

EtherCAT/ PROFINET Gateway

GT300-EC-PN

User Manual

V 3.4



SST Automation

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Important Information

Warning

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The product has many applications. The users must make sure that all operations and results are in accordance with the safety of relevant fields, and the safety includes laws, rules, codes and standards.

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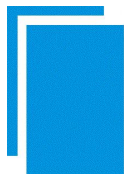


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1 Product Overview

1.1 Product Function

The GT300-EC-PN gateway enables seamless connectivity between EtherCAT devices and a PROFINET network.. This module acts as a device on the PROFINET side and a **master** on the EtherCAT side. It can connect up to 32 EtherCAT devices to the PROFINET network.

1.2 Product Features

- ◆ **Wide Application:** Supports connecting multiple EtherCAT devices to a PROFINET network, such as inverters with EtherCAT interfaces, servo motors, remote I/O modules, field measurement devices, and PLCs. On the PROFINET side, it connects to Siemens S7-1200/1500 PLCs.
- ◆ **Strong Real-Time Performance:** Minimum protocol conversion time of 2ms.
- ◆ **Easy to Use:** Supports hot-swapping of slave devices, allowing direct replacement with the same model for immediate operation.
- ◆ **Isolated Power Supply:** Uses an isolated power supply with strong anti-interference capabilities.
- ◆ **Professional Configuration Software SST-ECAT-COM:** The software supports parsing EtherCAT slave device description files (ESI) and allows for offline configuration.

1.3 Technical Specification

- [1] The EtherCAT master supports CoE and complies with the CiA402 standard.
- [2] The EtherCAT master supports a maximum of 32 slave connections, with a maximum total input byte size of 1440 and a maximum total output byte size of 1440.
- [3] The EtherCAT master supports a maximum of 1000 (input) + 1000 (output) mapped objects.
- [4] The EtherCAT master supports a single network port, SM, and DC synchronization modes, with a configurable distributed clock (DC) period ranging from 2ms to 20ms.
- [5] Supports hot-swapping of EtherCAT slaves, and replacing a slave will not affect communication with other slaves.
- [6] Supports the standard PROFINET RT and IRT protocols.
- [7] PROFINET supports up to 32 slots, with a maximum input byte size of 1440 and a maximum output byte size of 1440 (the usable length is limited by the specific PLC and the PDU size of the communication).

module; when configuring slots, each slot will occupy 1 or 2 bytes of status information, so the actual maximum valid data is 1428 bytes: 512+512+256+128+16+4). Slot configuration can be done in the PLC.

[8] The supported PROFINET module types are as follows:

- Input 001 byte
- Input 002 bytes
- Input 004 bytes
- Input 008 bytes
- Input 016 bytes
- Input 032 bytes
- Input 064 bytes
- Input 128 bytes
- Input 256 bytes
- Input 512 bytes
- Output 001 byte
- Output 002 bytes
- Output 004 bytes
- Output 008 bytes
- Output 016 bytes
- Output 032 bytes
- Output 064 bytes
- Output 128 bytes
- Output 256 bytes
- Output 512 bytes
- Input / Output 001 byte
- Input / Output 002 bytes
- Input / Output 004 bytes
- Input / Output 008bytes
- Input / Output 016 bytes
- Input / Output 032 bytes
- Input / Output 064 bytes
- Input / Output 128 bytes
- Input / Output 256 bytes
- Input / Output 512 bytes

[9] EMC:

- Electrostatic Discharge (ESD) Immunity
For non-metallic device enclosures, a test voltage of $\pm 8\text{KV}$ is applied using the air discharge method.
For metallic device enclosures, a test voltage of $\pm 4\text{KV}$ is applied using the air discharge method.
- Radio-Frequency Electromagnetic Field Immunity
Amplitude-modulated waves with an intensity of 10V/m in the frequency range of 80 MHz to 1000 MHz.
- Electrical Fast Transient/Burst Immunity
A maximum test voltage of $\pm 1\text{KV}$ at 5 kHz is applied to cables containing CDI communication media.

A maximum test voltage of $\pm 2\text{KV}$ at 5 kHz is applied to all other cables and ports.

- Radio-Frequency Conducted Disturbance Immunity
Amplitude-modulated waves of 10V rms. in the frequency range of 150 kHz to 80 MHz
- Emission
Compliant with GB4824, Group 1, Class A.
- Conducted Emission
Compliant with GB4824, Group 1, Class A.

[10] Power supply: 24VDC (9V ~ 30V), 90mA (24VDC);

[11] Working temperature: $-40^{\circ}\text{F} \sim 158^{\circ}\text{F}$ ($-40^{\circ}\text{C} \sim 70^{\circ}\text{C}$), relative humidity: 5% ~ 95% (no condensation);

[12] Built-in electrostatic protection: 15 KV ESD; communication port isolation: 3 KV.

[13] External dimensions (W*H*D): 1.3 in*4.6 in*4.1 in (34mm*116mm*105mm).

[14] Installation: 35mm DIN rail;

[15] Protection class: IP20

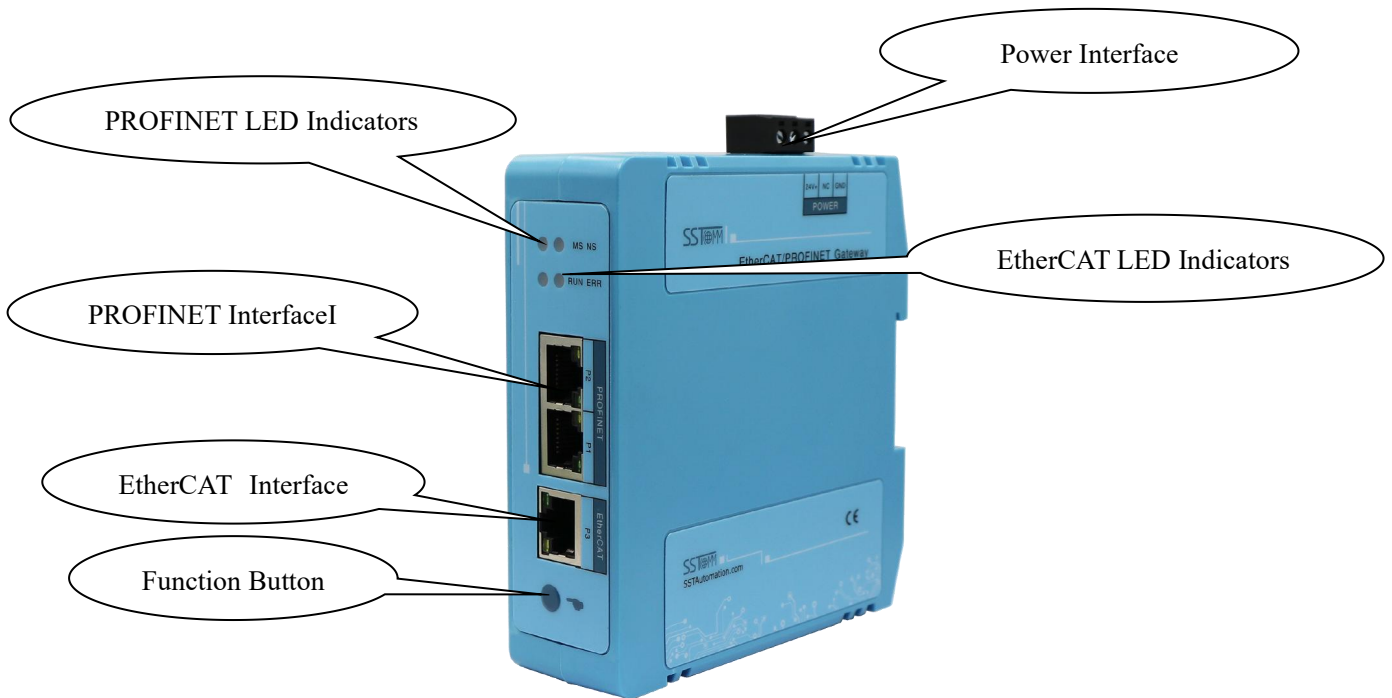
1.4 Revision History

Revision	Date	Chapter	Description
V3.4	10/23/2024	ALL	NEW release



2 Hardware Description

2.1 Appearance



Notes: This picture is for reference only. The product appearance is subject to the actual product.

2.2 LED Indicators

PROFINET LED INDICATORS.

MS	NS	Description
Red On	Off	Start-up state, waiting to initialize
Green On	Red flashing (1Hz).	Module initialized but no connection with PLC.
Green On	Red flashing (2Hz).	connection doesn't match the configuration(irt)
Green On	Red On	network cable is not plugged in.
Green On	Green On	PLC has connected

EtherCAT LED INDICATORS.

INDICATORS	State	Description
RUN	Orange ON	Start-up state, waiting to initialize
	Orange flashing(1HZ)	ECAT initialization state (Init)
	Green flashing(2HZ)	ECAT pre-operational state (Pre-Operational)
	Green flashing(1HZ)	ECAT safe-operational state (Safe-Operational)
	Green On	ECAT operational state (Operational)
ERR	Red Off	No errors
	Red flashing(1HZ)	A slave device has disconnected(slave devices (incorrect physical connection)
	Red flashing(1HZ)	Slave ECAT communication error
	RED on	ECAT interface has no physical connection

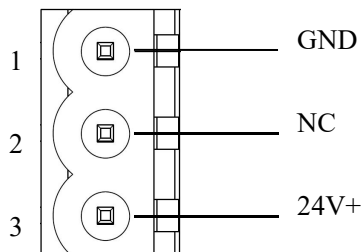
2.3 Function Button

After the device starts and enters operational mode, the RUN and ERR indicators on the EtherCAT interface will flash orange once each time a key operation is successfully detected. The detailed functionality is as follows:

Operation	Function	Exit Operation
double-clicking button and hold on 3s (10 seconds after the double-click, the operation will be canceled)	Restore default configuration	After a successful key operation, the device will automatically reboot and apply the default configuration. The default parameters are: IP address 192.168.0.83, Device name: dut83.
Press and hold the button while powering on.	Bootloader Mode	Restart Gateway

2.4 Interface

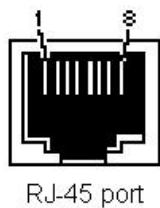
2.4.1 Power Interface



Pin	Function
1	Power GND
2	NC, no connection
3	24V+ , DC

2.4.2 Ethernet Interface

Ethernet interface apply RJ-45 connector, 10/100M adaptive.



