Universal Serial/PROFINET IO Gateway

GT200-PN-RS

User Manual

V 3.5

Rev A

SST Automation

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www.SSTAutomation.com

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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Catalog

1 Product Overview

1.1 Product Function

GT200-PN-RS is a gateway which can provide a seamless connection between PROFINET network and Modbus. It can connect devices with RS232 or devices with RS485 interface to PROFINET network.

1.2 Product Features

- **Wide application**: Any devices with RS232/RS485 interface can use this gateway to realize exchanging data. For example, Such as frequency converters with Modbus protocol interface, motor startup protection devices, intelligent high and low voltage electrical appliances, power measuring devices, transmitters, intelligent field measuring equipment and instruments etc.
- **Easy configuration**: Users don't need to know the technical details of Modbus. Users only need to refer to this manual and use the gateway configuration software SST-TS-CFG to easily complete the configuration of gateway according to requirements. No complicated programming is required, and connection and communication can be realized in a short time.

1.3 Technical Specification

[1] At PROFINET side GT200-PN-RS is PROFINET slave and acts as Modbus master or Modbus slave at serial side.

[2] Supports standard PROFINET I/O protocol.

[3] PROFINET: Supports up to 32 slots, input/output data buffer is up to 384 bytes (the length uses can use is limited to specific PLC and PDU size of communication module), the length of input/output bytes can be set by configuration software of PROFINET Master such as TIA Portal or STEP7.

[4] With 2 serial ports: Serial I support RS485,serial II support RS232,Two serial ports can be used as communication ports, and they can communicate at the same time.

[5] The protocol type serial ports support: Modbus master, Modbus slave, Custom protocol, User Config.

[6] Serial port parameters:

- Operation mode: Half-duplex.
- Baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bps optional.

- Data bits: 7, 8 optional.
- Parity: None, Odd, Even, Mark and Space optional.
- Stop bits: 1,2 optional.

[7] Modbus master:

- Function code: 01H, 02H, 03H, 04H, 05H, 06H, 0FH and 10H.
- Format: RTU and ASCII.
- Function: Cycle output, forbidden output and change of value output of write command.
- Each master can configure up to 48 Modbus commands.
- When serial port 1 (RS485 serial port) and serial port 2 (RS232 serial port) simultaneously connect the slave equipment as the Modbus master, Serial port 1 supports connection of 4 Modbus slave devices, and serial port 2 can configure up to 1 node.

  When configuring serial port 1 as the Modbus master independently, it can configure up to 4 nodes.

[8] Modbus slave:

- Function code: 03H, 04H, 06H and 10H.
- Format: RTU and ASCII.

[9] Power: 24VDC (11~30VDC).

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

[11] Built-in electrostatic protection: 15 KV ESD. Communication interface isolation: 3KV.

[12] Dimensions (W*H*D): 1.33 in*4.56 in*4.21 in (34mm*116mm*107mm)..

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

[14] Protection level: IP20.

1.4 Related Products

The related products include: GT200-DN-RS, GT200-DP-RS.

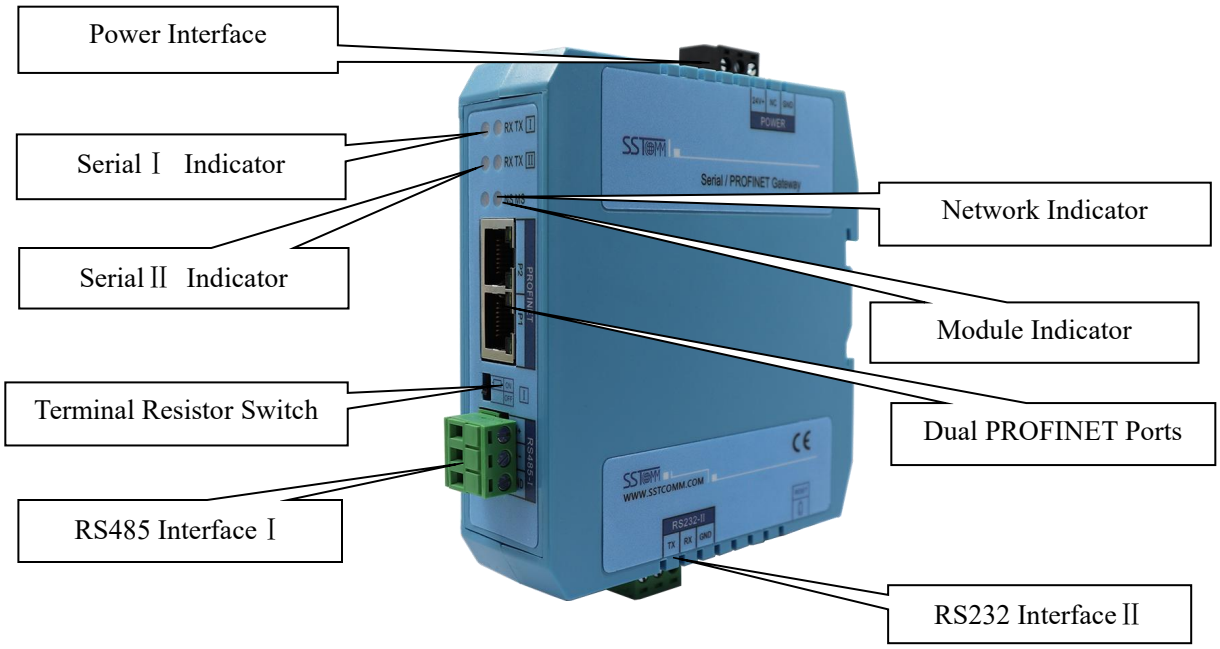
To get more information about related products, please visit SSTCOMM website: www.sstautomation.com.

1.5 Revision History

Revision	Date	Chapter	Description
V1.0 Rev A	2/22/2018	All	New release
V1.0 Rev B	12/28/2021	All	Updated the format
V3.5 Rev A	8/4/2022	PART	Updated the product picture, dimensions and software screenshot

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	State	Description
SerialI/II TX	Green Blinking	Serial port data sending
	OFF	No data is sending
SerialI/II RX	Green Blinking	Serial port data receiving
	OFF	No data is receiving
MS	See below table	
NS	See below table	

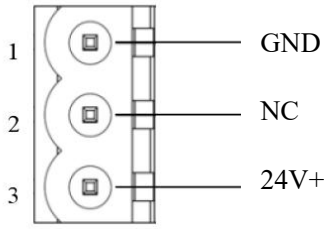
Module indicator and network indicator:

Module indicator state MS	Network indicator state NS	Description
OFF	Red blinking	Start-up state, waiting to initialize
Green on	Red blinking	Initialize complete, no connection with PLC
Green on	Green on	PLC has connected
Other	Other	Undefined state

2.3 Interface

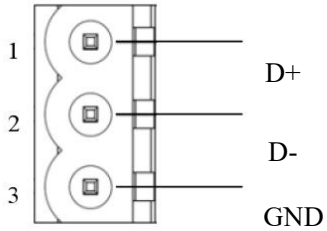
2.3.1 Power Interface

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



2.3.2 Serial I RS485

Pin	Function
1	D+, RS485 Data Positive
2	D-, RS485 Data Negative
3	GND



The basic characteristics of RS485 transmission technology:

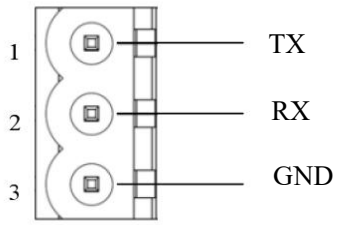
- Network topology: Linear bus, there are active bus terminal resistors at both sides. If the communication quality is unstable, users can turn on the terminal resistor (120Ω, 1/2W) switch on the gateway.
- Media: Shielded twisted-pair cable and also can cancel the shielding, depending on environmental conditions (EMC).
- Station number:

  (1) When serial port 1 and serial port 2 simultaneously connect the slave equipment as the Modbus master or User config, serial port 1 can configure up to 3 nodes.

When configuring serial port 1 as the Modbus master independently, it can configure up to 4 nodes.

2.3.3 Serial II RS232

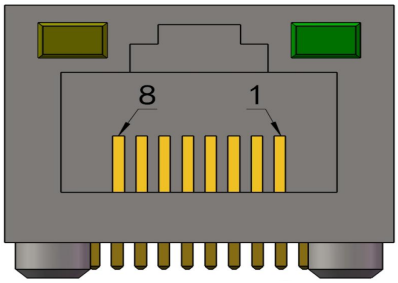
Pin	Function
1	TX, connect RS232's RX of user device
2	RX, connect RS232's TX of user device
3	GND,connect RS232's GND of user device



2.3.4 Ethernet Interface

The Ethernet interface uses RJ45 interface, follows the IEEE802.3u 100BASE-T standard, 10/100M adaptive. its pin (standard Ethernet signal) is defined as below:

Pin	Signal Description
S1	TXD+, Transmit Data+
S2	TXD-, Transmit Data-
S3	RXD+, Receive Data+
S4	Bi-directional Data+
S5	Bi-directional Data-
S6	RXD-, Receive Data-
S7	Bi-directional Data+
S8	Bi-directional Data-

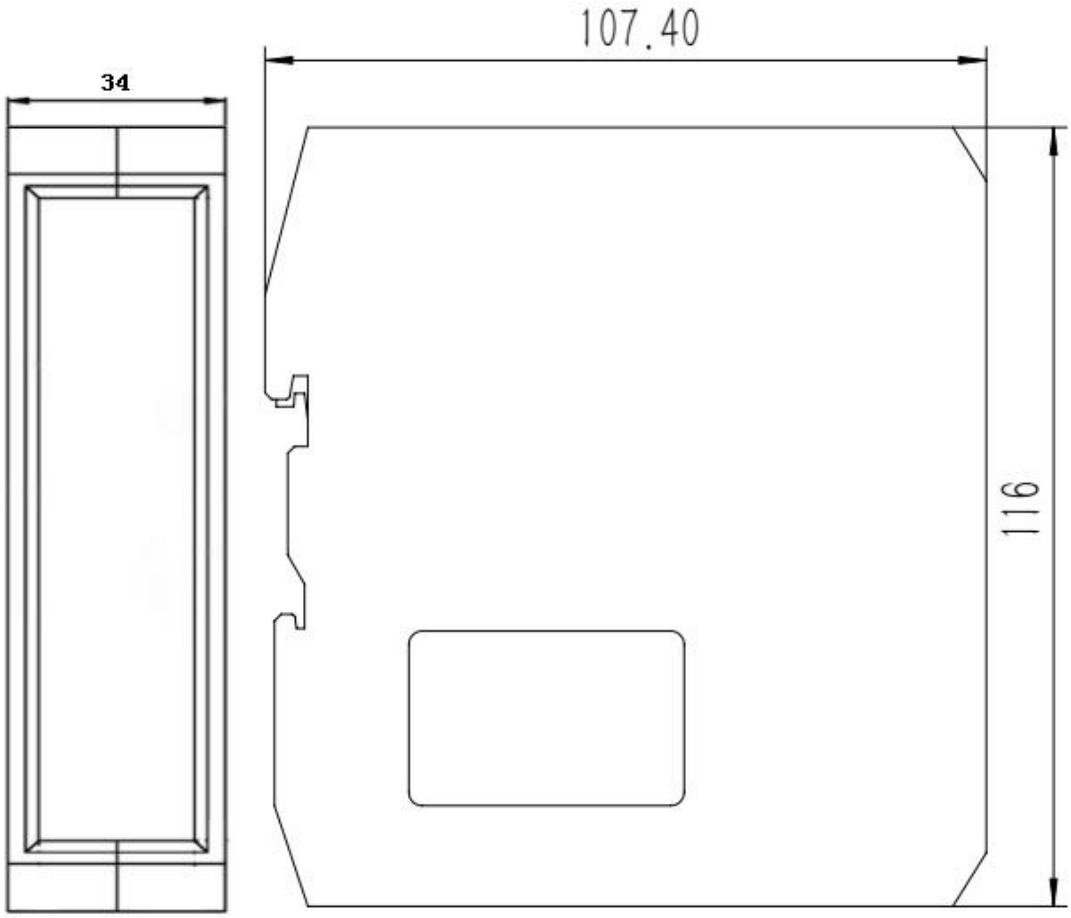


3 Installation

3.1 Machine Dimension

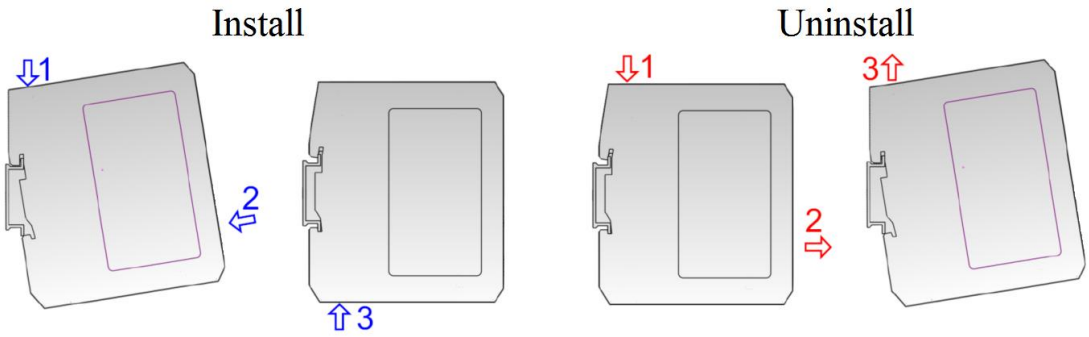
Size (width * height * depth):

1.33in * 4.56in * 4.21in (34mm * 116mm * 107.4mm)



3.2 Installation Method

Using 1.4 in (35mm) DIN RAIL.



4 Quick Start Guide

Basic steps when configuring GT200-PN-RS :

1. Wiring：See also Chapter2.3 Interface.

   (1) Connect the network port of the gateway to the PC with a network cable for downloading the configuration. Another network port can be connected to PROFINET master equipment such as PLC for data communication.

