Modbus / CANopen Gateway

GT200-CO-RS

User Manual

V 4.0

Rev A

SST Automation

Important Information

Warning

The data and examples in this manual cannot be copied without authorization. SST Automation reserves the right to upgrade the product without notifying users.

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.

Copyright

Copyright © 2022 by SST Automation. All rights reserved.

Trademark

is the registered trade mark of SST Automation.

Technical Support Contact Information

www.sstautomation.com

www.sstcomm.com

E-mail: support@sstautomation.com

Catalog

SST⊕M

1 Product Overview

1.1 Product Function

GT200-CO-RS can act as two different communication gateways, that is:

(1) A communication gateway between CANopen master protocol and Modbus slave protocol, can establish connection between many CANopen slaves and Modbus master device.

(2) A communication gateway between Modbus master protocol and CANopen slave protocol, can establish connection between many Modbus slave devices and CANopen master device.

1.2 Product Feature

1.2.1 CANopen Master/Modbus Slave

- Easy to configure, just through USB port on PC;
- Acts as a master in CANopen network and a slave at Modbus side, the gateway can provide data communication between many CANopen slaves and a Modbus master;
- Supports CANopen DS301V4.02; Supports NMT, PDO, SDO, Heartbeat and Guardlife;
- Supports maximum 8-byte TPDO and RPDO, fast Download SDO and fast Upload SDO;
- Supports up to 128 CANopen commands;
- Function code of Modbus slave supports: 03H, 04H, 06H and 10H; Supports communication mode: RTU, ASCII;
- CANopen baud rate: 5K~1Mbps;
- Supports many CANopen slave node;
- Serial port baud rate: 1200~115200bps;
- Serial port supports: RS-232, RS-485, RS-422;
- Data exchange buffer is 1K; (512 bytes input and 512 bytes output)
- CAN port and RS-232 (RS-485/RS-422) can stand 1KV photoelectric isolation;
- Built-in terminal resistor switch;

1.2.2 CANopen Slave/Modbus Master

- Easy to configure just through USB port on PC;
- Acts as a slave in CANopen network and a master at Modbus side, the gateway can provide data communication between many Modbus slaves and a CANopen master;

- Supports CANopen DS301V4.02; Supports NMT, PDO, SDO, Heartbeat and Guardlife, The cycle for TPDO transmission and Timestamp;

- Acts as a CANopen slave, supports Pre-operational or Operational state optional after power-on;

- Acts as a CANopen slave, supports LSS function;

- Supports maximum 8-byte TPDO and RPDO, 4 bytes fast Download SDO and fast Upload SDO;

- Supports up to 64 TPDO, 64 RPDO and SDO for input/output data exchange buffer;

- Function code of Modbus master supports: 01H, 02H, 03H, 04H, 05H, 06H, 0FH and 10H; Supports communication mode: RTU, ASCII;

- CANopen baud rate: 5K~1Mbps;

- Supports many Modbus slave nodes;

- Serial port baud rate: 1200~115200bps;

- Serial port supports: RS-232, RS-485, RS-422;

- Data exchange buffer is 1K; (Input is 512 bytes and output is 512 bytes)

- CAN port and RS-232 (RS-485/RS-422) can stand 1KV photoelectric isolation;

- Built-in terminal resistor switch;

1.3 Technical Specifications

1.3.1 CANopen Master/Modbus Slave

- The gateway can achieve data communication between many CANopen slaves and Modbus master.

- CANopen master features:

  - CANopen supports DS301V4.02; Supports NMT, PDO, SDO, Heartbeat and Guardlife

  - CANopen interface supports: 5Kbps, 10Kbps, 20Kbps, 50Kbps, 100Kbps, 125Kbps, 250Kbps, 500Kbit/s and 1Mbps

  - CAN interface supports CAN2.0A protocol

  - Supports maximum 8 bytes TPDO and RPDO, fast Download SDO and fast Upload SDO;

  - TPDO and RPDO can use default COBID, or use user-defined COBID, default COBID:
    TPDO COBID: 384 + node address (0x180+node address) or 640 + node address (0x280+node address) or 896 + node address (0x380+node address) or1152 + node address (0x480+node address); Default value of RPDO: 512 + node address (0x200+node address) or 768 + node address (0x300+ node address) or 1024 + node address (0x400+ node address) or 1280 + node address (0x500+node address)

  - Supports TPDO, RPDO, SDO command numbers configuration, configure up to 128 commands (not limited to command numbers of one kind)

- Modbus slave features:

- ➢ Supports function code: 03H, 04H, 06H, 10H
- ➢ Supports communication mode: RTU and ASCII
- ➢ Supports RS-485 or RS-232 interface, half-duplex, bard rate: 1200~115200bps;
    (Supports baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
- ➢ Data bits: 8
- ➢ Parity: None, Odd and Even optional
- ➢ Stop bits: 1 and 2 optional
- Operating environment:
  - ➢ REL Humidity: 5% to 95% (non-condensing)
  - ➢ Working circumstance temperature: -4℉~140℉(-20℃ to 60℃)
  - ➢ Pollution level: class 3
- Power: 24VDC (11V~30V), maximum 60mA (24V)
- External dimensions (W*H*D): 0.98 in*3.94 in *3.54 in (25mm*100mm*90mm)
- Installation: 35mm DIN RAIL

1.3.2 CANopen Slave/Modbus Master

- The gateway can achieve data communication between many Modbus slaves and CANopen master.
- CANopen slave features:
  - ➢ CANopen supports DS301V4.02; Supports NMT, PDO, SDO, Heartbeat and Guardlife, The cycle for TPDO transmission and Timestamp;
  - ➢ CANopen interface supports: 5Kbps, 10Kbps, 20Kbps, 50Kbps, 100Kbps, 125Kbps, 250Kbps, 500Kbit/s and 1Mbps
  - ➢ CAN interface supports CAN2.0A protocol
  - ➢ Acts as a CANopen slave, supports Pre-operational or Operational state optional after power-on;
  - ➢ Acts as a CANopen slave, supports LSS function;
  - ➢ Supports maximum 8 bytes TPDO and RPDO, 4 bytes fast Download SDO and fast Upload SDO
  - ➢ TPDO and RPDO can use default COBID, or use user-defined COBID, default COBID:
    TPDO COBID: 384 + node address (0x180+node address) or 640 + node address (0x280+node address) or 896 + node address (0x380+node address) or1152 + node address (0x480+node address);
    Default value of RPDO: 512 + node address (0x200+node address) or 768 + node address (0x300+ node address) or 1024 + node address (0x400+ node address) or 1280 + node address (0x500+node address)
  - ➢ Supports at most 64 TPDO, 64 RPDO commands
- Modbus master features:
  - ➢ Function code of Modbus master supports: 01H, 02H, 03H, 04H, 05H, 06H, 0FH and 10H

- ➢ Supports communication mode: RTU, ASCII
- ➢ Write command output mode: Cycle, forbidden or change of value optional
- ➢ Modbus master can configure at most 48 commands
- ➢ Supports RS-485 or RS-232 interface, half-duplex, bard rate: 1200~115200bps;
  (Supports baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
- ➢ Data bits: 8
- ➢ Parity: None, Odd and Even optional
- ➢ Stop bits: 1 and 2 optional
- ● Operating environment:
  - ➢ REL Humidity: 5% to 95% (non-condensing)
  - ➢ Working circumstance temperature: -40℉~140℉(-40℃ to 60℃)
  - ➢ Pollution level: class 3
- ● Power: 24VDC (11V~30V), maximum 60mA (24V)
- ● External dimensions (W*H*D): 0.98 in*3.94 in *3.54 in (25mm*100mm*90mm)
- ● Installation: 35mm DIN RAIL

1.4 Attention

- ✧ To prevent stress, prevent module panel damage;
- ✧ To prevent bump, module may damage internal components;
- ✧ Power supply voltage control in the prospectus, within the scope of the requirements to burn module;
- ✧ To prevent water, water module will affect the normal work;
- ✧ Please check the wiring, before any wrong or short circuit.

1.5 Related Products

Related products include:

GT100-CO-RS, GT100-CA-MS485 and so on.

More information about these products, please visit: https://www.sstautomation.com.

1.6 Revision History

Revision	Date	Chapter	Description
V1.3	10/31/2017	ALL	New release
V2.2	11/13/2020	ALL	Revision for GT200-CO-RS V2.2
V4.0	8/30/2021	PART	Added LSS function
V4.0 Rev A	8/31/2021	PART	Updated software screenshot

2 Quick Start Guide

2.1 Hardware Wiring

1. According to Modbus ports description (refer to chapter 3.4), wire correctly.

2. According to CAN port description (refer to chapter 3.3), wire at least pin 2 and pin 4 correctly.

3. Check whether wiring comply with the manual description.

4. Power on the module, double click the button to let the module enter into configuration (CF) state, use SST-CM-CFG configuration software to configure GT200-CO-RS through USB port.

5. After configuration, restart the module to enter the run mode.

2.2 Software Installation

Double click the software application and install the software according to the instruction of SST-CM-CFG.

2.3 Quick Use of Software

1. Connect power with GT200-CO-RS, double click the button, the LED display will show "CF", that means the gateway is in the configuration state.

2. Connect GT200-CO-RS with PC through USB, open the software.

3. According to the configuration method of chapter 4, configure CAN and serial parameters.

4. Configure CANopen commands. (Refer to chapter 4)

5. Configure Modbus commands. (Refer to chapter 4)

6. Choose download configuration after configuring commands.

7. Double click the button again, the module will restart and the configuration will take affect.

8. Install the GT200-CO-RS on the DIN rail; use the gateway after powering on.

3 Hardware Installation

3.1 Mechanical Dimensions

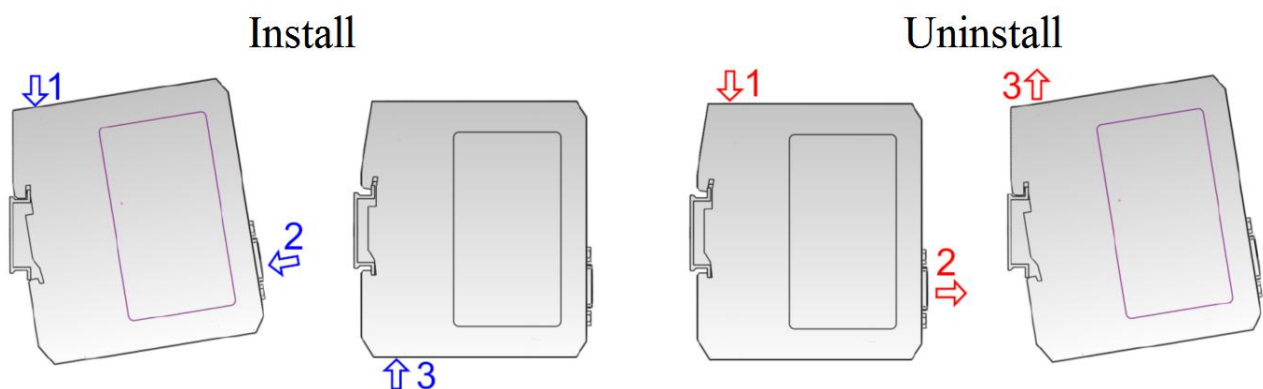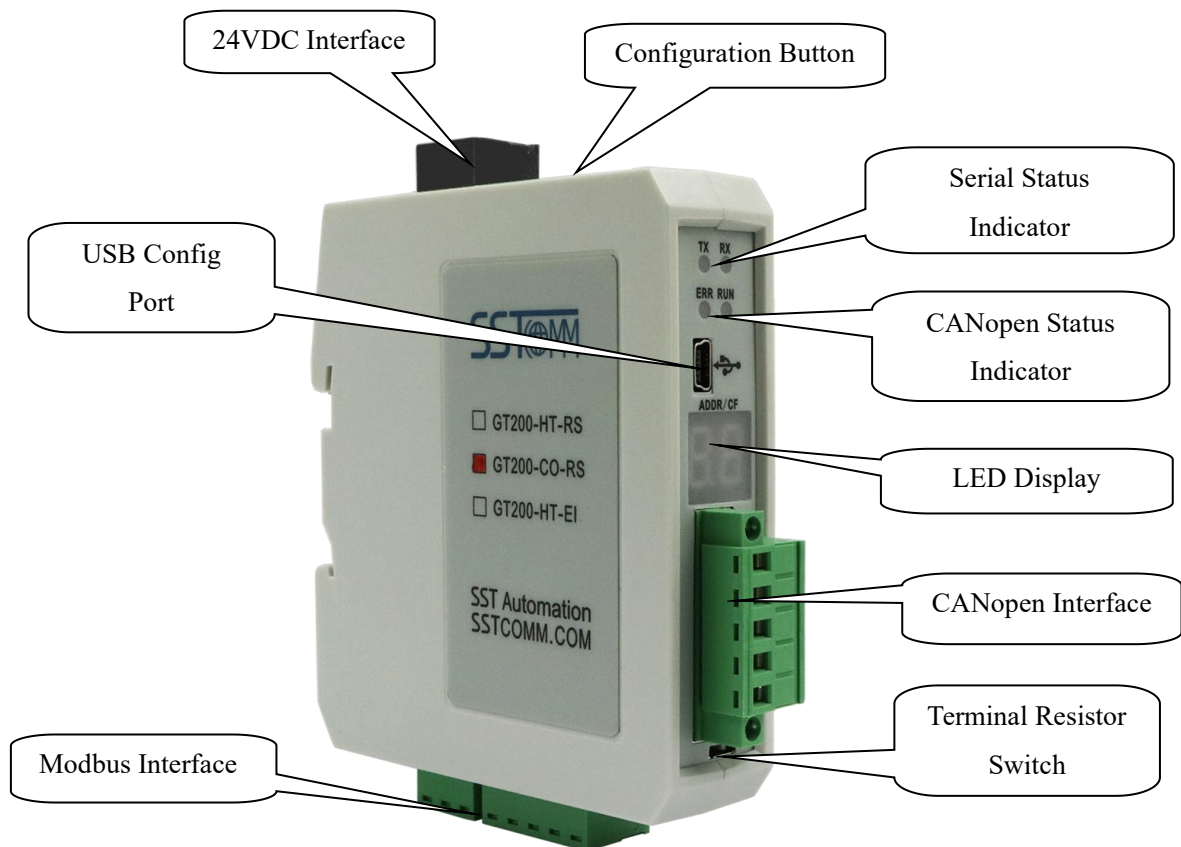**Size (width * height * depth):**

