Modbus / MQTT Gateway
GT100-MQ-RS

User Manual

V 1.2

SST Automation

E-mail: support@sstautomation.com

www.SSTAutomation.com

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.

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Technical Support Contact Information

www.sstautomation.com

E-mail: support@sstautomation.com

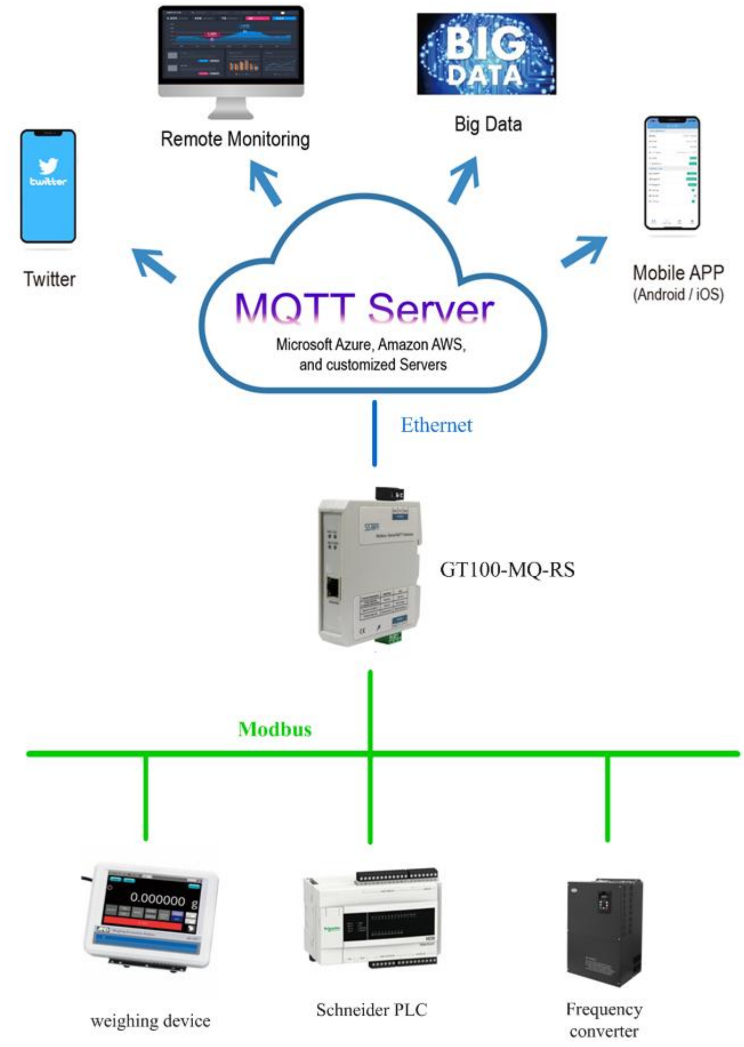
Catalog

1 Product Overview

1.1 Product Function

GT100-MQ-RS is a gateway that can exchange data between Modbus Serial (RTU/ASCII) through RS-485 and a MQTT Broker through a wired WAN connection. It can connect Modbus RTU/ASCII Master or Slave devices to the IoT Cloud by MQTT. The wired Ethernet interface supports MQTT connections to various IoT cloud platforms such as Microsoft Azure IoT, Amazon AWS IoT, Mosquitto and other generic MQTT Brokers.

Note: To connect to AWS or Azure using authentication, you must use a security certificate.



1.2 Product Features

- One RS-485 Interface - Modbus Master/Slave
  - As a Modbus Master interface, it can connect field devices to the IoT Cloud Platform by implementing a data acquisition and device control Ethernet network.
  - As a Modbus Slave interface, it can integrate a PLC, DCS and other Modbus master stations into an IoT Cloud Platform Ethernet network.
- Ethernet network is always online. Supports connection detect and auto reconnect functions.
- Supports MQTT connections through a wired WAN network.
- TLS V1.2. Supports custom Client ID.
- QoS 0 and 1 supported.
- Supports debugging function on both the Modbus and MQTT side.
- Supports publishing timestamp and time zone (Configurable Feature).
- Supports two publish modes: Publish when data changes or publish periodically at custom cycle time, which can reduce the data traffic.
- Real-time device status monitoring on the IoT Cloud Platform.
- Ethernet connection status display.
- Applies to industrial fields with high reliability. Supports real-time monitoring and automatic reset.
- Supports remote upgrade device firmware.

Note: Remote update services may be affected by your network firewall, and firmware updates may fail.

1.3 Technical Specifications

[1] One serial interface

- Physical standard: RS-485.
- Parity: Odd, Even, None, Mark, Space.
- Stop bits: 1 or 2.
- Baud rate: 1200~115200 bps.
- Protocol: Modbus RTU/ASCII Master/Slave.
- Modbus command: 01, 02, 03, 04, 05, 06, 15, 16.
- Interface type: 3.81 mm 3-pin port.
- Galvanic isolation: 1kV photoelectric isolation.

[2] One Ethernet interface

- Physical standard: RJ-45, full-duplex / half-duplex.

- ◆ Speed: 10/100 Mbps, Auto-Negotiation.
- ◆ Supports DHCP and Static Configuration.

[3] Maximum data and connections:

- ◆ Modbus RTU/ASCII:

  Input bytes ≤ 512 bytes

  Output bytes ≤ 512 bytes

  Maximum connections: 31 serial devices

  Maximum commands: 100 commands (as Modbus master)

- ◆ Maximum properties:

  Modbus Master-Slave: 1000 properties.

[4] Power: 24 VDC (11~30 VDC),<1W

[5] Operating temperature: -4°F~140°F (-20°C~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] Protection level: IP20.

1.4 Related Products

Related products include:

- ➢ IOT600-TWX-TS
- ➢ GT200-MQ-IE
- ➢ GT100-MQ-IE

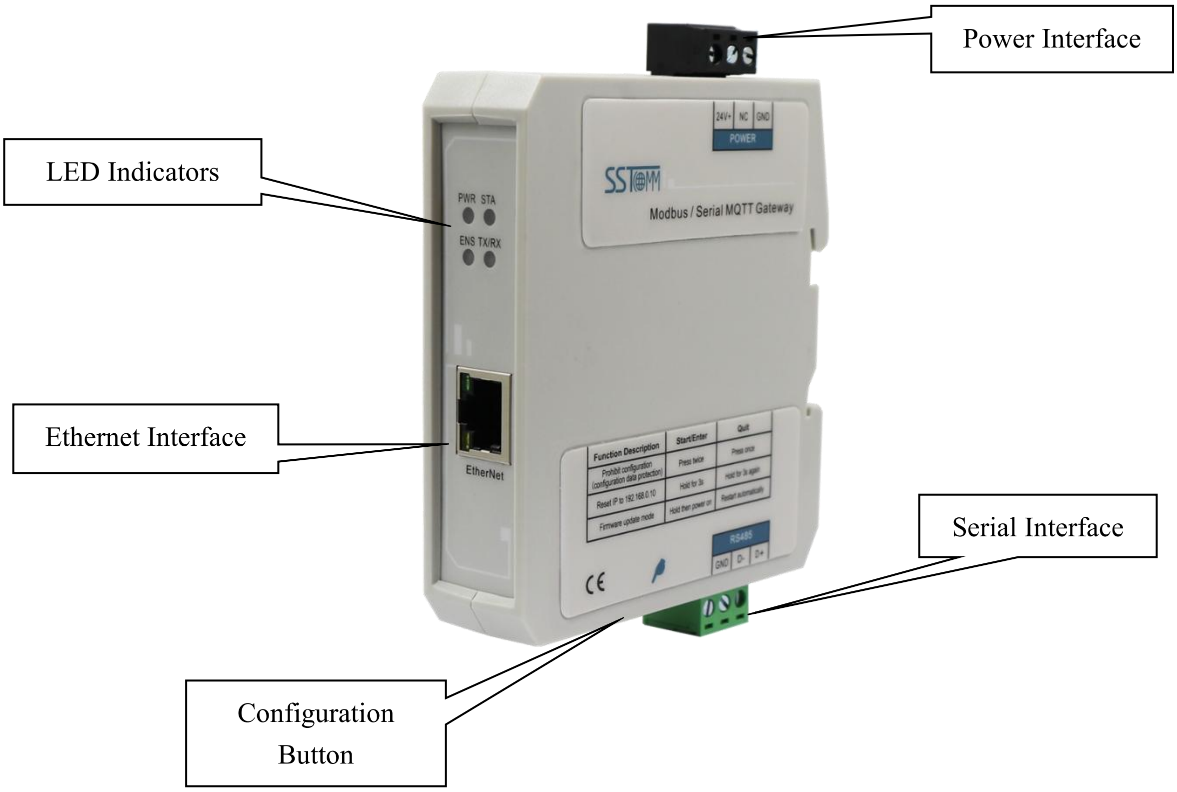
To get more information about related products, please visit SST Automation's website: www.sstautomation.com.

1.5 Revision History

Revision	Date	Chapter	Description
V1.2	6/7/2023	MQTT Chapters 5.2.4 and 5.2.5.	Added details on how to configure Microsoft Azure and Amazon AWS.
V1.0	2/16/2023	ALL	New release

2 Hardware Description

2.1 Product Appearance



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

2.2 LED Indicators

LED	State	State description
PWR	OFF	The device is not powered on.
	Green ON	The device is powered on.
SG	Green ON	MQTT connection succeeded.
	Green Blinking	MQTT connection failed.
TX/RX	Red Blinking / OFF	The RS-485 interface is sending / not sending data.
	Green Blinking / OFF	The RS-485 interface is receiving / not receiving data.
ENS	Green, slow Blinking	Failed to connect to the Internet.
	Green, quick Blinking	Fixed IP Address: 192.168.0.10
	Red Blinking	Locating the gateway.
	Green ON	Successfully connected to the Internet.

2.3 Configuration Button

The configuration button is located on the bottom of the GT100-MQ-RS. It is used to reset the IP address and to enable/disable configuration data protection.

To reset the IP address, hold the configuration button for 3 seconds after powering on the GT100-MQ-RS. The IP address will then be set to 192.168.0.10 and the ENS indicator will quickly blink green. This function can fix the IP address when the GT100-MQ-RS can't be searched in normal status. Hold the configuration button for 3 seconds again, and the GT100-MQ-RS will be restarted and begin operating normally.

To toggle configuration data protection, double press the configuration button after powering on the GT100-MQ-RS to disable uploading/downloading configuration data. The GT100-MQ-RS can be searched but cannot be configured. This function can be used to prevent unauthorized operations to the device. Press the button again to set the device back to normal.

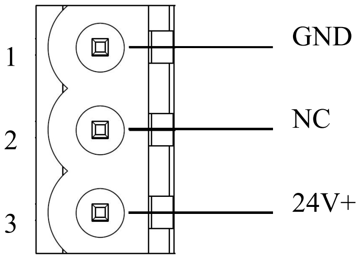
Button Action	Description
Hold for 3 Seconds	**IP Address Reset:** The IP address is set to 192.168.0.10 and the ENS is blinking green quickly. Hold the button for 3 seconds again to set the device back to normal.
Press Twice	**Configuration Data Protection:** Uploading/downloading configuration data is disabled. The GT100-MQ-RS can be searched but cannot be configured. Press the button again to set the device back to normal.

2.4 Interfaces

2.4.1 Power Interface

The GT100-MQ-RS gateway uses a 24V DC power supply.

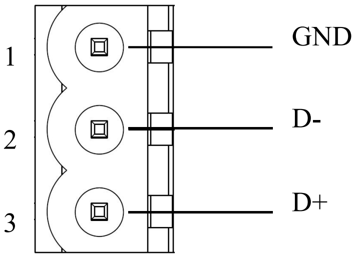
Pin	Function
1	GND, Power ground
2	NC, Not connected
3	24V+, DC



2.4.2 RS-485 Serial Interface

The GT100-MQ-RS has an RS-485 serial interface which uses a 3-pin terminal. Its pinout is defined as follows:

Pin	Function
1	GND
2	D-, RS-485 Data Negative
3	D+, RS-485 Data Positive

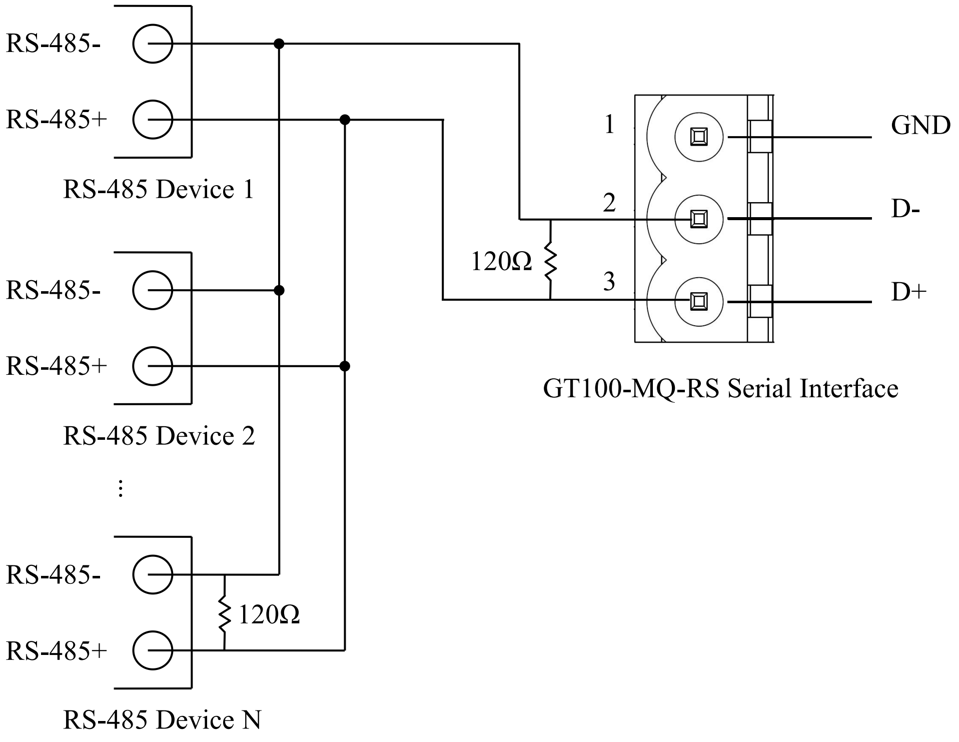


RS-485 Specification:

1. Network topology: Linear bus with active terminal resistors at both sides.
2. Baud rate: 1200 bps ~ 115.2 Kbps.
3. Physical Media: Shielded twisted-pair cable that also can cancel the shielding, depending on environmental conditions (EMC).
4. Station number: 31 stations per section (without repeater), and up to 127 stations in total (with repeaters).
5. Plug connection: 3-pin terminal.

RS-485 Installation:

1. All stations are connected with RS-485 bus.
2. Up to 31 stations can be connected per section.
3. Connect a terminal resistor (120Ω, 1/2W) in parallel at both ends of the communication lines to ensure stable communication.

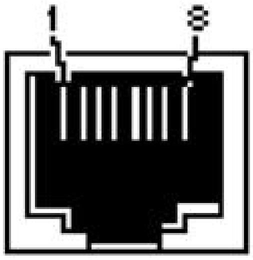


Note: There is no internal terminal resistor inside of the GT100-MQ-RS gateway's RS-485 interface.