   (2) Connect the serial port of the gateway to the serial device for communication with the serial port device.

   (3) Connect the gateway power supply and power on.

2. Download SST-TS-CFG software from www.sstautomation.com/Download1/ and install it.
3. Download the latest device description file for GT200-PN-RS from www.sstautomation.com/Download1/.
4. Build your configuration using SST-TS-CFG and download it to the gateway. For more details,see Chapter5.
   When the download is completed, it will give hints “whether to restart the gateway”, click “Yes”.
5. Install the appropriate device description file in the PROFINET configuration tool.
6. Configure the PROFINET network as required. Make sure that the configuration matches the configuration present in the GT200-PN-RS.
   When GT200-PN-RS establishes a connection with the PROFINET master, the gateway will display: NS green on, MS green on.

Please note the following three points:

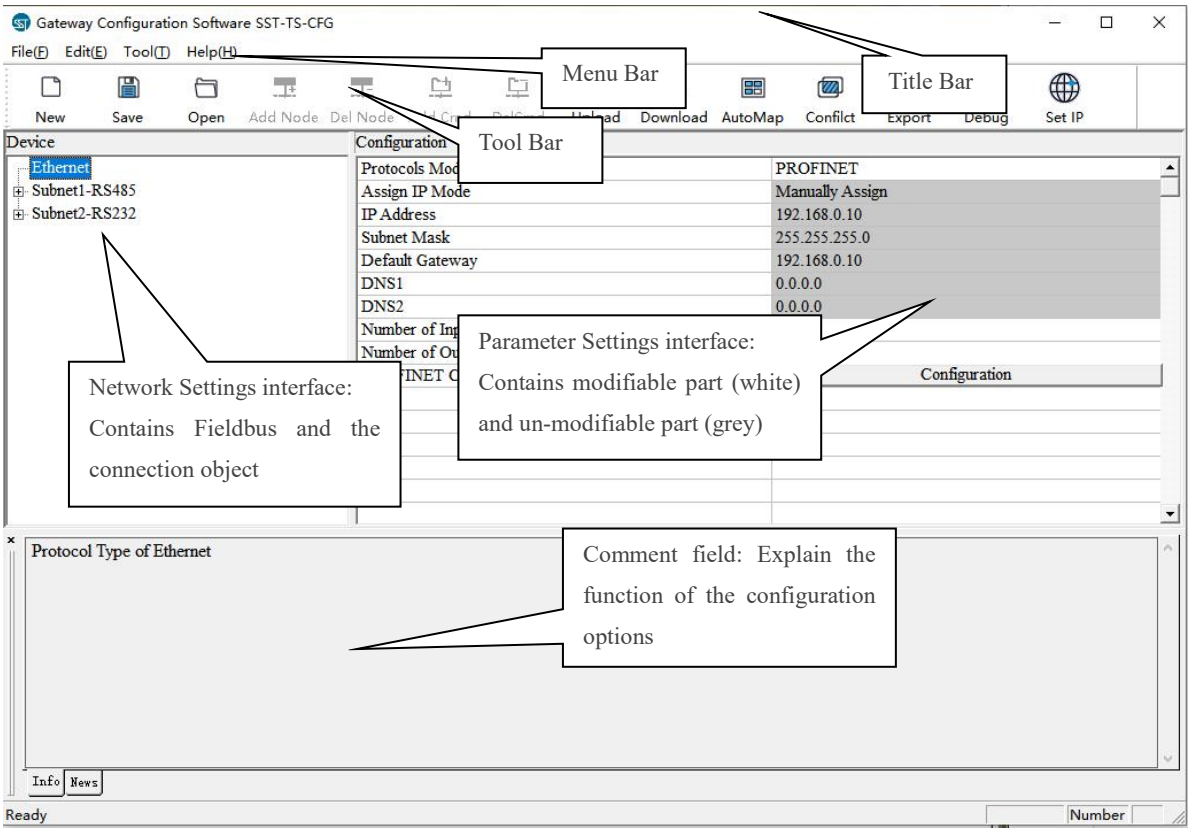
The gateway configuration in SST-TS-CFG must be consistent with the settings of configuration software of PROFINET Master station.

1) Device IP Address. Also see Chapter5.3.4.
2) Device Name. Also see Chapter5.3.4.
3) The type and order of the “PROFINET Configuration Module”. Also see Chapter5.2.1.

5 Software Instructions

5.1 Software Interface Description

SST-TS-CFG is the configuration software based on Windows, and used to configure GT200-PN-RS through network Interface. Double click software icon ,select GT200-PN-RS, enter the main interface of software:



Tool bar interface is shown as below:

New: Create a new configuration project.

Save: Save the configuration project.

Open: Open the configuration project.

Add Node: Add a Modbus slave node.

Delete Node: Delete a Modbus slave node.

Add Command: Add a Modbus command.

Delete Command: Delete a Modbus command.

Upload: Read the configuration information from the module and shown in the software.

Download: Download the configuration file to the gateway.

AutoMap: Used to automatically calculate the mapped memory address without confliction by each command.

Conflict Detection: To check whether there are conflicts with configured commands in the gateway memory data buffer.

Export EXCEL: Export current configuration to the local hard disk, saved as .xls file.

Debug: Monitor or modify the gateway memory buffer data.

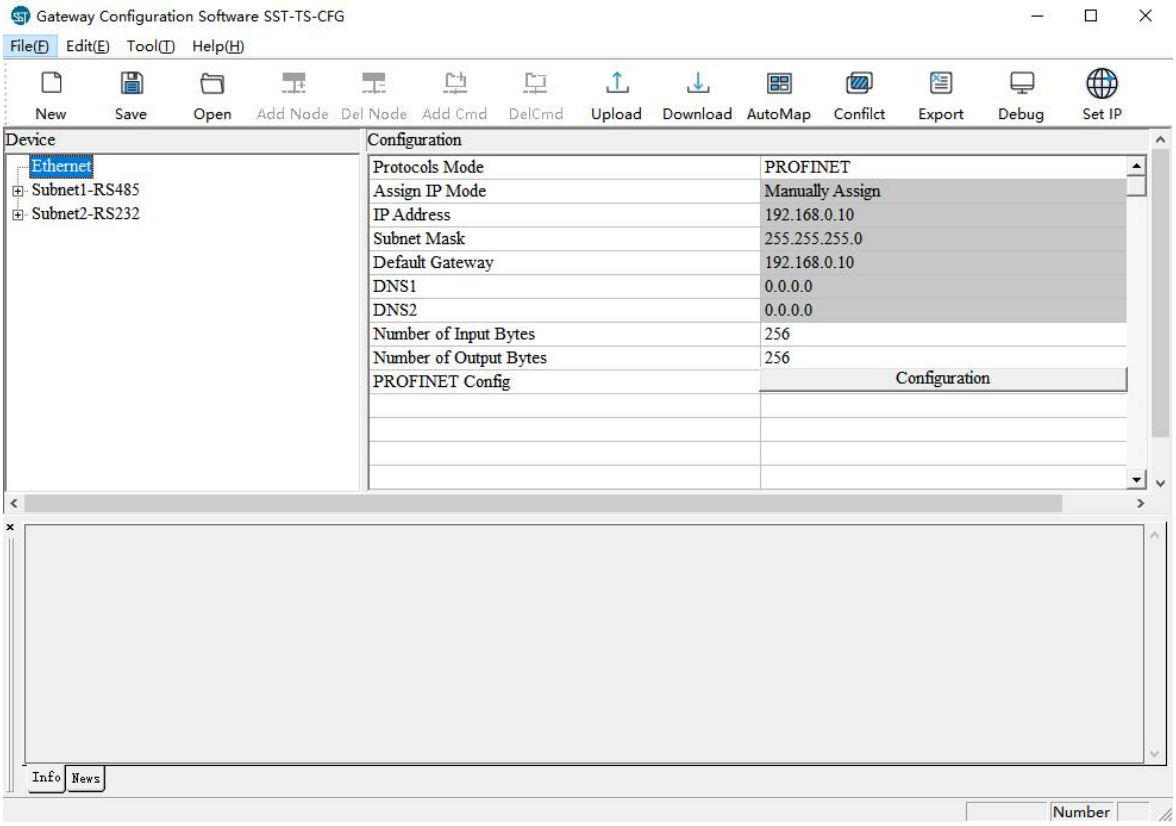
Assign Ethernet Parameters: Used to assign the IP, subnet and gateway information on the LAN.

5.2 Device View

Ethernet is used to configure PROFINET network parameters. Subnet is used to configure serial port parameters. The operations of Subnet 1 and Subnet 2 are the same.

5.2.1 Ethernet Configuration View

The Ethernet configuration interface is shown as below:



IP Address: IP address of GT200-PN-RS.

Subnet Mask: Subnet mask of GT200-PN-RS.

Gateway Address: Gateway address GT200-PN-RS is located in LAN.

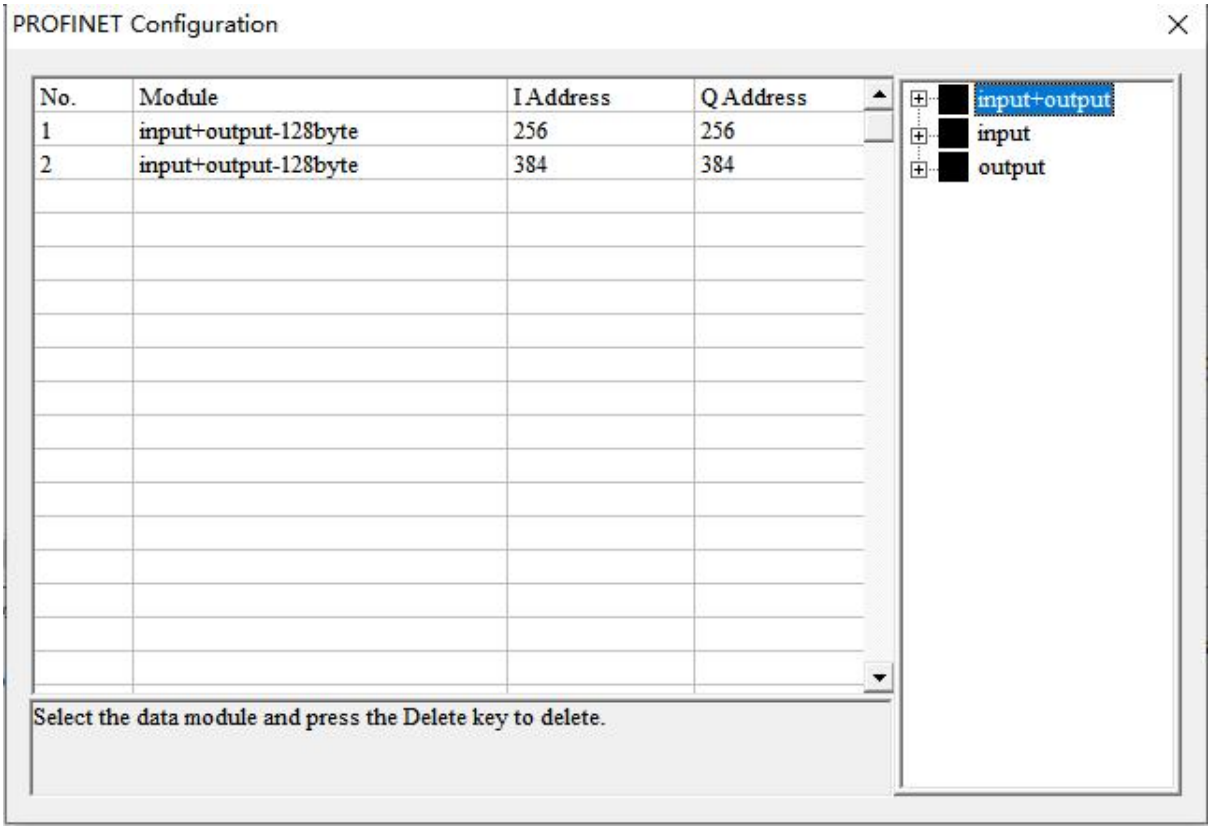
Numbers of Input Bytes: The length of input data needs to be exchanged between GT200-PN-RS and PLC. It depends on the PROFINET configuration dialog box.

Numbers of Output Bytes: The length of output data needs to be exchanged between GT200-PN-RS and PLC. It depends on the PROFINET configuration dialog box.

PROFINET Config: Input/output bytes length of GT200-PN-RS.

Notes: This configuration items must be the same as that of relevant slots in configuration software of PROFINET Master station.