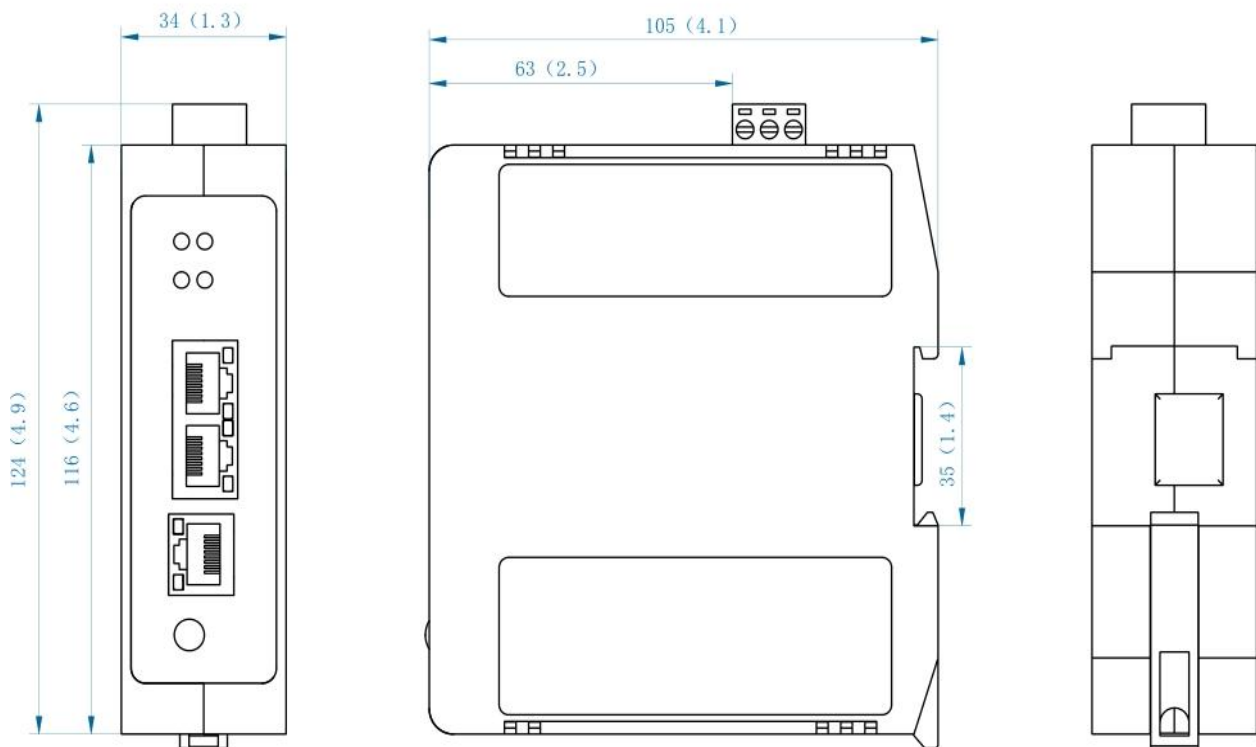
Pin	Signal Description
S1	TXD+, Tranceive Data+, Output
S2	TXD-, Tranceive Data-, Output
S3	RXD+, Receive Data+, Input
S6	RXD-, Receive Data-, Input
S4,5,7,8	Reserved



3 Hardware Installation

3.1 Mechanical Dimensions

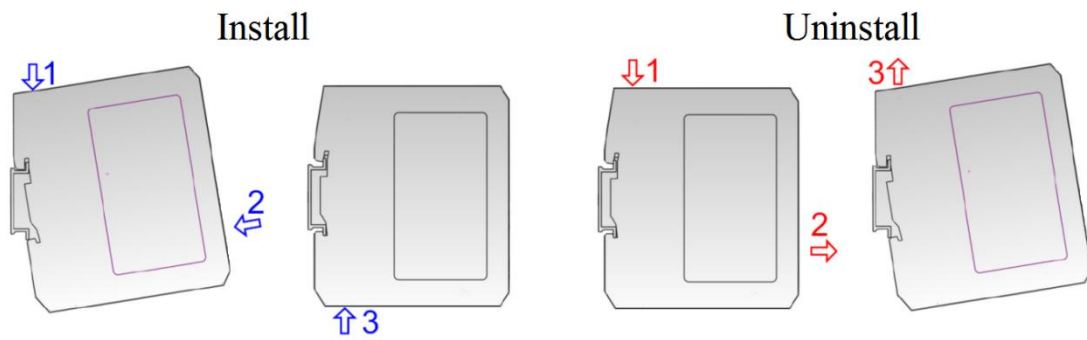
1.3in * 4.6in * 4.1in (34mm * 116mm * 105mm)





3.2 Installation Method

Using 1.4 in (35mm) DIN RAIL.

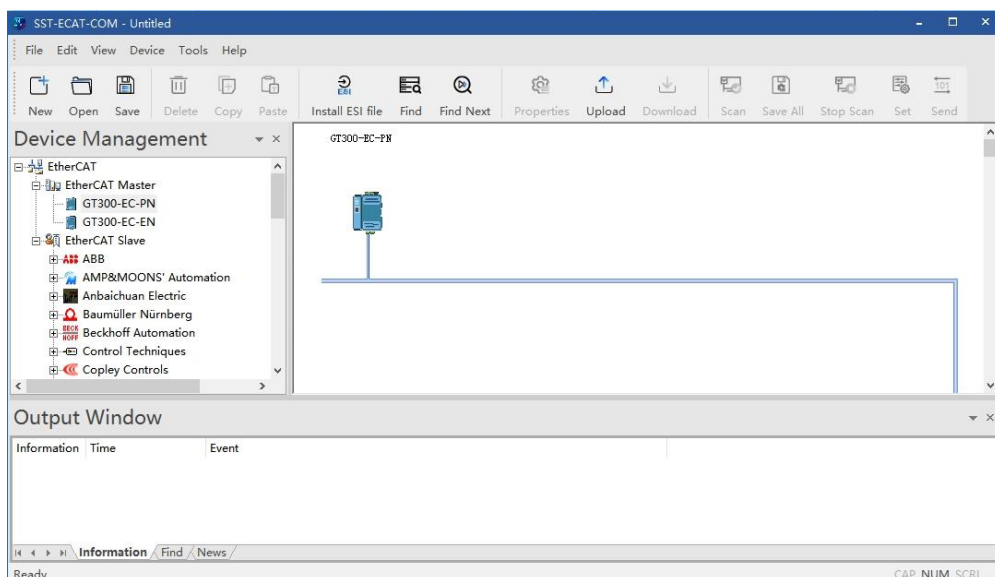


4 How to Start

4.1 Quick Start Guide

1) Connect either PROFINET port of the GT300-EC-PN to the PC or the PC's switch. The EtherCAT port of the GT300-EC-PN should be connected to the input port (IN port) of the EtherCAT slave device. For multiple slave devices, connect the output port (OUT port) of the current slave device to the input port (IN port) of the next device, cascading them in sequence.

2) Double-click the SST-ECAT-COM software installed on the PC, as shown in the figure below:



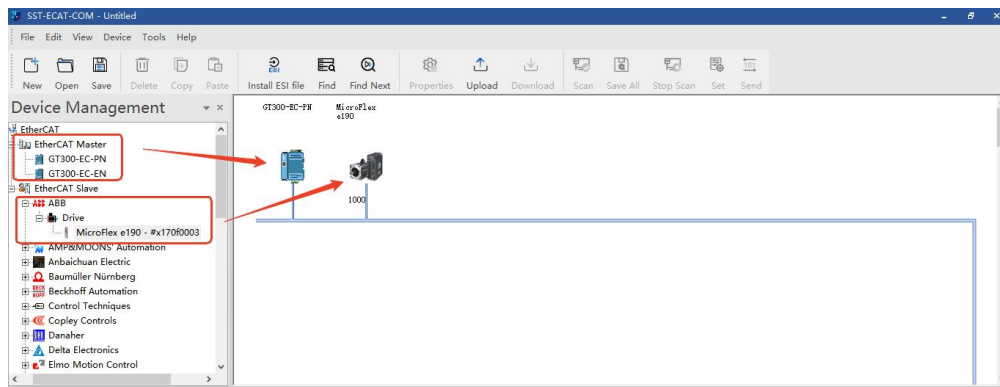
3) Click the ESI Wizard and follow the instructions to import the ESI (*.xml) file for the connected EtherCAT slave device.

4) Drag the GT300-EC-PN gateway device and the required slave devices from the device management panel into the bus network on the right.

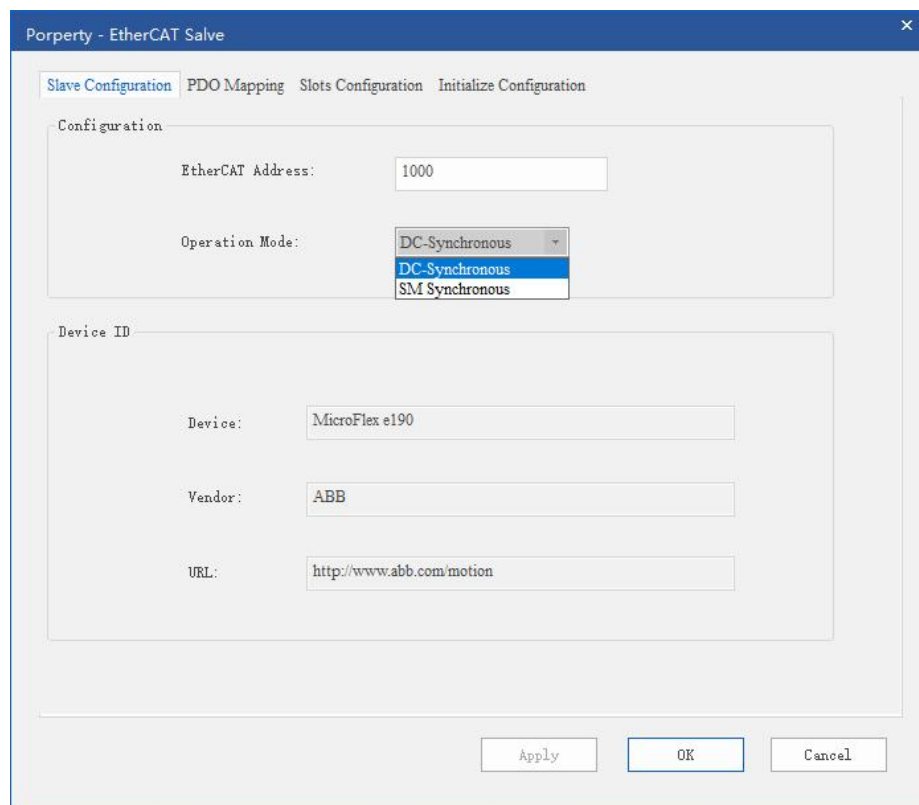
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5) Double-click the slave device icon, browse the basic information of the slave in the 'Slave Configuration' window that appears, and select the synchronization mode according to the actual requirements.