2.4.3 Ethernet Interface

The Ethernet interface uses an RJ-45 connector and follows the IEEE 802.3u 100BASE-T standard. Its pinout (standard Ethernet signal) is defined below:

Pin	Signal description
S1	TXD+, Transmit Data+, Output
S2	TXD-, Transmit Data-, Output
S3	RXD+, Receive Data+, Input
S4	-
S5	-
S6	RXD-, Receive Data-, Input
S7	-
S8	-



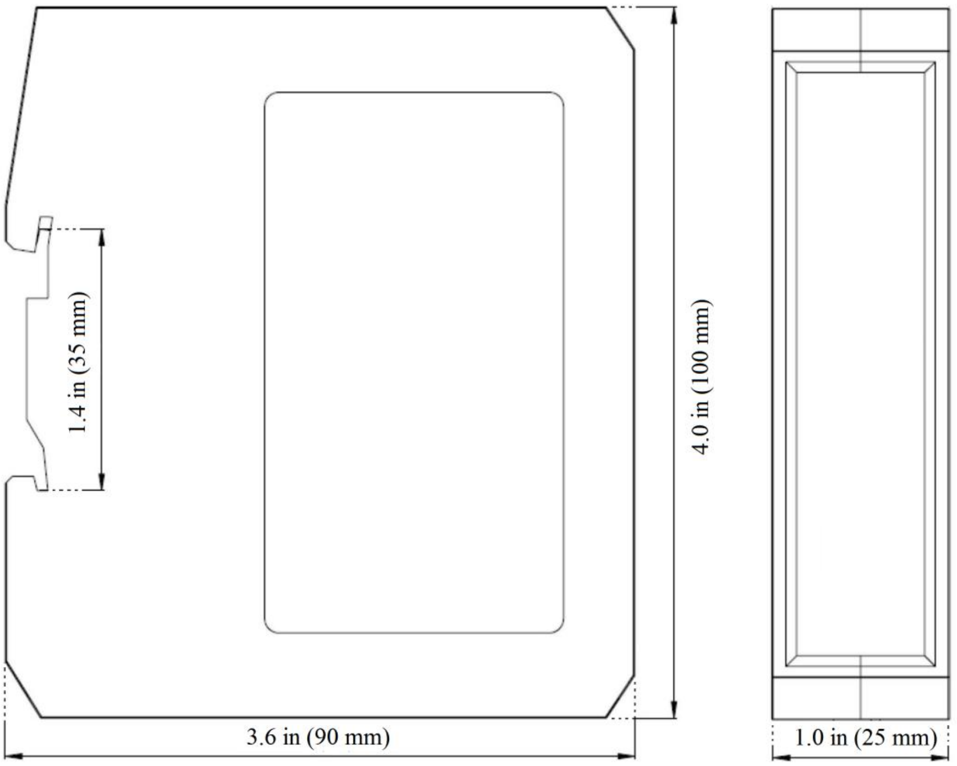
RJ-45 port

3 Mounting

3.1 Mechanical Dimensions

Size (width * height * depth):

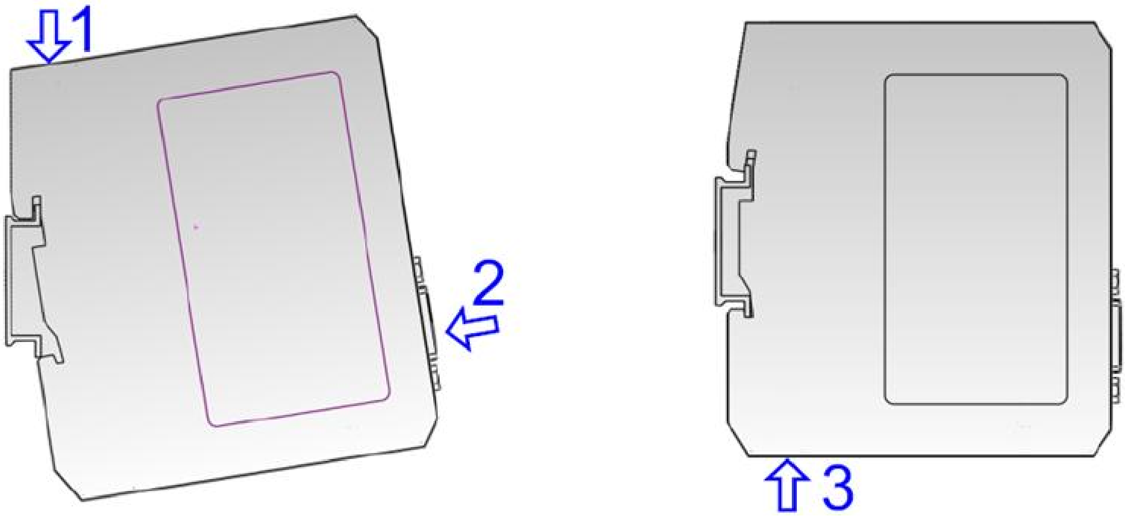
1.0 in * 4.0 in * 3.6 in (25 mm * 100 mm * 90 mm)



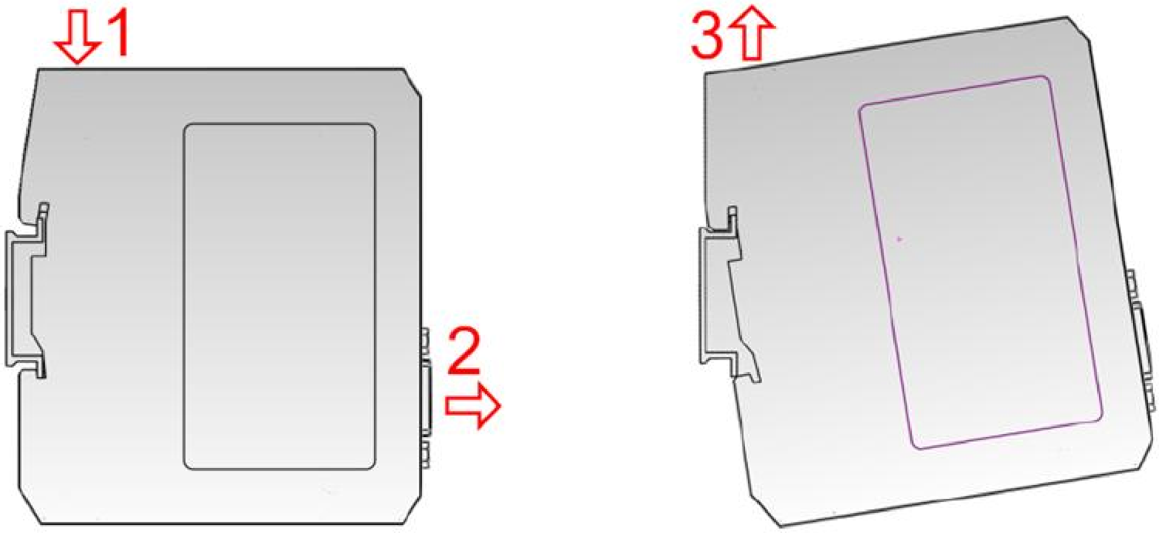
3.2 Installation Method

Using 1.4 in (35mm) DIN RAIL.

Install



Uninstall

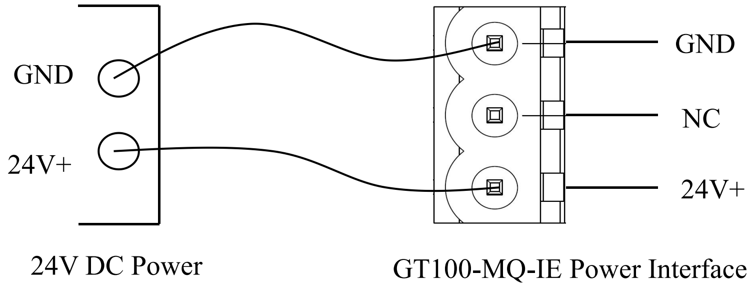


4 Quick Start Guide

4.1 Hardware Connection

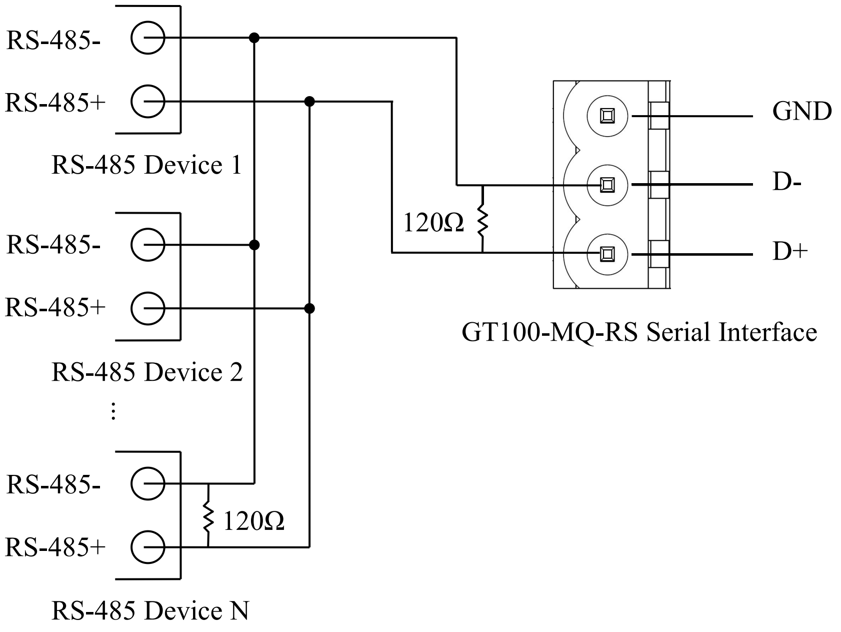
1. Connect the power supply to the GT100-MQ-RS as follows.

   Note: Please do not power on the devices before finishing and confirming all the connections.



2. Connect the serial devices to the GT100-MQ-RS. For more details on wiring, see Chapter 2.4.2.

   Note: The GT100-MQ-RS doesn't have a terminal resistor in the RS-485 serial interface. When connecting multiple RS-485 serial devices, it's recommended to connect a terminal resistor (120Ω, 1/2W) in parallel at both ends of the communication lines to ensure stable communication.



3. Connect the GT100-MQ-RS with the PC via Ethernet cable. The GT100-MQ-RS can be connected directly to the PC or to a network router.

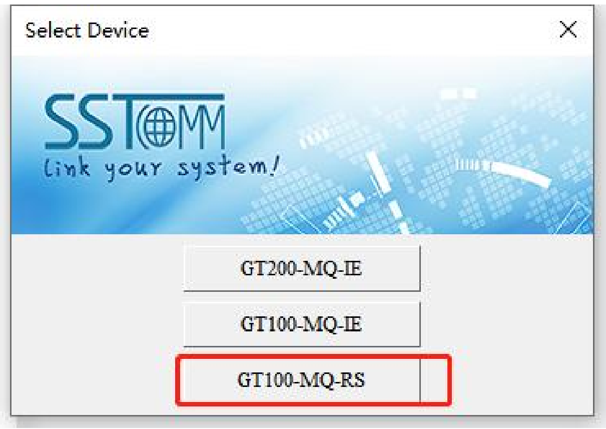
   Note: Ensure that the GT100-MQ-RS network segment matches the PC's network segment.

4. Power on the GT100-MQ-RS.

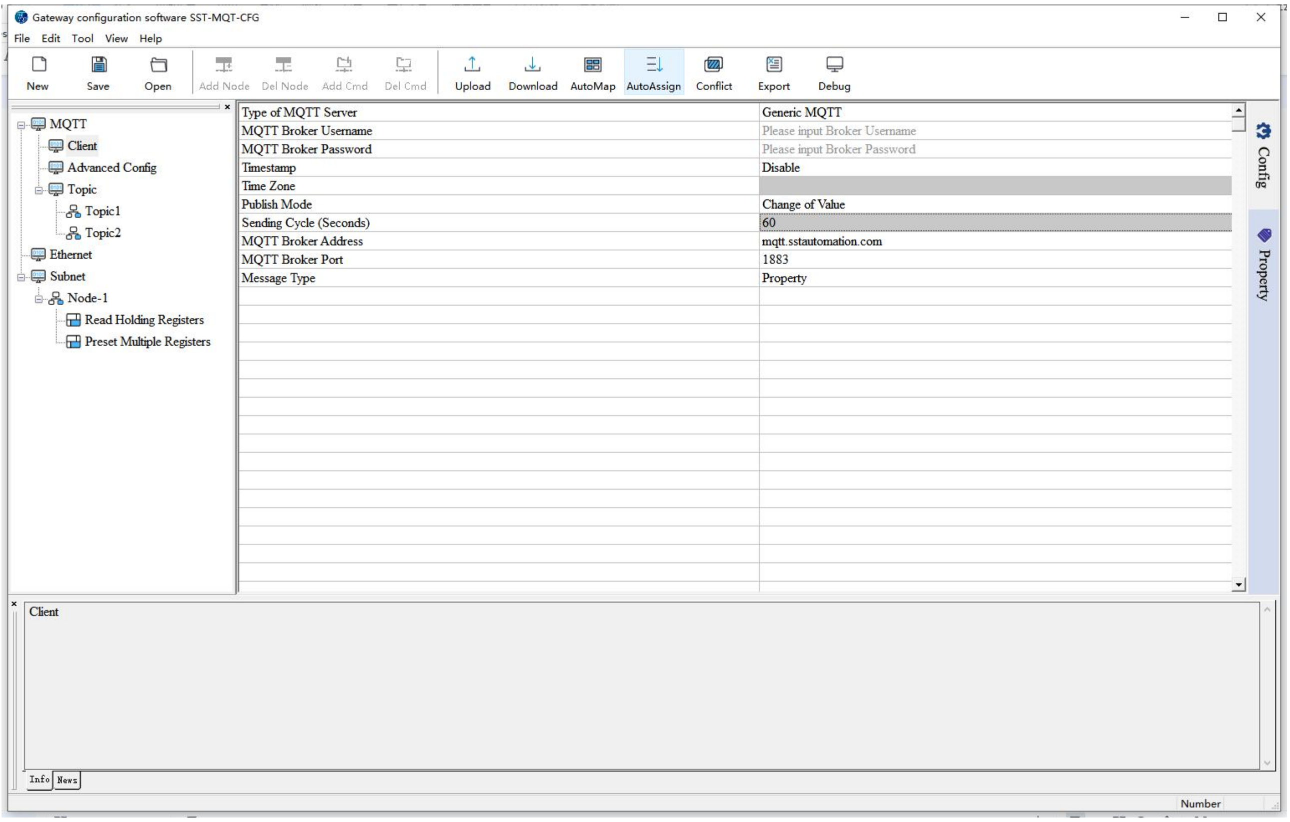
4.2 Software Configuration

Download, install, and run the configuration software SST-MQT-CFG. For more details, please see Chapter 5.

1. Download the configuration software SST-MQT-CFG from www.sstautomation.com and install it. Open the software and select the GT100-MQ-RS product.

