

Modbus / CANopen Gateway

GT100-CO-RS

User Manual

V 2.2

Rev A



SST Automation

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Important Information

Warning


The data and examples in this manual cannot be copied without authorization. SSTCOMM 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.

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Catalog

1 Product Overview.....	1
1.1 Product Function.....	1
1.2 Product Feature.....	1
1.2.1 CANopen Master/Modbus Slave.....	1
1.2.2 CANopen Slave/Modbus Master.....	1
1.3 Technical Specifications.....	2
1.3.1 CANopen Master/Modbus Slave.....	2
1.3.2 CANopen Slave/Modbus Master.....	3
1.4 Related Products.....	4
1.5 Revision History.....	4
2 Hardware Descriptions.....	5
2.1 Product Appearance.....	5
2.2 Indicators.....	6
2.3 LED Display.....	6
2.4 Configuration Button.....	6
2.5 Interface.....	7
2.5.1 Power Interface.....	7
2.5.2 CAN Interface.....	7
2.5.3 Serial Interface.....	7
2.5.4 Mini B Type USB.....	8
3 Installation.....	9
3.1 Machine Dimensions.....	9
3.2 Installation Method.....	9
4 Quick Start Guide.....	10
5 Software Instructions.....	12
6 Working Principle.....	14
6.1 CANopen Master/Modbus Slave.....	14
6.2 CANopen Slave/Modbus Master.....	17
7 Typical Application.....	21
7.1 CANopen Master/Modbus Slave.....	21
7.2 CANopen Slave/Modbus Master.....	22
8 Troubleshooting.....	23

1 Product Overview

1.1 Product Function

GT100-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 one CANopen slave 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 master at the side of CANopen network and slave at Modbus side, the gateway can provide data communication between one CANopen slave and Modbus master.
- CANopen supports DS301V4.02. Supports NMT, PDO, SDO, Heartbeat and Guardlife.
- Supports maximum 8 bytes TPDO and RPDO, fast Download SDO and fast Upload SDO.
- Supports up to 128 CANopen commands.
- Function code Modbus slave supports: 03H, 04H, 06H and 10H.
- Supports communication mode: RTU, ASCII.
- CANopen baud rate: 5K~1Mbps.
- Supports single CANopen slave node.
- Serial port baud rate: 1200~115200bps.
- Serial port supports: RS232, RS485, RS422.
- Data exchange buffer is 1K. (512 bytes input and 512 bytes output)
- CAN port and RS232 (RS485/RS422) can stand 1KV photoelectric isolation.
- Built-in terminal resistor and switch.

1.2.2 CANopen Slave/Modbus Master

- Easy to configure just through USB port on PC.
- Acts as slave at the side of CANopen network and master at Modbus side, the gateway can provide data communication between many Modbus slave and CANopen master.
- Supports CANopen DS301V4.02. Supports NMT, PDO, SDO, Heartbeat and Guardlife, The cycle for TPDO

transmission and Timestamp.

- Supports maximum 8 bytes TPDO and RPDO, 4 bytes fast Download SDO and fast Upload SDO.
- Supports up to 64 TPDO, 64 RPDO and SDO visit for input/output data exchange buffer.
- Function code 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: RS232, RS485, RS422.
- Data exchange buffer is 1K. (Input is 512 bytes and output is 512 bytes)
- CAN port and RS232 (RS485/RS422) can stand 1KV photoelectric isolation.
- Built-in terminal resistor and switch.

1.3 Technical Specifications

1.3.1 CANopen Master/Modbus Slave

[1] The gateway can achieve data communication between one CANopen slave and Modbus master.

[2] 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) or 1152 + node address (0x480+node address).
RPDO COBID: 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)

[3] Modbus slave features:

- Supports function code: 03H, 04H, 06H, 10H.
- Supports communication mode: RTU and ASCII.
- Supports RS485 or RS232 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.

[4] Power: 24VDC (11~30VDC), maximum 60mA (24VDC).

[5] Operating temperature: -4°F~140°F (-20°C to 60°C). Humidity: 5% to 95% (non-condensing).

[6] Dimensions (W*H*D): 1.0 in*4.0 in *3.6 in (25mm*100mm*90mm).

[7] Installation: 1.4 in (35mm) DIN RAIL.

[8] Pollution level: Class 3.

1.3.2 CANopen Slave/Modbus Master

[1] The gateway can achieve data communication between many Modbus slave and CANopen master.

[2] CANopen slave features:

- CANopen supports DS301V4.02. Supports NMT, PDO, SDO, both 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.
- 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) or 1152 + node address (0x480+node address).
RPDO COBID: 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.

[3] Modbus master features:

- Function code 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 RS485 or RS232 interface, half-duplex, baud 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.

[4] Power: 24 VDC (11~30 VDC), maximum 60mA(24VDC).



- [5] Operating temperature: -40°F ~140°F (-40°C to 60°C). Humidity: 5%~95% (non-condensing).
- [6] Dimensions (W*H*D): 1.0 in * 4.0 in * 3.6 in (25 mm * 100 mm * 90 mm).
- [7] Installation: 1.4 in (35 mm) DIN RAIL.
- [8] Pollution level: class 3.

1.4 Related Products

The related products include: GT200-CO-RS, GT100-CA-MS485, GT100-CA-RS etc.