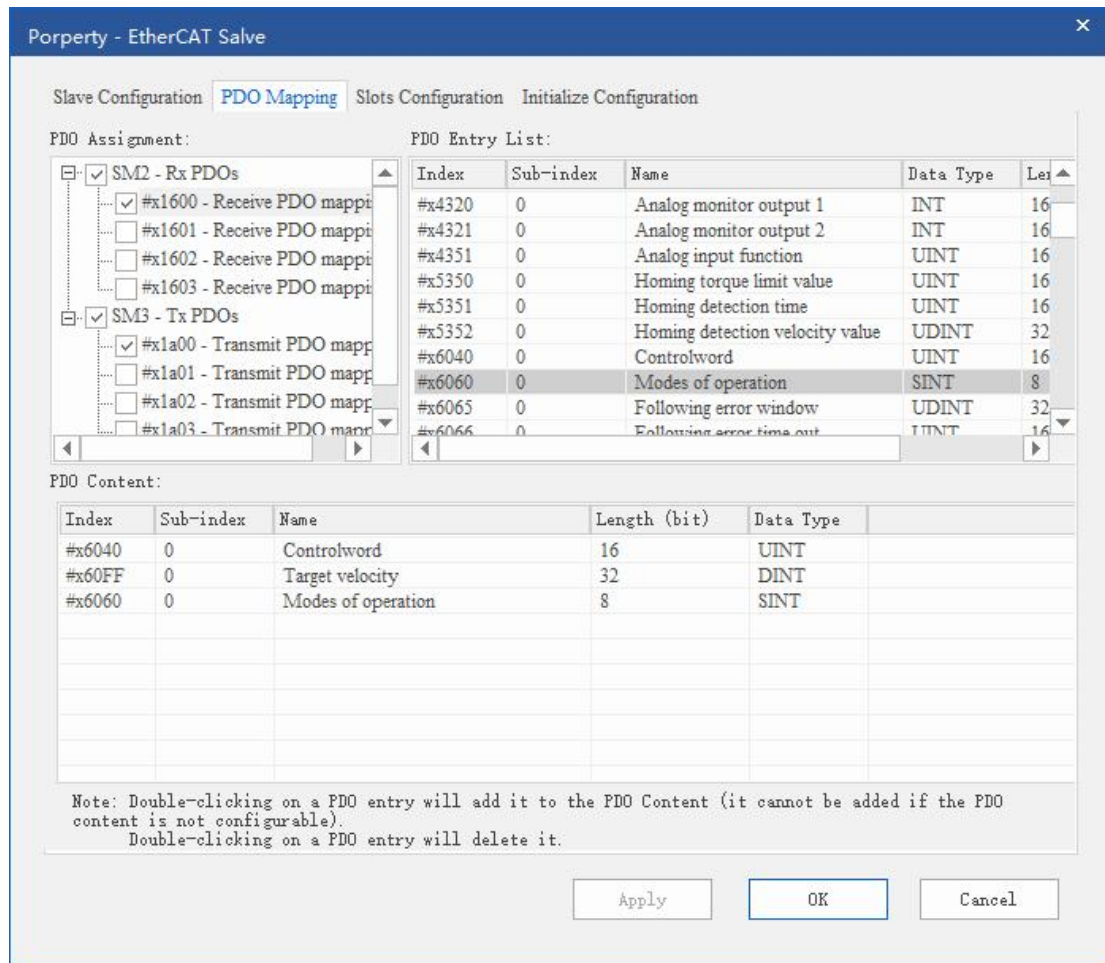


6) In the 'PDO Mapping' interface, you can select the default PDO configuration from the ESI file. If the slave supports PDO mapping, you can add or remove mapping objects by double-clicking items in the mappable object list and the mapping area in the top right. Once the configuration is complete, click the OK button in the bottom right corner.

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7) Double-click the master and configure the gateway in the 'Master Configuration' interface. Set the IP address and device name, ensuring they match the IP address and device name used in the PLC's GSDML file configuration. After making the changes, click 'Apply Configuration' and select the gateway device to apply the settings. In the parameter settings, configure the EtherCAT master's data transmission cycle and specify whether the PROFINET data is displayed in big-endian or little-endian format.

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Property - GT300-PN-EC

Master Configuration Device Allocation Manager PDO Mapping

Set IP Address and Device Name

IP Address: 192.168.0.88

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.0.8

Device Name: dut88

Change Configuration

Note: To apply any changes made to the Device IP / Device Name, please click [Change Configuration].

Parameter Settings

Set Cycle Time (ms): 5 (Range: 2~20)

PROFINET Parameter Display: Little Endian Display

Apply OK Cancel

Device Search

IP Address	MAC Address	Device Name	Default Gateway	Subnet Mask
192.168.0.88	08:00:27:08:00:08	dut88	192.168.0.88	255.255.255.0

Select Refresh Cancel

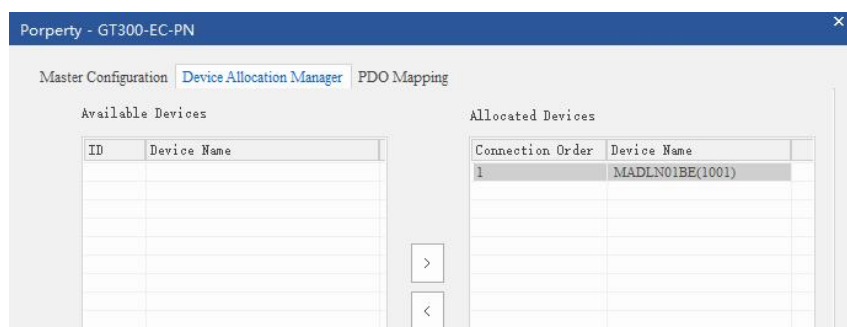
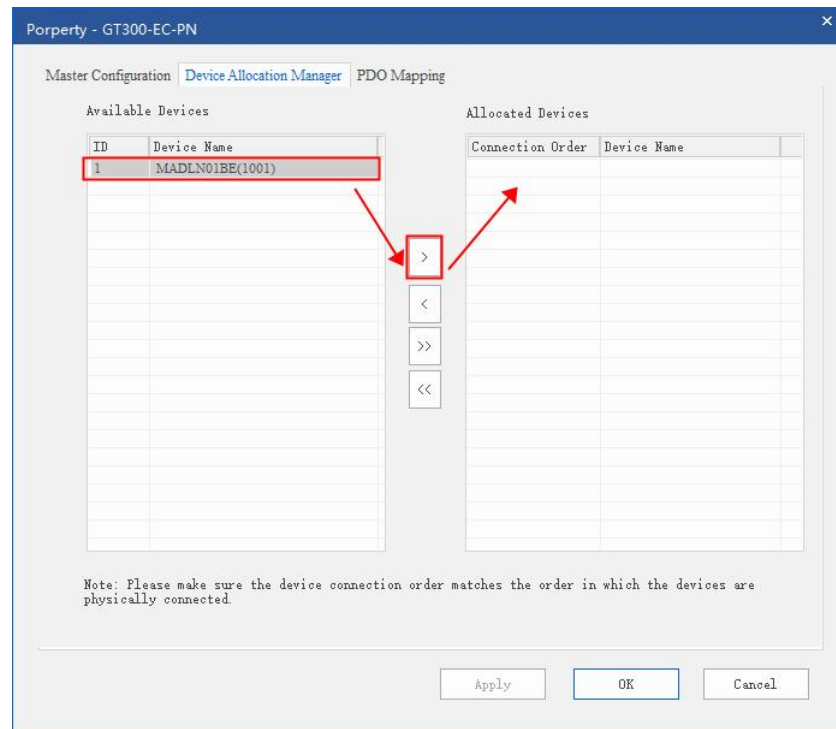
Search Completed

8) Select the slave device from the available devices and add it to the slave list. In the slave list, you can adjust the connection order between the master and slave devices by dragging. Be sure to ensure that the connection order in the configuration matches the actual physical connection order of the devices.

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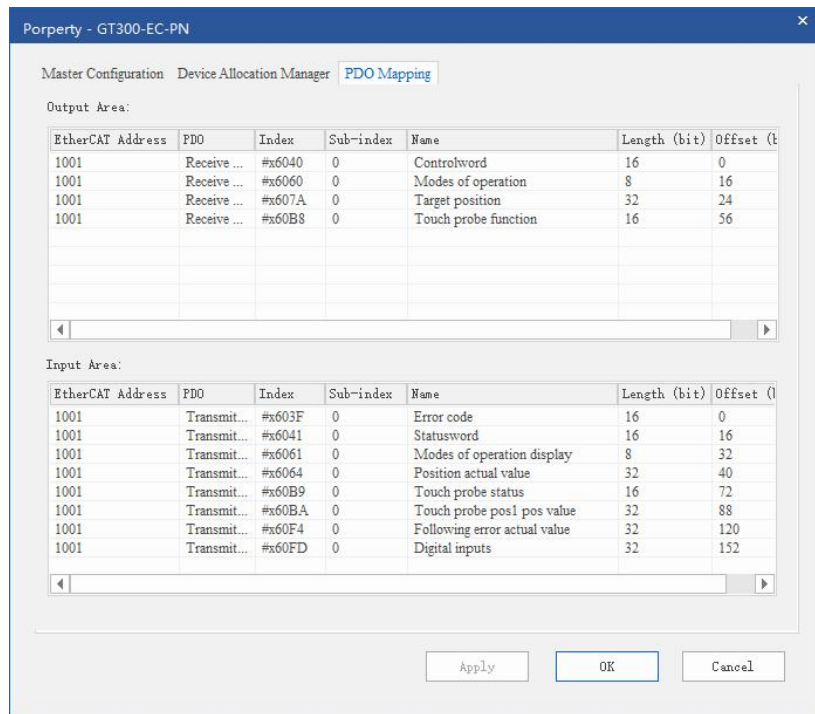
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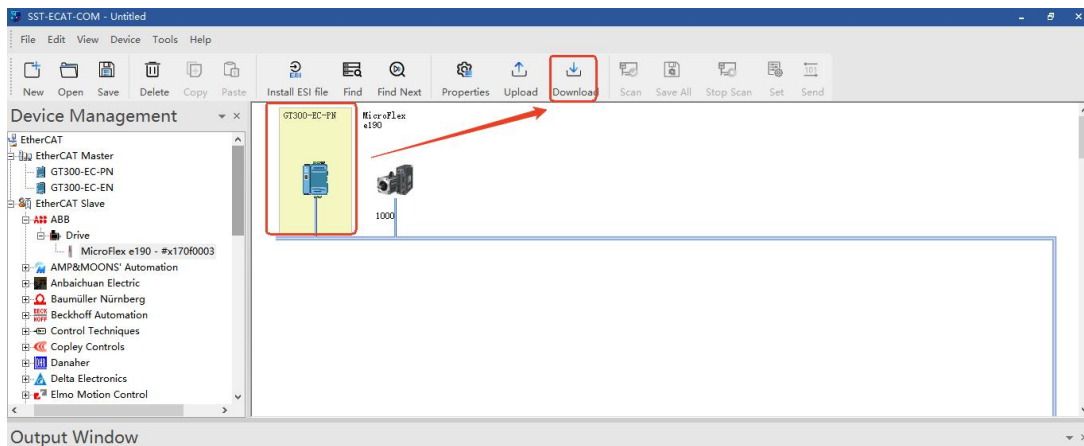


9) Click on PDO Mapping to view the offset and data length information for each object on the PROFINET side.