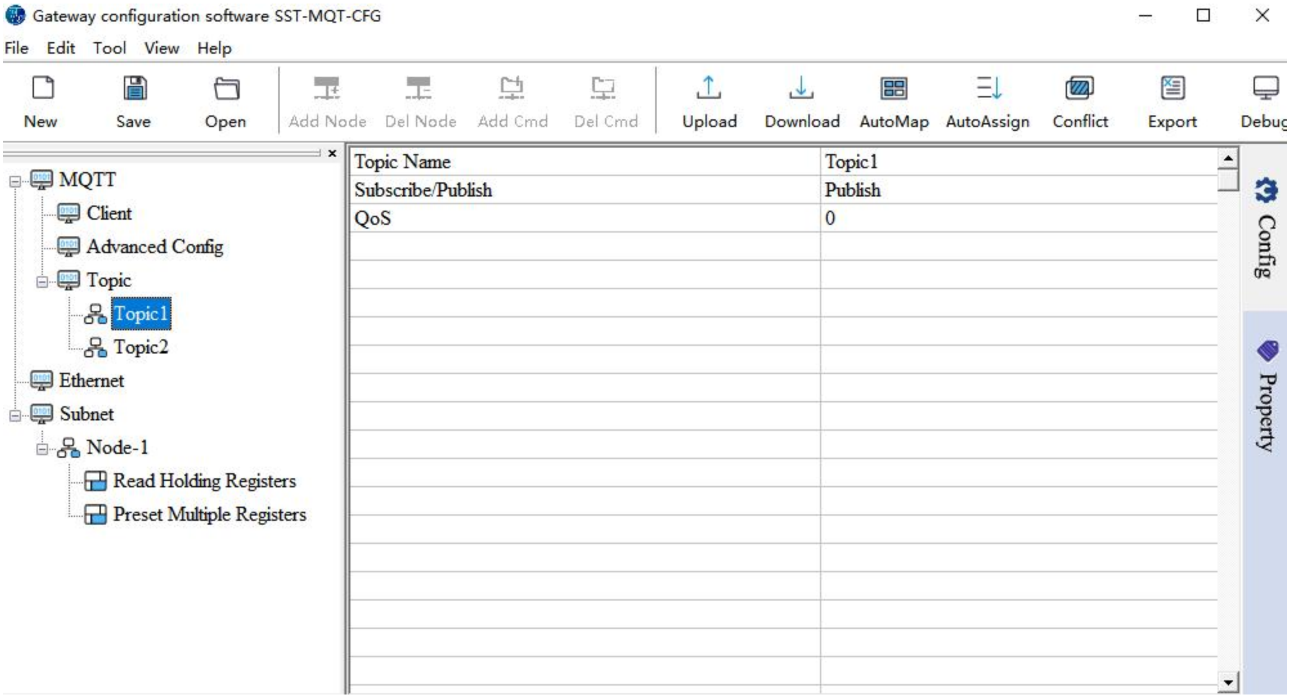


2. Configure the Client (MQTT Client configuration).



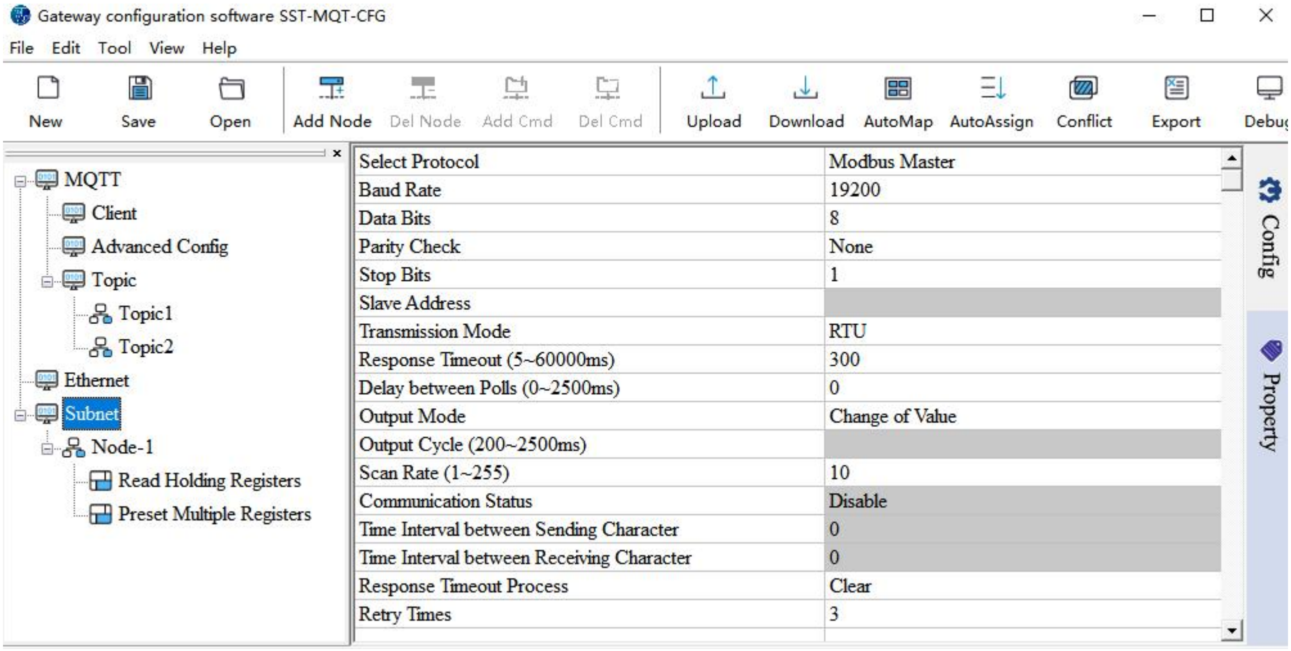
Type of MQTT Server	Generic MQTT
MQTT Broker Username	Please input Broker Username
MQTT Broker Password	Please input Broker Password
Timestamp	Disable
Time Zone	
Publish Mode	Change of Value
Sending Cycle (Seconds)	60
MQTT Broker Address	mqtt.sstautomation.com
MQTT Broker Port	1883
Message Type	Property

3. Add or edit MQTT Topics.


Gateway configuration software SST-MQT-CFG
File Edit Tool View Help
New Save Open Add Node Del Node Add Cmd Del Cmd Upload Download AutoMap AutoAssign Conflict Export Debug
MQTT
Client
Advanced Config
Topic
Topic1
Topic2
Ethernet
Subnet
Node-1
Read Holding Registers
Preset Multiple Registers
Config
Property

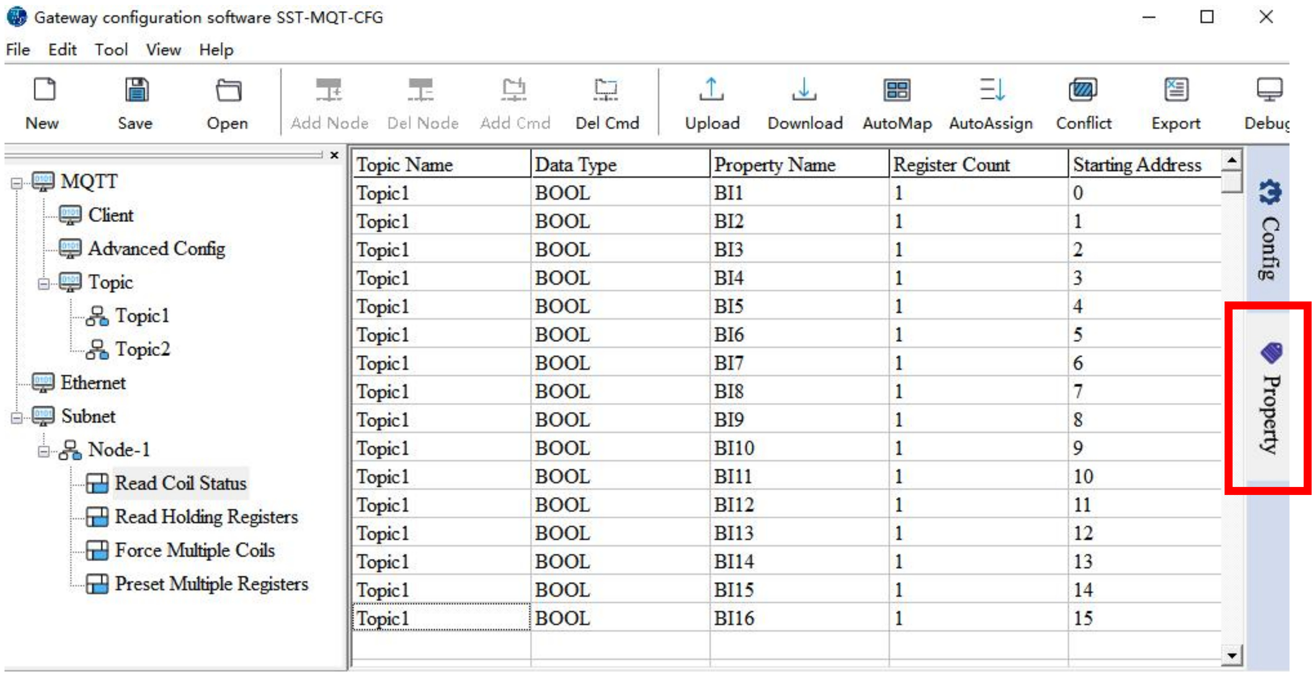
Topic Name	Topic1
Subscribe/Publish	Publish
QoS	0

4. Configure the Ethernet and Subnet Interface parameters.


Gateway configuration software SST-MQT-CFG
File Edit Tool View Help
New Save Open Add Node Del Node Add Cmd Del Cmd Upload Download AutoMap AutoAssign Conflict Export Debug
MQTT
Client
Advanced Config
Topic
Topic1
Topic2
Ethernet
Subnet
Node-1
Read Holding Registers
Preset Multiple Registers
Config
Property

Select Protocol	Modbus Master
Baud Rate	19200
Data Bits	8
Parity Check	None
Stop Bits	1
Slave Address	
Transmission Mode	RTU
Response Timeout (5~60000ms)	300
Delay between Polls (0~2500ms)	0
Output Mode	Change of Value
Output Cycle (200~2500ms)	
Scan Rate (1~255)	10
Communication Status	Disable
Time Interval between Sending Character	0
Time Interval between Receiving Character	0
Response Timeout Process	Clear
Retry Times	3

5. Configure the properties.


Gateway configuration software SST-MQT-CFG
File Edit Tool View Help
New Save Open Add Node Del Node Add Cmd Del Cmd Upload Download AutoMap AutoAssign Conflict Export Debug
MQTT
Client
Advanced Config
Topic
Topic1
Topic2
Ethernet
Subnet
Node-1
Read Coil Status
Read Holding Registers
Force Multiple Coils
Preset Multiple Registers
Config
Property

Topic Name	Data Type	Property Name	Register Count	Starting Address
Topic1	BOOL	BI1	1	0
Topic1	BOOL	BI2	1	1
Topic1	BOOL	BI3	1	2
Topic1	BOOL	BI4	1	3
Topic1	BOOL	BI5	1	4
Topic1	BOOL	BI6	1	5
Topic1	BOOL	BI7	1	6
Topic1	BOOL	BI8	1	7
Topic1	BOOL	BI9	1	8
Topic1	BOOL	BI10	1	9
Topic1	BOOL	BI11	1	10
Topic1	BOOL	BI12	1	11
Topic1	BOOL	BI13	1	12
Topic1	BOOL	BI14	1	13
Topic1	BOOL	BI15	1	14
Topic1	BOOL	BI16	1	15

6. Check the mapping buffer and the property names. Use the “Auto Mapping” and “Name Properties in Order” functions.

7. Save the configuration and download to GT100-MQ-RS through network cable configuration.

Note:

1. Make sure that the GT100-MQ-RS and your computer are in the same 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.

3. If you can’t discover any gateways, press and hold the configuration button for 3 seconds after powering on. At this time, the IP address is restored to 192.168.0.10. The device can be searched under the same network segment as the gateway and computer, and the configuration can be uploaded and downloaded.

5 Software Instructions

SST-MQT-CFG is the configuration software which can be used to configure GT100-MQ-RS.

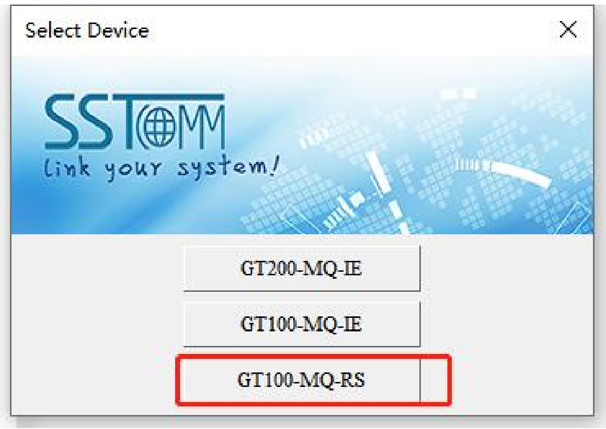
It can be downloaded from the product page or Download page (www.sstautomation.com/Download1/) of the website.

The software is based on Windows OS.

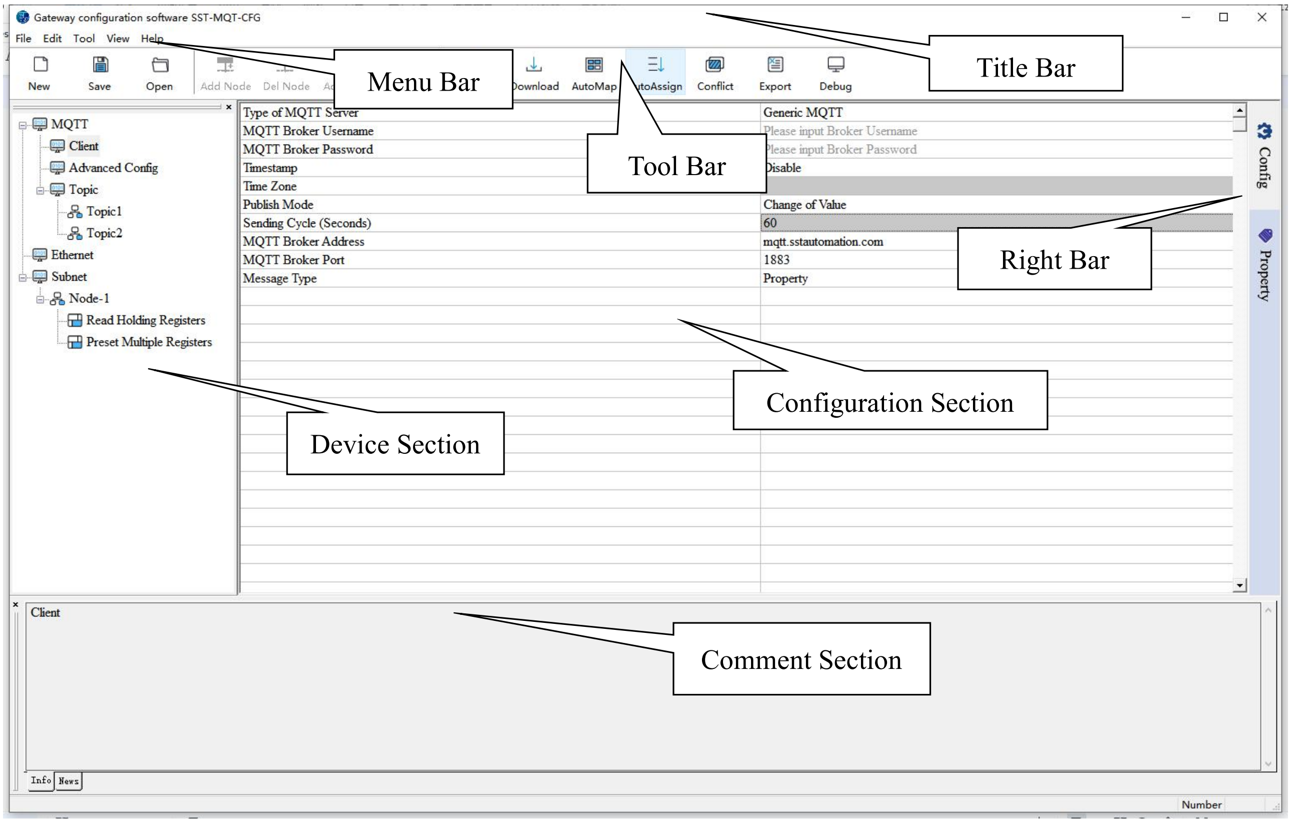
Operating System: Win7, Win10, Win11.

5.1 Software Interface Description

Double click on the SST-MQT-CFG icon to enter Device Select interface.



