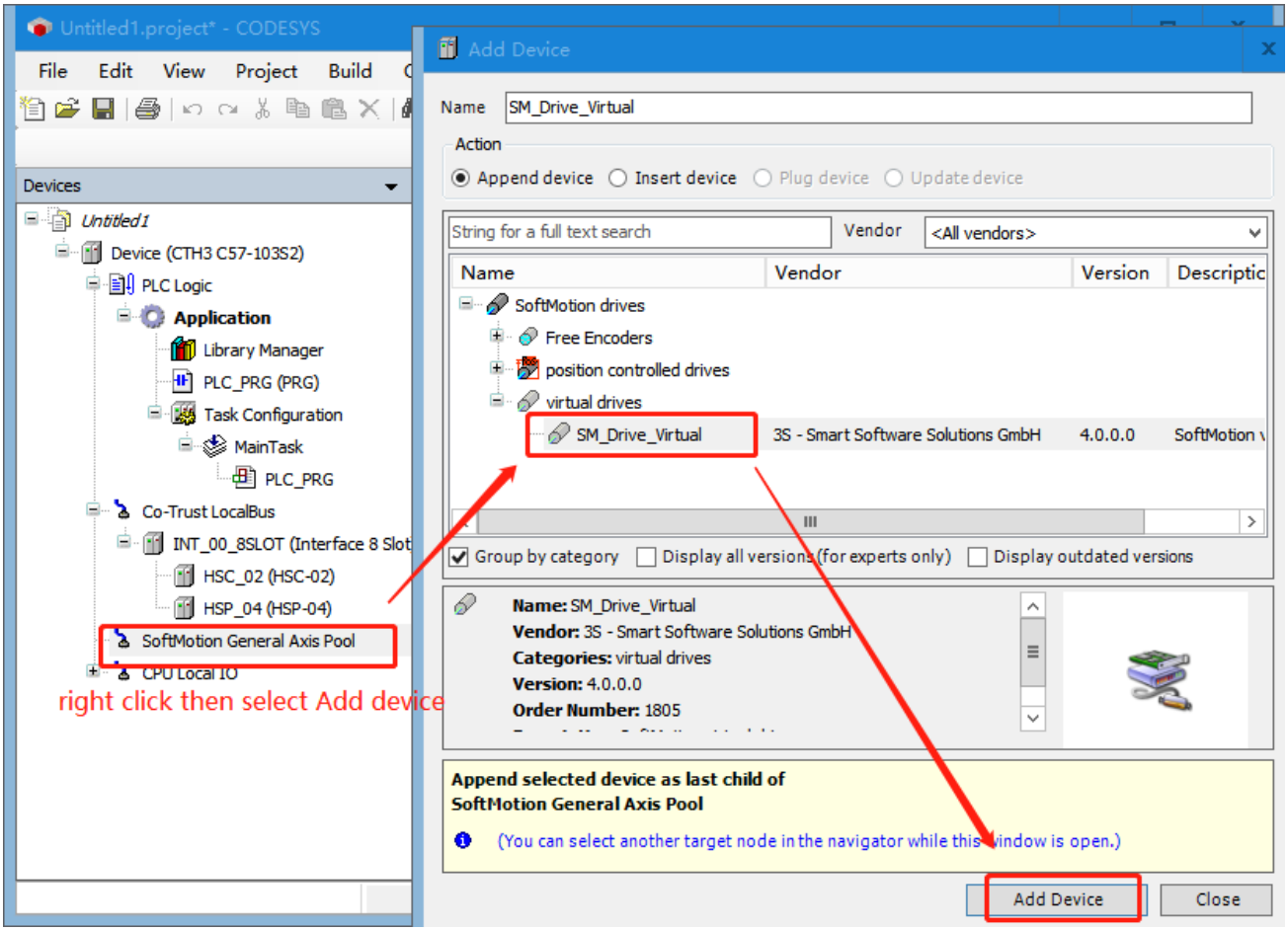
The mapping of the global variables of HSP-04 to the corresponding parameters is as follows.



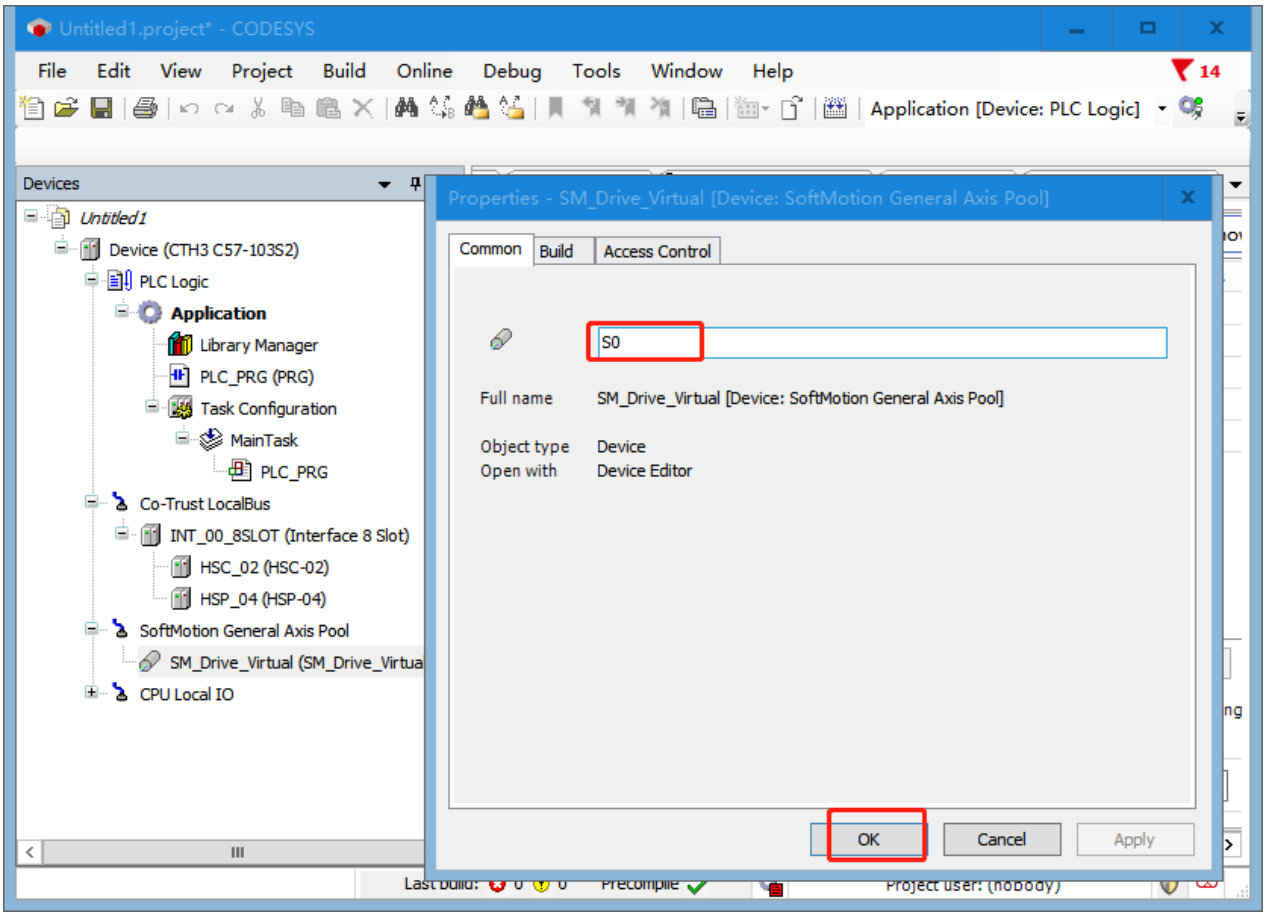
Associate the current count variable in HSC_02.

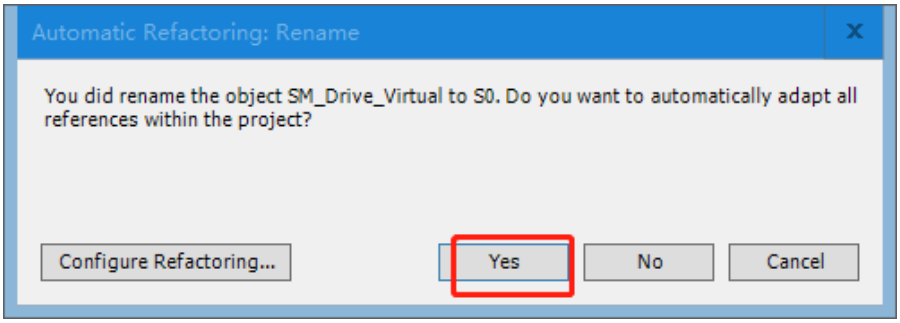


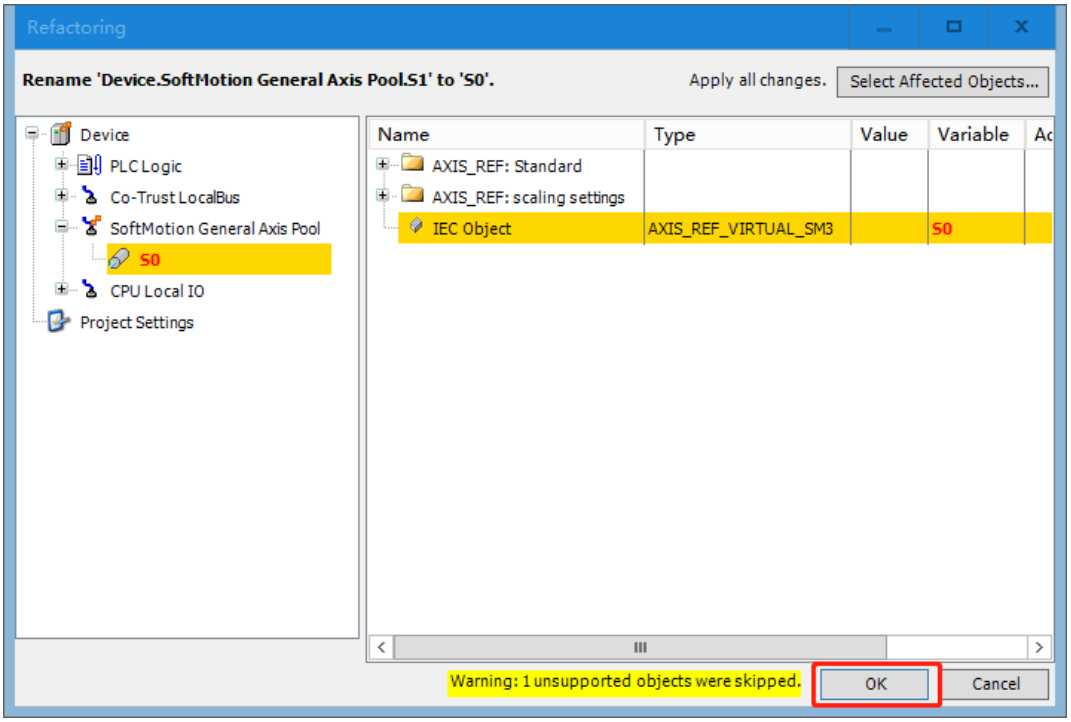
6. Add the virtual axis, the virtual axis is an ideal axis, the use of virtual axis to test the relevant function blocks, write the project programme, the actual position of the axis and the axis of the set position is completely consistent, will not produce movement deviation.

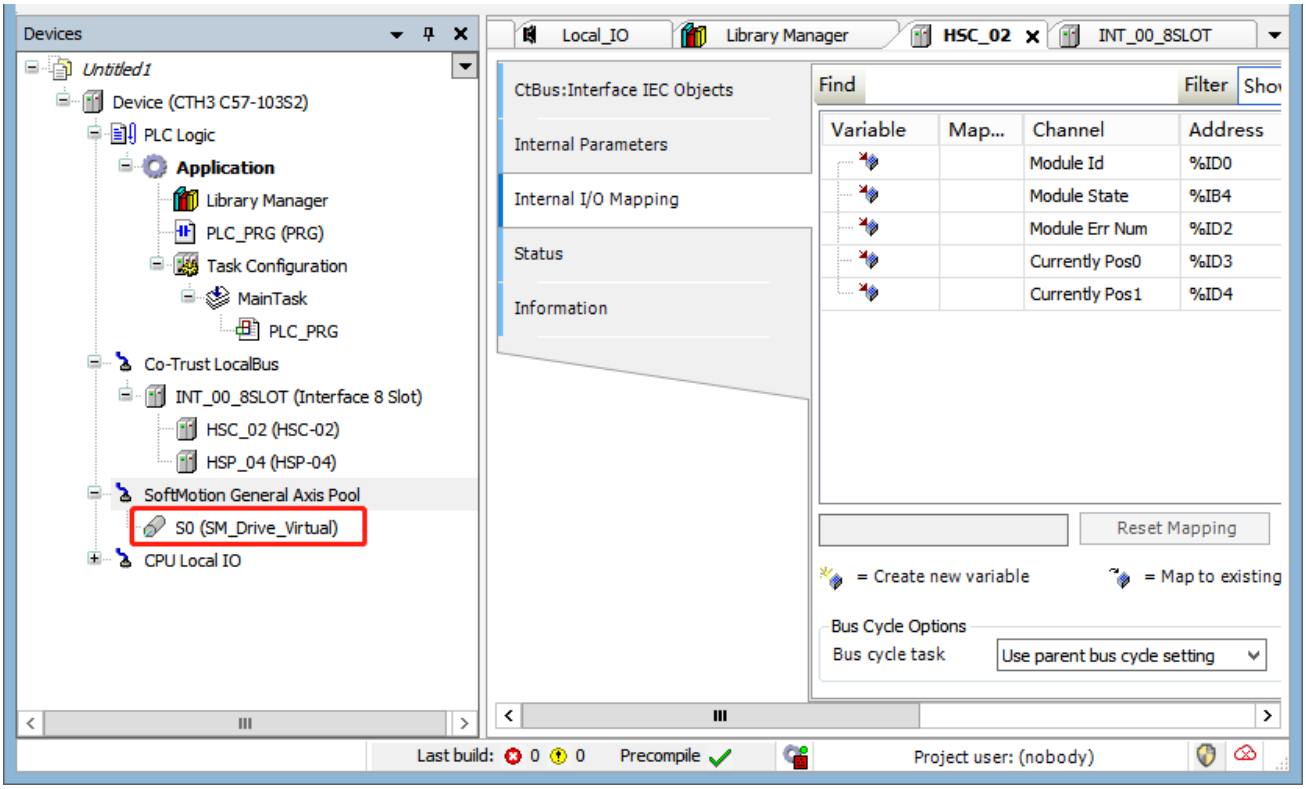


7. Right-click the virtual axis, and modify the axis name, access control privileges, etc. in Properties.





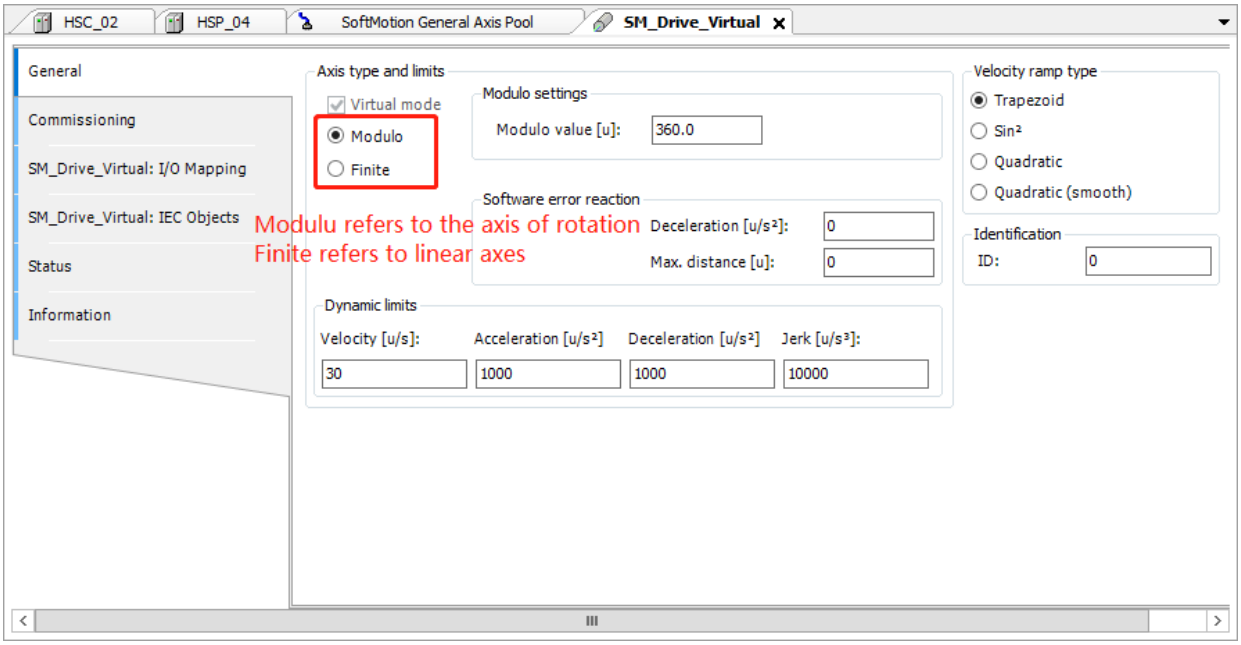




8. Define virtual axis parameters

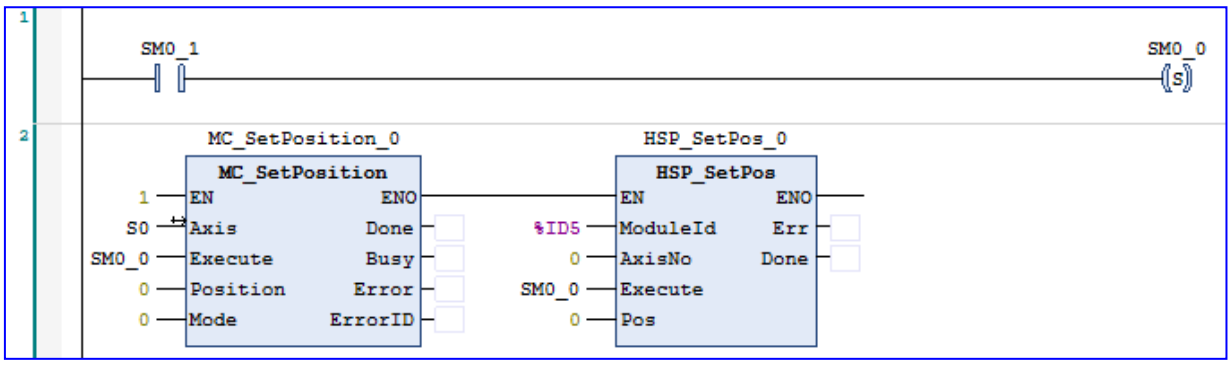
Double click on each virtual axis and define the corresponding virtual axis parameters, as shown in the

following figure:



Programme editing

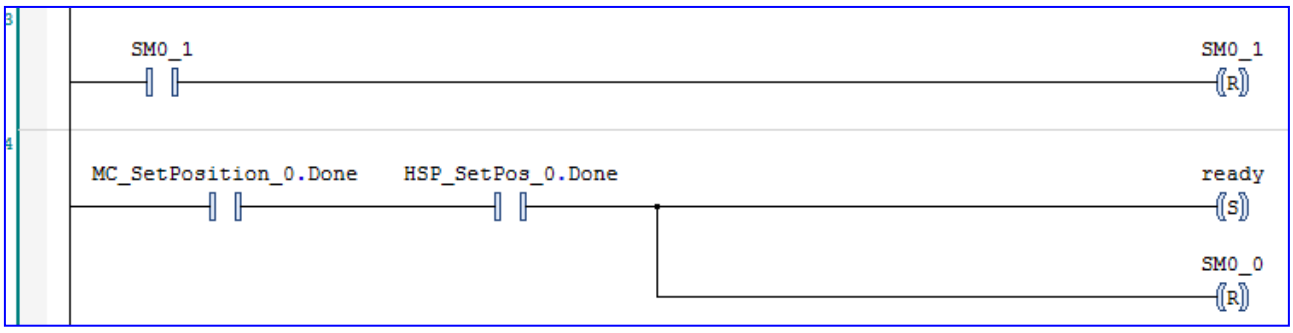
1. Trigger MC_SetPosition function and HSP_SetPos instruction before using the axes to unify the virtual axis and HSP axis coordinates.

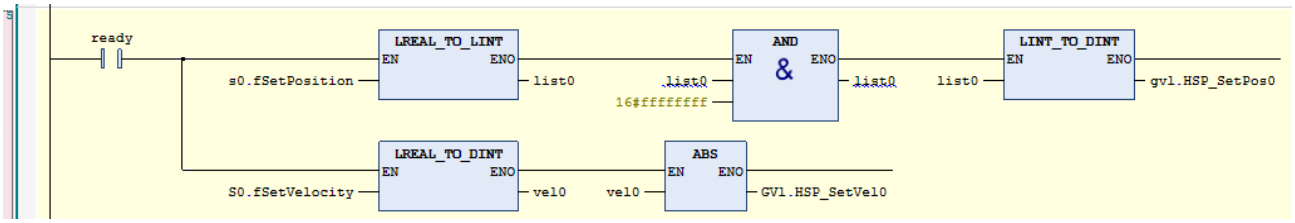


Note: (1) MC_SetPosition is the instruction that comes with CODESYS, HSP_SetPos instruction needs to install ExtBus Library to call.

(2) If the coordinates of the virtual axis and the HSP axis are not unified, the actpos and setpos positions of the HSP are not the same, then the axis will send out pulses by itself until the actpos and setpos positions are the same.

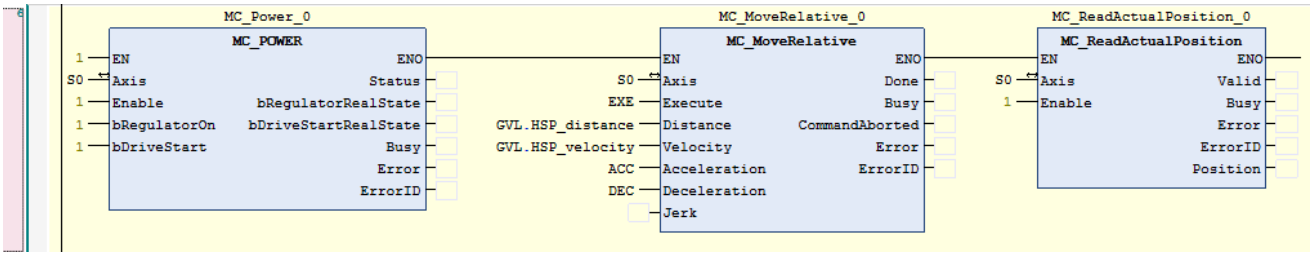
2. Transform the set coordinates and set speed of the virtual axis and assign them to the HSP axis parameters.



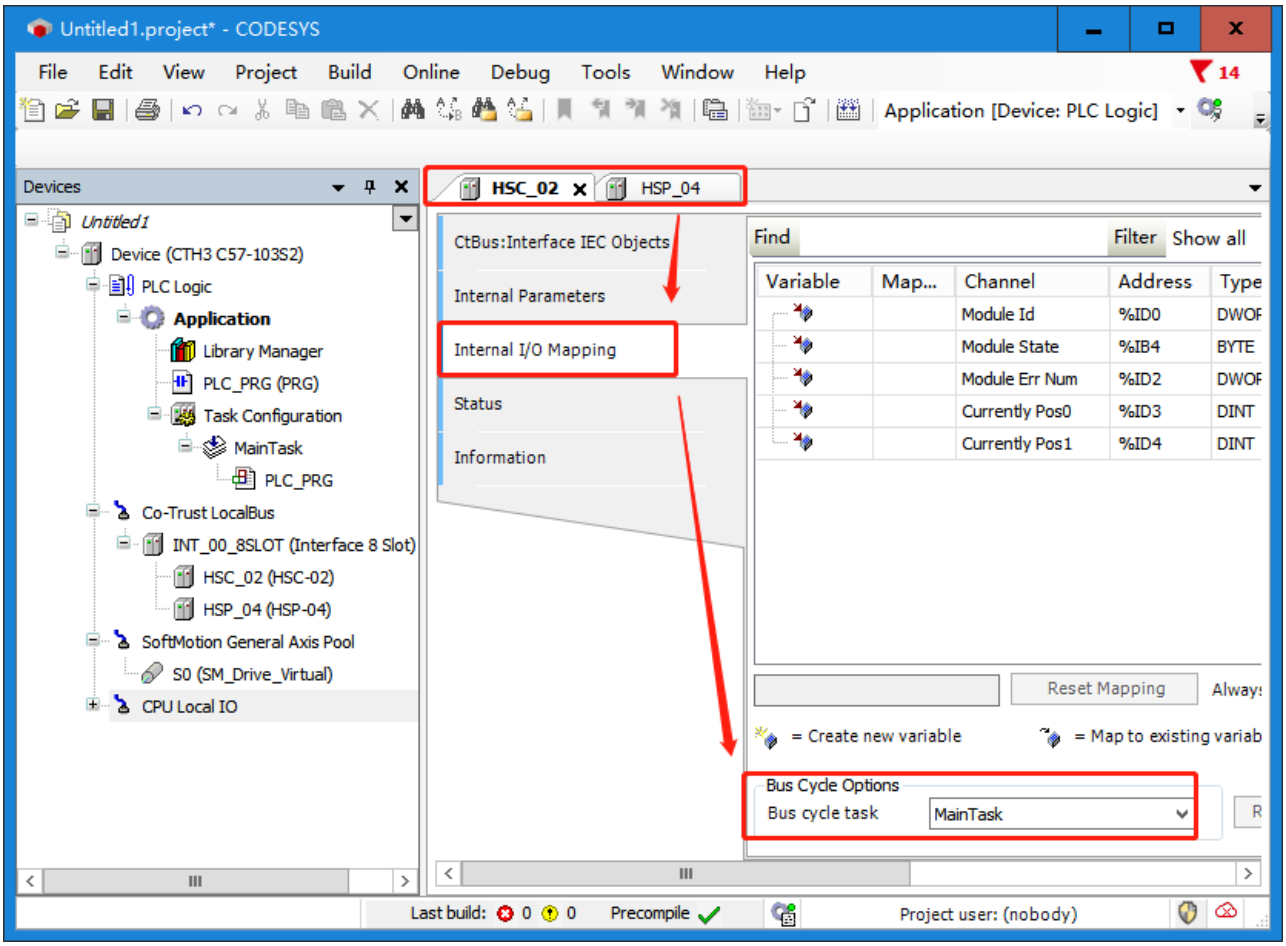


Note: After converting the set coordinates and set speed of the virtual axis, when assigning the value to the HSP axis parameter (64-bit to 32-bit), you cannot use the LREAL_TO_DINT instruction to convert the value directly, otherwise the value will be faulty in the event of an overflow.

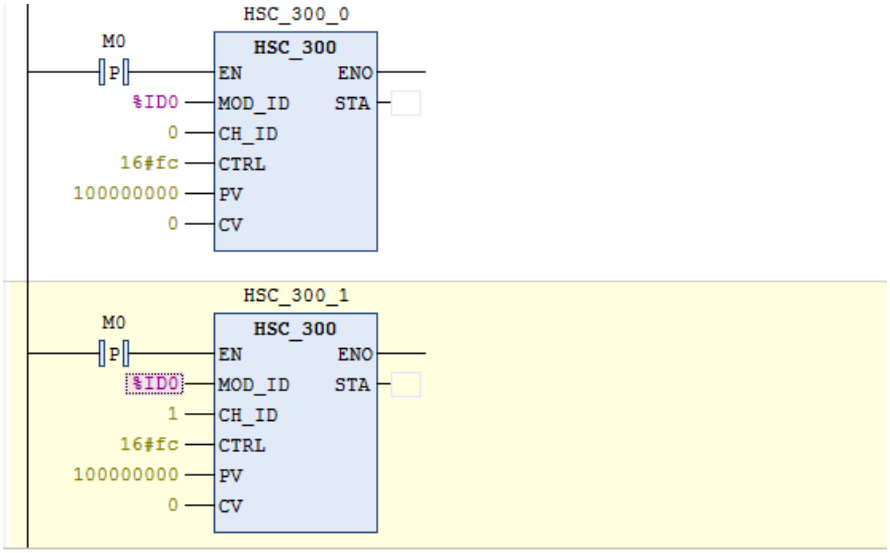
3. Call MC_ Power, MC_ MoveRelative and other commands control the axis.