PROFINET configuration dialog box is shown as below:



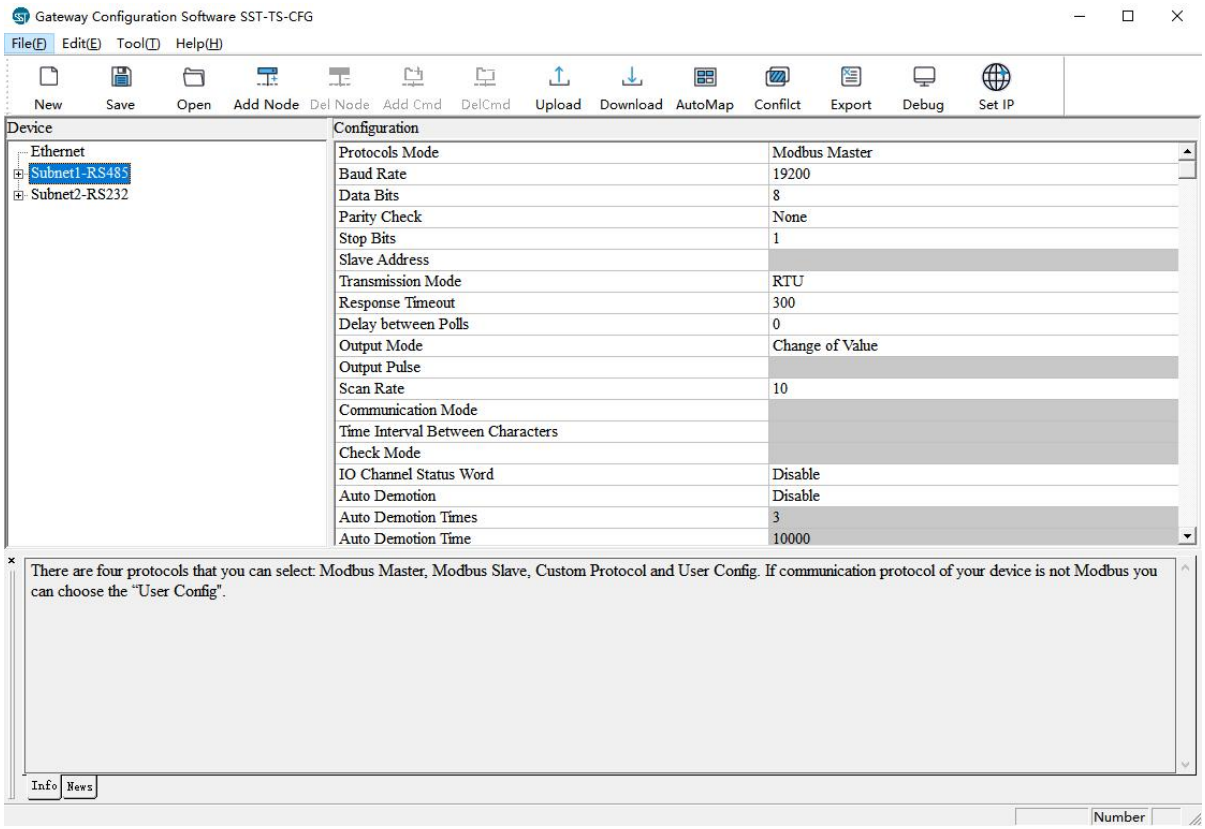
As is shown above, there are 2 slots configured, that is: 128byte input + output, 128byte input + output.

The type and order of these modules must be the same as the settings of configuration software of PROFINET Master station.

5.2.2 Subnet Configuration View-Modbus Master

1. Modbus Master configuration view

The “Modbus Master” configuration interface of “Protocols Select” is shown as below:



Baud Rate: 300, 600, 1200, 2400, 4800,9600, 19200, 38400, 57600 and115200bps optional.

Data Bits: 7,8.

Parity Check: None, Odd, Even, Mark and Space optional.

Stop Bits: 1, 2.

Transmission Mode: RTU, ASCII.

Response Timeout: After the Modbus Master sends request, it waits the Modbus slave's response time. range: 300 ~ 60000ms.

Delay between Polls: Delay between a response has been received and sending next request, the range is 0~ 2500ms.

Output Mode: Modbus write command, there are three modes: cycle, forbidden, change of value.

Cycle: Same as Modbus read command output way, start scan output according to scan rate.

Forbidden: Disable output of Modbus write command.

Change of Value: When the output data change, the write command will be sent and stop to output when receiving the right response.

Scan Rate: Scan Rate is the ratio of fast scan cycle to slow scan cycle. If this parameter value is set to 10 then every fast scan command will be sent 10 times and those slow scan commands will be sent once.

IO Channel Status Word: When enabled, an area is reserved at the front end of the input buffer to indicate the execution of each command under the subnet.

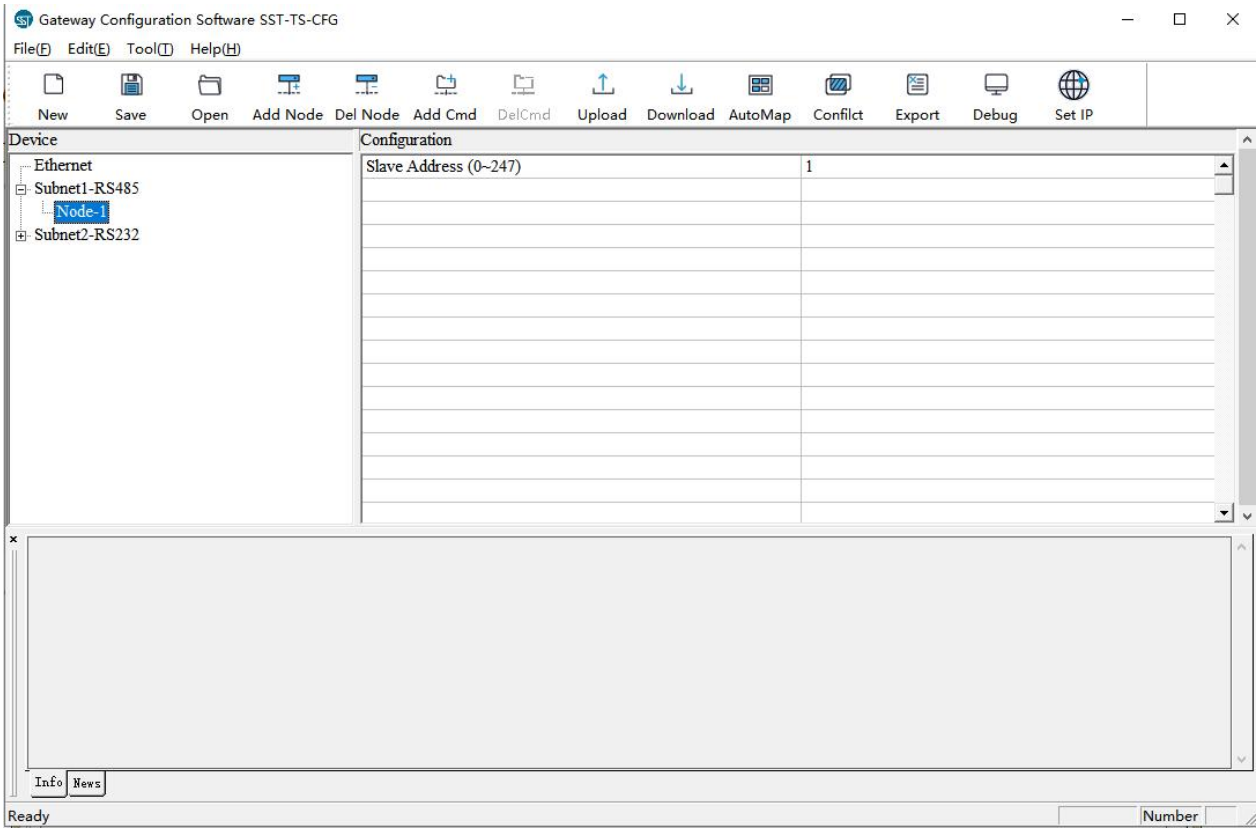
Enable Auto Demotion: Default value is Disable. When Enable Auto Demotion and a command is a fast scan command without correct response for N times, then the command will demote a slow scan command. This parameter is valid for Modbus Reading command and cycle Writing command.

Auto Demotion: After N times successive incorrect Response the command will be demoted a slow scan command. The range of the parameter value is 1 to 255. Default value is 3.

Auto Demotion Time: When the Demotion Time timeout the command will promote a fast command. The range of the parameter value is100 to 3600000ms. Default value is 10000ms.

2. Node Configuration

Under the "Modbus Master" mode, left click on a node and then the configuration interface is shown as below:

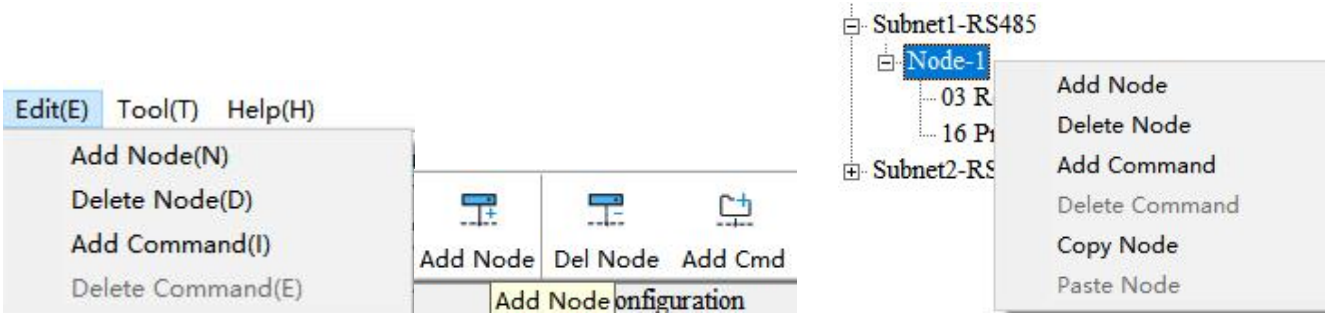


- Parameter Description:

(1) When the subnet protocols Mode is selected as "Modbus Master", the node is the Modbus slave station address, ranging from 0 ~ 247.

(2) When serial port 1 (RS485 serial port) and serial port 2 (RS232 serial port) simultaneously connect the slave equipment as the Modbus master, Serial port 1 supports connection of 3 Modbus slave devices, and serial port 2 can configure up to 1node. When configuring serial port 1 as the Modbus master independently, it can configure up to 4 nodes.

- Instructions: For device view, the software supports three kinds of operation modes: edit menu, edit toolbar, and right-click edit menu.



(1) Add node: Left click on subnet or existing nodes, and then perform the operation of adding a new node. Then there is a new node named “The new node” under subnet.

(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) Copy node: Select an existing node and copy the node. The commands under the node will be copied at the same time.

(4) Paste node: Select the Subnet or an existing node and paste the node. The pasted node has the same parameters with the copied node.

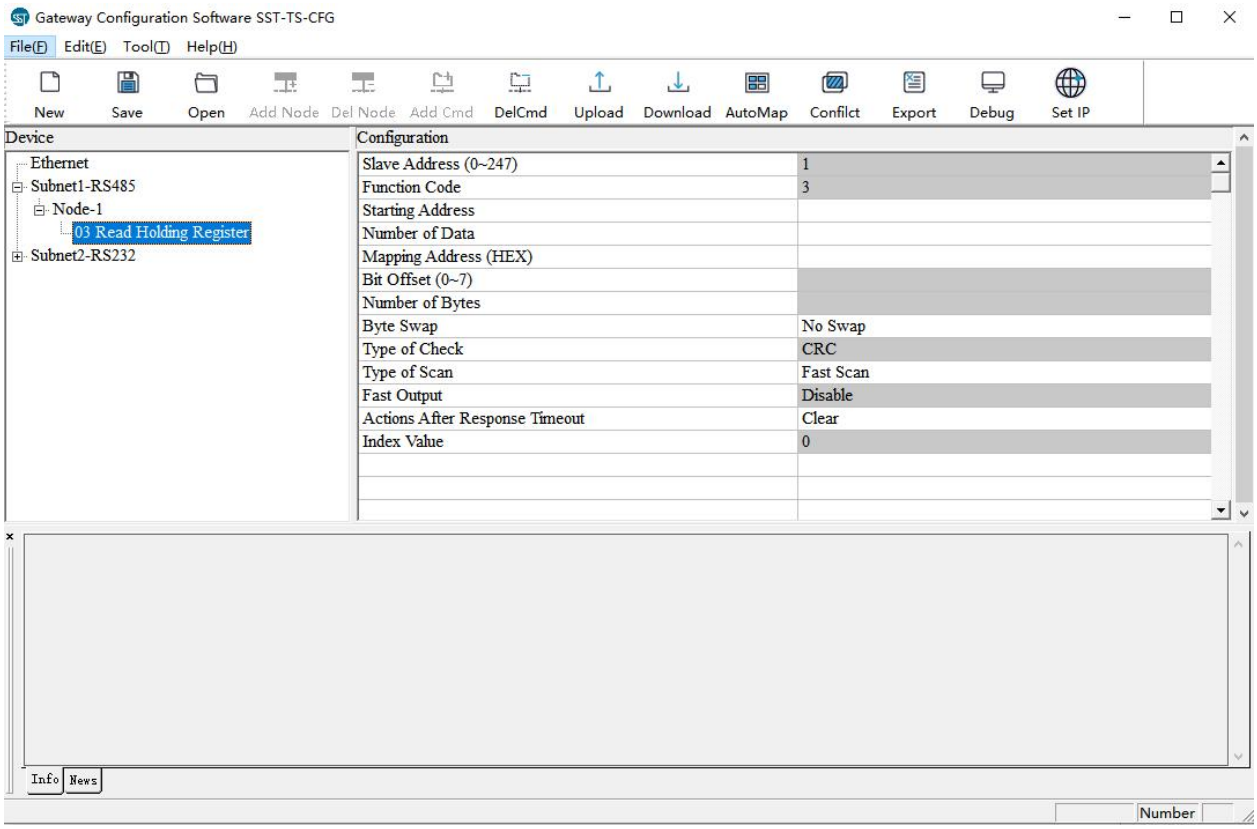
3. Command Configuration

- Parameter Description: Commands No. supported: 01, 02, 03, 04, 05, 06, 15, 16.
- Instructions: The Command Configuration view supports three types of operation: Edit Menu, Edit Toolbar and Right click edit Menu.

  (1) Add commands: Left click on the node, and then perform the operation of adding command to add a command for the node.

  (2) Delete commands: Left-click on the command and perform the operation of deleting command.

Under the “Modbus Master” mode, left click on a command and then the configuration interface is shown as below:



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

Number of Data: Number of the register/switching value/coil of Modbus slave devices.

Memory Mapped Staring Address (HEX): Starting address of data in the module.

The address range of data mapping in the module memory:

Read command (1, 2, 3, 4): 0x0000~0x03FF.

Write command (5, 6, 15, 16): 0x4000~0x43FF.

Users can also use this area when write command is used as local data exchange: 0x0000~0x03FF.

Memory Mapped Bit Offset (0~7): For the bit operation command, the position where the start bit is located in, range: 0~7.

Scan Mode: There are two ways, fast and slow 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 (configured in the subnet configuration interface).