Select “GT100-MQ-RS” to enter the corresponding configuration interface:



Type of MQTT Server	Generic MQTT
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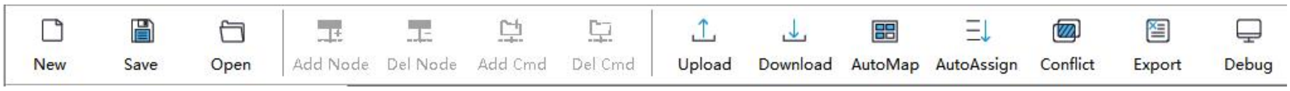
Timestamp	Disable
Time Zone	
Publish Mode	Change of Value
Sending Cycle (Seconds)	60
MQTT Broker Address	mqtt.sstautomation.com
MQTT Broker Port	1883
Message Type	Property

Client

Toolbar:



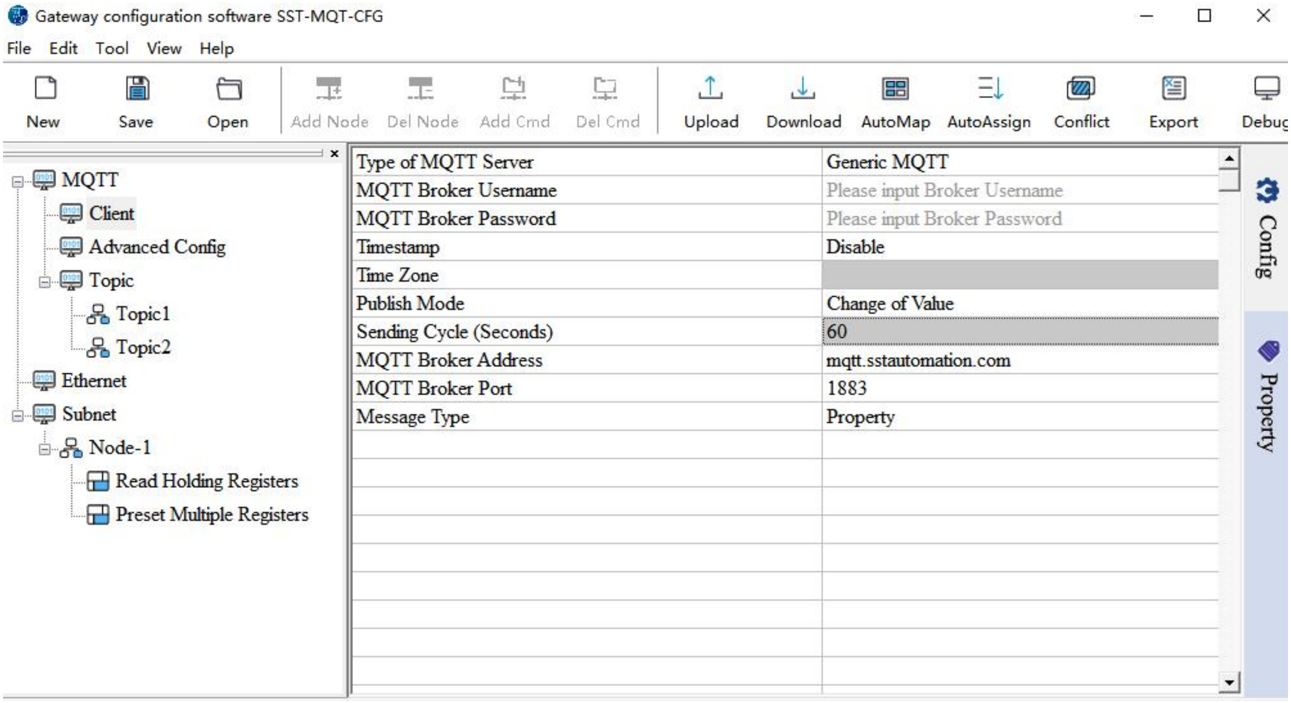
The function from left to right is: New, Save, Open, Add Node, Delete Node, AddCommand, Delete Command, Upload, Download, AutoMap, Conflict Detection, Export XLS, and Debug.

New	**New:** Create a new configuration project.
Save	**Save:** Save the current configuration.
Open	**Open:** Open a configuration project.
Add Node	**Add Node:** Add a Modbus node.
Del Node	**Delete Node:** Delete a Modbus node.
Add Cmd	**Add Command:** Add a Modbus command.
Del Cmd	**Delete Command:** Delete a Modbus command.
Upload	**Upload:** Upload the configuration from the gateway.
Download	**Download:** Download the configuration to the gateway.
AutoMap	**Auto Map:** Automatically calculate the mapped memory addresses for each command without conflicts.
AutoAssign	**Auto Assign:** Automatically assign property names for each command without conflicts.
Conflict	**Conflict Detection:** Check whether there are mapped data address conflicts with the configured commands in the gateway memory data buffer.
Export	**Export Excel:** Export current configuration as a table and save it as *.xls file.
Debug	**Debug:** Debug Modbus communication and view MQTT connection information.

5.2 MQTT

5.2.1 Client

Select the "Client" in the left tree view and enter the MQTT Client configuration window.



Type of MQTT Server	Generic MQTT
MQTT Broker Username	Please input Broker Username
MQTT Broker Password	Please input Broker Password
Timestamp	Disable
Time Zone	
Publish Mode	Change of Value
Sending Cycle (Seconds)	60
MQTT Broker Address	mqtt.sstautomation.com
MQTT Broker Port	1883
Message Type	Property

Type of MQTT Server: Supports Generic MQTT.

MQTT Broker Username: The username is used for authentication on the MQTT broker. Please refer to the corresponding MQTT server guide.The length should be less than 512bytes

MQTT Broker Password: The password is used for authentication on the MQTT broker. Please refer to the corresponding MQTT server guide.The length should be less than 512bytes

Timestamp: The time when the data is collected by the gateway, and will be published together with the data when enabled.

Time zone: Please select the local time zone to obtain the accurate time.

Publish Mode: Supports two publish mode: Change of Value and Cyclic.

Change of Value: Publish messages when value changes.

Cyclic: Publish Messages periodically.

Sending Cycle: The cycle time when publishing messages periodically. Range: 5~100000s. The default value is 60s. It's valid when the Publish Mode is "Cyclic".

MQTT Broker Address: The URL or IP Address to connect with the MQTT broker. Please refer to the guide of corresponding MQTT Server.The length should be less than 512bytes

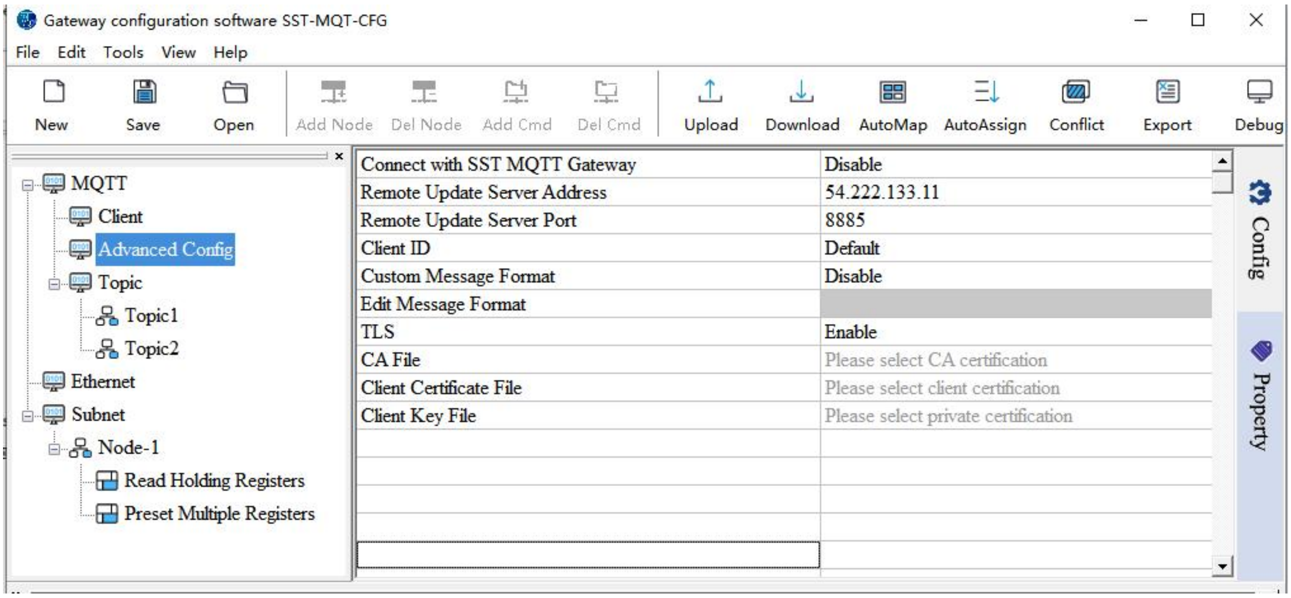
MQTT Broker Port: The access port of the MQTT broker. Please refer to the guide of corresponding MQTT Server.

Message Type: Property type.

Property: The data is transmitted with the properties in the following message format:

```
{
   "version":        "1.1.1.0",
   "time":           "19/03/07,17:04:07",
   "properties":{
   "BI3":            false,
   "BI4":            true,
   "BI5":            false,
   "BI6":            false
   }
}
```

5.2.2 Advanced Config



Connect with SST MQTT Gateway	Disable
Remote Update Server Address	54.222.133.11
Remote Update Server Port	8885
Client ID	Default
Custom Message Format	Disable
Edit Message Format	
TLS	Enable
CA File	Please select CA certification
Client Certificate File	Please select client certification
Client Key File	Please select private certification

Select the “Advanced Config” in the left tree view and enter the Advanced configuration window.

Connect with SST MQTT Gateway: If enabled, the GT100-MQ-RS is able to publish or subscribe topics of other SST gateways, that allows the gateways to communicate with each other. The interconnecting gateways should connect to the same MQTT broker.

Remote Update Server Address: The default remote update service IP Address is 54.222.133.11. The gateway can be updated remotely by SST Automation. Please do not change this IP address.

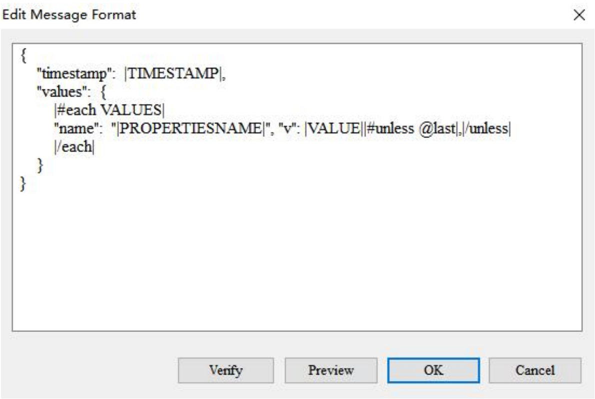
Note： Remote update services may be affected by your network firewall, and firmware updates may fail.

Remote Update Server Port: The default remote update server port is 8885. The gateway can be updated remotely by SST Automation. Please do not change this port.

Client ID: The Client ID is specified for the gateway. The default ID is the serial number of the gateway. When connecting to a MQTT Server, each Client should have a unique ID. It’s recommended to use the default ID.

Custom Message Format: If enabled, the message format is set by “Edit Message Format”.

Edit Message Format:



```
{
    "timestamp":  |TIMESTAMP|,
    "values":  {
        |#each VALUES|
        "name":  "|PROPERTIESNAME|", "v": |VALUE||#unless @last|,|/unless|
        |/each|
    }
}
```

For example:

{

"timestamp": |TIMESTAMP|,

"values":   {

|#each VALUES|

"name": "|PROPERTIESNAME|","v": |VALUE||#unless @last|,|/unless|

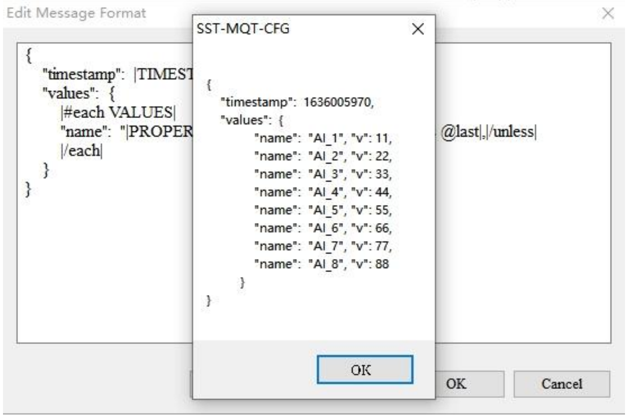
|/each|

}

}

|PROPERTIESNAME| is the property name, |VALUE| is the value of the tag, and |TIMESTAMP| is the time to read the tag. Please see Appendix A.2 for more details.

Click “Verify” to verify the JSON format. Click “Preview” to see a message preview.



```
{
    "timestamp":  1636005970,
    "values":  {
            "name":  "AI_1", "v": 11,
            "name":  "AI_2", "v": 22,
            "name":  "AI_3", "v": 33,
            "name":  "AI_4", "v": 44,
            "name":  "AI_5", "v": 55,
            "name":  "AI_6", "v": 66,
            "name":  "AI_7", "v": 77,
            "name":  "AI_8", "v": 88
        }
}
```

TLS: If enabled, the gateway supports the connection under TLS. Please refer to the corresponding MQTT Server guide. TLS 1.2 is supported.

CA File:Select a CA certificate and download it .(Only supported when TLS is enabled)

Client Certificate File:Select a Client certificate and download it.(Only supported when TLS is enabled)

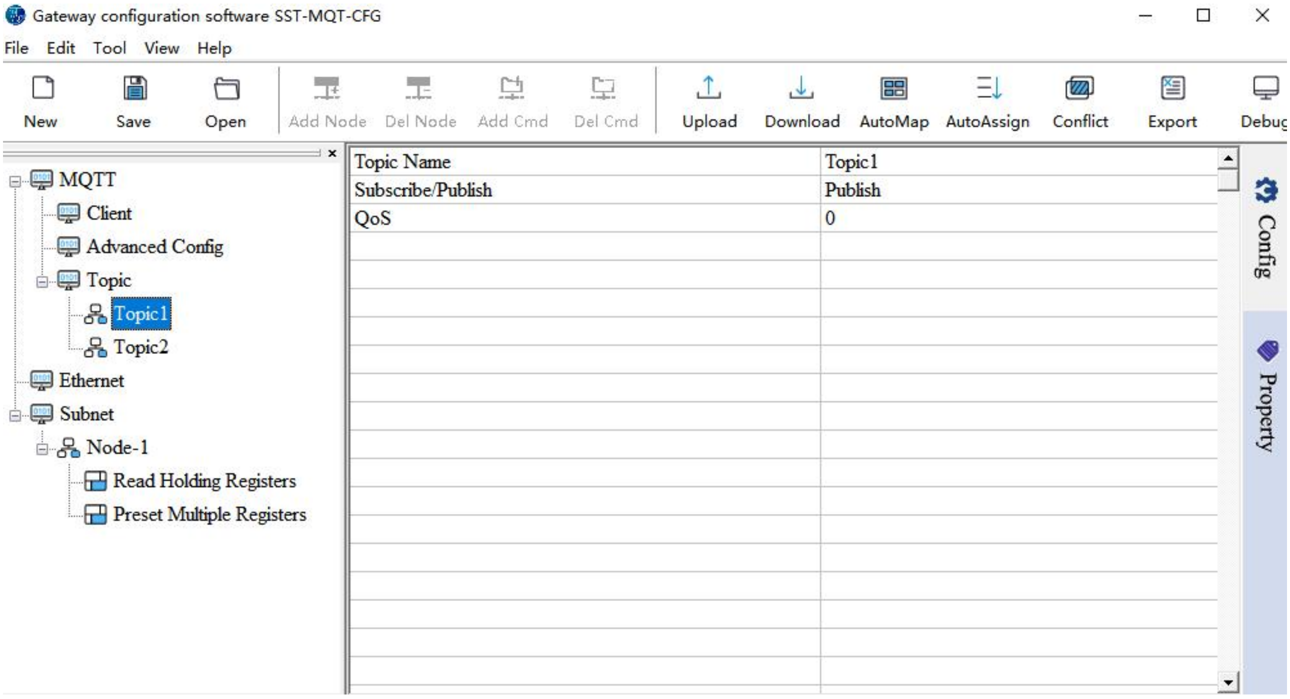
Client Key File:Select a Client Key certificate and download it.(Only supported when TLS is enabled)

5.2.3 Topic

Right click “Topic” to add a MQTT topic. If you want to delete a topic, please right-click the topic and click “Delete Topic”.