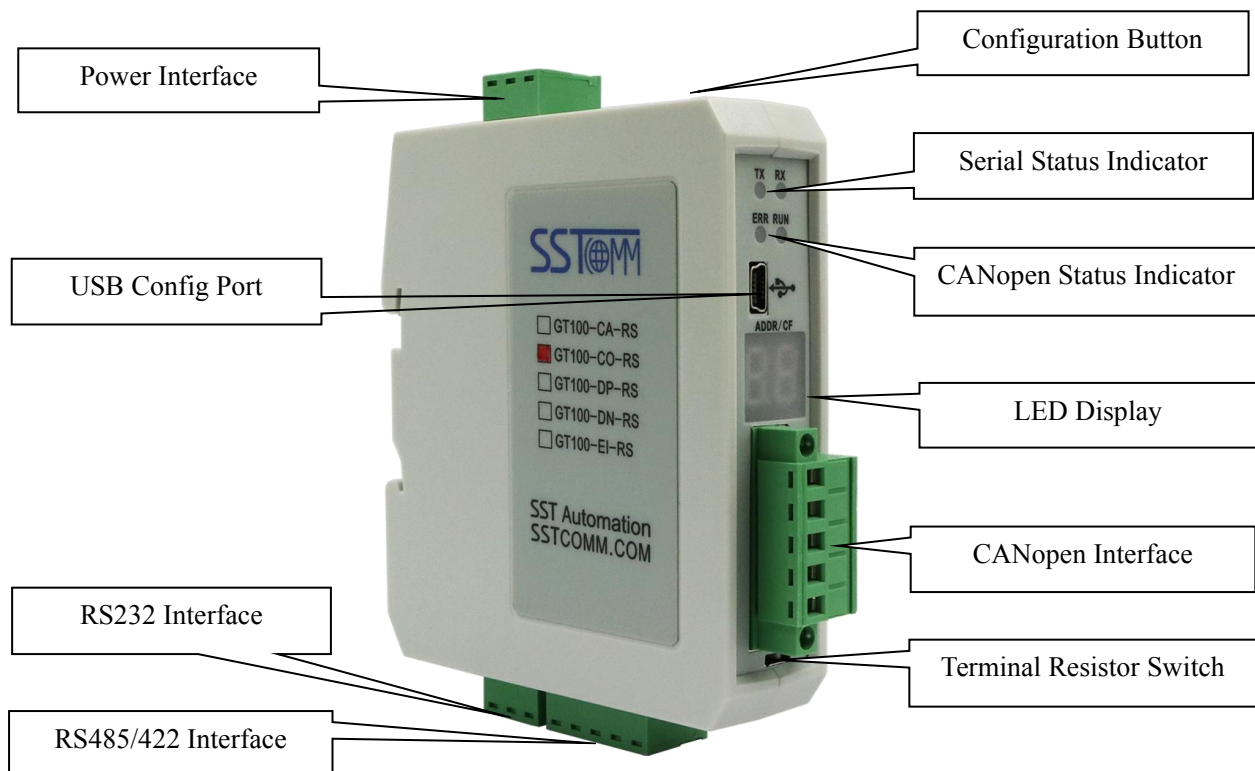
To get more information about related products, please visit SSTCOMM website: www.sstcomm.com.

1.5 Revision History

Revision	Date	Chapter	Description
V2.2, RevA	1/25/2022	ALL	Update the format.

2 Hardware Descriptions

2.1 Product Appearance



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

2.2 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	run state.
		green light on every 200ms, off every 1000ms	stop state.
		green light on every 200ms, off every 200ms	pre-run 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.

2.3 LED Display

LED Display	Description
“01”~“99”	The slave address when the GT100-CO-RS acts as a CANopen slave or a Modbus slave.
CF	The GT100-CO-RS is in the configuration state.
Eo	CAN sending error.
“88” (blink once)	Restarting.

2.4 Configuration Button

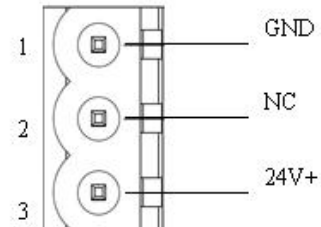
Double click the button to enter into the configuration mode. The LED displays "CF", users can configure relevant communication parameters through configuration software.

Under configuration mode, double click the button, the gateway will keep the current configuration and reset the system after waiting for a while and enter into the run state.

2.5 Interface

2.5.1 Power Interface

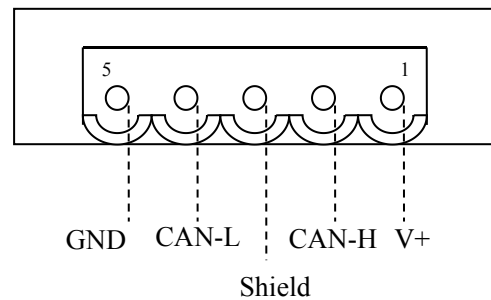
Pin	Function
1	Power GND
2	NC(Not Connected)
3	24V+, DC Positive 24V



2.5.2 CAN Interface

CAN interface of GT100-CO-RS uses 5-pin connector:

Pin	Wiring
Pin 1	V+, 24VDC(optional)
Pin 2	CAN-H
Pin 3	Shield (optional)
Pin 4	CAN-L
Pin 5	GND, GND of 24V (optional)



Note:

(1) Here, shield port is optional. The CAN-L and CAN-H must be connected. Here pin 1 and 5 are connected to the pin 3 and pin 1 of power port internally(Chapter2.5.1).

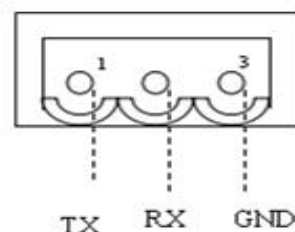
(2) Chapter2.5.1 and Chapter2.5.2 both contain power interfaces, and only one of them is required to connect.