Response Timeout Processing: It's the processing mode when the gateway doesn't receive the response within

response wait time (set in “Response Timeout” of the subnet)

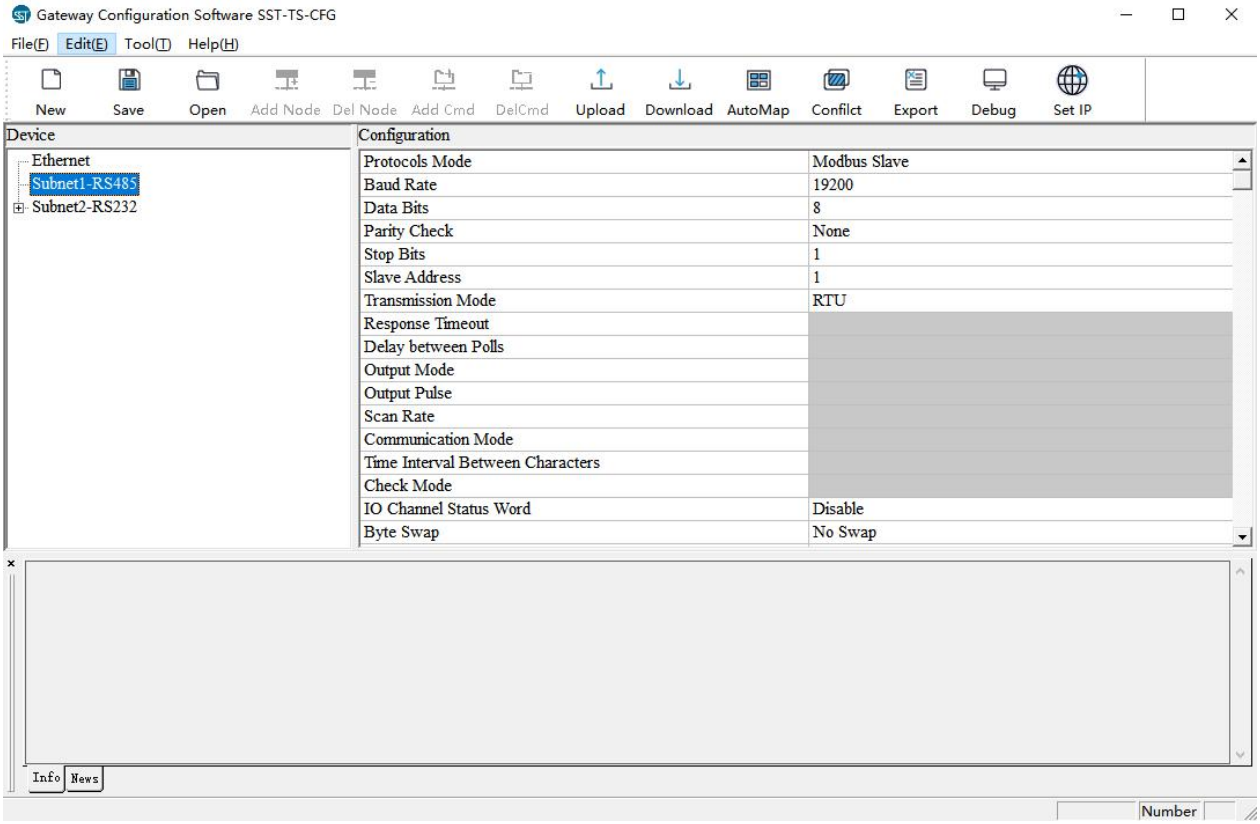
Clear: Sets the response data in the input buffer to zero.

Hold: The data in the input buffer remains the same.

For specific communication instructions, please see Chapter6.2.4.

5.2.3 Subnet Configuration View-Modbus Slave

The “Modbus Slave” configuration interface of “Protocols Select” is shown as below:



Baud Rate: 300, 600, 1200, 2400,4800, 9600, 19200, 38400, 57600 and 115200bps optional.

Data Bits: 7, 8.

Parity Check: None, Odd, Even, Mark and Space optional.

Stop Bits: 1, 2.

Slave Address: 0~247.

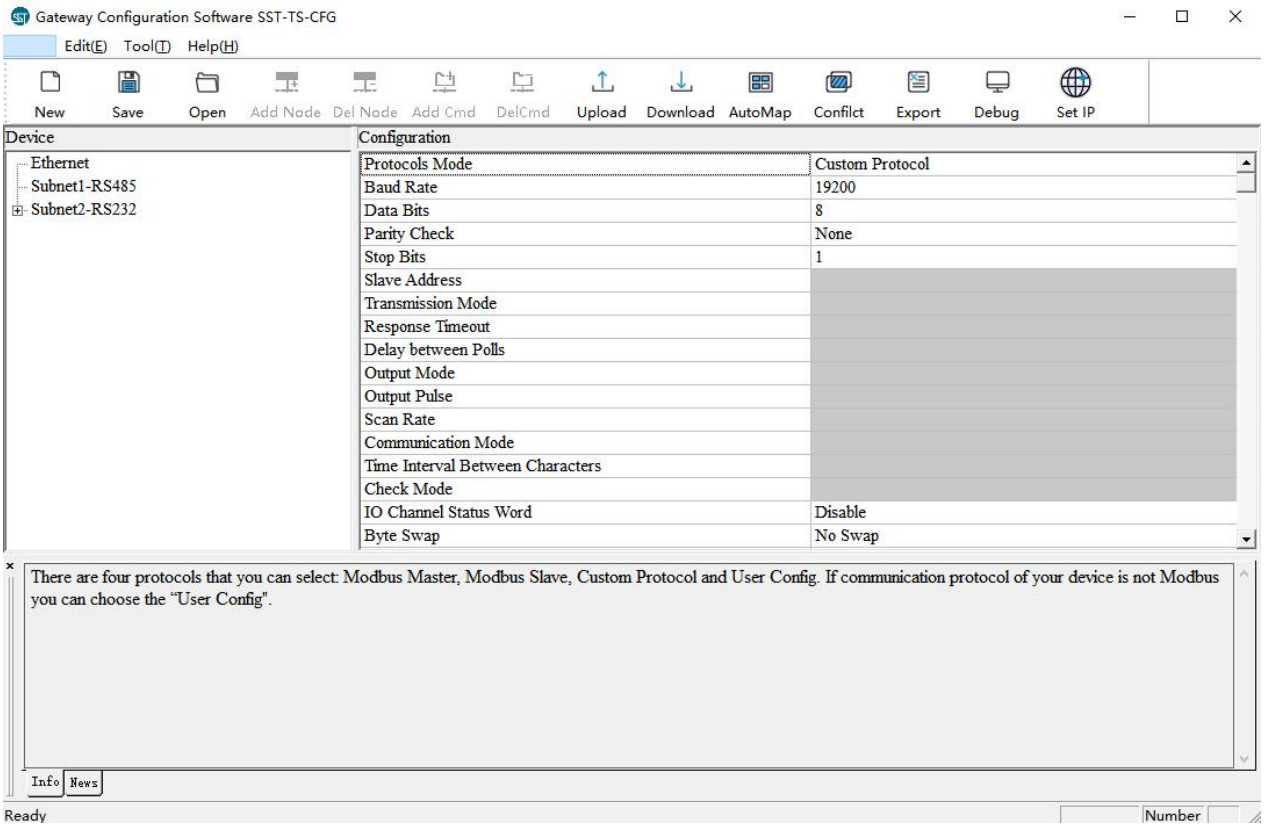
Transmission Mode: RTU, ASCII.

IO Channel Status Word: Enabled, will use a 16-bit integer to represent receives the correct number of frames.

Byte Swap: No swap, double-byte swap, four-byte swap and Four-Byte Big-endian and Little-endian Swap.

5.2.4 Subnet Configuration View-Custom Protocol

The “Custom Protocol” configuration interface of “Protocols Select” is shown as below:



Baud Rate: 300, 600, 1200, 2400, 4800,9600, 19200, 38400, 57600 and 115200bps optional.

Data Bits: 7, 8.

Parity Check: None, Odd, Even, Mark and Space optional.

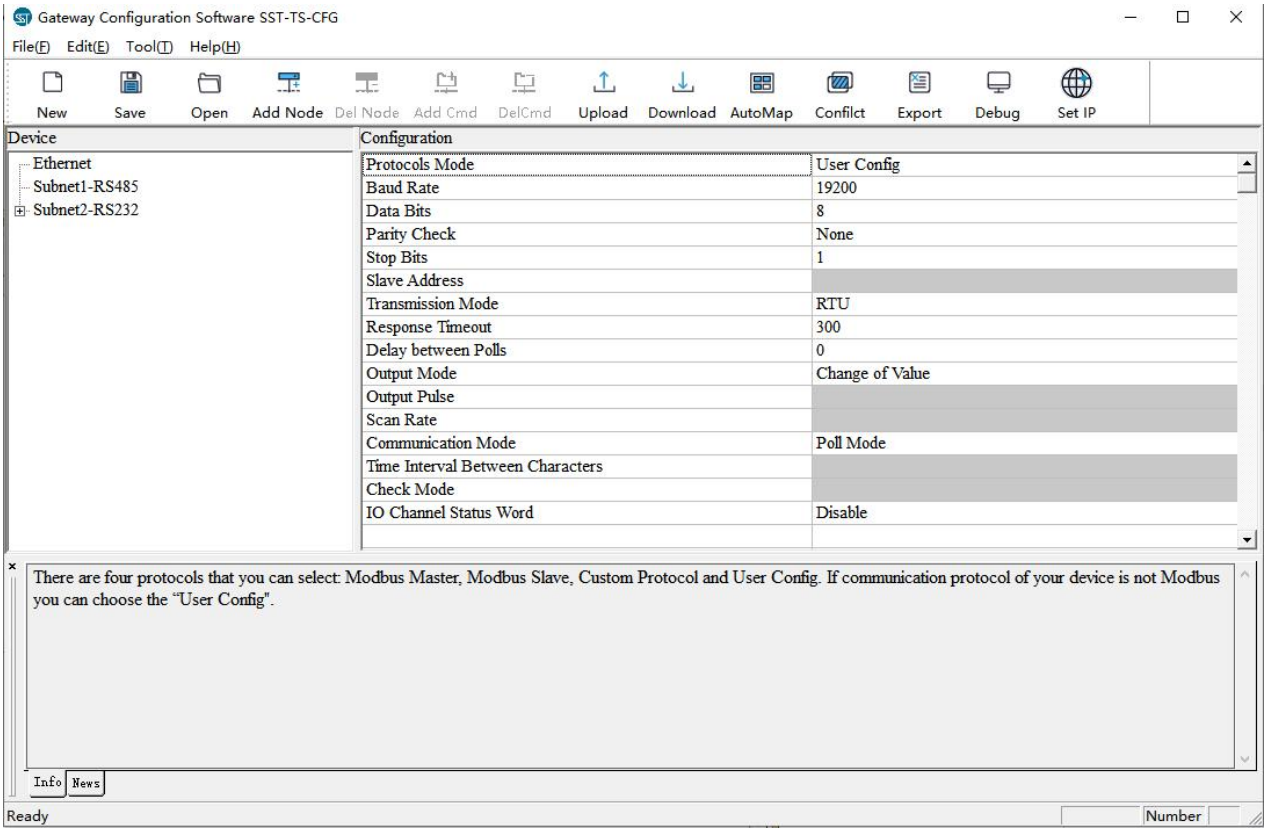
Stop Bits: 1,2.

IO Channel Status Word: Enabled, will use a 16-bit integer to represent receives the correct number of frames.

Byte Swap: No swap, double-byte swap, four-byte swap and Four-Byte Big-endian and Little-endian Swap.

5.2.5 Subnet Configuration View-User Config

The “User config” configuration interface of “Protocols Select” is shown as below:



Baud Rate: 300,600, 1200, 2400,4800, 9600, 19200, 38400, 57600 and 115200bps optional.

Data Bits: 7, 8.

Parity: None, Odd, Even, Mark and Space optional.

Stop Bits: 1, 2.

Transmission Mode: RTU, ASCII, valid when communication mode is poll mode.

Response Timeout: After the Modbus Master sends request, it waits the Modbus slave's response time. range: 300~60000ms.

Delay between Polls: Delay between a response has been received and sending next request, the range is 0~ 2500ms. Valid when communication is poll mode.

Output Mode： (valid when communication is poll mode)

Write command (command with data in request). There are three types of output command: Cycle, Forbidden and

Change of value.

Cycle: Same as Modbus read command (command without data in request) output way.

Forbidden: Disable output of Modbus write command.

Change of Value: When the output data change, the write command will be sent and stop to output when receiving the right response.

Communication Mode: Poll Mode and Receiving Only Mode. Poll Mode is similar to the Modbus communication. Receiving only Mode is that the gateway only receives data. For specific communication instructions, please see Chaper 6.4 User Config.

Time Interval between Characters: Start to count after receiving last byte. If exceeding that time, this will be regarded one full frame is received and ready to receive next frame. Range: 1~300ms. Valid when communication mode is read mode.

Check Mode: None, CRC and Sum optional. Valid when communication mode is Read Mode.