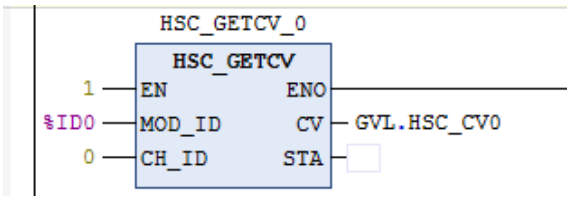
Note: The bus cycle of the task calling the axis command and the HSP-04 module should be set to the same, if the bus cycle is faster than the axis command cycle, the axis may report an error.

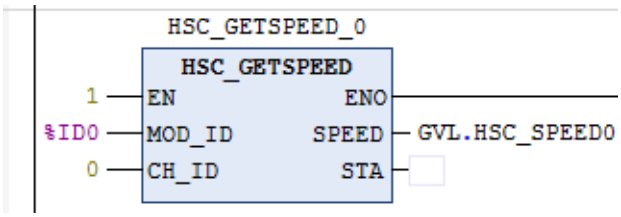


4. Call HSC_300 to set HSC parameters, the counting mode defaults to mode 0 in internal parameters, if you need to set other counting modes, you can directly call HSC_SETMODE instruction to set, you can also set the counting mode in internal parameters.



5. Get the current count value, get the current count speed, the current value is the number of pulses received by the counter.





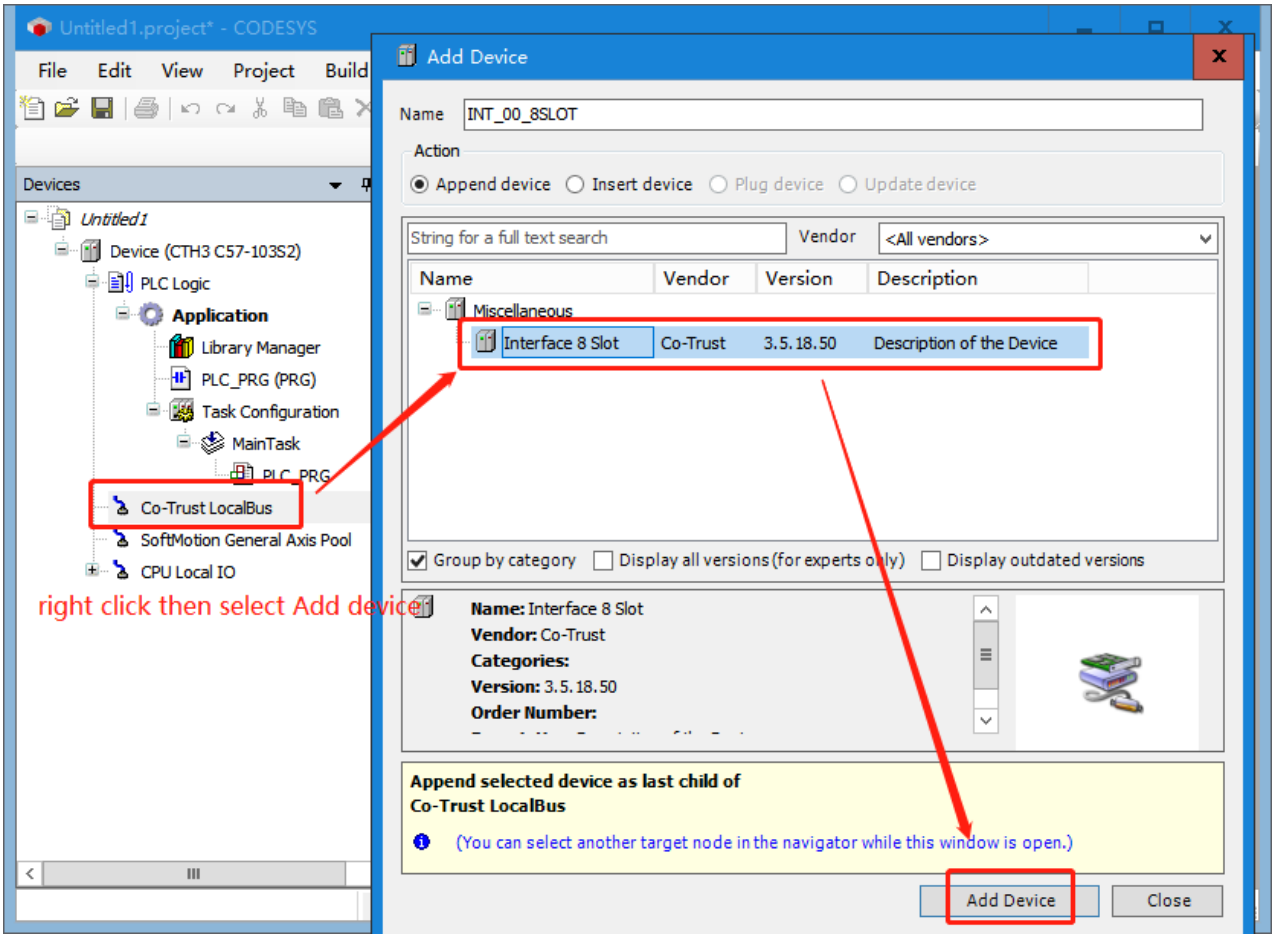
4.3 Use of digital modules

In this section, we will do an example of running light project configuration, CTH3 C35-003S2 as the master, and briefly explain the use of digital modules. The function is as follows: **Let the digital output module port on the intermediate expansion module carry out the running light output, and move 1 bit from low to high every 2 seconds, and cycle within the range of 8 bits.**

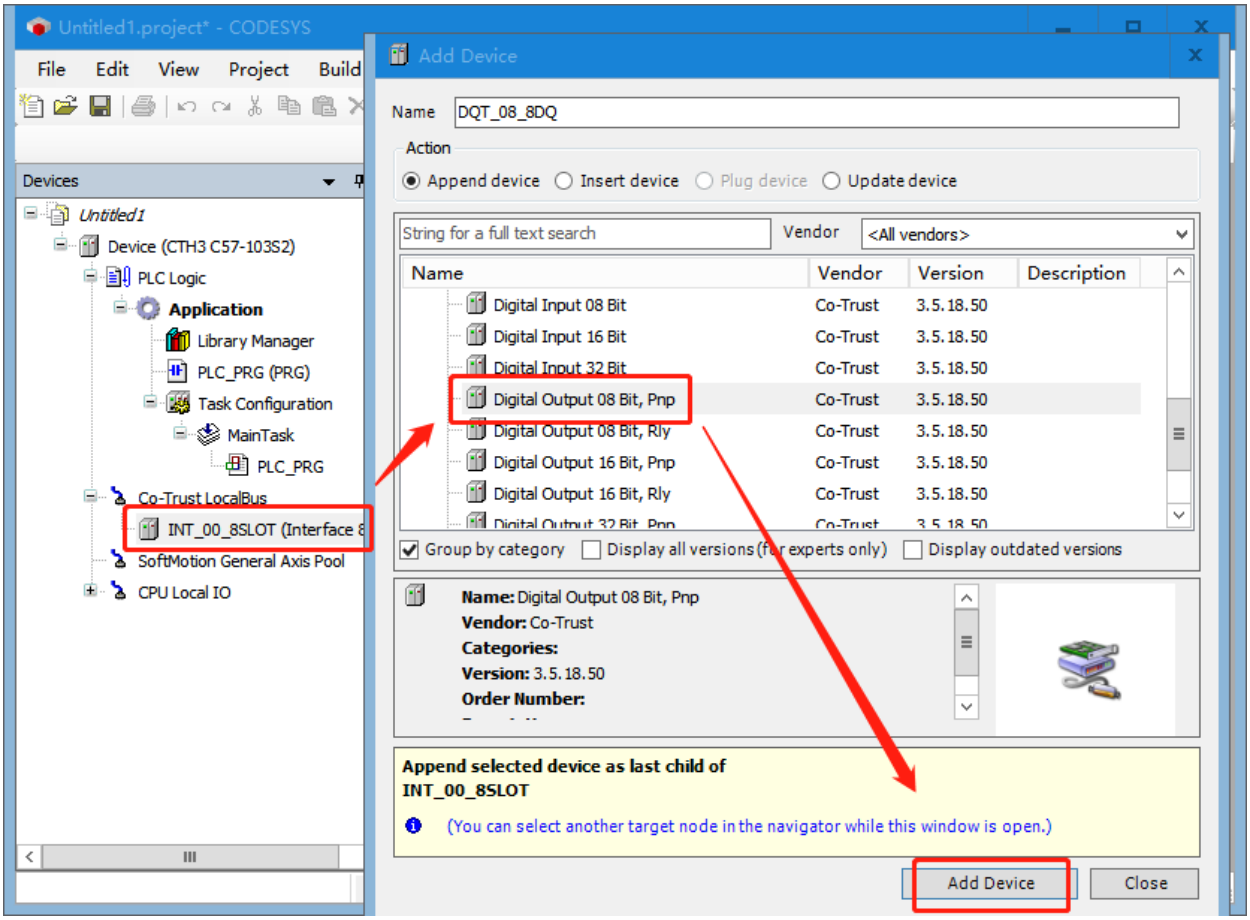
The approximate steps of the whole project configuration are as follows.

Step 1: Create a new project, add intermediate expansion module（INT-00） and digital output module to the project.

(1) Open CODESYS SP18 to create a new project, in the device view, right-click on the "Co-Trust LocalBus" and select "Add Device", then select and add the intermediate expansion module（INT-00）, refer to the following schematic diagram.



2) Add digital output module DQT_08 under INT_00



Step 2. Write the programme

In PLC_PRG to write a running light programme, to achieve every 2s from the low to the high level of movement.

Variable declare:

	Scope	Name	Address	Data type	Initialization	Comment	Attributes
1	VAR	**q00**		BOOL			
2	VAR	**q01**		BOOL			
3	VAR	**q02**		BOOL			
4	VAR	**q03**		BOOL			
5	VAR	**q04**		BOOL			
6	VAR	**q05**		BOOL			
7	VAR	**q06**		BOOL			
8	VAR	**q07**		BOOL			
9	VAR	**ton1**		Standard.TON			
10	VAR	**index**		BOOL			

Main Programme:

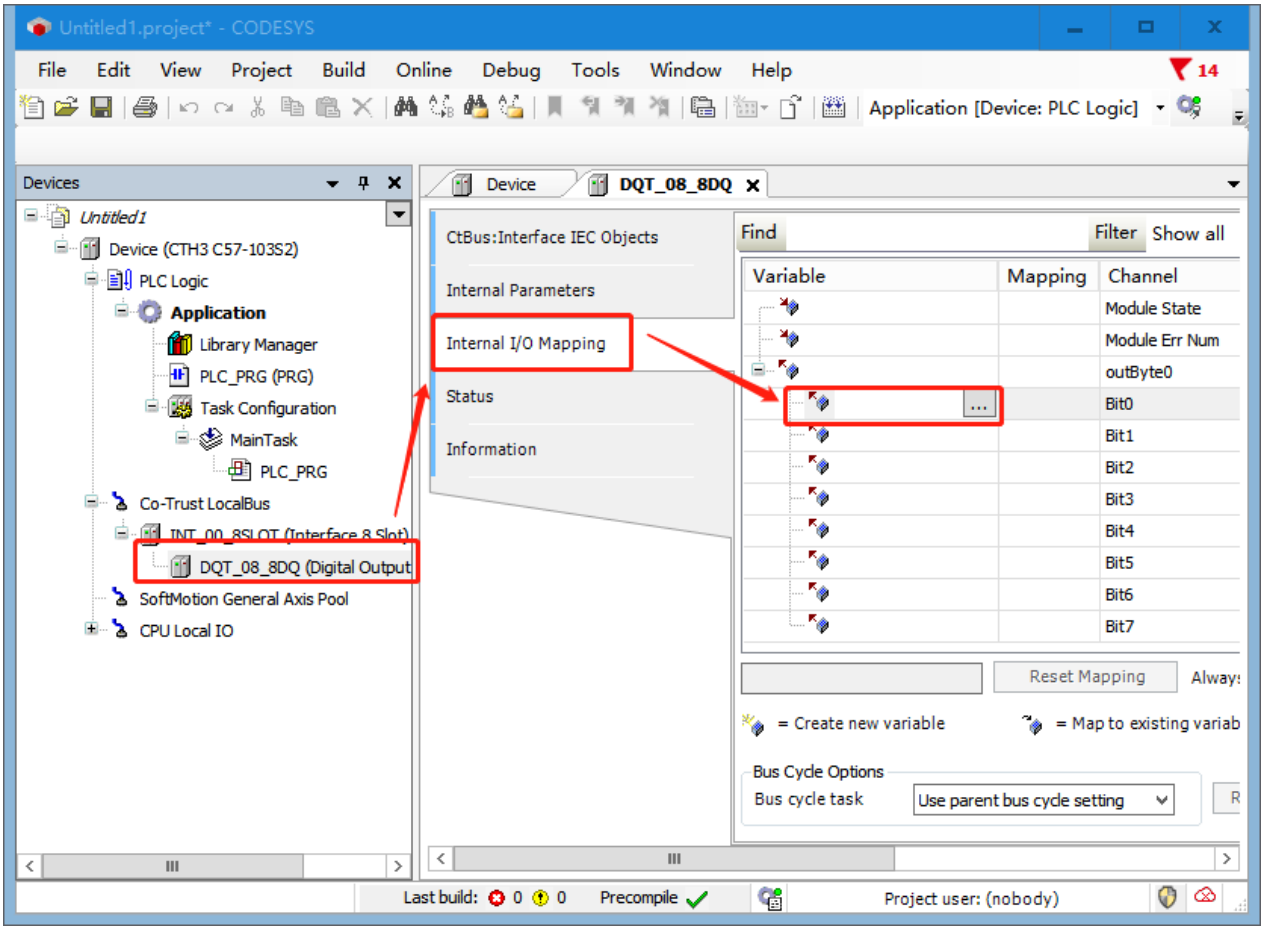
```
1   ton1(IN:=NOT ton1.Q,PT:=T#2S,);//Timing is set to 2s and restarts when time is up.
2   CASE index OF   //Cycle lighting Q0.0-Q0.7 every 2s
3       0:
4       q00:=1; q01:=0; q02:=0; q03:=0; q04:=0; q05:=0; q06:=0; q07:=0;
5           IF ton1.Q THEN
6           index:=1;
7       END_IF
8       1:
9       q00:=0; q01:=1; q02:=0; q03:=0; q04:=0; q05:=0; q06:=0; q07:=0;
10          IF ton1.Q THEN
11          index:=2;
12      END_IF
13          2:
14      q00:=0; q01:=0; q02:=1; q03:=0; q04:=0; q05:=0; q06:=0; q07:=0;
15          IF ton1.Q THEN
16          index:=3;
17      END_IF
18          3:
19      q00:=0; q01:=0; q02:=0; q03:=1; q04:=0; q05:=0; q06:=0; q07:=0;
20          IF ton1.Q THEN
21          index:=4;
22      END_IF
23          4:
24      q00:=0; q01:=0; q02:=0; q03:=0; q04:=1; q05:=0; q06:=0; q07:=0;
25          IF ton1.Q THEN
26          index:=5;
27      END_IF
28          5:
29      q00:=0; q01:=0; q02:=0; q03:=0; q04:=0; q05:=1; q06:=0; q07:=0;
30          IF ton1.Q THEN
31          index:=6;
32      END_IF
33          6:
34      q00:=0; q01:=0; q02:=0; q03:=0; q04:=0; q05:=0; q06:=1; q07:=0;
35          IF ton1.Q THEN
36          index:=7;
37      END_IF
38          7:
39      q00:=0; q01:=0; q02:=0; q03:=0; q04:=0; q05:=0; q06:=0; q07:=1;
40          IF ton1.Q THEN
41          index:=0;
42      END_IF
43  END_CASE
```

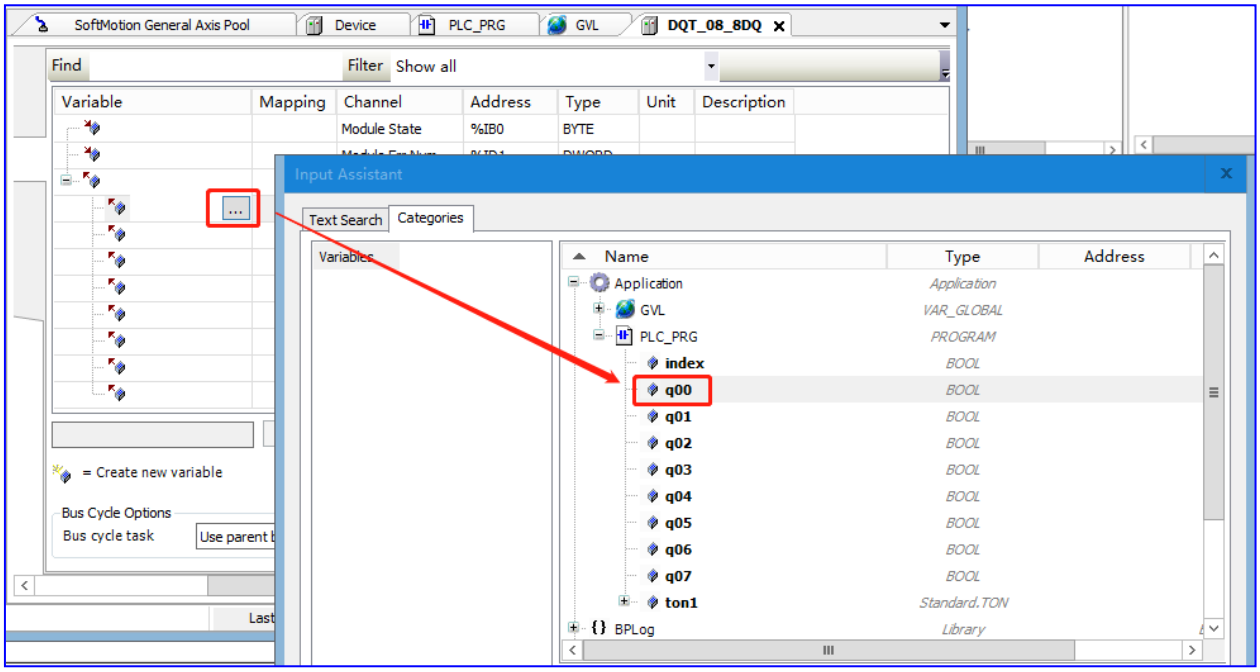
Step 3. Setup Communication

Refer to Section 3.4 Set communication to set up PLC to communicate with CODESYS SP18.

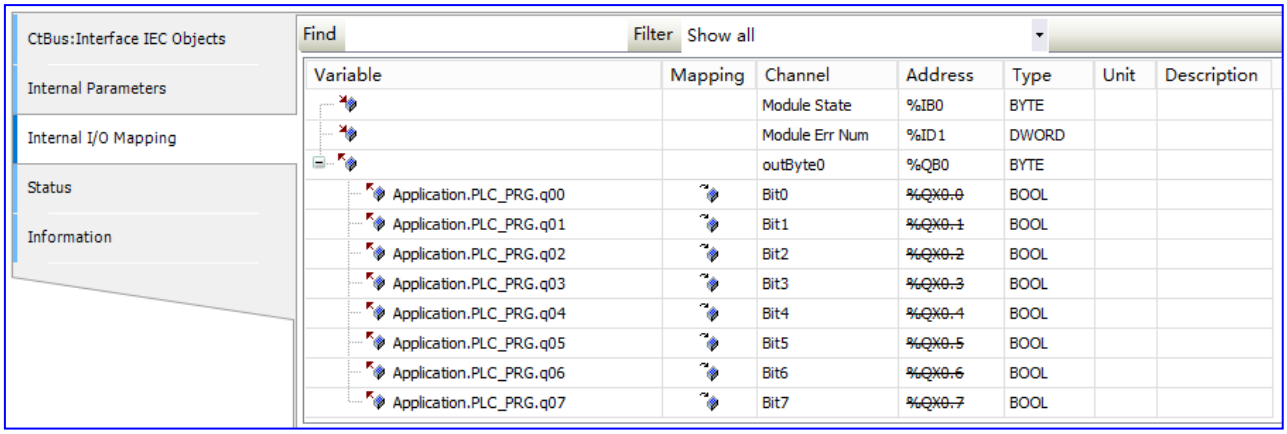
Step 4. Associate user program variables with digital output module ports

1) Double click DQT_08, enter Internal I/O mapping, expand the variables under outByte0, and then assign a variable to each bit.





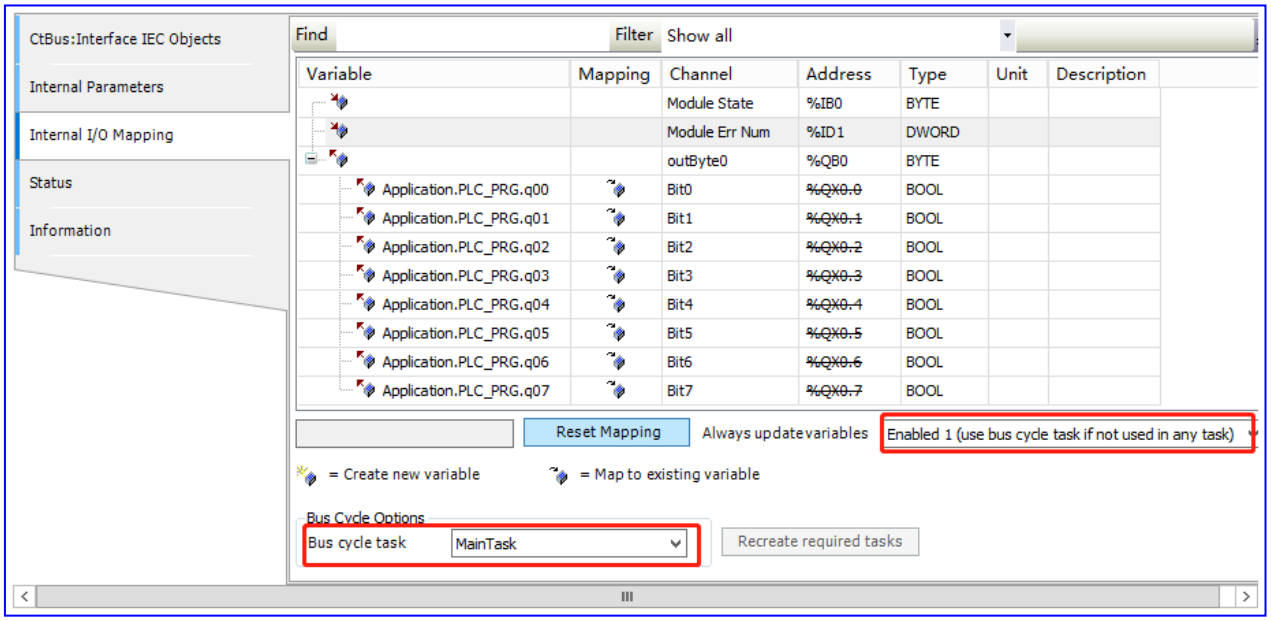
2) The association of the variable with the digital output module port is completed as follows.



3) Select "Main Task" for bus cycle task, and "Enable 1 (use bus cycle task if not used in any task)" for bus cycle.

• Use parent device setting: Update according to the setting of the parent device.

• Enable 1 (use bus cycle task if not used in any task): CODESYS updates the I/O variables in the bus loop task if they are not used in any other task.



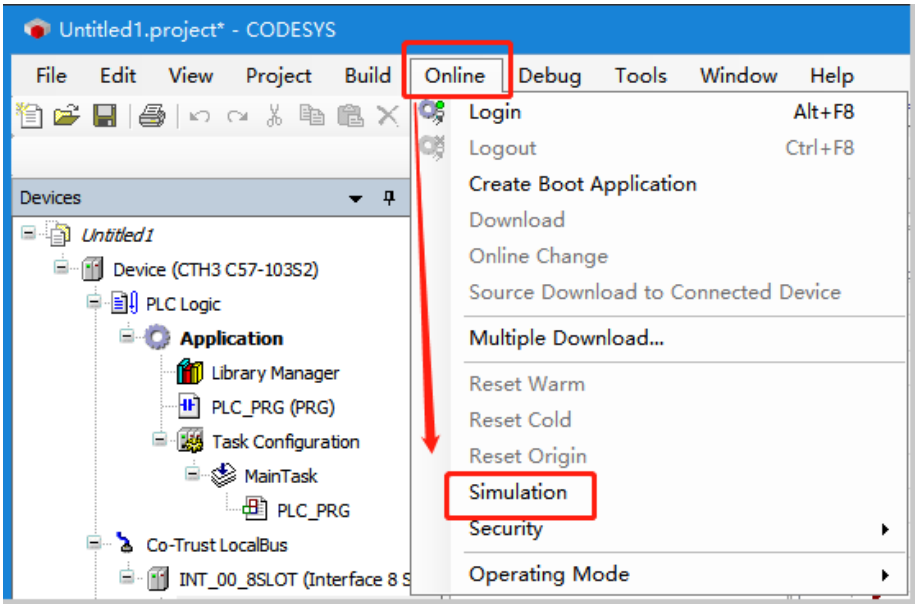
Step 5. Compile, Login

Firstly, click  to compile project, or press F11 key to compile the code, and then click Login icon  to download the project to PLC.

Step 6: Run and monitor

By simulating and demonstrating the execution results of the program, first enable the simulation function, and then log in to the PLC. To enable simulation, there is no need to go through step 3. Simply log in and run to view the execution results in the IO mapping of the digital output expansion module.

(1) Select the menu item "Online" → "Simulation" to open the simulation.



2) Click the login icon to connect the application to the virtual CTH3 C35-003S2 and enter the online status. Then click the "RUN" icon to run the application in CTH3 C35-003S2, and enter the Internal I/O mapping of DQT_08 to see the programme running as follows.