If two power interfaces are connected at the same time, the gateway will be burned.

2.5.3 Serial Interface

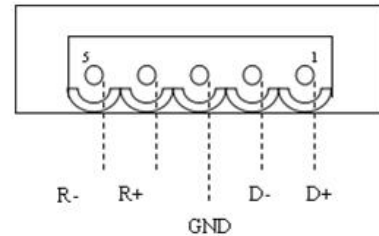
RS232 interface:

Pin	Function
1	RX, Connect RS232's RX of user device
2	TX, Connect RS232's TX of user device
3	GND, Connect RS232's GND of user device



RS485/RS422 interface:

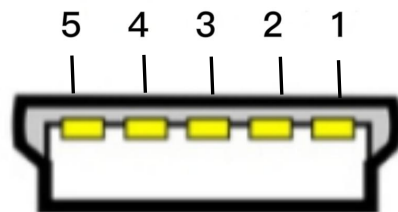
Pin	Symbol	RS485 Function	RS422 Function
1	D+	Connect D+ of user device	Connect D+ of user device
2	D-	Connect D- of user device	Connect D- of user device
3	GND	Connect shielding ground (optional)	Connect shielding ground (optional)
4	R+	Reserved	Connect R+ of user device
5	R-	Reserved	Connect R+ of user device



2.5.4 Mini B Type USB

The USB port is used to configure the gateway. Mini B type USB interface is defined as below:

Pin	Name	Function
1	VBUS	+5V
2	D-	Data negative
3	D+	Data positive
4	IN	NC
5	GND	Signal Ground

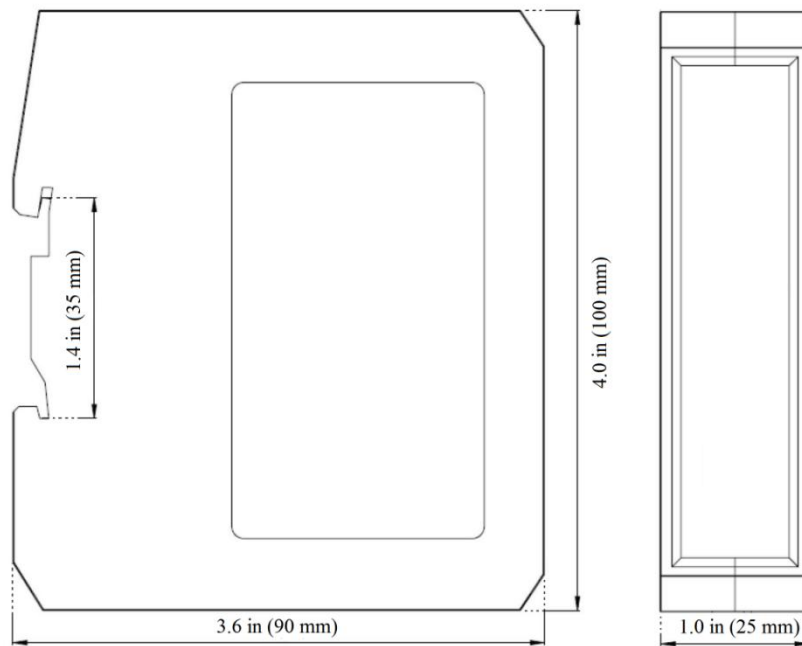


3 Installation

3.1 Machine Dimensions

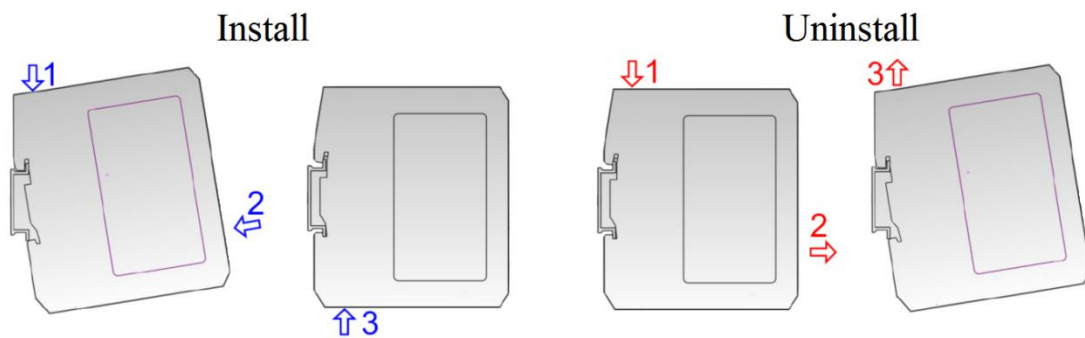
Size (width * height * depth):

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.