After adding a Topic, select the Topic in the left tree view to enter Topic configuration window:

Note: For the setting description of Property, please refer to Chapter 5.6.


Gateway configuration software SST-MQT-CFG
File Edit Tool View Help
New Save Open Add Node Del Node Add Cmd Del Cmd Upload Download AutoMap AutoAssign Conflict Export Debug
MQTT
Client
Advanced Config
Topic
Topic1
Topic2
Ethernet
Subnet
Node-1
Read Holding Registers
Preset Multiple Registers
Config
Property

Topic Name	Topic1
Subscribe/Publish	Publish
QoS	0

Topic Name: The topic name can be composed of characters and numbers, but does not include+and #. The length should be less than 512bytes. It supports up to 25 Topics.

Subscribe/Publish: There are three options: “Publish”, “Subscribe”, “Publish and Subscribe”.

Publish: The gateway publishes the data to the MQTT Server.

Subscribe: The gateway subscribes the data from the MQTT Server.

QoS: Supports QoS 0 and QoS 1.

QoS 0: The gateway will send the data package only once, whether it is received or not. It applies to the less important data.

QoS 1: There will be an ACK to ensure that the Client or Server received the data. Data will be sent until successfully received or sent 3 times.

5.2.4 Connecting to Microsoft Azure

The GT100-MQ-RS supports the following device authentication methods to connect to Azure IoT:

1. Symmetric Key / Shared Access Signature (SAS) Token:
Simply configure the correct username and password, and enable TLS. A certificate file does not need to be imported. The following fields in the SST-MQT-CFG configuration software will need to match the following format to connect to Azure:

Property	Format
Client ID	**<deviceID>**
MQTT Broker Username	<**IoT Hub Name**>/<**deviceID>**/?api-version=2018-06-30
MQTT Broker Password	**<SAS Token>**
MQTT Broker Address	**<IoT Hub Name>**.azure-devices.net
MQTT Broker Port	8883
Publish Topic	devices/**<deviceID>**/messages/events/
Subscription Topic	devices/**<deviceID>**/messages/devicebound/#

2. Self-Signed X.509 Certificate:
When creating a device in Azure IoT, it is necessary to fill in the fingerprint information of the certificate along with the Device ID. In the SST-MQT-CFG configuration software, configure the correct username, enable TLS, and import the Client Certificate and Client Key. The following fields in the SST-MQT-CFG configuration software will need to match the following format to connect to Azure:

Property	Format
Client ID	**<deviceID>**
MQTT Broker Username	**<IoT Hub Name>/<deviceID>**/?api-version=2018-06-30
MQTT Broker Password	No password is required
MQTT Broker Address	**<IoT Hub Name>**.azure-devices.net
MQTT Broker Port	8883
CA File	No CA file is required
Client Certificate File*	**<Device Certificate.pem>**
Client Key File*	**<Private Key.pem.key>**
Publish Topic	devices/**<deviceID>**/messages/events/
Subscription Topic	devices/**<deviceID>**/messages/devicebound/#

***Note:** Certificates and keys must be in PEM format.

3. Signed X.509CA Certificate:

When creating a device in Azure IoT, it is necessary to register the X.509 CA certificate to your IoT Hub. Detailed instructions can be found on Microsoft's website.

In the SST-MQT-CFG configuration software, configure the correct username, enable TLS, and import the correct certificates (CA Certificate, Client Certificate, and Client Key). The following fields in the SST-MQT-CFG configuration software will need to match the following format to connect to Azure:

Property	Format
Client ID	**<deviceID>**
MQTT Broker Username	**<IoT Hub Name>**/**<deviceID>**/?api-version=2018-06-30
MQTT Broker Password	No password is required
MQTT Broker Address	**<IoT Hub Name>**.azure-devices.net
MQTT Broker Port	8883
CA File*	**<X.509 CA.pem>**
Client Certificate File*	**<Device Certificate.pem>** **Note:** The certificate subject Common Name (CN) must match the **<deviceID>**.
Client Key File*	**<Private Key.pem.key>**
Publish Topic	devices/**<deviceID>**/messages/events/
Subscription Topic	devices/**<deviceID>**/messages/devicebound/#

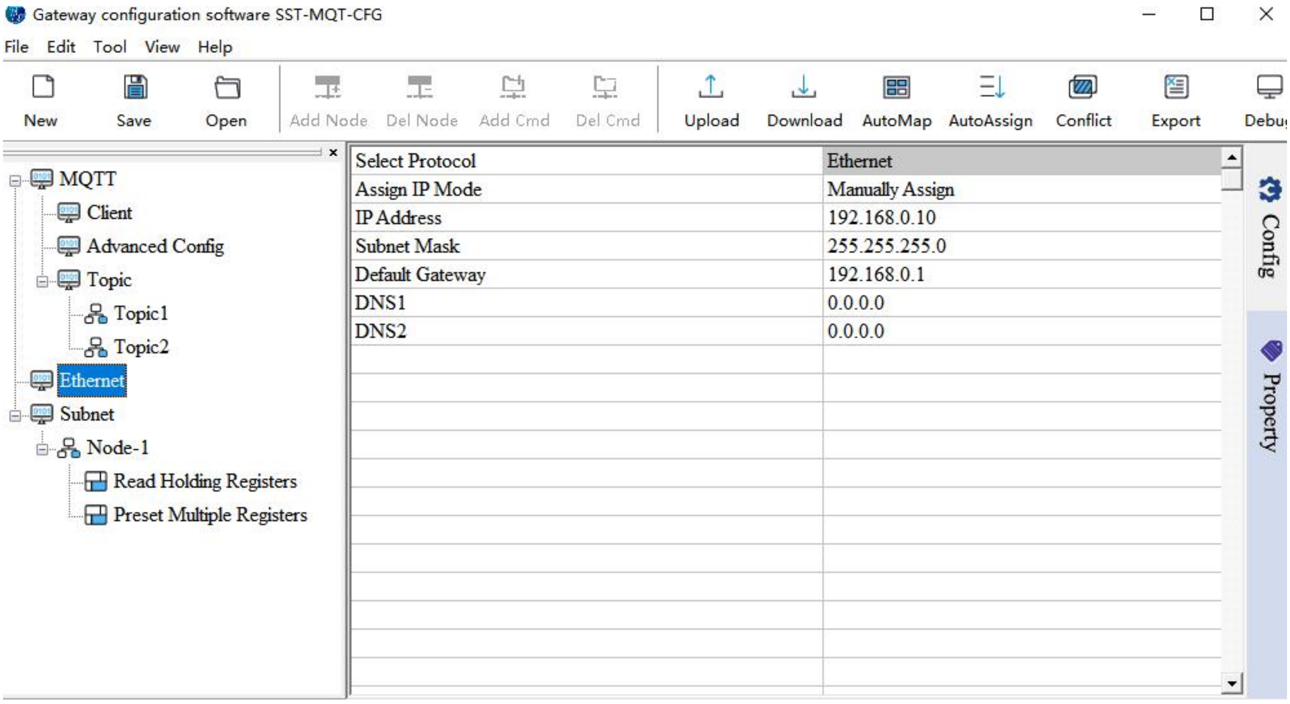
***Note:** Certificates and keys must be in PEM format.

5.2.5 Connecting to Amazon AWS

To connect the GT100-MQ-RS to AWS IoT, configure the MQTT broker address and port, enable TLS and import the correct certificates (CA Certificate, Client Certificate, and Client Key). The following fields in the SST-MQT-CFG configuration software will need to match the following format to connect to AWS:

Property	Format
MQTT Broker Username	No username is required
MQTT Broker Password	No password is required
MQTT Broker Address	**<AWS Endpoint URL String>**.amazonaws.com
MQTT Broker Port	8883
CA File	**<Amazon Root CA.pem>**
Client Certificate File	**<Device Certificate.pem.crt>**
Client Key File	**<Private Key.pem.key>**

5.3 Ethernet



Select Protocol	Ethernet
Assign IP Mode	Manually Assign
IP Address	192.168.0.10
Subnet Mask	255.255.255.0
Default Gateway	192.168.0.1
DNS1	0.0.0.0
DNS2	0.0.0.0

Select Protocol: Ethernet.

Assign IP Mode: Supports Manually Assign / DHCP. In DHCP mode, the gateway needs to connect to a DHCP server or switch to get a valid IP address.

IP Address: IP Address of the GT100-MQ-RS. The device can be searched when the IP address is in the same network segment with the computer.

> **Note:** Whether you use this protocol or not, please assign an IP address to the gateway. The configuration software uses the IP address to search for the gateway when uploading/downloading the configuration.

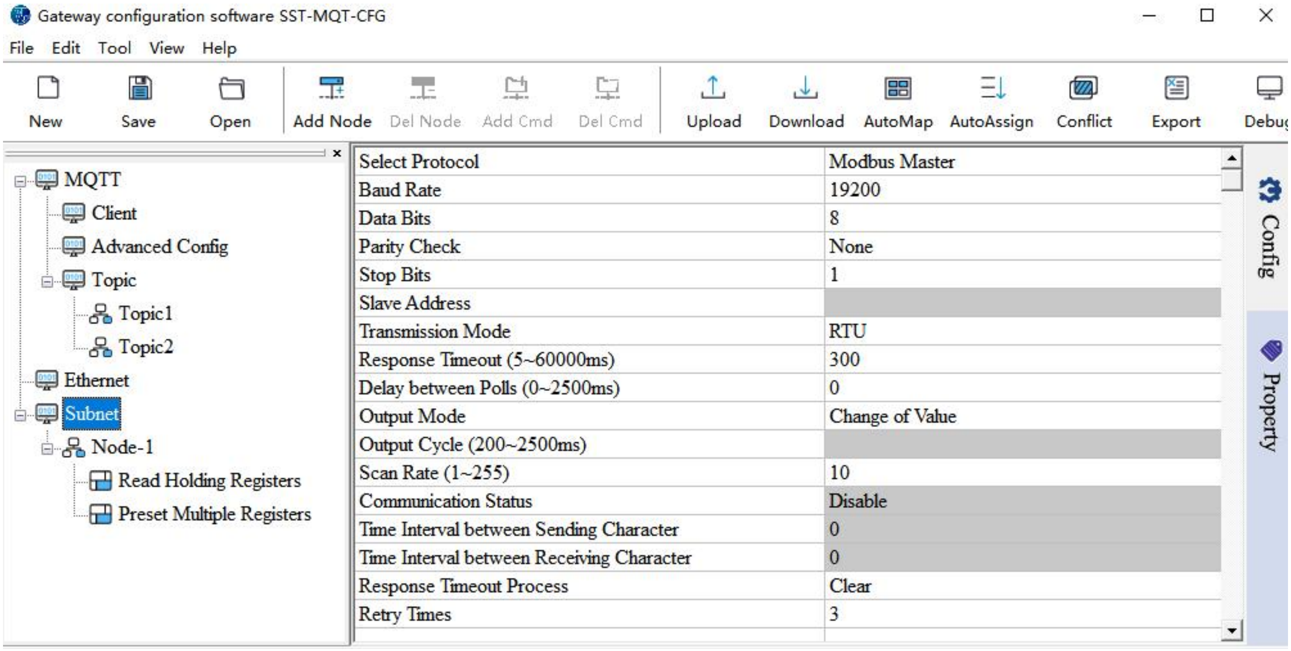
Subnet Mask: Subnet mask of the GT100-MQ-RS.

Default Gateway: Gateway address of the GT100-MQ-RS.

DNS1, 2: DNS (Domain Name System) is a service of the Internet. It acts as a distributed database that maps domain names and IP addresses to each other.

5.4 Subnet

Select the “Subnet” in the left tree view to enter Modbus interface configuration window.



Select Protocol	Modbus Master
Baud Rate	19200
Data Bits	8
Parity Check	None
Stop Bits	1
Slave Address	
Transmission Mode	RTU
Response Timeout (5~60000ms)	300
Delay between Polls (0~2500ms)	0
Output Mode	Change of Value
Output Cycle (200~2500ms)	
Scan Rate (1~255)	10
Communication Status	Disable
Time Interval between Sending Character	0
Time Interval between Receiving Character	0
Response Timeout Process	Clear
Retry Times	3

Select Protocol: The current protocol.

Baud Rate: Baud Rate of the serial interface. Supports 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200.

Data Bits: The number of data bits of each byte.

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

Stop Bits: 1 or 2.

Slave Address: It’s invalid when selecting “Modbus Slave” protocol.

Transmission Mode: Modbus transmission mode. Supports RTU and ASCII.

Response Timeout: Time to wait for response from Modbus Slave after Modbus Master sends a command. Range: 5~60000ms. Invalid for “Modbus Slave” protocol.

Delay between Polls: Delay time before Modbus master send a new command after the previous command is sent and Modbus slave gives correct response or response times out. Range: 0~2500ms. The actual polling delay time is in multiples of 10 and will be rounded down from the input value. If the input value is 9, the actual polling delay time is 0ms. If the input value is 15, the actual polling delay time is 10ms. Invalid for “Modbus Slave” protocol.

Output Mode: Three options: Cyclic, Forbidden, Change of Value. Invalid for “Modbus Slave” protocol.

Cyclic: The write command will be sent periodically.

Forbidden: The write command won't be sent.

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

Output Cycle: The cycle time to send write command. Range: 200~2500ms. Invalid for “Modbus Slave” protocol.

Scan Rate: The ratio of fast-scan command to slow-scan command. If the value is set to 10, a slow-scan command will be sent once every ten fast-scan commands are sent. Invalid for “Modbus Slave” protocol.

Communication Status: Unused. Modbus command status. It’s off by default and can’t be modified. The first few bytes indicate the Modbus command status. Bit0 of Byte1 represents the first command and Bit1 of Byte2 represents the tenth command.

The initial value is 0. When the communication is normal, the value is 1.

Time Interval between Sending Character: Unused. Every byte will be sent at this interval.

Time Interval between Receiving Character: Unused. The interval determines when to stop receiving a frame of data.

Response Timeout Process: When the gateway doesn’t receive the response within the time set in “Response Timeout”. “Modbus slave” protocol is not supported.

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

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

Retry Times: The number of retries to send the command when response error. Range: 2~254. The default value is 3. “Modbus slave” protocol is not supported.

5.4.1 Modbus Master Interface Configuration

1. Node

The Configuration view supports three types of operation: Edit Menu, Edit Toolbar and Right click edit Menu.