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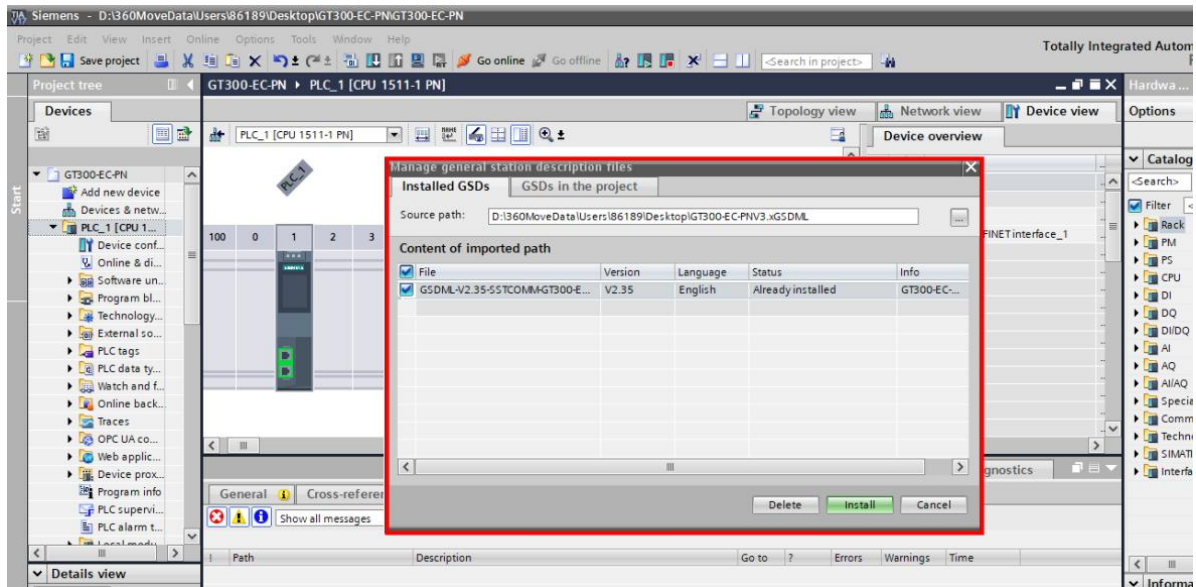


10) After completing the configuration, click OK to download the settings to the gateway device. Once the download is finished, restart the device for the configuration to take effect.

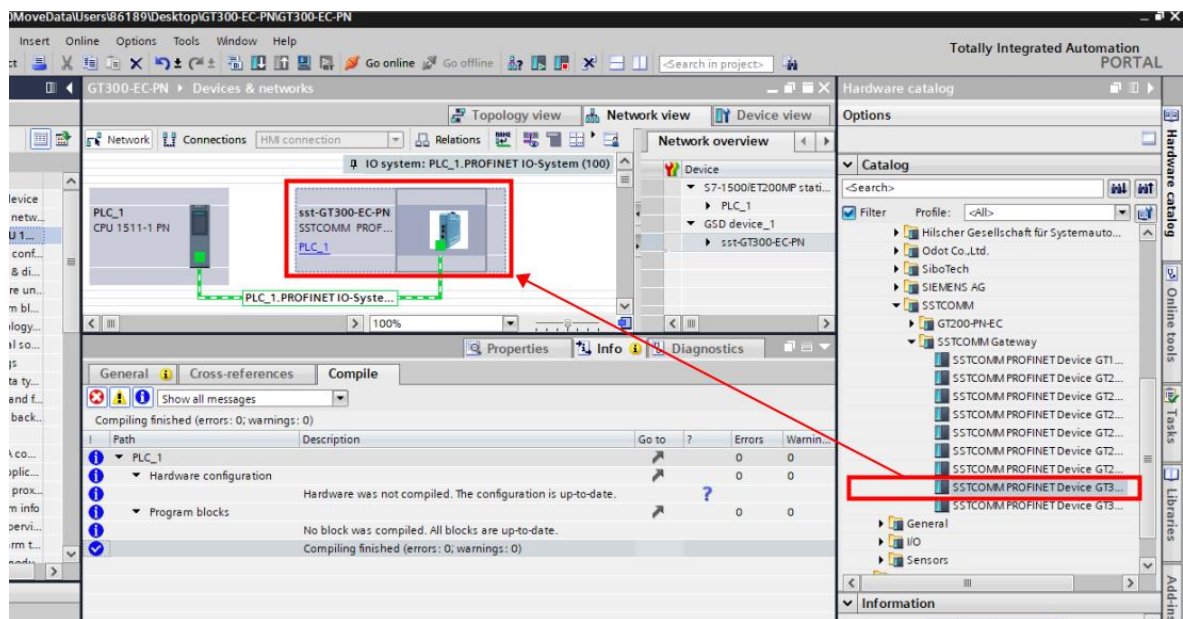


11) Use Siemens TIA Portal to configure the PLC project. Click on 'Options' – 'Manage General Station Description Files', select the GSDML file for the GT300-EC-PN, and import it into the project (the GSDML file can be obtained from the company's website)

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12) Drag GT300-EC-PN from the hardware catalog and add it to the PLC master network."

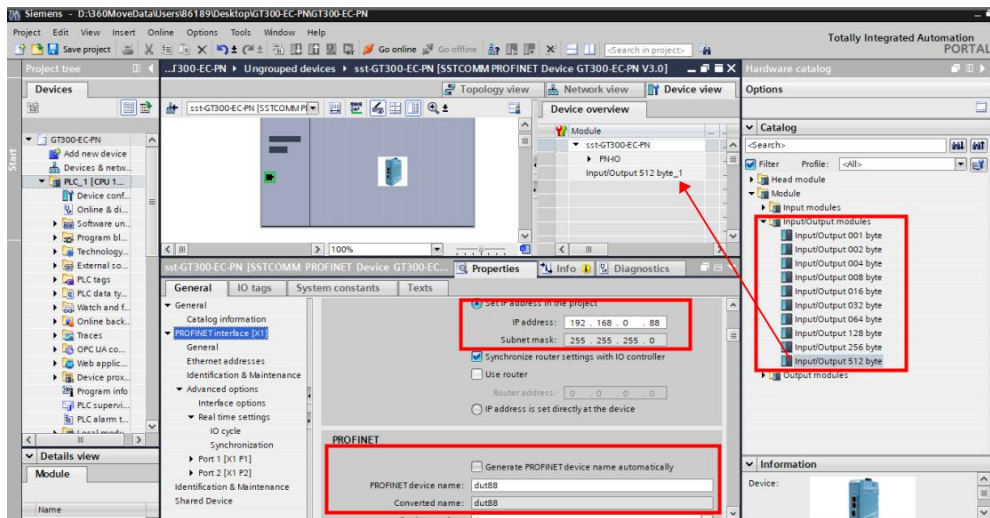


13) "Double-click GT300-EC-PN, add the necessary communication bytes from the module catalog on the right, and verify that the device name and IP address match the configuration.

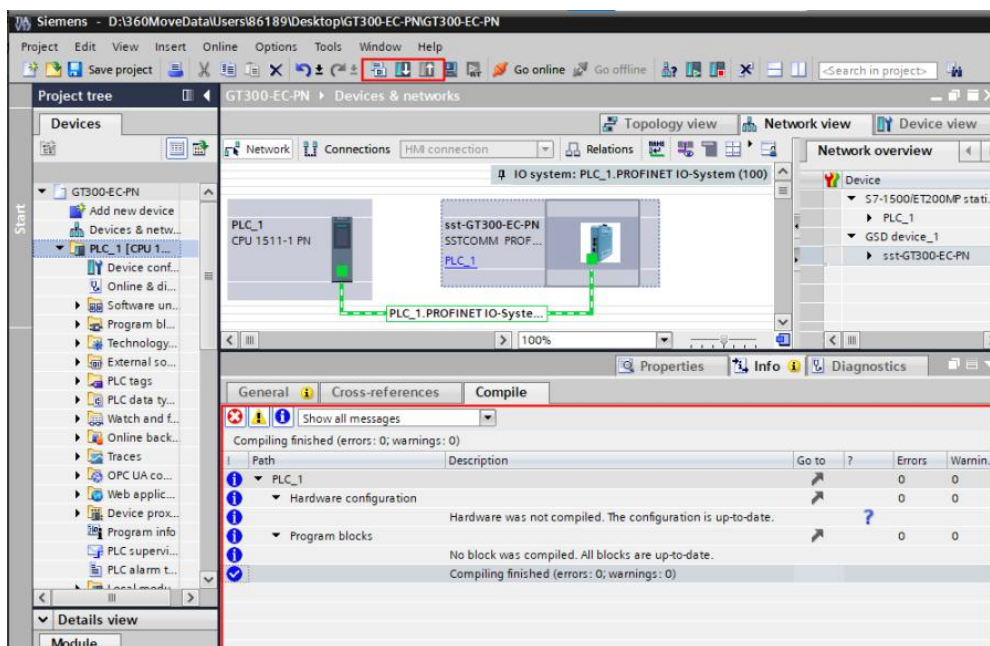
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14) Once the compilation is complete, download the project to the PLC.

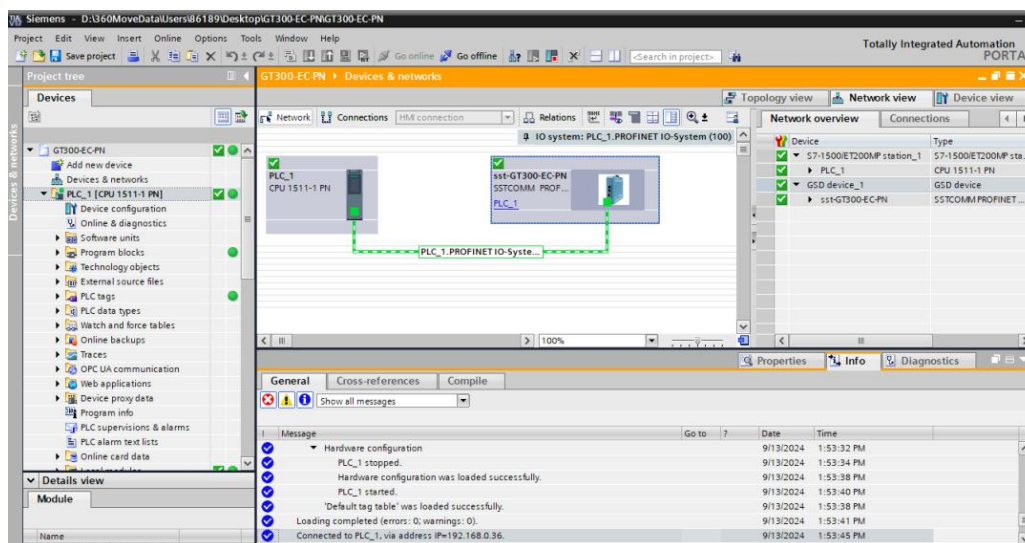


15) You can add a monitoring table in the Monitoring and Forcing table, send a motor start command to control the motor rotation, and read back the rotation data.