Variable	Mapping	Channel	Address	Type	Current Value	Prepared Value	Unit	Description
		Module State	%IB0	BYTE	0			
		Module Err Num	%ID1	DWORD	0			
		outByte0	%QB0	BYTE	Only subelements up...			
Application.PLC_PR...		Bit0	%QX0.0	BOOL	TRUE			
Application.PLC_PR...		Bit1	%QX0.1	BOOL	FALSE			
Application.PLC_PR...		Bit2	%QX0.2	BOOL	FALSE			
Application.PLC_PR...		Bit3	%QX0.3	BOOL	FALSE			
Application.PLC_PR...		Bit4	%QX0.4	BOOL	FALSE			
Application.PLC_PR...		Bit5	%QX0.5	BOOL	FALSE			
Application.PLC_PR...		Bit6	%QX0.6	BOOL	FALSE			
Application.PLC_PR...		Bit7	%QX0.7	BOOL	FALSE			

Variable	Mapping	Channel	Address	Type	Current Value	Prepared Value	Unit	Description
		Module State	%IB0	BYTE	0			
		Module Err Num	%ID1	DWORD	0			
		outByte0	%QB0	BYTE	Only subelements up...			
Application.PLC_PR...		Bit0	%QX0.0	BOOL	FALSE			
Application.PLC_PR...		Bit1	%QX0.1	BOOL	TRUE			
Application.PLC_PR...		Bit2	%QX0.2	BOOL	FALSE			
Application.PLC_PR...		Bit3	%QX0.3	BOOL	FALSE			
Application.PLC_PR...		Bit4	%QX0.4	BOOL	FALSE			
Application.PLC_PR...		Bit5	%QX0.5	BOOL	FALSE			
Application.PLC_PR...		Bit6	%QX0.6	BOOL	FALSE			
Application.PLC_PR...		Bit7	%QX0.7	BOOL	FALSE			

Variable	Mapping	Channel	Address	Type	Current Value	Prepared Value	Unit	Description
		Module State	%IB0	BYTE	0			
		Module Err Num	%ID1	DWORD	0			
		outByte0	%QB0	BYTE	Only subelements up...			
Application.PLC_PR...		Bit0	%QX0.0	BOOL	FALSE			
Application.PLC_PR...		Bit1	%QX0.1	BOOL	FALSE			
Application.PLC_PR...		Bit2	%QX0.2	BOOL	TRUE			
Application.PLC_PR...		Bit3	%QX0.3	BOOL	FALSE			
Application.PLC_PR...		Bit4	%QX0.4	BOOL	FALSE			
Application.PLC_PR...		Bit5	%QX0.5	BOOL	FALSE			
Application.PLC_PR...		Bit6	%QX0.6	BOOL	FALSE			
Application.PLC_PR...		Bit7	%QX0.7	BOOL	FALSE			

Table 4-8 Parameter Information for I/O Mapping

Parameter	Description
Module State	Module Status 0x00: No error 0x01: Module busy 0x02: Timeout not responding 0x03: Module type match 0x04: Module version mismatch 0x05: Software error 0x06: Wait flag timeout 0x07: Bus answer error 0x08: Bus CRC check error 0x0E: Address not configured 0x10: Memory offset out of range 0x11: Module not ready 0x12: Module configuration error 0x13: Module does not support this instruction 0x15: Module internal diagnostics 0x16: Module not powered 0X17: Check error
outByte0	Digital Output Channel Value outByte0 represents the output channel byte 0 of the module
Module Err Num	Number of module errors

Internal Parameters

The Internal parameter contains some basic configuration parameters required for the module to start up. When the device starts up, it will perform operations with the values set in the internal parameter.

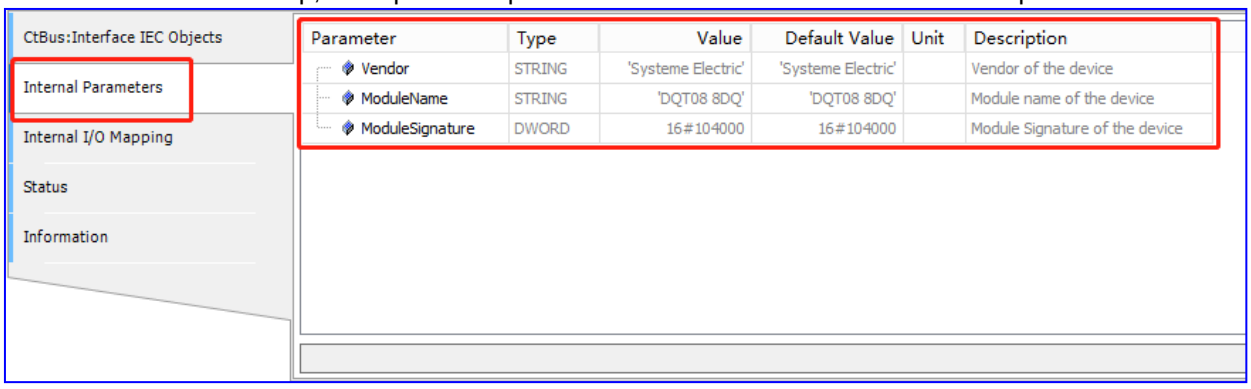


Table 4-9 Internal Parameter Information

Parameter	Description
vender	Vendor of the device
ModuleName	Module name of the device
Modulesignature	Module Signature of the device

4.4 Use of analogue modules

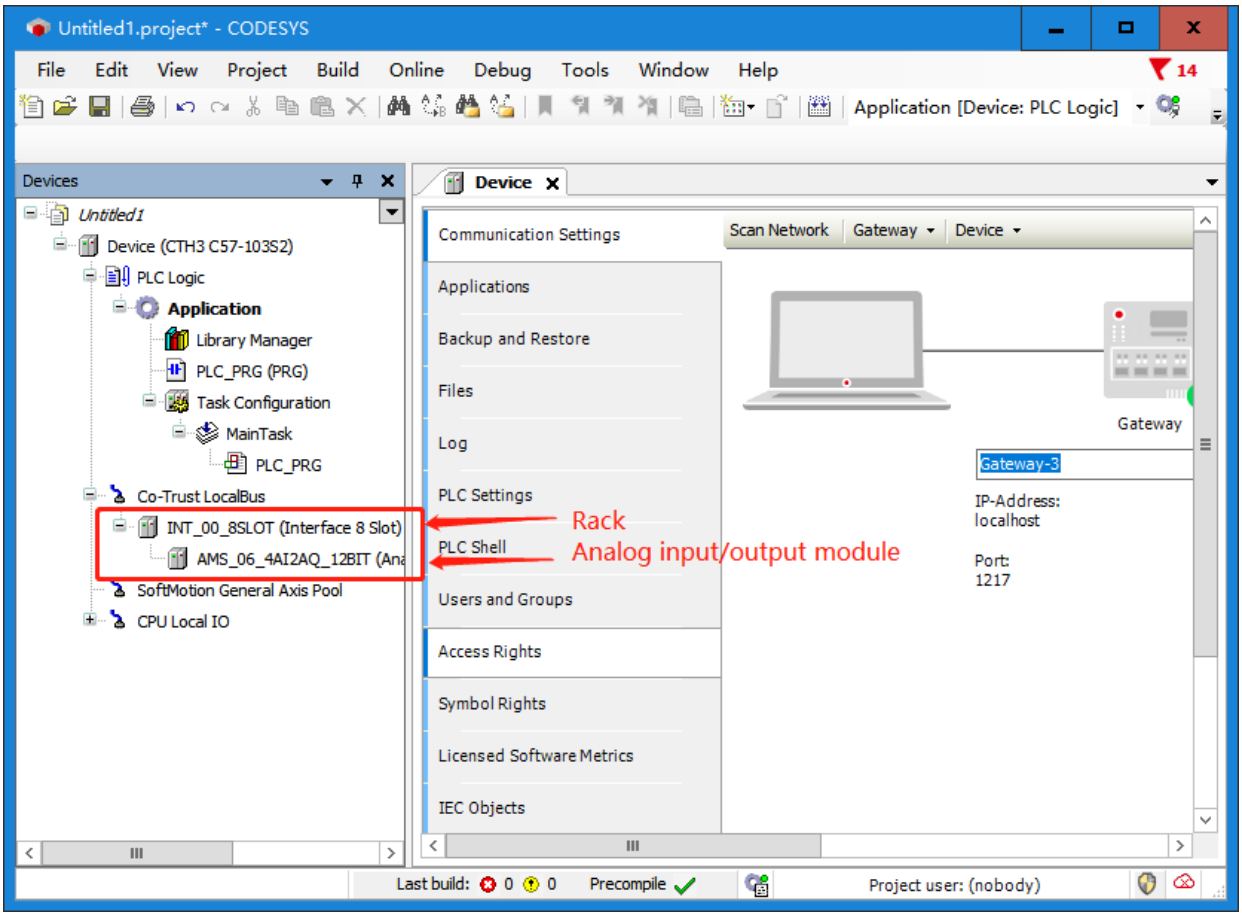
Hardware: CTH3 C57-103S2, analogue input/output module (current/voltage output)

Software: CODESYS V3.5 SP18 Path5

Function implemented: The input of the analog input and output module is connected to the output, and M253CE10 provides an output value. The input collects the output signal, which is then transmitted to CTH3 C57-103S2 through the bus.

Project configuration:

1. Add a rack (INT-00) under Syteme Electric LocalBus, and then add the analog input/output module to the rack.



2. Double click the analog input module to enter the configuration interface. In the Internal parameters, you can view information such as the module name and control words. The Internal parameter contains some basic configuration parameters required for module startup. When the device is started, the operation will be executed based on the values set in the Internal parameter.

The following is the configuration interface of analogue input/output module, you need to set the value of the control word in Internal parameter, and set the analogue input type, input range and sampling period by input control word, and set the output range by output control word.

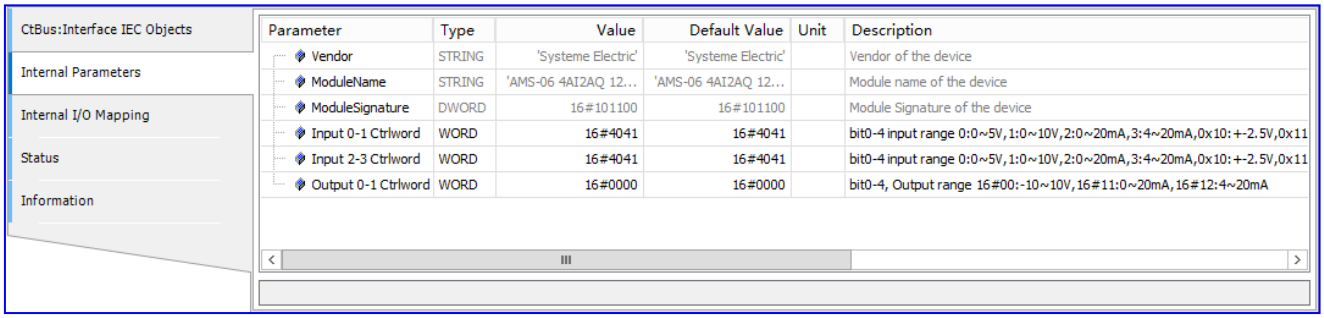


Table 4-10 Analogue Input Control Word (default is 16#4041, means the input is a voltage signal, its range is 0~10V, sampling period is 50Hz. differentiate between unipolar and bipolar by bit4, bit4 is 1 means bipolar, 0 means unipolar)

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

Set sampling period

Module type	Update frequency (sampling period)	Sampling period coding (bit7~5)
AI module 4 channels	200 Hz	000
	100 Hz	001
	50 Hz(Defaults)	010
	20 Hz	011
	10 Hz	100
AI module 8 channels	50 Hz	000
	20 Hz	001
	10 Hz(Defaults)	010
	5 Hz	011
	2 Hz	100

Set input type and input range

Input Type	input range	Range code (bit4~0)
voltage	0~5V	00000
	0~10V(default)	00001
	±2.5V	10000
	±5V	10001
currents	0~20mA(default)	00010
	4~20mA	00011

bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8
reserve	Must be 1	reserve	When the input range is 4-20mA, set the direction of the disconnection. 0: Positive direction (default) 1: Negative direction This bit is reserved for other ranges	reserve	reserve	reserve	

Remarks.

• When the used channel is disconnected, the channel value displays a fixed value (disconnected value), and the SF red light blinks to alarm.

• Two disconnection directions, one positive and one negative, select the value of bit12, when the analogue channel is disconnected, the disconnection value will be displayed in the corresponding channel, bit12=0 for positive disconnection value, bit12=1 for negative disconnection value. You can refer to section 2.8 Analog Module to check the disconnected value of the corresponding module.

Table 4-11 Analogue Output Control Word (Default is 16#0000, indicating the output range is -10V~10V)

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Reserve			Setting the output range				

			16#00: -10V~10V 16#11: 0~20mA 16#12: 4~20mA				
bit 15	**bit 14**	**bit 13**	**bit 12**	**bit 11**	**bit 10**	**bit 9**	**bit 8**
Reserve							

<Remarks> Analogue module has input module, output module, input/output module, module control word is not the same, specific control word according to the above steps in the Internal parameter of the corresponding module to view.

3. Internal I/O address

After adding the analog expansion module to the rack, the system will automatically allocate the channel address of the module in the Internal I/O address. In the Internal I/O address, you can also view the status of the module and the number of module errors.

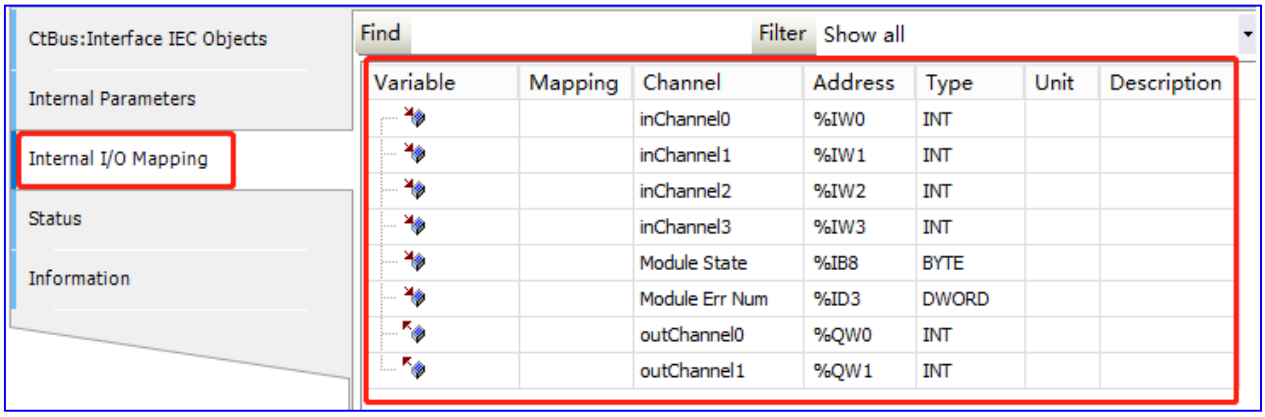


Table 4-12 Internal I/O Information

Name	Description
inChannel	When the project is running, it will display the detected input value on the channel, and the disconnected value when it is disconnected.
Module State	Module State 0x00 No errors; 0x01 Module busy; 0x02 Timeout not responding; 0x03 Module type match; 0x04 Module version mismatch; 0x05 Software Error; 0x06 Wait flag timeout; 0x07 Bus answer error; 0x08 Bus CRC check error 0x0E Address not configured; 0x10 Memory offset out of range; 0x11 Module not ready; 0x12 Module configuration error; 0x13 Module does not support this instruction; 0x15 Module internal diagnostics; 0x16 Module not powered; 0X17 Comparison error; 0XFF Control word error(Only applicable to analog input modules)
Module Err Num	Number of module errors
outChannel	Provide output values to control the output

4. After downloading the project to the PLC you can see the values of the input and output channels in the I/O mapping.

Power supply budget

5

After selecting the CPUs, power modules, intermediate expansion module and expansion modules for each rack, it is also necessary to verify that the current consumption and power consumption of the system bus meet the following conditions.

Condition 1: Bus current consumption confirmation

The internal bus voltage is 5VDC, and the current is supplied by the CPU (when no intermediate expansion module) or the intermediate expansion module. The sum of the expansion module bus current consumption in each rack must not exceed the maximum bus current allowed by the CPU or Intermediate expansion module.

Condition 2: Power Consumption Confirmation

When using a power supply module, the sum of the power consumption of the other modules in each rack must not exceed the maximum power consumption allowed by the power supply module.

When using an external power supply, select a power supply with an appropriate power level according to the sum of the connected power.

Table 5-1 5VDC Bus Current Supply and Consumption

Product Model	Supply current	Current consumption
CTH3 C35-003S2	1600mA	--
CTH3 C57-103S2	1600mA	--
CTH3 INT-000S1	1600mA	--
CTH3 DIT-080S1	--	60mA
CTH3 DIT-160S1	--	80mA
CTH3 DIT-320S1 CTH3 DIT-320S2	--	130mA
CTH3 DQT-080S1	--	70mA
CTH3 DQT-160S1	--	120mA
CTH3 DQT-320S1 CTH3 DQT-320S2	--	210mA
CTH3 DQR-080S1	--	45mA
CTH3 DQR-160S1	--	60mA
CTH3 AIS-040S1	--	50mA
CTH3 AIC-080S1	--	30mA
CTH3 AIV-080S1	--	30mA
CTH3 AQS-040S1	--	40mA
CTH3 AQS-080S1 CTH3 AQS-080S2	--	40mA
CTH3 AMS-060S	--	50mA
CTH3 AIT-040S1	--	50mA
CTH3 AIT-080S1	--	50mA

CTH3 AIR-040S1	--	50mA
CTH3 AIR-080S1 CTH3 AIR-080S2	--	50mA
CTH3 HSC-020S1	--	100mA
CTH3 HSP-040S1 CTH3 HSP-040S2	--	100mA

Table 5-2 24VDC Current Supply and Consumption

Product Model	Supply current	Current consumption
CTH3 PWR-020S1	2000mA	--
CTH3 C35-003S2	--	800mA
CTH3 C57-103S2		800mA
CTH3 INT-000S1	--	800mA
CTH3 DIT-080S1	--	--
CTH3 DIT-160S1	--	--
CTH3 DIT-320S1 CTH3 DIT-320S2	--	--
CTH3 DQT-080S1	--	50mA
CTH3 DQT-160S1	--	95mA
CTH3 DQT-320S1 CTH3 DQT-320S2	--	180mA
CTH3 DQR-080S1	--	64mA
CTH3 DQR-160S1	--	130mA
CTH3 AIS-040S1	--	65mA
CTH3 AIC-080S1	--	50mA
CTH3 AIV-080S1	--	50mA
CTH3 AQS-040S1	--	110mA
CTH3 AQS-080S1 CTH3 AQS-080S2	--	200mA
CTH3 AMS-060S	--	110mA
CTH3 AIT-040S1	--	50mA
CTH3 AIT-080S1	--	50mA
CTH3 AIR-040S1	--	60mA
CTH3 AIR-080S1 CTH3 AIR-080S2	--	80mA
CTH3 HSC-020S1	--	--
CTH3 HSP-040S1 CTH3 HSP-040S2	--	100mA

Appendix

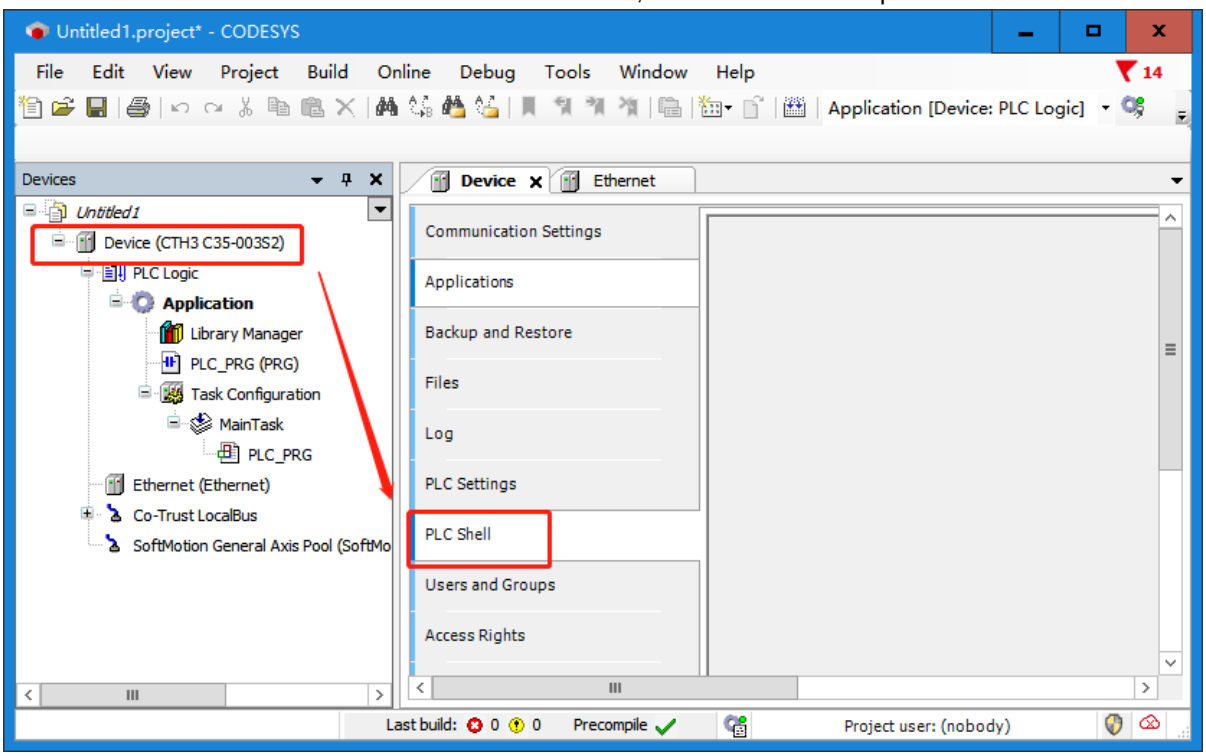
6

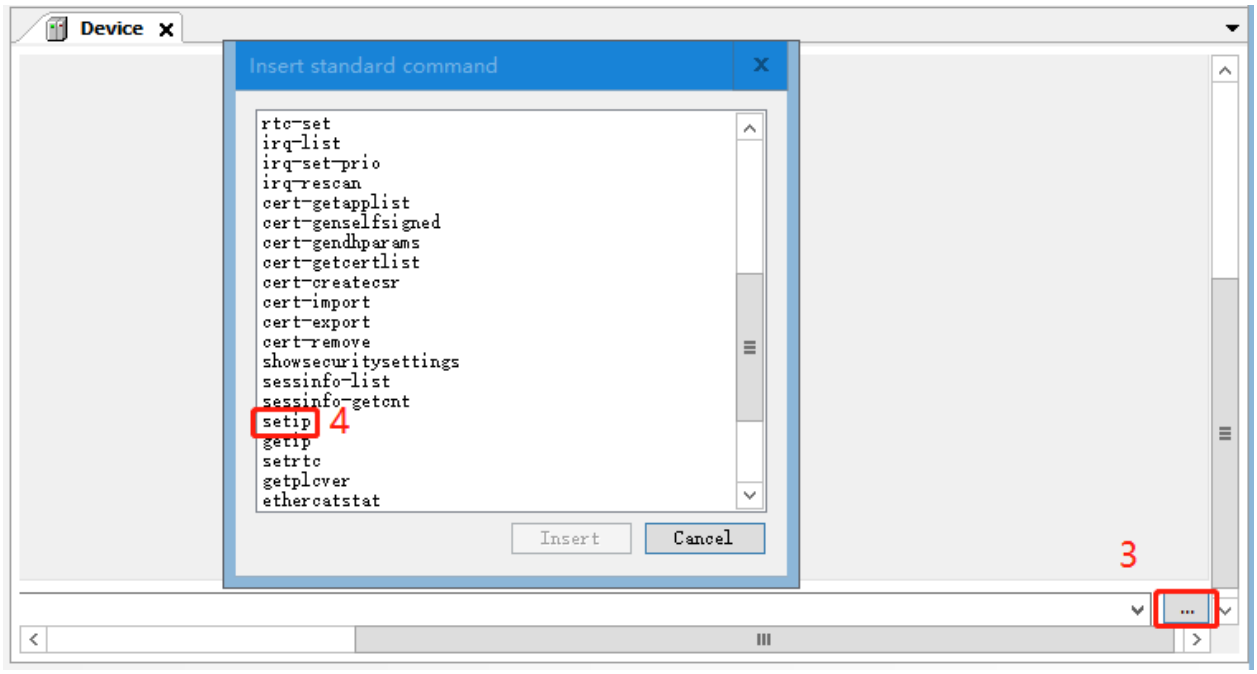
6.1 Modifying the PLC IP and Gateway

Before modifying the IP address and gateway of the PLC, communication must be established between the PLC and CODESYS. There are three ways to modify the IP address and gateway, one is to set the IP address and gateway in the PLC shell, one is to modify the IP address and gateway by using the "Ethernet Adapter" software device, and another is to modify the IP address and gateway by calling the changeIPAddress command.

6.1.1 Setting IP and gateway in PLC shell

1. Double-click device to enter the PLC shell interface, and then select setip.





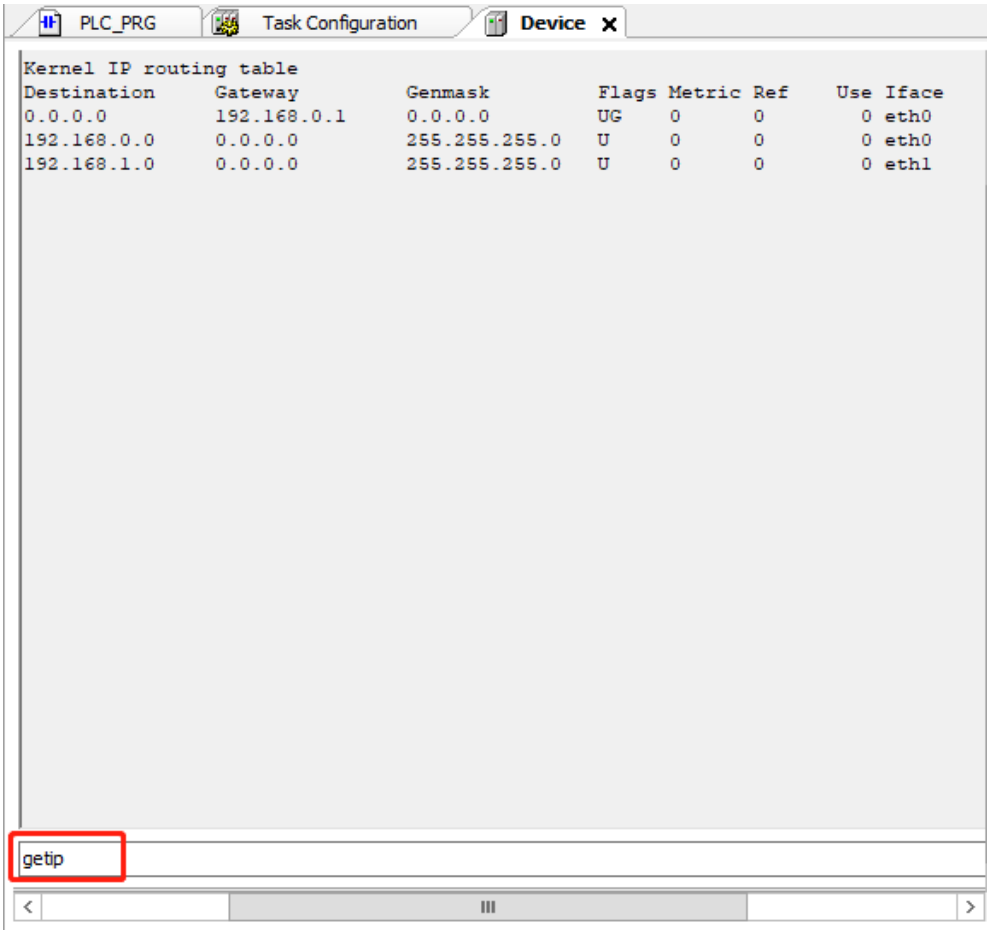
2. You can also ignore the above 3 and 4, directly in the input box, type "setip ...".

• If you only modify IP address, input “setip eth0 ip:192.168.0.X” (X is octal, X range: 1~254), then enter.

• To modify gateway and IP address, directly input "setip 192.168.0.X mask 255.255.255.0 gateway 192.168.0.X" in the input box, and then enter.

Note: The X value of PLC IP address, PC IP address and gateway address cannot be the same.