1.0 in * 4.0 in * 3.6 in (25 mm * 100 mm * 90 mm)
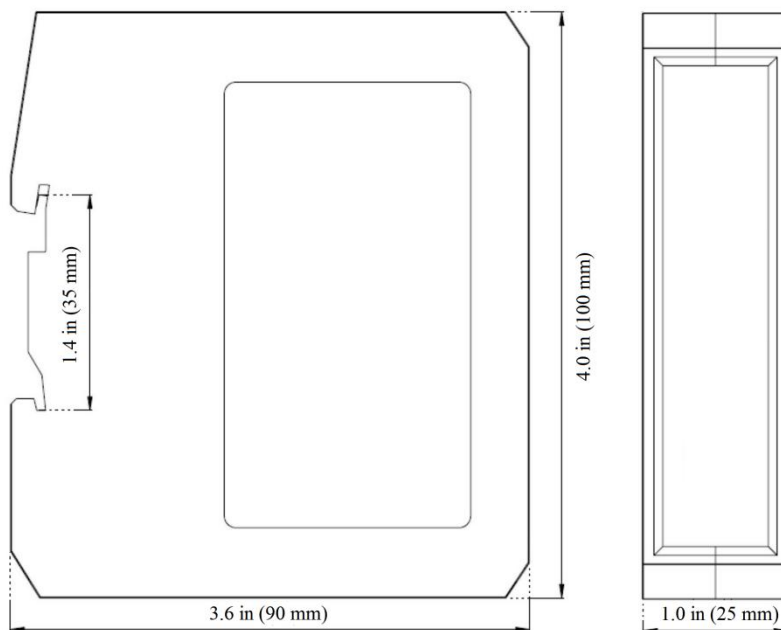
3.2 Installation Method

Using 1.4 in (35mm) DIN RAIL

# 4 Hardware Descriptions

4.1 Product Appearance

24VDC Interface

Configuration Button

Serial Status Indicator

USB Config Port

CANopen Status Indicator

LED Display

CANopen Interface

Terminal Resistor Switch

Modbus Interface

4.2 Indicators

Indicators		Status	Description
CANopen status	ERR	Red off	CAN network is normal
		Red on	CAN port error (baud rate error, Bus off, etc)
		Red blinking	The error counter of CAN controller reach or exceed alarm value
	RUN	Green on	Operation state
		Green light on every 200ms, off every 1000ms	Stop state
		Green light on every 200ms, off every 200ms	Preoperation state
serial status	TX	Green blinking	Serial port is sending data
		Green off	Serial port no connection or error
	RX	Green blinking	Serial port is receiving data
		Green off	Serial port no connection or error

4.3 LED Display

LED Display	Description
"01"~"99"	The slave address when the GT200-CO-RS acts as a CANopen slave or a Modbus slave.
CF	The GT200-CO-RS is in the configuration state.
Eo	CAN sending error.
"88" (blink once)	Restarting.

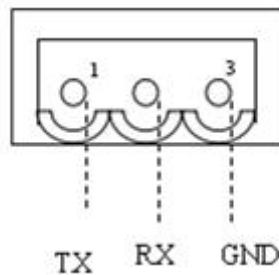## 4.4 CAN Interface Wiring

CAN interface of GT200-CO-RS uses 5-pin connector:
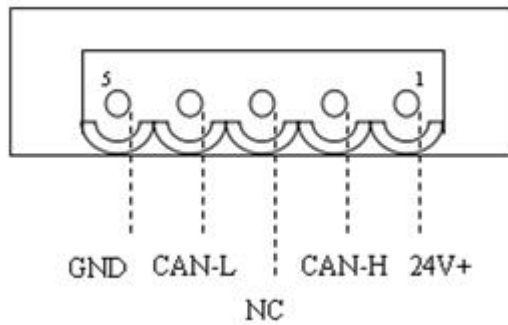
Note: Voltage between 24V+ and GND is 24V, power range is 11V~30V.

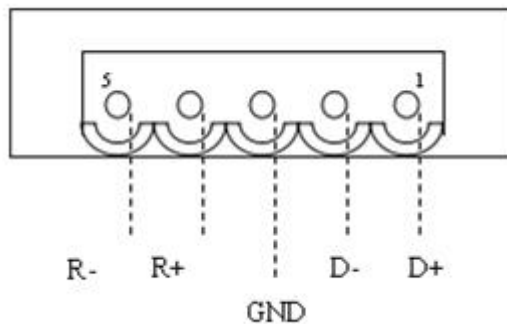## 4.5 Serial Interface

RS-232 interface:

Pin	Function
1	TX, Connect RS-232's RX of user device
2	RX, Connect RS-232's TX of user device
3	GND, Connect RS-232's GND of user device

RS-485/RS-422 interface:

Pin	Symbol	RS-485 Function	RS-422 Function
1	D+	Connect A+ of user device	Connect D+ of user device
2	D-	Connect B- of user device	Connect D- of user device
3	GND	Connect shielding ground (optional)	Connect shielding ground (optional)
4	R+	Reserved	Connect R+ of user device
5	R-	Reserved	Connect R- of user device

4.6 Power Interface
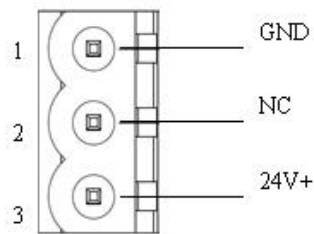
Pin	Function
1	GND
2	NC(Not Connected)
3	24V+, DC Positive 24V

4.7 Configuration Button

Double press the button to enter the configuration mode; the LED displays "CF", users can configure relevant communication parameters through configuration software.

Under configuration mode, double press the button, the gateway will keep the current configuration and restart after a while and enter the operation state.

5 Software Instructions

5.1 Notes before Configuration

SST-CM-CFG is based on Windows platforms, being used to configure parameters and commands of GT100-CO-RS and GT200-CO-RS. This manual tells the method of configuring the gateway GT200-CO-RS. Please read the manual carefully before using it.

Double-click the icon of the software, and you can see the "Select Device" interface of the software:

Select "GT200-CO-RS", and you will see the "Select Mode" interface, choose CANopen Slave/Modbus Master mode.
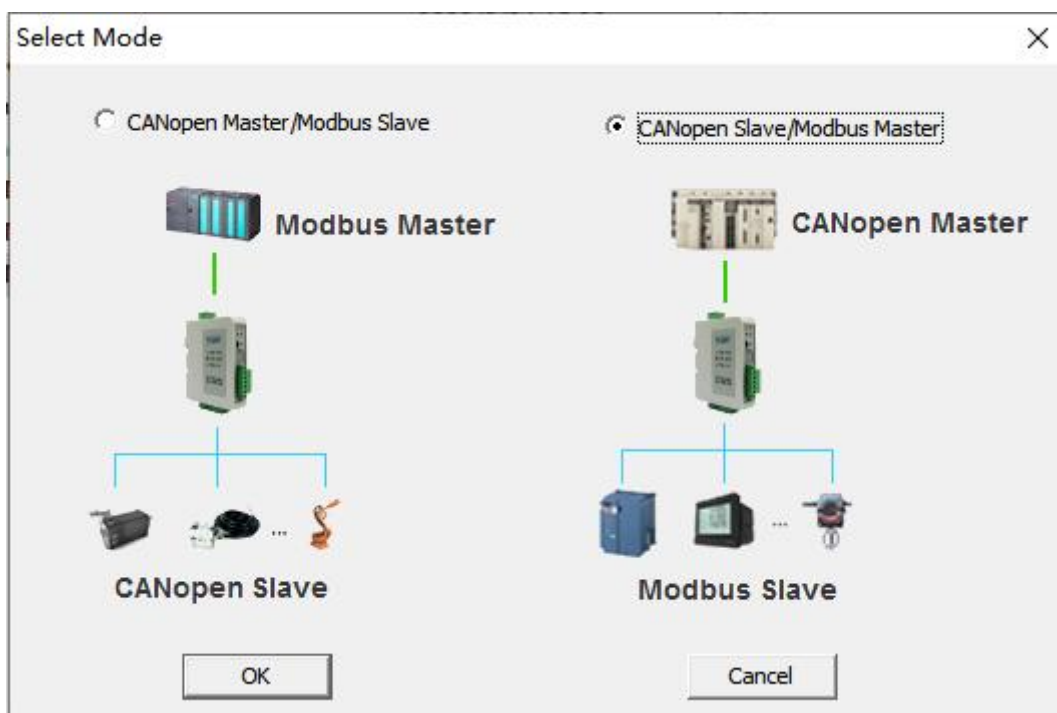
Select the mode you want, such as "CANopen Slave/Modbus Master", and you can see the main interface of the software:

5.2 User Interface

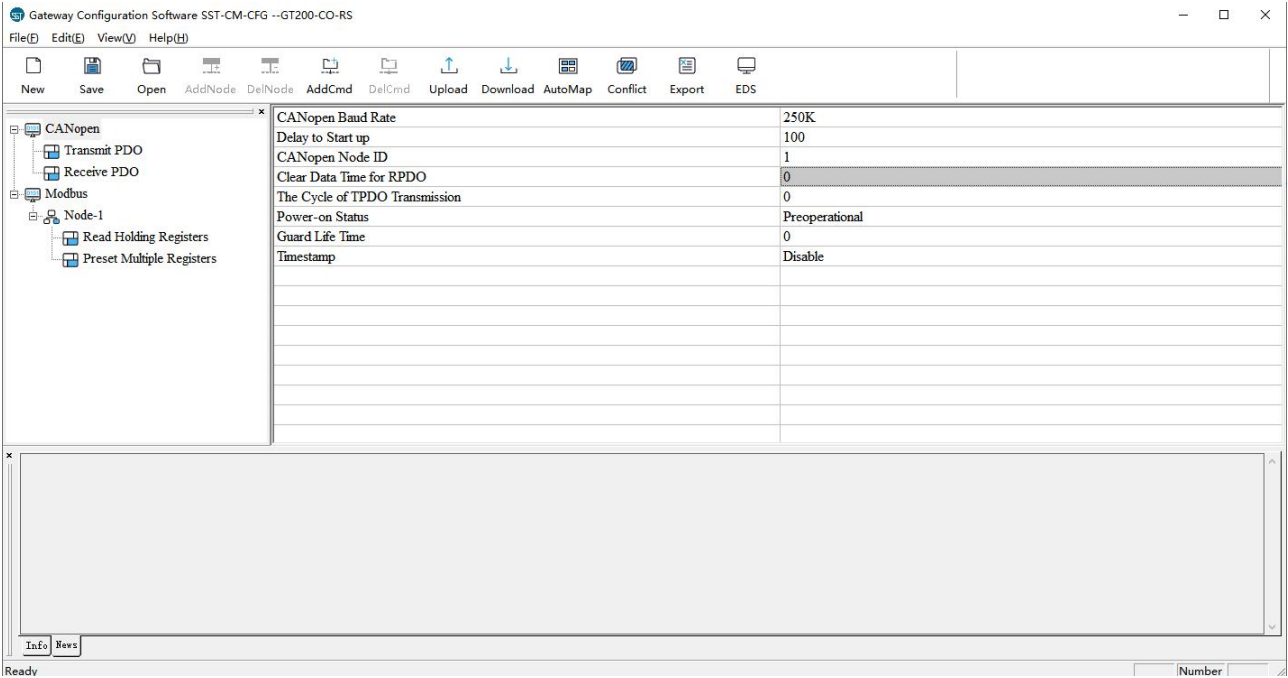Software interface include: Title bar, Menu bar, Toolbar, Tree View, Configuration Window and Contents.