5.3 Tools

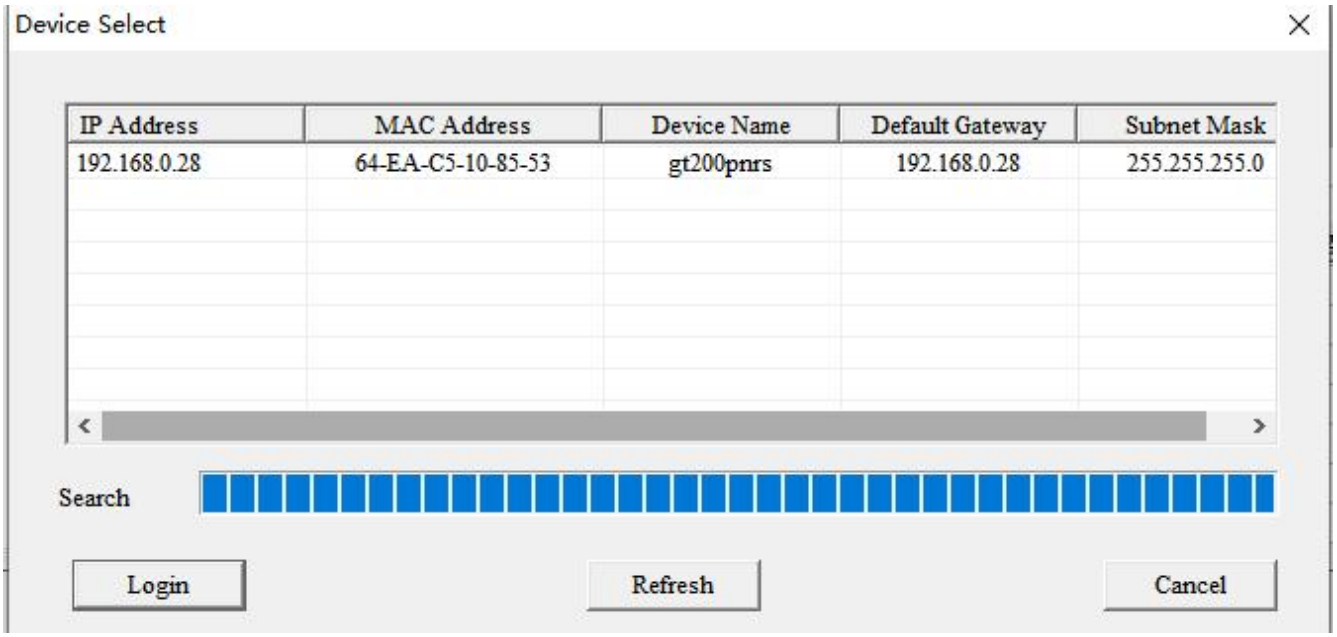
The “Tools” tab on the menu bar contains the following functions:

- Upload Config
- Download Config
- Conflict Detection
- Export EXCEL
- Assign Ethernet Parameters

5.3.1 Upload and Download

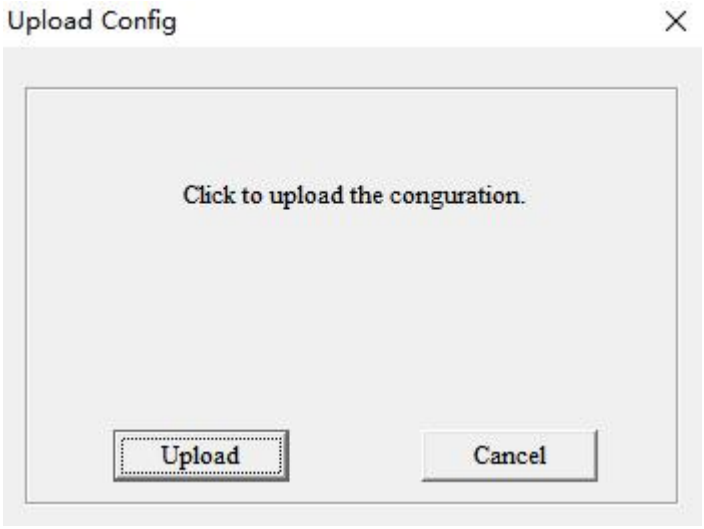
The gateway upload and download via a network cable.

After configuration, click “Upload” or “Download” on the tool bar, it will pop up the following interface:

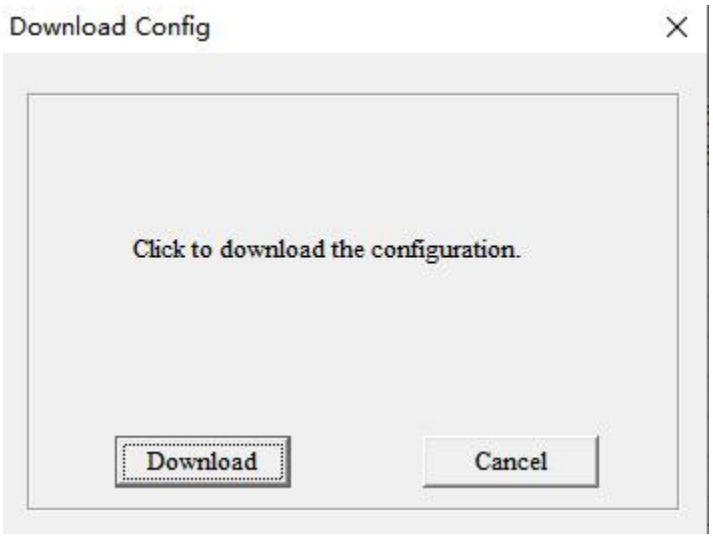


If scanning no device, please click “Refresh”. In the above picture, GT200-PN-RS shows, first select the device and click “Log In”.

Select “Upload”, it will read configurations form the gateway, and the interface is shown as below:



Select “Download”, it will download configurations to the gateway, and the interface is shown as below:



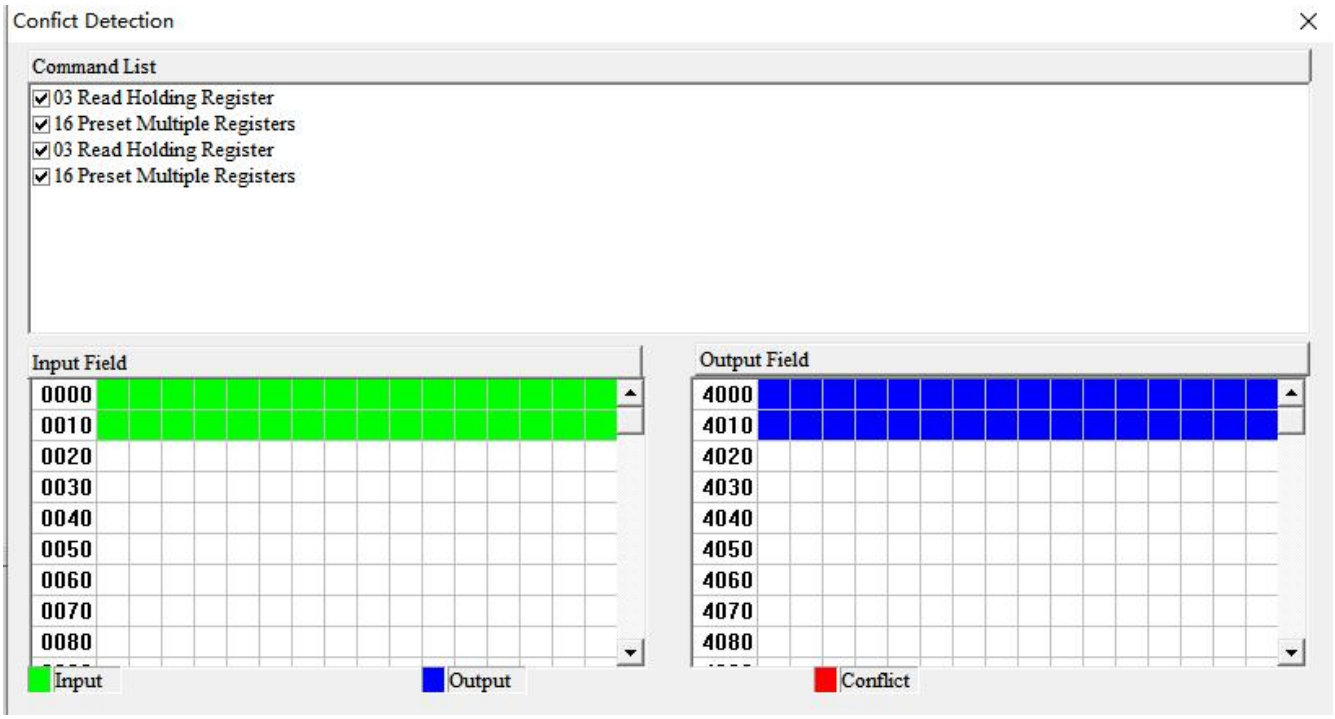
Remark: Please confirm the configurations are correct before downloading configurations.

If the gateway cannot be searched:

- Please check whether the computer and gateway are in the same network segment. When using the gateway for the first time, the gateway is in the 192.168.0.X network segment.
- Please test the network connection first. Please refer to the note "How to Use the Ping Command" located on our Support page on the sstautomation.com website.

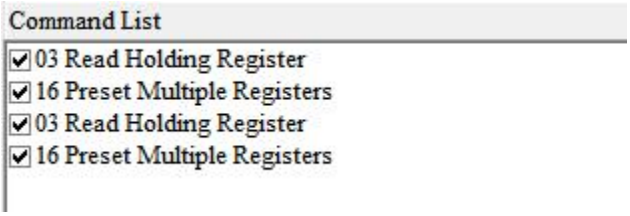
5.3.2 Conflict Detection

It is used to check whether there exists confliction in "memory mapping data". If users find confliction, it can be adjusted in time. The interface is shown below:



(1) Command List Operation

It shows configured command in the command list interface. Check box before each command is used to check the position of this command in memory mapping area. Click one command and check the box, it will show the position where relevant commands occupy in the memory mapping area. Click the command again and uncheck the box, the command will not be shown in the mapping area. This function will be used for confliction detect among commands in memory mapping area.



(2) Memory Mapping Area Operation

Memory mapping area divides into input area and output area.

Input mapping address range: 0x0000 ~ 0x3FFF.

Output mapping address range: 0x4000 ~ 0x7FFF.

Each grid represents one byte address.

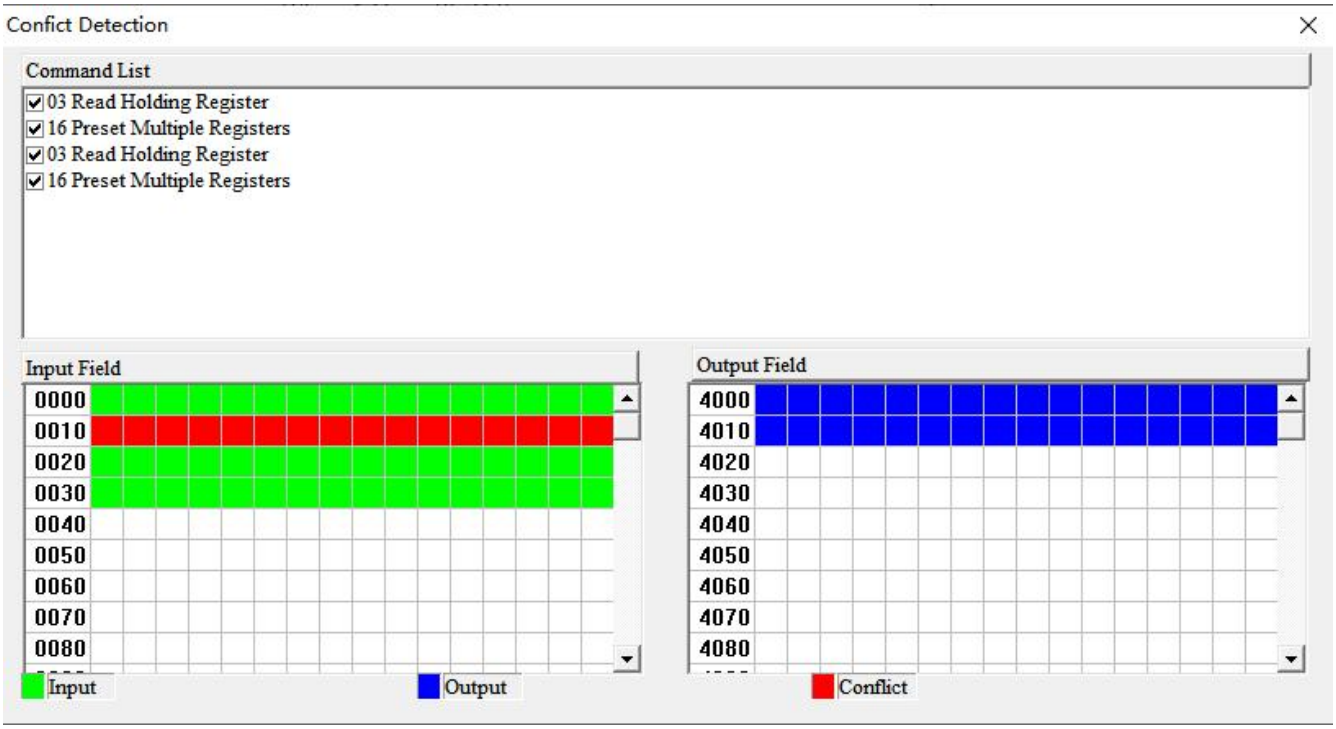
Green: Read command is shown in input mapping area, it will be in green without conflict.

Blue: When address mapping area is located in output area, it will be in blue without conflict.

Red: In input area or output area, different command occupied on the same byte, this byte area will be in red.

For bit operation command, the above grid displaying meaning works the same.

Click input/output area grids, each bit of relevant byte in the grid will show whether each bit is occupied. As is shown below:



5.3.3 Export EXCEL

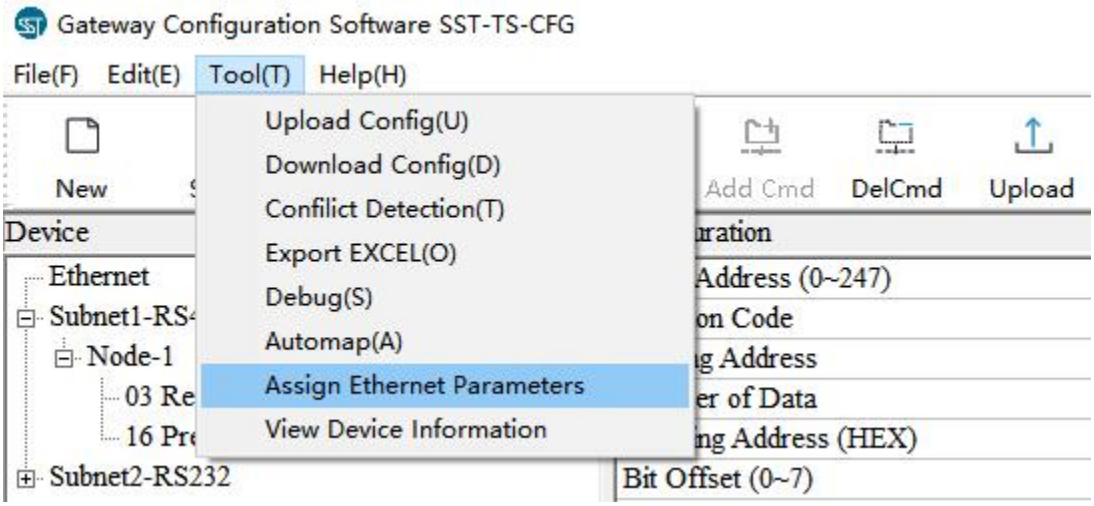
Users can use the function to check the gateway configurations.