3、After modifying the address, you can get ip



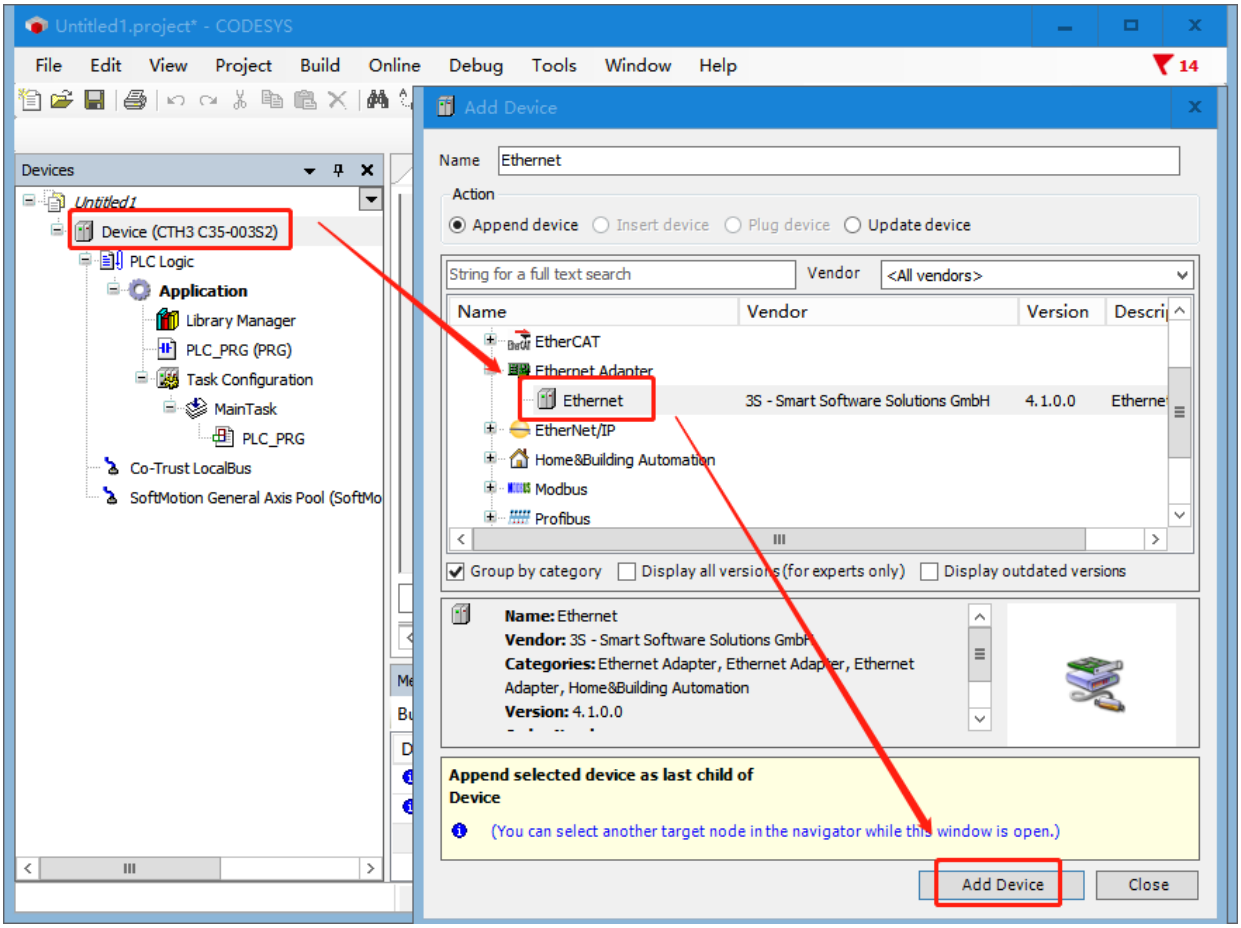
6.1.2 Setting the IP address using the "Ethernet adapter" software device.

Advantages: IP and gateway can be easily set by configuration, and does not need to be modified by inputting PLC shell.

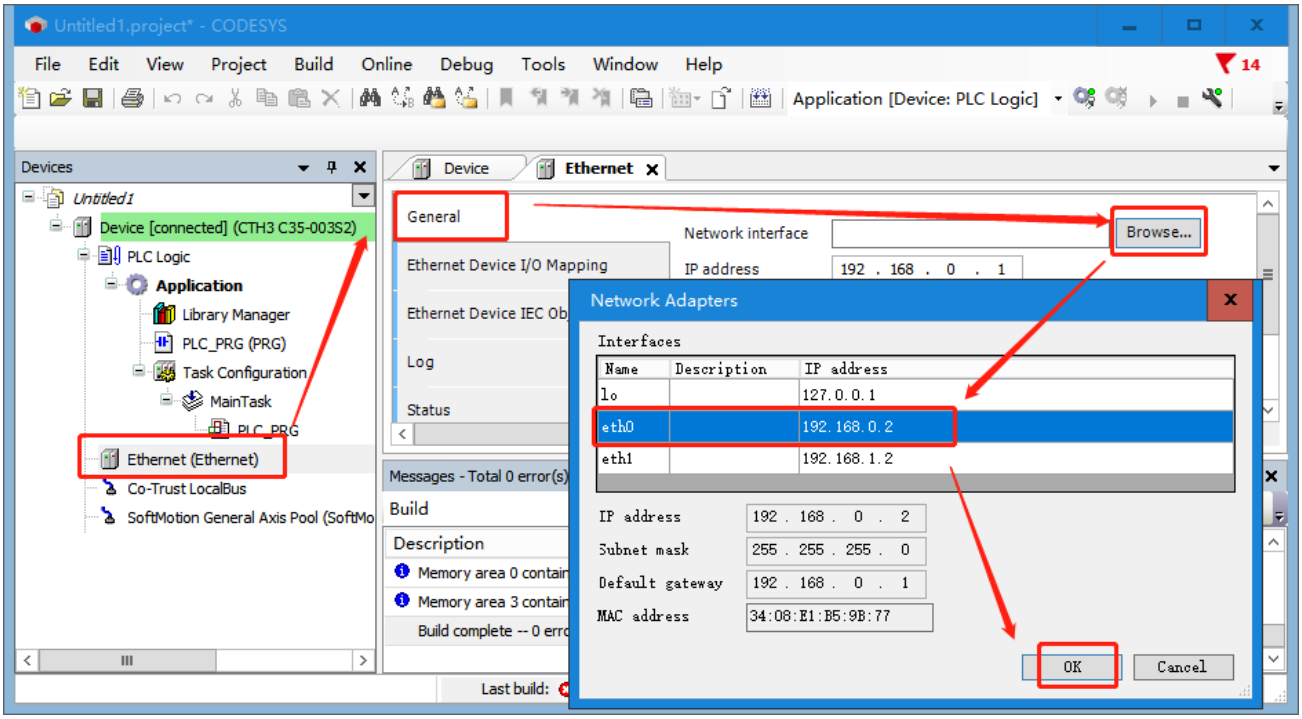
Disadvantages: Cannot map address for modification, default gateway cannot be modified. (CODESYS software problem)

Operate as follows:

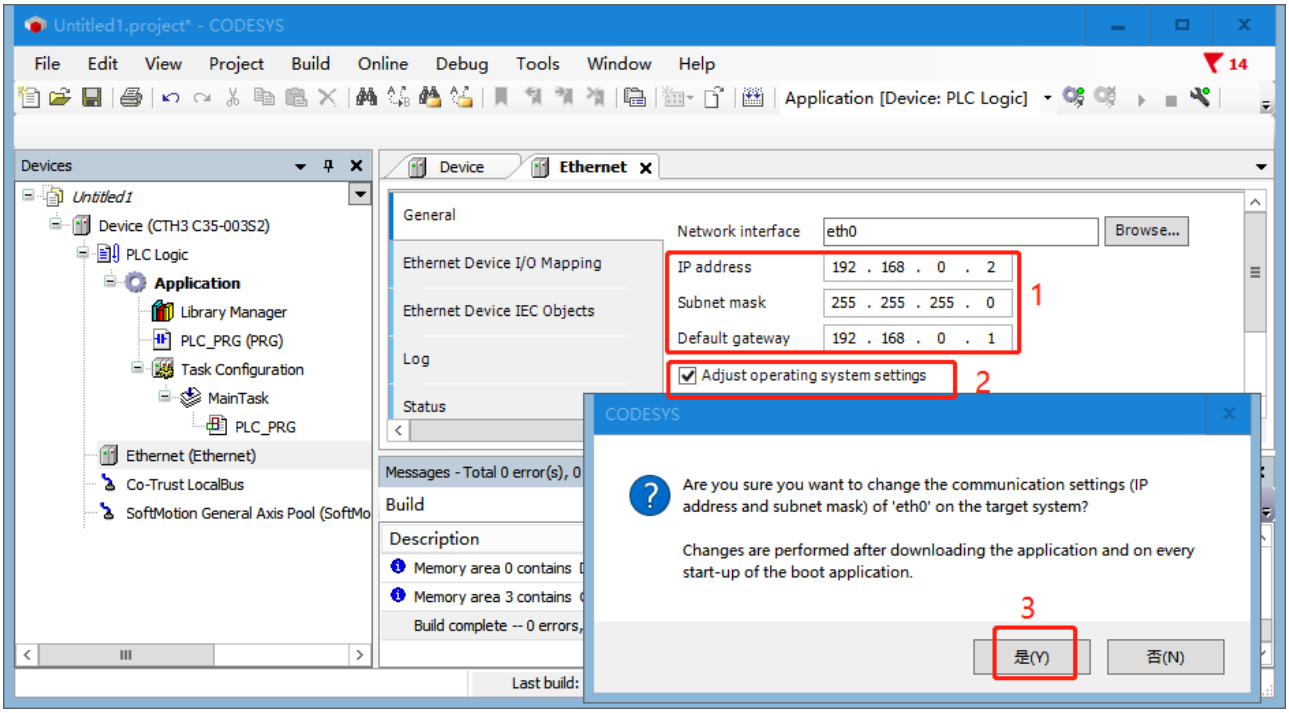
1. CODESYS software interface select Device to add devices, select Ethernet adapter below Ethernet.



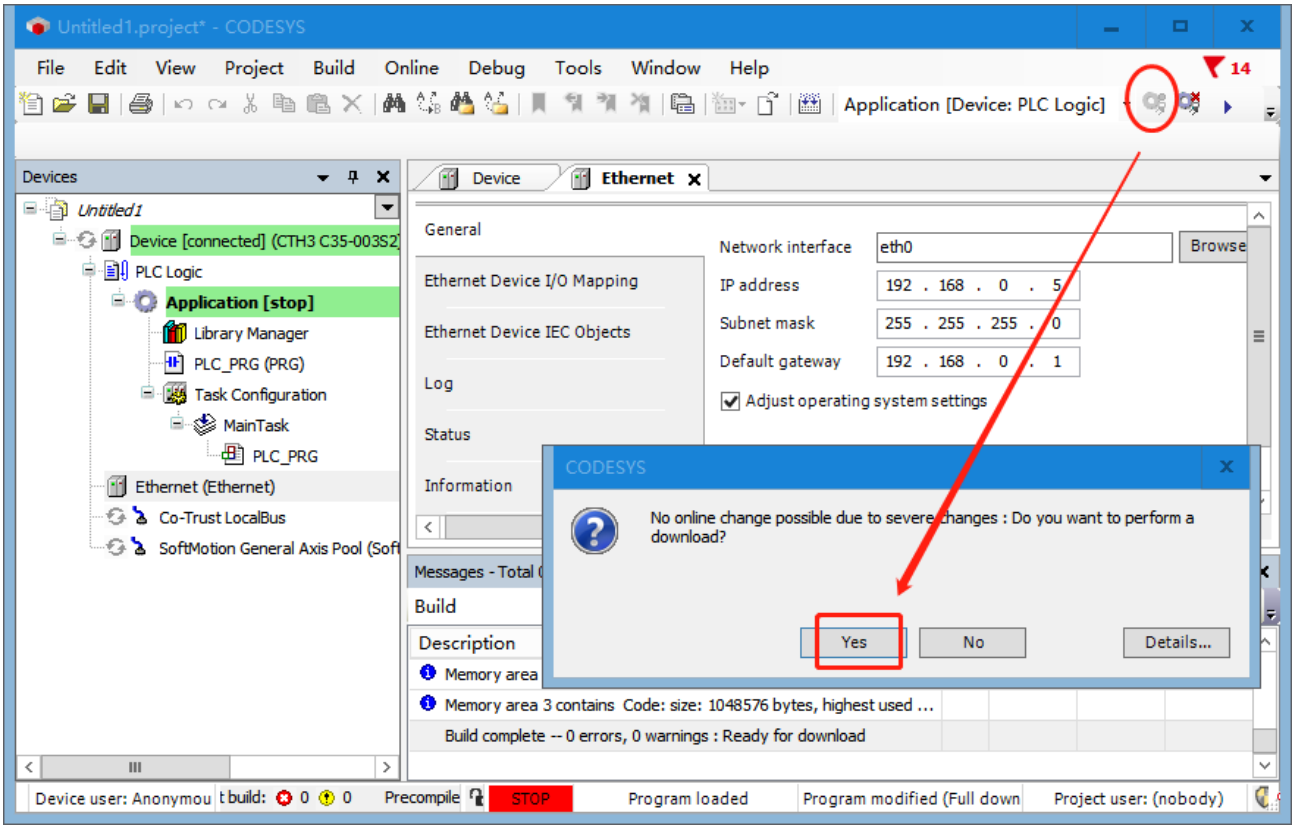
2. Double-click "Ethernet" and click "General", you can directly click "Browse" to select "eth0 and then set IP/subnet mask.



3. Set the IP, gateway and subnet mask, tick "Adapt operating system settings".



4. Click login, download the configuration to the PLC, and wait for the CPU to resume communication.

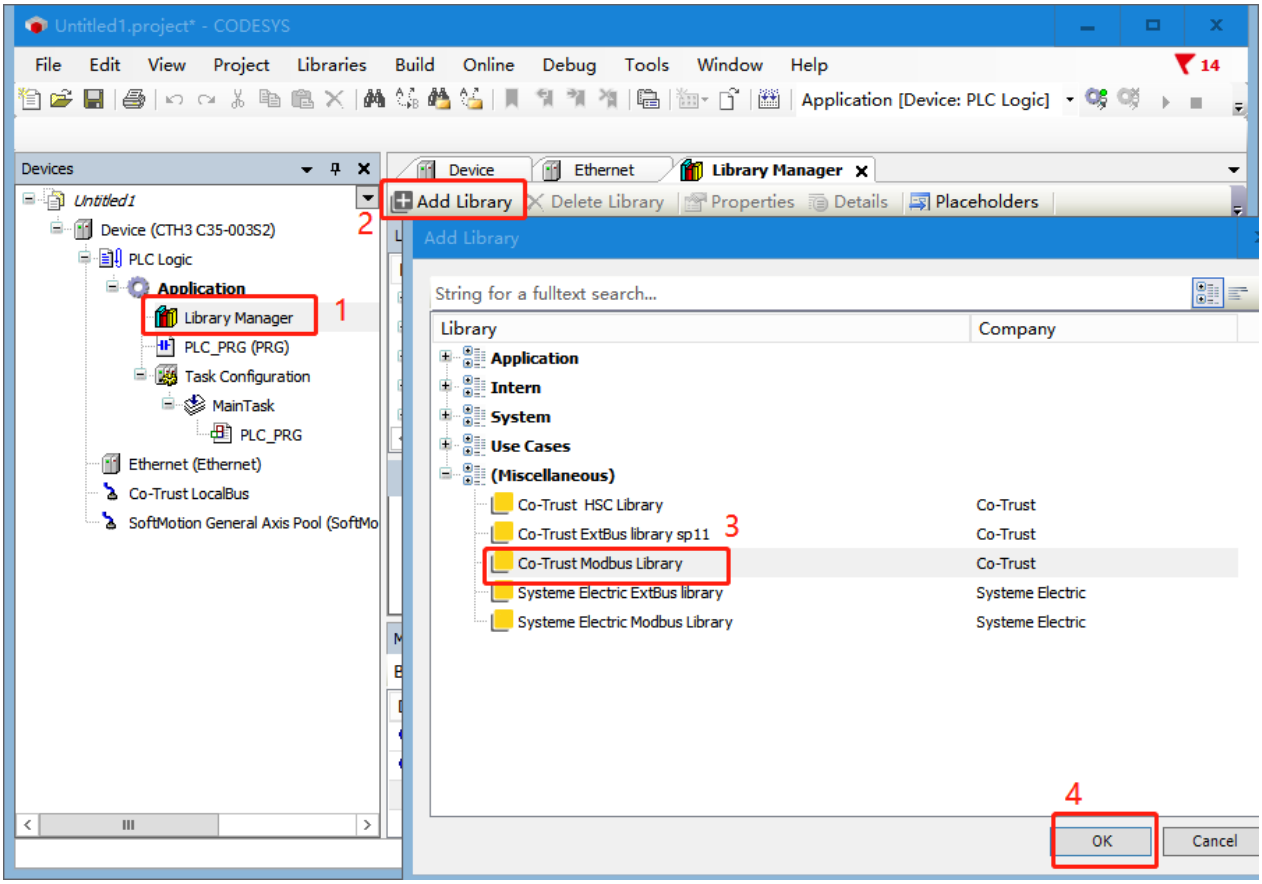


5. After successful downloading, you can obtain the IP and gateway in the PLC shell to check if the modification was successful.

6.1.3 Calling the changeIPAddress command to set the IP address

Calling the changeIPAddress command to directly modify the IP and gateway requires adding libraries and assigning addresses to libraries for use.

1. Add Modbus library



2. Call the changeIPAddress command to modify the IP and gateway, and then download the project to the PLC. You can see the current IP, gateway, and subnet mask of the PLC.

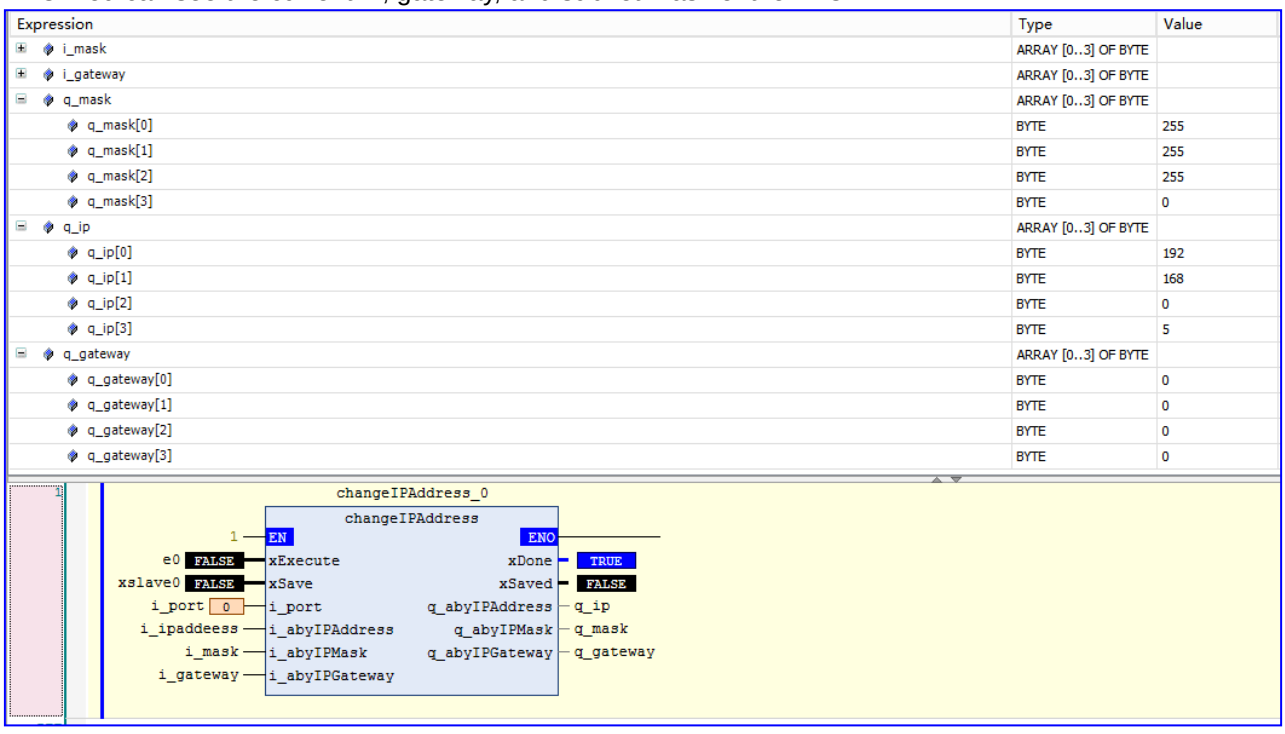


Table 6-1 The instructions for the changeIPAddress command are as follows:

Parameter	Input/ output	Data type	Remarks
xExecute	IN	BOOL	The rising edge sets the network parameters, and the falling edge resets the output.
xSave	IN	BOOL	Save the configuration and use it next time.

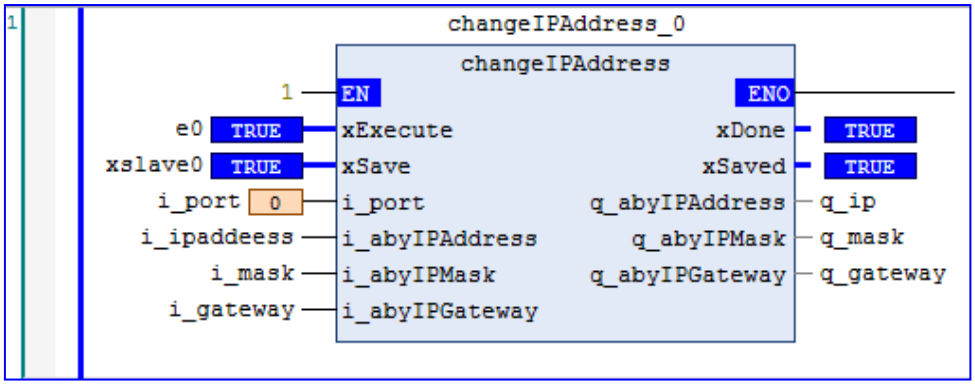
i_port	IN	BYTE	0: eth0. 1: eth1
i_abyIPAddress	IN	BYTE	IP address, format 0.0.0.0. Restore default IP when set to 0.0.0.0
i_abyIPMask	IN	BYTE	Subnet mask, format 0.0.0.0.
i_abyIPGateway	IN	BYTE	Default gateway, format 0.0.0.0.
xDone	OUT	BOOL	TRUE set successfully.
xSaved	OUT	BOOL	TRUE Successfully saved the configuration.
q_abyIPAddress	OUT	BYTE	Current IP address, format 0.0.0.0.
q_abyIPMask	OUT	BYTE	Current subnet mask, format 0.0.0.0.
q_abyIPGateway	OUT	BYTE	The current default gateway, format 0.0.0.0.

Write the IP address, subnet mask, and gateway that needs to be modified in the corresponding parameters. The complete correspondence between the IP, subnet mask, and gateway in the input and output indicates successful modification.

Expression	Type	Value	Prepared value	Address
xslave0	BOOL	TRUE		
i_port	BYTE	0		
i_ipaddeess	ARRAY [0..3] OF BYTE			
i_ipaddeess[0]	BYTE	192		
i_ipaddeess[1]	BYTE	168		
i_ipaddeess[2]	BYTE	0		
i_ipaddeess[3]	BYTE	8		
i_mask	ARRAY [0..3] OF BYTE			
i_mask[0]	BYTE	255		
i_mask[1]	BYTE	255		
i_mask[2]	BYTE	255		
i_mask[3]	BYTE	0		
i_gateway	ARRAY [0..3] OF BYTE			
i_gateway[0]	BYTE	0		
i_gateway[1]	BYTE	0		
i_gateway[2]	BYTE	0		
i_gateway[3]	BYTE	0		
q_mask	ARRAY [0..3] OF BYTE			
q_mask[0]	BYTE	255		
q_mask[1]	BYTE	255		
q_mask[2]	BYTE	255		
q_mask[3]	BYTE	0		
q_ip	ARRAY [0..3] OF BYTE			
q_ip[0]	BYTE	192		
q_ip[1]	BYTE	168		
q_ip[2]	BYTE	0		
q_ip[3]	BYTE	8		
q_gateway	ARRAY [0..3] OF BYTE			
q_gateway[0]	BYTE	0		
q_gateway[1]	BYTE	0		
q_gateway[2]	BYTE	0		
q_gateway[3]	BYTE	0		

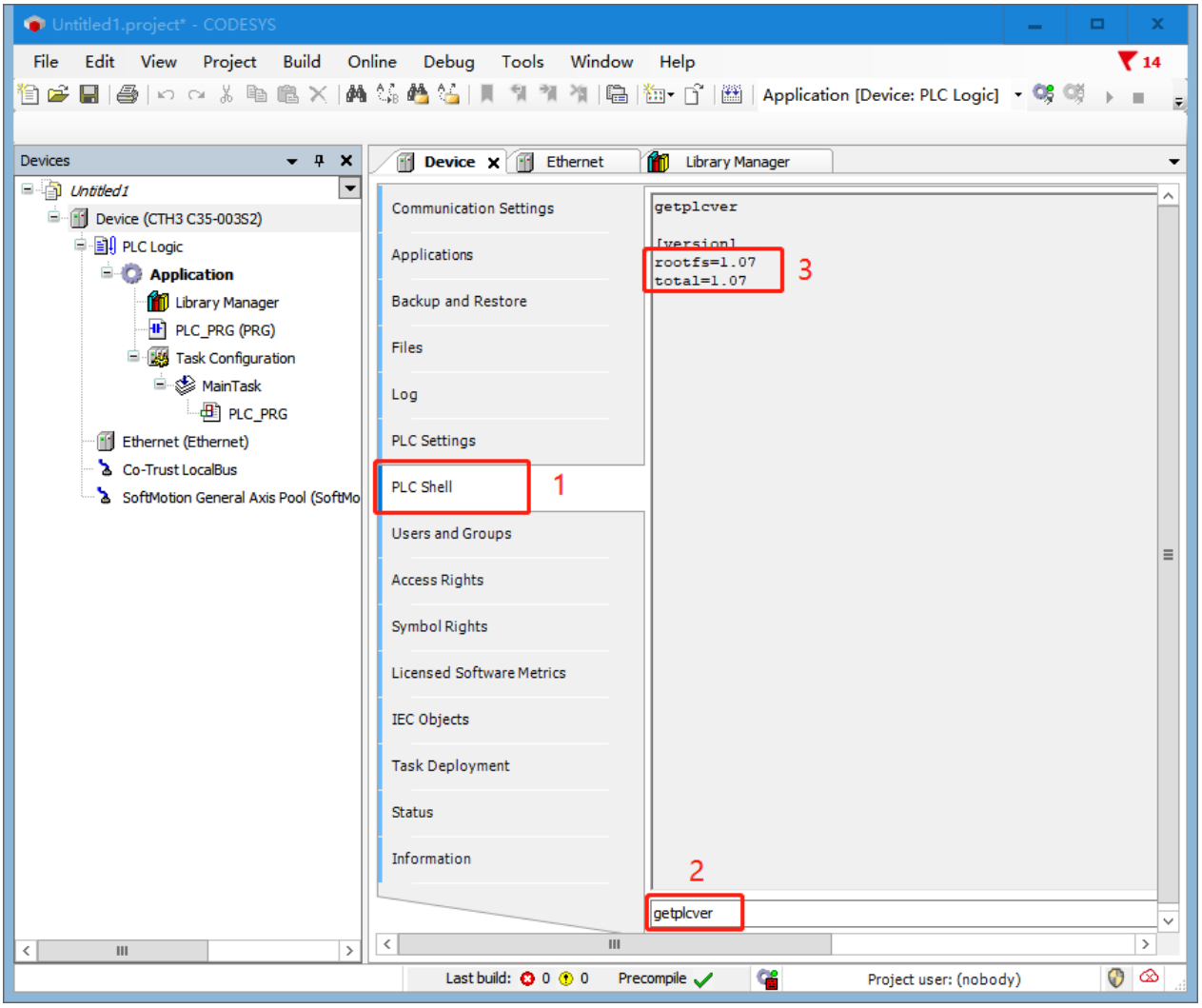
Modified IP, Gateway, Mask

If the IP, gateway and mask are the same as those modified above, the modification is successful.



6.2 Get PLC version

1. If the PLC is online, double click Device, select PLC shell, click right..., select getplcver in the pop-up window, or directly input getplcver, execute enter (computer key). The number that appears in the pop-up window is the version number, as shown below, the PLC firmware version is 1.08.



6.3 USB firmware update

After the CPU is powered off and the switch is turned to the shutdown state, insert the USB flash drive into the PLC's USB port and then power on. After a few seconds, except for the power light, all other lights remain on, indicating the loading process. After loading, all lights except the power light will flash, and then the CPU will be powered off and restarted.