Note: All the gray sections in the software cannot be changed.
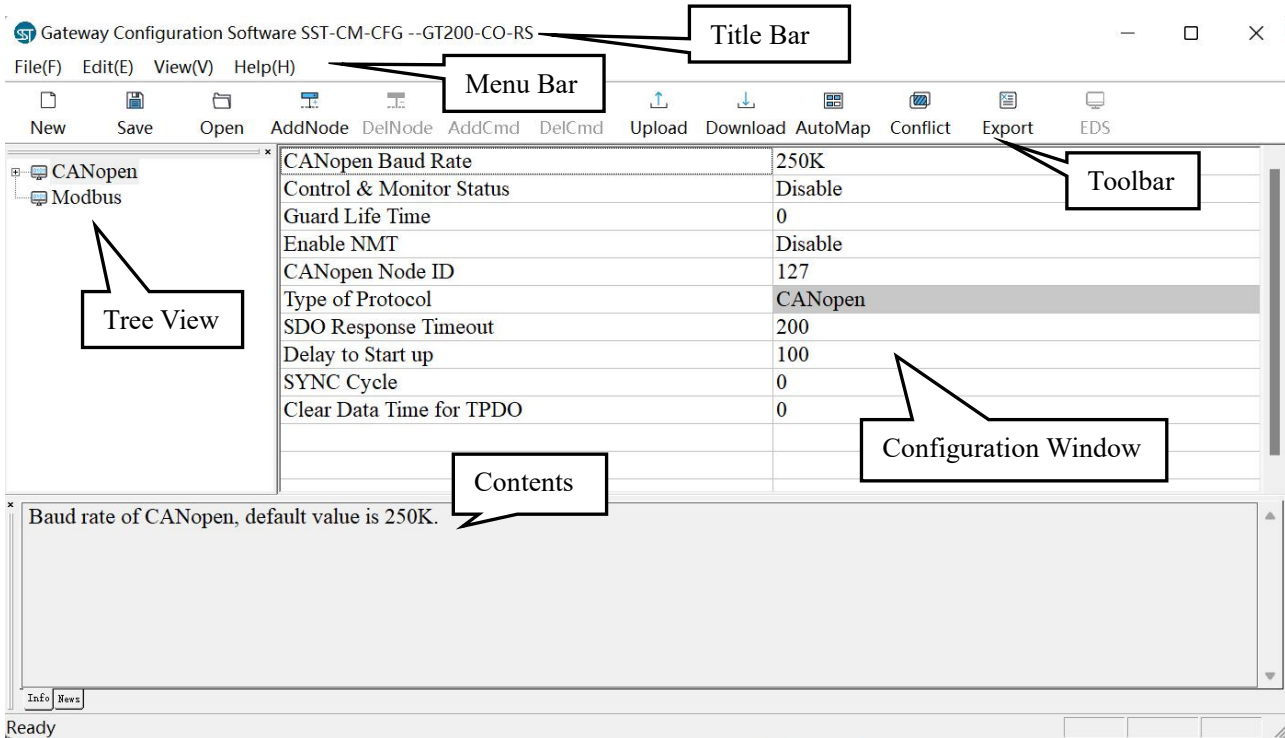
Toolbar:

The function of Toolbar: Add Node, Delete Node, Add Command, Delete Command, Upload Configuration, Download Configuration, Calculate Mapping Address, Export EXCEL and Export EDS file:

AddNode: Add a node for CANopen master.

DelNode: Delete a node for CANopen master.

AddCmd: Add a new command.

DelCmd: Delete commands.

Upload: Read the configuration from the module, and show them in the software.

Download: Download the configuration to module from the software.

Mapping: Calculate the mapping address in gateway memory of every command.

Export Excel: Export current configuration and save it in local disk and with ".xls" as its extension.

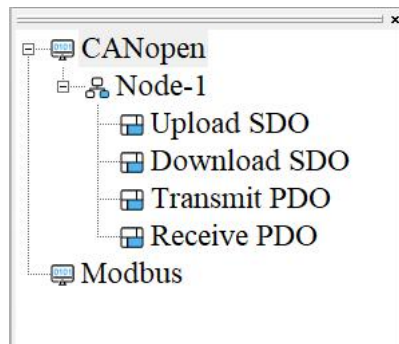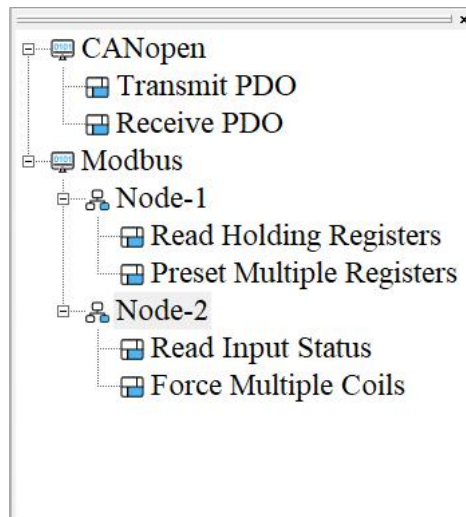EDS: Export current configuration and save it in local disk and with ".eds" as its extension.

5.3 Device View Operation

5.3.1 Device View Interface

CANopen Master/Modbus Slave mode:

CANopen Slave/Modbus Master mode:

5.3.2 Operation Mode

Support three kinds of modes of operation: edit menu bar, edit toolbar, and right-click edit menu.

Edit(E) View(V) Help(H)

Add Node(I)

Delete Node(S)

Add Command(A)

Delete Command(L)

Upload(U)

Download(D)

AutoMap(M)

Export EXCEL(E)

Create EDS File(G)

Conflict Detection

AddNode	DelNode	AddCmd	DelCmd	Upload	Download	AutoMap	Conflict	Export	EDS

CANopen

Modbus

Node-1

Add Node

Add Command

Delete Node

Delete Command
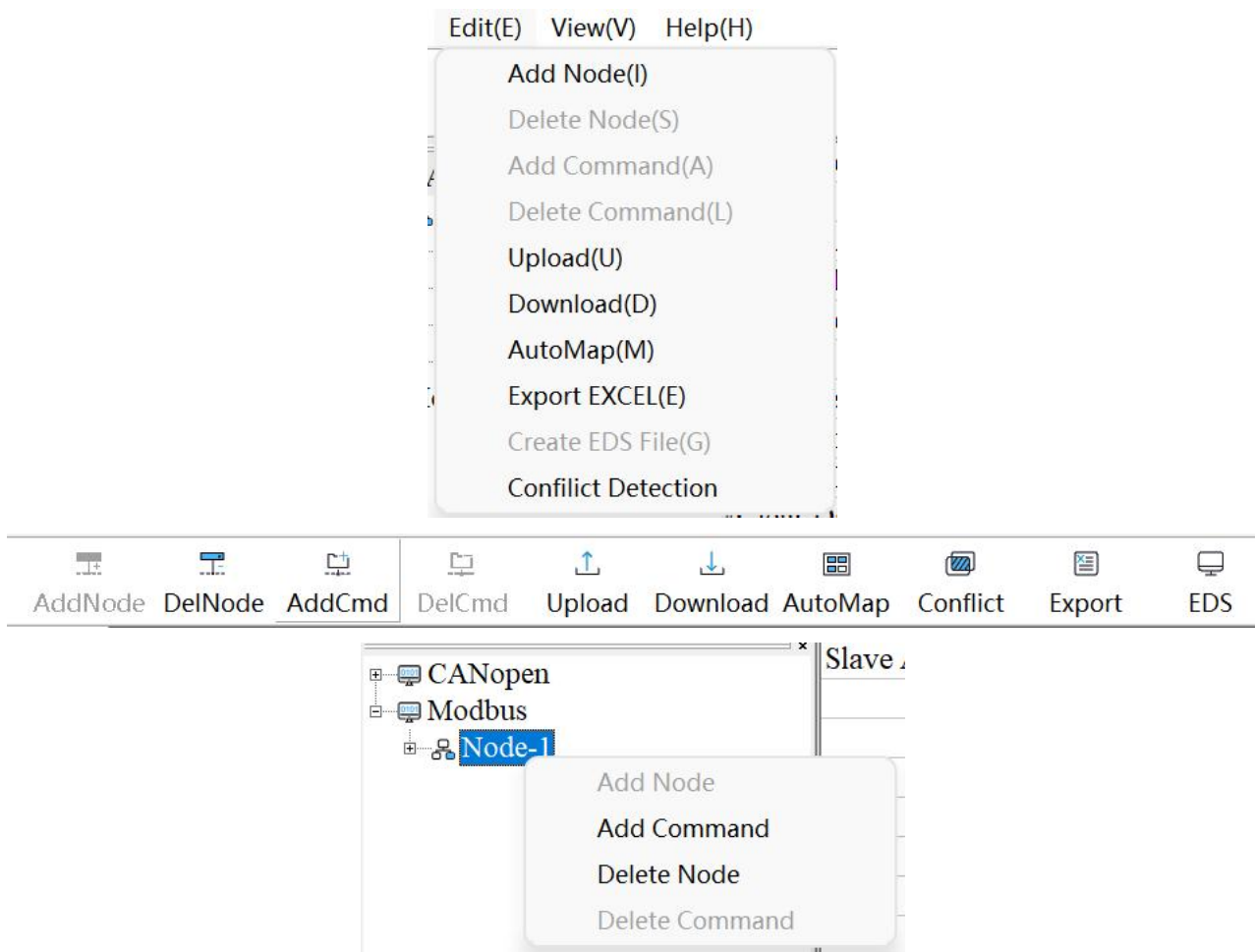
Slave

5.3.3 Operation Types

CANopen Master/Modbus Slave

1) Add node: Left click on CANopen Network, and then perform the operation of adding a new node. Then there is a new node named "Node-x" under CANopen.

2) Delete node: Left click on the node to be deleted, and then perform the operation of deleting node. The node and all commands will be deleted.

3) Add command: Left click on the node, and then perform the operation of adding command to add a command for the node. It will pop up the command selecting dialog box for users to choose. Shown as below:

Currently, it supports these commands: Upload SDO, Download SDO, Transmit PDO, Receive PDO

Select the command: Double click one command

Select Commands ✕

Upload SDO
Download SDO
Transmit PDO
Receive PDO

4) Delete command: Left click on the command you want to delete and then perform the operation of deleting the command.

CANopen Slave/Modbus Master

1) Add node: Left click on "Modbus" and then perform "Add Node" operation to add a new node in the subnet.

2) Delete node: Left click a node and you can delete the node and all its commands.

3) Add command: Left click a node or CANopen and you can add commands for the node or CANopen. You can see the Commands window which is shown as below:

Modbus supports function codes: 01, 02, 03, 04, 05, 06, 15, 16. CANopen support commands: Receive PDO, Transmit PDO.

Select commands: Double click a command to add.

Select Commands   ✕

01 Read Coil Status
02 Read Input Status
03 Read Holding Registers
04 Read Input Registers
05 Force Single Coil
06 Preset Single Register
15 Force Multiple Coils
16 Preset Multiple Registers

Select Commands   ✕

Transmit PDO
Receive PDO
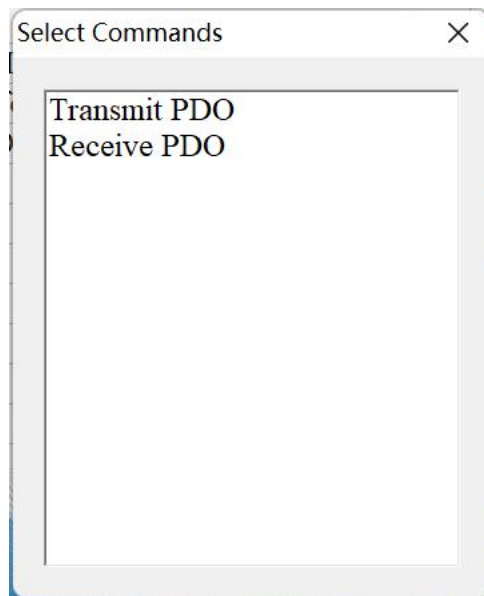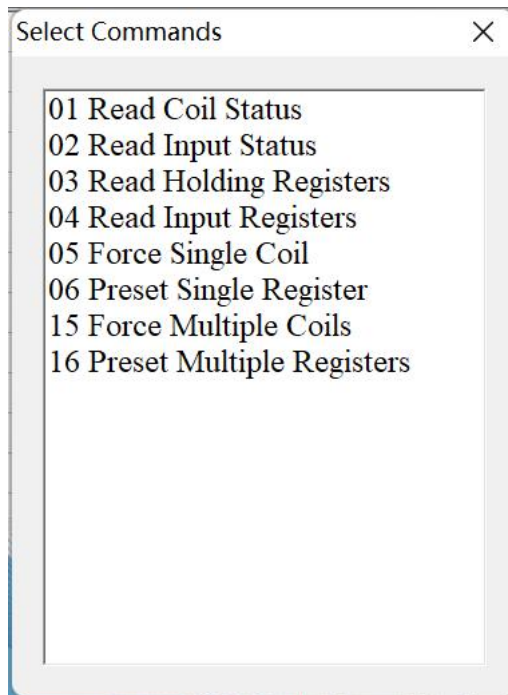
4) Delete commands: Left-click a command and you can delete it.

5.4 Configuration View Operation

5.4.1 CANopen Master/Modbus Slave

Modbus Configuration Interface

Left click on Modbus in Device Section, and you can see configuration section of Modbus network.