Click icon Export on the tool bar you can save the configuration with .xls as its extension.

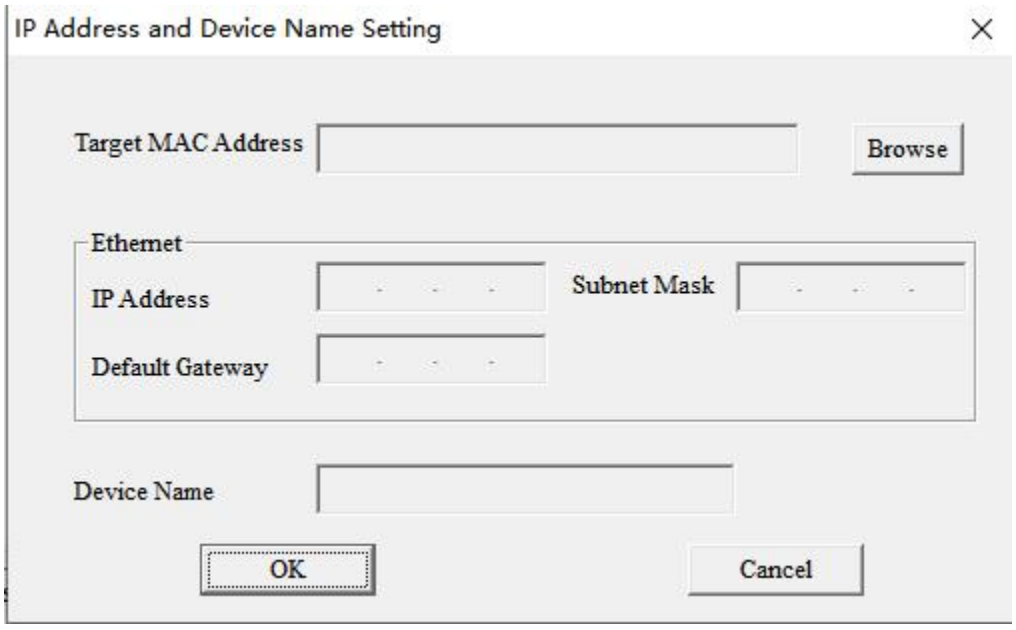
5.3.4 Assign Ethernet Parameters

1. Scan Devices on LAN

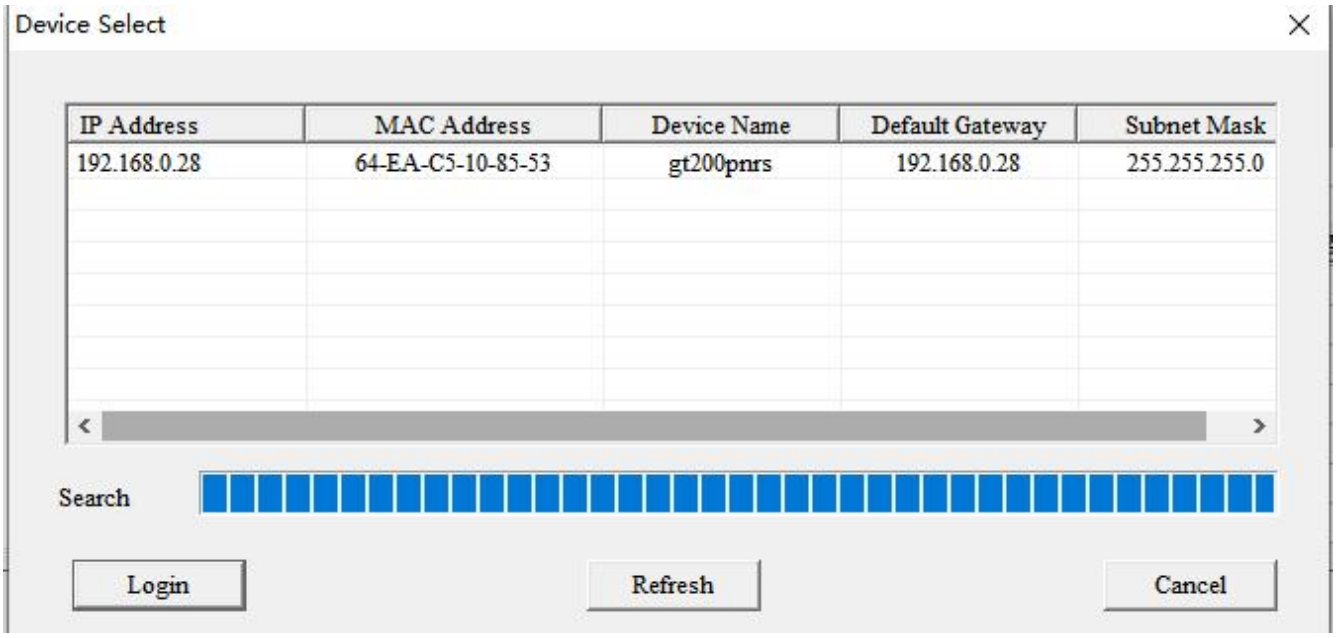
1) Open SST-TS-CFG and click Tools on the menu bar, shown as below:



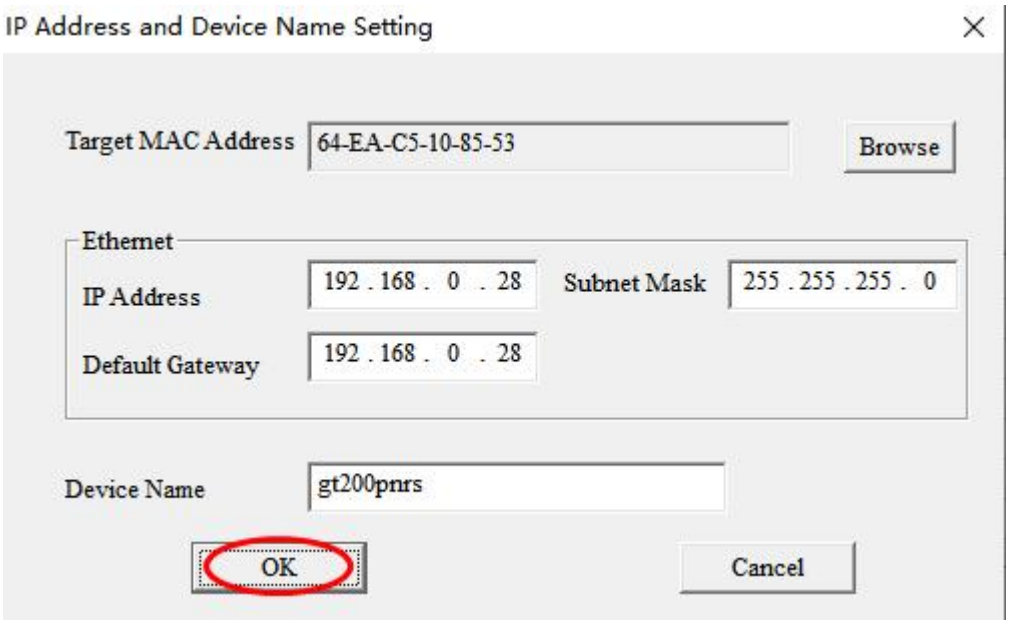
2) Click “Assign Ethernet Parameters” will pop up below interface:



3) Click “Browse”, the dialog box will be shown as below:



Please select the gateway you want to modify and click “Login”.You will see the Ethernet information of the device, for example:



“Target MAC Address” : Shows MAC address of GT200-PN-RS (unmodified).

Notes:

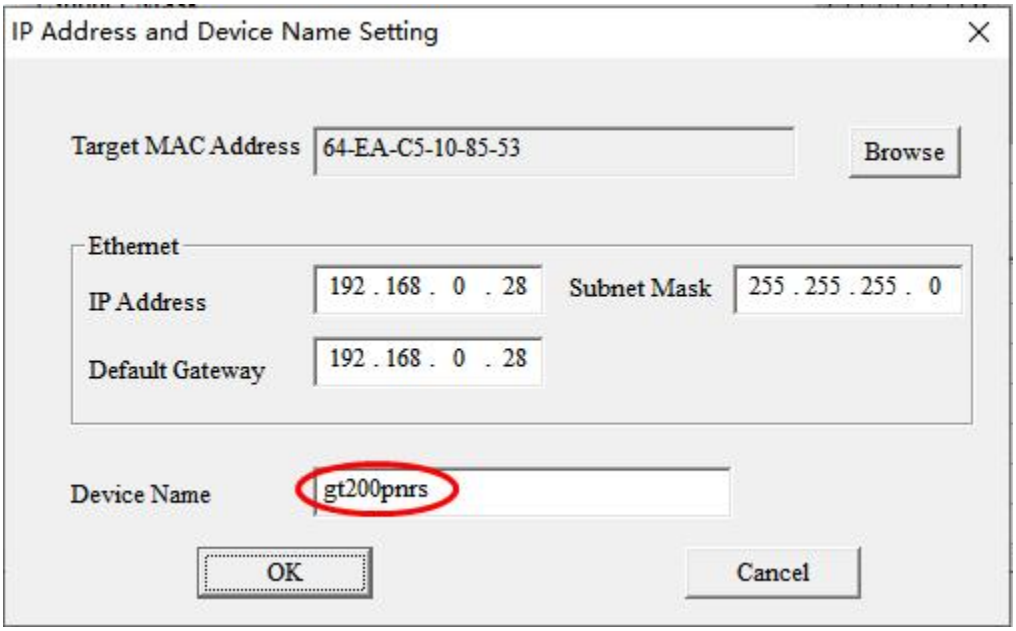
① Make sure that the GT200-PN-RS and your computer are in the same network segment. When using the gateway for the first time, the gateway is in the 192.168.0.X network segment.

② If you can't discover any gateways, please test the network connection first. Please refer to the note "How to Use the Ping Command" located on our Support page on the sstautomation.com website.

2. Set IP Address and Device Name

1) Example of Ethernet parameter and Device Name setting:

Modify IP address to "192.168.0.188", gateway address to "192.168.0.1" and Subnet Mask to "255.255.255.0", Change Device Name to "gt200pnrs" , shown as below:



Click "OK" to complete the setting of Ethernet and Device Name.

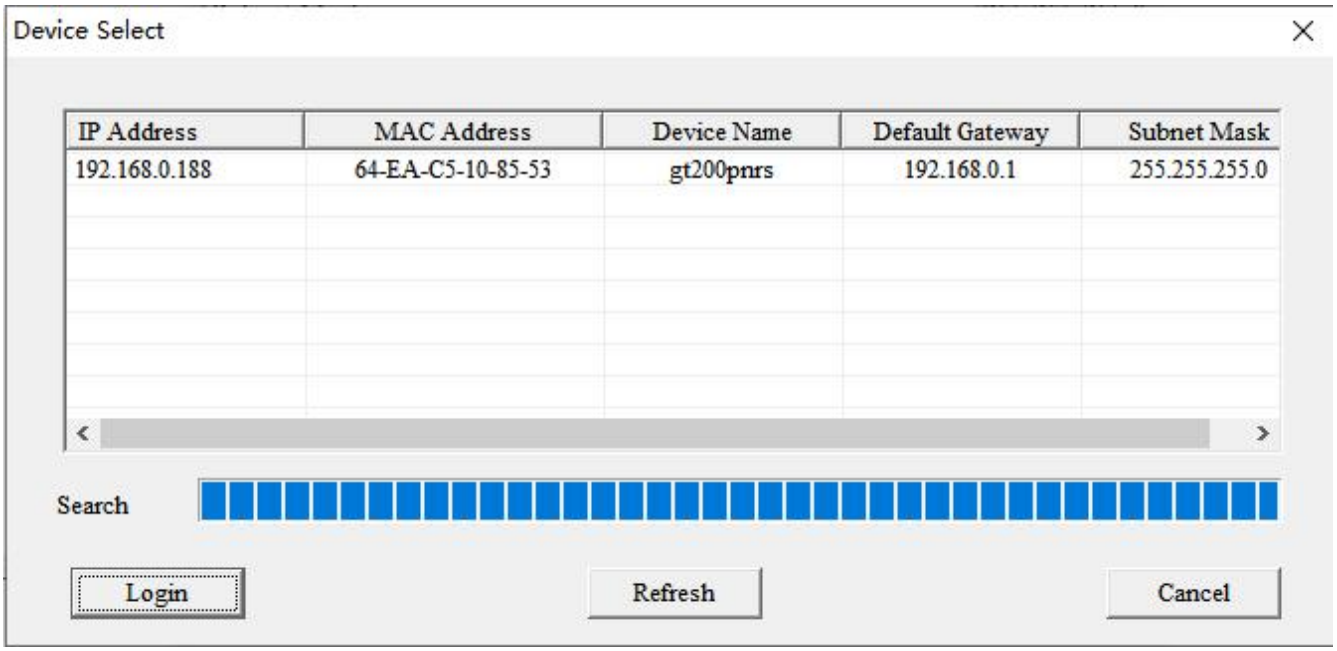
Note:

- The IP address and Device Name settings of the gateway here must be consistent with those set in the PROFINET master configuration software.
- The device name of GT200-PN-RS,which supports only a combination of lowercase letters and numbers, and must begin with a lowercase letter.

  The following are legal names: dut28, dut28nn32.

  The following are illegal names: 28dut, dut28$, dut28+uu.