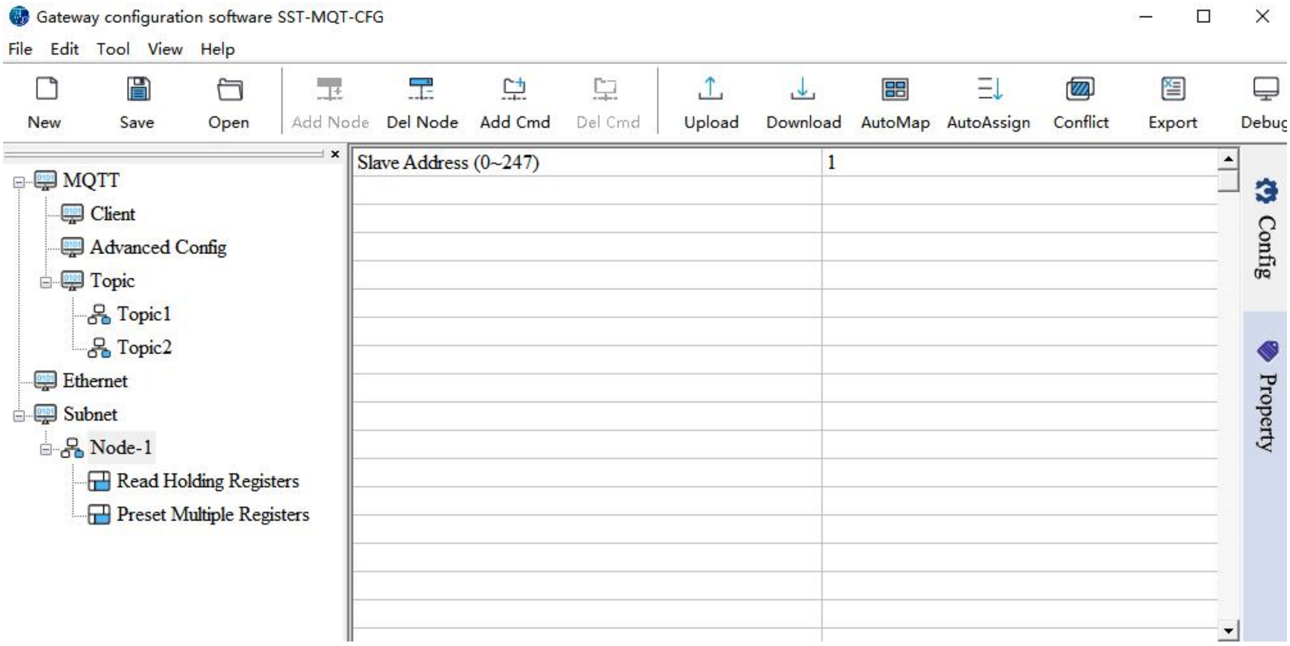
(1) Add node: Select the “Subnet” and add a new node. A new node named “Node-X” will be added under the Subnet. The maximum number of nodes is 100.

(2) Delete node: When deleting a node, all commands under the node 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.

The node is the Modbus slave address, ranging from 0 to 247. The node interface is displayed as follows:



Slave Address (0~247)	1

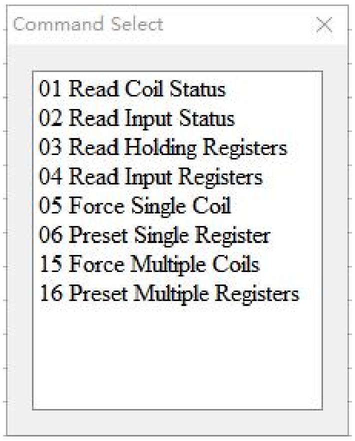
2. Modbus Command

The Configuration view supports three types of operation: Edit Menu, Edit Toolbar and Right click edit Menu.

(1) Add command: Select a node and add a command. The maximum command number is 100.

(2) Delete command: Select a command and then delete it.

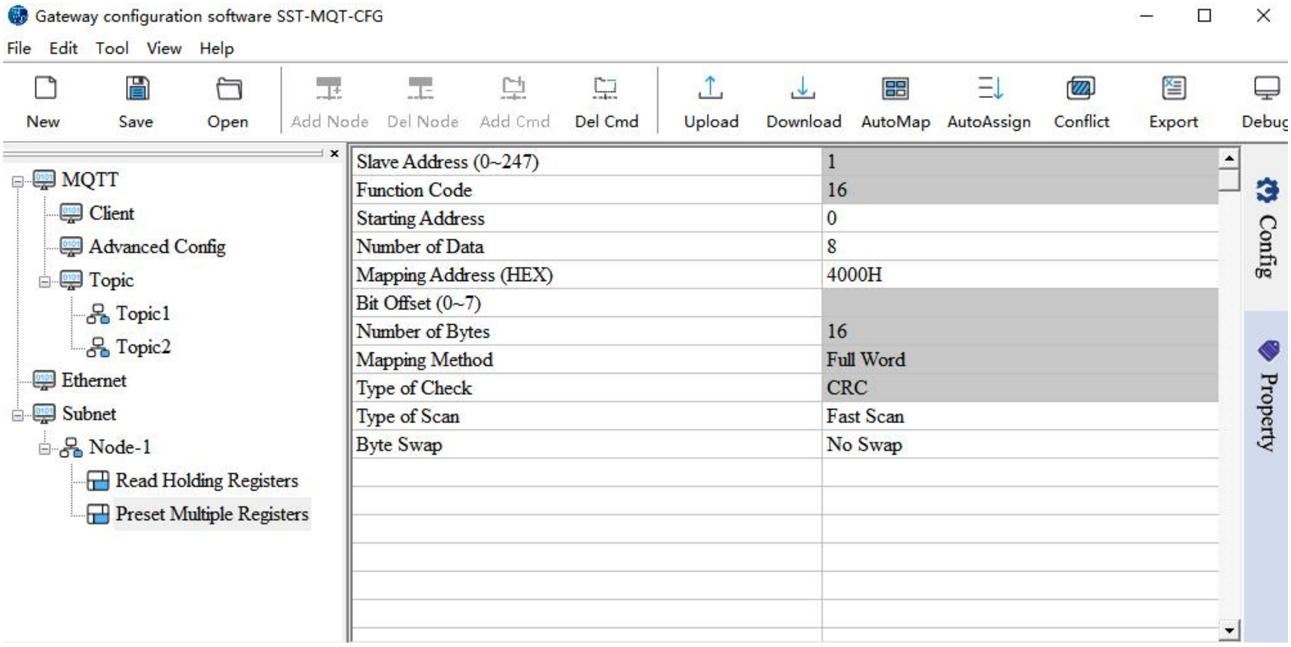
It supports the commands: 01, 02, 03, 04, 05, 06, 15 and 16. Double click the command to select the command.



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

The command interface is displayed as follows:

Note: For the setting description of Property, please refer to Chapter 5.6.



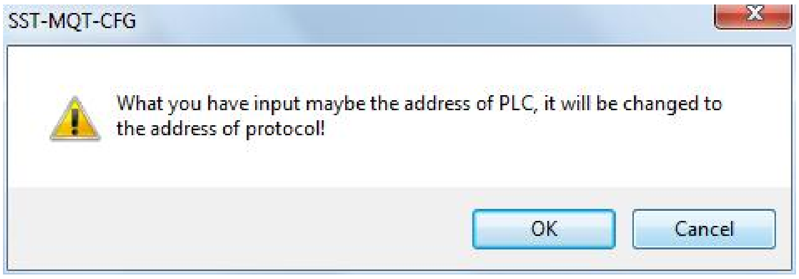
Slave Address (0~247)	1
Function Code	16
Starting Address	0
Number of Data	8
Mapping Address (HEX)	4000H
Bit Offset (0~7)	
Number of Bytes	16
Mapping Method	Full Word
Type of Check	CRC
Type of Scan	Fast Scan
Byte Swap	No Swap

Slave Address: Modbus Slave address.

Function Code: Modbus Function Code.

Starting Address: The starting address of status or register. Range: 0~65535.

Note: This address refers to the protocol address. When the user enters the PLC address, there will be a pop-up window asking for confirmation. Click "OK" to convert the input address into a protocol address. Click "Cancel" to refuse the converting.


SST-MQT-CFG

What you have input maybe the address of PLC, it will be changed to the address of protocol!

Examples of PLC addresses and corresponding protocol addresses.

Block	PLC Address	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

Number of Data: The number of data(registers or coils or status). The range is 1~122 (Modbus function code 3,4,16) or 1~244 (Modbus function code 1,2,15).

Mapping Address (HEX): The starting address of data in the buffer.

Read command: 0x0000~0x01FF.

Write command: 0x4000~0x41FF.

When users want to exchange the data between slave devices, the write command can be mapping in 0x0000～0x01FF.

Bit Offset (0-7): When reading/writing a coil or reading input status, its value will be mapped into bits of input or output buffer.

Number of Bytes: The number of the data bytes.

Mapping Method: Unused. Support only full-word mapping now. When reading or writing a register, you can map a full word into the buffer, or only map MS/LS byte into the buffer.

Type of Check: Data communication error check.

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 the ratio of fast-scan command to slow-scan command.

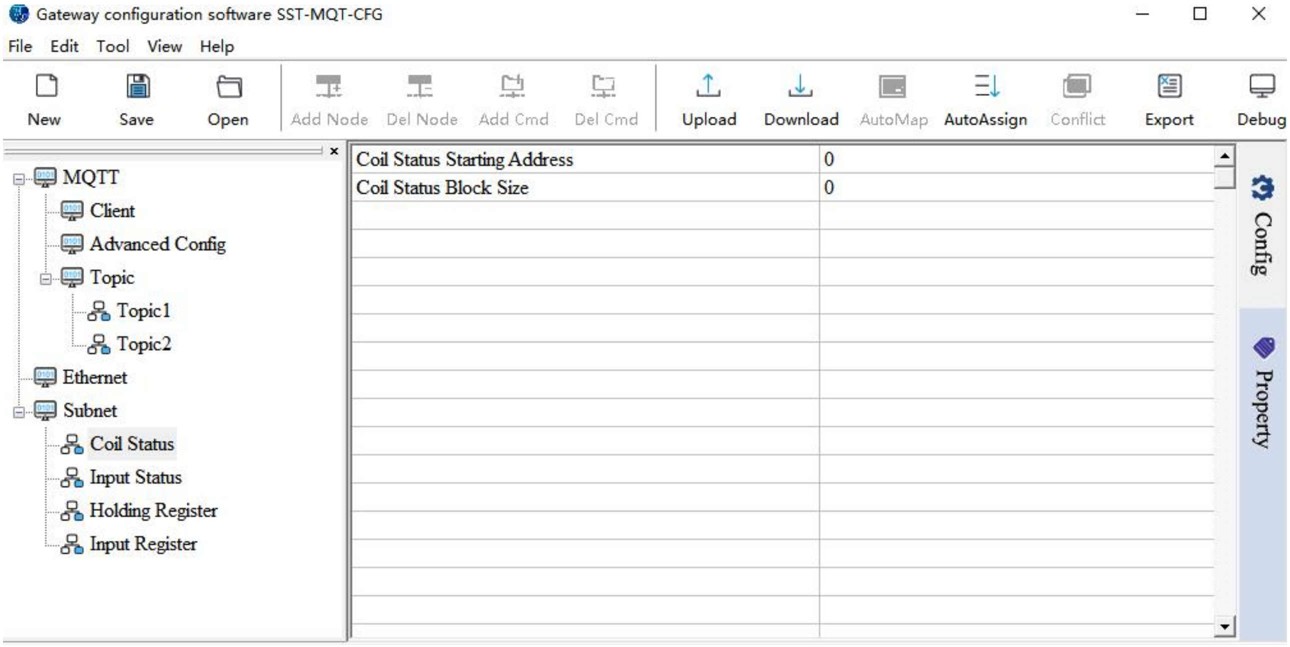
Byte Swap: There are three modes of Byte Swap: No Swap, Two Bytes Swap and Four Bytes Swap. It's valid for registers.

Two Bytes Swap: The high and low bytes of 2 bytes (one register) are exchanged, e.g. 0x1234 to 0x3412.

Four Bytes Swap: The first two bytes are exchanged with the last two bytes, e.g. 0x12345678 to 0x78563412.

5.4.2 Modbus Slave Interface Configuration

Select a Status/Register block to enter Modbus slave block configuration window.



Coil Status Starting Address	0
Coil Status Block Size	0

Coil/Input Status Starting Address: The start address of 0/1XXXX area. The range is 0~65535, the default is 0.

Coil/Input Status Block Size: The block size of the 0/1XXXX area. The range is 0~512, and the default is 0.

Holding/Input Register Starting Address: The start address of the 4/3XXXX area. The range is 0~65535, and the default is 0.

Holding/Input Register Block Size: The block size of the 4/3XXXX area. The range is 0~256, and the default is 0.

For the setting description of Property, please refer to Chapter 5.6.

5.5 Tools

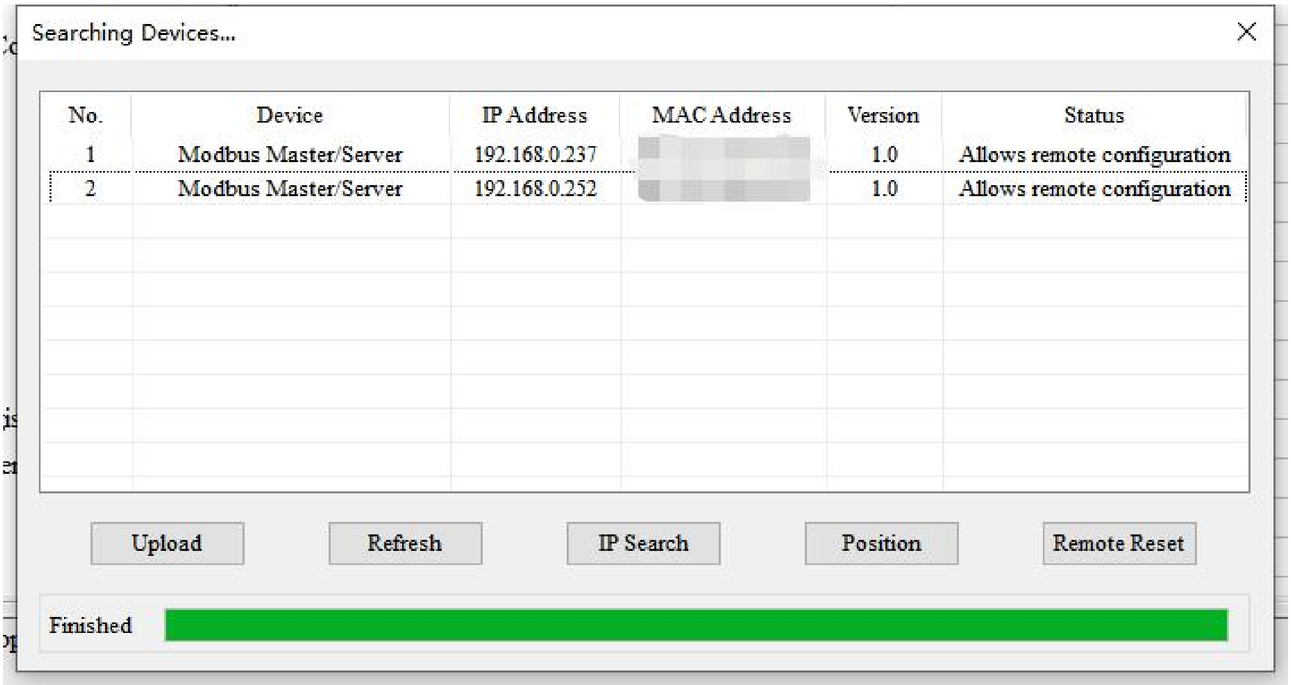
The “Tool” option on the menu bar contains the following functions:

- Upload Config
- Download Config
- Confilict Detection
- Export Excel
- Communication Debug
- AutoMap
- Name Properties in Oder
- Properties Name Conflict Detection

5.5.1 Upload Config and Download Config

1. Search Device

Click “Upload” or “Download” to open the search window. It will automatically search the available devices once after opening the search window.