Configurable items:

Baud Rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200bps

Data Bits: 8

Check Bit: None, Even or Odd

Slave Address: 1~99, default value is 1

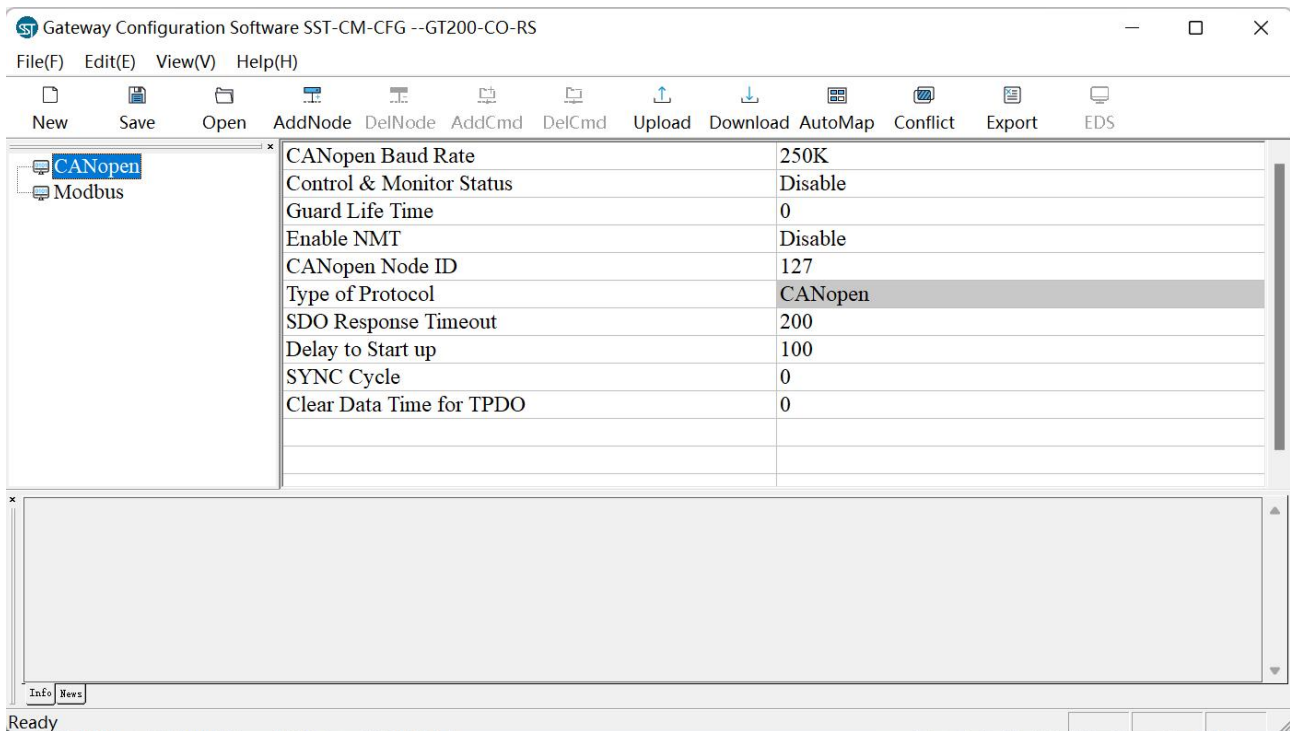**Stop Bits:** 1, 2

Transmission Mode: RTU or ASCII
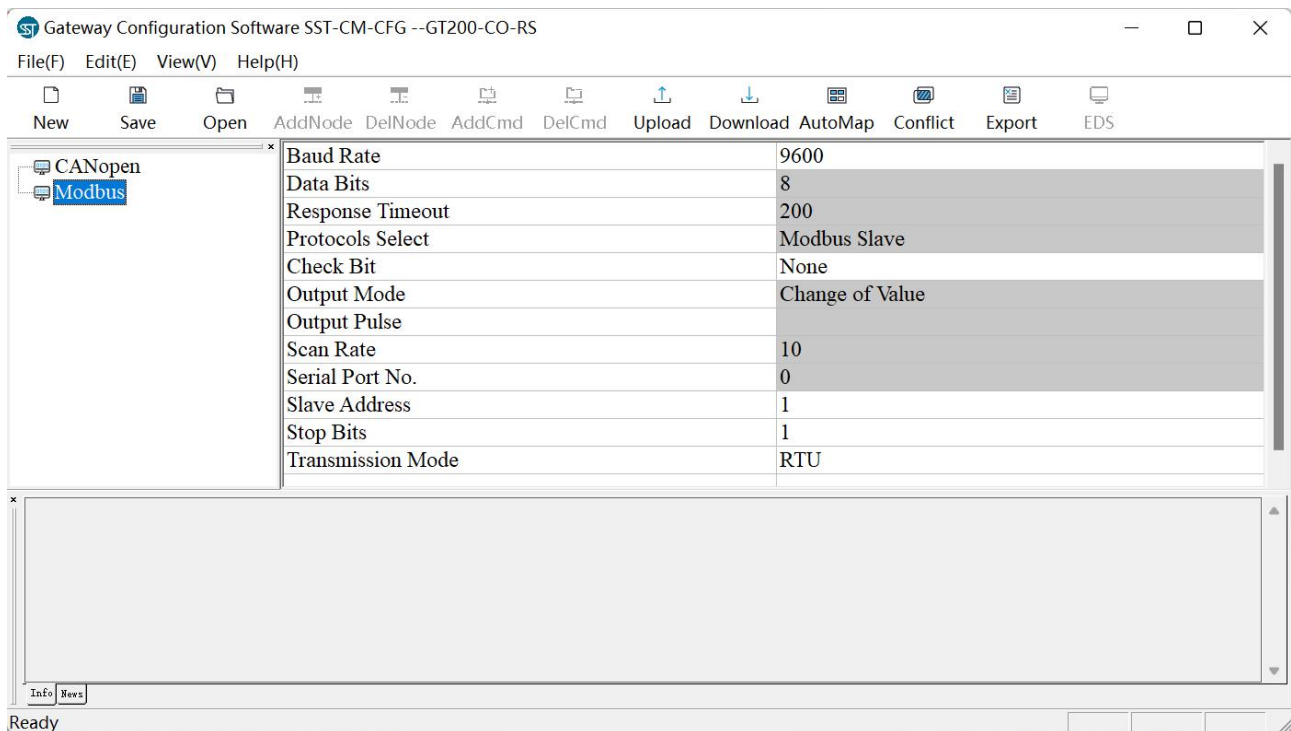
CANopen Configuration Interface

Configurable items:

CANopen Baud Rate, Control & Monitor Status, Guard Life Time, Enable NMT, CANopen Node ID, SDO Response Timeout, Delay to Start up, SYNC Cycle and Clear Data Time for TPDO.

CANopen configuration interface is shown as below:

CANopen Baud Rate: 5K, 10K, 20K, 50K, 100K, 125K, 250K, 500K and 1Mbps, default value is 250K.

Control& Monitor Status: When the Control & Monitor Status is set to be Enable, Modbus master station can read the states of CANopen slaves and also change the states of CANopen slave.

Guard Life Time: It uses Guard life when input value is non-zero, else use heartbeat. The default is 0, which adopts the heartbeat protocol (range from 0 to 2000).

Enable NMT: Whether to start all CANopen nodes on the network or not, the default is disable

CANopen Node ID: This parameters is the gateway's address as CANopen node. The range is 1 to127, the default value is 127.

SDO Response Timeout: This parameter is based on 10 milliseconds. The range of the parameter value is 1 to 2000. Default value is 200.

Delay to Start up: Delay value

0: Do not use the function;

Nonzero value: Use the function, and delay value is nonzero integral multiple of 10 milliseconds, the range is 0 to 2000, the default is 100. When the value of "Enable NMT" is "Enable", the parameter is valid.

SYNC Cycle: Synchronizing cycle

0: Do not use synchronizing cycle function;

Nonzero value: Use the function, and the synchronizing cycle is nonzero integral multiple of 10 milliseconds, the range is 1 to 2000, the default is 0.

Clear Data Time for TPDO:

0: Do not use this function;

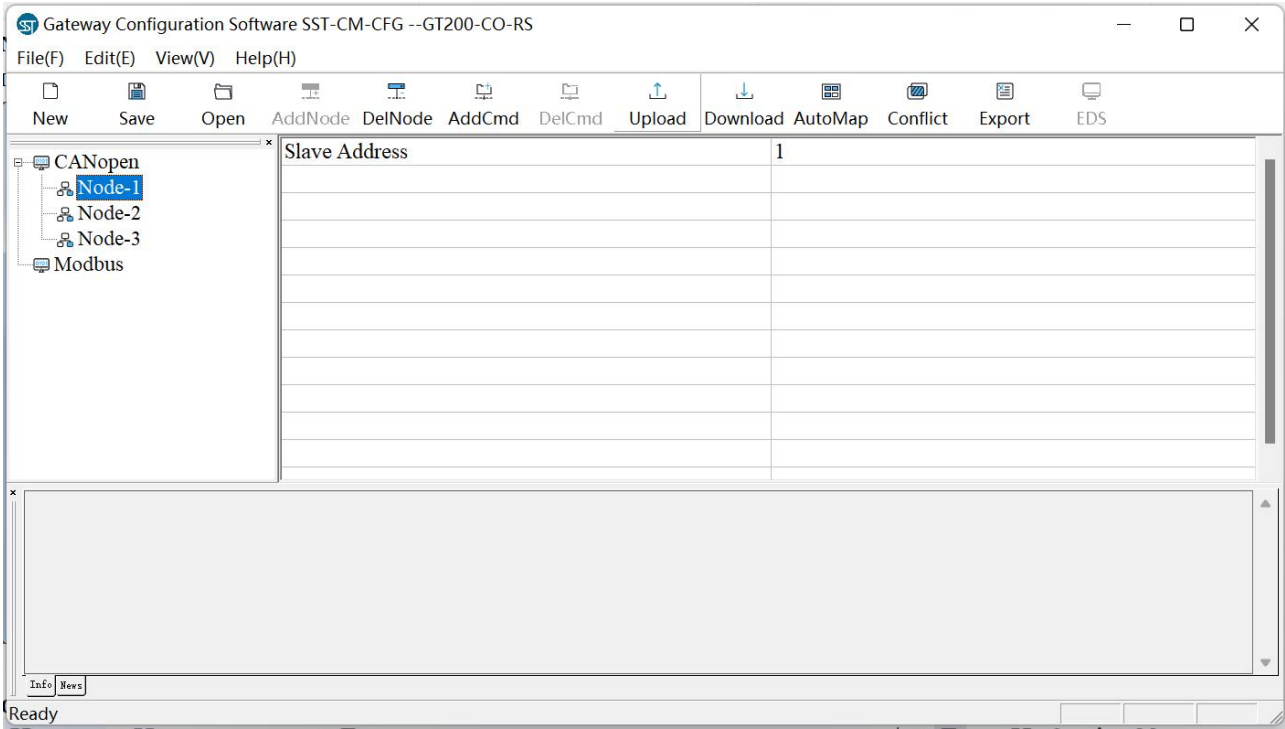Nonzero value: Use this function, and the time is nonzero integral multiple of 10 milliseconds, range is 0~2000, default value is 0.
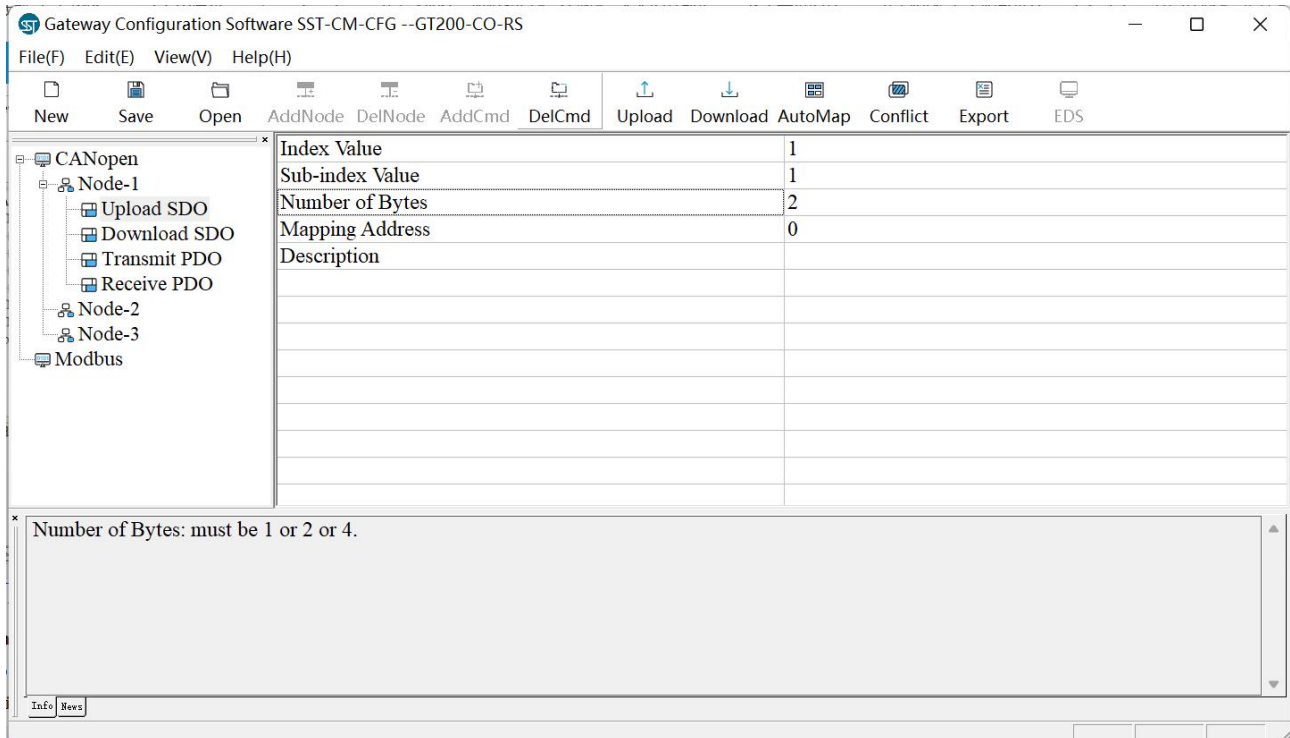
Node Configuration

In the device interface, left click on the new node and then the configuration interface is shown as below:

Command Configuration

In the device interface, left click on a command and then the configuration interface is shown as below:

Index value: Object index value in object dictionary (decimal)

Sub-index value: Object sub-index value in object dictionary (decimal)

Number of Bytes: Number of bytes of mapping item

Mapping address: Memory address mapped in the gateway (Read only)

COB-ID: The CAN ID (decimal) of CANopen PDO:

Default value of Transmit PDO command: 384(0x180) + node ID or 640(0x280) + node ID or 896 (0x380) + node ID or 1152(0x480) + node ID

Default value of Receive PDO: 512(0x200) + node ID or 768(0x300) + node ID or 1024 (0x400) + node ID or 1280 (0x500) + node ID

Comment interface shows the instruction of configuration items. When the configuration item is "COB-ID" in Receive PDO command, the comment section is shown as below:
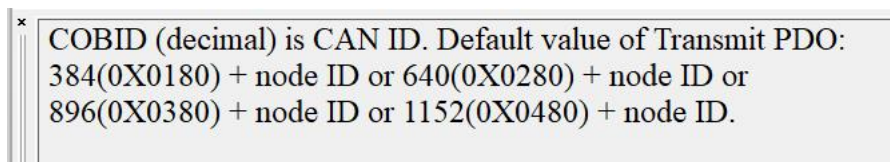
5.4.2 CANopen Slave/Modbus Master

Modbus Configuration Interface

Left click on Modbus in Device Section, and you can see configuration section of Modbus network.