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For GT300-EC-PN to communicate properly with the PLC (PROFINET master), the following two conditions must be met simultaneously:

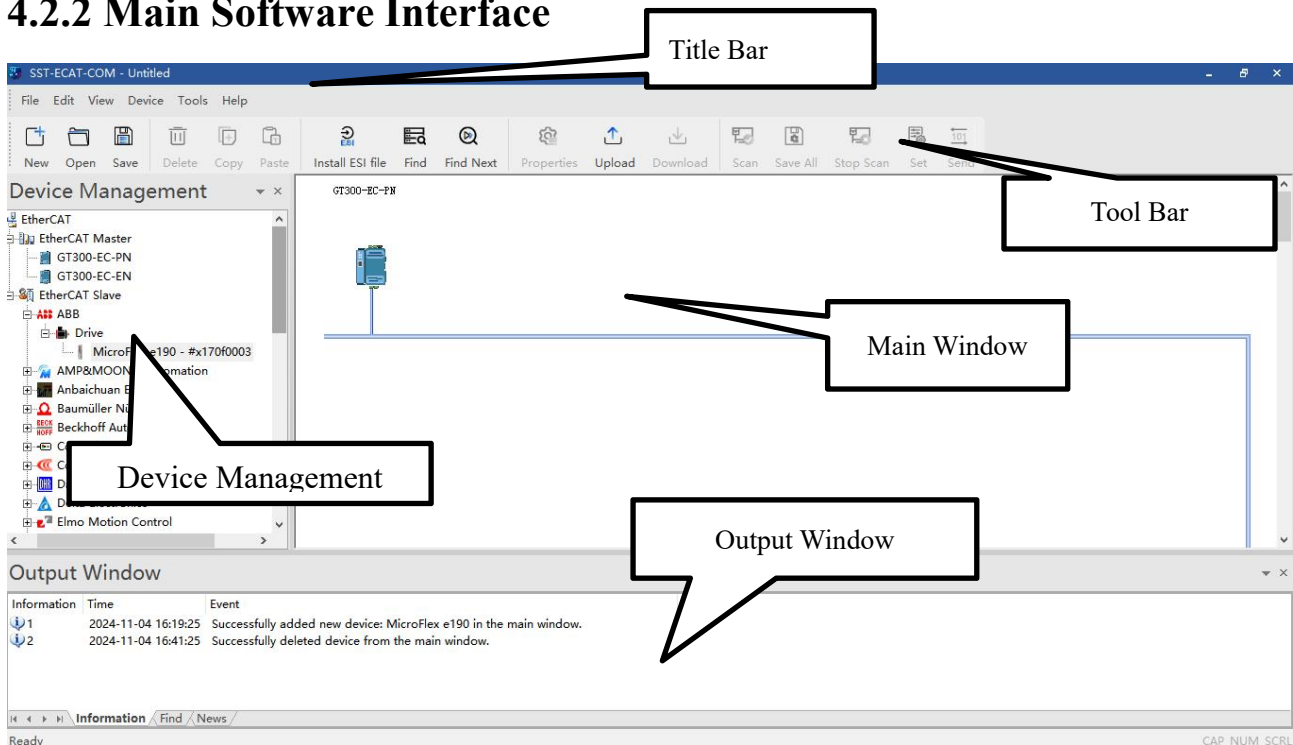
- The PROFINET device name of the gateway must match the device name in the PLC configuration.
- The IP address of the gateway's PROFINET interface must match the device IP address in the PLC configuration.

4.2 SST-ECAT-COM Software Instructions

4.2.1 Precautions Before Configuration

After powering on the GT300-EC-PN, wait for the MS indicator to turn solid green and the NS indicator to either flash red or turn solid green. Once this occurs, you can use the EtherCAT configuration software to locate the gateway and upload or download configurations. The EtherCAT network configuration software, SST-ECAT-COM, is developed by SST Automation and is designed for use with the GT300-EC-PN or other SST EtherCAT gateways.

4.2.2 Main Software Interface

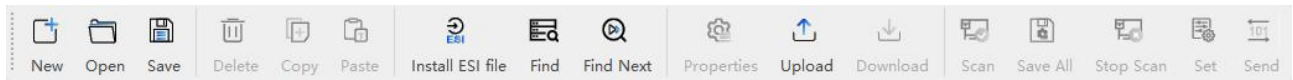


Main window: The configuration interface. In offline mode, you can view the properties of devices by dragging their icons into this window.

Device management window: Displays registered EtherCAT devices. Slave devices are further categorized by manufacturer type.

Output window: Shows information on devices that have been added or removed, along with the results of 'Find Device' and 'Find Next'.

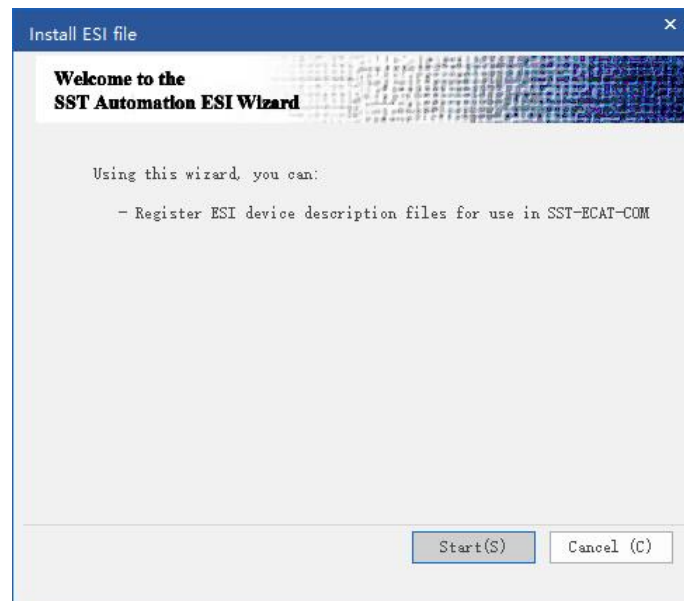
4.2.3 Toolbar



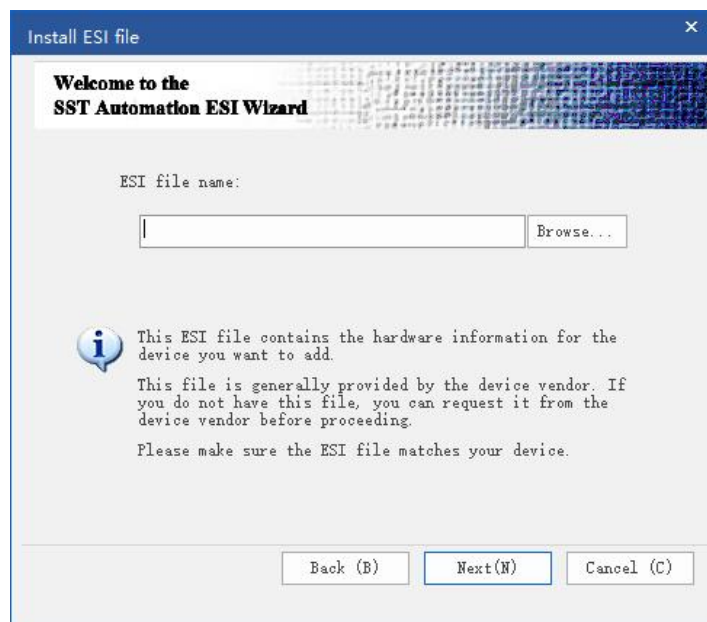
The functions from left to right are: New, Open, Save, Delete, Copy, Paste, Install ESI file, Find, Find Next,, Properties, Upload, Download, Scan, Save All, Stop Scan, Config, Send Message.

4.2.4 Install ESI file

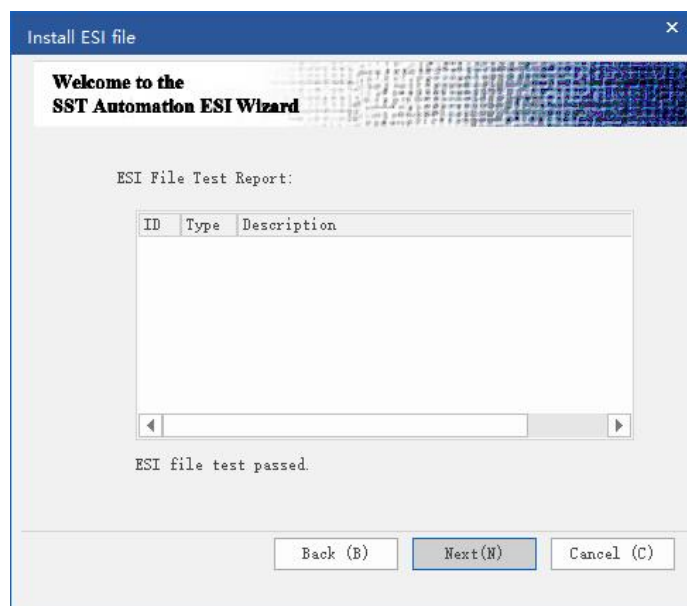
Users can configure different EtherCAT devices by registering new ESI files. To register a new ESI (*.xml) file, you can either select 'Tools' -> 'Install ESI file', click the 'Install ESI file' button in the toolbar, or right-click in the device management window and select 'Install ESI file'. The Install ESI file interface will then appear.



Select 'Start', and the following interface will appear:



In the pop-up window, select the path to the ESI file, as shown in the figure below:

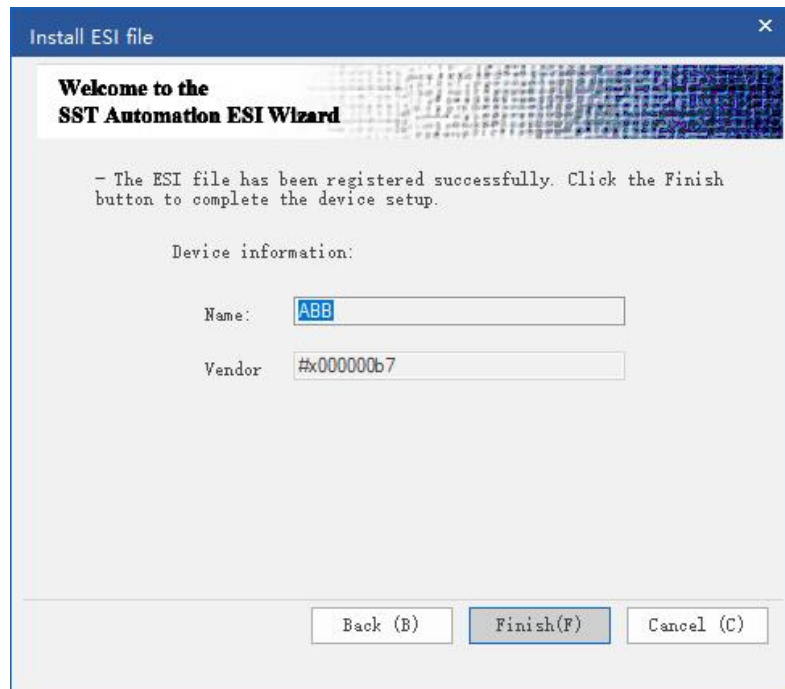


Click 'Next' to display the ESI file test report interface. If the ESI file contains errors, you will not be able to proceed. If no errors are found, click 'Next' to complete the ESI registration.