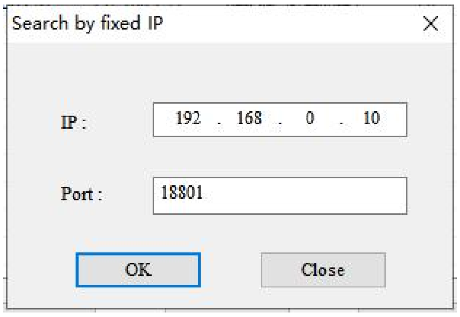
Searching Devices...

No.	Device	IP Address	MAC Address	Version	Status
1	Modbus Master/Server	192.168.0.237	[redacted]	1.0	Allows remote configuration
2	Modbus Master/Server	192.168.0.252	[redacted]	1.0	Allows remote configuration

Login: Select the device and click “Login” to upload / download the configuration.

Position: Select the device and click “Position”, the ENS indicator on the selected gateway will turn red.

IP Search: Search the device in specific IP address and port.



Search by fixed IP

IP : 192 . 168 . 0 . 10

Port : 18801

Refresh: Search the device again.

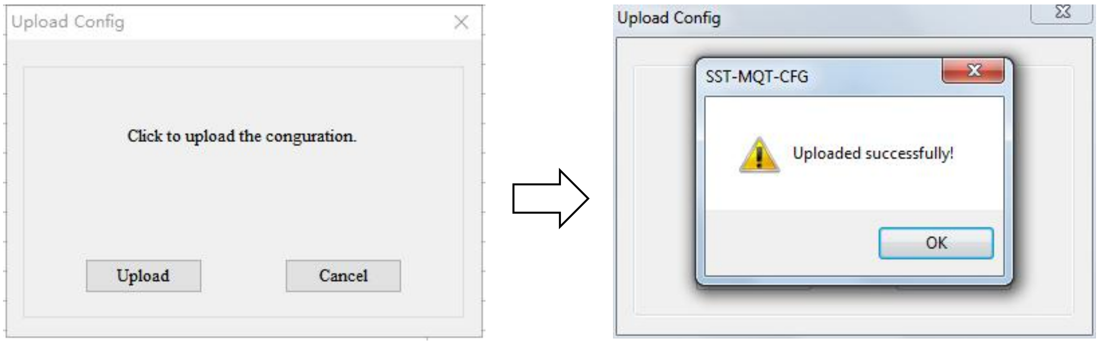
Cancel: Close the search window.

If the gateway cannot be searched, please refer to the “Notes” section of Chapter 4.2.

2. Upload

Select “Upload” to upload the gateway configuration information from the device to the software.

When uploading the configuration from the gateway to the software, the pop-up window will be shown as below:



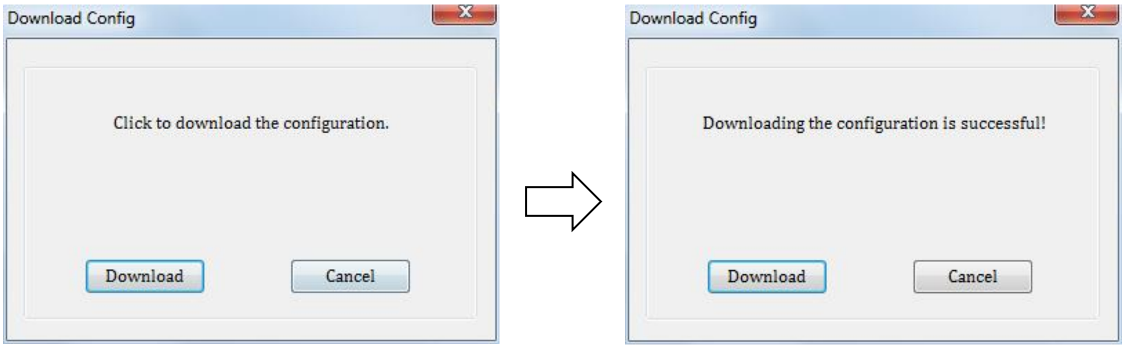
Click to upload the conguration.

Uploaded successfully!

3. Download

Select “Download” to download the configured gateway information to the gateway device.

When downloading the configuration to the gateway, the pop-up window will be shown as below:



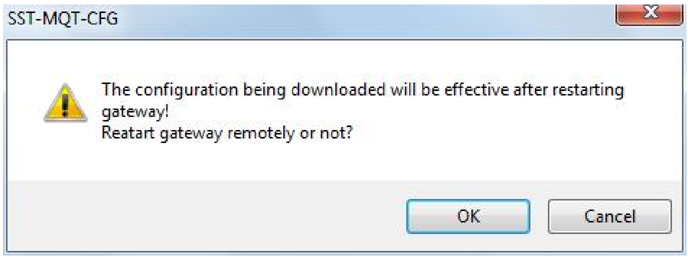
Download Config

Click to download the configuration.

Download Config

Downloading the configuration is successful!

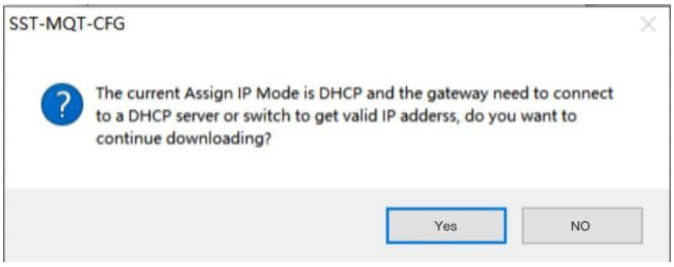
Click “Cancel” and the pop-up window will ask for remote restart. The new configuration is effective after restarting. Click “OK” to restart the gateway. Click “Cancel” to refuse to restart.



SST-MQT-CFG

The configuration being downloaded will be effective after restarting gateway!
Reatart gateway remotely or not?

Note: If Modbus TCP Assign IP Mode is set to DHCP, the following dialog box is displayed.



SST-MQT-CFG

The current Assign IP Mode is DHCP and the gateway need to connect to a DHCP server or switch to get valid IP adderss, do you want to continue downloading?

5.5.2 Confilict Detection

To detect whether there are address conflicts in the mapping buffer. The configuration cannot be downloaded to the gateway if there are conflicts. This function is used for Modbus commands.

The mapping buffer is divided into input area and output area.

Input area address is from 0x0000 to 0x3FFF.

Output area address is from 0x4000 to 0x7FFF.

Each square represents a byte. The colors indicate the status of the address.

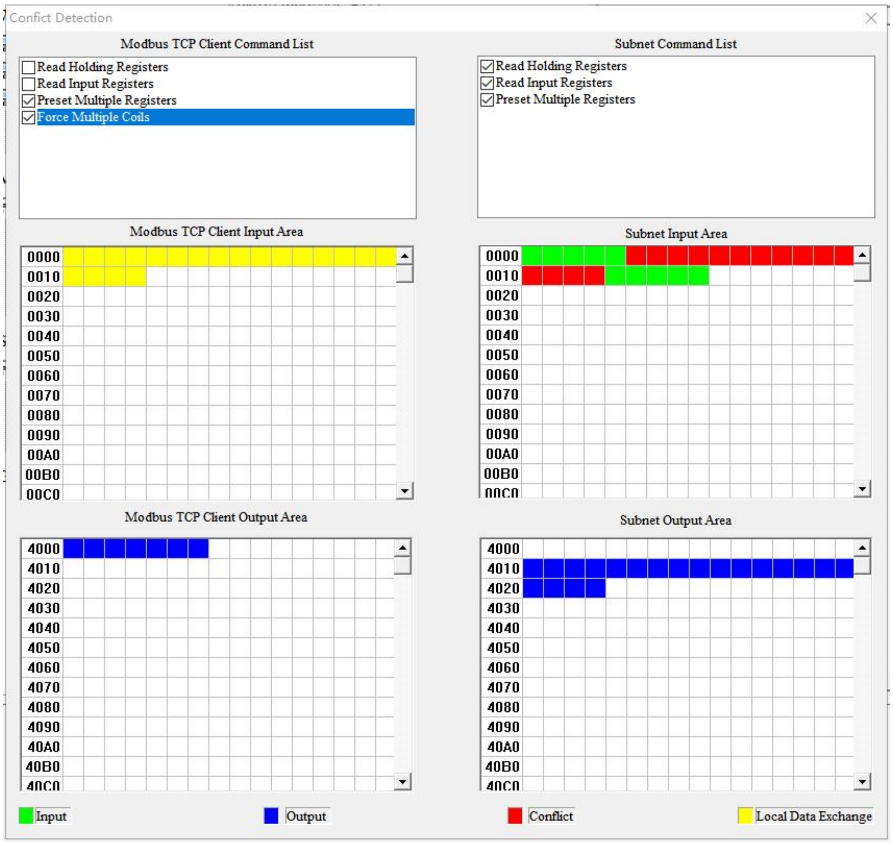
Green: No conflict of read commands in input area.

Yellow: The write commands are used to exchange data between slave devices and there is no conflict.

Blue: No conflict of write commands in output area.

Red: Address conflicts.

White: None data is mapped in this address.



Confict Detection

Modbus TCP Client Command List

- ☐ Read Holding Registers
- ☐ Read Input Registers
- ☑ Preset Multiple Registers
- ☑ Force Multiple Coils

Subnet Command List

- ☑ Read Holding Registers
- ☑ Read Input Registers
- ☑ Preset Multiple Registers

Modbus TCP Client Input Area

0000 0010 0020 0030 0040 0050 0060 0070 0080 0090 00A0 00B0 00C0

Subnet Input Area

0000 0010 0020 0030 0040 0050 0060 0070 0080 0090 00A0 00B0 00C0

Modbus TCP Client Output Area

4000 4010 4020 4030 4040 4050 4060 4070 4080 4090 40A0 40B0 40C0

Subnet Output Area

4000 4010 4020 4030 4040 4050 4060 4070 4080 4090 40A0 40B0 40C0

🟩 Input 🟦 Output 🟥 Conflict 🟨 Local Data Exchange

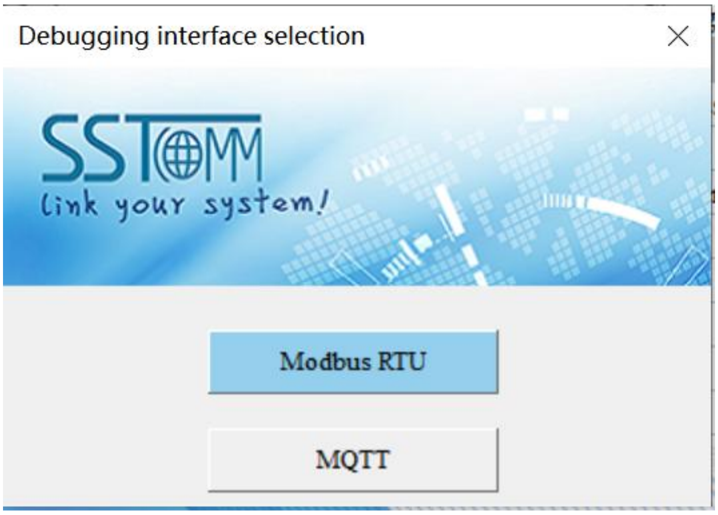
5.5.3 Export Excel

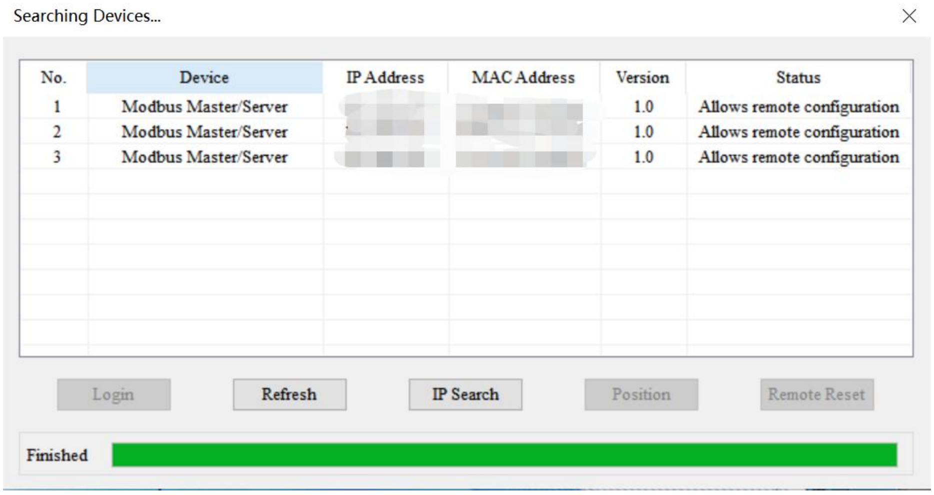
Excel documents help users examine the configuration. Save the configuration as excel document and choose the right path.

5.5.4 Communication Debug

The Communication Debug function is to Debug modbus communication and view MQTT connection information.

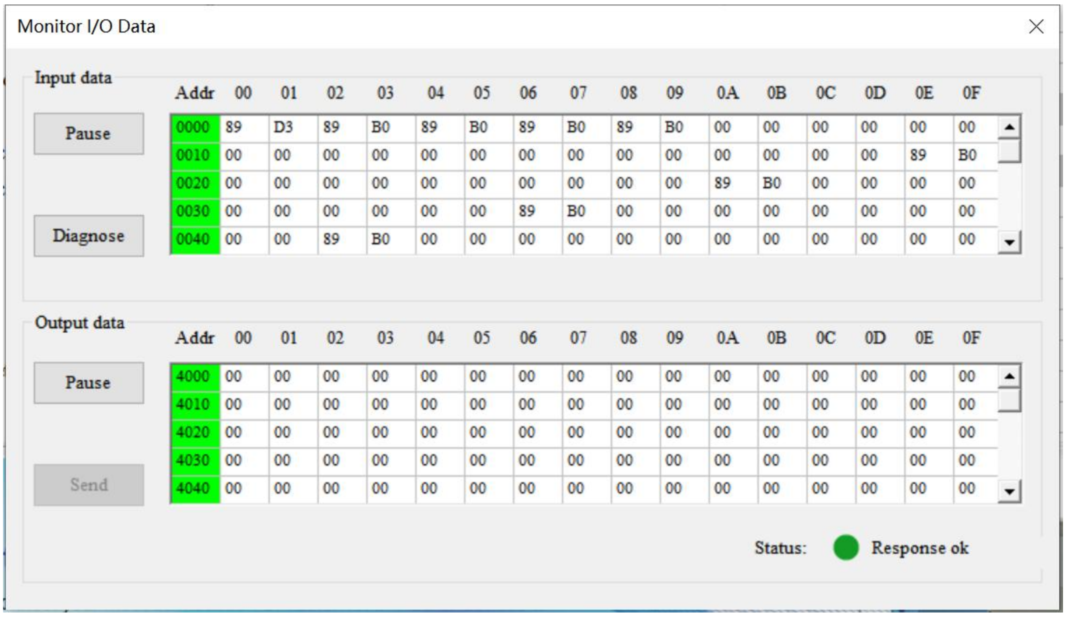
Select “Tool” >> “Communication Debug” to open the debug window.




Searching Devices...

No.	Device	IP Address	MAC Address	Version	Status
1	Modbus Master/Server	[redacted]	[redacted]	1.0	Allows remote configuration
2	Modbus Master/Server	[redacted]	[redacted]	1.0	Allows remote configuration
3	Modbus Master/Server	[redacted]	[redacted]	1.0	Allows remote configuration

Modbus RTU: When the gateway is in modbus master mode, modbus communication debug can be available.