Configurable items:

Baud Rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200bps optional.

Response Timeout: After the gateway sends request, it waits the Modbus slave's response for max time which is in 10ms.The range of the parameter value is 30 to 6000.

Delay between Polls: Delay between polls means delay between a response has been received and sending next request. The range of the parameter value is 0 to 250 in units of millisecond.
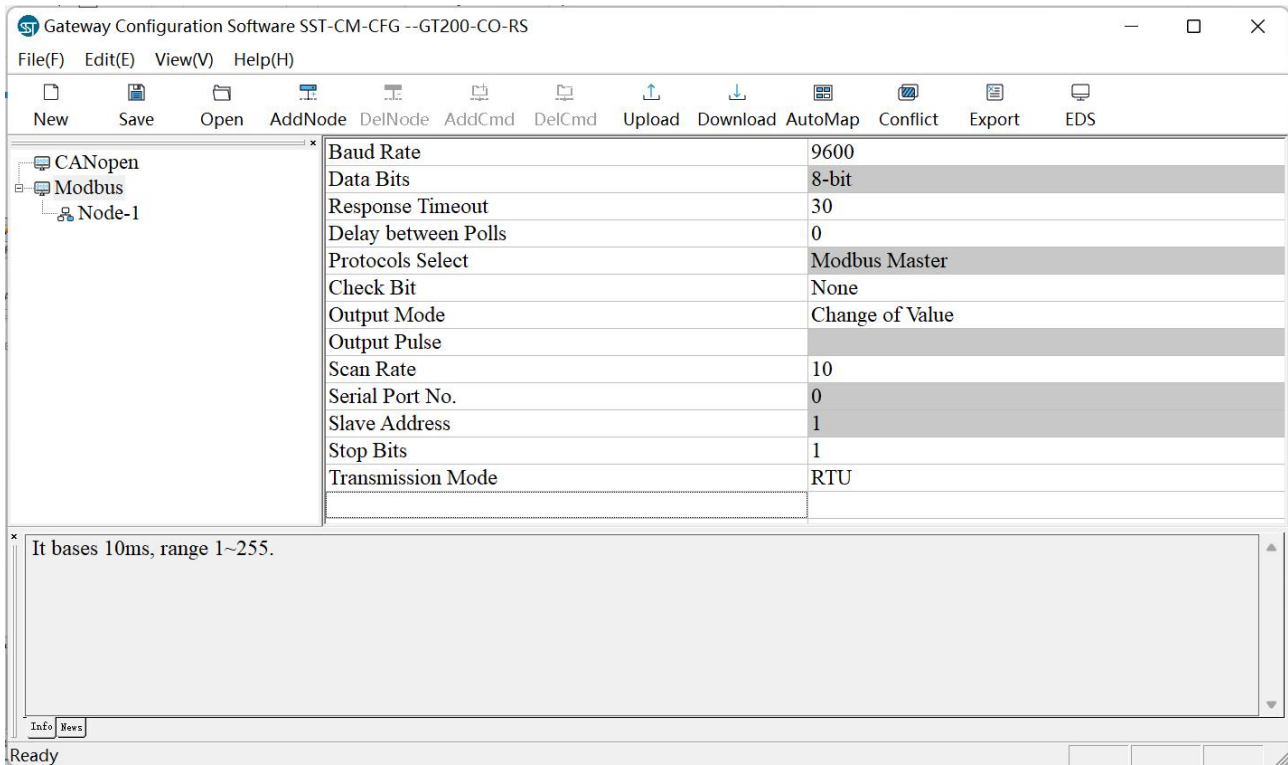
Check bit: None, Even or Odd.

Output Mode:

There are three types of output mode:

Cycle: The write commands will be sent periodically;

Forbidden: The gateway will not send write commands;

Change of Value: When the output data change, the write commands will be sent.

Scan Rate: Scan Rate is ratio of fast scan to slow scan. Every Modbus command can be set to fast scan or slow scan. If this parameter value is set to 10 then every fast scan command will be sent 10 times and those slow commands will be sent once. The range of the parameter is 1 to 255.

Stop Bits: Number of stop bits, 1 or 2.

Transmission Mode: Modbus has two transmission modes, Modbus RTU and Modbus ASCII.
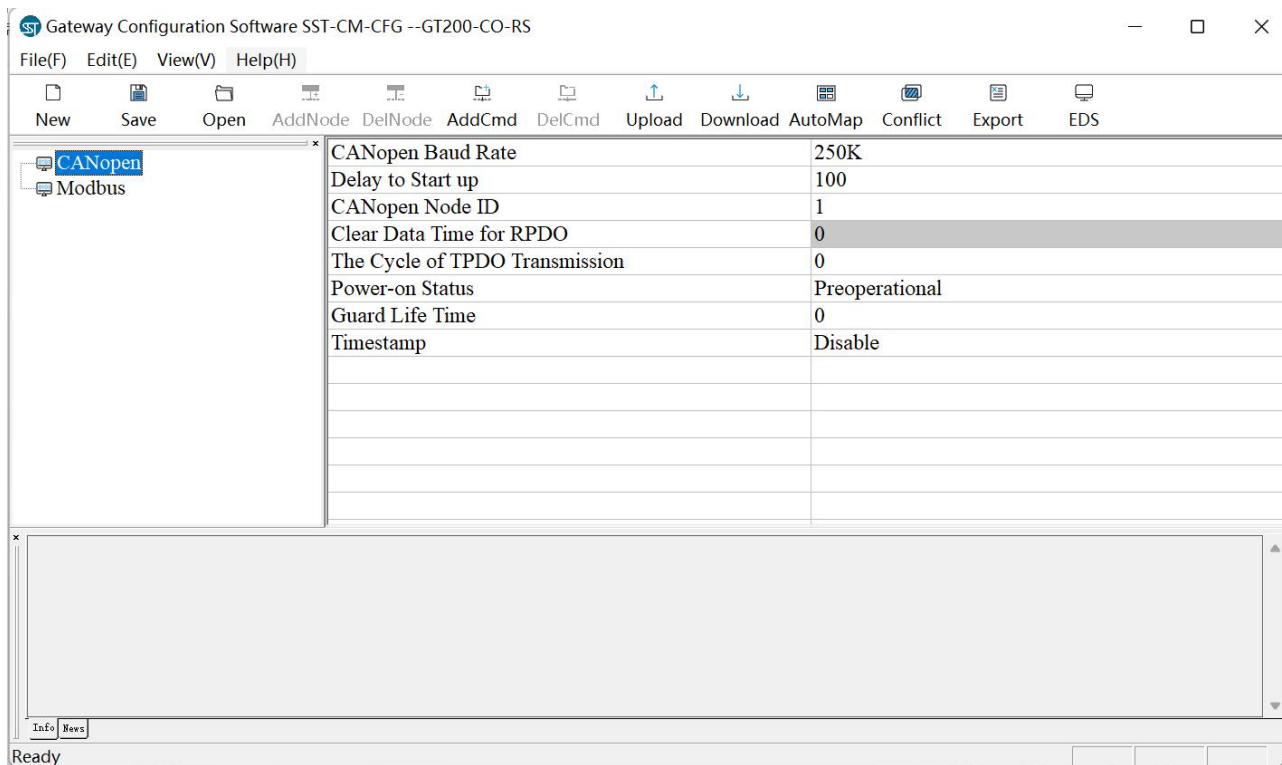

CANopen Configuration Interface

Configurable items:

CANopen Baud Rate, Delay to Start up, CANopen Node ID, The Cycle for TPDO Transmission, Guard Life Time, Timestamp.

CANopen configuration interface is shown as below:

CANopen Baud Rate: 5K, 10K, 20K, 50K, 100K, 125K, 250K, 500K and 1Mbps optional, default value is 250K.

Delay to Start up: Delay to Start up, this parameter is based on 10ms. The gateway will send bootup message after a period of time. The range of the parameter value is 0 to 200. Default value is 100.

CANopen Node ID: This parameter is the gateway's address as CANopen slave node. The range of the parameter value is 1 to 99. Default value is 1.

The Cycle of TPDO Transmission: The gateway has two modes for TPDO Transmission, one is Change of Value, and the other is Cycle. If the parameter is non-zero the gateway will send TPDO according to the parameter value. This parameter is based on 10ms. The range of the parameter value is 0 to 60000. Default value is 0.

Power-on Status: The status when the gateway powers on. Notes: The gateways of version V2.2 or lower do not support this function and are always at Preoperation status after power on.
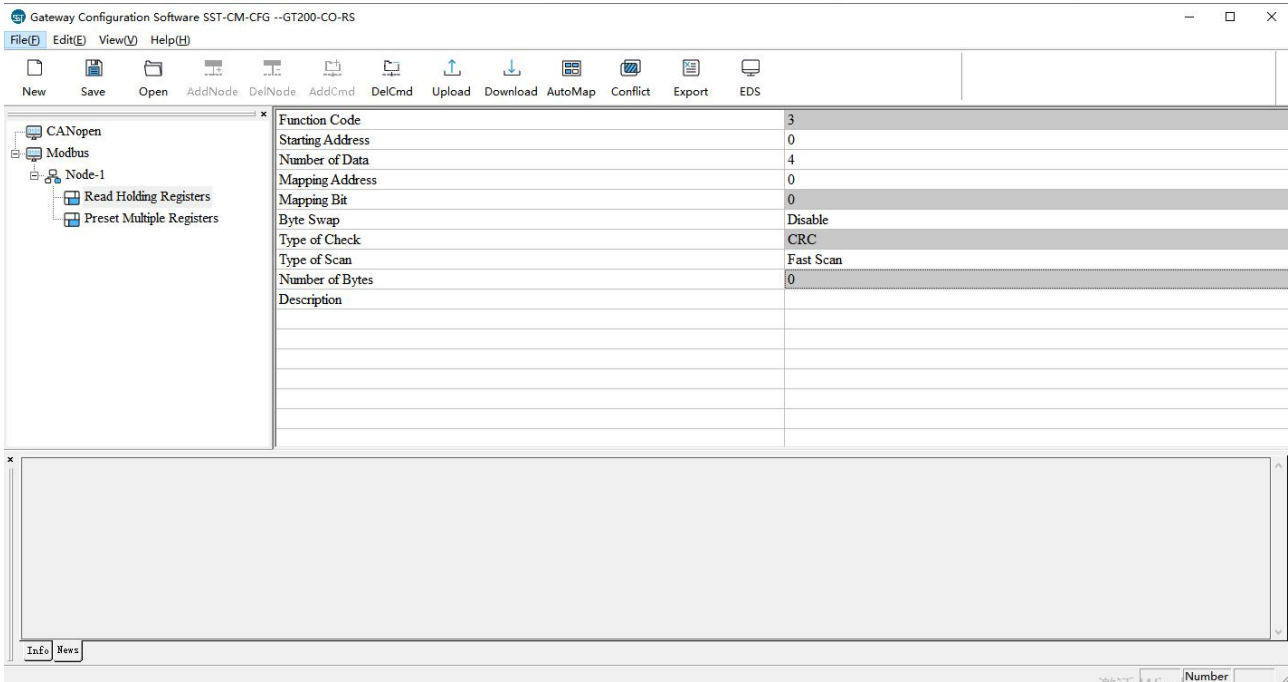
Guard Life Time: It uses Guard life when input value is non-zero, else use heartbeat. The default is 0, which adopts the heartbeat protocol. (range from 0 to 60000)

Timestamp: Disable or Enable, the default is Disable.

Node Configuration

In the device interface, left click on a node and then the configuration interface is shown as below:

Command Configuration

In the device interface, left click on a command and then the configuration interface is shown as below:

Configurable items:

Starting Address: the starting address of the register/switching value/coil in Modbus salve device. The range of the parameter value is 0 to 65535.

Notes: This item of SST-CM-CFG indicates protocol address. When users input PLC address, this needs to converted and fill in the blanks, PLC address range: 1~65535.