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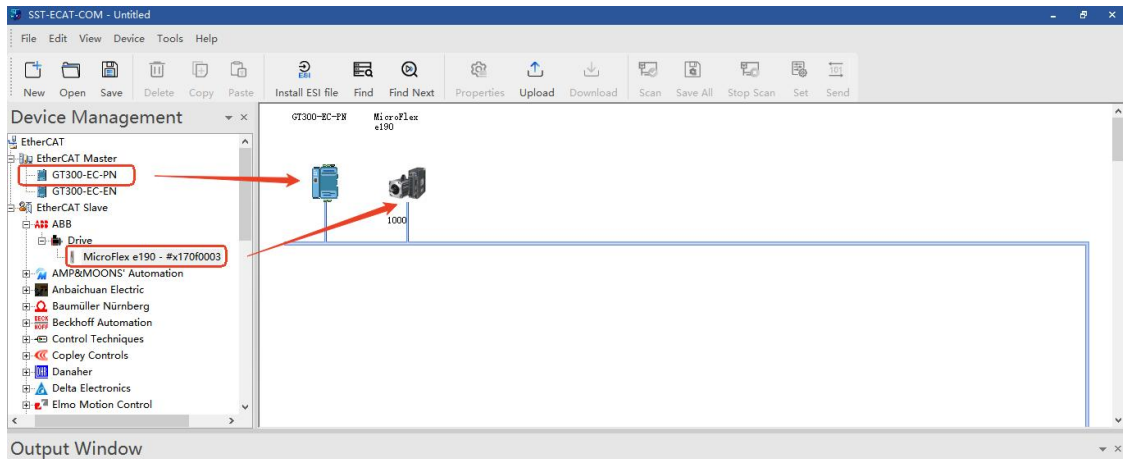
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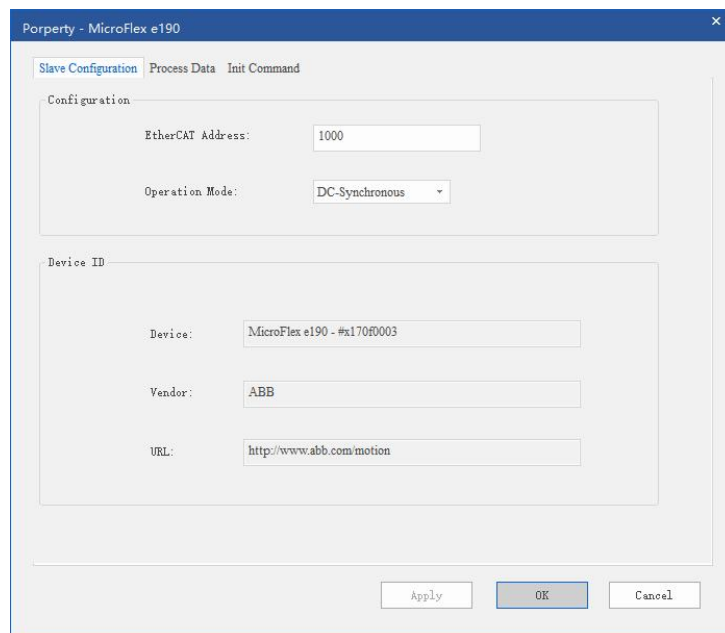
Once the registration is complete, the registered device will be visible in the device management window

4.2.5 EtherCAT Configuration

1. Drag the GT300-EC-PN gateway device and the required slave devices from the device management panel into the bus network on the right.



2. Double-click the slave device icon, browse the basic information of the slave in the 'Slave Configuration' window that appears, and select the synchronization mode according to the actual requirements.



EtherCAT Address: The address assigned to slave devices during EtherCAT address configuration.

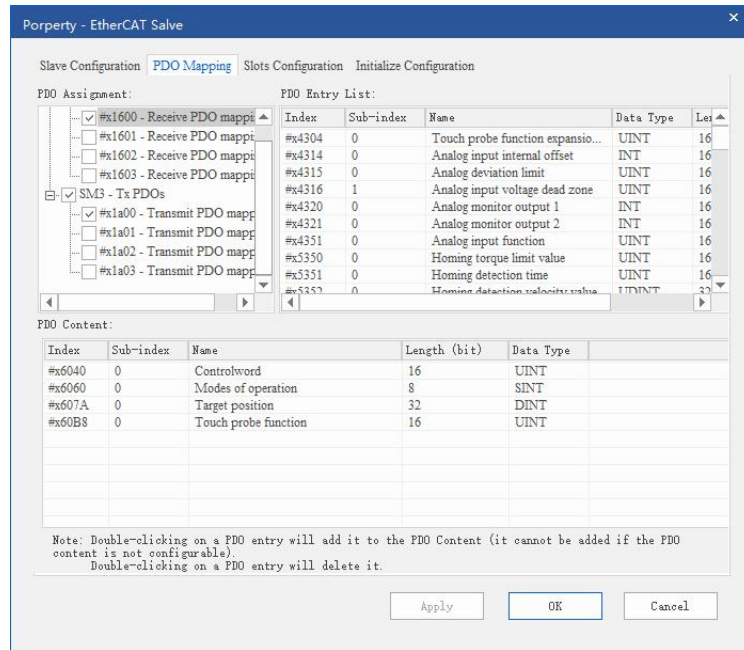
Operation Mode Selection: Available synchronization modes for EtherCAT slave operation:

DC-Synchronous: Triggered by distributed clock cycles.

SM-Synchronous: Triggered by read/write events.

FreeRun: Triggered by the slave's internal operating cycle.

3. In the 'PDO Mapping' interface, you can select the default PDO configuration from the ESI file. If the slave supports PDO mapping, you can add or remove mapping objects by double-clicking in the mappable object list and mapping area in the top-right corner. Once the configuration is complete, click the OK button in the bottom-right corner.



4. Double-click the master, and configure the gateway in the 'Master Configuration' interface. Set the IP address and device name, ensuring they match the IP address and device name in the GSDML file imported into the PLC. After making changes, click 'Apply Configuration' and select the gateway device to activate the settings. In the parameter settings, configure the EtherCAT master's data transmission cycle and specify whether the data on the PROFINET side is displayed in big-endian or little-endian format.

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Property - GT300-EC-PN

Master Configuration Device Allocation Manager PDO Mapping

Set IP Address and Device Name

IP Address: 192.168.0.88

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.0.8

Device Name: dut88

Change Configuration

Note: To apply any changes made to the Device IP / Device Name, please click [Change Configuration].

Parameter Settings

Set Cycle Time (ms): 5 (Range: 2-20)

PROFINET Parameter Display: Little Endian Display

Apply OK Cancel

Set Cycle Time (ms): Distributed clock cycle/EtherCAT data transmission cycle.

Default: 5ms, Range 2-20ms.

PROFINET Parameter Display: The format in which EtherCAT device data is shown on the PROFINET side.

When big-endian display is enabled, 2-byte data swaps its high and low bytes, and 4-byte data changes from “abcd” to “dcba”.

Device Search

IP Address	MAC Address	Device Name	Default Gateway	Subnet Mask
192.168.0.88	[blurred]	dut88	192.168.0.8	255.255.255.0

Select Refresh Cancel

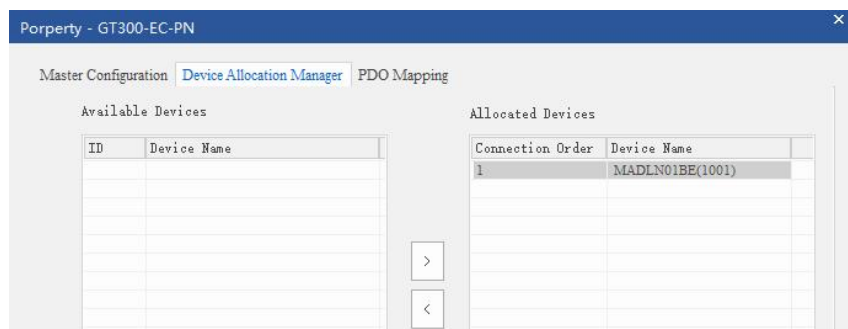
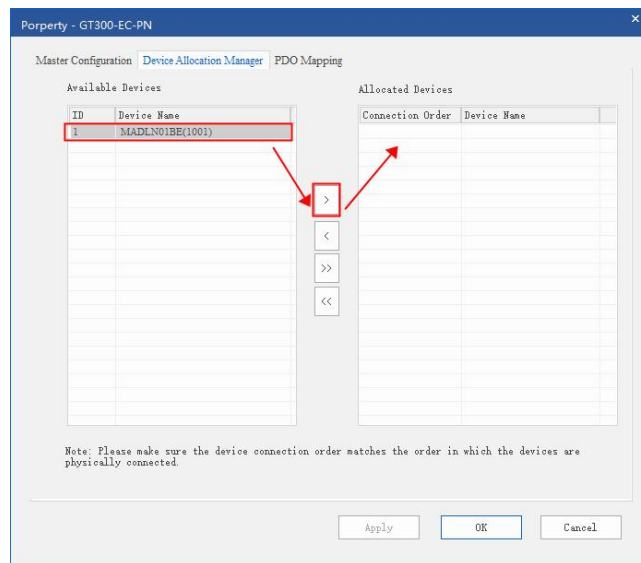
Searching [Progress Bar]

5. In the slave list, select the available slave devices and add them to the list. You can change the connection order between the slaves and the master by dragging. Be sure that the connection order in the configuration matches the actual physical connection order of the devices.

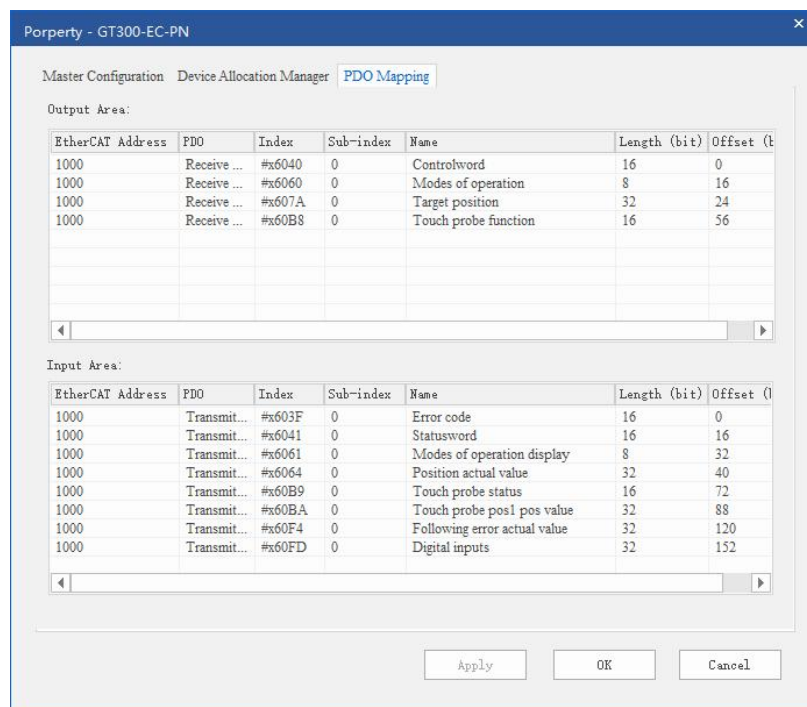
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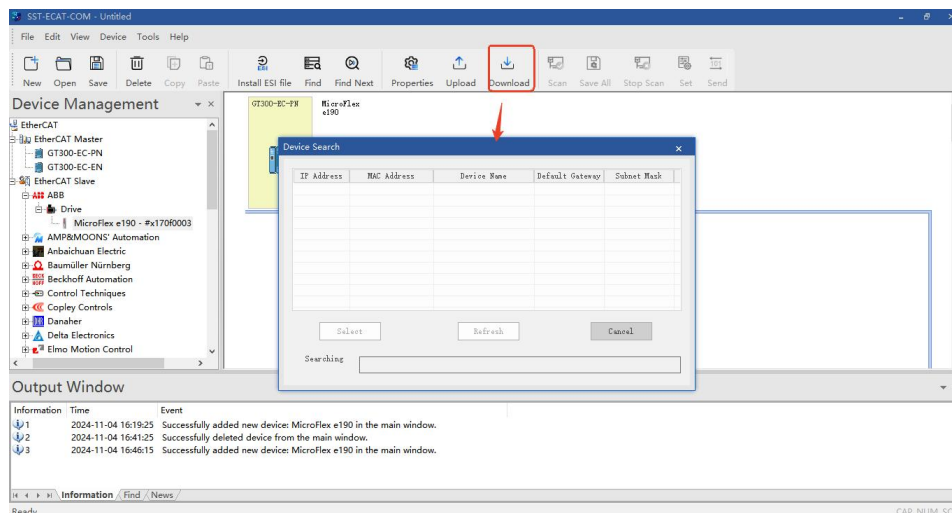


6. Click on PDO Mapping to view the offset and data length information for each object on the PROFINET side.



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7. Once the configuration is complete, click OK to download the settings to the gateway device. After the download is finished, restart the device to apply the configuration.