6.4 Power-down data retention

Power down hold variable, is a variable with persistent (persistent remain) attribute, the variable in addition to the power down and hot Reset Warm retained value, but also has a Reset Cold retained value and program download retained value of the characteristics of the power down hold variable only in the initial

reset to be initialised.

The meaning of power-off holding variables: When the device is powered off, hot and cold reset, program download, or online program modification, certain parameters associated with practical applications can maintain their current values and will not be initialized to their original state.

Table 6-1 List of Power Failure Maintenance Variables

Online Order	VAR	VAR RETAIN	VAR PERSISTENT	VAR PERSISTENT RETAIN
Reset Origin	Initialize	Initialize	Initialize	Initialize
Download	Initialize	Initialize	Initialize	Remain
Reset Cold	Initialize	Initialize	Initialize	Initialize
Reset Warm	Initialize	Remain	Initialize	Remain
Power Down	Initialize	Remain	Initialize	Remain
Online change	Remain	Remain	Remain	Remain

Notes:

•I/O area cannot be set as a power-off hold variable

•The local variables in the functional module are defined as power-off hold variables, and the entire instance of the functional block occupies the reserved memory, but only the defined power-off hold variables have power-off hold functions.

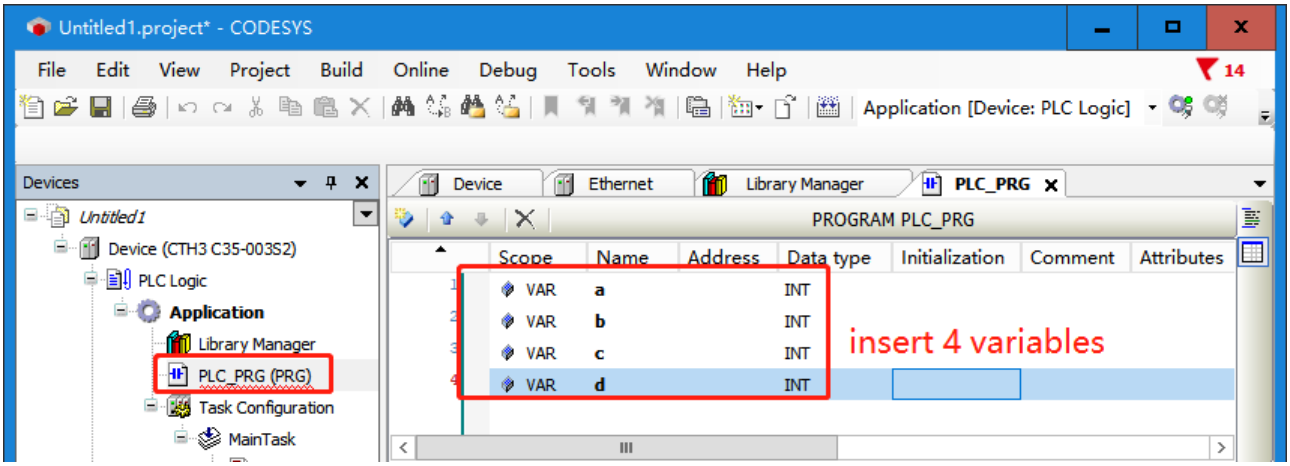
•If a local variable in the program is defined as a power-off hold variable, it also occupies the reserved area memory.

Example of using power-off holding variables:

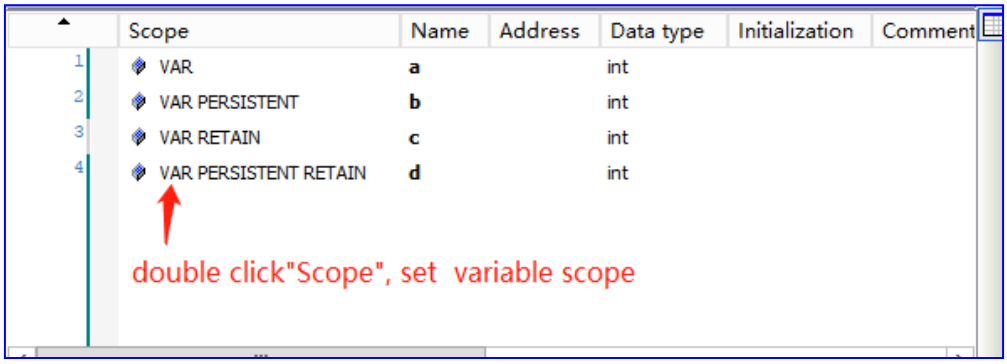
Explain the power-off retention properties by creating two power-off retention variables and two regular variables

The specific operations are as follows:

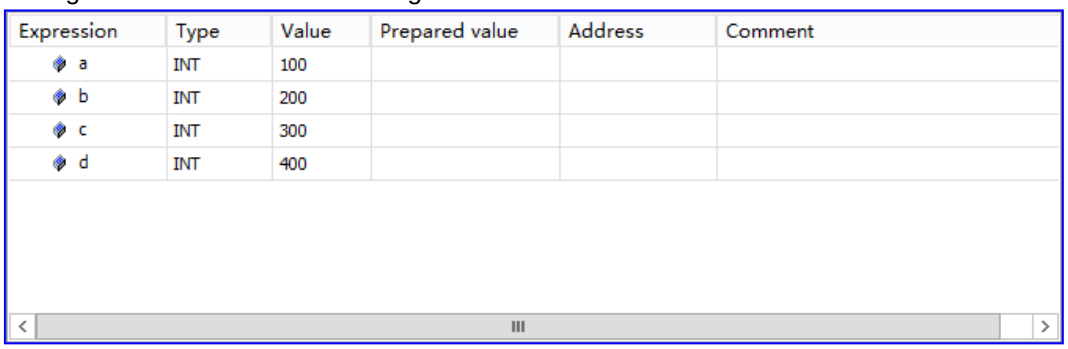
1. Add variables to PLC_PRG (PRG)



2. Set the variable categories as follows



3. Log in to the PLC and then assign values to four variables



Expression	Type	Value	Prepared value	Address	Comment
a	INT	100			
b	INT	200			
c	INT	300			
d	INT	400			

4. Log out, power down the PLC and restart it, then observe the values of the four variables.The value of a variable with the RETAIN attribute remains unchanged after power failure, Initialize the value of variables without RETAIN attribute after power failure

Device.Application.PLC_PRG

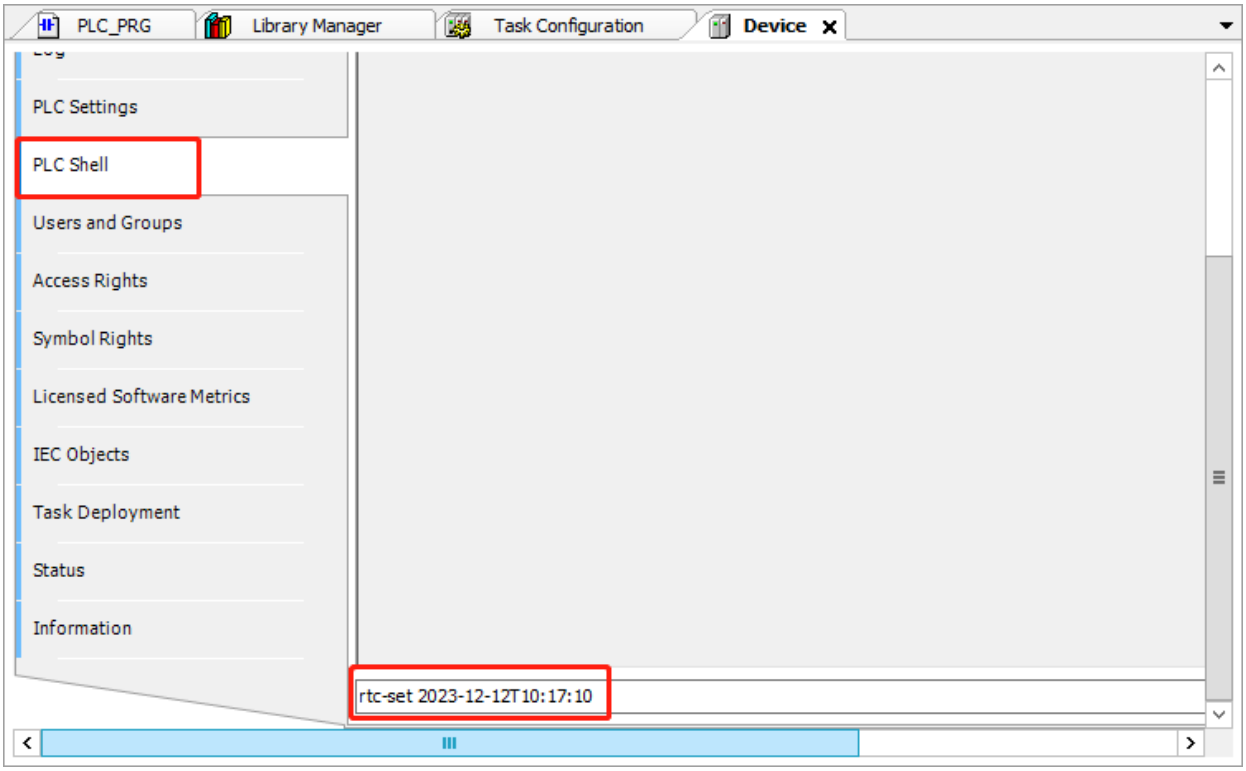
Expression	Type	Value	Prepared val...	Address	Comment
a	INT	0			
b	INT	200			
c	INT	0			
d	INT	400			

6.5 Write to PLC time

The PLC write time operation is as follows:

The computer communicates with PLC, then double click device, enter PLC command, input "rtc-set YYYY-MM-DDThh:mm:ss[,sss]". For example, to set the time as 2023-11-30T17:57:35, directly input "rtc-set 2023-11-30T17:57:35[,888]", and finally enter.

The value [sss] is milliseconds, which can be set or not when setting the time.

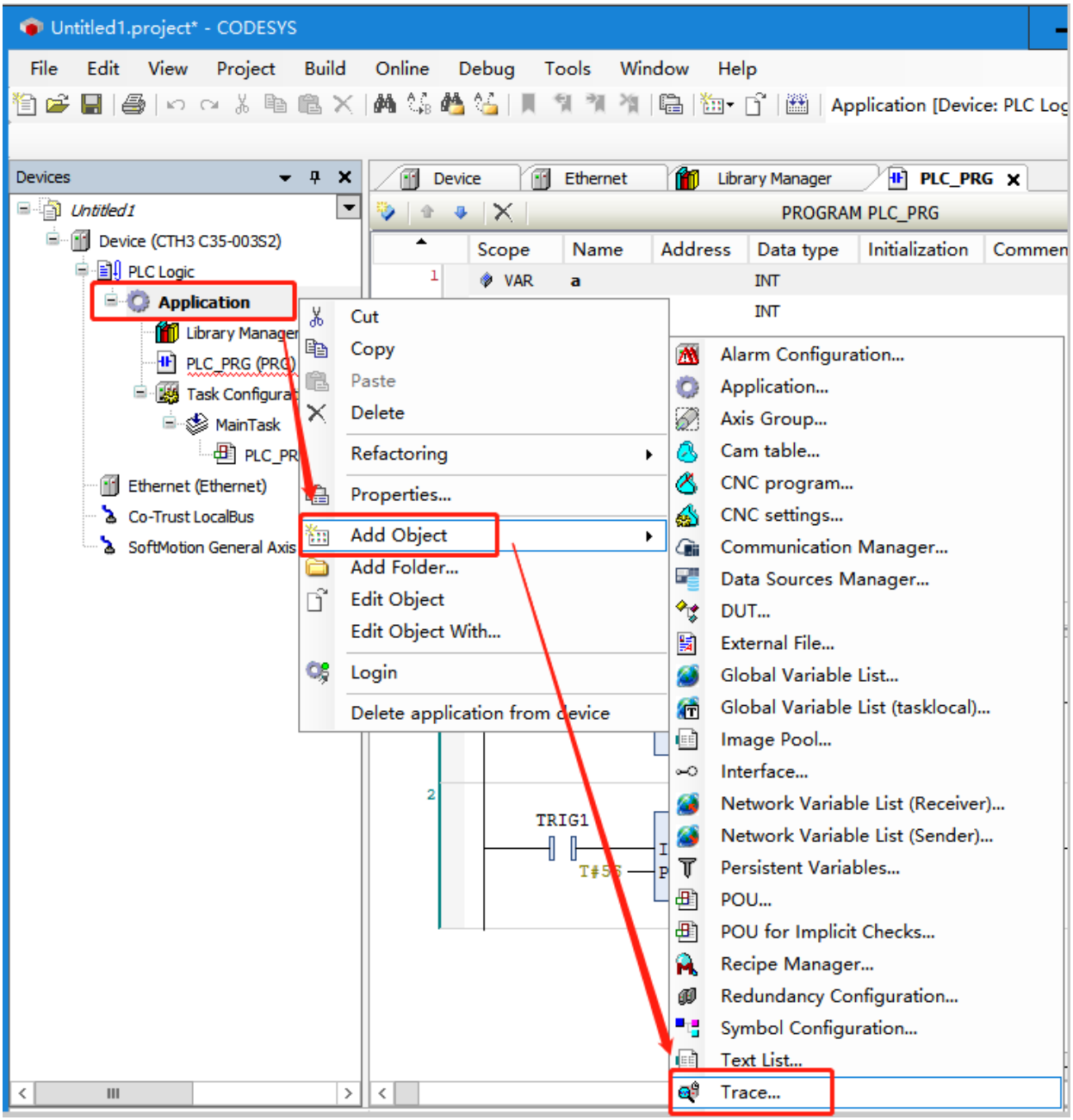


6.6 Trace

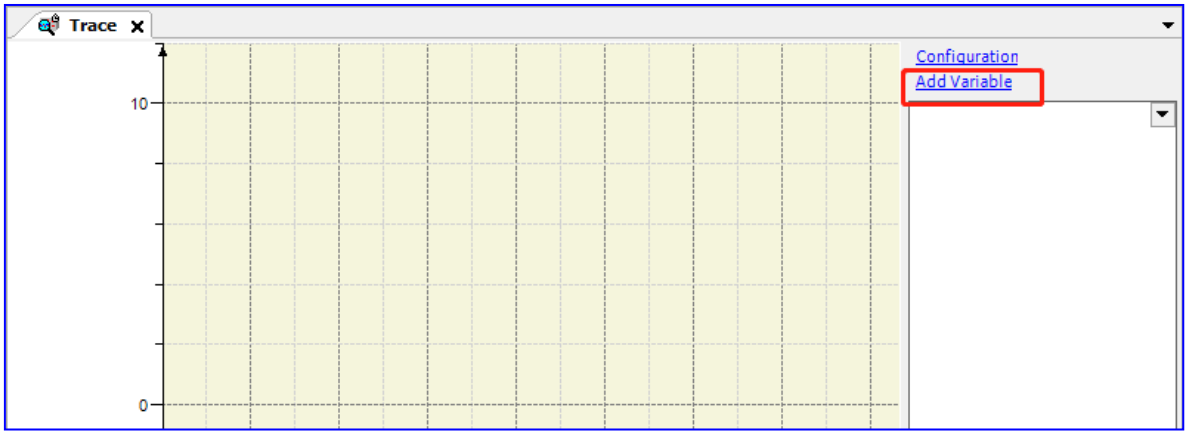
Trace is a graphical data monitoring software provided by CODESYS, similar to an oscilloscope. The data generated during the process of running a program is fleeting and cannot be analysed based on the data generated in real time. By using Trace, all the process data generated during the execution of the program can be recorded. For example, the current position, speed and acceleration of the motor in the motion

control process. By analysing the collected data, the whole process of system operation can be clearly observed. Sample tracking can collect the data waveforms generated during PLC operation, users can create multiple tracking profiles under the same PLC application, and if necessary, users can also set the sampling trigger conditions, sampling period, and save the sampling data.

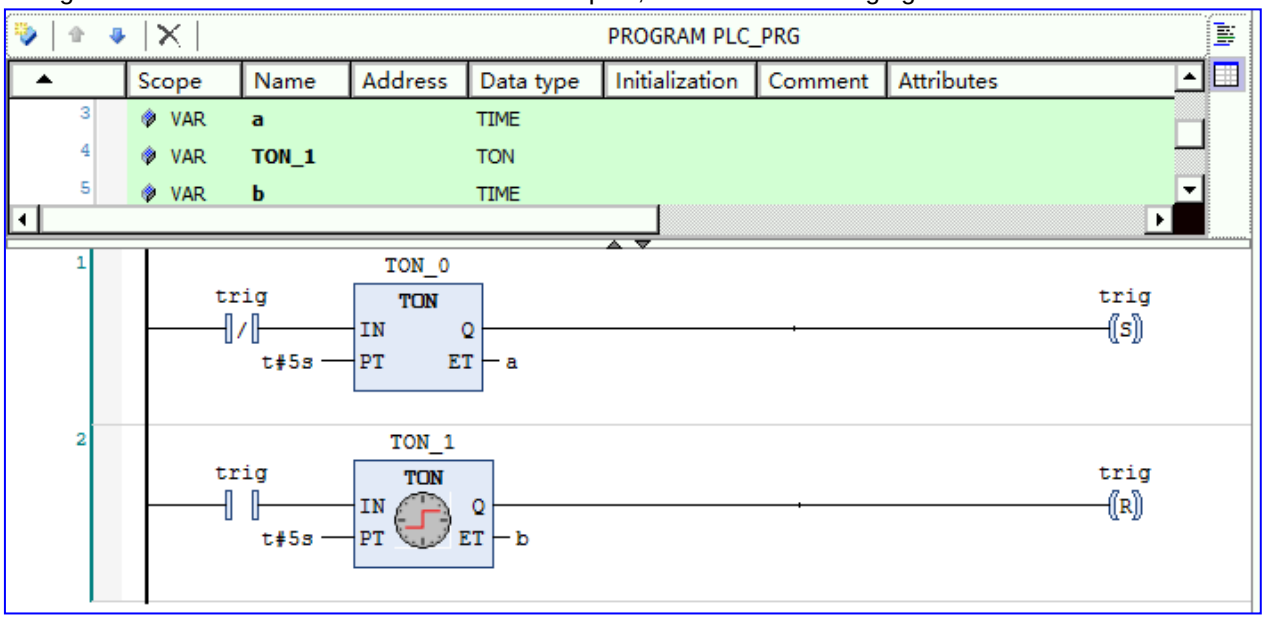
1. Right-click "Application", select "Add Object" → "Trace...", enter the tracking name and confirm the addition.



2. After opening the trace, select "Add Variable" on the right side of the interface to add variables.

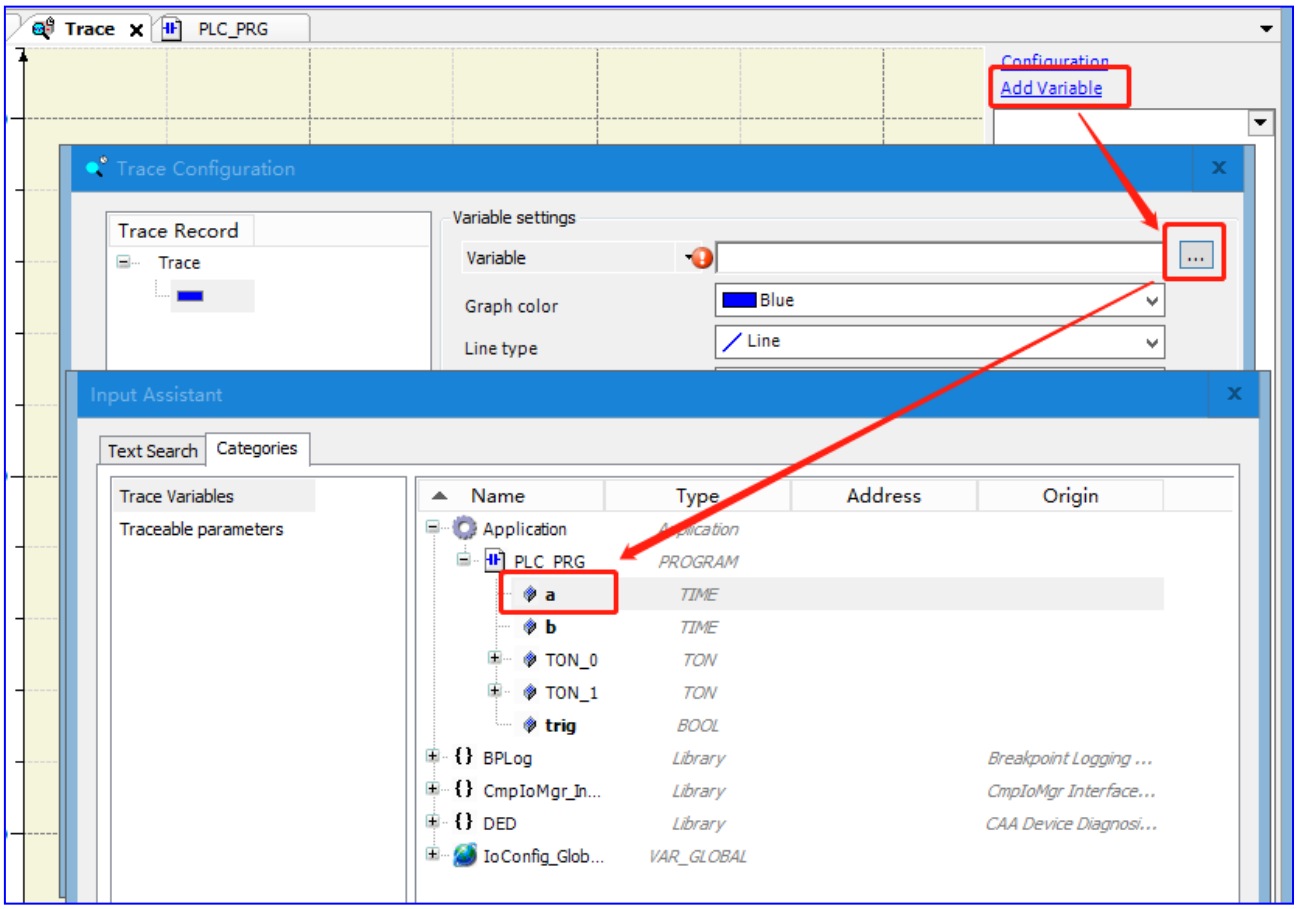


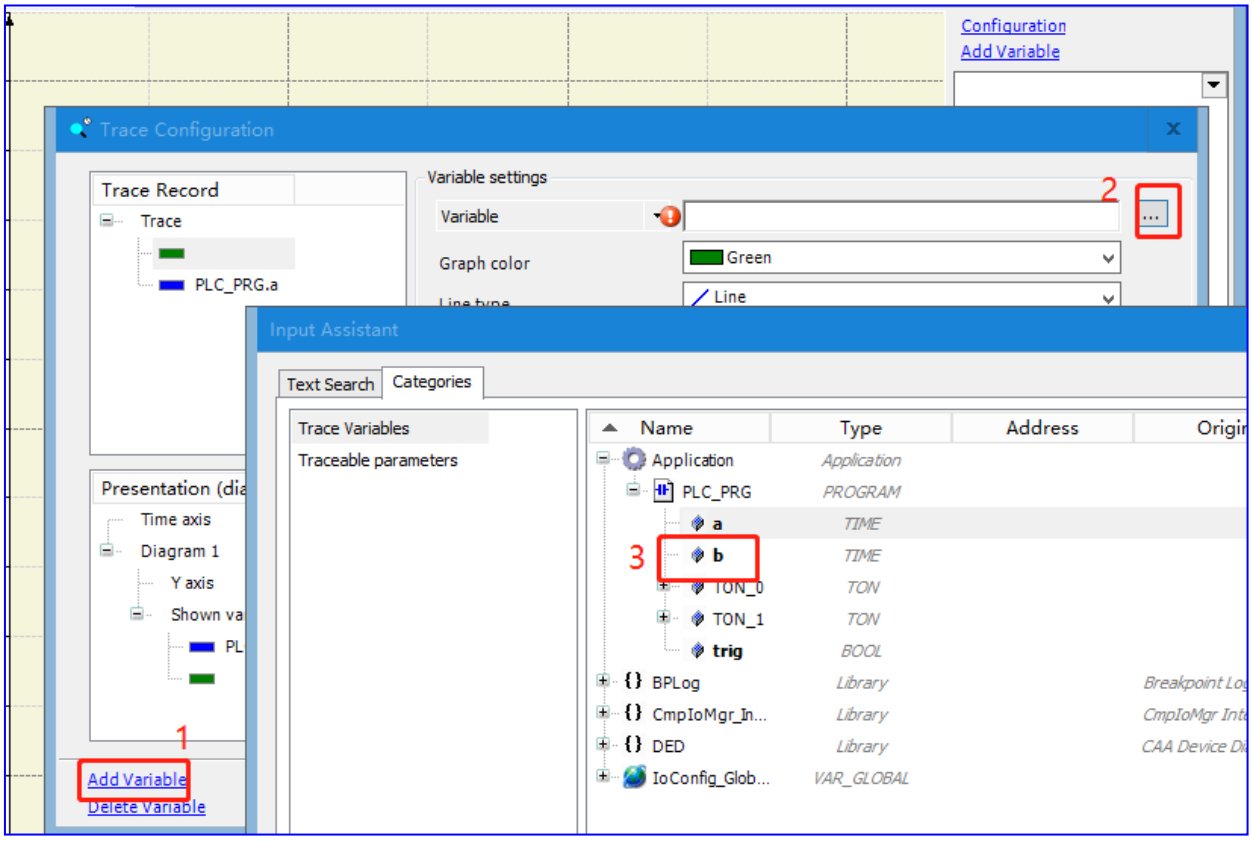
Using the variables var1 and var2 below as examples, monitor their changing trends.