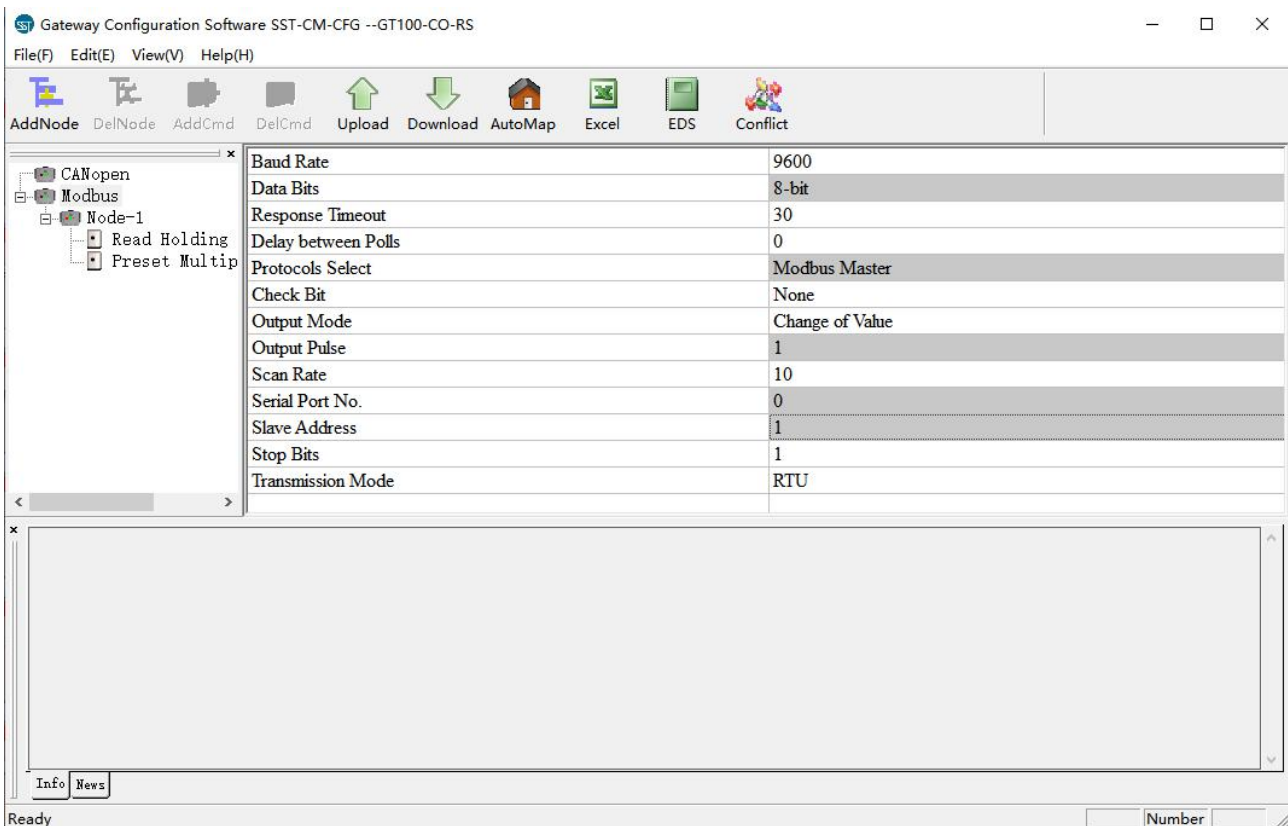


4 Quick Start Guide

The following steps will help users to quickly configure GT100-CO-RS:

1. Wiring and button setting: See also [Chapter2](#)
 - (1) Connect the gateway power supply and power on. Please note that two terminals of this product can be connected to the power supply, and the user only needs to connect one terminal. If two power interfaces are connected at the same time, the gateway will be burned. (Refer to [Chapter 2.5.1](#) and [Chapter 2.5.2](#))
 - (2) Connect GT100-CO-RS with PC through USB for download Configuration.
 - (3) Double click the button, the LED display will show “CF”, that means the gateway is in the configuration state.(Refer to [Chapter2.4](#))
2. Download SST-CM-CFG software from www.sstcomm.com/Download1/ and install it.
3. Build your configuration using SST-CM-CFG and download it to the gateway. For more details,see [SST-CM-CFG software->Help->Content](#).

SST-CM-CFG is based on Windows platforms, you can use it to configure CANopen and Modbus protocol related parameters. The operation interface of SST-CM-CFG configuration software is as follows:



- (1) When using the gateway for the first time, you can click the "Upload" button to upload the example configuration for reference.
- (2) If upload/download failed, please view the following reasons:

- Please confirm that the gateway is in configuration mode.
 - The gateway is configured with USB port. Please try to connect again replacing another USB cable.
 - Please make sure that the COM port used by the computer is correct. Try to connect again using other COM ports of the computer.
 - Please confirm that the USB driver is installed. When installing the configuration software, the USB driver will be installed. If it is not installed, please confirm the installation.
4. After configuring and downloading Configuration into the gateway. Double click the button again, the module will restart and the configuration will take affect. The gateway enters RUN mode.
 5. Connect the CANopen and Modbus protocol ports of the gateway to the equipment respectively for communication. (For port wiring, see [Chapter2.5.2](#) and [Chapter2.5.3](#))