2) Click again "Browse" will lead to scanning device again. See below:



You can see that IP address has been modified “192.168.0.188”, Device Name is “gt200pnrs”.

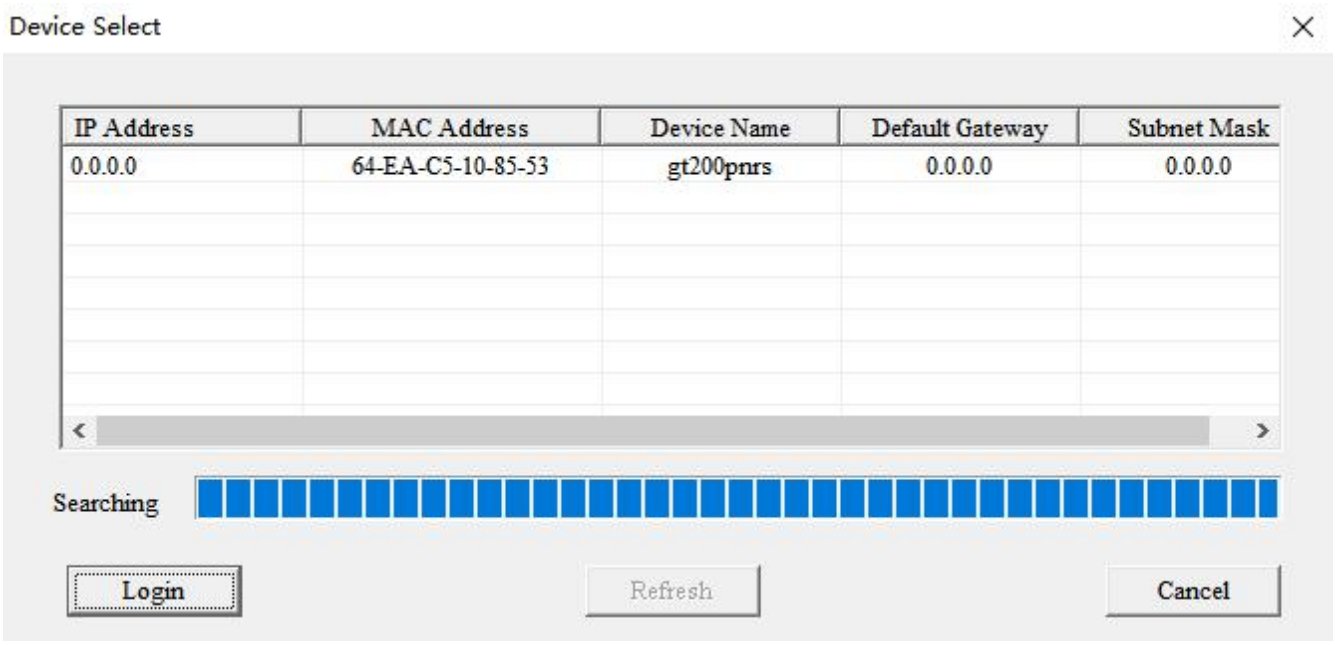
3. IP Address Conflict Resolution

According to the specification of PROFINET protocol, acting as a PROFINET slave, GT200-PN-RS must obey the rule that there can’t be more than 1 PROFINET device which has the same IP address and name on the same LAN when connecting many GT200-PN-RS devices.

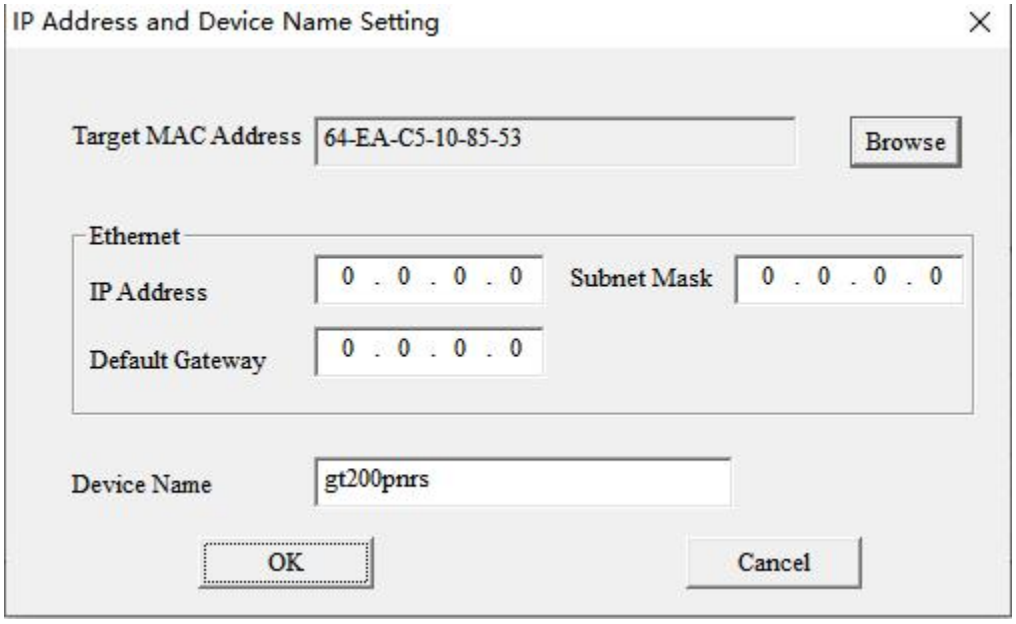
If there are conflictions of IP address and device name, users can change IP address and name of GT200-PN-RS according to chapter “Set IP Address and Device Name” and ensure that others IP address and name are different (Notes: after changing is complete, some relevant change should be taken in PLC modeling and users must ensure the IP address and name of GT200-PN-RS is the same with that of PLC modeling).

For example:

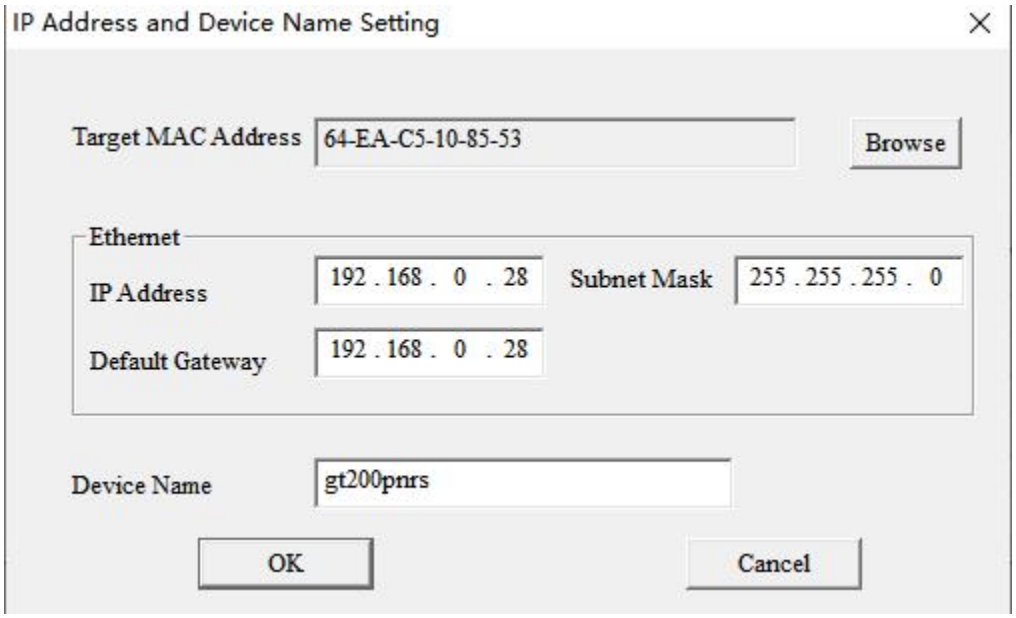
When it happens to IP address confliction, IP address, subnet mask and gateway address of GT200-PN-RS will be reset to “0.0.0.0”. Now, users can't use “Upload” or “Download” to scan GT200-PN-RS and only use chapter “Scan Devices on LAN” to scan the device, the scanning result is shown as below:



You can see the IP address is reset to “0.0.0.0”, choose the device and log in, the dialog box is shown as below:



Set “IP”, “Subnet” and “Gateway” to “192.168.0.188”, “255.255.255.0” and “192.168.0.1” and you will see the below picture:


IP Address and Device Name Setting
Target MAC Address
64-EA-C5-10-85-53
Browse
Ethernet
IP Address
192 . 168 . 0 . 28
Subnet Mask
255 . 255 . 255 . 0
Default Gateway
192 . 168 . 0 . 28
Device Name
gt200pnrs
OK
Cancel

Click “OK”.

6 Work Principle

6.1 Data Exchange

The data conversion between PROFINET network and serial of GT200-PN-RS is established by "mapping". GT200-PN-RS has two data buffers, one is input buffer (1K bytes) with address range 0x0000-0x03FF. the other is output buffer (1K bytes) with address range 0x4000-0x43FF.

6.1.1 PROFINET Slave

Presuming the input data length users have configured is N1, output data length is N2. GT200-PN-RS will periodically send the data within the address range of [0x0000, N1] to PROFINET network. When receiving data from PROFINET network, GT200-PN-RS will write the data to the address range of [0x4000, 0x4000+N2].

6.1.2 Modbus Master

When one serial runs Modbus master protocol, for all write registers, write coils command GT200-PN-RS supports, GT200-PN-RS can get data from address range 0x0000-0x03FF, 0x4000-0x43FF and send them to the Modbus slave. For all read registers, read coils command, GT200-PN-RS can write the data returned from Modbus slave to address range 0x0000-0x03FF.

Notes: Each Modbus master can configure 48 commands, and every command can get one continuous Modbus register.

6.1.3 Modbus Slave

When one serial runs Modbus slave protocol, for No. 03 commands master sent, GT200-PN-RS will get data from address range 0x0000-0x03FF. For No. 04 commands, it will get data from 0x4000-0x43FF and return them to the Modbus master. For No. 06, 16 command, it will write the Modbus master data to the address range of 0x0000-0x03FF.

6.1.4 Custom Protocol

When one serial runs self-defined protocol, users' serial device can read/write data to any address of two buffers of 0x0000-0x03FF and 0x4000-0x43FF.

6.1.5 User Config-Poll Mode

When one serial runs universal mode-ask and answer, request part of command can get data from any address of buffer 0x0000-0x03FF and 0x4000-0x43FF and send data to the serial slave device. When serial slave devices didn't give any response (if they did), if there exists data in response, GT200-PN-RS will write them to the address range of

0x0000-0x03FF. The specific data size will depend on users' configuration.

6.1.6 User Config-Receiving Only Mode

When one serial runs universal mode-receive, it will receive data sent from serial master device and don't give any response. In this way, GT200-PN-RS will write the data which it received to some address areas of 0x0000-0x03FF.

6.2 Command execution instructions

6.2.1 IO Status Word

This content is applicable to the four modes of the gateway.

In order to easily obtain the state of the execution of each command under each master station, the IO state word is introduced.

- MODBUS master protocol and User Config-POLL protocol.

Both of these protocols are the master protocol and are also based on command. We use a bit to indicate whether the execution of each command is successful or not. When the command execution is successful, the corresponding bit is set to 1, otherwise it is set to 0.When a subnet is configured as a master protocol, the number of bytes occupied by the IO status word of the subnet is calculated using the following formula:

The number of bytes in IO status word = ((integer, Discard decimal part) (command bar number under subnet + 15) / 16) * 2.

For example:

MODBUS master station protocol is configured in subnet 1, with a total of 15 commands, according to the calculation formula above:

(15 + 15) / 16 = 1, 1*2 = 2 (bytes)

So the IO status of these 15 commands takes up 2 bytes. The specific IO status indication information is as follows:

	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Byte 0	Command 7 indicate bit	Command 6 indicate bit	Command 5 indicate bit	Command 4 indicate bit	Command 3 indicate bit	Command 2 indicate bit	Command 1 indicate bit	Command 0 indicate bit
Byte 1		Command 14 indicate bit	Command 13 indicate bit	Command 12 indicate bit	Command 11 indicate bit	Command 10 indicate bit	Command 9 indicate bit	Command 8 indicate bit

- MODBUS slave protocol and Self-defined protocol.

The two protocols are slave protocols. Their IO status word is used to indicate the running state of the protocol by a 16-bit integer change. Every time a correct request frame is received from the slave. The value is automatically added 1.

The 16-bit integer is represented in a Little-endian, where the low address represents the low byte of the 16-bit integer and the high address represents the high byte of the 16-bit integer.

6.2.2 Byte-swap

This content is only applicable to he three modes of the gateway: Modbus Master/Modbus Slave/Custom Protocol.

1. Byte swap introduction

There are four types: No swap, double-byte swap, four-byte register swap and Four-Byte Big-endian and Little-endian Swap.

- double-byte swap

  When using double-byte swap, the number of bytes exchanged must be 2 times integer.

  Double-byte swap is 2 bytes for unit exchange, and the exchange mode is shown in the following table:

Before exchange		After exchange	
Byte index	Byte value	Byte index	Byte value
0	0x12	0	0x34
1	0x34	1	0x12

- four-byte register swap

  When using four-byte register swap, the number of bytes exchanged must be 4 times integer.

  Four-byte register swap is 2 registers for unit exchange, and the exchange mode is shown in the following table:

Before exchange		After exchange	
Byte index	Byte value	Byte index	Byte value
0	0x12	0	0x56
1	0x34	1	0x78
2	0x56	2	0x12
3	0x78	3	0x34

- Four-Byte Big-endian and Little-endian Swap

  When using Four-Byte Big-endian and Little-endian Swap, the number of bytes exchanged must be 4 times

integer.

Four-Byte Big-endian and Little-endian Swap is 4 bytes for unit exchange, and the exchange mode is shown in the following table:

Before exchange		After exchange	
Byte index	Byte value	Byte index	Byte value
0	0x12	0	0x78
1	0x34	1	0x56
2	0x56	2	0x34
3	0x78	3	0x12

2. Bytes Exchange Way in Various Protocols

The schematic diagram is as follows:

As you can see from the figure, the byte-exchange program is only a process between the buffer and the request or response frame of the command, without changing the length of the total data, only changes the organization way of the data.