Here is the example of PLC address and corresponding protocol address.

Command	PLC address	Corresponding protocol address
Coil Status	00001~00010	00000~00009
Input Status	10001~10010	00000~00009
Holding Register	40001~40010	00000~00009
Input Register	30001~30010	00000~00009

PLC address and protocol address corresponding relations:

PLC address range: (4) 00001 -- (4) 65535

Protocol address range: 00000 -- 65535

PLC address = (4) Protocol address + 00001

Number of Data: Number of Data (Register or coils), when the Modbus function code is 3,4,or 16, the range is 1 to 127; when the Modbus function code is 1,2, or 15, the range is 1 to 2000; Others must be 1.

Mapping Address: There are two buffers in the gateway, one is input buffer and the other is output buffer. Here the mapping address refer to the two buffers' address, it bases zero.

Byte Swap: Enable or Disable

Type of Scan: Every Modbus command can be set to fast scan or slow scan. The gateway will send Modbus command according to the Scan Rate. Scan Rate is ratio of fast scan to slow scan.

Description: The description of this command.

After configuring Modbus commands, it is suggested using "Mapping" tool.

The following is configuring CANopen commands:
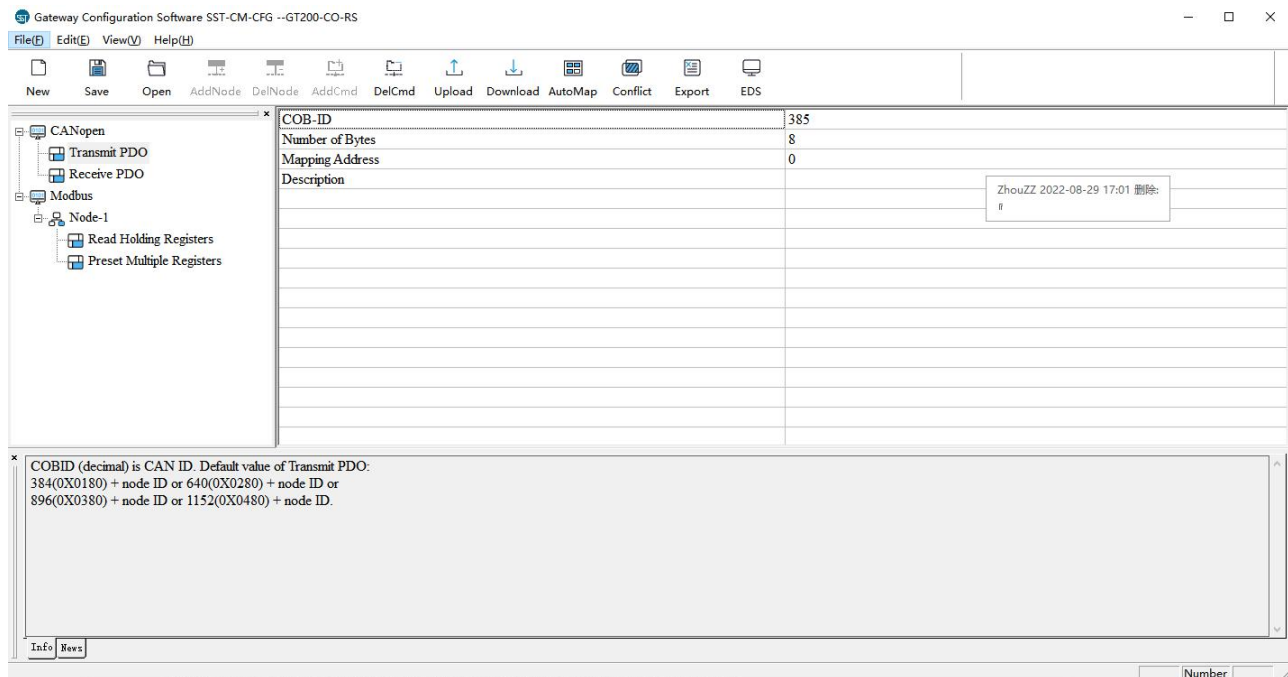
Configurable items:

COB-ID: COBID (decimal) is CAN ID.

Default value of Transmit PDO command: 384(0X0180) + node ID or 640(0X0280) + node ID or 896(0X0380) + node ID or 1152(0X0480) + node ID.

Default value of Receive PDO command: 512(0X0200) + node ID or 768(0X0300) + node ID or 1024(0X0400) + node ID or 1280(0X0500) + node ID.

Number of Bytes: The range of the parameters value is 1~8.

Description: The description of this command.

After configuring all commands, it is recommended to use "Mapping" tool (See Toolbar), and export Excel spreadsheets to check the configurations.

Comment interface shows the instruction of configuration items. When the configuration item is "COB-ID", the comment section is shown as below:

COBID (decimal) is CAN ID. Default value of Transmit PDO:
384(0X0180) + node ID or 640(0X0280) + node ID or
896(0X0380) + node ID or 1152(0X0480) + node ID.

5.5 Hardware Communication

Communication menu is shown as below:

Edit(E) View(V) Help(H)

Add Node(I)
Delete Node(S)
Add Command(A)
Delete Command(L)
Upload(U)
Download(D)
AutoMap(M)
Export EXCEL(E)
Create EDS File(G)
Conflilct Detection
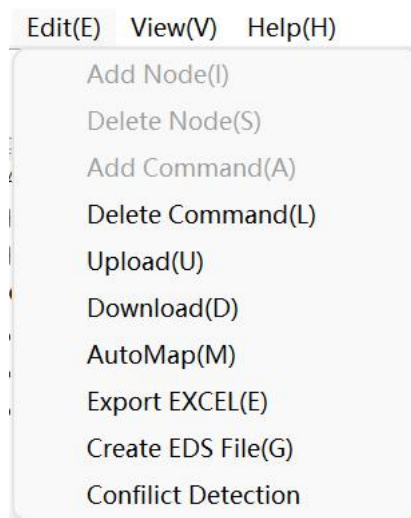
5.5.1 Upload

Select "Upload", it will read configurations from the gateway, and the interface is shown as below:

Upload

Select Serial Port

Upload   Cancel
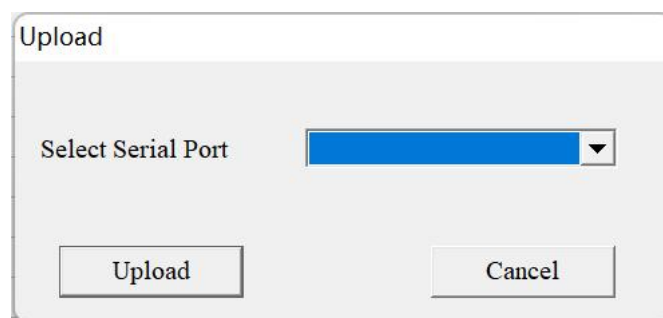
Remark: Please check the port in "COM Config" is the port that you are using before uploading the configurations;

5.5.2 Download

Select "Download", it will download configurations to the gateway, and the interface is shown as below:
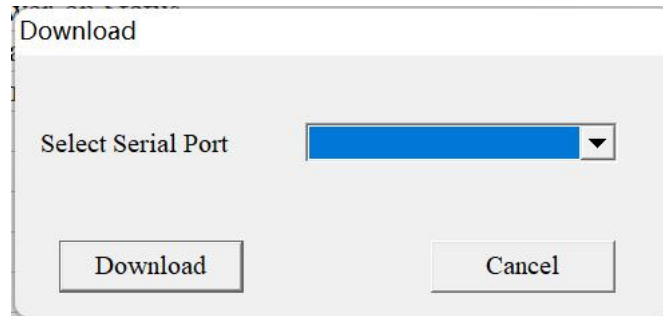
Remark 1: Please check the port in "COM Config" is the port that you are using before downloading the configurations;

Remark 2: Please check the configurations are correct before downloading configurations (you can use "Export EXCEL" function and it can help you check the configurations).

5.6 Load and Save Configuration

5.6.1 Load Configuration Project

Select "Open", you can open the configuration project that you have saved.
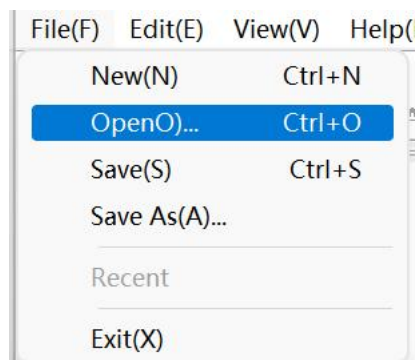
5.6.2 Save Configuration Project

Select "Save" or "Save as", you can save the configuration file with .chg as its extension.
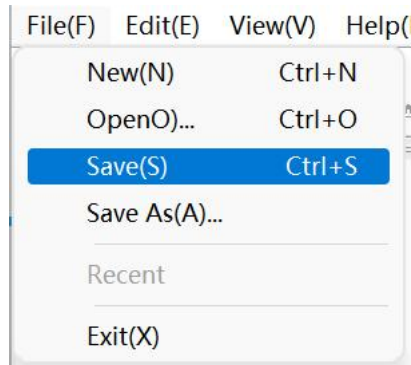
5.7 Mapping

The mapping address of every command in the gateway must be calculated by fixed formula, users can use "Calculate Mapping Address" to calculate mapping address automatically.
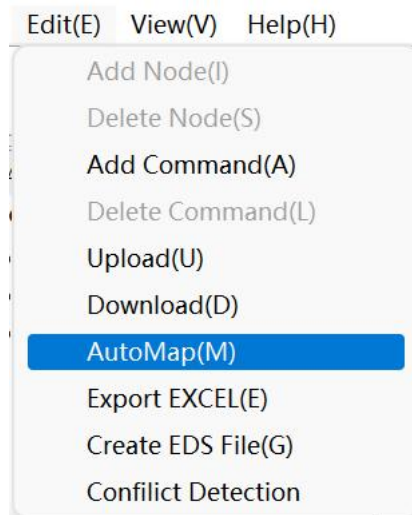
5.8 Create EDS File

Users can use the function to create the EDS file of GT200-CO-RS according to the current configurations.

Click EDS icon   EDS   in toolbar, you can create the EDS file of GT200-CO-RS.

5.9 Export Excel File

Users can use the function to check the gateway configurations.

Click Excel icon **Export** in toolbar, you can save the configuration with *.xls as its extension.
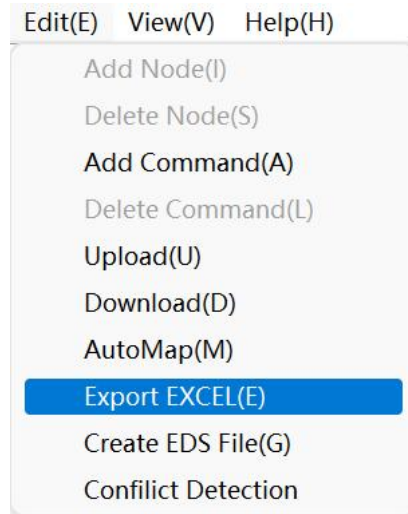
6 Working Principle

6.1 CANopen Master/Modbus Slave

Communication mode between CANopen and Modbus is asynchronous mode, as shown below:
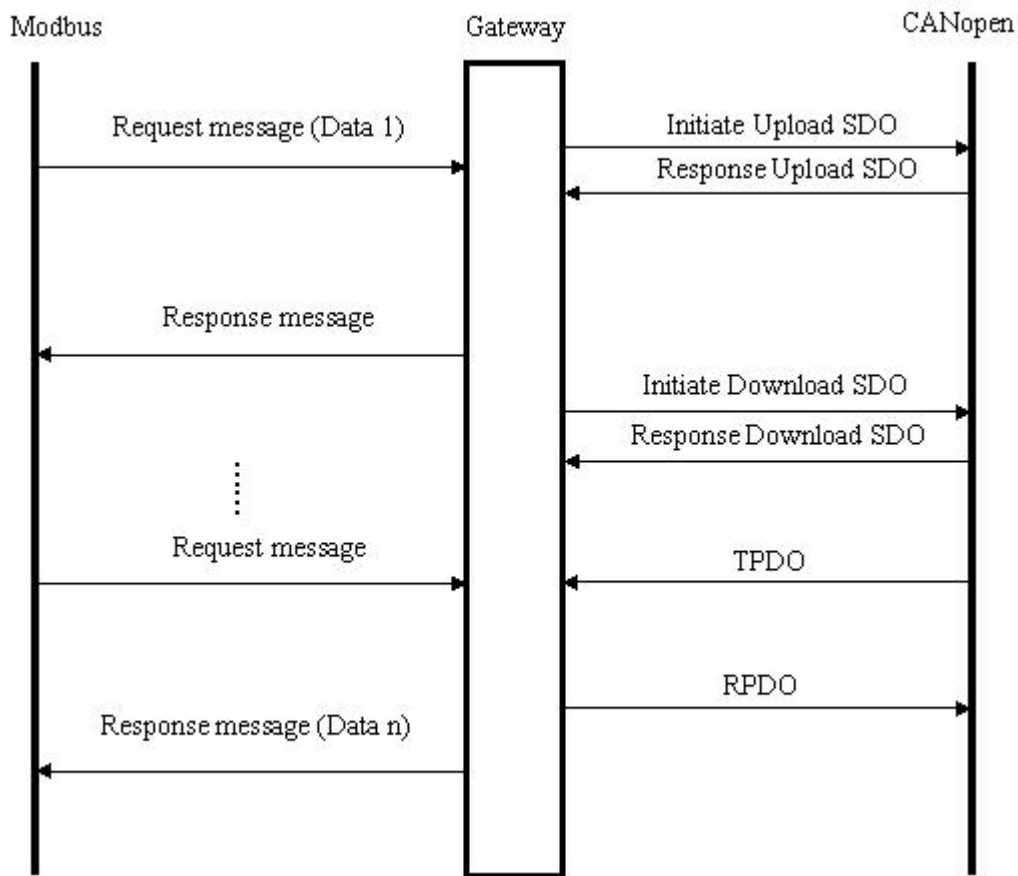
"Data 1" shows the data transfer process from Modbus to CANopen; "Data 2" shows the data transfer process from CANopen to Modbus.