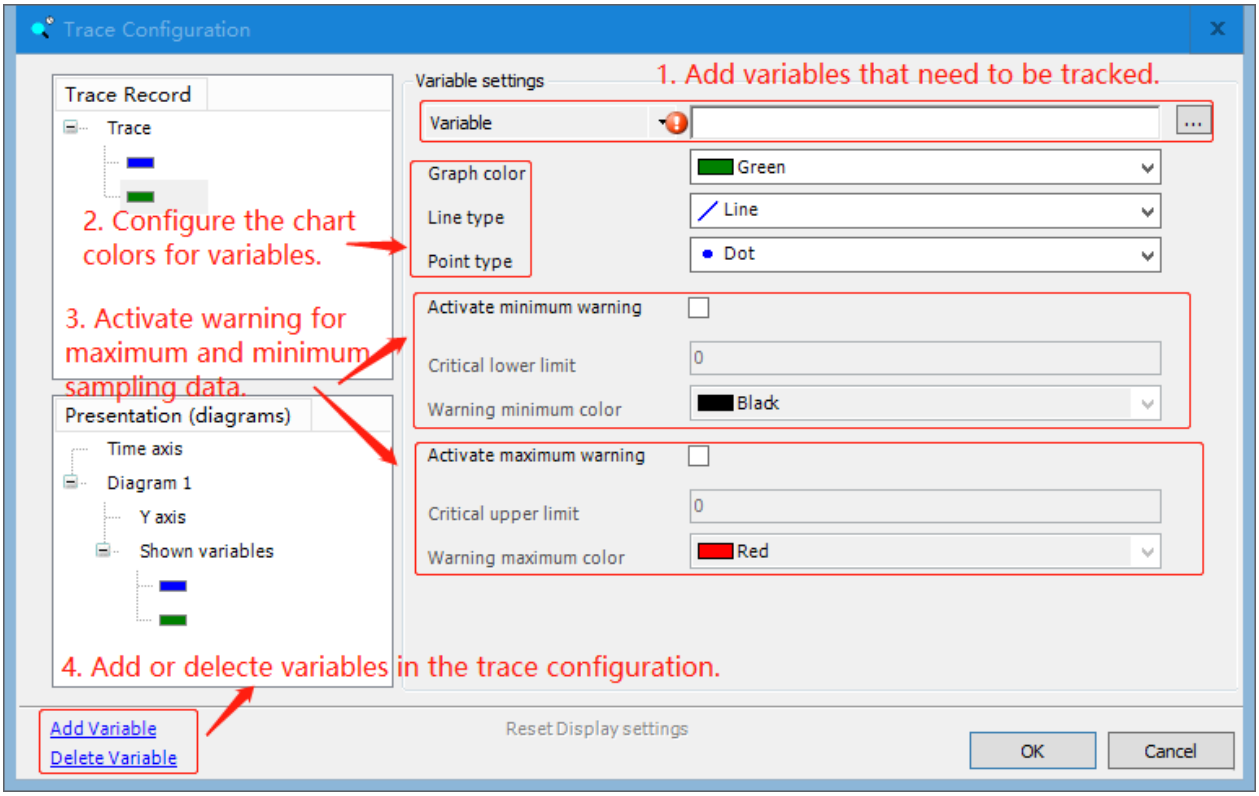
3. Log in to the PLC, run and monitor the above programs

4. Add monitored variables a and b to the trace

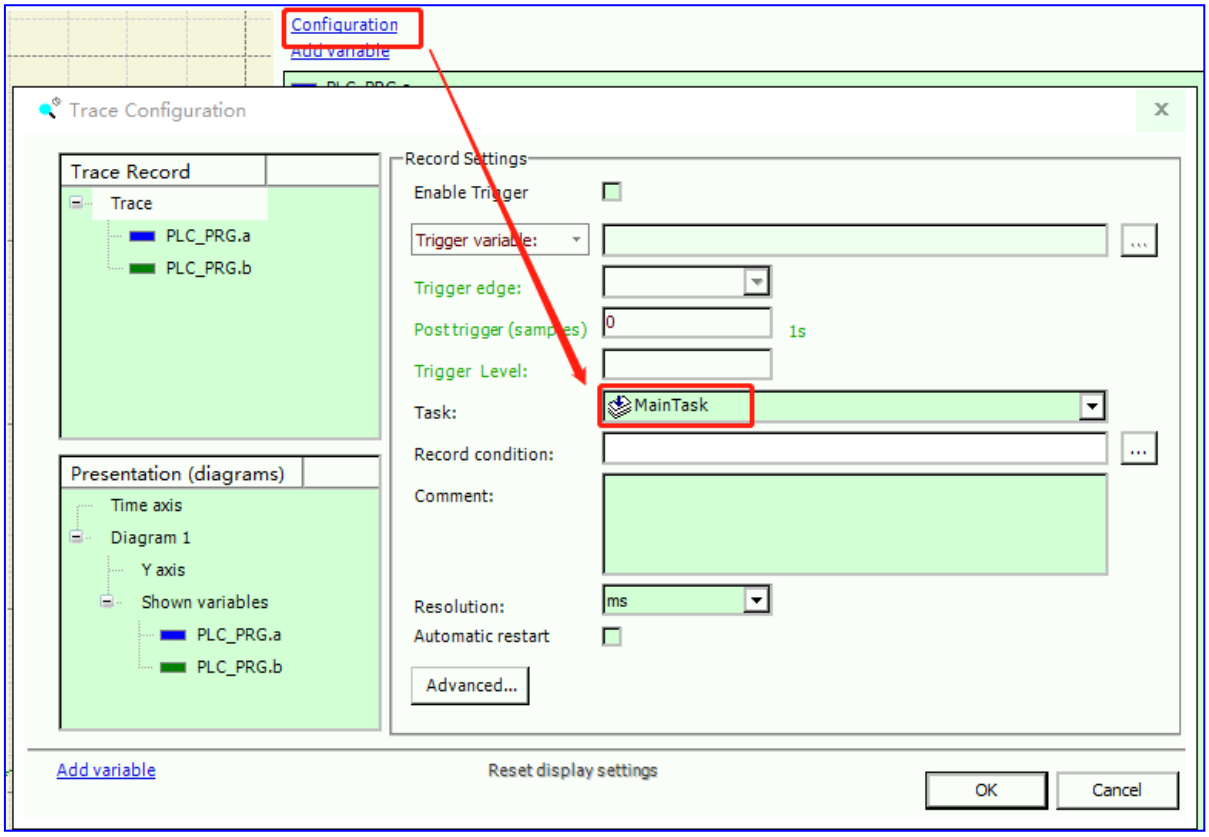




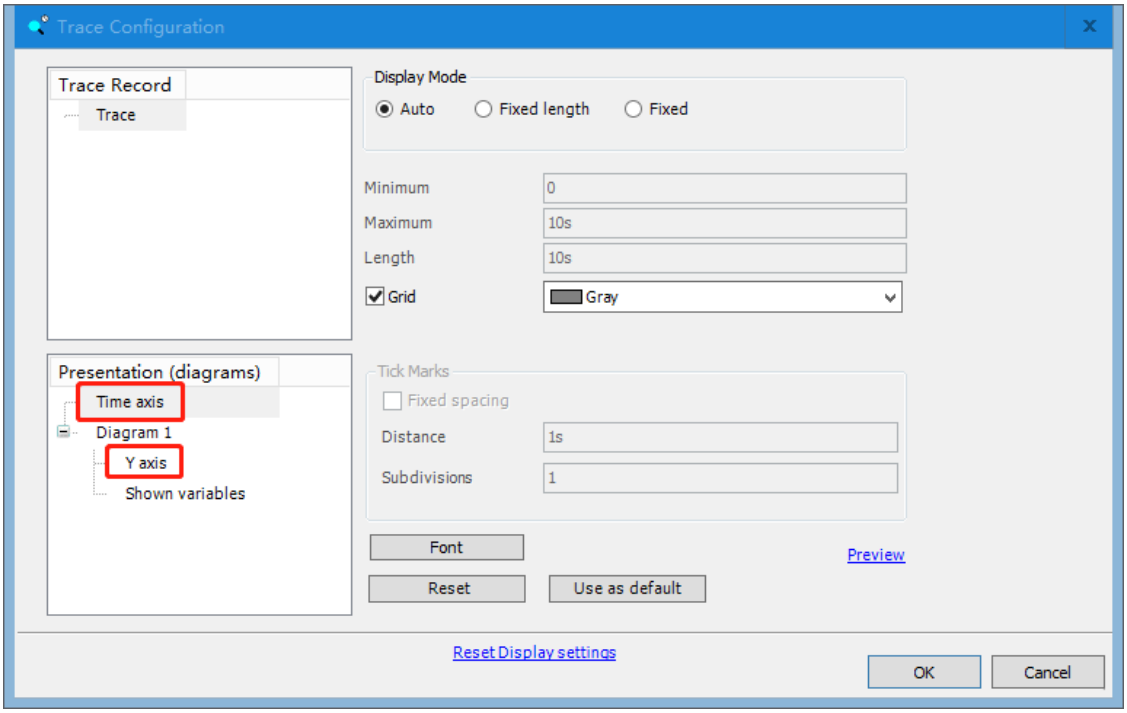
5. Variable configuration



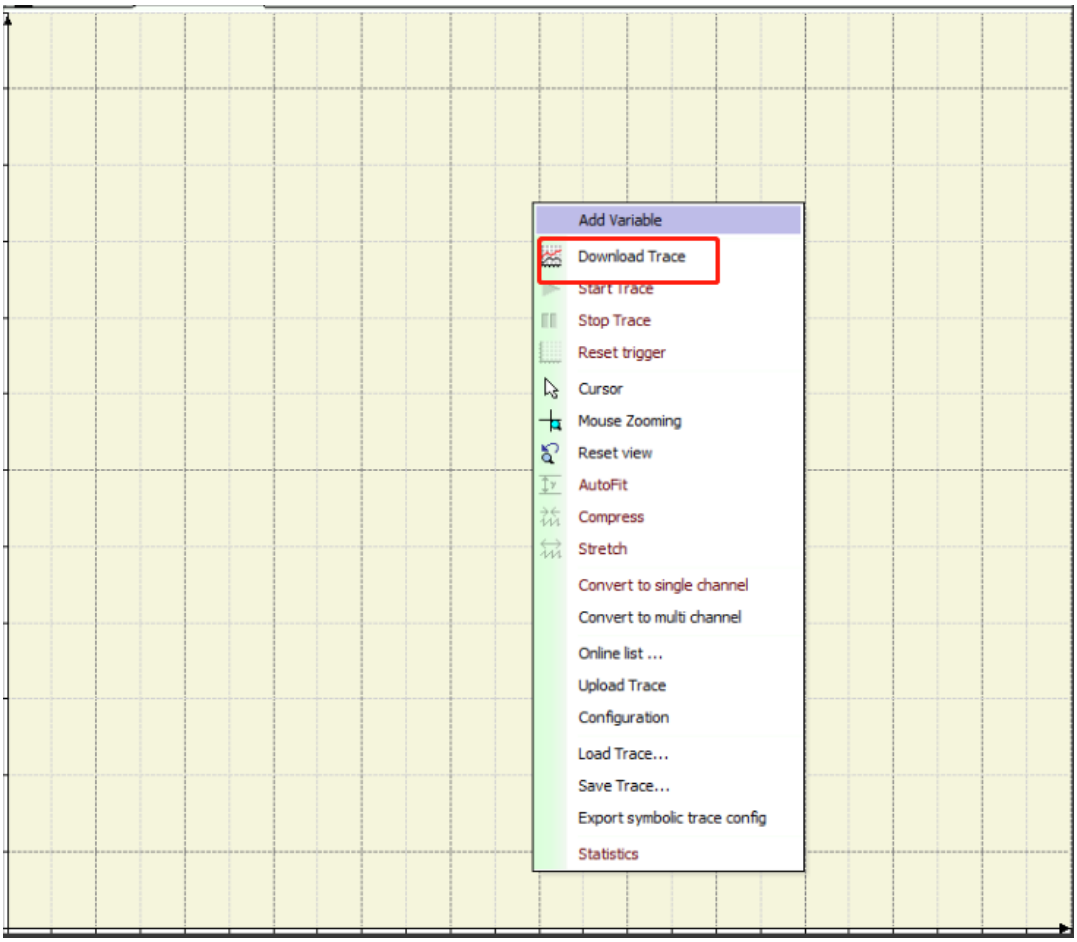
6. Select main tasks in the configuration



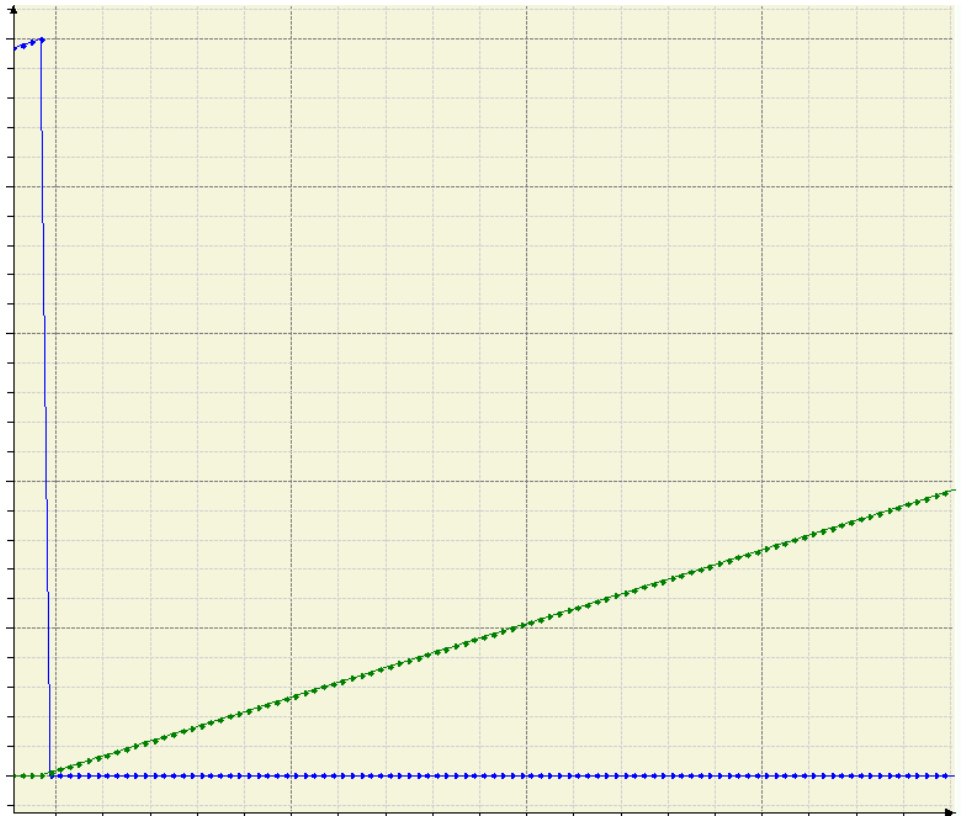
7. In "Configuration", you can also set the background and coordinate axis for tracking. In "TimeAxis", you can configure the display mode to automatic, fixed length, and fixed. After setting it to automatic, the timeline will be automatically adjusted during the sampling process. If a fixed length is selected, the display duration will be customized by the user, and the sampling window will only display the sampling results within the length range. Finally, set to fixed, the user will specify the display of a curve for a certain segment during the sampling process. On the same page, you can also configure fonts, grids, etc. After selecting the Y-axis, you can observe similar pages and configure them according to your needs.



8. Right click in the view below and download trace



9. The tracked variable view is as follows:

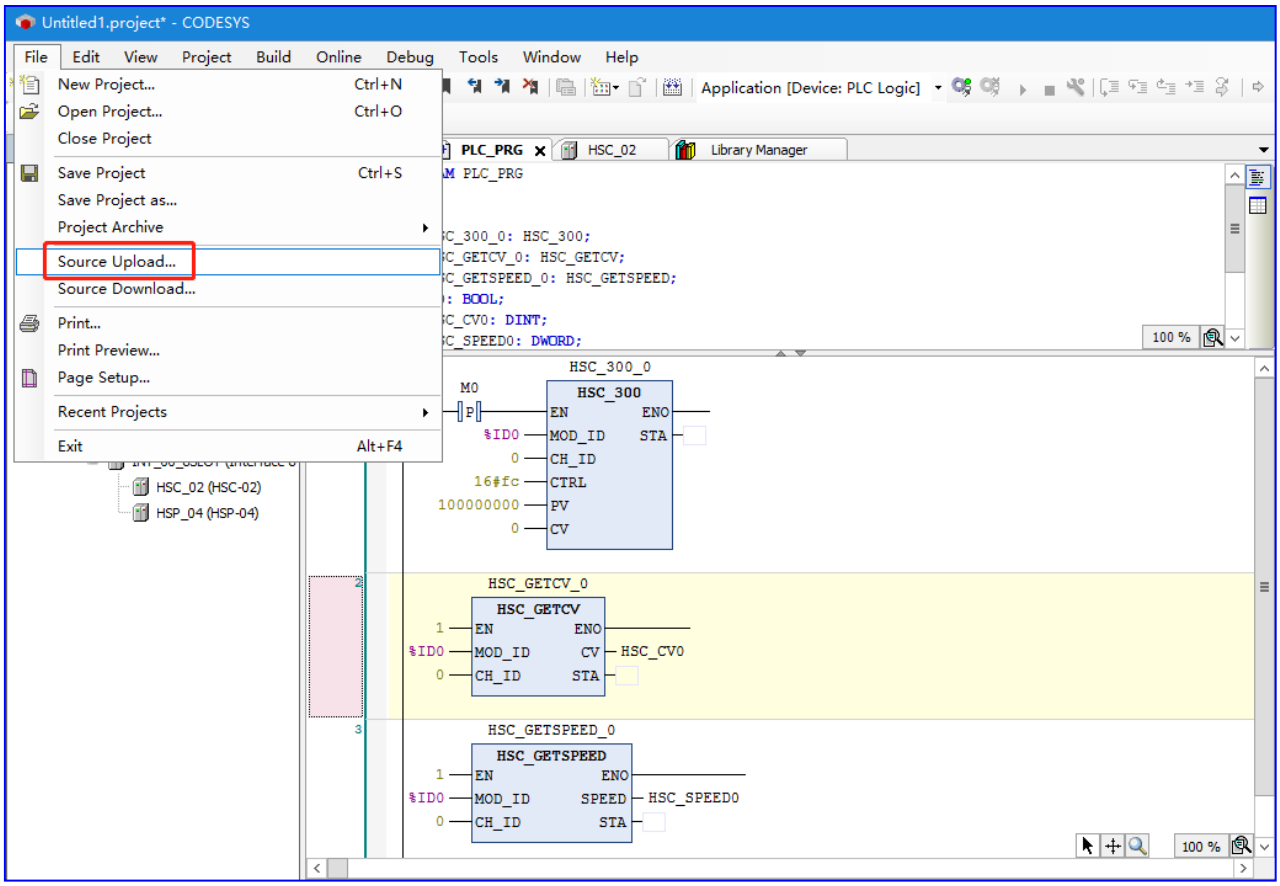


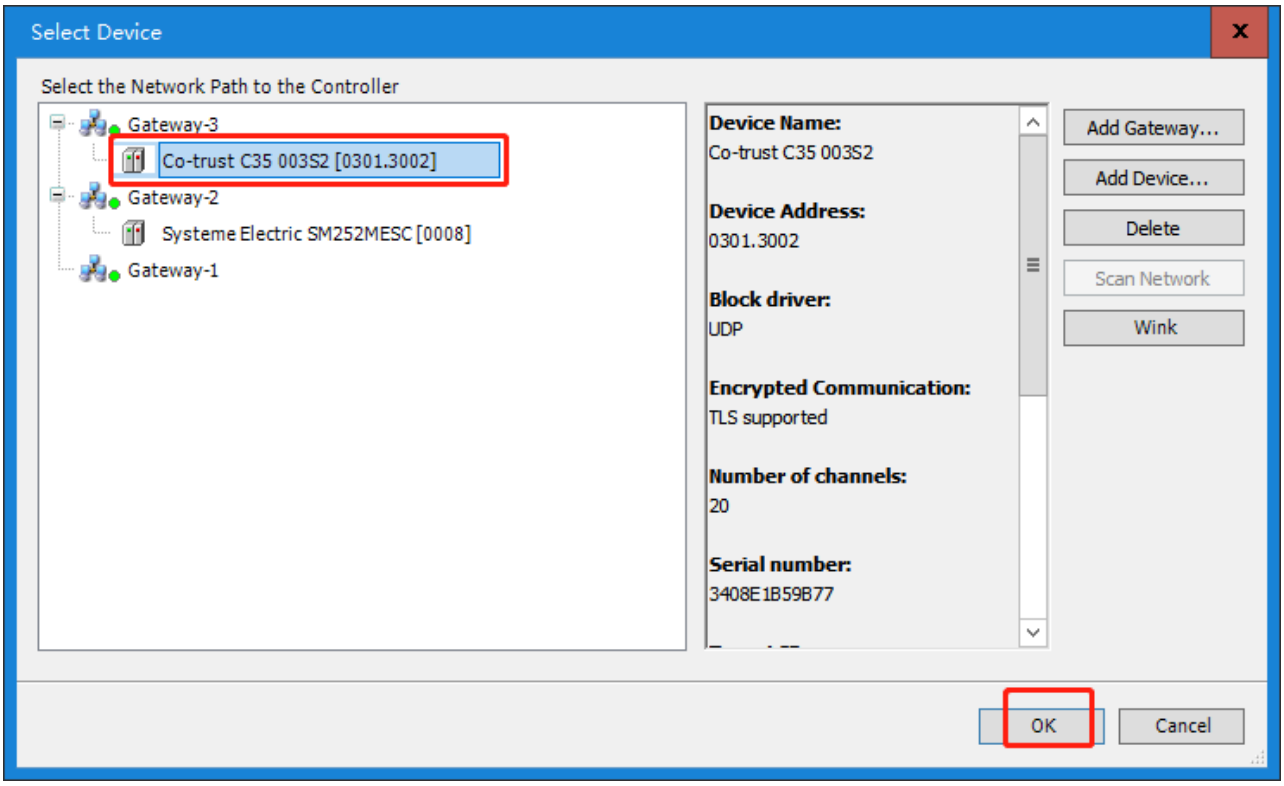
6.7 Download and upload the source programme

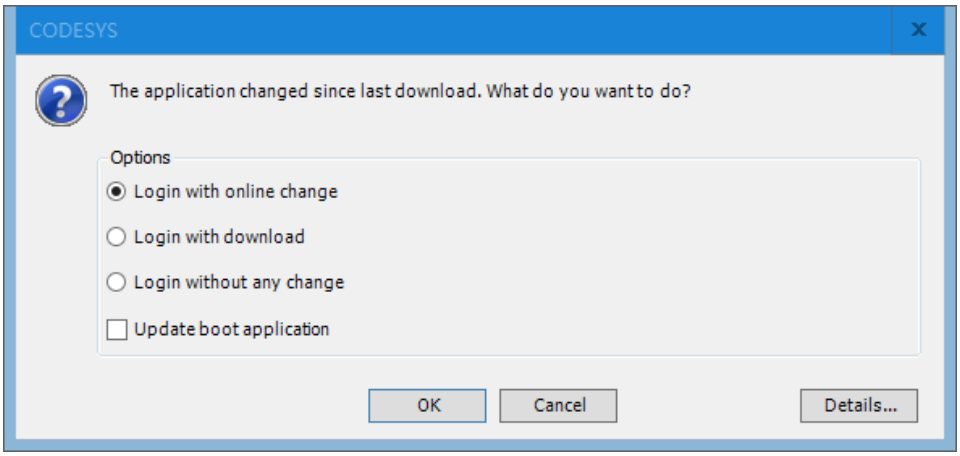
Program download is different from source program download. When you log in and download a program, the files downloaded to the PLC are execution files, and you cannot upload a program in this way. Programs can only be uploaded after downloading the source programme. The following describes the operation of program download:

Source programme download

Before downloading the source programme, ensure that it compiles correctly.


Untitled1.project* - CODESYS
File
Edit
View
Project
Build
Online
Debug
Tools
Window
Help
New Project... Ctrl+N
Open Project... Ctrl+O
Close Project
Save Project Ctrl+S
Save Project as...
Project Archive
Source Upload...
Source Download...
Print...
Print Preview...
Page Setup...
Recent Projects
Exit Alt+F4
Application [Device: PLC Logic]
PLC_PRG
HSC_02
Library Manager
PLC_PRG
HSC_02 (HSC-02)
HSP_04 (HSP-04)
HSC_300_0
HSC_300
M0
EN
ENO
%ID0
MOD_ID
STA
CH_ID
16#fc
CTRL
100000000
PV
CV
HSC_GETCV_0
HSC_GETCV
HSC_CV0
HSC_GETSPEED_0
HSC_GETSPEED
HSC_SPEED0
SPEED
100 %


Select Device
Select the Network Path to the Controller
Gateway-3
Co-trust C35 003S2 [0301.3002]
Gateway-2
Systeme Electric SM252MESC [0008]
Gateway-1
Device Name:
Co-trust C35 003S2
Device Address:
0301.3002
Block driver:
UDP
Encrypted Communication:
TLS supported
Number of channels:
20
Serial number:
3408E1B59B77
Add Gateway...
Add Device...
Delete
Scan Network
Wink
OK
Cancel

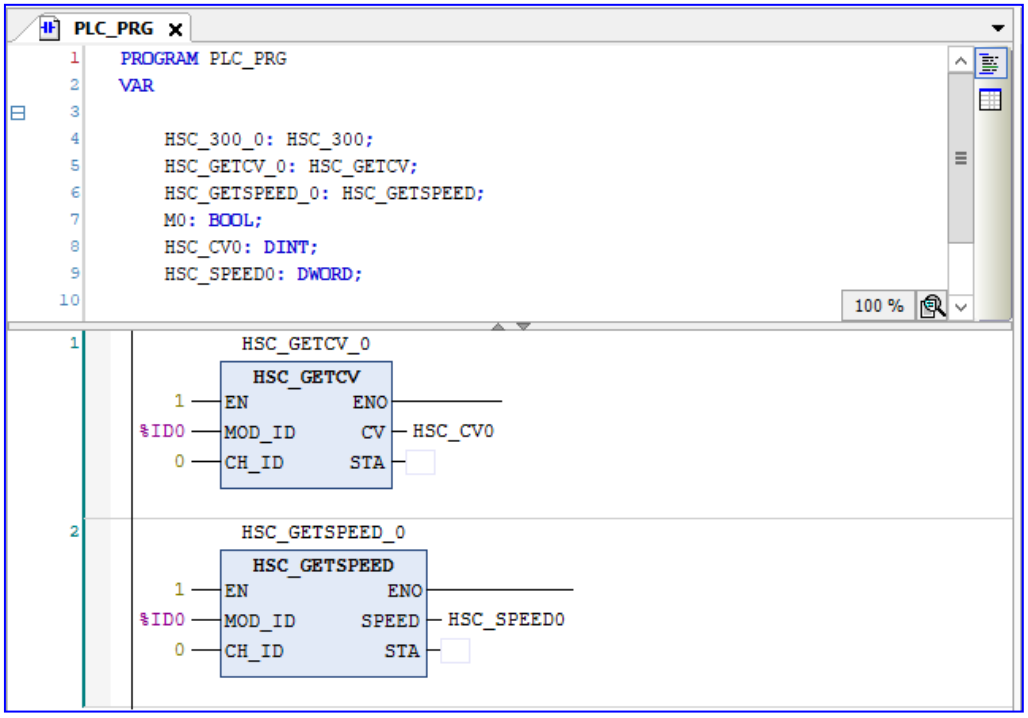


Source programme upload

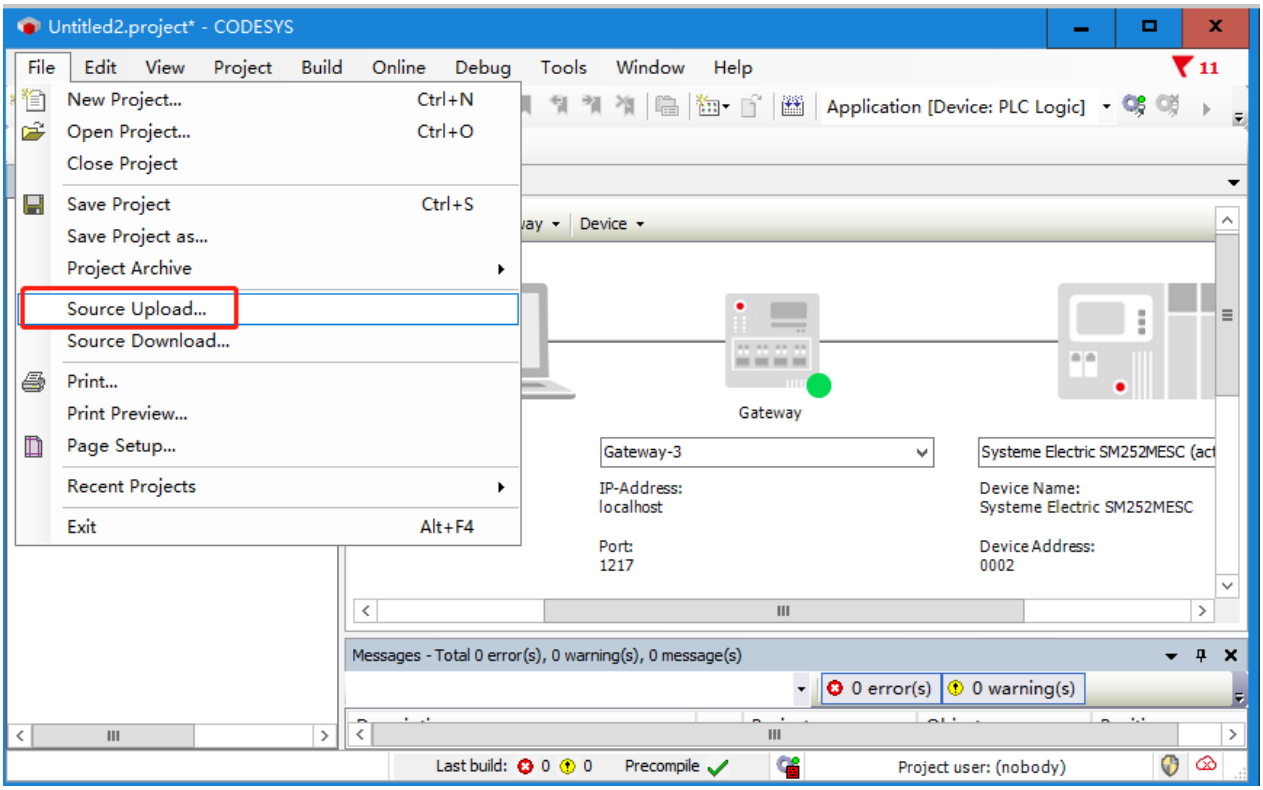
If the user needs to upload the programme from PLC after commissioning, login to PLC and select Source Upload, then select the device to upload the source programme.