Monitor I/O Data

Input data

Addr	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0000	89	D3	89	B0	89	B0	89	B0	89	B0	00	00	00	00	00	00
0010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	89	B0
0020	00	00	00	00	00	00	00	00	00	00	89	B0	00	00	00	00
0030	00	00	00	00	00	00	89	B0	00	00	00	00	00	00	00	00
0040	00	00	89	B0	00	00	00	00	00	00	00	00	00	00	00	00

Output data

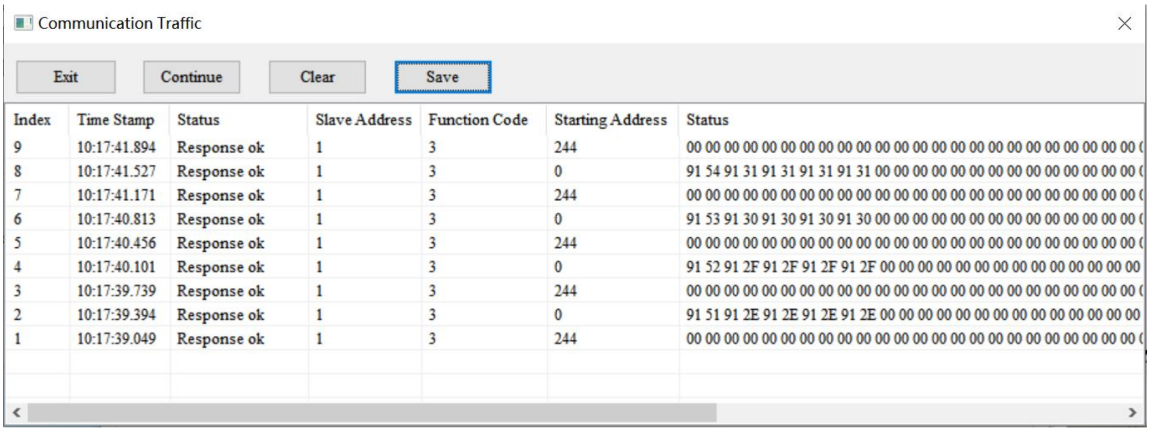
Addr	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
4000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
4010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
4020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
4030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
4040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Status: ● Response ok

Input data: Shows serial data received from the RS-485 interface.

Pause: Pause input buffer data display.

Diagnose: Display specific Modbus command response status.



Communication Traffic

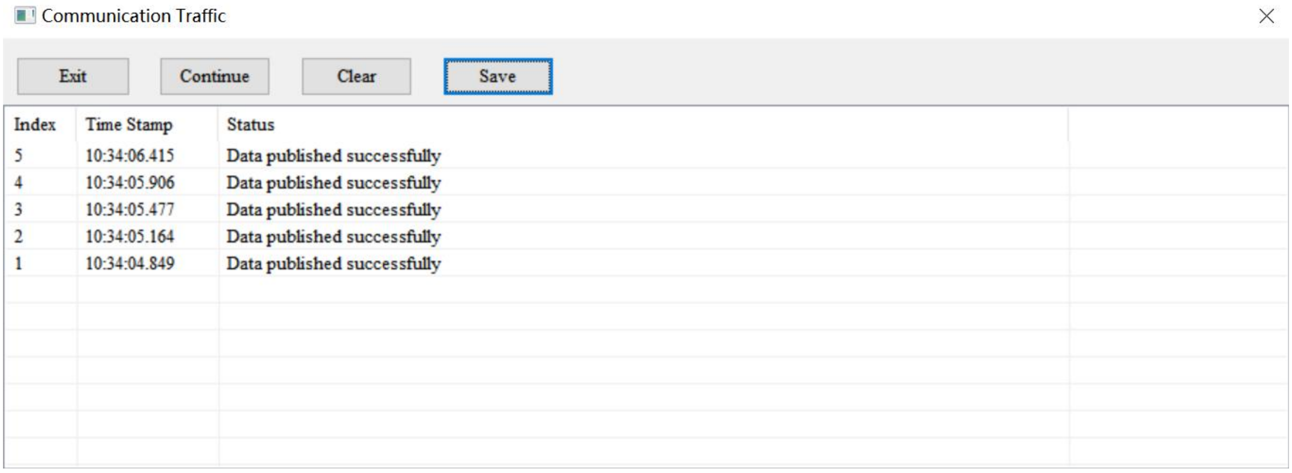
Index	Time Stamp	Status	Slave Address	Function Code	Starting Address	Status
9	10:17:41.894	Response ok	1	3	244	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
8	10:17:41.527	Response ok	1	3	0	91 54 91 31 91 31 91 31 91 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00
7	10:17:41.171	Response ok	1	3	244	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
6	10:17:40.813	Response ok	1	3	0	91 53 91 30 91 30 91 30 91 30 00 00 00 00 00 00 00 00 00 00 00 00 00 00
5	10:17:40.456	Response ok	1	3	244	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
4	10:17:40.101	Response ok	1	3	0	91 52 91 2F 91 2F 91 2F 91 2F 00 00 00 00 00 00 00 00 00 00 00 00 00 00
3	10:17:39.739	Response ok	1	3	244	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
2	10:17:39.394	Response ok	1	3	0	91 51 91 2E 91 2E 91 2E 91 2E 00 00 00 00 00 00 00 00 00 00 00 00 00 00
1	10:17:39.049	Response ok	1	3	244	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Output data: Shows serial data transmitted from the RS-485 interface.

Pause: Pause output buffer data display.

Send: After suspending the display of output buffer data, modify the buffer data and click Send to send modbus data to the device.

MQTT: Display MQTT network connection information



Index	Time Stamp	Status
5	10:34:06.415	Data published successfully
4	10:34:05.906	Data published successfully
3	10:34:05.477	Data published successfully
2	10:34:05.164	Data published successfully
1	10:34:04.849	Data published successfully

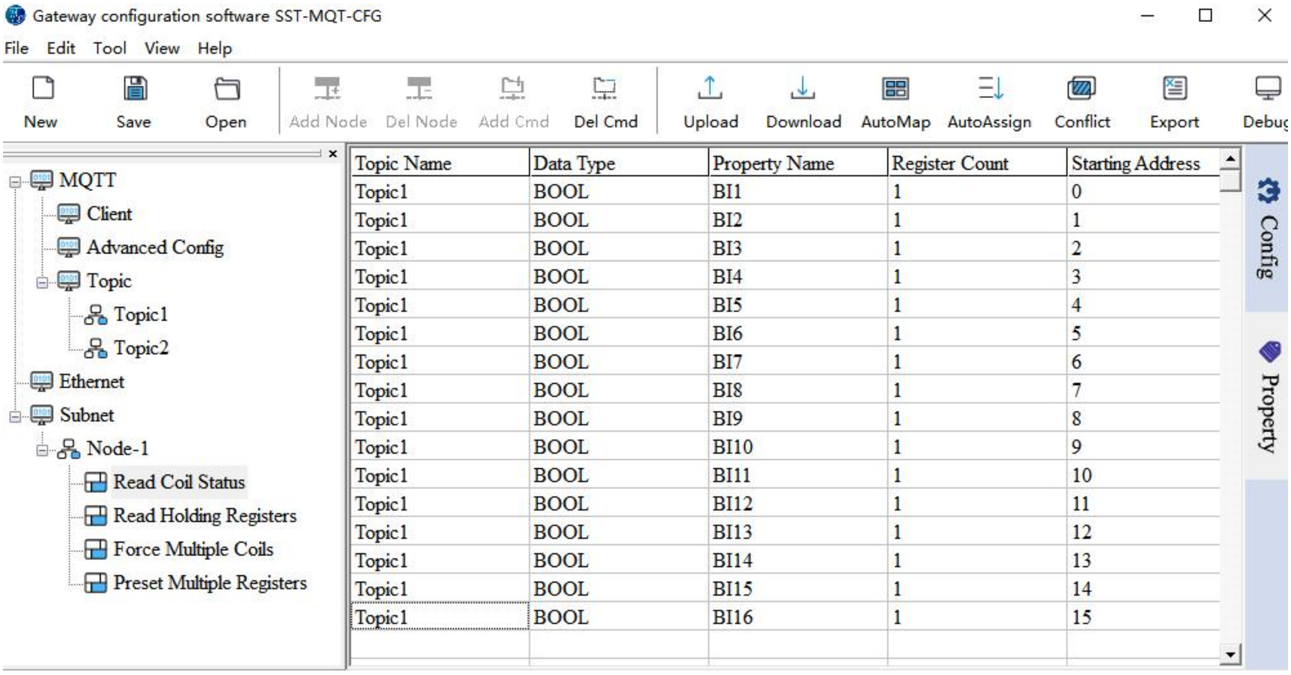
5.5.5 AutoMap

Click “AutoMap” to automatically calculate the non-conflicting mapped memory address for each command.

5.6 Property Operations

5.6.1 Property Configuration

Click “Property” in the right bar to enter the property window.



Topic Name	Data Type	Property Name	Register Count	Starting Address
Topic1	BOOL	BI1	1	0
Topic1	BOOL	BI2	1	1
Topic1	BOOL	BI3	1	2
Topic1	BOOL	BI4	1	3
Topic1	BOOL	BI5	1	4
Topic1	BOOL	BI6	1	5
Topic1	BOOL	BI7	1	6
Topic1	BOOL	BI8	1	7
Topic1	BOOL	BI9	1	8
Topic1	BOOL	BI10	1	9
Topic1	BOOL	BI11	1	10
Topic1	BOOL	BI12	1	11
Topic1	BOOL	BI13	1	12
Topic1	BOOL	BI14	1	13
Topic1	BOOL	BI15	1	14
Topic1	BOOL	BI16	1	15

Topic Name: Select the topic for properties.

Data Type:

For command 1, 2, 5 and 15: The data type can be BOOL.

For command 3, 4, 6 and 16:

When using 1 register, the data type can be UINT/INT16.

When using 2 registers, the data type can be UINT32/INT32/Float/UINT32V/INT32V/FloatV.

When using 4 registers, the data type can be UINT64/INT64/Double/UINT64V/INT64V/DoubleV.

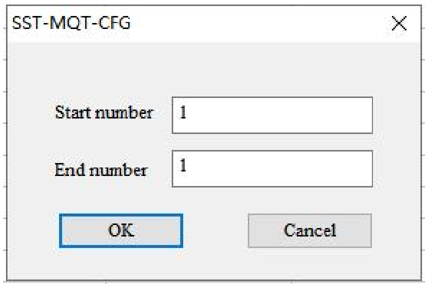
“V” refers to exchange of the bytes.

For example: Float 12.56 corresponds to HEX F5 C3 41 48. FloatV 12.56 corresponds to HEX 41 48 F5 C3.

Double 3.38 corresponds to HEX D7 0A 70 A3 0A 3D 40 0B. DoubleV 3.38 corresponds to 40 0B 0A 3D 70 A3 D7 0A.

Property Name: The property can be named automatically in orders or as custom names.

Copy Property Name: Click the right mouse button on any command option, and then select copy property name selection. Click the left mouse button, and fill in the start and end numbers of the properties to be copied in the prompt box.



Paste Property Name: Click the right mouse button on any command option, then select paste property name selection, fill in the prompt box to paste attribute name start number and end number to complete the paste attribute name.

Copy scope = Paste scope.

Copy scope > Paste scope, modifications are subject to pasting.

Copy scope < Paste scope, modifications are subject to copying.

Register Count: The number of the register.

Starting Address: The starting address of data.

5.6.2 Name Properties in Order

Select "Tool" >> "Name Properties in Order" to use this function.

The "Name Properties in Order" function is to automatically sort the properties of one topic and name them in order, with no conflict.

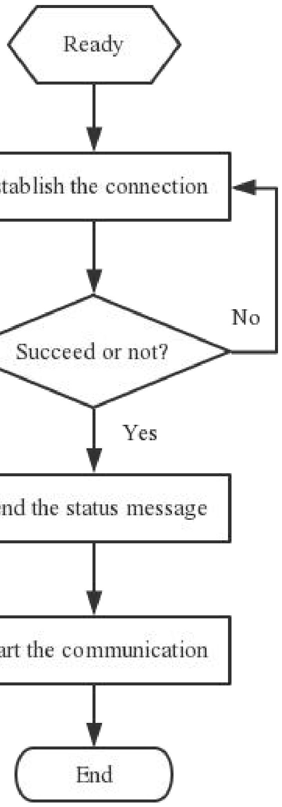
5.6.3 Properties Name Conflict Detection

Select "Tool" >> "Properties Name Conflict Detection" to use this function.

The "Properties Name Conflict Detection" function is to automatically detect whether there are repeated property names in the same Topic and pop up the prompt.

6 Working Principle

6.1 Connection Process



6.2 Data Exchange

The GT100-MQ-RS is able to connect Modbus RTU/ASCII devices to MQTT Servers, such as Amazon AWS IoT, EMQ and custom Servers.

Appendix A: MQTT Message Format

A.1 Default Format

A.1.1 Publish Message

Note: "//" indicates the comments part.

Property type:

Read Coil Status / Input Status:

```
{
    "version":     "1.1.1.0",           //Version information
    "time":    "19/03/07,17:04:07",     //Time stamp
    "properties":{
    //When publishing messages in property type, the GT100-MQ-RS can publish 8 properties at most in one
    message. If more than 8 properties need to be transmitted, the GT100-MQ-RS will publish multiple messages
    of 8 or less properties.
    "BI3":    false,
    "BI4":    true,
    "BI5":    false,
    "BI6":    false

    }
}
```

Read Holding Register / Input Register:

```
{
    "version":     "1.1.1.0",
    "time":    "19/03/07,17:10:03",
    "properties":{
    "AI2":    9999,     //The data type (for example, Float) consists with the property configuration
    "AI3":    8888,
    "AI4":    7777,
    "AI5":    6666
    }
}
```

A.1.2 Subscribe Message

Note: "//" indicates the comments part.

Property type: (Up to 8 properties can be changed at one time)

Modbus Master/Slave / Modbus TCP Server:

Change Coil/Input Status:

```
{
    "properties":   {
    "BO3":    false,
    "BO4":    true,
    "BO5":    false
    }
}
```

Change Holding/Input Register:

```
{
"properties":   {
    "AO3":   123,
    "AO4":   321,
    "AO5":   555
    }
}
```

A.2 Custom Message Format

```
{
    "timestamp": |TIMESTAMP|,
    "values":   {
        |#each VALUES|
        "name": "|PROPERTIESNAME|", "v": |VALUE||#unless @last|,|/unless|
        |/each|
    }
}
```

(1) Variable description

|PROPERTIESNAME|: Property Name. For example, AI1.

|VALUE|: The value of the property.

|TIMESTAMP|: The time when the property was read.

(2) Grammar

```
|#each VALUES|
    |PROPERTIESNAME|, |VALUE|, |TIMESTAMP|,
|/each|
```

The "each" is to generate text for each property. Users just need to edit one single property template between "|#each VALUES|" and "|/each|" and it will be copied to every property. Up to 8 properties can be published in one message.

Template example:

```
{
    |#each VALUES|
        "|PROPERTIESNAME|_value": |VALUE|,
        "|PROPERTIESNAME|_timestamp": |TIMESTAMP|,
    |/each|
}
```

Message example:

```
{
    "AI1_value": 23,
    "AI1_timestamp": 1456150184825,
    "AI2_value": 17,
    "AI2_timestamp": 1456150184984,
    …
}
```

(3) Additional grammar description:

|#unless @last|,|/unless|

This line means "Must insert a comma at the end of each line, unless it's the last line". It cancels the comma in the last line. If users regard the comma in the last line as a syntax error, the template must contain this line.