Command execution mode:

(1) Read a certain length of data from the buffer (input or output) and put it in the frame buffer of the command. Then, send the command.

(2) When the command has a response, the data is separated from the response frame of the command and copied to the buffer.

After adding byte swap processing:

(1) Read a certain length of data from the buffer (input or output), byte swap processing, then put it in the frame buffer of the command, and finally send the command.

(2) When the command has a response, the data is separated from the response frame of the command ,byte swap processing, then copied to the buffer.

Note: When the byte swapping process is performed, the data to be processed is divided according to a specific length. For example, when 2 bytes are exchanged, data is processed in units of 2 bytes. When 4 bytes are exchanged, data is processed in units of 4 bytes.

6.2.3 Command Output Mode

The content of this section is only applicable to MODBUS Master protocol and User Config-POLL Mode.

Write command: The request frame contains commands for memory mapping area data of GT200-PN-RS.For example, the 5, 6, 15 and 16 function codes of MODBUS master protocol are written commands. The command with "data" field in the request frame of User Config-POLL is written command.

Read command: The command that is not written is read.

Command execution process:

1. The number of timeout retransmission is set to 0.
2. Request frame for sending commands. After sending, the response timeout timer begins.
3. Wait for the command response frame.
4. If a response frame is received within the response timeout period, a response is considered. Whether the response is correct depends on the specific response frame format. If the response frame is correct, the execution of the command ends, If a response frame is not received within the response timeout period, the response timeout is considered. Response error and response timeout, enter 5.
5. Determine whether the number of retransmission is 3.If 3, the execution of the command ends. Otherwise, the timeout retransmission times add 1,enter 2.

- Cycle output mode

  In the Master protocol, each command has a unique command index in each subnet.

  The Master protocol works in Cycle output mode and is executed as follows:

  1. Execute the command N.
  2. Wait for "command delay time", N plus 1. If N is greater than the number of command, N is 0. Execute order N.

- Change of Value output mode

  The Master protocol works in Change of Value output mode and is executed as follows:

  1. If command N is read, execute command N. Otherwise, check whether the memory mapping data contained in the request frame of command N is changed. If there is a change, execute the command N.
  2. Wait for "command delay time", N plus 1. If N is greater than the number of command, N is 0. Execute order N.

- Quick output mode

Note: Quick output is valid only if "Output Command Polling Mode" in the subnet is "Change of Value" and only for write commands.

When the system is initialized, if a Quick output command is found under the subnet, all commands under the subnet

will be divided into two queues. Queue 1 is a Quick output command queue, and queue 2 is an normal command queue.

The Master protocol works in Quick output mode and is executed as follows:

1. Check the commands in the “Quick Output Command” queue one by one, and execute the command if the data of a command changes. Until the data of all commands in the queue did not change.
2. Execute a command in the normal queue. An execution index in a normal queue plus one. If the number of commands in a normal queue is exceeded, the index value is 0. Enter 1.

As you can see from the above execution, Quick output is preferred to write commands, which is of great benefit to the transmission of control information as soon as possible at some low baud rates (<= 19200), but this advantage is small for high baud rates.

6.2.4 Response Timeout Handling for Master Protocol

The content of this section is only applicable to MODBUS Master protocol and User Config-POLL Mode.

The specific application scene is like this: After the master sends the request frame, it will wait for the response of the slave device within the limited time. If the slave does not respond within a limited time, the master protocol will trigger the response timeout processing. How to deal with this?

If the command is successfully executed the previous time, it will be reissued three times (a total of four times), In the process of retransmission, if any response is given from the slave, it will stop repeating and transferred to the next command. If the slave still has no response after three retransmission, the processing method given in the response timeout handling option is executed. Namely: Clear or Hold. It should be noted that the clear or hold here is for the data part of the slave response frame. Because GT200-PN-RS transformation between protocols is achieved by mapping, so the data part of each command’s response frame will have a mapping area in the input buffer of GT200-PN-RS.Our “clear or hold” is for this mapped data area. Specifically, if “clear” is selected, all data in the map area will be set to 0 after the response timeout. if “hold”, the content of the map data area will not be changed after the response timeout.

If the command is unsuccessfully executed the previous time, re-transmission is not executed.

6.3 Custom Protocol

6.3.1 Definition

User device acts as initiator, send output data in the request frame.

GT200-PN-RS acts as responder which sends input data in the response frame.

Communication way is point to point.

Time interval between bytes in request frame should be less than 50ms, or GT200-PN-RS will dispose this frame data. For every valid request frame, GT200-PN-RS should make response in 200ms.

Supports communication baud rate range 300~115200 bps, 8 data bits, parity (None, Odd, Even, Mark, Space) and 1 or 2 stop bits.

6.3.2 Communication Message Format

1) Request Frame Message

[Output data length] [High byte of output data start address] [Low byte of output data start address] [Input data length] [High byte of input data start address] [Low byte of input data start address] [Output data 1]…… [Output data n] [Parity]

Notes: Output means the data that users device writes to GT200-PN-RS, input means the data that users device gets from GT200-PN-RS.

Data number n equals output data length.

Output data address range: 0x0000-0x03FF, 0x4000-0x43FF.

Input data address range: 0x0000-0x03FF, 0x4000-0x43FF.

2) Response Frame Message

Correct response:

[Input data length] [High byte of input data start address] [Low byte of input data start address] [Input data 1]…… [Input data n] [Parity]

Data number n equals input data length.

Wrong response:

[0x00] [0xFF] [0xFF] [error code] [parity]

6.3.3 Parity

Accumulated sum of 8 bits of all data, ignore the flow bit. That is:

[Message parity code] = [output data length] + [high byte of output data start address] + [low byte of output data start address] + [input data length] + [high byte of input data start address] + [low byte of input data start address] + [output data 1] +……+ [output data n].

[Response parity code] = [input data length] + [high byte of input data start address] + [low byte of input data start address] + [output data 1] +……+ [output data n].

6.3.4 Error Code

Error Code	Meaning
0x01	Output data length error.
0x02	Accumulated sum parity error.
0x03	Output data start address error or illegal output data area.
0x04	Input data start address error or illegal input data area.

6.3.5 Message Examples

If input data number is 50 bytes, output data is 32 bytes.

Now, users want to output all zero data and get all input data, examples are as below:

[The following data format is all HEX]

Request frame message:

[20] [40 00] [32] [00 00] [00……00] [92]

| output data length | output start address | input data length | input start address | 32 output data | parity (accumulated sum) |

Response frame message:

[32] [00 00] [00……00] [92]

| input data length | input start address | 50 output data | parity (accumulated sum) |

Here the output and input address is memory mapping address of GT200-PN-RS.

6.4 User Config

6.4.1 Definition

Common mode protocol message of GT200-PN-RS can be set freely by users, which solves the communication problem between Modbus standard protocol and Modbus nonstandard protocol devices. There are two operation modes under common mode: POLL and READ. Working principle of POLL is similar with Modbus communication protocol, which uses request and response communication way and every subnet can set 30 commands under common mode. READ only receives stored data and doesn't respond after receiving data, such as bar code scanner and device communication etc.

6.4.2 User Config-POLL Mode

Users need to configure request message and response message of User Config-POLL before using it.

Frame header: HEX input, max bytes number: 8.

Data: HEX input, every item occupies two bytes.

Constant: HEX input, max bytes number: 8.

Parity: None, CRC check, LRC check, Sum check.

End of Frame: HEX input, max bytes number: 3.

Send order in RTU format: Header, data, constant, parity and end.

Receive order in RTU format: Header, data, constant, parity and end.

Send order in ASCII format: Header, constant, data, parity and end.

Receive order in ASCII format: Header, constant, data, parity and end.

For example, configuring Modbus commands, RTU transmission format:

Request:

Slave address: 01

Function code: 03

Register address H: 00

Register address L: 00

Number of data H: 00

Number of data L: 02

CRC check H: C4

CRC check L: 0B

Message: 01 03 00 00 00 02 C4 0B

Response:

Slave address: 01

Function code: 03

Number of data: 04

Data: 00

Data: 00

Data: 00

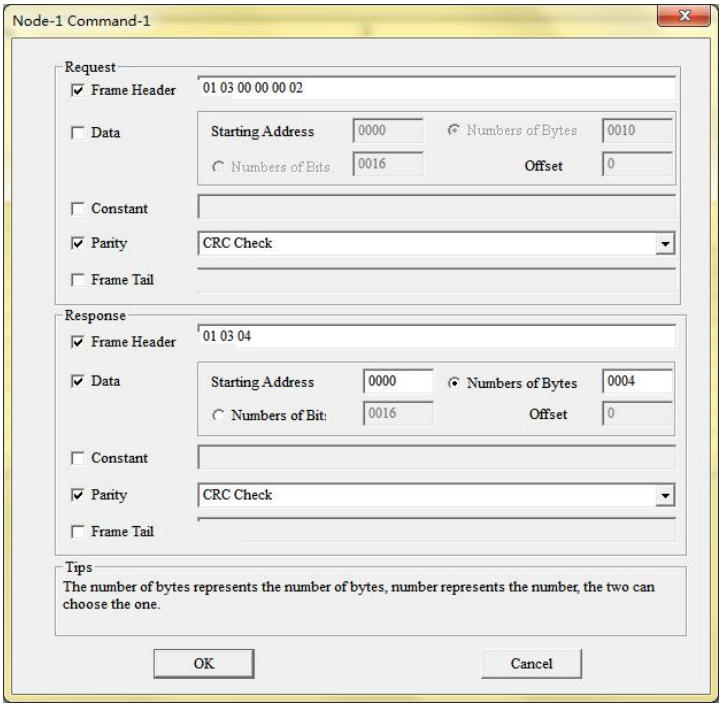
Data: 00

CRC check H: FA

CRC check L: 33

Message: 01 03 04 00 00 00 00 FA 33

Command configuration example is as below:



Notes: Under RTU transmission format, supports following parity: None, CRC check and sum check.

For example, configuring Modbus command, ASCII transmission format:

: (3A)

Slave

Function

Number of data

Data 1

……

Data n

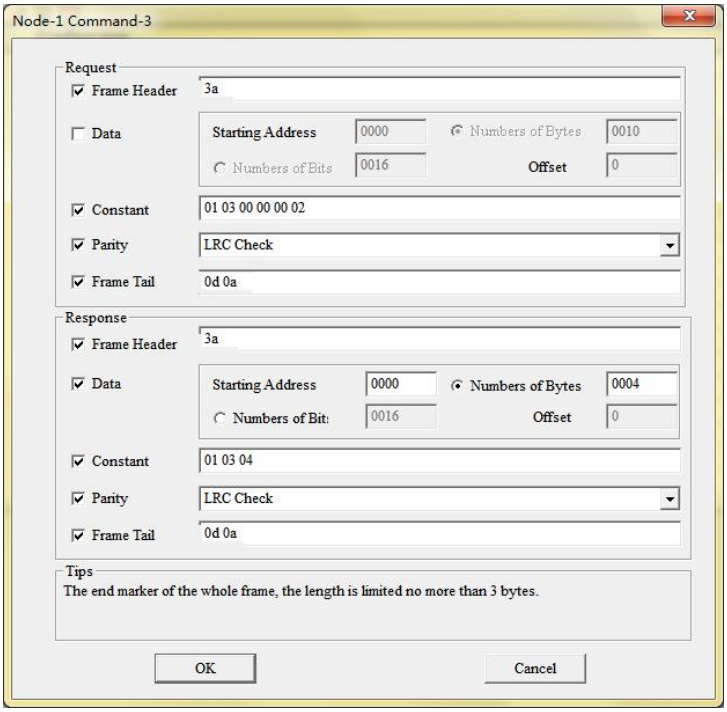
LRC high byte

LRC low byte

CR (0D)

LF (0A)

Command configuration example is as below:



Note: Under ASCII transmission format, supports parity: None, LRC check and sum check.

Note: User Config-POLL in different "communication mode", the frame format is different!!!.

RTU frame: Header+ data+constant+parity +end

ASCII frame: Header+constant(ASCII)+data(ASCII)+parity(ASCII) +end

6.4.3 User Config-Receiving only Mode

User Config-Receiving only mode only receives data and doesn't respond. It can be used in receiving data of bar code scanner devices. Each subnet of User Config-Receiving only has 16 group data receiving buffer and receiving data buffer of each group is 128 bytes.

Configuring interface is as below:

Configuration	
Protocols Select	User Config
Baud Rate	19200
Data Bits	8
Parity Check	None
Stop Bits	1
Slave Address	
Transmission Mode	
Response Timeout	
Delay between Polls	
Output Mode	
Output Pulse	
Scan Rate	
Communication Mode	Receiving Only Mode
Time Interval Between Characters	3
Check Mode	None
Memory Mapped Starting Address (Hex)	
Mapping Data Length	

Configurable domain introduction:

"Time interval between characters": In Receiving only Mode, it is maximum time interval between characters and used to decide whether a frame is terminated or not. If the receiving time interval for two consecutive characters is greater than this value, GT200-PN-RS will think it receives two frames.

"Check Mode": There are three checking method: no parity check, CRC check, and sum check. Note that when the GT200-PN-RS transmits data to the PN side, the field will automatically lose the check value according to the check mode. For example, one byte of the end of the frame is discarded when the sum check is performed, and two bytes of the end of the frame are discarded when the CRC check is performed.

"Memory Mapped Starting Address": The address offset in the input buffer, range 0-0x3FF.

"Mapping Data Length": The number of bytes mapped to the input buffer, range: 2-128.

User Config-Receiving only mode ,the format for transferring data to PN is:

0	1	2..N
Transaction No.	Data length(N-2)	N-2 Valid data

Whenever GT200-PN-RS receives a correct User Config-Receiving only frame, the transaction number will automatically add one.

The connection diagram is as follows: