Modbus / Modbus TCP / MQTT Gateway
GT100-MQ-IE

User Manual

V 3.0

REV A

SST Automation

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Important Information

Warning

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Technical Support Contact Information

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Catalog

1 Product Overview

1.1 Product Function

The GT100-MQ-IE is a RS485 and 10/100M-RJ45 based wireless gateway with GPS function. The gateway can connect Modbus RTU/ASCII and Modbus TCP devices to the IoT Cloud by MQTT. Wireless networks support eMTC and NB-IoT,It supports the MQTT connection to various IoT cloud platforms, such as Amazon AWS IoT, Microsoft Azure IoT and generic MQTT servers.

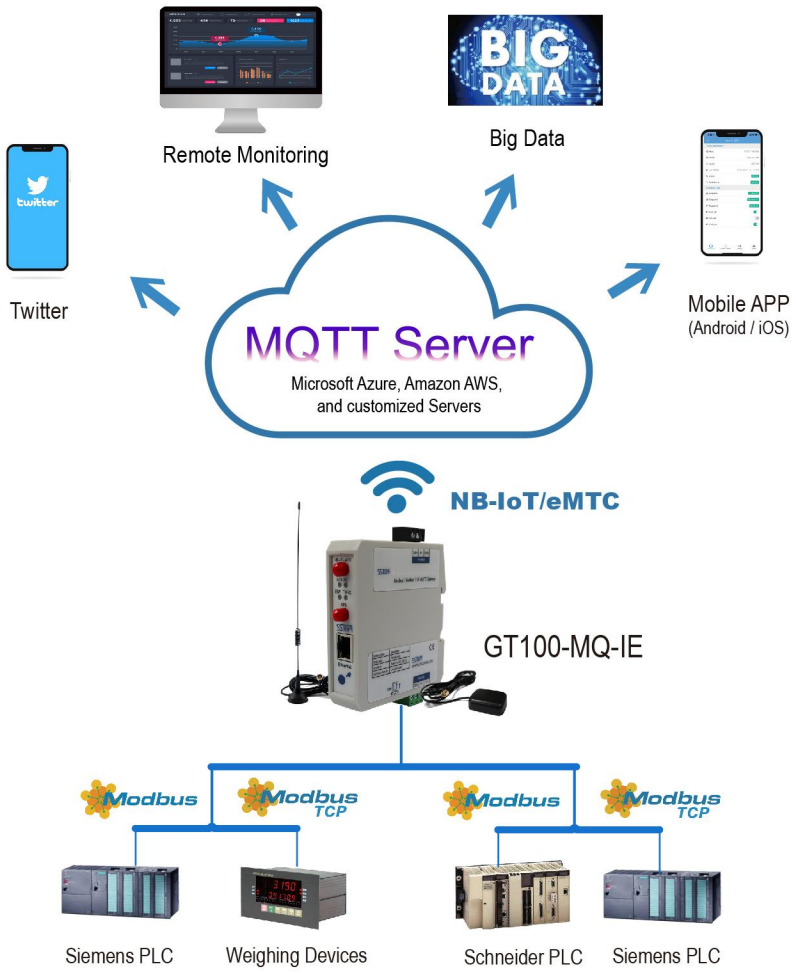
Note:The authentication method to connect to AWS or Azure, you need to use a security certificate.

GT100-MQ-IE integrates two firmware modes, which can be switched by downloading the BIN file of the corresponding mode. For details, please refer to Appendix B.

The following table shows the specific functions corresponding to the two modes:

Firmware Mode	Description
A: Modbus TCP Client / Modbus Master	Modbus TCP Client, Modbus RTU/ASCII Master
B: Modbus TCP Server/ Modbus Master-Slave	Modbus TCP Server, Modbus RTU/ASCII Master/Slave

The GT100-MQ-IE is wildly used in unmanned industrial spots such as water quality monitor stations, environmental monitor stations, intelligent building systems, intelligent agriculture systems, and energy and electricity systems that require remote monitoring.



Modbus RTU/ASCII and Modbus TCP devices to the IoT Cloud by MQTT

1.2 Product Feature

- One RS485 Interface - Modbus Master/Slave
  - As Modbus Master: Connects field devices to the IoT Cloud Platform, implementing data acquisition and device control via eMTC / NB-IoT network.
  - As Modbus Slave: Integrates PLC, DCS and other Modbus master station with the IoT Cloud Platform via eMTC / NB-IoT network.
- One Ethernet Interface - Modbus TCP Client/Server

- ✧ As Modbus TCP Client: Connects Modbus TCP Server devices, such as intelligent instruments.
- ✧ As Modbus TCP Server: Connects Modbus TCP Client devices, such as SCADA systems.

- ➢ Supports GPS.
- ➢ eMTC / NB-IoT network is always online. Supports connection detect and auto reconnect functions.
- ➢ Supports MQTT broker URL connection.
- ➢ TLS V1.2 and DTLS 1.0/1.2. Supports custom Client ID.
- ➢ Supports MQTT version 3.1.1. Uses JSON format to upload data to the cloud platform, users can customize the JSON content format.
- ➢ QoS 0 and 1 supported.
- ➢ Supports two publish mode:
  - ① Publish when data changes.
  - ② Publish periodically at custom cycle time, which can reduce the data traffic.
- ➢ Supports two Message Types: Register message or Property message.
- ➢ Real-time device status monitoring on the IoT Cloud Platform.
- ➢ eMTC / NB-IoT network quality detection and display.
- ➢ Applies to industrial field with high reliability. Supports real-time monitoring and automatic reset.

1.3 Technical Specifications

[1] eMTC / NB-IoT network

- ◆ Supported standard:
  - CAT-M(eMTC): B1/B2/B3/B4/B5/B8/B12/B13/B14/B18/B19/B20/B25/B26/B27/B28/B66/B85
  - CAT-NB(NB-IoT): B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B28/B66/B71/B85

  Note: APN (Access point name) identifies the mobile network type. The APN is automatically obtained by default. Users can configure the APN if they have special requirements.
- ◆ Transmission speed:
  - CAT-M: Uplink: 1119Kbps; Downlink:589Kbps
  - CAT-NB: Uplink: 150Kdps; Downlink:136Kdps

[2] One serial interface

- Physical standard: RS485.
- Parity: Odd, Even, None, Mark, Space.
- Stop bits: 1 or 2.
- Baud rate: 600~115200 bps.
- Protocol: Modbus RTU/ASCII Master/Slave.
- Modbus Function codes: 01, 02, 03, 04, 05, 06, 15, 16.
- Interface type: 3.81 mm 3-pin port.
- Galvanic isolation: 1kV photoelectric isolation.

[3] One Ethernet interface

- Physical standard: RJ45, full-duplex / half-duplex.
- Speed: 10/100 Mbps, auto-detected.
- Protocol: Modbus TCP Client/Server (supports Function codes: 01, 02, 03, 04, 05, 06, 15, 16).
- Supports DHCP and Manual Assign.

[4] 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)

- Modbus TCP:

  Input bytes ≤ 512 bytes

  Output bytes ≤ 512 bytes

  Maximum connections: 4 Clients or 4 Servers

  Maximum commands: 100 commands (as Modbus TCP Client)

- Maximum properties:

  The maximum total number of all the properties that can be configured on the configuration software: 1000 properties.

[5] Power: 24 VDC (11~30 VDC)

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

[7] Dimensions: 1.0 in * 4.0 in * 3.6 in (25 mm * 100 mm * 90 mm).

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

[9] Protection level: IP20.

1.4 Related Products

The related products include: GT200-MQ-IE etc.

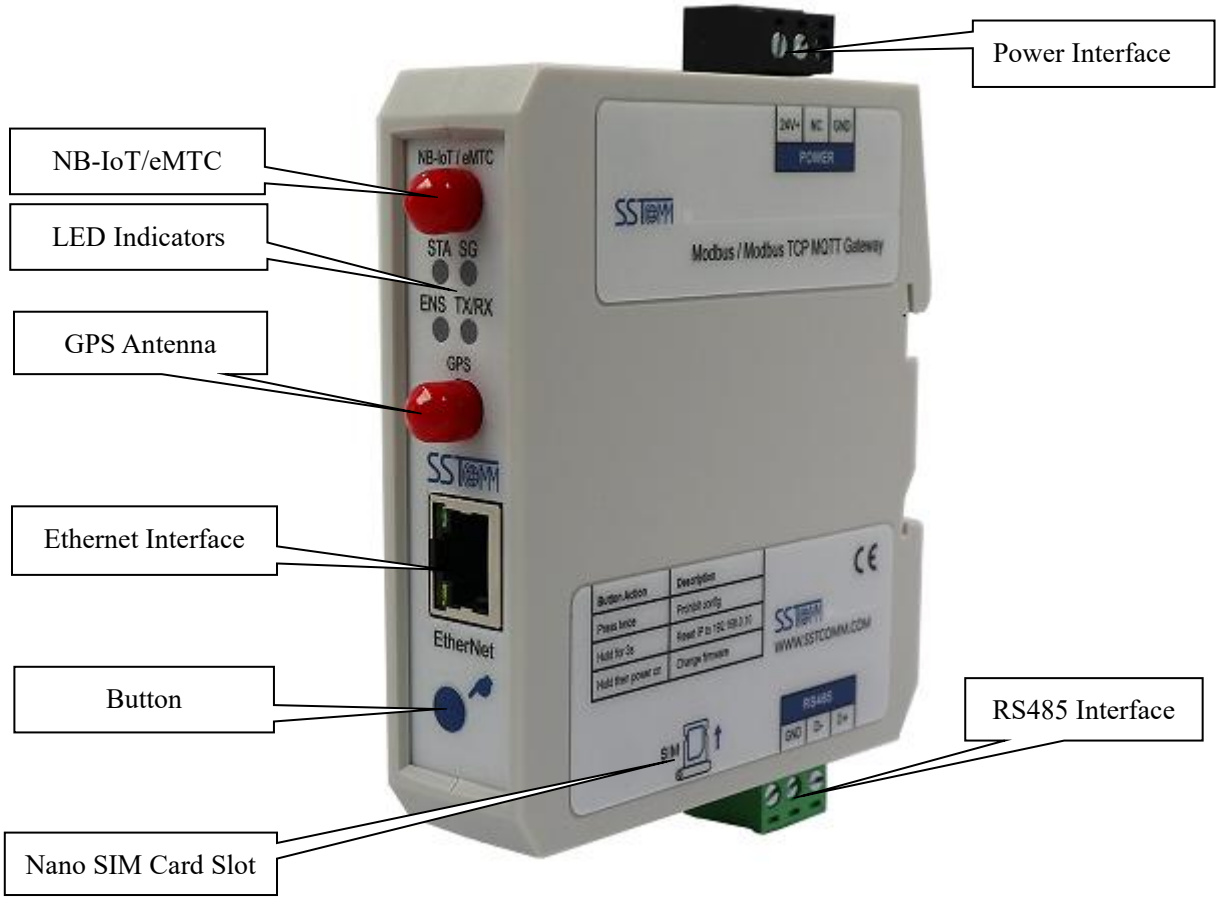
To get more information about related products, please visit SSTCOMM website: www.sstautomation.com.

1.5 Revision History

Revision	Date	Chapter	Description
V3.0, REV A	12/24/2021	ALL	New release

2 Hardware Descriptions

2.1 Product Appearance



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

2.2 LED Indicators

Indicator	State	State description
STA	OFF	The wireless module is not started.
	Green, slow blinking (200 ms ON / 1800 ms OFF)	The gateway is searching available network.
	Green, slow blinking (1800 ms ON / 200 ms OFF)	The wireless module is in standby.
	Green, quick blinking (125 ms ON /125 ms OFF)	Data transmission via wireless module.
SG	Green,OFF	The SIM card is invalid.
	Green, ON	The connection is being established or could not be established.
	Green, slow blinking (1000 ms ON / 1000 ms OFF)	Poor signal
	Green, blinking (500 ms ON / 500 ms OFF)	Weak signal
	Green, quick blinking (200 ms ON / 200 ms OFF)	Strong signal
TX/RX	Green, blinking / OFF	The RS485 interface receives/receives no data.
	Red,blinking / OFF	The RS485 interface Sends / Sends no data.
ENS	Green, slow blinking	No Modbus TCP connection.
	Green, quick blinking	Fixed IP Address: 192.168.0.10
	Red, blinking	Locating the gateway / Disconnect after successful TCP connection.
	Green,ON	Modbus TCP connections.

2.3 Configuration Button

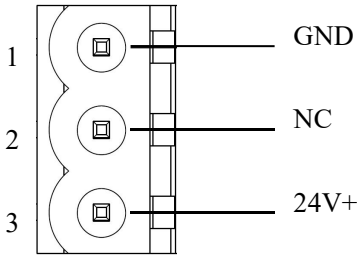
The function and operation instructions of the buttons are as follows:

Button action	Function Description
Long press for 3 seconds	The IP address is set to 192.168.0.10 and the ENS is blinking green quickly. Press the button again to set back to normal status. (This function can be used if you do not know the IP address of the gateway or cannot search the gateway using the configuration software.)
Double press	Uploading/downloading configuration is disabled. The GT100-MQ-IE can be searched but can't be configured. Press the button again to set back to normal status. (This function can be used to prevent this gateway from being modified by others. For example, when there are multiple GT100-MQ-IEs in the LAN, misoperation is likely to occur.)
Press and then power on	This function is used to modify the mode of the gateway to adapt to support different Modbus protocol content. Please refer to Appendix B for specific operation steps.

2.4 Interface

2.4.1 Power Interface

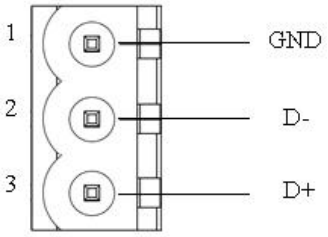
Pin	Function
1	Power ground
2	Not connected
3	24V+, DC



2.4.2 RS485 Serial Interface

The GT100-MQ-IE has a RS485 serial interface. The interface is a 3-pin port and the wiring is as follows:

Pin	Function
1	GND
2	D-
3	D+



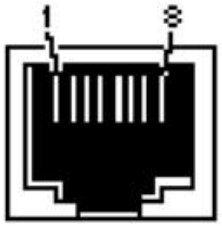
RS485 Specification:

1. Network topology: Linear bus with active terminal resistors at both sides. If the communication quality is unstable, it can be considered to add terminal resistor (120Ω, 1/2W) at both ends.
2. Physical Media: Shielded twisted-pair cable that also can cancel the shielding, depending on environmental conditions (EMC).
3. Station number: 31 stations per section (without repeater), and up to 127 stations in total (with repeaters).

2.4.3 Ethernet Interface

The Ethernet interface is a RJ45 socket.

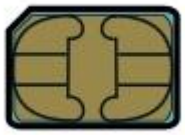
Pin	Signal description
S1	TXD+
S2	TXD-
S3	RXD+
S4	-
S5	-
S6	RXD-
S7	-
S8	-



RJ-45 port

2.4.4 Nano SIM Card Slot

Please use NB card (for CAT-NB network) or eMTC card (for CAT-M network).



Format: Nano-SIM (4FF)

Length * Width: 12.3mm * 8.8 mm (0.48 in * 0.35 in)

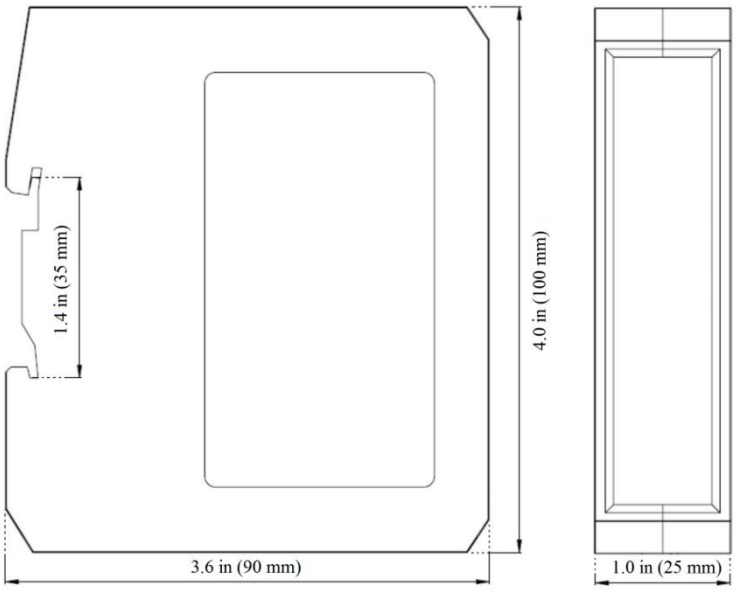
Thickness: 0.67 mm (0.026 in)

3 Hardware Installation

3.1 Machine Dimension

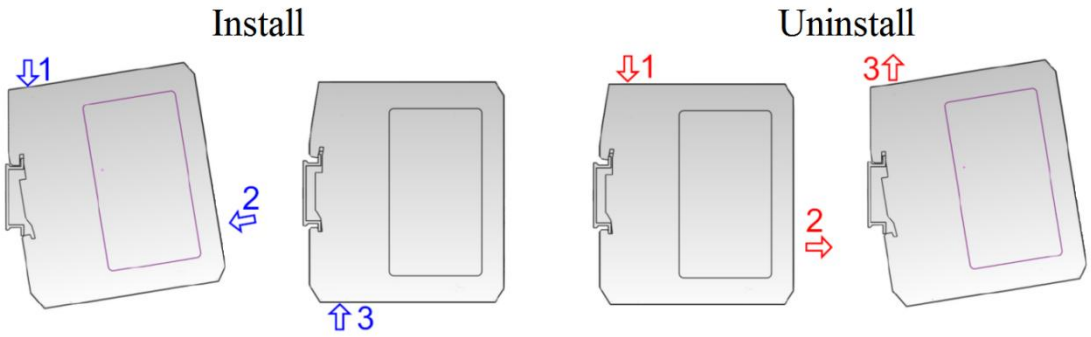
Size (width * height * depth):

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



3.2 Installation Method

Using 1.4 in (35mm) DIN RAIL.

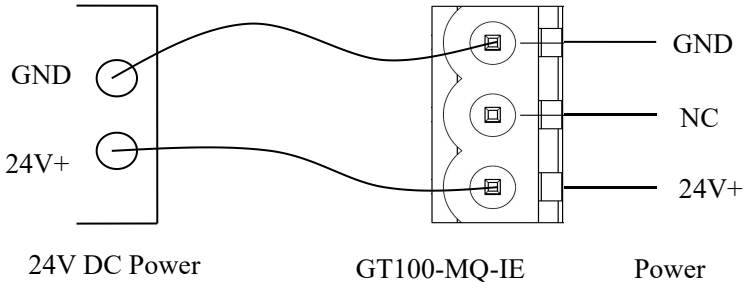


4 Quick Start Guide

4.1 Connection

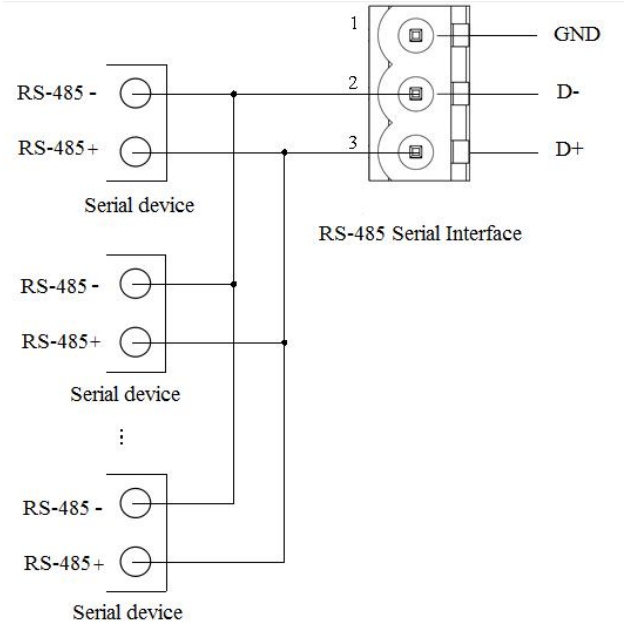
1. Insert the Nano SIM card into the slot behind the GT100-MQ-IE correctly.
2. Connect NB-IoT /eMTC network antenna (long straight antenna) and GPS antenna (square head antenna).
3. Connect the power supply as follows.

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



4. Connect the serial devices.

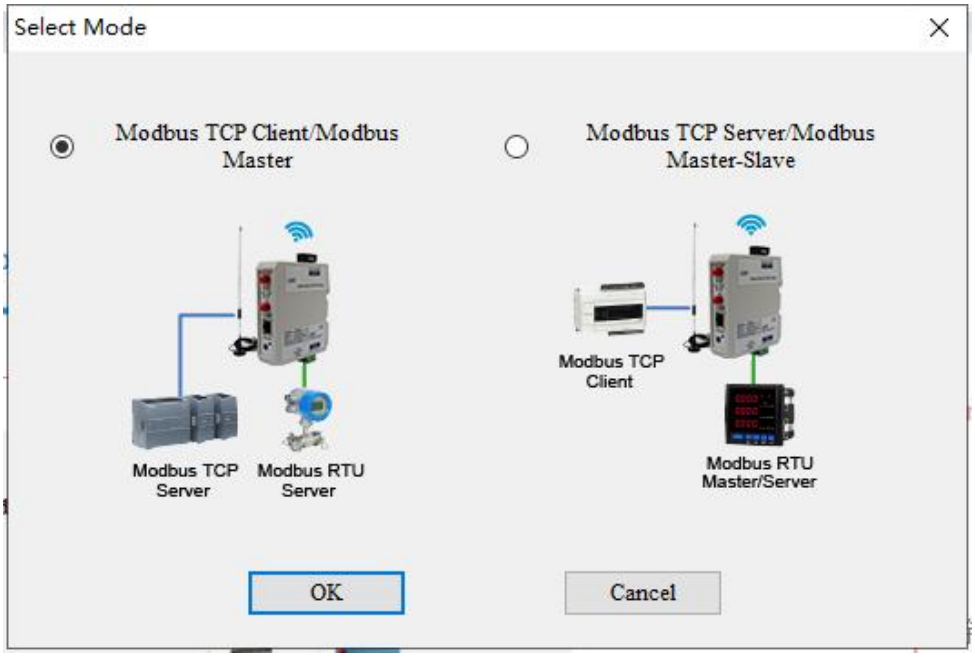
   Note: The GT100-MQ-IE doesn't have the terminal resistor in the RS485 serial interface. When connecting multiple RS485 serial devices, it's recommended to connect a terminal resistor (120Ω, 1/2W) in parallel at both ends of the communication lines to ensure stable communication.



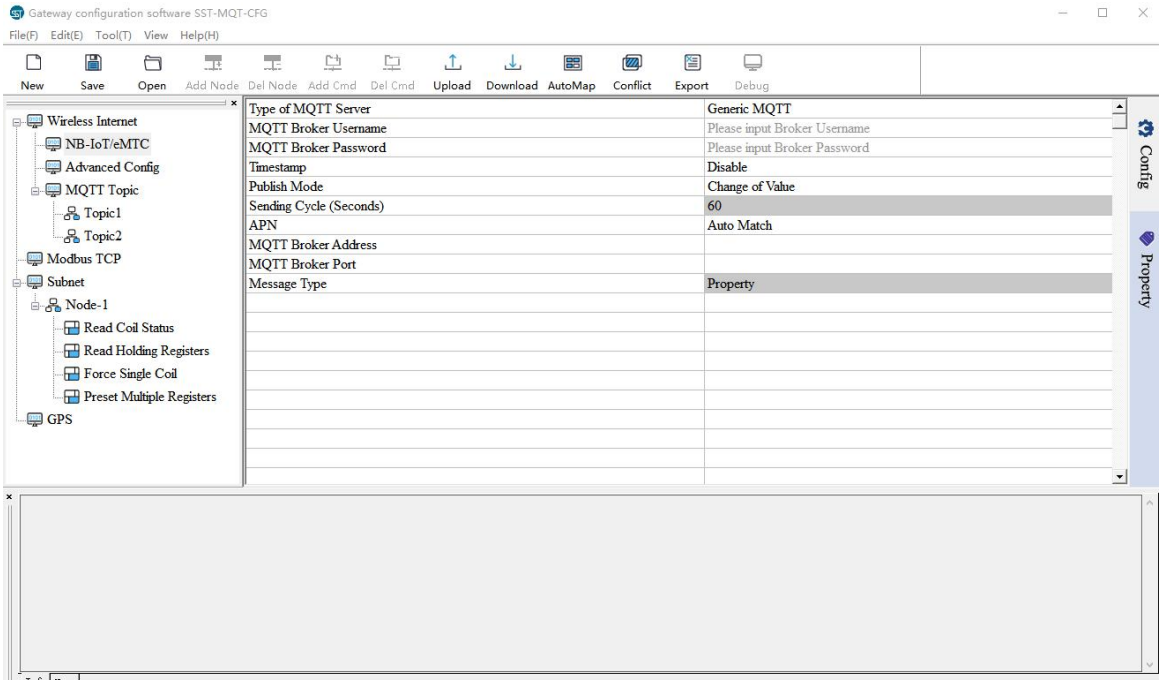
5. Connect the Modbus TCP clients/servers via Ethernet cable.
6. Connect the GT100-MQ-IE with the PC via Ethernet cable.(Use when configuring)
7. Power on the GT100-MQ-IE.

4.2 Configuration

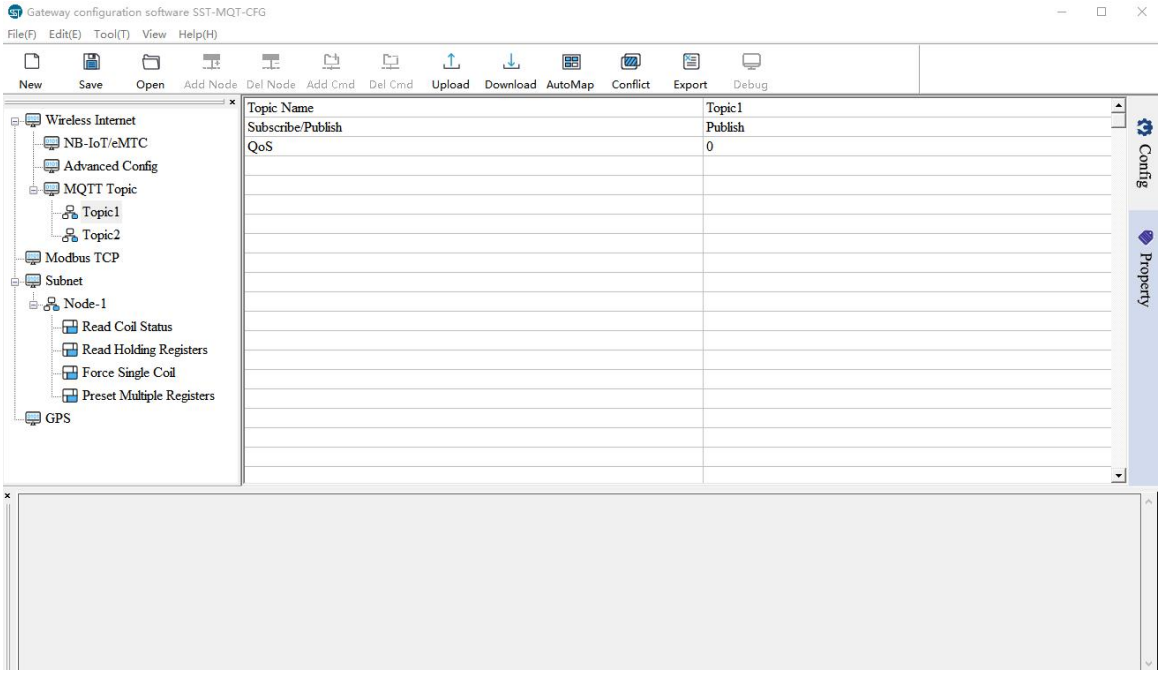
1. Download the configuration software SST-MQT-CFG from https://www.sstautomation.com/Download1/ and install it. Open the software and select the GT100-MQ-IE, then confirm the gateway mode.



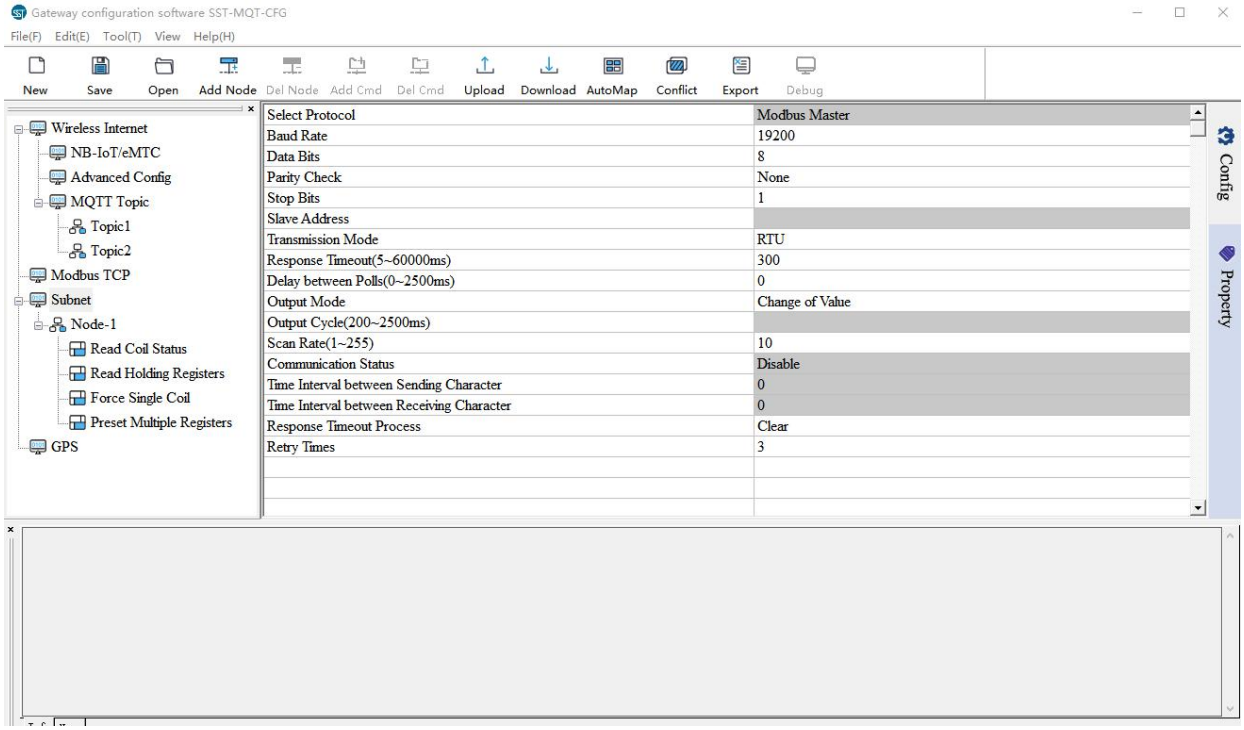
2. Configure the Wireless Internet (MQTT Server configuration).



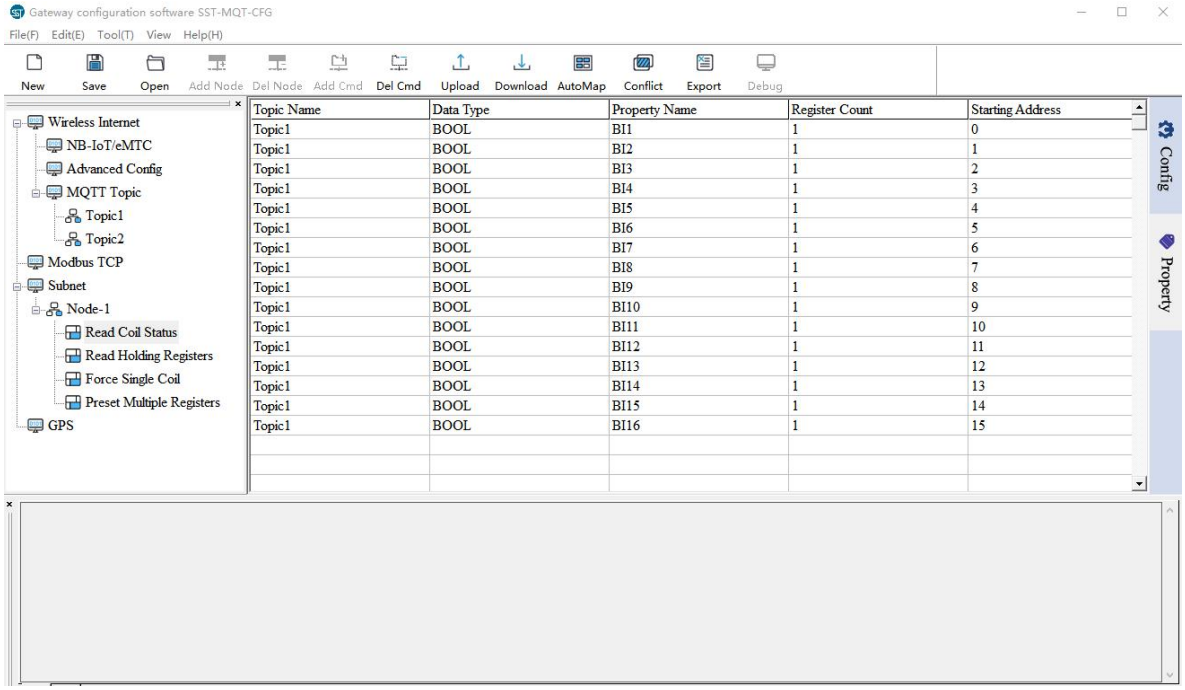
3. Add or edit MQTT Topic.



4. Configure the Modbus TCP and Subnet Interface parameters.



5. Configure the properties.



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-IE through network cable configuration.

Notes:

① Make sure that the GT100-MQ-IE 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 the Assign IP mode is DHCP, and there is no DHCP Server or you can't search the GT100-MQ-IE. Please power on, then press and hold the button for 3 seconds. At this time, the IP address is restored to 192.168.0.10, and 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-IE.

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

The software is based on Windows OS.

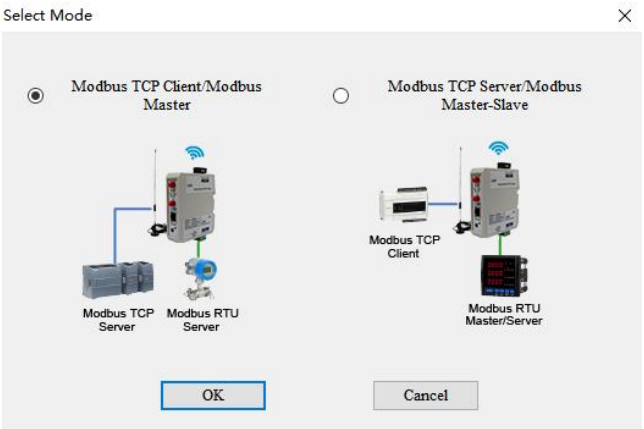
Operating System: Win7, Win10.

5.1 Software Interface Description

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

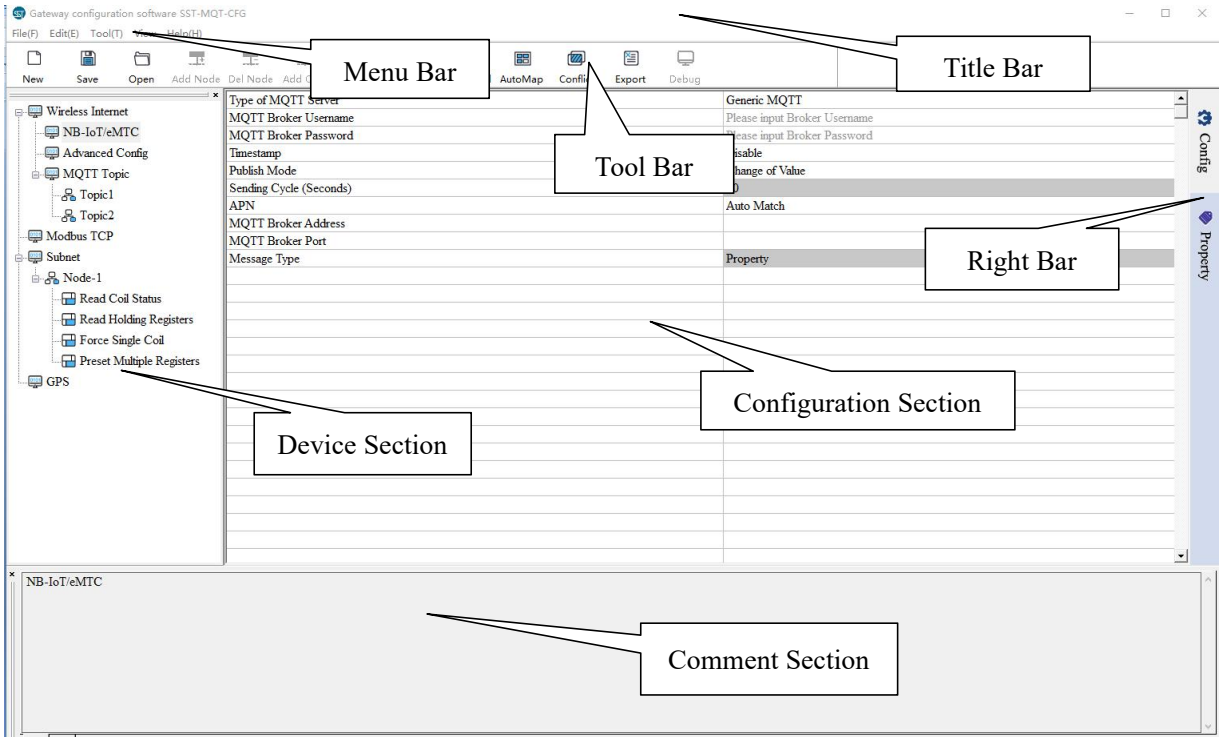
Select “GT100-MQ-IE” and click OK, then select the mode:

Note: Please select Mode according to the actual Firmware type in GT100-MQ-IE. The default factory firmware mode is “A: Modbus TCP Client / Modbus Master”. If you want to change the firmware model of the gateway, please refer to Appendix B.



Select the appropriate mode and click OK. For example, select “Modbus TCP Client/Modbus Master” mode then click OK to enter the corresponding configuration interface.

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



Toolbar:

The function from left to right is: New, Save, Open, AddNode, DelNode, AddCmd, DelCmd, Upload, Download, AutoMap,Conflict, Export and Debug.

New: Create a new configuration project.

Save: Save the current configuration.

Open: Open a configuration project.

Add Node: Add a Modbus node.

Delete Node: Delete a Modbus node.

Add Command: Add a Modbus command.

Delete Command: Delete a Modbus command.

Upload: Upload the configuration from the gateway.

Download: Download the configuration to the gateway.

Auto Map: Automatically calculate the mapped data address of each command.

Conflict Detection: Check whether the configured commands' mapped data addresses conflict with others in the gateway data buffer.

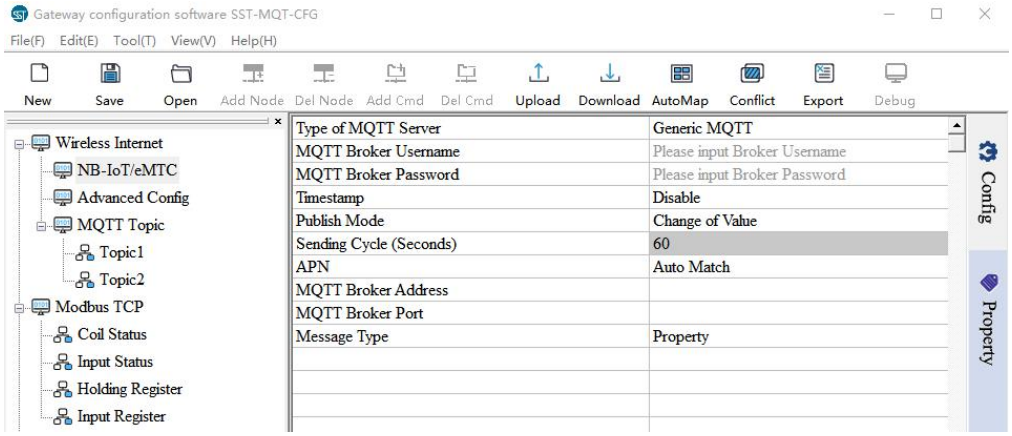
Export Excel: Export current configuration as a table and save it as *.xls file.

Debug: Not currently supported.

5.2 Wireless Internet

5.2.1 NB-IoT/eMTC

Select the "NB-IoT/eMTC" in the left tree view and enter the NB-IoT/eMTC configuration window.



Type of MQTT Server: Support Generic MQTT.

MQTT Broker Username: The username is used for authentication on the MQTT broker, please refer to the corresponding MQTT server guide.

MQTT Broker Password: The password is used for authentication on the MQTT broker, please refer to the

corresponding MQTT server guide.

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

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".

APN: Supports Auto Match and Customize. The APN (Access Point Name) is used to identify the mobile network type. Please ask the network operator for details.

MQTT Broker Address: The URL or IP Address to connect with the MQTT broker. Please refer to the guide of corresponding MQTT Server.

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

Message Type: Register and Property type are optional.

Register: The data is directly transmitted in the following message:

```
{
   "version":      "1.1.1.0",
   "type":          "MODBUS_TCP_SLAVE",
   "block":           1,
   " addr ":          3,
   "npoint":          2,
   "data":             "18",
   "time":           "18/12/27,16:23:35"
}
```

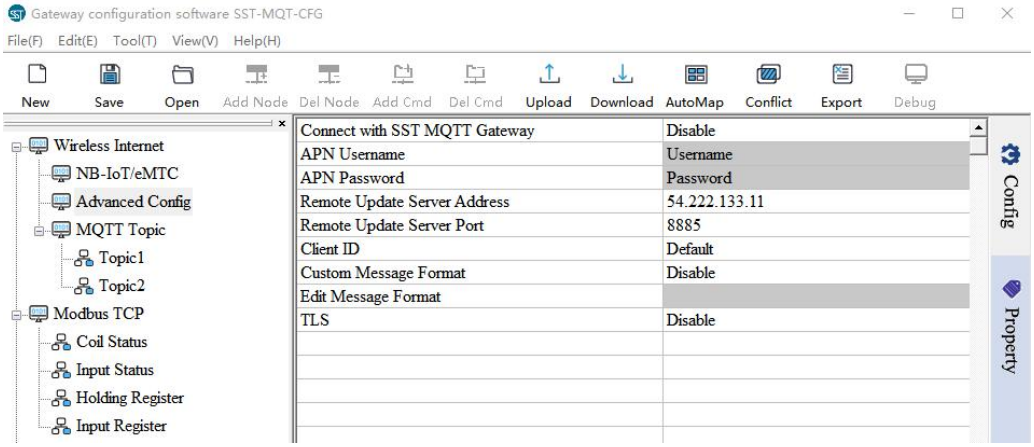
Property: The data is transmitted with the properties in the following message:

```
{
   "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

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



Connect with SST MQTT Gateway: If enable, the GT100-MQ-IE 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.

APN Username: It is provided by the network operator and used for authentication. It can be modified only when “APN” is configured as “Customize”.

APN Password: It is provided by the network operator and used for authentication. It can be modified only when “APN” is configured as “Customize”.

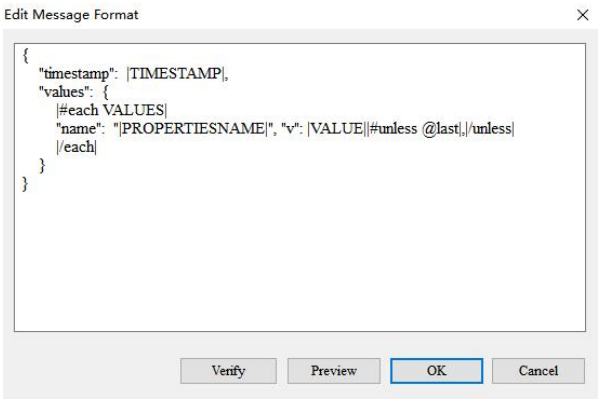
Remote Update Server Address: The default remote update service IP Address is 54.222.133.11. The gateway can be updated remotely by SST Automation. Please do not change this IP address.

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 disable, the message format is set by "Edit Message Format".

Edit Message Format:



For example:

{

"timestamp": |TIMESTAMP|,

"values": {

|#each VALUES|

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

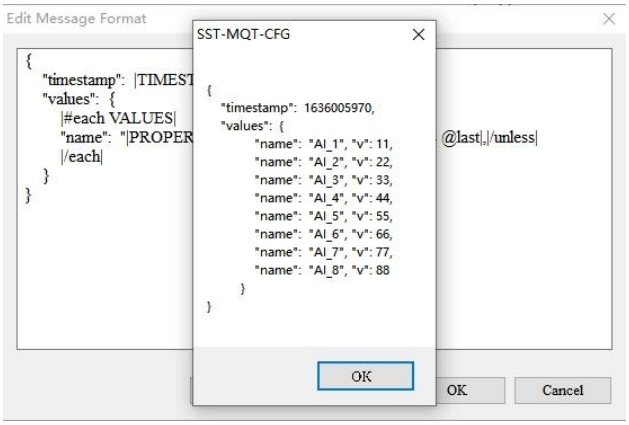
|/each|

}

}

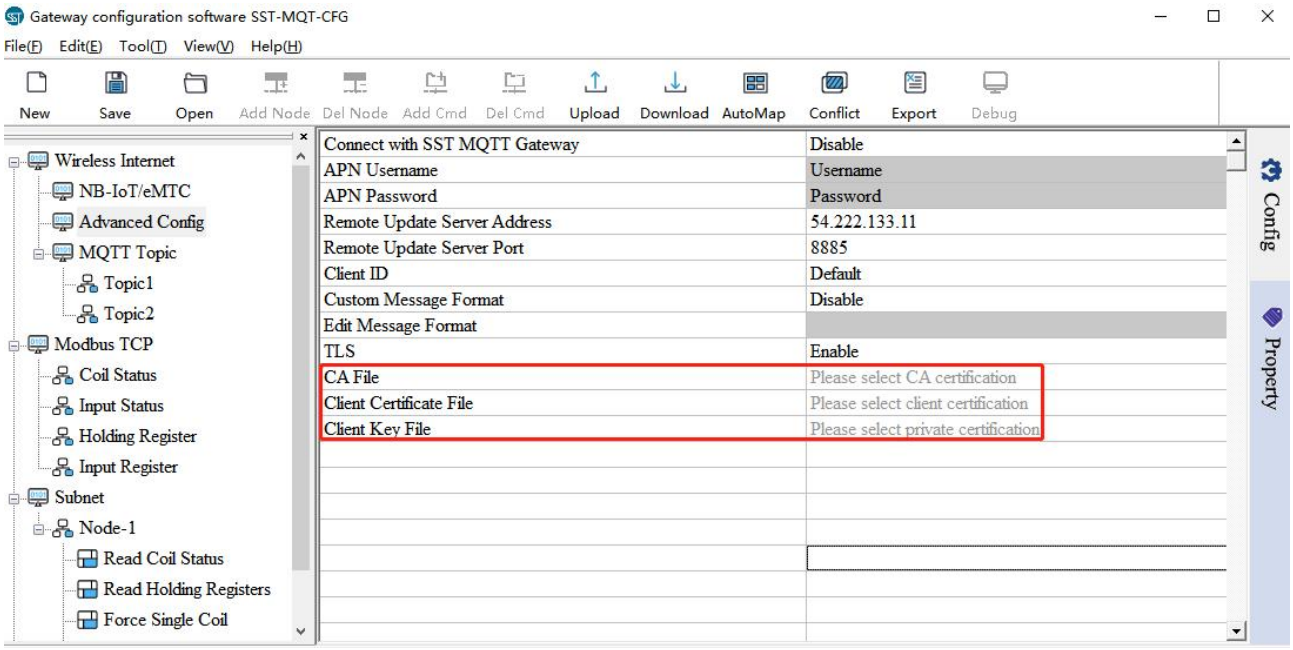
|PROPERTIESNAME| is the property name, |VALUE| is the value of the tag, and |TIMESTAMP| is the time to read the tag. Please see "Custom Message Format"chapter for details.

Click "Verify" to verify the JSON format. Click "Preview" to see message preview.



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

AWS IoT or Azure IoT configuration: Only displayed when “TLS” is set to “Enable”,Take AWS as an example:



CA File: The CA certificate is provided by AWS. Please refer to AWS IoT Core Developer Guide.

Client Certificate File: The client certificate is provided by AWS IoT Core.

Client Key File: The private key is provided by AWS IoT Core.

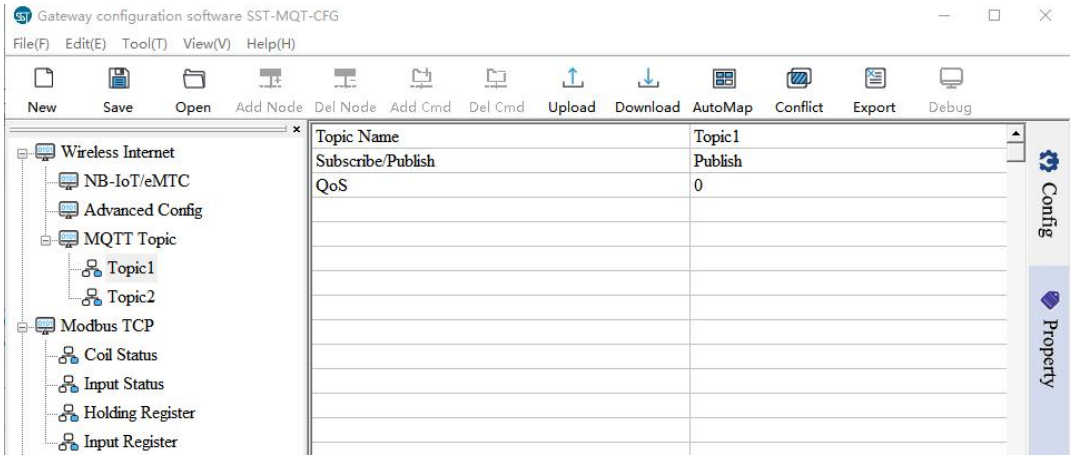
5.2.3 MQTT Topic

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

“Delect 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 Chapter5.7.



Topic Name: Topic name can consist of character, number, “_” , “ / ” , “ - ” and “ $ ” . The length should be less than 128 bytes. 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.

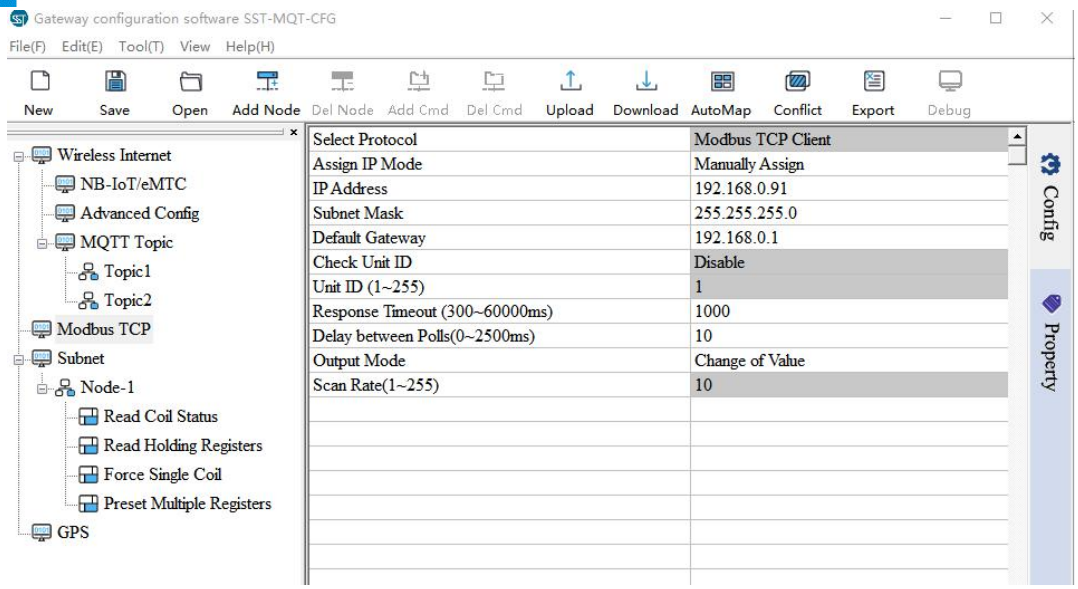
QoS 1: There will be an ACK to ensure that the Client or Server received the data. Data will be sent until successfully received or sent 3 times.

5.3 Modbus TCP Client / Server Configuration

5.3.1 Modbus TCP Client Configuration

Double click on the SST-MQT-CFG icon ->GT100-MQ-IE ->Select Mode：Modbus TCP Client / Modbus Master:

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



Select Protocol: Modbus TCP Client. At this time, the gateway acts as a Modbus TCP client to connect to the Modbus TCP Server device.

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

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

Whether you use this protocol or not, please assign an IP address to the gateway. Because the configuration software searches the gateway through the IP address for uploading/downloading configuration.

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

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

Response Timeout: Time to wait for response from Modbus TCP server after client sends a command. Range: 300ms~60000ms. The default value is 1000ms.

Delay between Polls: Delay time between the last response (or response timesout) and the new command. The actual delay time is the multiples of 10. Range: 0~2500 ms. 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.

Output Mode: Three output modes: Cyclic, Forbidden, Change of Value.

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.

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. The range is 1 to 255.

1. Node

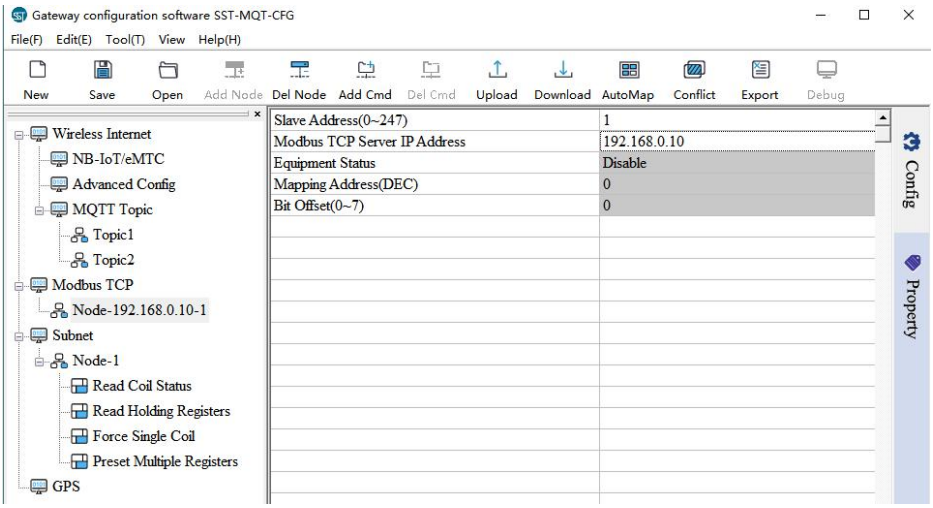
(1) Add node: Select the "Modbus TCP" and add a new node. A new node named "Node-X" will be added under the Subnet. The maximum number of nodes is 4.

(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.

Select a node to enter the Modbus TCP client's node configuration window:



Slave Address: Modbus Slave address. The range is 0 to 247. For a Modbus TCP server, it's the Unit ID.

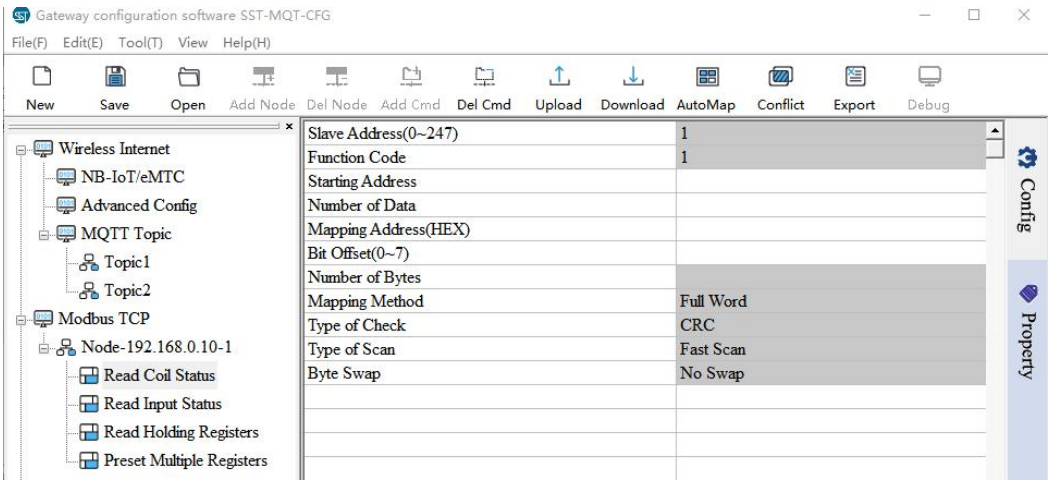
Modbus TCP Server IP address: When accessing the Modbus TCP Server at the same IP address, the slave address cannot be the same.

Equipment Status: Unused.

Mapping Address: Unused.

Bit Offset: Unused.

2. Modbus Command

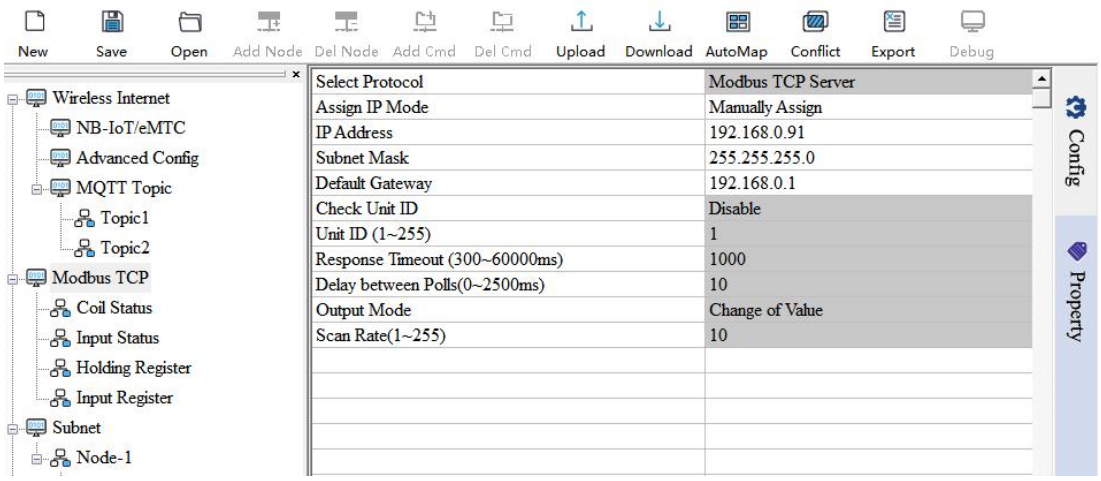


For the setting description of Modbus command, please refer to the “Modbus Command” section in the Chapter5.4.1.

For the setting description of Property, please refer to Chapter5.7.

5.3.2 Modbus TCP Server Configuration

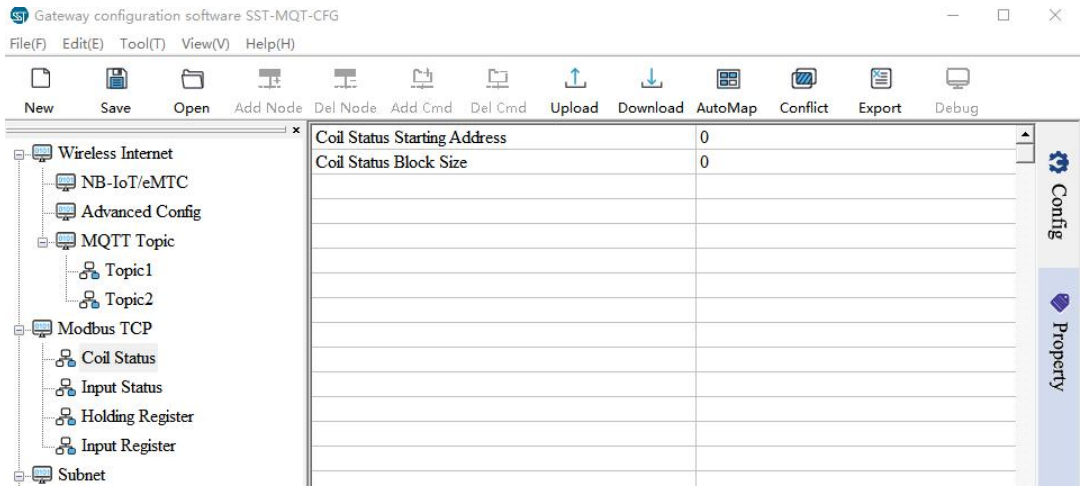
Double click on the SST-MQT-CFG icon ->GT100-MQ-IE ->Select Mode： Modbus TCP Server / Modbus Master-Slave:



Select Protocol: Modbus TCP Server. At this time, the gateway acts as a Modbus TCP server to connect to the Modbus TCP Client device.

For descriptions of other parameters, see Chapter 5.3.1.

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

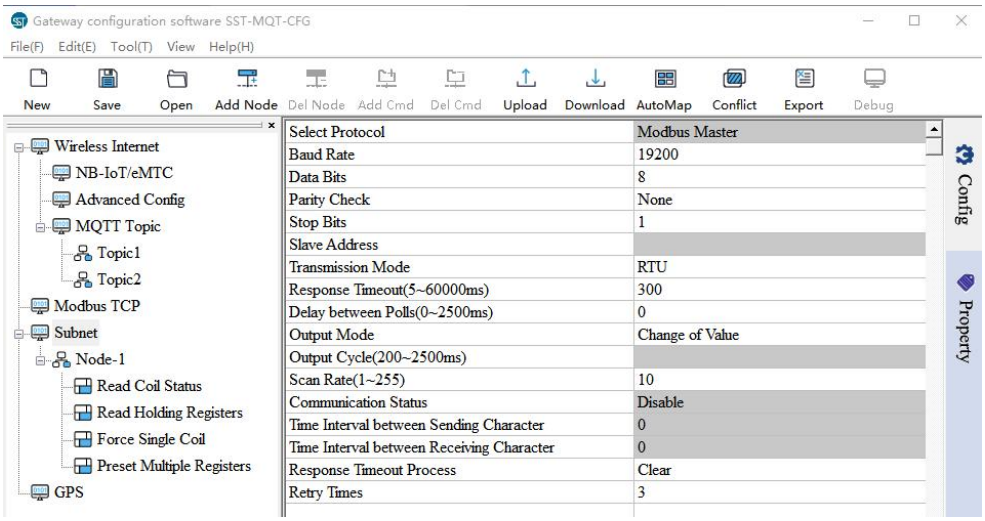


For the setting description of Status/Register block, please refer to Chapter5.4.2.

For the setting description of Property, please refer to Chapter5.7.

5.4 Subnet Configuration

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



Select Protocol: The current protocol.

Baud Rate: Baud Rate of the serial interface. Supports 600, 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 the multiples of 10. 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

When the running mode is “Modbus TCP Server / Modbus Master-Slave” or “Modbus TCP Client / Modbus Master”, the GT100-MQ-IE enables the Modbus RTU/ASCII master interface.

Refer to Chapter 5.4 for parameter description on Modbus Master interface.

1. Node

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

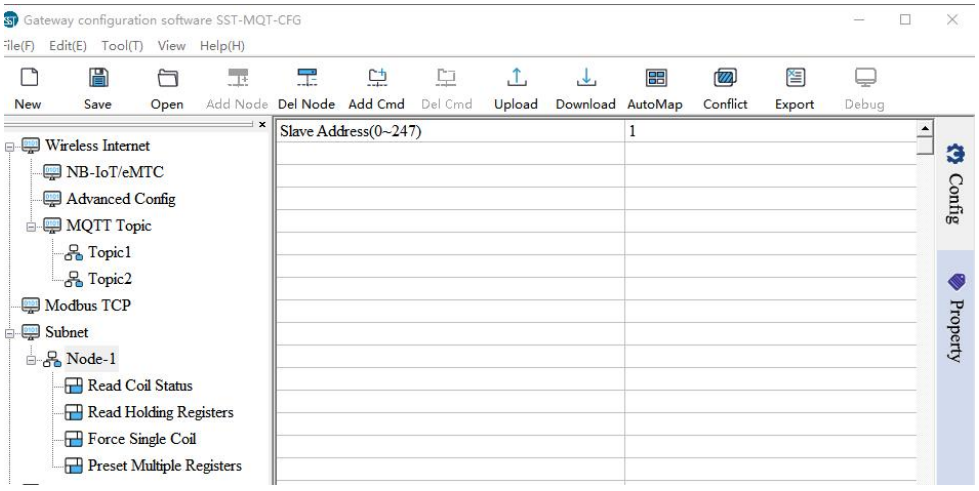
(1) Add node: Select the “Subnet” and add a new node. A new node named “Node-X” will be added under the Subnet. The maximum number of nodes is 100.

(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:



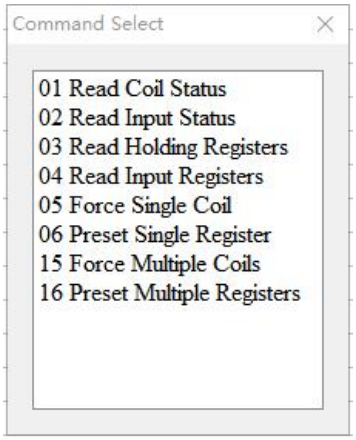
2. Modbus Command

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.

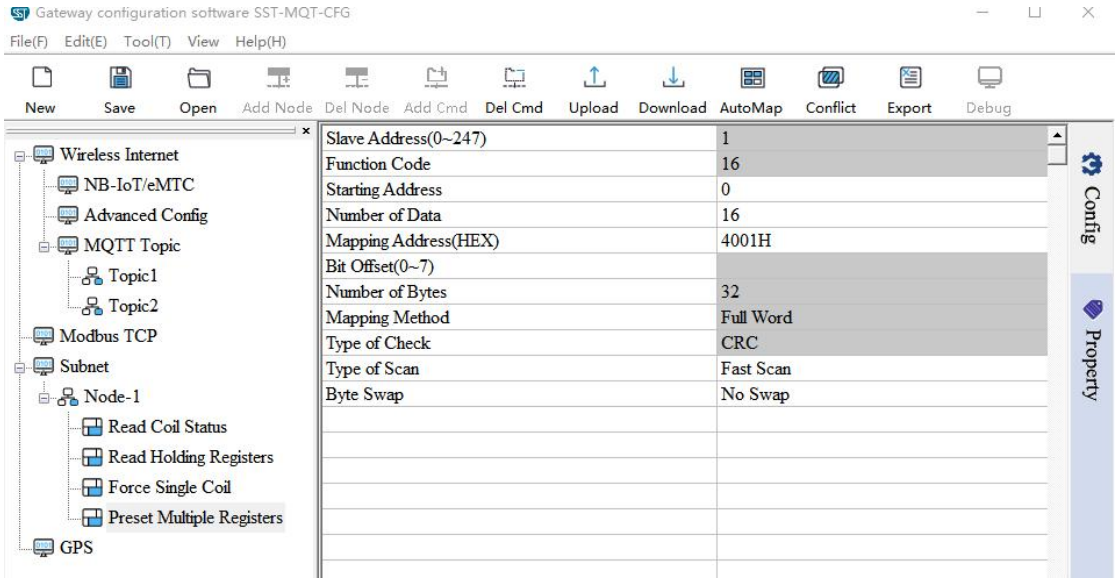
(2) Delete command: Select a command and then delete it.

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



The command interface is displayed as follows:

Note: For the setting description of Property, please refer to Chapter5.7.

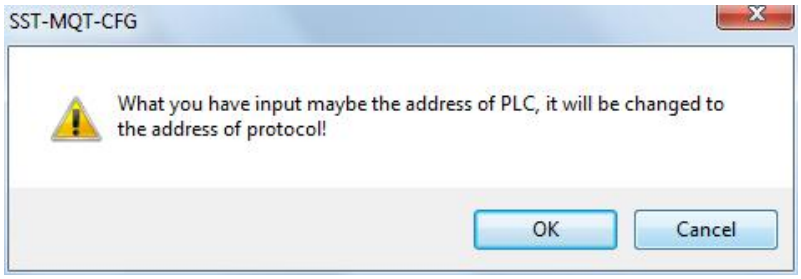


Slave Address: Modbus Slave address.

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.



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.

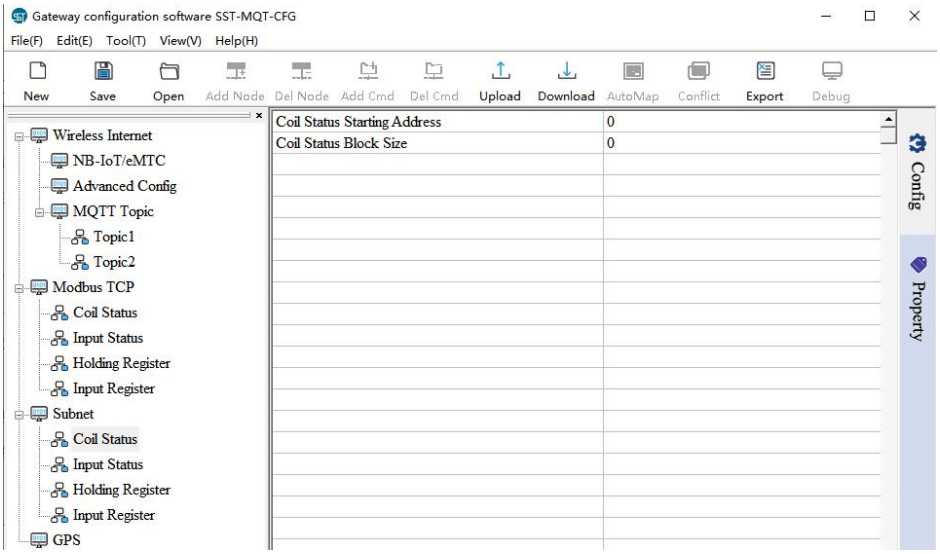
Four Bytes Swap: The first two bytes are exchanged with the last two bytes, e.g. 0x12345678 to 0x78563412.

5.4.2 Modbus Slave Interface Configuration

When the running mode is “Modbus TCP Server / Modbus Master-Slave”, the GT100-MQ-IE enables the Modbus RTU/ASCII slave interface.

Refer to Chapter 5.4 for parameter description on Modbus Slave interface.

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



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.

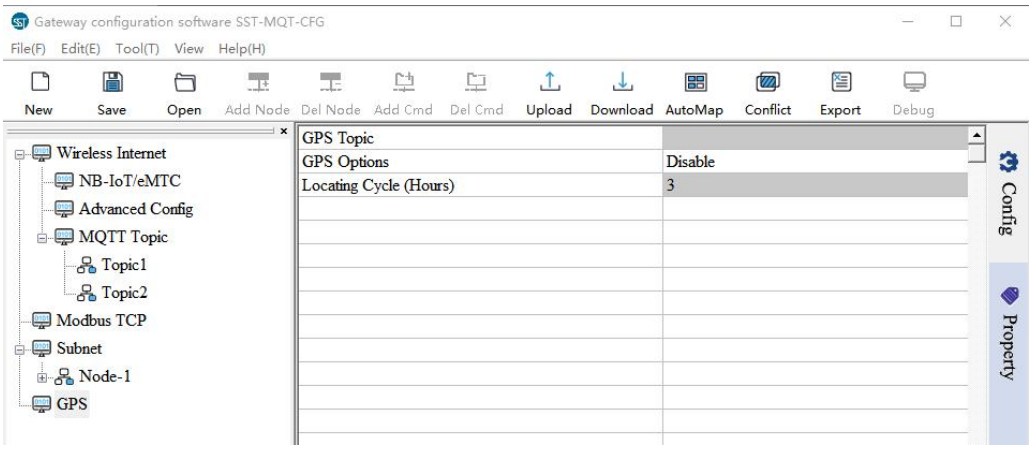
Holding/Input Register Starting Address: The start address of the 4/3XXXX area. The range is 0~65535, and the default is 0.

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 Chapter5.7.

5.5 GPS

Select the “GPS” in the left tree view to enter the GPS configuration window.



GPS Topic: Only “Publish” topic can be selected.

GPS Options: Two options: Disable, Cyclic.

This function is influenced by network quality. The data transmission may be slowed down when locating the device. It suggests to locate the device once at boot or set a large locating cycle.

Locating Cycle (Hours): The cycle time when locating the device. It’s valid when the GPS Location Mode is “Cyclic”. Range: 1~1000h. The default value is 3h.

Note: The GPS positioning data sent by the device is WGS-84 coordinate system data.

5.6 Tool

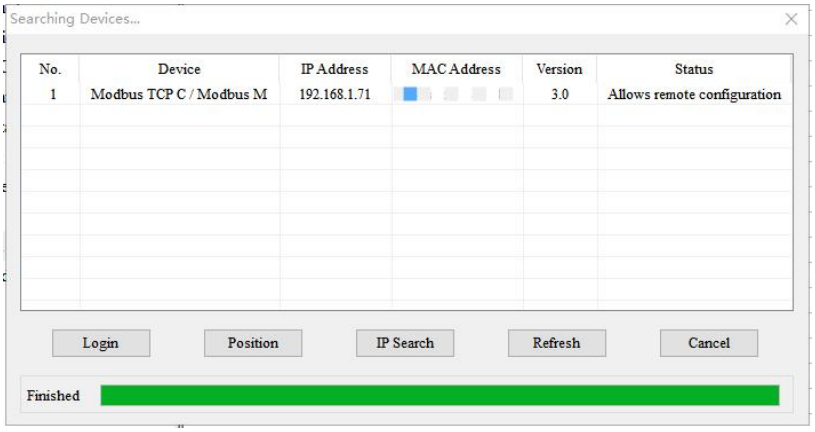
The “Tool” option on the menu bar contains the following functions:

- Upload Config
- Download Config
- Confilict Detection
- Export Excel
- AutoMap
- Traffic Forecast
- Remote Update Server File

5.6.1 Upload Config and Download Config

1. Search Device

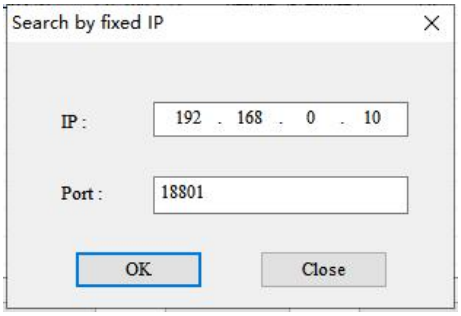
Click “Upload” or “Download” to open the search window. It will automatically search the available devices once after opening the search window.



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.



Refresh: Search the device again.

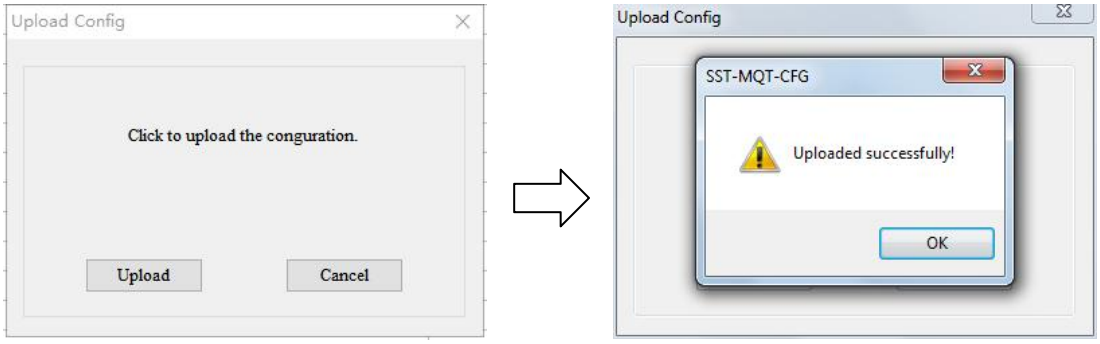
Cancel: Close the search window.

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.

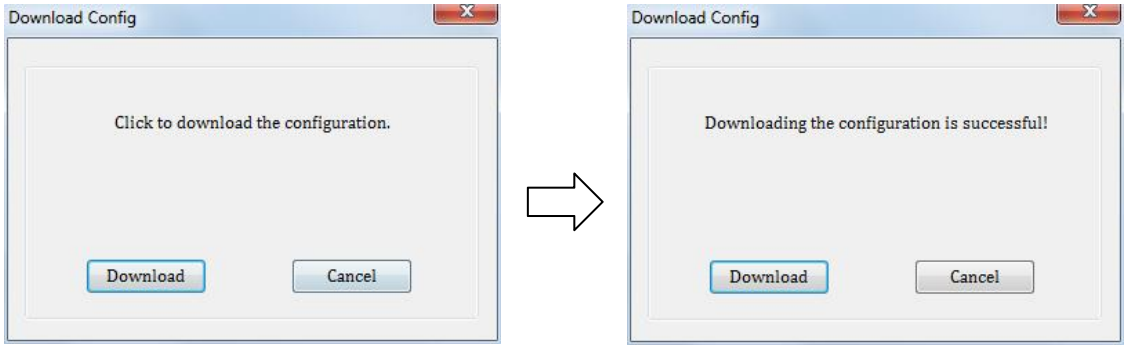
When uploading the configuration from the gateway to the software, the pop-up window is as below:



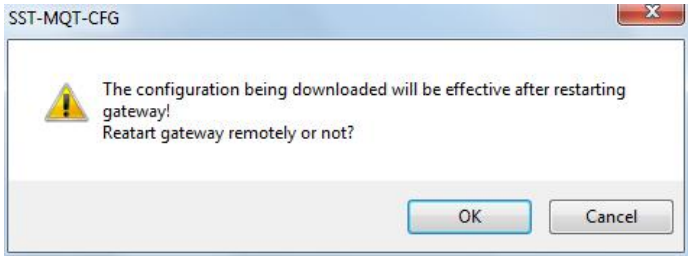
3. Download

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

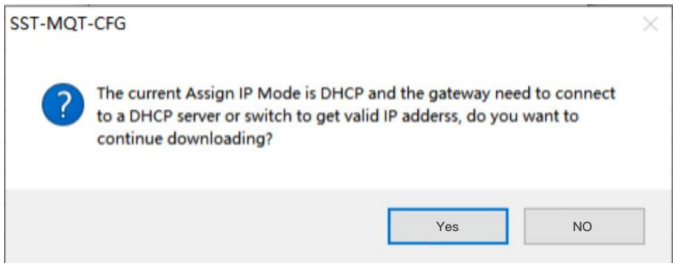
When downloading the configuration to the gateway, the pop-up window is as below:



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.



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



5.6.2 AutoMap

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

5.6.3 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.

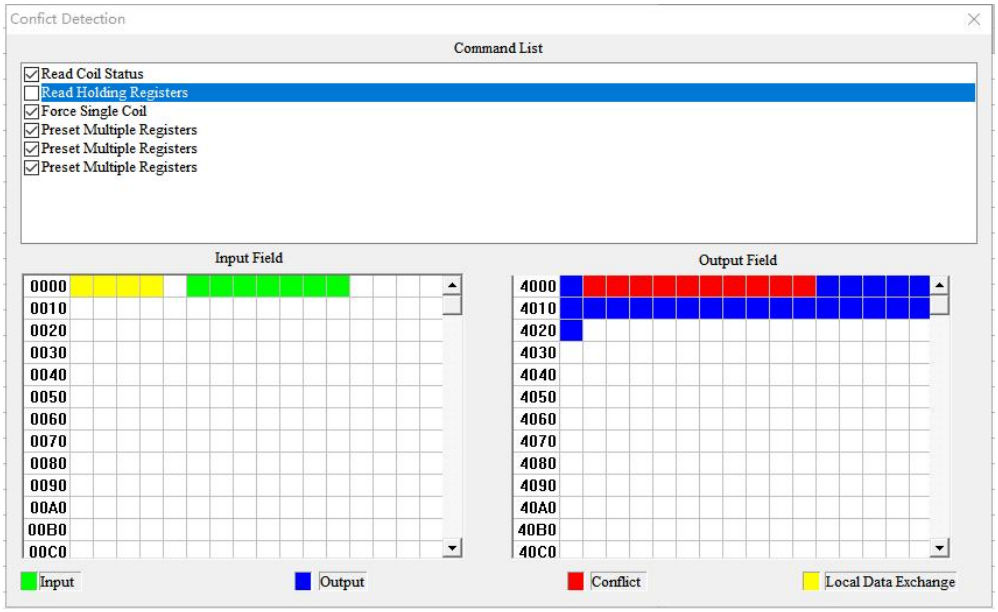
Yellow: The write commands are used to exchange data between slave devices and there is no conflict.

Blue: No conflict of write commands in output area.

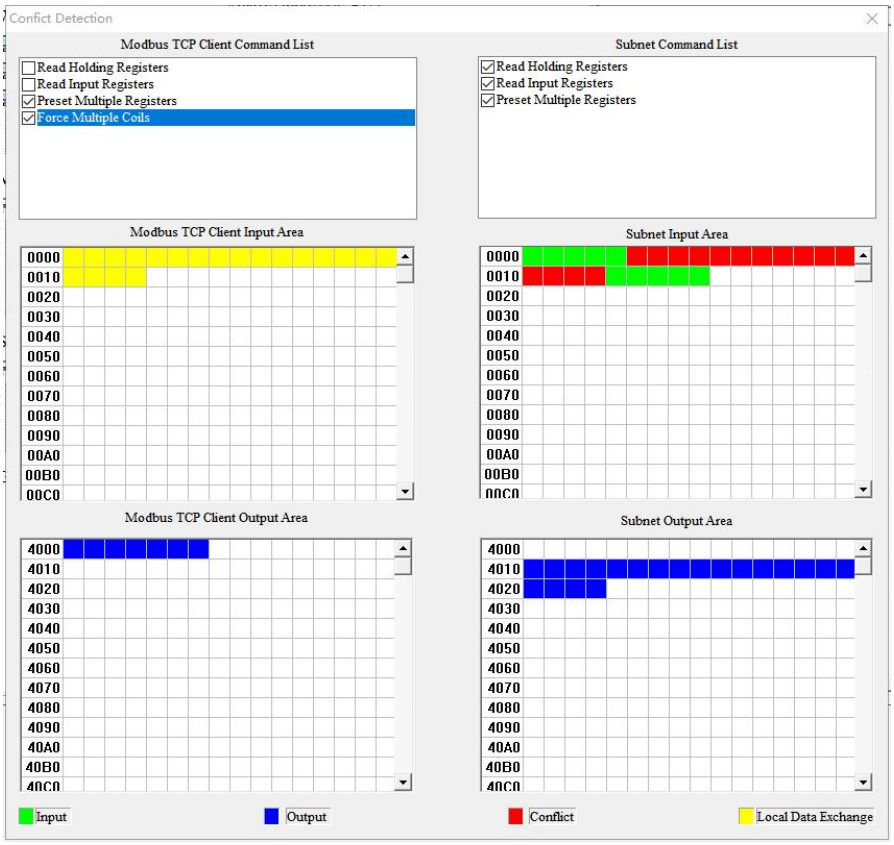
Red: Address conflicts.

White: None data is mapped in this address.

(1) Modbus TCP Server / Modbus Master-Slave



(2) Modbus TCP Client / Modbus Master



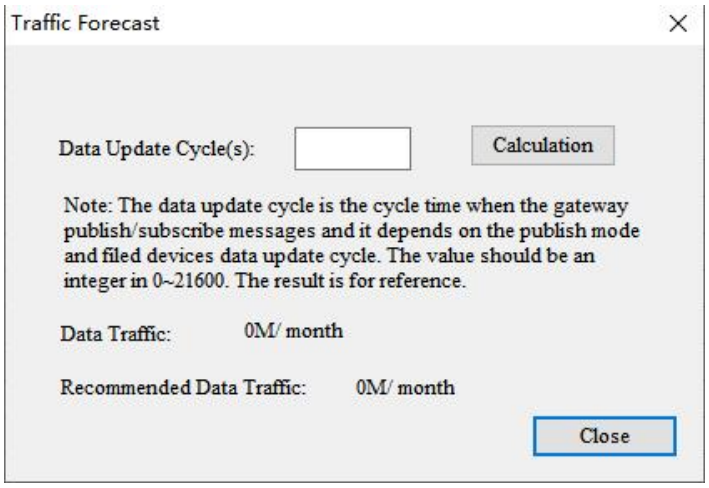
5.6.4 Export Excel

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

5.6.5 Traffic Forecast

The Traffic Forecast function is to calculate the data traffic within 1 month (30 days).

Select “Tool” >> “Traffic Forecast” to open the calculate window.



Data Update Cycle(s): It's the cycle time when the gateway publish/subscribe messages. It depends on the Publish Mode and field devices data update cycle. The value should be an integer in 0~21600. When the Publish Mode is "Cyclic", the Data Update Cycle is the Sending Cycle time.

Data Traffic: The expected data traffic in 1 month.

Recommended Data Traffic: The recommended data plan.

Note: The result is for reference.

5.6.6 Remote Update Server File

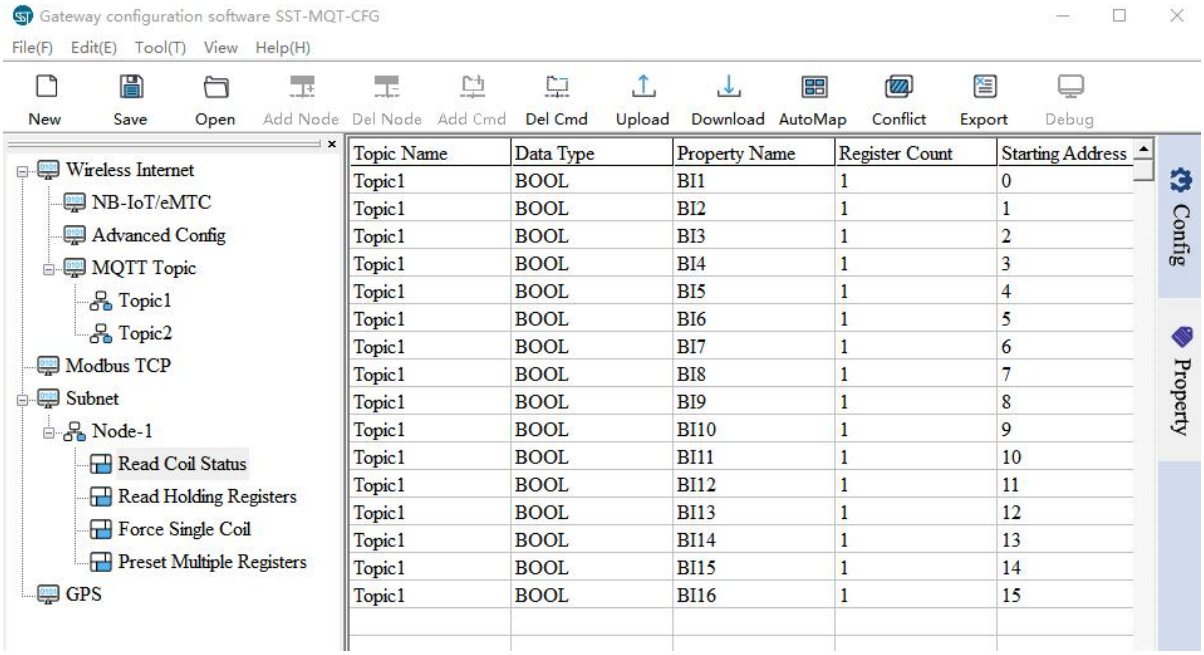
Support exporting remote update files.

When remote update configuration is needed, you can click "Remote Update Server File" to export and send to relevant personnel to operate on a proprietary platform.

5.7 Property Operations

5.7.1 Property Configuration

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



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.

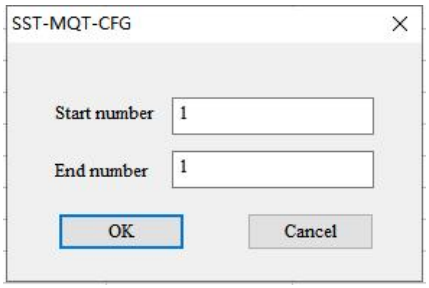
“V” refers to exchange of the bytes.

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.

5.7.2 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.

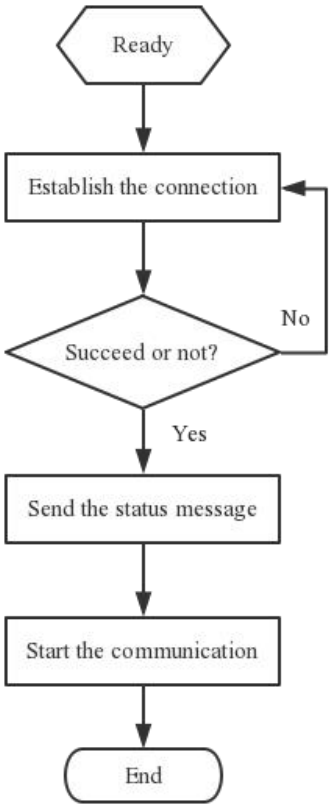
5.7.3 Properties Name Conflict Detection

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.

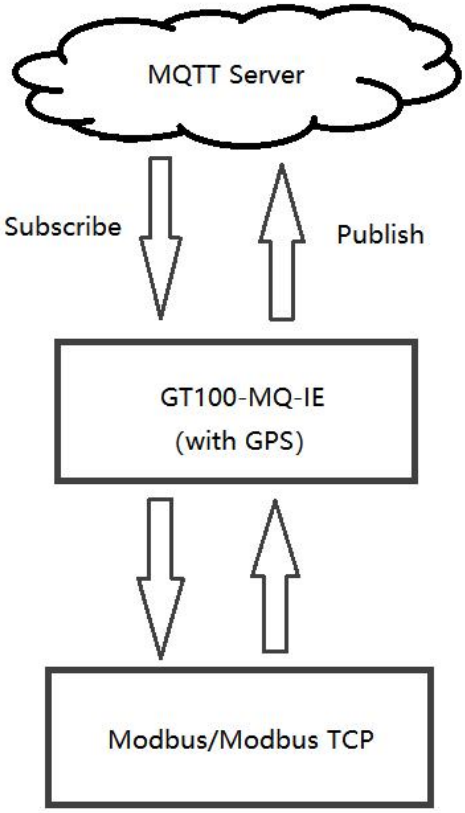
6 Working Principle

6.1 Connection Process



6.2 Data Exchange

The GT100-MQ-IE is able to connect Modbus RTU/ASCII and Modbus TCP devices to MQTT Servers, such as Amazon AWS IoT, Microsoft Azure IoT and customized Servers.



Appendix A: MQTT Message Format

A.1 Default Format

A.1.1 Publish Message

Note: "//" indicates the comments part.

Property type:

GPS: *//Global Positioning System*