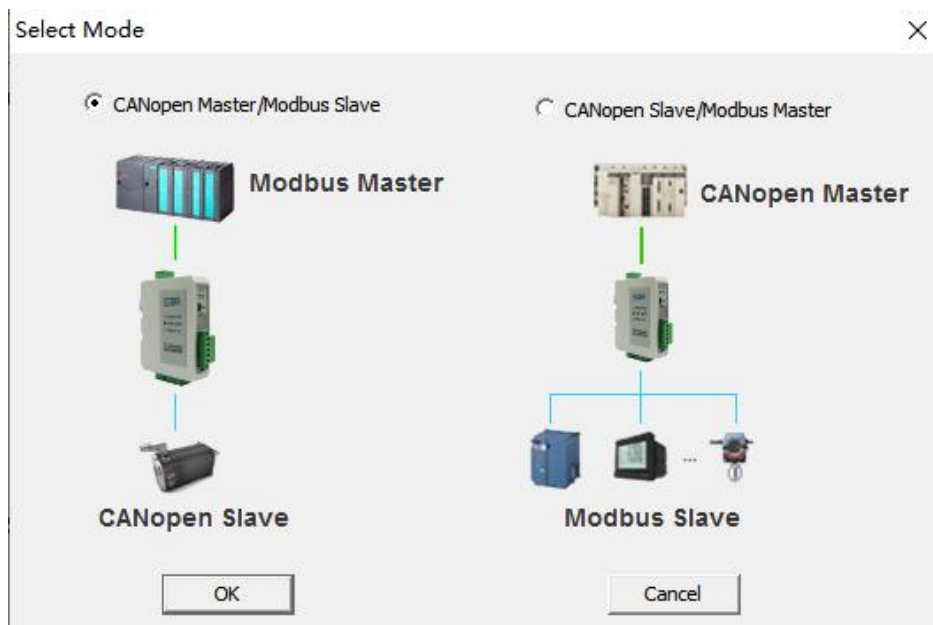
5 Software Instructions

SST-CM-CFG is based on Windows platforms, being used to configure parameters and commands of GT100-CO-RS. Download the software on www.sstcomm.com/Download1/ and run the setup program to begin the installation. Please follow the prompts to install the software.

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

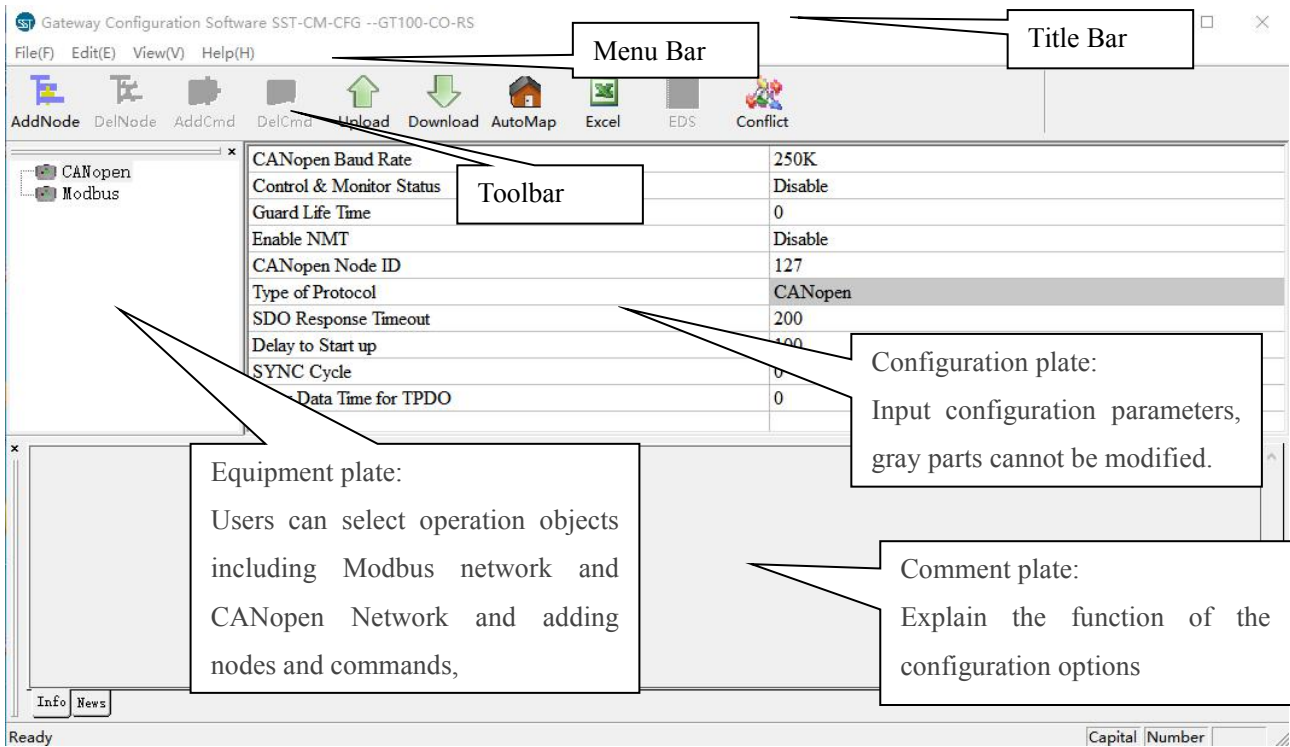


Select "GT100-CO-RS", and you will see the "Select Master" interface.



Select the mode you want, such as "CANopen Master/Modbus Slave", and you can see the main interface of the software:

GT100-CO-RS Modbus/CANopen Gateway User Manual

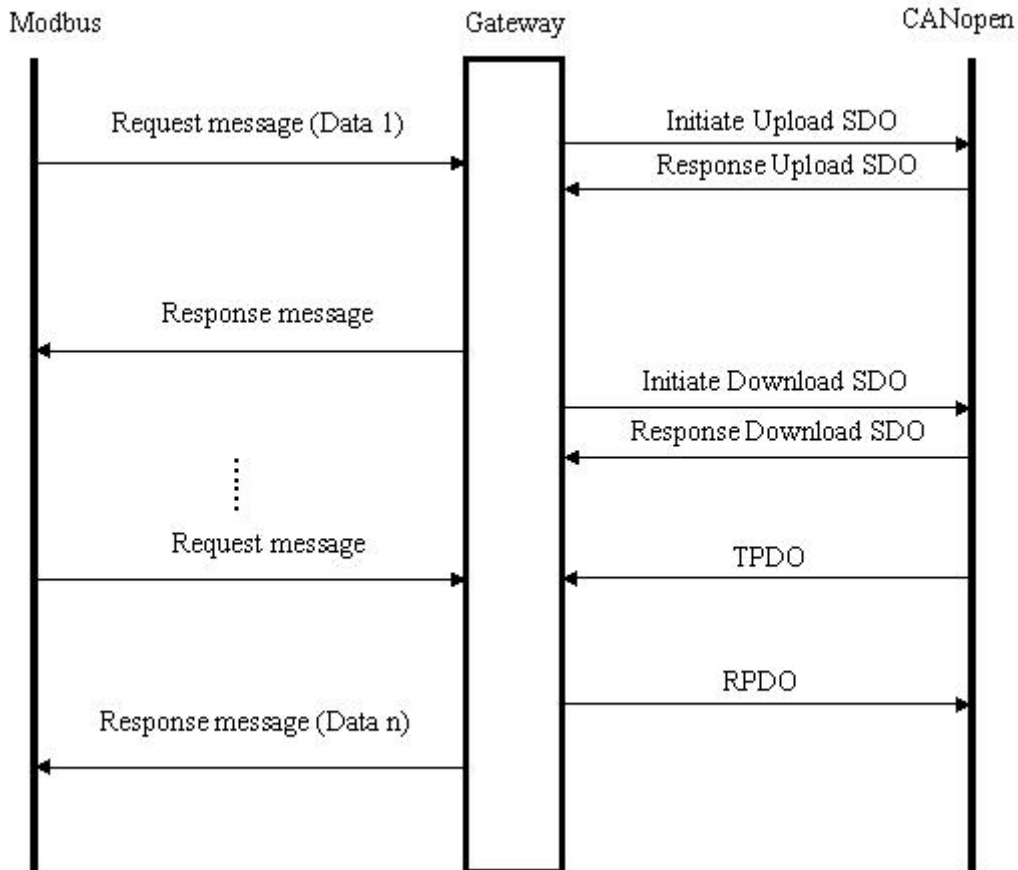


For detailed software content, please open the SST-CM-CFG, select “Help” >> “Content” on the menu bar.

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 PROFIBUS.

The gateway runs in CANopen network independently, and transmits Upload SDO commands of CANopen parameters periodically according 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.

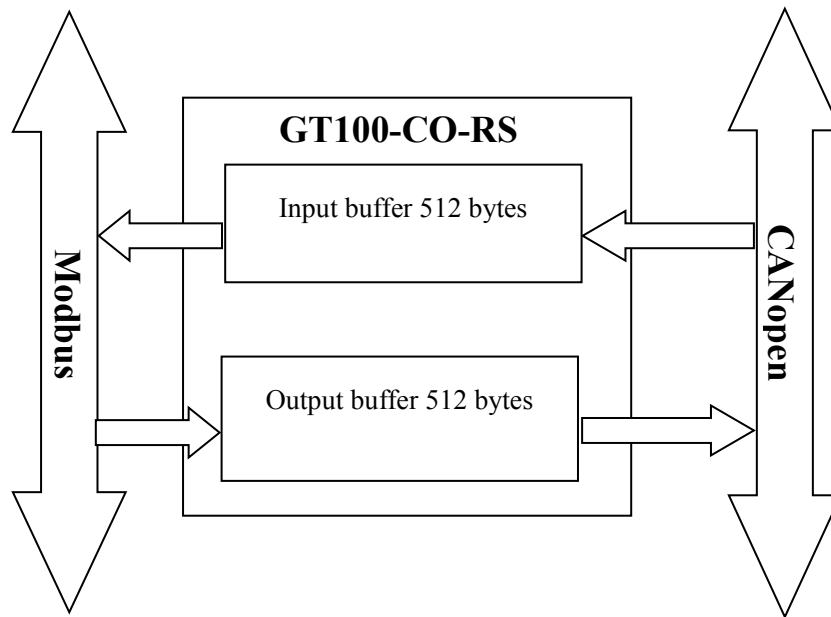
TPDO and RPDO applies producer/consumer mode, and often be used in the occasion with high requirement about speed. Upload SDO and Download SDO applies client/server mode, the mode can guarantee safety of data, and often be used in the occasion with low requirement about speed.

The data in Modbus output buffer of GT100-CO-RS is the data being mapped to RPDO or Download SDO commands of CANopen slave. Output mode of GT100-CO-RS is change of value, that is, until the Modbus output

data is changed, GT100-CO-RS transmits corresponding commands (RPDO or Download SDO) to CANopen network. For Modbus input data, GT100-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.

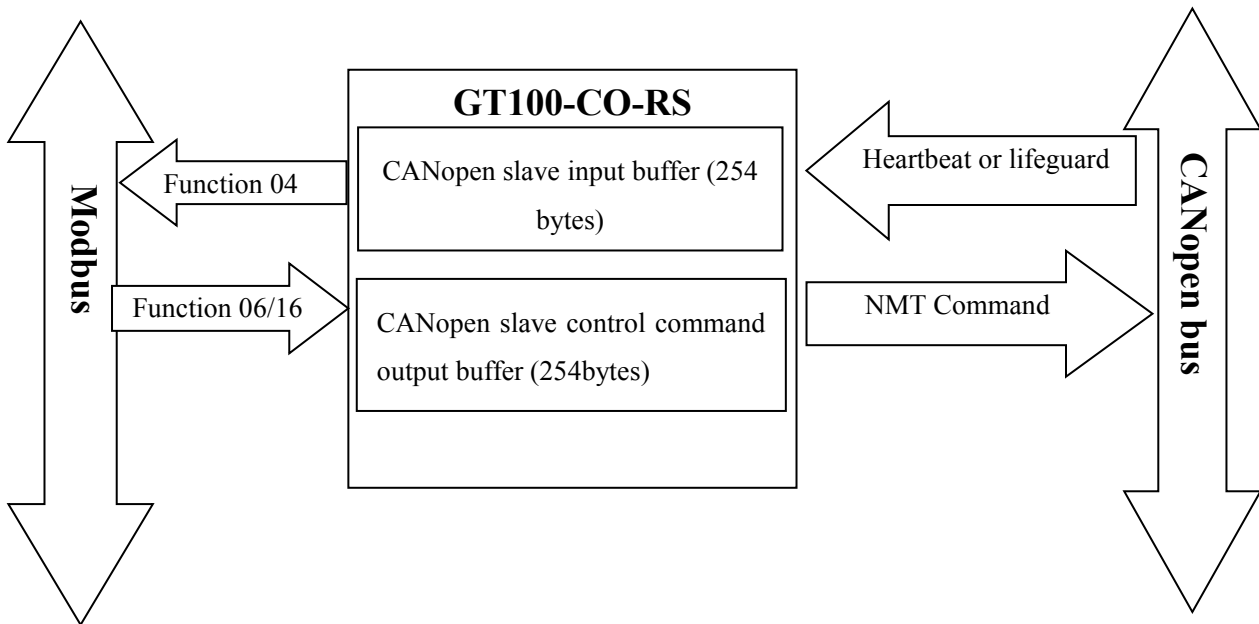
Output buffer address range: 0x0000~0x01FF.

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 GT100-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 GT100-CO-RS. Meanwhile, it can also change the operation state (Reset slave, Reset Communication and change the slave state) of CANopen slave through GT100-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.

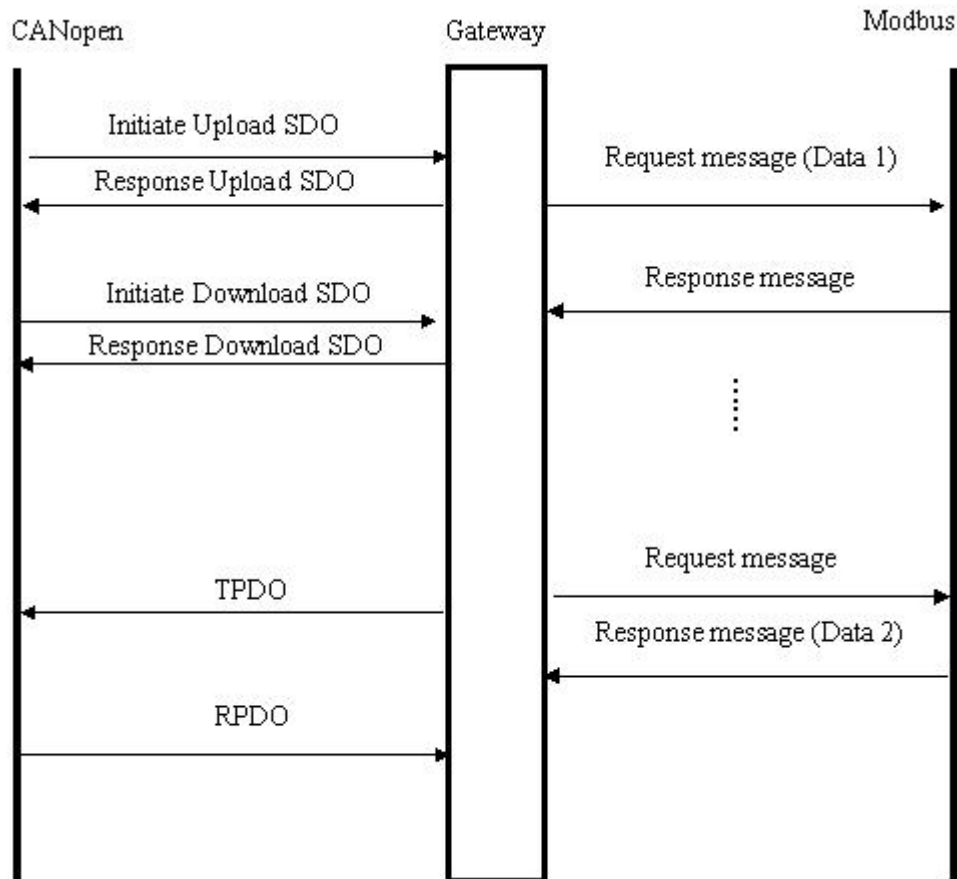
The starting address of input/output buffer:

		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:

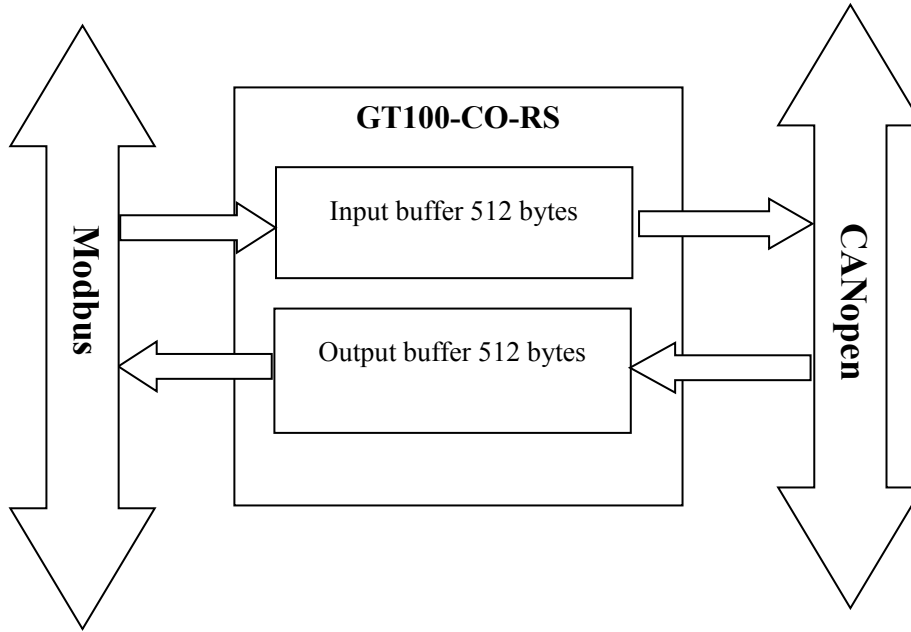


“Data 1” shows the data transfer process from CANopen to Modbus. “Data 2” shows the data transfer process from Modbus to CANopen.

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).



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)
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

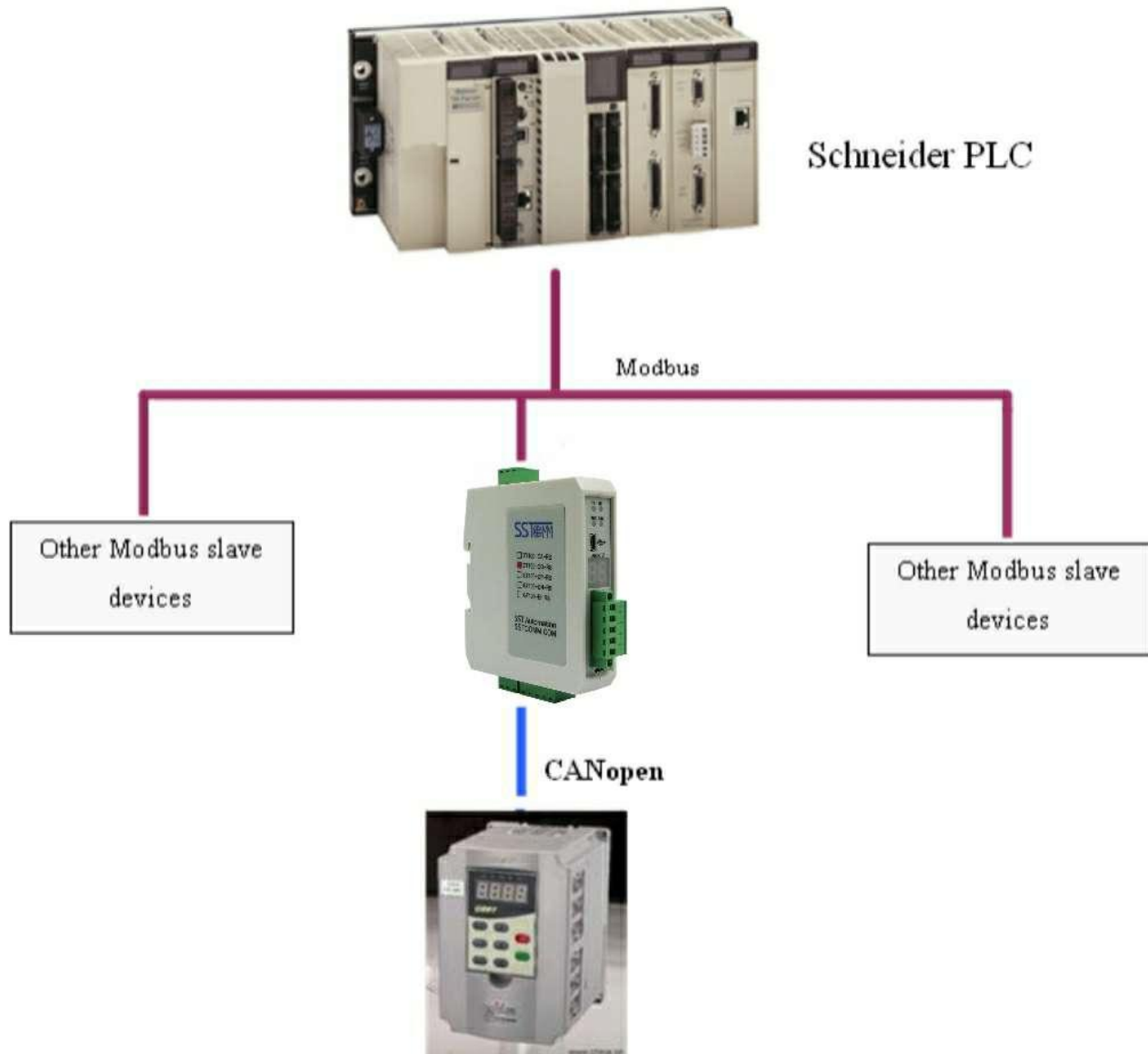
Request: COBID=0x601 8 bytes data 23 00 30 00 01 02 03 04

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.

7 Typical Application

7.1 CANopen Master/Modbus Slave



7.2 CANopen Slave/Modbus Master



8 Troubleshooting

Number	Description	Suggestions
1	ERR red light on in run 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 run state.	Need a terminal resistance ¹ on CAN network or the gateway has no connection to CAN network.
3	ERR red light off in run 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 baudrate of all the nodes on the CAN network. If they are all the same, please change a low baudrate and try again.
6	Serial indicators (TX) green blinking.	Modbus slave address on Modbus network is not the same with that of GT100-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 GT100-CO-RS.

Note: Terminal resistance¹

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.