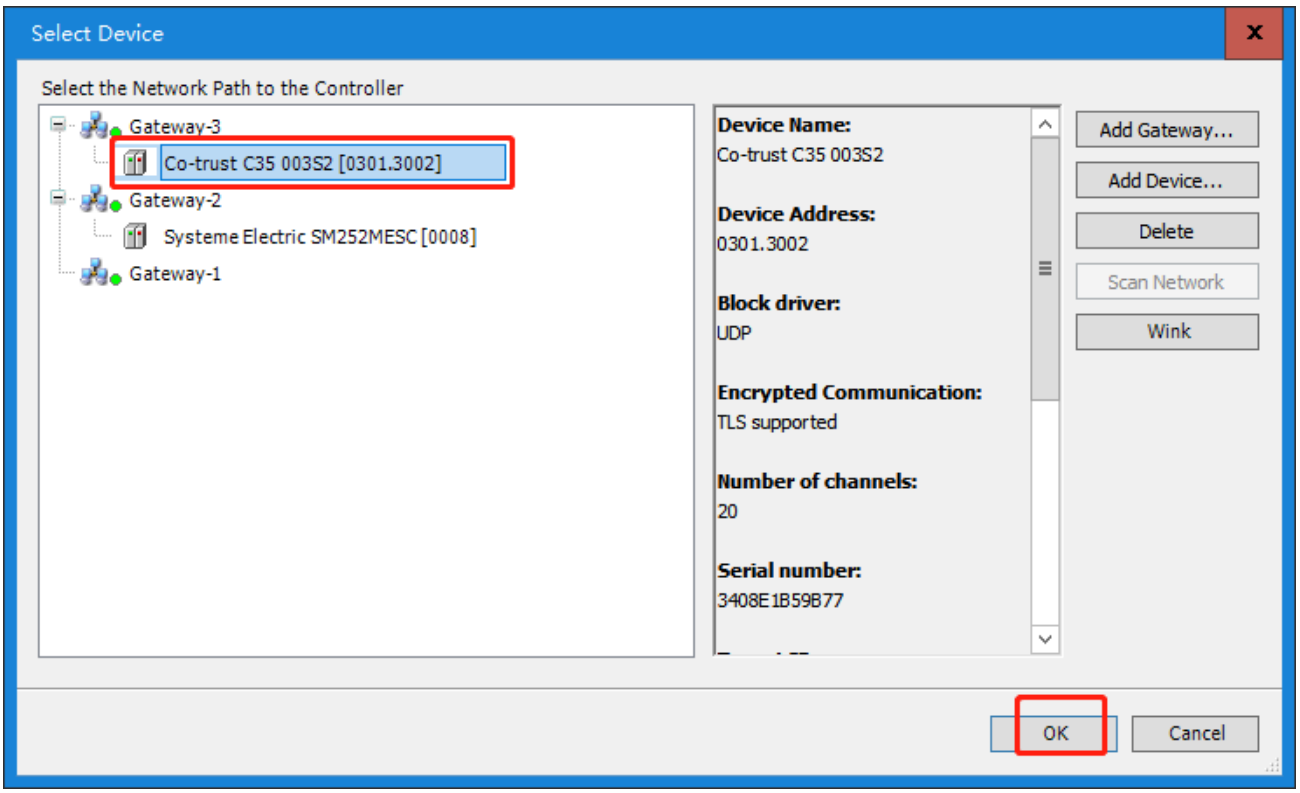
In order to verify whether the programme is uploaded successfully, before uploading the source programme, we delete the HSC_300 instruction before logging on to the PLC, and then finally upload the programme to see whether it is the same as the source programme downloaded earlier.

Delete the HSC_300 instruction:

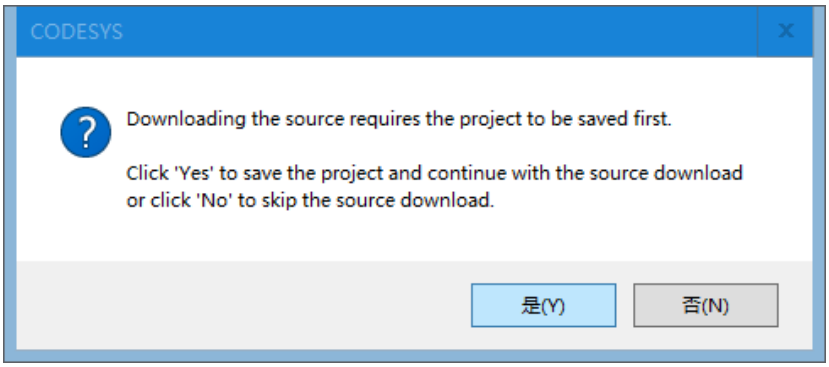


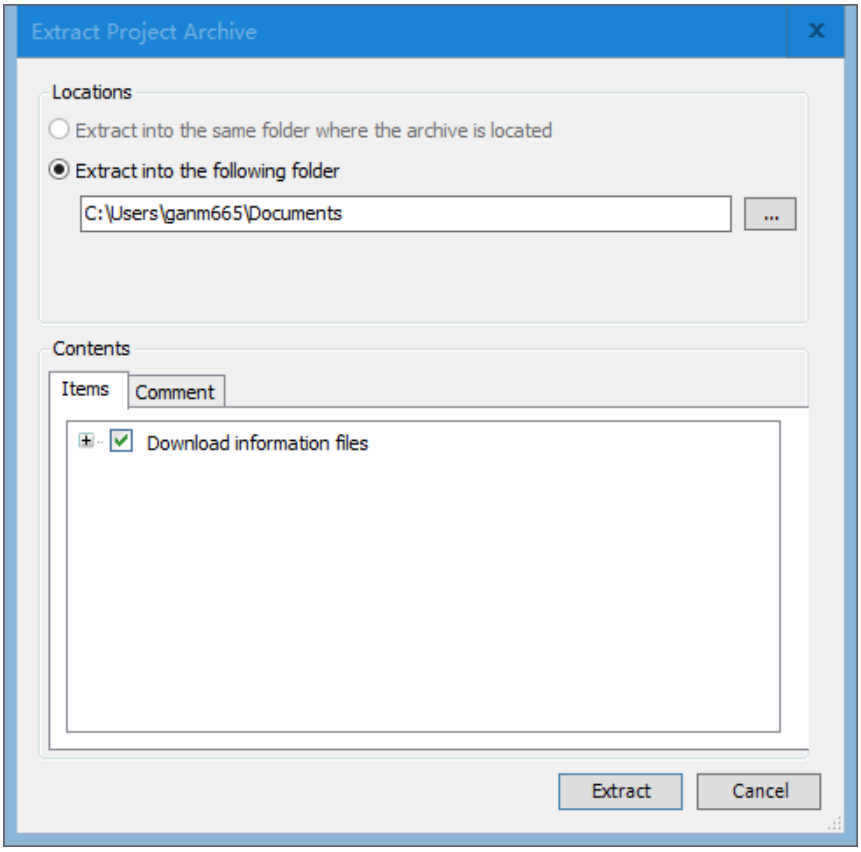
Upload the source program:

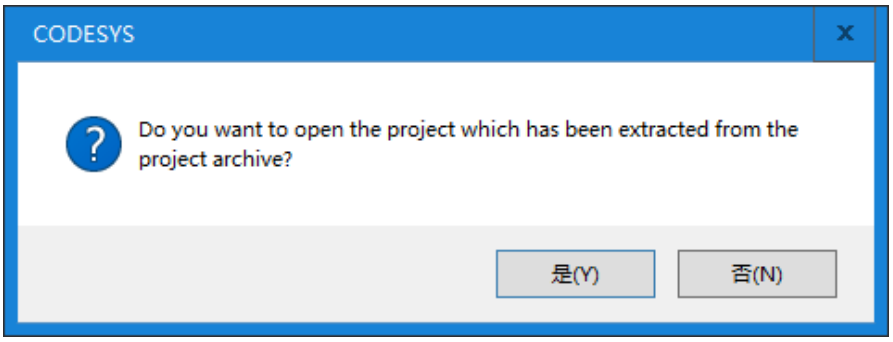


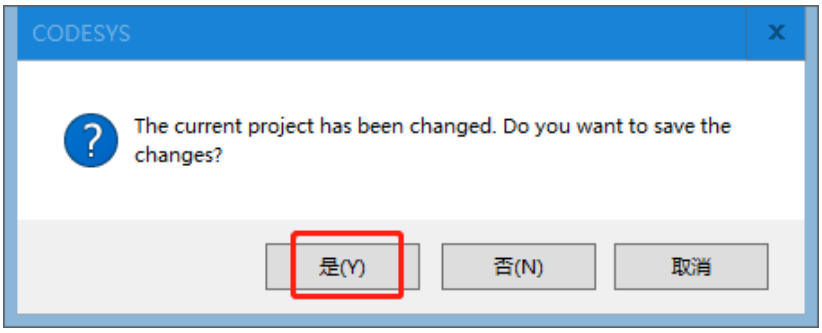


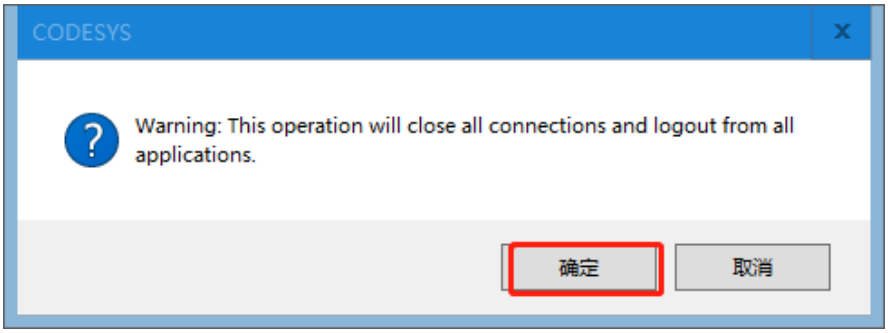
Select YES for all of the following options.



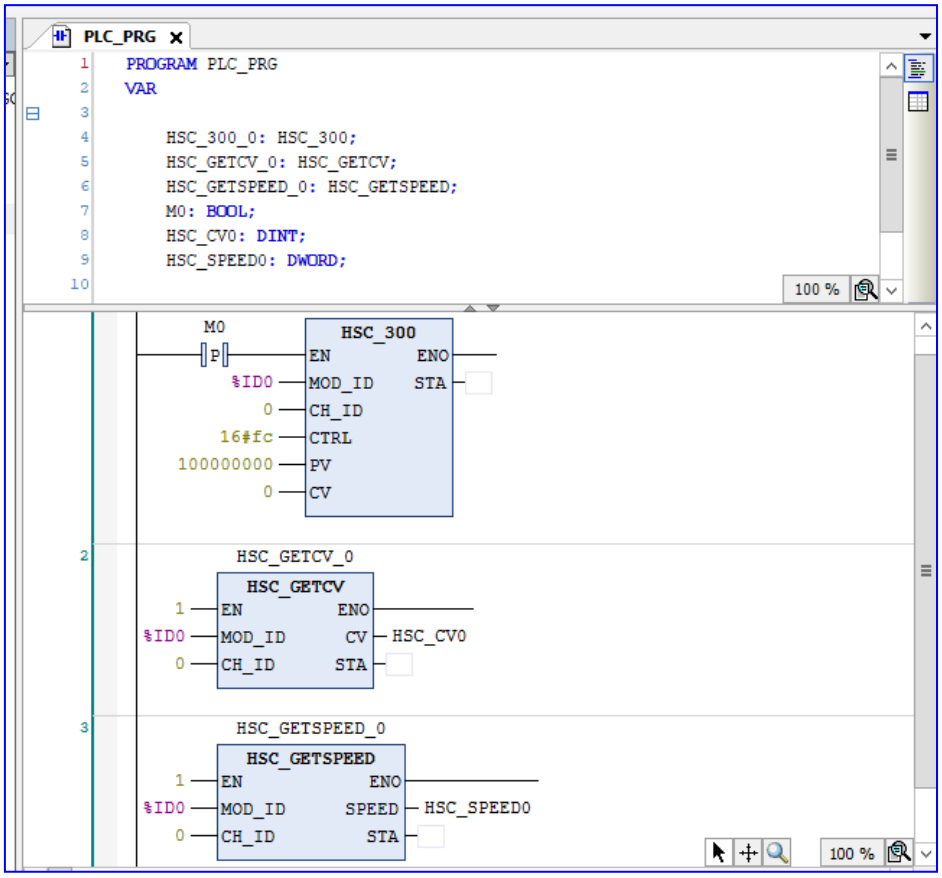








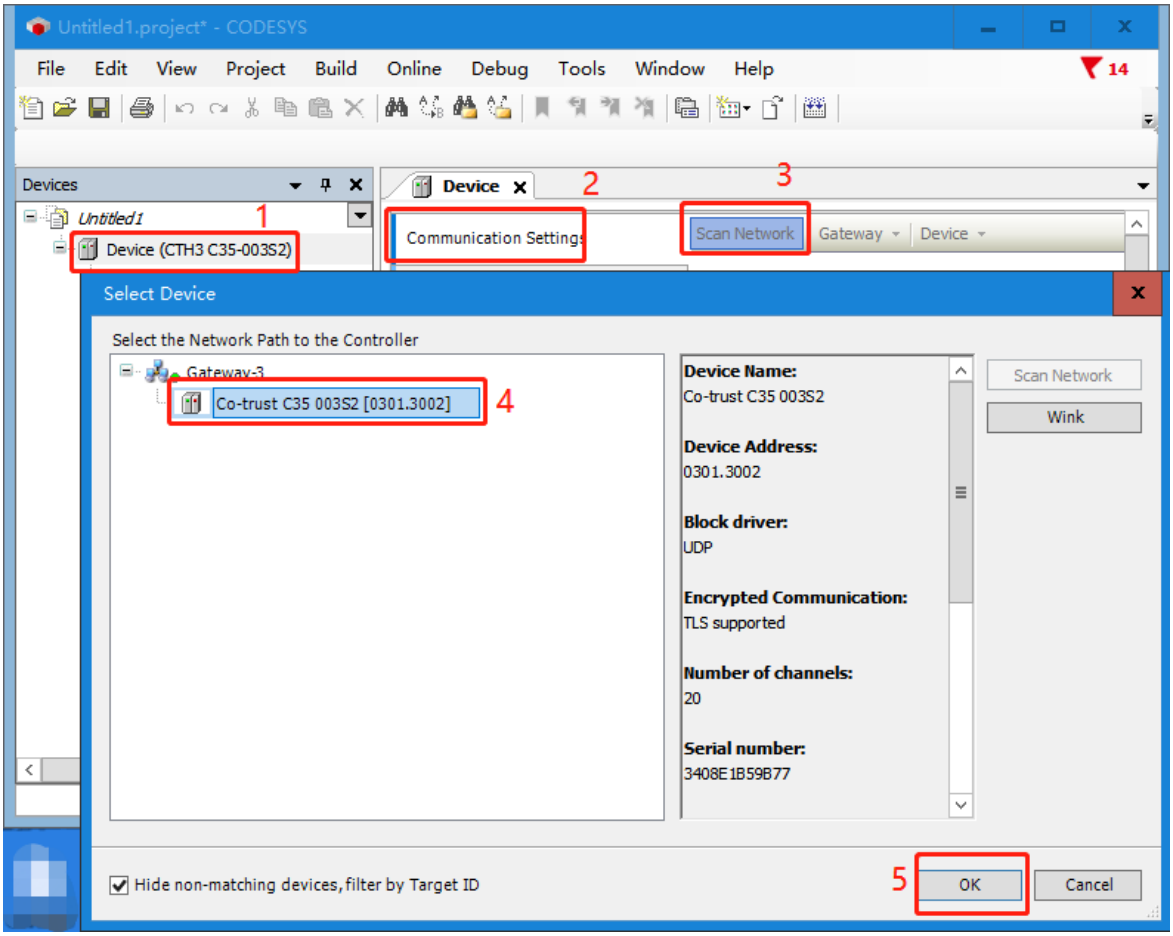
The programme for a successful upload is as follows:



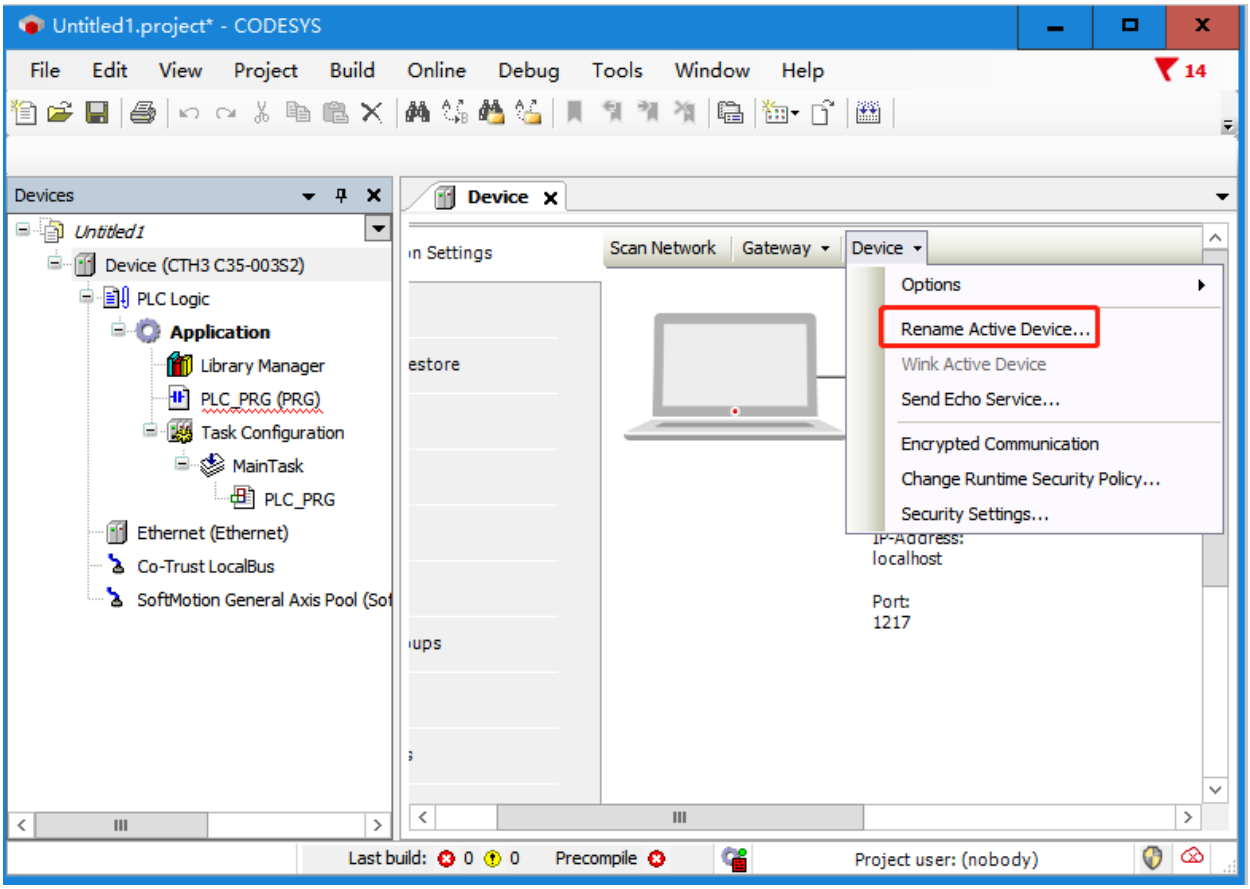
6.8 Changing the PLC name when there are multiple PLCs on the same network

When there are several identical PLCs in the same network, it is not easy to distinguish which PLC is to be operated, so it is possible to rename the PLCs in the following way.

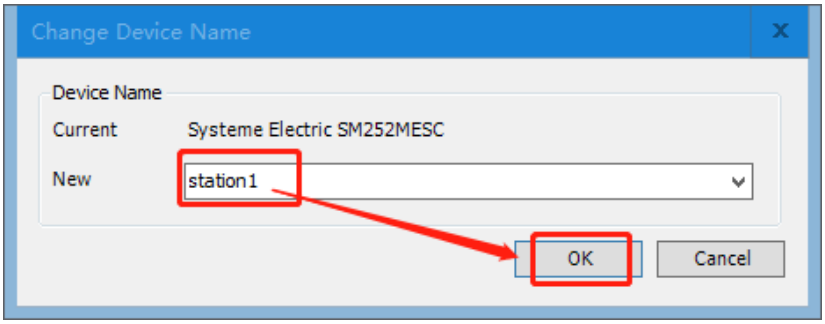
1. First and PLC to establish communication



2. Then select the device → Rename The Active Device



3. Enter the new name and click OK to complete the rename

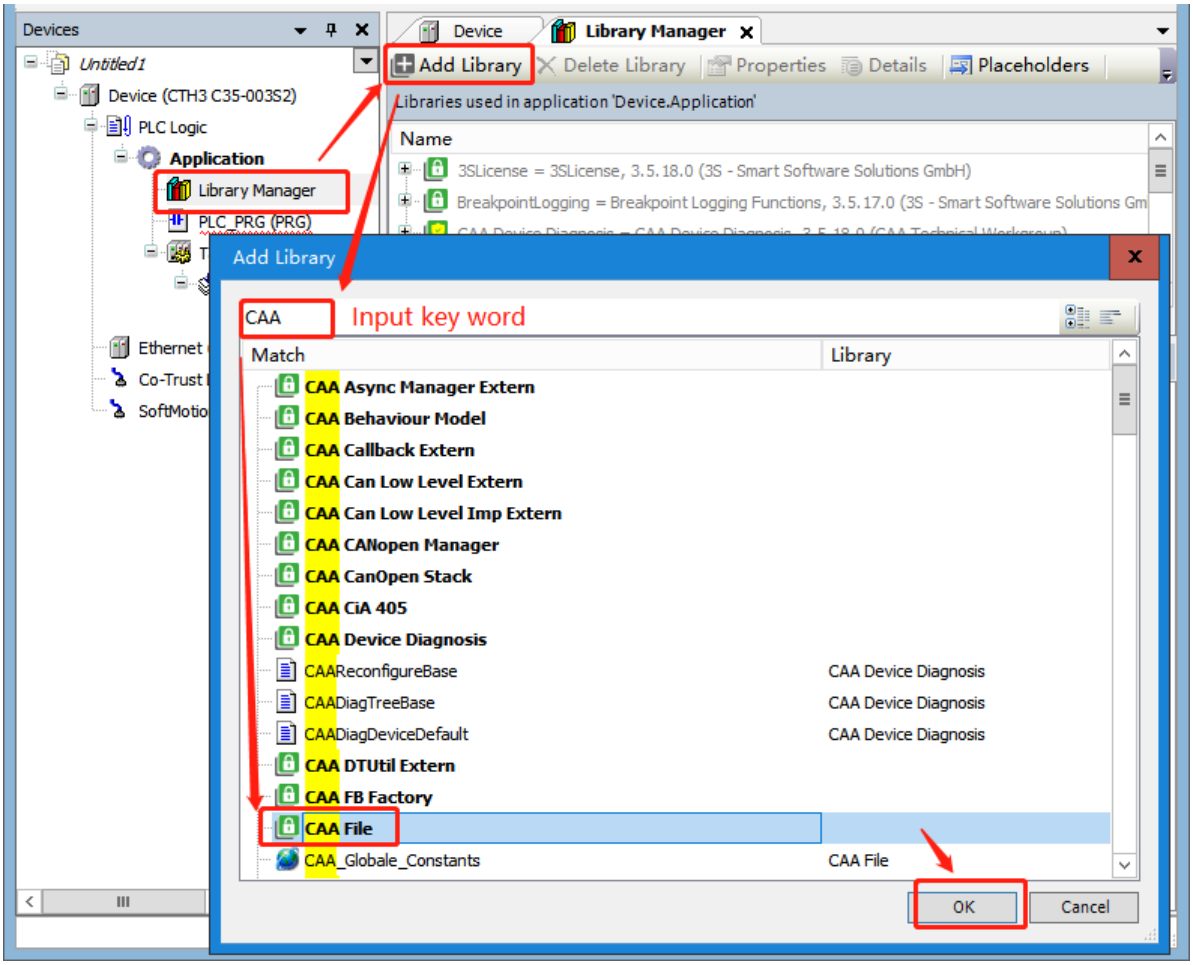


6.9 How to write files to a USB flash disk

Usage Scenario: With the development of motion control, we need to deal with more and more data, in the CNC application, the G code file is usually a few K to a few hundred K. In the electronic cam sampling data application, we also have tens of thousands of data. In electronic cam sampling data applications, we have tens of thousands of data, PLC permanent storage is only 64KB, but CNC files need more than 100K data to be saved by power down.

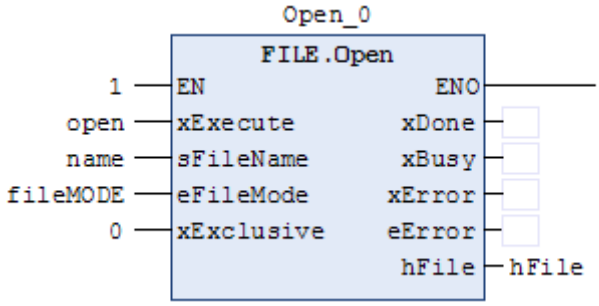
Solution: The CAA_FILE.library in the CODESYS Integrated CAA Libraries provides a library of functions for reading and writing files. This library provides function for accessing the file directory system and files. The following article describes how to use this library.

Mainly introduces the use of the following library commands, including FILE.Open, FILE.Close, FILE.Write, FILE.Read and FILE.Flush, as well as the variable types FILE.MODE and FILE.ERROR. For other modules and variable types, please refer to the CODESYS help file.



1. FILE.Open

This block opens an existing file or creates a new one.



Input/Output	Parameter Name	Datatypes	Descriptions
IN	xExecute	BOOL	Trigger bit, should be on at all times while the file is being processed.
IN	sFileName	STRING	The name of the document, in English, is recommended.
IN	eFileMode		Mode of access to the file, type FILE.MODE. there are four types. FILE.MODE.MWRITE: Write access, the file will be overwritten or created. FILE.MODE.MREAD: Read access, the file will be opened for reading. FILE.MODE.MRDWR: Read and write access, the file will be overwritten or created. FILE.MODE.MAPPD: The file will be opened in WRITE mode, but the written data will be appended to the end of the file.
IN	xExclusive	BOOL	Number of file accesses. TRUE: Exclusive data access, only one FILE.Open module can access the file, other modules can not access the file, other FILE.Open modules access the file will error, xError is TRUE. FALSE: Multiple FILE.Open modules can access the file, other FILE.Open modules can not access the file, other FILE.
OUT	xDone	BOOL	Module execution completion will be set to 1
OUT	xBusy	BOOL	Module execution in progress will be set to 1
OUT	xError	BOOL	Set to 1 when an error occurs in the module
OUT	eError		Error code, type FILE.ERROR
OUT	hFile		The return value is a file handle, which can be used as input "hFile" in the function blocks FILE.Read, FILE.Write, FILE.Close.