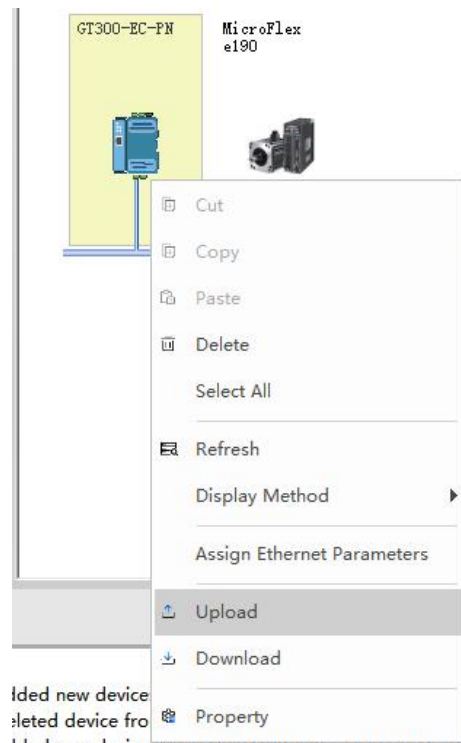


Note: After completing the EtherCAT software configuration, refer to Section 4.1 Quick Start Guide, parts 11 to 15, for the PROFINET configuration.

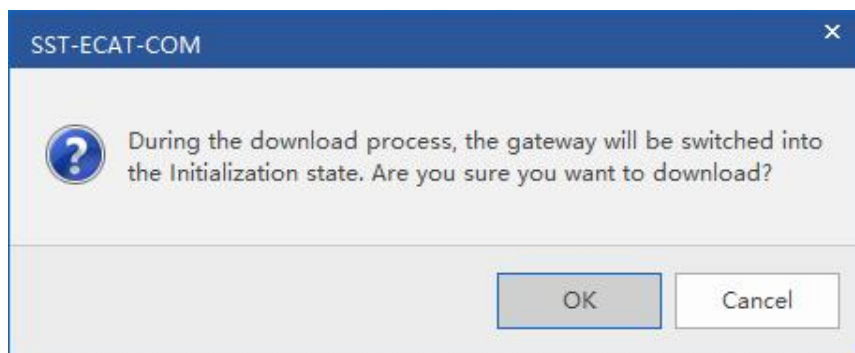
4.2.6 Upload/Download

Download Configuration:

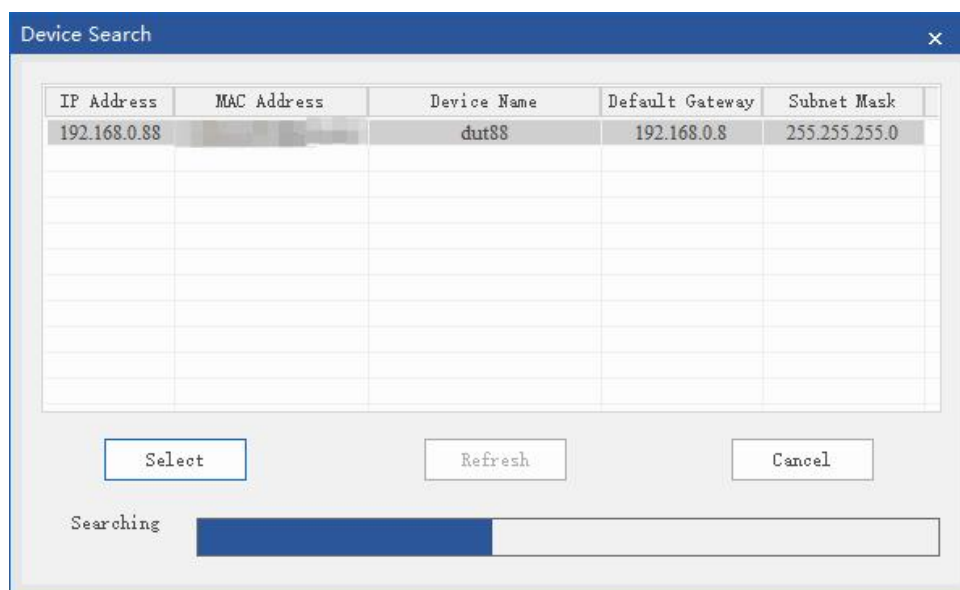
After completing the configuration, left-click the GT300-EC-PN icon and click 'Download', as shown in the figure below:



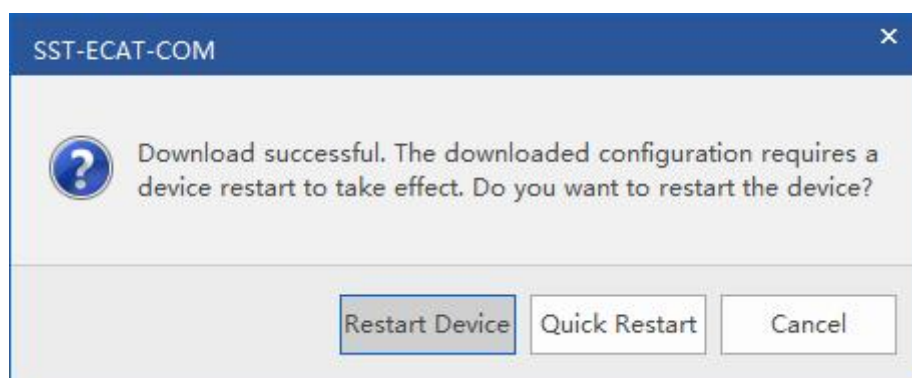
A dialog box will pop up; select 'OK'.



Select the detected gateway and click 'Select'.



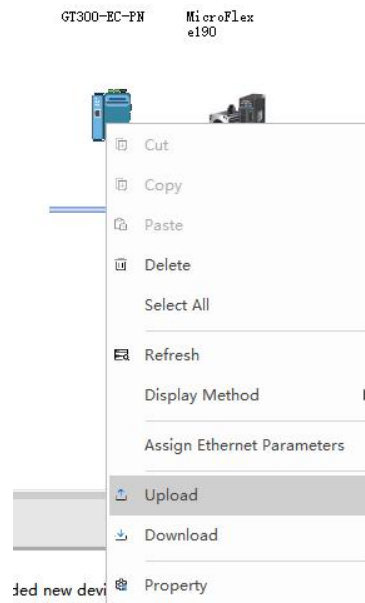
Once the download is successful, a 'Download Successful' dialog box will appear. Click 'Restart Device' or 'Quick Restart'. The gateway will reboot and function according to the new configuration.



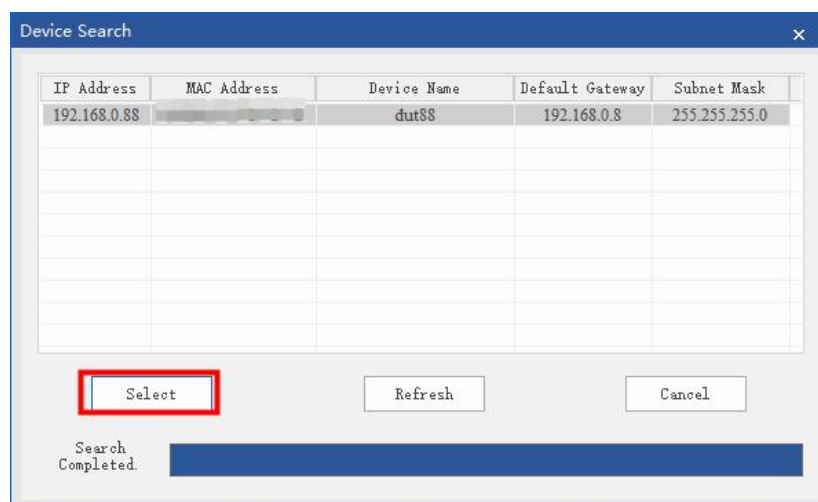
Upload Configuration:

Click the 'Upload' button, or right-click on a blank area in the 'Main Window' to open a dialog box, then select 'Upload'

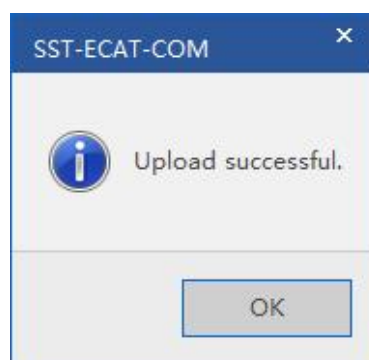
GT300-EC-PN EtherCAT/PROFINET Gateway User Manual



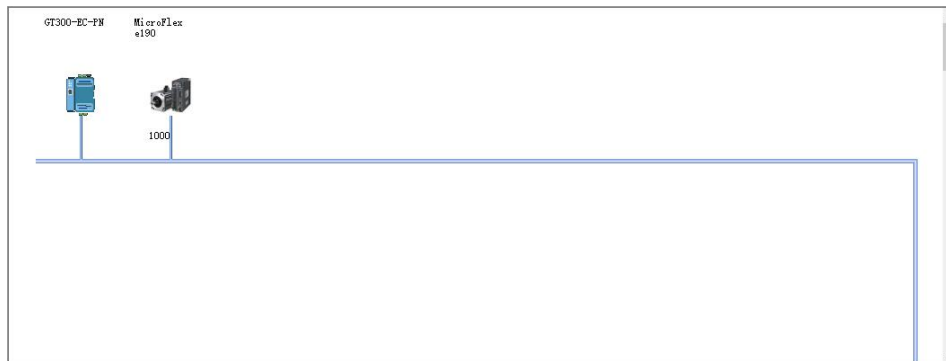
Select the detected gateway and click 'Select'



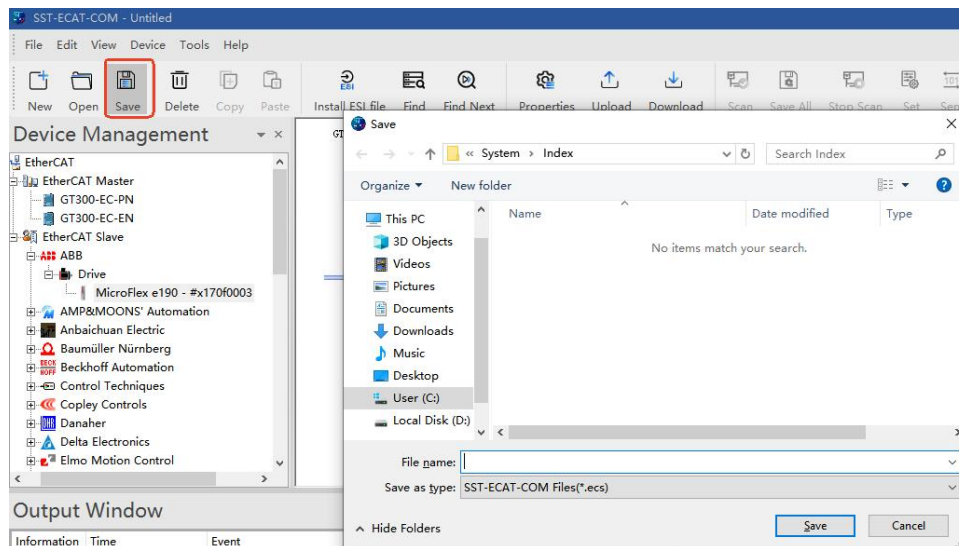
After the 'Upload Successful' dialog box appears, click OK, and the gateway configuration will be displayed in the blank area of SST-ECAT-COM.