```
{
    "version":      "1.1.1.0",
    "GPS":{
    "Latitude":     31.057020,
    "Longitude":    121.189590
    }
}
```

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-IE can publish 8 properties at most in one
    message. If more than 8 properties need to be transmitted, the GT100-MQ-IE 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":    999999.500000,    //The data type (for example, Float) consists with the property configuration
    "AI3":    888888.500000,
    "AI4":    777777.500000,
    "AI5":    666666.500000
    }
}
```

Register / Data only type:

GPS:

```
{
    "version":      "1.1.1.0",
    "type":    "GPS",
    "Latitude":     31.057243,
    "Longitude":   121.188759
}
```

Modbus Master:

Read Coil Status/Read Input Status:

Example (Read Coil Status):

```
{
    "version":      "1.1.1.0",
    "type":    "MODBUS_MASTER",
    "slave id":     1,              //The slave address of the field device
    "fc": 1,                        //Modbus function code
    " addr ":  0,                   //Modbus coil/register starting address, starting form 0
    "npoint": 2,                    //The number in data
    "data":    "42,81",             //The data type consists with that in Modbus protocol
    "time":    "19/02/27,16:05:14"//Time stamp. If disable, the message will not contain this line.
}
```

Read Holding Register/Read Input Register:

Example (Read Holding Register):

```
{
    "version":      "1.1.1.0",
    "type":    "MODBUS_MASTER",
    "slave id":     1,
    "fc": 3,
    " addr ":  0,
    "npoint":32,
    "data":"11,11,00,00,33,33,00,00,55,55,00,00,77,77,00,00,99,99,00,00,11,11,00,00,13,13,00,00,15,15,00,00"
}
```

Modbus Slave / Modbus TCP Server:

Coil Status:

When only one coil' status changes:

```
{
    "version":      "1.1.1.0",
    "type":   "MODBUS_TCP_SLAVE",
    "block":  0,        //Modbus Block. For example, "0" indicates the Coil Status block.
    " addr ":  2,       //Modbus status/register starting address, starting form 0
    "npoint":    1,
    "data":   "FF",     //00 or FF indicates 0 or 1.
    "time":   "19/02/27,16:13:40"
}
```

When multiple coils' status change:

Example 1:

```
{
    "version":      "1.1.1.0",
    "type":   "MODBUS_TCP_SLAVE",
    "block":  1,
    " addr ":  3,       //Modbus coil/register starting address, starting form 0
    "npoint": 2,
    //In this example, the 4th and 5th bits of the 1st byte are the two coils' statue.
    "data":   "18",     //It's HEX data.
    "time":   "19/02/27,16:23:35"
}
```

Example 2:

```
{
    "version":      "1.1.1.0",
    "type":   "MODBUS_TCP_SLAVE",
    "block":  0,
    " addr ":  6,       //Modbus coil/register starting address, starting form 0
    "npoint": 4,
    //In this example, the 1st bit of the 1st byte, the 7th and 8th bits of the 2nd byte is the three coils' status.
    "data":   "c0,03",
    "time":   "19/02/27,16:35:01"
}
```

Holding Register:

Example:

```
{
    "version":      "1.1.1.0",
    "type":    "MODBUS_TCP_SLAVE",
    "block":   4,
    " addr ":  1,
    "npoint":  4,
    "data":    "11,22,33,44",
    "time":    "19/02/27,16:48:39"
}
```

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":    123.5,
    "AO4":    321.5,
    "AO5":    555.6
    }
}
```

Register / Data Only Type:

Modbus Master:

Force Single Coil:

```
{
    "type":    "MODBUS_MASTER",
    "slave id":      1,
    "fc": 5,                //Modbus function code
```

```
    " addr ":  0,
    "npoint": 1,          //00 or FF indicates 0 or 1.
    "data":    "FF"
 }
```

Force Multiple Coils:

```
{
    "type":    "MODBUS_MASTER",
    "slave id":      1,
    "fc": 15,             //Modbus function code
    " addr ":  0,
    "npoint": 2,
    //The data contains multiple coils' status.
    "data":    "ff,aa"
}
```

Preset Single Register:

```
{
    "type":    "MODBUS_MASTER",
    "slave id":      1,
    "fc": 6,
    " addr ":  0,
    "npoint": 2,
    "data":    "aa,bb"
 }
```

Preset Multiple Registers:

```
{
    "type":    "MODBUS_MASTER",
    "slave id":      1,
    "fc": 16,
    "addr":    0,
    "npoint":32,
    "data":"11,11,00,00,22,22,00,00,33,33,00,00,44,44,00,00,00,00,00,00,00,00,00,00,00,88,8
    8,00,00,99,99"
}
```

Modbus Slave / Modbus TCP Server

Change single input status bit:

```
{
    "type":    "MODBUS_SLAVE",
    "block":   1,         //Modbus Block. "1" indicates the Input Status block.
    "addr ":   0,
```

```
    "npoint": 1,
    "data":   "FF"
 }
```

Change multiple input status bits:

```
{
    "type":   "MODBUS_SLAVE",
    "block":  1,
    "addr":   0,
    "npoint": 8,
    //In this example, 8 bits are sent in a byte.
    "data":   "aa"
 }
```

Change Input Register:

```
{
    "type":   " MODBUS_SLAVE ",
    "block":  3,
    "addr":   1,
    "npoint": 12,
    "data":   "02,22,03,33,04,44,05,55,06,66,07,77"
}
```

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.

Appendix B: Change Product Firmware Mode

The GT100-MQ-IE integrates two Firmware modes A and B, switched by downloading the BIN file.

Preparation：

Tools: Web browser

Connect cables: Network cable

Bin file: Please go to the installation directory of the configuration software SST-MQT-CFG to obtain the bin file.

✧ Path example:

C:\Program Files\SST Automation\SST-MQT-CFG V4.0.4\gt100-mq-ie-bin

✧ Bin file example:

Modbus TCP C -Modbus M (GT100-MQ-IE-A)-F3.0.2.0.bin

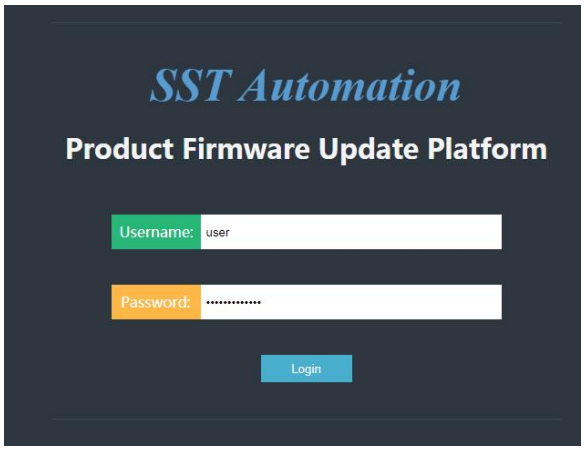
Modbus TCP S-Modbus MS (GT100-MQ-IE-B)-F3.0.3.1.bin

See the following for specific operation steps.

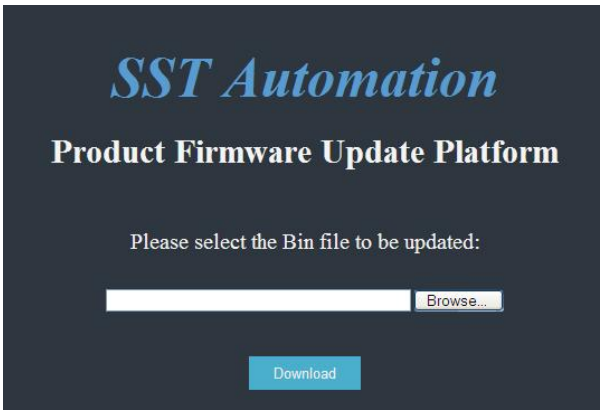
1. Change the IP address of PC as fixed 192.168.0.xxx.
2. Hold the button on the GT100-MQ-IE and power it on. The ENS and TX / RX LED will blink green, that indicates the GT100-MQ-IE is ready to update the firmware. Then release the button.
3. Enter 192.168.0.10 in your web browser to enter SST Automation Product Firmware Update Platform. Login with the following information:

   Username: user

   Password: sstautomation



4. Click “Browse...” to select a Bin file. The Bin files are located in the installation path of the SST-MQT-CFG software.



5. Click “Download” to download the specified firmware into the GT100-MQ-IE.

6. After download, it shows the firmware update is successful. Click “Reboot” to restart the GT100-MQ-IE.

7. Wait for the GT100-MQ-IE to restart.