FILE.ERROR type, this data structure describes errors that may occur when processing functions of CAA_File.library. The error range 5100 to 5199 is reserved for CAA.File.library.

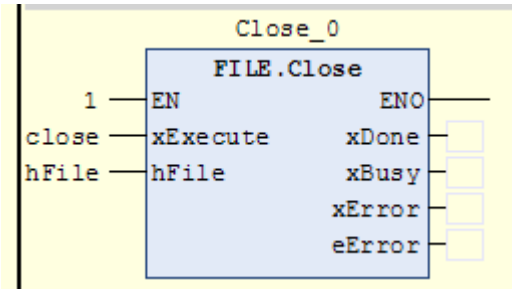
Error code

Error	Error code	Describe
NO_ERROR	0	No error

FIRST_ERRO	5100	The first library specific error
TIME_OUT	5101	Time limit exceeded
ABORT	5102	Abort operation by activating input xABORT
HANDLE_INVALID	5103	Invalid handle
NOT_EXIST	5104	The directory or file does not exist
EXIST	5105	The directory or file already exists
NO_MORE_ENTRIES	5106	No other entries available
NO_EMPTY	5107	The directory or file is not empty
READ_ONLY_CAA	5108	Files or directories are write protected
WRONG_PARAMETER	5109	Wrong parameter
ERROR_UNKNOWN	5110	Unknown error
WRITE_INCOMPLETE	5111	Not all parameters are written
NOT_IMPLEMENTED	5112	Unrealized
FIRST_MF	5150	First manufacturer specific error
LAST_ERROR	5199	Latest library-specific bugs

2. FILE.Close

This block terminates file access, i.e. closes the file.

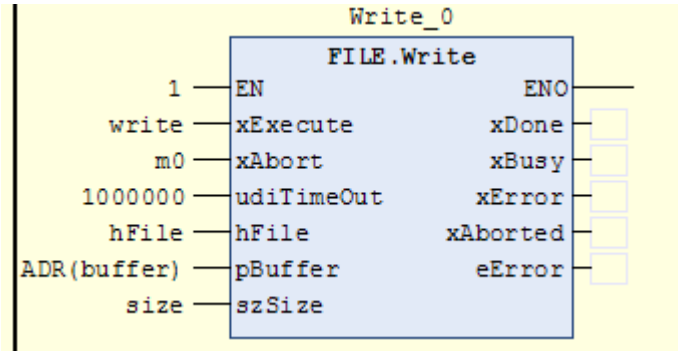


Input/Output	Parameter Name	Datatypes	Descriptions
IN	xExecute	BOOL	Trigger bit, should be on at all times while the file is being processed.
IN	hFile		File handle, obtained from the result of FILE.
OUT	xDone	BOOL	Module execution completion will be set to 1
OUT	xBusy	BOOL	Module is executing will be set to 1
OUT	xError	BOOL	Module execution error will be set to 1
OUT	eError		Error code, type FILE.ERROR

3. FILE.Write

This function block writes data to a file, which should have been previously opened by FILE.Open. The

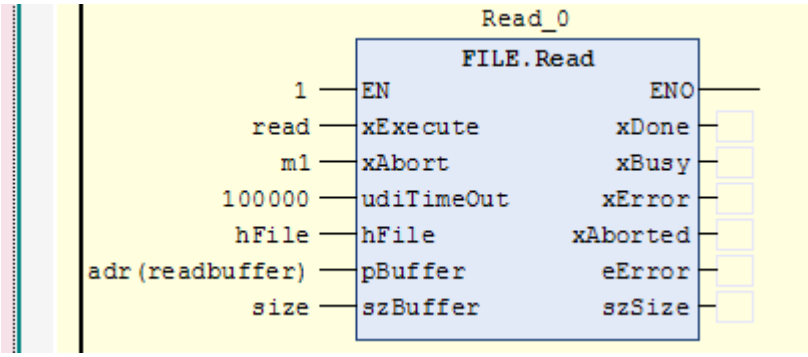
content of the memory area indicated by the pointer "pBuffer" cannot be modified during the write operation! The size of the memory structure containing the bytes to be written and the number of bytes to be written are not checked.



Input/Output	Parameter Name	Datatypes	Descriptions
IN	xExecute	BOOL	Trigger bit, should be on at all times while the file is being processed.
IN	xAbort	BOOL	Stop
IN	udiTimeOut		Timeout
IN	hFile		File handle, created by FILE Obtained from the execution result of Open
IN	pBuffer		Obtain the address of the data using the ADR instruction
IN	szSize		The number of bytes to be written can be retrieved through the sizeof operation
OUT	xDone	BOOL	Module execution completion will be set to 1
OUT	xBusy	BOOL	Module is executing will be set to 1
OUT	xError	BOOL	Module execution error will be set to 1
OUT	xAborted		Writing a file is interrupted
OUT	eError		Error code, type FILE.ERROR

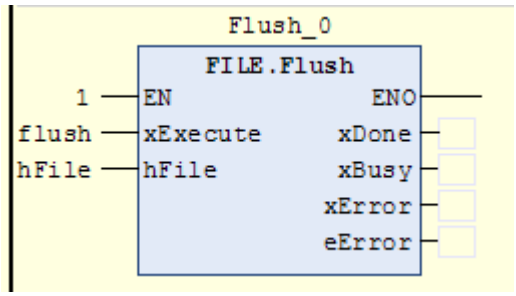
4. FILE.Read

This function block reads a file that was previously opened with FILE.Open. If the number of characters read is less than the number of characters specified in "szBuffer", the function block returns an active "xDone", indicating the number of characters in "szSize". The function block returns an active "xDone", indicating the current number of characters in "szSize". The size of the target memory structure of the bytes to be read and the number of bytes to be read are not checked.



Input/Output	Parameter Name	Datatypes	Descriptions
IN	xExecute	BOOL	Trigger bit, should be on at all times while the file is being processed.
IN	xAbort	BOOL	Stop
IN	udiTimeOut		Timeout
IN	hFile		File handle, obtained from the result of FILE.Open.
IN	pBuffer		To store the address of the data, use the adr instruction.
IN	szBuffer		Maximum number of bytes to be read; can be retrieved via operator sizeof
OUT	xDone	BOOL	Module execution completion will be set to 1
OUT	xBusy	BOOL	Module is executing will be set to 1
OUT	xError	BOOL	Module execution error will be set to 1
OUT	xAborted		Writing file interrupted
OUT	eError		Error code, type is FILE Error
OUT	szSize		Number of bytes of data read

5. FILE.Flush



Flush write buffer of an opened file to disk.

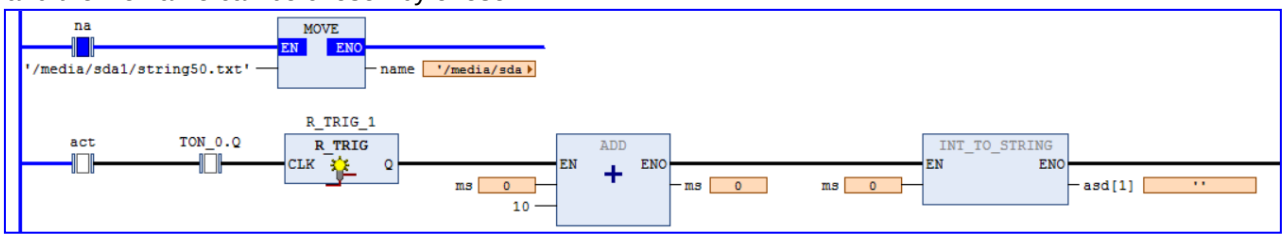
Input/Output	Parameter Name	Datatypes	Descriptions
IN	xExecute	BOOL	Trigger Bit
IN	hFile		File handle, obtained from the result of FILE.
OUT	xDone	BOOL	Module execution completion will be set to 1
OUT	xBusy	BOOL	Module is executing will be set to 1
OUT	xError	BOOL	Module execution error will be set to 1
OUT	eError		Error code, type FILE.ERROR

The following is the specific use of the process

Read operation: open the file (FILE.MODE.MREAD mode) →read the data →close the file
Write operations: open or create a new file (FILE.MODE.MRDWR mode), write data, save data close file

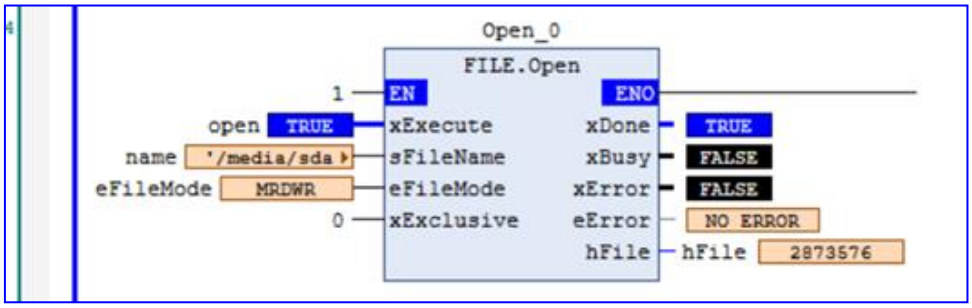
According to the process of reading and writing files, this article provides a programming example as follows:

1. Name should be written in the form of file path+file name./media/sda1 is the path to the PLC's USB drive, and the file name can be chosen by oneself.

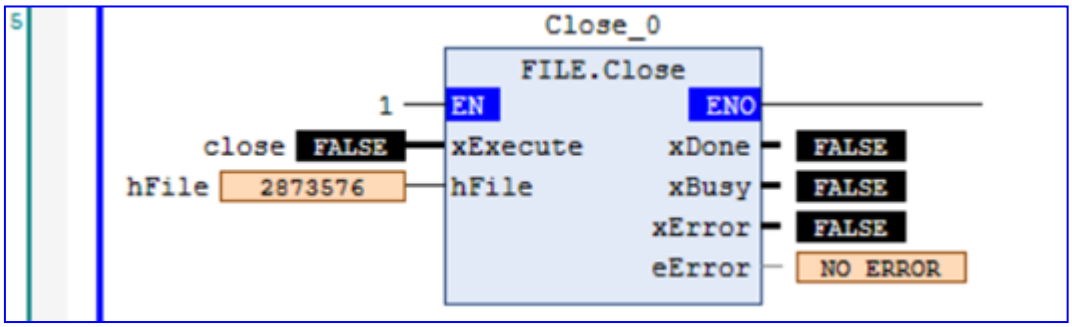


2、This function is used to create or open a file.

eFileMode needs to be changed to the type of MRDWR, and then open set to 1, hFile automatically generates a number means that the file is created successfully.

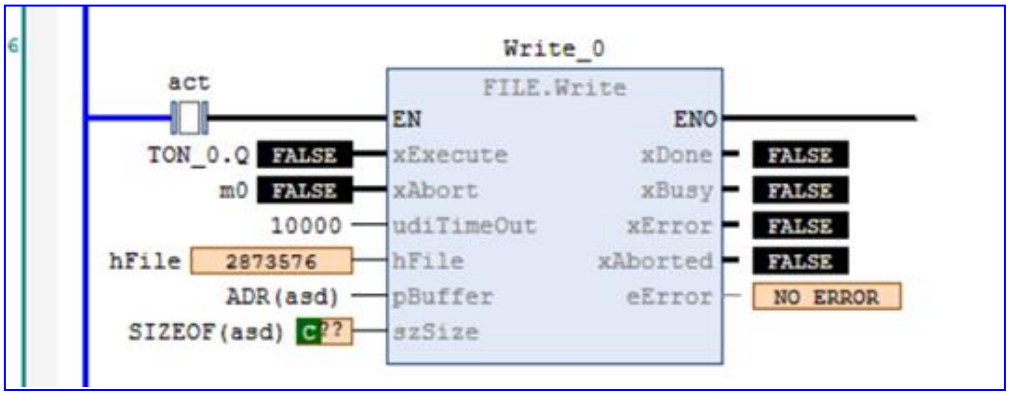


3. This function is used to close files.



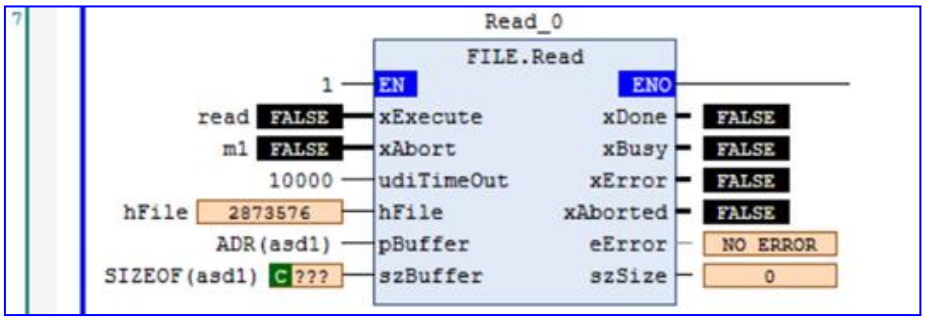
4. This function is used to write files.

PBuffer obtains the address of the data and can use the ADR instruction. (Write the data that needs to be written to the USB drive to that address)

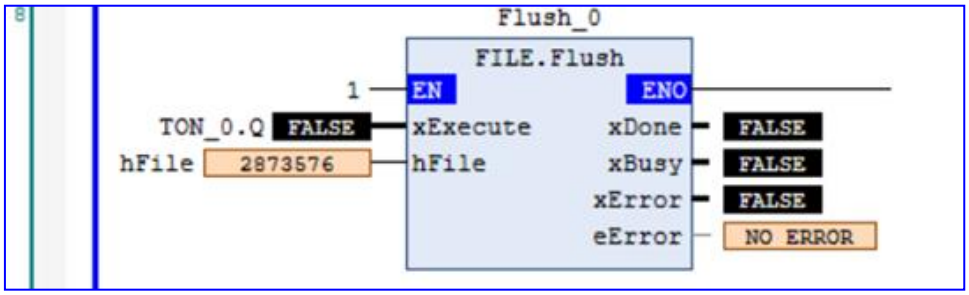


5. This function is used to write and read the file.

pBuffer to get the address of the data, you can use the adr instruction.



6. This function can copy the data of the folder to the U-disk.



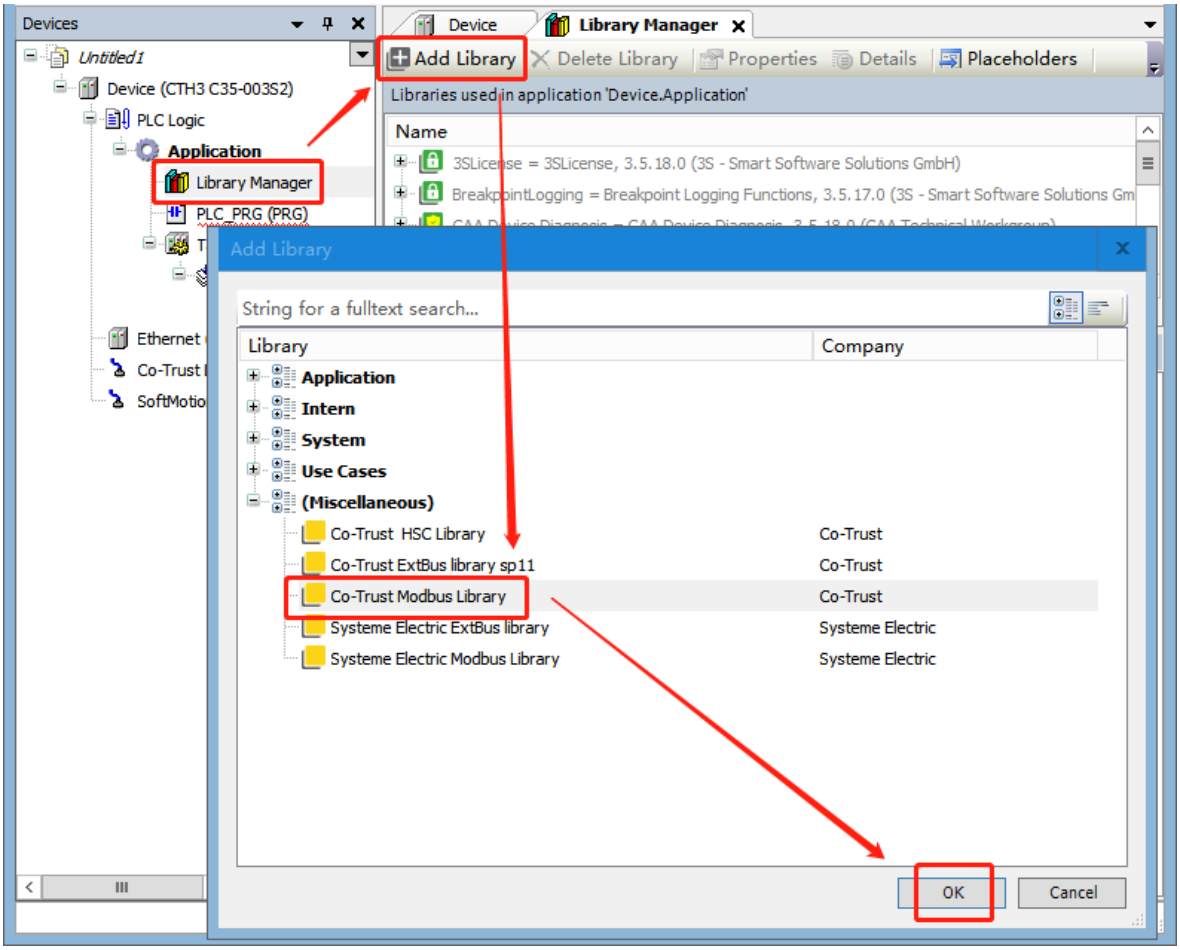
If the written data type is STRING, you can directly open it in .txt format and view it.

If the type of data written is DINT directly open will appear garbled, you can use LabVIEW software to change the DINT type to STRING type. (Other data types are the same)
LabVIEW software can also be used to modify the data format of the U-disk, use CODESYS Trace function to open and display.

6.10 Adding Library Files to a Project

When writing a programme, some instructions or function blocks are often used, such as triggers, function blocks, communication libraries, counting function blocks, PID control function blocks, etc. CODESYS categorizes these instructions and function blocks, and then creates special libraries.

In general, when the project is built, the Standard library is in the project by default. When the project uses instructions from other libraries, it is necessary to add the library to the project.



<Note> Adding libraries to a project is different from adding libraries to CODESYS, first we need to add external libraries to CODESYS, so that there are external libraries in CODESYS, but these external libraries are not included in the project when you build the project, so you need to add libraries to the project when you need to use these external libraries in the project.

6.11 Reset function

Resetting the application stops the program and resets the variables to their initialised values. CODESYS has three types of reset: Reset Warm, Reset Cold and Reset Origin. The three types of reset can be selected from the "Online" menu.

Reset Warm: This is an online command, valid in online mode. After reset, all currently active variables are reinitialised except persistent variables. If the initial value is set, the value of the variable will be the initial value after the reset, and all other variables will be set to the standard initial value (e.g., 0).

Reset Cold: This is an online command, valid only in online mode. Unlike the Reset Warm command, the Reset Cold command not only sets the value of common variables to the initial value of the currently active application, but also sets the value of persistent variables to the initial value. Reset Cold occurs after the programme is downloaded to the PLC and before it is run (cold start). Generally, this method can be used to restart the bus after a bus interruption.

Reset Origin: Reset all variables (including the remaining variables) to their initial values. Erase all user files on the controller and place it in an "empty" state.

6.12 Order Information

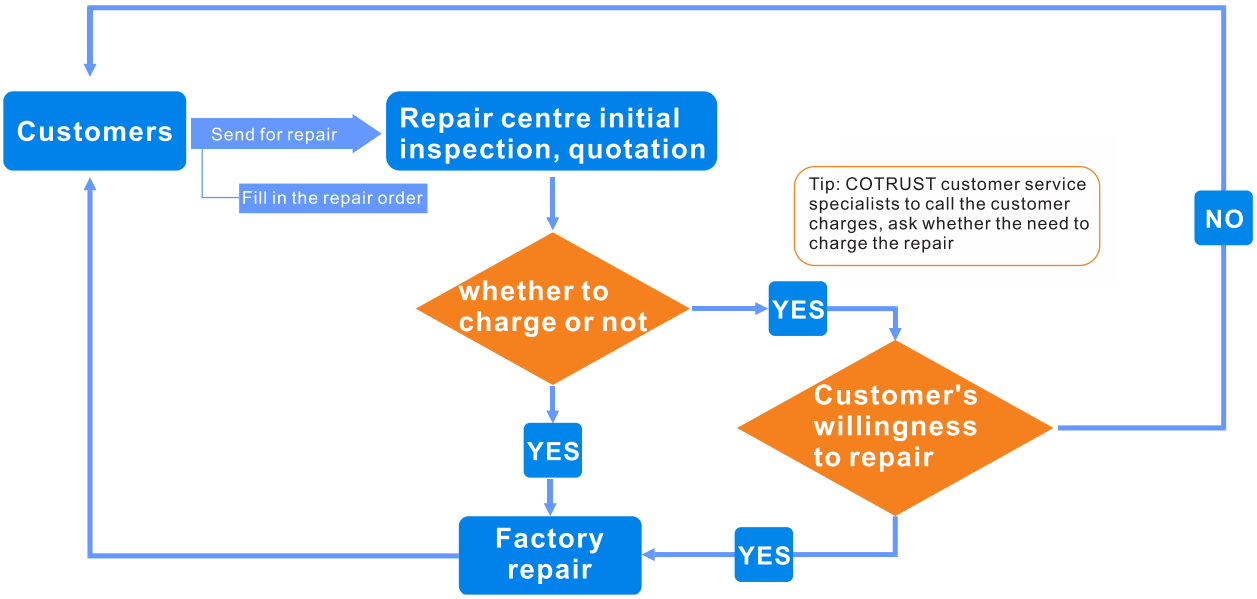
Table 6-1 Product Ordering Information Table

C35-03 Motion Controller	
CTH3 C35-003S2	CODESYS-SP18 version programming environment, EtherNET × 1. EtherNET/EtherCAT × 1. CANopen × 1. RS485 × 2. USB × 1. 32MB program data space, supporting visual WebVisu, EtherNet/IP master station, Modbus (RTU/TCP) master-slave official authorization, cascading, and dual independent IP.
C57-A3 Motion Controller	
CTH3 C57-103S2	CODESYS-SP18 version programming environment, PLC native comes with 10 channels of DI, 6 channels of high-speed counters, EtherNET × 1. EtherCAT × 1. CANopen/RS485 × 1. USB × 1. 32MB program data space, supporting visual WebVisu, EtherNet/IP master station, Modbus (RTU/TCP) master-slave official authorization, and dual independent IP.
Power supply module	
CTH3 PWR-020S1	Power module, input 85～264V AC, output 24V DC/2A
Intermediate expansion module	
CTH3 INT-000S1	INT-00 intermediate expansion module
High-speed counting module	
CTH3 HSC-020S1	HSC-02 high-speed counting module, 2-channel differential/single-ended signal input
High-Pulse output module	
CTH3 HSP-040S1	HSP-04 pulse output module, 4-channel differential/single-ended signal output
CTH3 HSP-040S2	HSP-04 pulse output module, Plug-in Crimp Terminals,4-channel differential /single-ended signal output
EtherCAT Slave Module	
CTH3 ECT-000S1	EtherCAT slave module, up to 8 expansion modules can be attached
Profinet Slave Modules	
CTH3 PNT-000S1	Profinet slave module
Digital module	
CTH3 DIT-080S1	Digital input, 8DI x 24VDC
CTH3 DIT-160S1	Digital input, 16DI x 24VDC
CTH3 DIT-320S1	Digital input, 32DI x 24VDC
CTH3 DIT-320S2	Digital input, Plug-in Crimp Terminals,32 x 24VDC
CTH3 DQT-080S1	Digital output, 8DQ x 24VDC
CTH3 DQT-160S1	Digital output, 16DQ x 24VDC

CTH3 DQT-320S1	Digital output, 32DQ x 24VDC
CTH3 DQT-320S2	Digital output, Plug-in Crimp Terminals, 32 x 24VDC
CTH3 DQR-080S1	Digital output, 8DQ x relay
CTH3 DQR-160S1	Digital output, 16DQ x relay
Analog module	
CTH3 AIS-040S1	Voltage and current input, 4AI x 12bit
CTH3 AMS-060S1	Analog voltage and current input and output, 4AI x 12bit, 2AQ x 12bit
CTH3 AIV-080S1	Voltage input,8AI x 16bit
CTH3 AIC-080S1	Current input,8AI x 16bit
CTH3 AQS-040S1	Voltage and current output, 4AQ x 12bit
CTH3 AQS-080S1	Voltage and current output, 8AQ x 12bit
CTH3 AQS-080S2	Voltage and current output, Plug-in Crimp Terminals, 8AQ x 12bit
Temperature module	
CTH3 AIT-040S1	Thermocouple input module, 4 x TC, isolated 16bit accuracy
CTH3 AIT-080S1	Thermocouple input module, 8 x TC, isolated 16bit accuracy
CTH3 AIR-040S1	Thermal resistance input module, 4 x RTD, isolated 16bit accuracy
CTH3 AIR-080S1	Thermal resistance input module, 8 x RTD, isolated 16bit accuracy
CTH3 AIR-080S2	Thermal resistance input module, Plug-in Crimp Terminals, 8-point* RTD, isolated 16bit accuracy
Accessories	
CTH3 BAT-000S1	PLC lithium battery, voltage 3.6V, capacity 2700mAh

6.13 After-sales repairs

After-sales repair process



Repair Notes:

(1) Please be sure to send the repair list attached to the repair products.

(2) Before sending the product, please back up and save the product programme parameters, the repair will clear all the product data.

(3) Please make sure to send the repair products and the repair list directly to our after-sales service centre, and the shipping cost will be borne by the customer.

(4) In order to ensure the integrity of the product, please be sure to send the repair products well-packaged to resist the adverse effects caused by long-distance transport process.

(5) Our maintenance centre will provide feedback on the initial inspection of the repair within 3 working days after receiving the repair parts. If you do not receive feedback on the initial inspection within a week after the repair products are sent out, please call us to ask, so as to avoid delaying your work due to the negligence of product mailing and fax confirmation.

Warranty Liability Statement

COTRUST is dedicated to providing comprehensive after-sales service guarantees for all customers, including:

1) Provide 24 months of free warranty service for PLC products from the date of production.

2) Provide 24 months of free warranty service for building control products from the date of production.

3) Provide 18 months of free warranty service for servo drive products from the date of manufacture.

4) For servo motor products, a free 18 month warranty service is provided from the date of manufacture.

5) Provide a free warranty service for HMI products for 18 months from the date of manufacture.

6) Provide paid repair services for artificially damaged and out of warranty products.

For detailed after-sales repair services, please call 0755-86226822-6601 (Ms. Liu), or call the service hotline at 400-700-4858.

Repair checklist

Company：_____

Address：_____

Name：_____ Tel：_____ Fax：_____

	Model	serial number	Fault phenomenon	Remark
1				☑General repair ☐test☐upgrade
2				☑General repair ☐test☐upgrade
3				☑General repair ☐test☐upgrade
4				☑General repair ☐test☐upgrade
5				☑General repair ☐test☐upgrade
6				☑General repair ☐test☐upgrade
7				☑General repair ☐test☐upgrade
8				☑General repair ☐test☐upgrade
9				☑General repair ☐test☐upgrade
10				☑General repair ☐test☐upgrade
11				☑General repair ☐test☐upgrade
12				☑General repair ☐test☐upgrade

Agent seal:

(Effective with seal)

Delivery info

Address: 268 New road, Yangyong village, Dalang town, Dongguan, CHINA
Addressee: Maintenance department
Tel: 0796-82220668
Postcode: 523770

Address: 9/F, block a, building 6, international innovation Valley, Nanshan District, Shenzhen

0755-86226822

market@co-trust.com

https://www.co-trust.com

Scan for more info