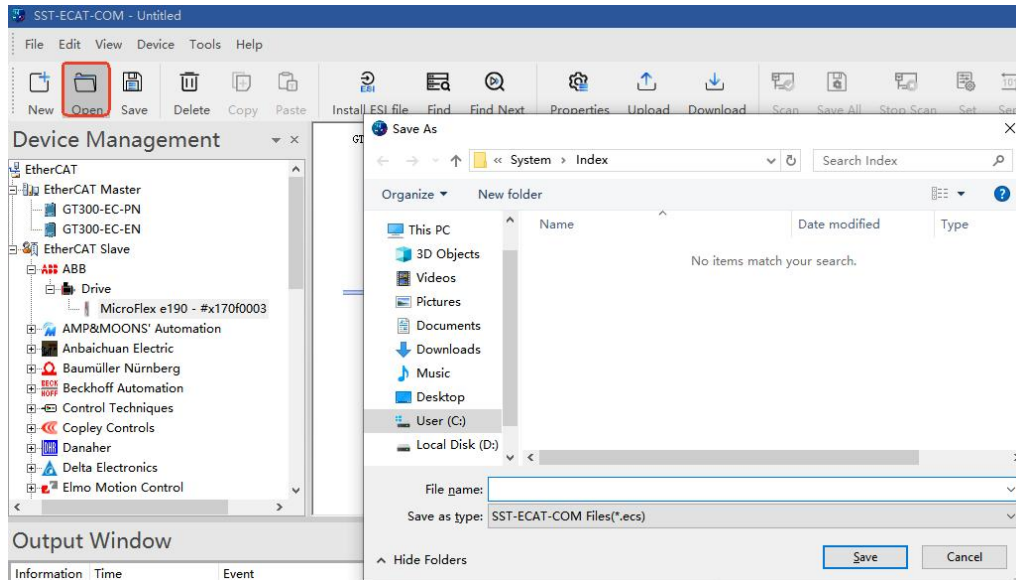
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4.2.7 Save Configuration



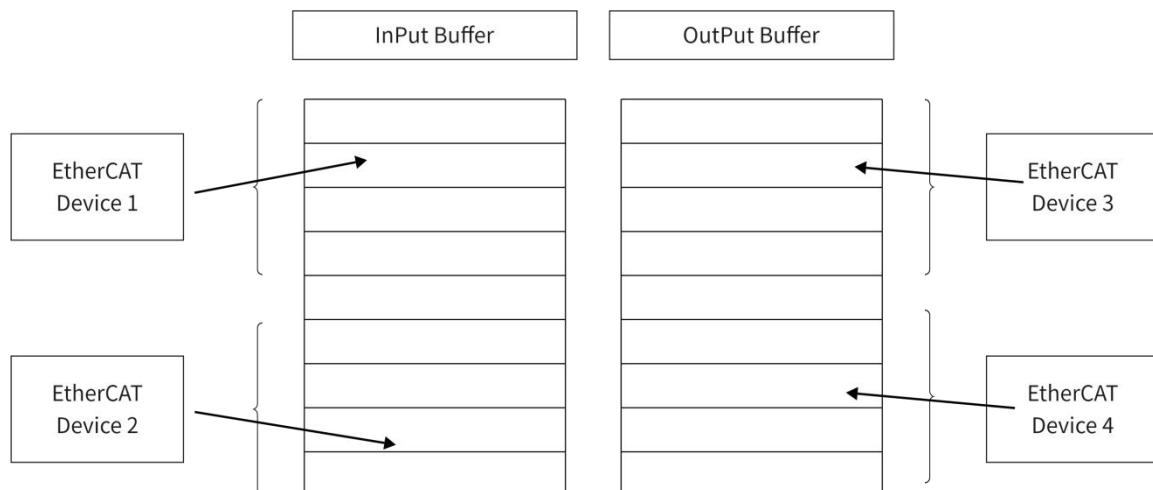
4.2.8 Load Configuration



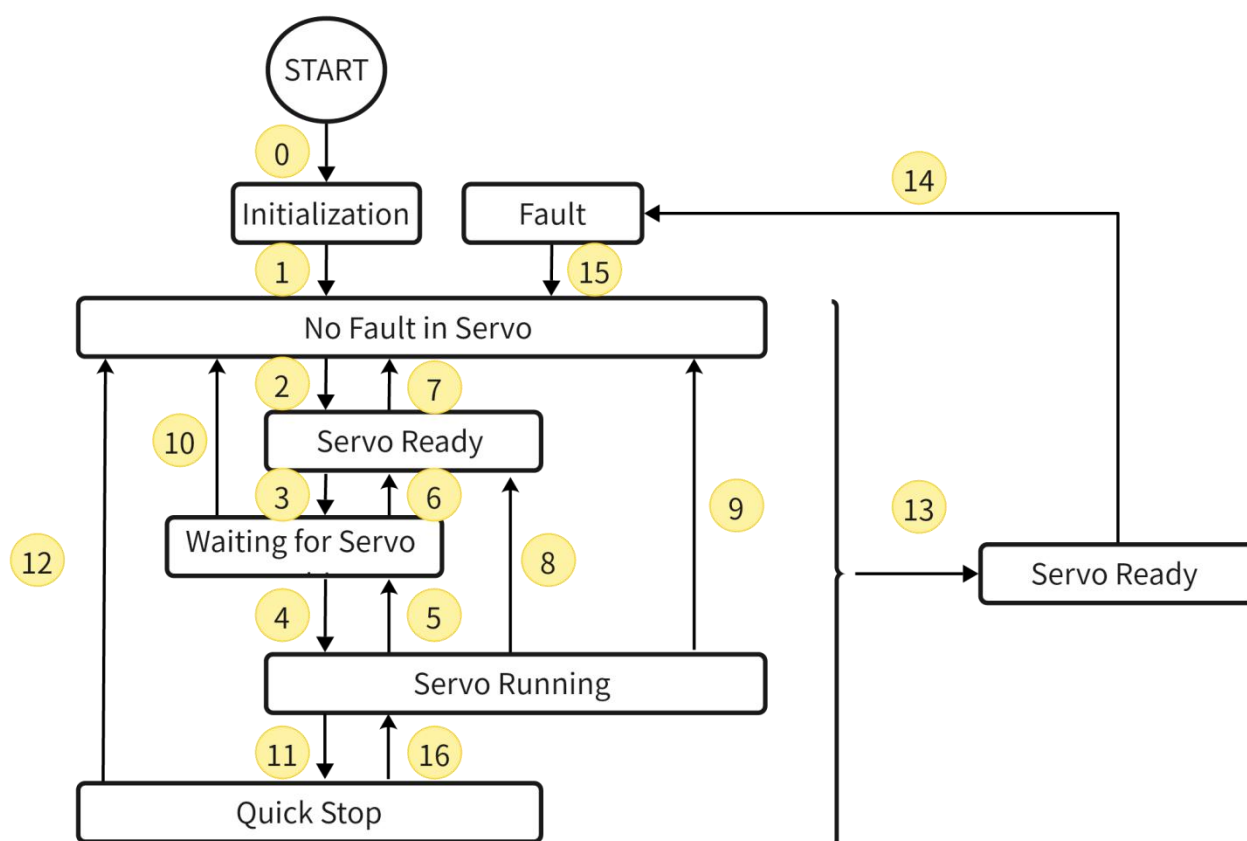
4.3 Operation

4.3.1 Gateway Operation Principle

Data conversion between EtherCAT and PROFINET in GT300-EC-PN is achieved through a 'mapping' relationship. GT300-EC-PN has two data buffers: one for network data input and another for network data output. The EtherCAT master transfers the read data into the network input buffer, where it can be accessed by the PROFINET master. The PROFINET master outputs data to the output buffer, which in turn sends process data to the corresponding EtherCAT devices.



Appendix 1: CiA 402 State Diagram



NO.	CiA402 State Transition	Control Word 6040H	Status Word 6041H bit0~bit9
0	Power on → Initialization	Natural transition, no control command needed	0x0000
1	Initialization → No servo fault	Natural transition, no control command needed	0x0250
		If an error occurs during initialization, directly enter state 13↴	
2	No servo fault → Servo ready	0x06	0x0231
3	Servo ready → Waiting to enable servo	0x07	0x0233
4	Waiting to enable servo → Servo running	0x0F	0x0237
5	Servo running → Waiting to	0x07	0x0233

	enable servo		
6	Waiting to turn on servo enable → Servo ready	0x06	0x0231
7	Servo ready → No servo fault	0x00	0x0250
8	Servo running → Servo ready	0x06	0x0231
9	Servo running → No servo fault	0x00	0x0250
10	Waiting to turn on servo enable → No servo fault	0x00	0x0250
11	Servo running → Rapid stop	0x02	0x0217
12	Rapid stop → No servo fault	Rapid stop mode, 605AH select 0-3. After the stop is completed, transition naturally, no control command needed	0x0250
13	In any state other than "Fault" → Fault stop	In any state other than "Fault," once the servo driver encounters a fault, it will automatically switch to the fault stop state, no control command needed	0x021F
14	Fault stop → Fault	After the fault stop is completed, transition naturally, no control command needed	0x0218
15	Fault → No servo fault	0x80, bit7 rise is valid; bit7 remains 1, other control commands are invalid	0x0250
16	Rapid stop → Servo running	Rapid stop mode, 605AH select 5~7, after the stop is completed, send 0x0F	0x0237



Appendix 2: Servo Control Mode

Mode	Control Mode 6060H
Profile Position Mode	1
Profile Velocity Mode	3
Profile Torque Mode	4
Homing Mode	6
Cyclic Synchronous Position Mode	8
Cyclic Synchronous Velocity Mode	9
Cyclic Synchronous Torque Mode	10