The gateway runs on CANopen network independently, and transmits Upload SDO commands of CANopen parameters periodically according to object dictionary, also transmits and receives PDO (Process Data Object) commands. When receiving I/O request from Modbus, the gateway will instantly respond with the latest CANopen data to realize the matching of network speed. This is asynchronous mode.

TPDO and RPDO applies producer/consumer mode, and often be used in the occasion with high requirement about speed; Upload SDO and Download SDO applies client/server mode, the mode can guarantee safety of data,

and often be used in the occasion with low requirement about speed.

The data in Modbus output buffer of GT200-CO-RS is the data being mapped to RPDO or Download SDO commands of CANopen slave. Output mode of GT200-CO-RS is change of value, that is, until the Modbus output data is changed, GT200-CO-RS transmits corresponding commands (RPDO or Download SDO) to CANopen network; For Modbus input data, GT200-CO-RS receives data through TPDO or Upload SDO commands configured in the configuration software SST-CM-CFG and save the data to Modbus input buffer.

The data exchange mode of Modbus and CANopen is shown as below:

The data exchange buffer size is 1KB, input buffer is 512 bytes and output buffer is 512 bytes.
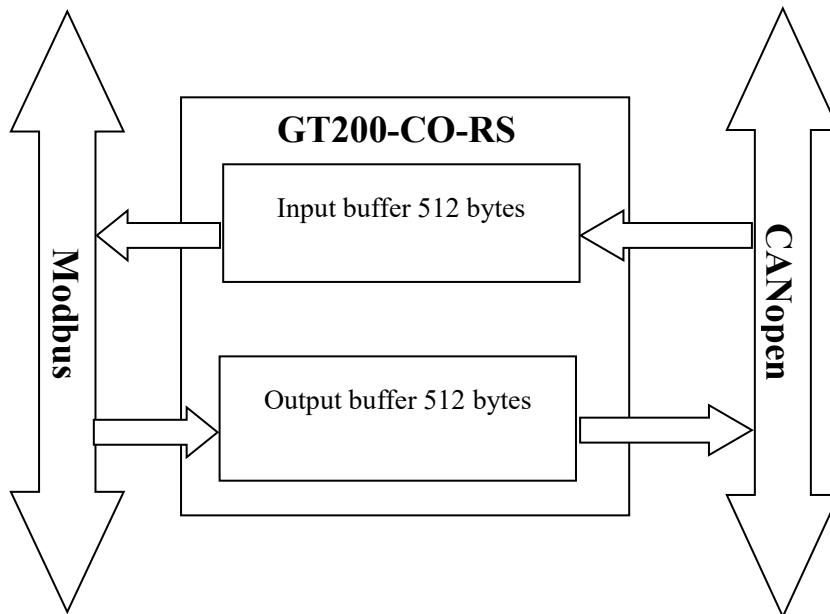
Modbus master reads 512 bytes input buffer data through No.4 function code, write data into 512 bytes output buffer through No.6&16 function code, and read 512 bytes output buffer data through No.3 function code.

Input buffer address range: 0x0000~0x01FF;

Output buffer address range: 0x0000~0x01FF;

Input & output buffer starting address:

	Input Buffer	Output Buffer
Memory mapping address	0000H~00FFH	0000H~00FFH
Modbus slave PLC address	30001~30256	40001~40256
Modbus slave protocol address	0000H~00FFH	0000H~00FFH

Each Modbus command can read one continuous Modbus registers.

When the "Control&Status" bit is "Enable" in configuration software (SST-CM-CFG), there are two bytes in the end of input and output buffer of GT200-CO-RS showing status of CANopen slaves and controlling status of CANopen slave. Modbus master can get the state (Operation, Preoperation, Stop state) of CANopen through

GT200-CO-RS. Meanwhile, it can also change the operation state (Reset slave, Reset Communication and change the slave state) of CANopen slave through GT200-CO-RS, that is to send NMT control command.
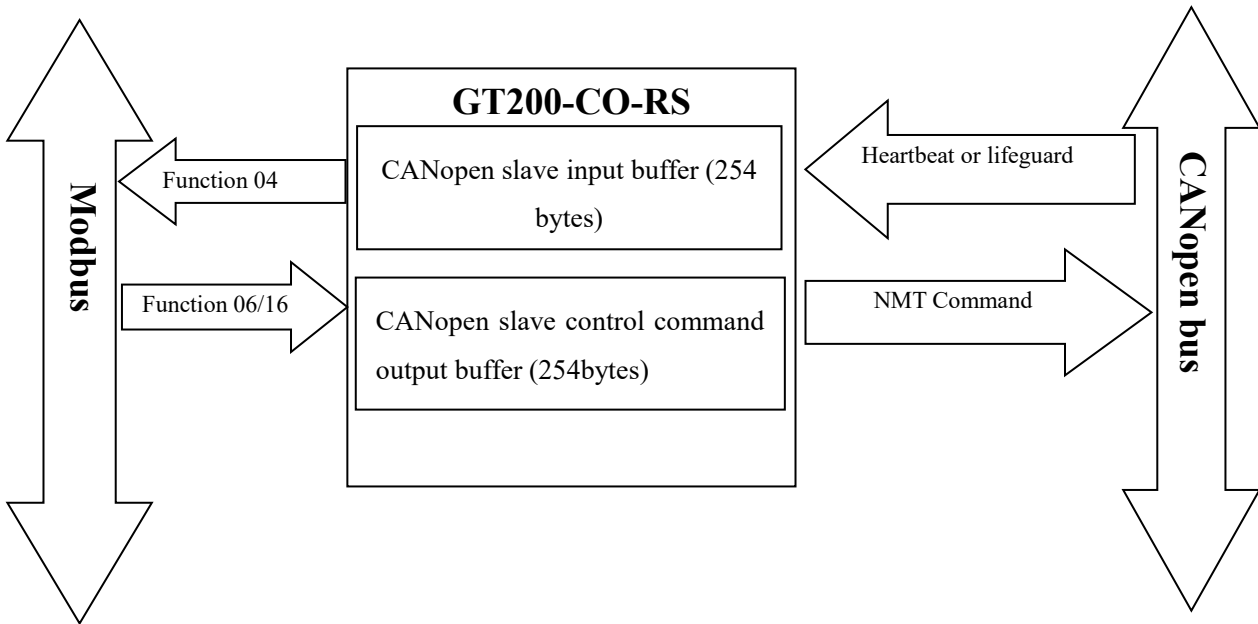
As is shown above, the gateway assigns 2-byte status input buffer and 2-byte control command output buffer   (it can have up to 127 nodes in CANopen, so the aggregates is 254 bytes) for each CANopen slave respectively. So, Modbus master can use function 04 to read status of each CANopen slave and also can use function 06 or 16 to control the running state of CANopen slave.

The address range of status input buffer of CANopen slave: 0x0200~0x02FD byte;

The address range of control command output buffer of CANopen slave: 0x0200~0x02FD byte.

The starting address of input/output buffer:

	CANopen slave status input buffer	control command output buffer
memory mapping address	0100H~017EH	0100H~017EH
Modbus slave PLC address	30257~30383	40257~40383
Modbus slave protocol address	0100H~017EH	0100H~017EH

memory mapping address (DEC)	CANopen slave status input buffer		Control command output buffer	
256-257	1 (256)	node state (257)	1 (256)	control command (257)
258-259	2	node state	2	control command
260-261	3	node state	3	control command
262-263	4	node state	4	control command
264-265	5	node state	5	control command

266-267	6	node state	6	control command
268-269	7	node state	7	control command
270-271	8	node state	8	control command
272-273	9	node state	9	control command
……	……	……	……	……
……	……	……	……	……
378-379	125	node state	125	control command
380-381	126	node state	126	control command
382-383	127	node state	127	control command

6.2 CANopen Slave/Modbus Master

Communication mode between CANopen and Modbus is asynchronous mode, as shown below:
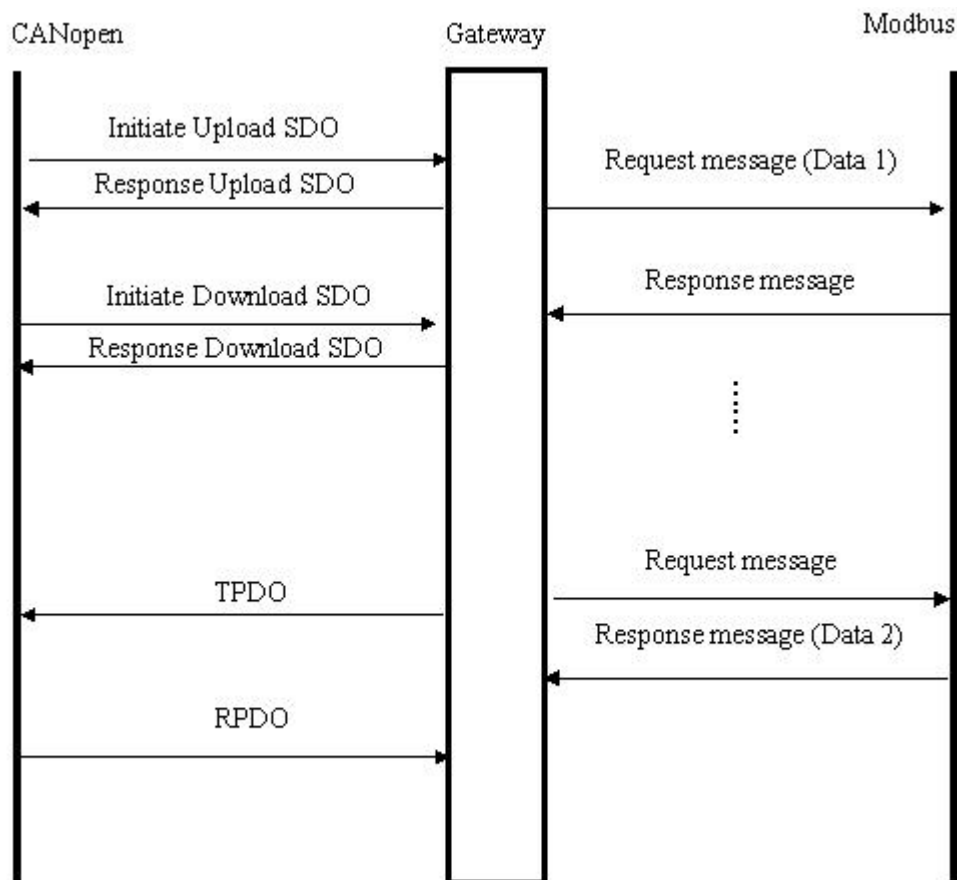
"Data 1" shows the data transfer process from CANopen to Modbus; "Data 2" shows the data transfer process

from Modbus to CANopen.

TPDO and RPDO applies producer/consumer mode, and often be used in the occasion with high requirement about speed; Upload SDO and Download SDO applies client/server mode, the mode can guarantee safety of data, and often be used in the occasion with low requirement about speed.

The data exchange mode between Modbus and CANopen is shown as below:

The data exchange buffer size between Modbus and CANopen is 1KB, among it input buffer is 512 bytes (Modbus slave sent, gateway received), output buffer is 512 bytes (CANopen master sent, gateway received).
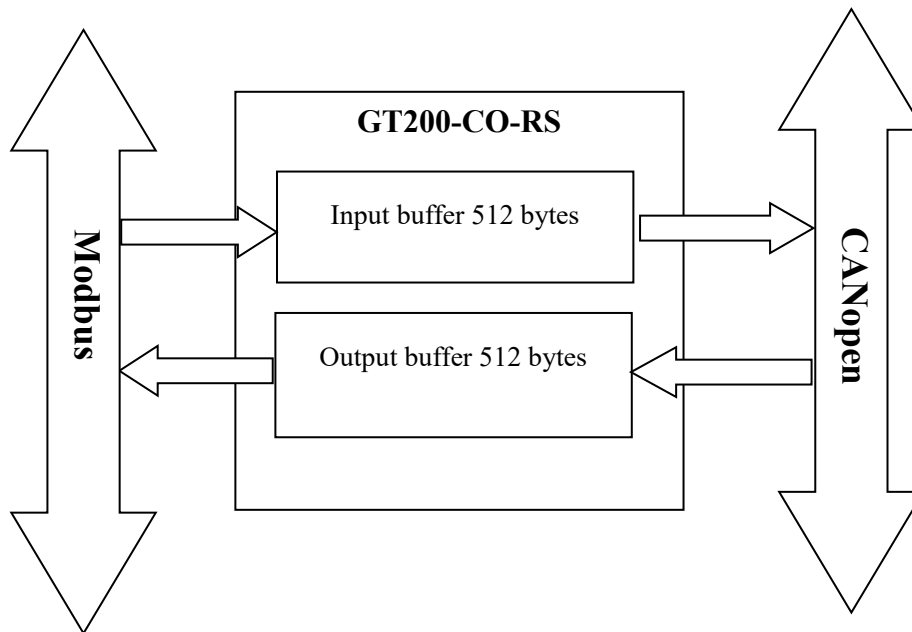
6.2.1 SDO Visit

Input/output buffer supports fast SDO visit, the position where input/output buffer is located in the object dictionary is listed as below table:

Index	Sub-index	Description
0x2000	00	Input No.0~No.3 byte of 512 bytes (4 bytes, readable)
0x2001	00	Input No.4~No.7 byte of 512 bytes (4 bytes, readable)
••••••	00	••••••
0x207e	00	Input No.504~No.507 byte of 512 bytes (4 bytes, readable)
0x207f	00	Input No.508~No.511 byte of 512 bytes (4 bytes, readable)
Index	Sub-index	Description
0x2080	00	Input No.0~No.1 byte of 512 bytes (2 bytes, readable)

Index	Sub-index	Description
0x2081	00	Input No.2~No.3 byte of 512 bytes (2 bytes, readable)
......	00	......
0x217e	00	Input No.508~No.509 byte of 512 bytes (2 bytes, readable)
0x217f	00	Input No.510~No.511 byte of 512 bytes (2 bytes, readable)
Index	Sub-index	Description
0x2180	00	Input No.0 byte of 512 bytes (1 bytes, readable)
0x2181	00	Input No.1 byte of 512 bytes (1 bytes, readable)
......	00	......
0x237e	00	Input No.510 byte of 512 bytes (1 bytes, readable)
0x237f	00	Input No.511 byte of 512 bytes (1 bytes, readable)
Index	Sub-index	Description
0x3000	00	Output No.0~No.3 byte of 512 bytes (4 bytes, writable)
0x3001	00	Output No.4~No.7 byte of 512 bytes (4 bytes, writable)
......	00	......
0x307e	00	Output No.504~No.507 byte of 512 bytes (4 bytes, writable)
0x307f	00	Output No.508~No.511 byte of 512 bytes (4 bytes, writable)
Index	Sub-index	Description
0x3080	00	Output No.0~No.1 byte of 512 bytes (2 bytes, writable)
0x3081	00	Output No.2~No.3 byte of 512 bytes (2 bytes, writable)
......	00	......
0x317e	00	Output No.508~No.509 byte of 512 bytes (2 bytes, writable)
0x317f	00	Output No.510~No.511 byte of 512 bytes (2 bytes, writable)
Index	Sub-index	Description
0x3180	00	Output No.0 byte of 512 bytes (1 bytes, writable)
0x3181	00	Output No.1 byte of 512 bytes (1 bytes, writable)
......	00	......
0x337e	00	Output No.510 byte of 512 bytes (1 bytes, writable)
0x337f	00	Output No.511 byte of 512 bytes (1 bytes, writable)

SDO read command (Upload SDO) request format

COBID=0x600+nodeID 8 bytes data 40 mm mm nn yy yy yy yy

Among them, 40 is fast read command, mm mm is index, nn is sub-index, yy yy yy yy is any value;

SDO read command response format

COBID=0x580+nodeID 8 bytes data 43 mm mm nn dd dd dd dd

Among them, 43 is the response of fast read command, mm mm is index, nn is sub-index, dd dd dd dd is the data read from output buffer;

For example: nodeID is 1, read output buffer index through SDO read command: 0x2000, sub-index: data of 00

Request: COBID=0x601 8 bytes data 40 00 20 00 yy yy yy yy

Response: COBID=0x581 8bytes data 43 00 20 00 01 02 03 04

Among them: 01 02 03 04 is the data read from output buffer.

SDO write command (Download SDO) format

COBID=0x600+nodeID 8 bytes data 23 mm mm nn dd dd dd dd

Among them, 23 is fast read command, mm mm is index, nn is sub index, dd dd dd dd is the data needs to be written to input buffer;

SDO write command format

COBID=0x580+nodeID 8 bytes data 60 mm mm nn 00 00 00 00

Among them, 60 is fast write response, mm mm is index, nn is sub index, 00 00 00 00 is default value;

For example, nodeID is 1, write data (01 02 03 04) to input buffer index through SDO write command: 0x3000, sub index: 00

Request: COBID=0x601 8 bytes data 23 00 30 00 01 02 03 04

Response: COBID=0x581 8bytes data 60 00 30 00 00 00 00 00

Among them: 01 02 03 04 is the data needs to be written to input buffer.

6.2.2 LSS Introduction

The LSS (Layer Setting Services) protocol is a CANopen proprietary sub-protocol, which provides the function of querying and changing the underlying parameters of the CANopen module. Only one node in a CANopen network can provide LSS master service, and this node must also be an NMT master. All other nodes on the network provide LSS slave service. The LSS function occupies two CAN-IDs, namely 0x7E4 (for slave) and 0x7E5 (for master), and the total length of the message is 8 bytes. The first byte is an identifier, which is used to identify the instruction or status information involved.

CANopen LSS slave function is as below.
- State switching: supports global state switching and selected state switching;
- Configuration service: supports setting the node address and baud rate through the network, no need to download the settings with configuration software;

➢ Query service: supports the query of vendor-id, product-code, revision-number and serial-number identifiers;

➢ Identity Service: supports the identification of remote slave nodes.

Code (HEX)	Function
04	Enter into LSS standby state
11	Configure new Node ID
13	Configure new baud rate
15	Start new baud rate
17	Save LSS configuration

Baud Rate	Index Value
1000 KBit/s	0
800 KBit/s	1
500 KBit/s	2
250 KBit/s	3
125 KBit/s	4
100 KBit/s	5
50 KBit/s	6
20 KBit/s	7
10 KBit/s	8

LSS switches slave Node ID (Default factory Node ID 0X7F, Set Node ID 0X44)

```
Send :        00     80 7F                    -> push node to Pre-opeartional state
Send :        7E5    04 01 00 00 00 00 00 00   -> Set configuration mode
Send :        7E5    11 44 00 00 00 00 00 00   -> Set node address 0x44
Receive:      7E4    11 00 00 00 00 00 00 00   -> Success
Send :        7E5    17 00 00 00 00 00 00 00   -> Store configuration
Receive:      7E4    17 00 00 00 00 00 00 00   -> Success
Send :        7E5    04 00 00 00 00 00 00 00   -> waiting state
Send:         00     81 7F                    -> reset node
Receive:      744    00                       ->New boot-up message
```
Note: New Node ID will take effect after reset or power off and power on the gateway.

LSS switches slave baud rate

```
Send :        7E5    04 01 00 00 00 00 00 00   -> Set configuration mode
Send :        7E5    13 00 02 00 00 00 00 00   -> Set 500 kBits
Receive:      7E4    13 00 00 00 00 00 00 00   -> Success
Send :        7E5    15 10 00 00 00 00 00 00   -> switch on 500 kBits
```

LSS Inquires Vendor-ID, product-code, revision-number and serial number

Send :	7E5	5A 00 00 00 00 00 00 00	-> Read Vendor-ID
Receive:	7E4	5A 1B 00 00 00 00 00 00	-> Success(Vendor-ID=0X1B)
Send :	7E5	5B 00 00 00 00 00 00 00	-> Read product-code
Receive:	7E4	5B 04 00 00 00 00 00 00	-> Success(product-code=0X04)
Send :	7E5	5C 00 00 00 00 00 00 00	-> Read revision-number
Receive:	7E4	5C 1B 00 00 00 00 00 00	-> Success
Send :	7E5	5D 00 00 00 00 00 00 00	-> Read serial-number
Receive:	7E4	5D xx xx xx xx 00 00 00	-> Success xx means product serial number

LSS switches selected state of Node

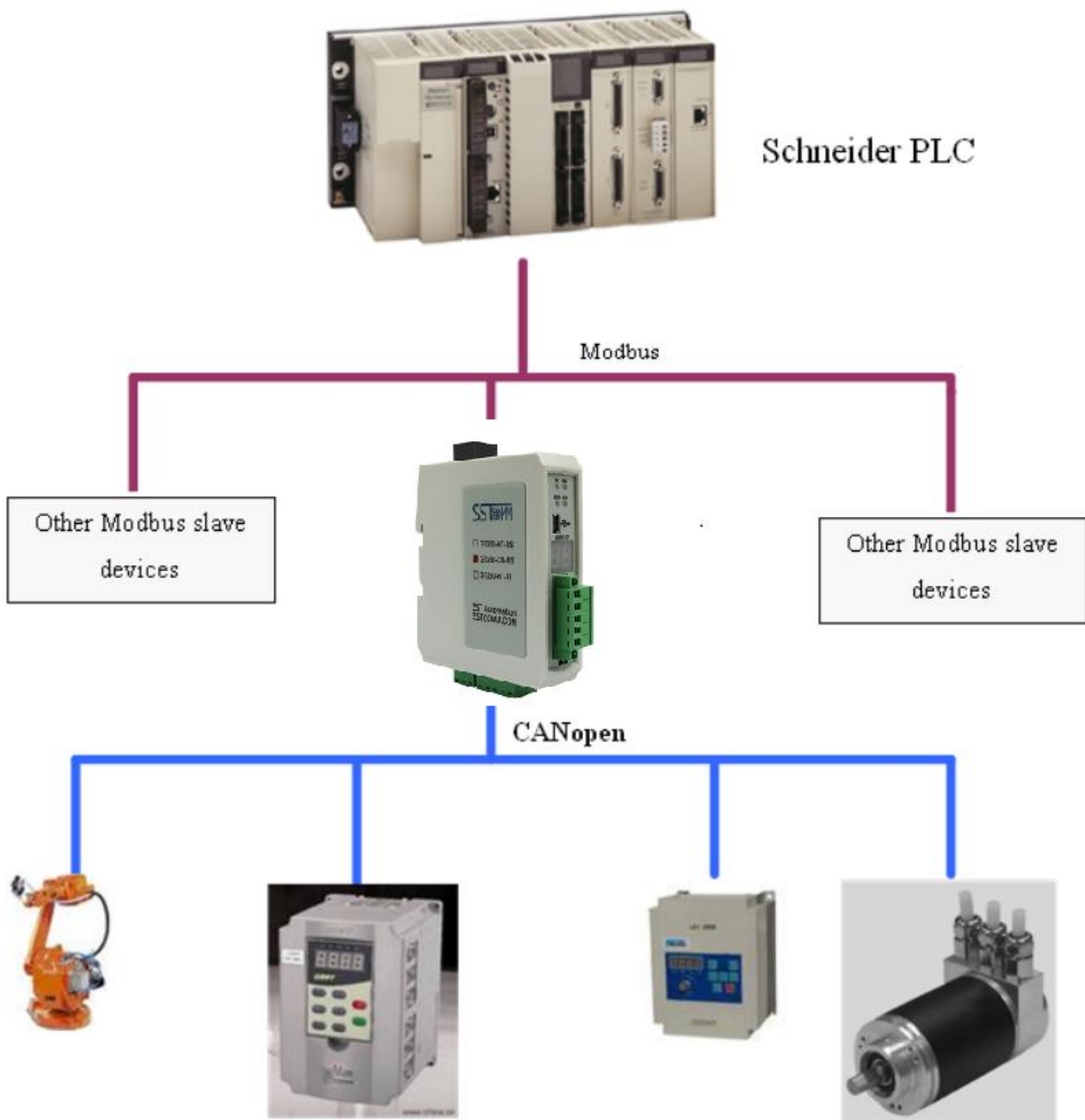|			
Send :	7E5	40 1B 00 00 00 00 00 00	-> Match VENDOR_ID
Send :	7E5	41 04 00 00 00 00 00 00	-> Match PRODUCT_CODE
Send :	7E5	42 00 04 00 00 00 00 00	-> Match REV_NUMBER
Send :	7E5	43 xx xx xx xx 00 00 00	-> Match SERIAL_NUMBER
Receive:	7E4	44 01 00 00 00 00 00 00	-> Success 01 means configuration mode

7 Troubleshooting

Number	Description	Suggestions
1	ERR red light on in operation state	CAN bus BUS OFF or sending/receiving error counter exceed alarm value. Check whether CAN baud rate of gateway is the same with that of other nodes on CAN network.
2	ERR red light blinking in operation state	Need a terminal resistance[1] on CAN network or the gateway has no connection to CAN network.
3	ERR red light off in operation state, but sending/receiving of CAN error	Need a terminal resistance[1] on CAN network or the node connected with gateway fail.
4	ERR red light blinking occasionally	There is error frame form CAN network, will not affect communication.
5	ERR red light always blinking, no data sending to Modbus	Check the baud rate of all the nodes on the CAN network; If they are all the same, please change a lower baud rate and try again.
6	Serial indicators (TX) green blinking	Modbus slave address on Modbus network is not the same with that of GT200-CO-RS ready to read
7	Serial indicators (TX) green blinking	Modbus slave device on Modbus network does not support the function code configured in GT200-CO-RS

Note: Terminal resistance[1]

CAN is differential level communication. When communication distance is long or communication baud rate is high, there exists echo interference on communication line. So, users need a terminal resistance (120Ω/2W) in both terminals of communication lines.

8 Typical Application

8.1 CANopen Master/Modbus Salve

Schneider PLC

Modbus

Other Modbus slave devices

Other Modbus slave devices

CANopen

8.2 CANopen Slave/Modbus Master