

HART/ Modbus Serial Gateway

GT200-HT-RS

User Manual

V4.1

Rev B



SST Automation

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Important Information

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1 Product Overview

1.1 Product Function

The GT200-HT-RS is an industrial gateway designed to seamlessly connect HART devices with Modbus networks. It operates as a HART master (primary or secondary) and as a Modbus RTU/ASCII slave. In Handheld Communicator mode, it also functions as a HART communicator, allowing parameter adjustment and diagnostics via the SST-HT-CFG software.

1.2 Product Features

- Dual Functionality: Acts as both a HART-to-Modbus converter and a HART communicator.
- Multi-Protocol Support: Supports HART 7 and earlier versions, Modbus RTU/ASCII, and transparent serial transmission.
- Comprehensive Diagnostics: Displays real-time communication data and diagnostic information.
- Flexible Configuration: Configurable via USB or RS-232 using SST-HT-CFG software.
- Robust Design: Wide temperature range (-40°C to 70°C) and DIN-rail mounting for industrial environments.

1.3 Technical Specifications

Modbus Serial Interface Features	
Serial Interfaces	One (1) RS485 interface + One (1) RS232 interface
Baud Rates	300 bps, 600 bps, 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps
Parity Options	None, Odd, Even, Mark, Space
Stop Bits	1 or 2
Serial Operation Modes	Modbus RTU Slave Modbus ASCII Slave Universal Serial (Transparent passthrough)
Modbus Function Codes Supported	03H: Read Holding Registers 4x 04H: Read Input Registers 3x 06H: Single Register Write 4x 10H: Multiple Register Write 4x
HART Input Data Read Command	Configurable via SST-HT-CFG: 03H: Read Holding Registers 4x or 04H: Read Input Registers 3x
Byte Swap Modes	No swap Register Swap (0x12345678 => 0x56781234)

HART Interface Features	
HART Interface	One (1) HART Channel
HART Operation Modes	HART Primary Master HART Secondary Master HART Handheld Communicator
HART Network Modes	Point-to-Point Mode Multi-Drop Mode
Internal HART Resistor	Built-in 270Ω, 2W resistor toggled via switch.
Maximum Number of HART Slave Devices in Multi-Drop Mode	Up to 13 HART devices using the internal resistor Up to 15 HART devices using an external resistor (250Ω)
HART Functions Supported	HART Burst-Mode supported in Point-to-Point Mode CommandID 103: Write Burst Period CommandID 104: Write Burst Trigger CommandID 105: Read Burst Mode Configuration CommandID 107: Write Burst Device Variables CommandID 108: Write Burst Mode Command No. CommandID 109: Burst Mode Control
HART Versions Supported	HART 7 and earlier
HART Debug Features	Live device scan Live node address modification Live data monitoring via SST-HT-CFG
HART Command Write Modes	Change-of-State Output Polling Output Initialization Only Output Disable Output
Maximum Number of HART Commands	Up to 128 HART Commands
Maximum HART Input Size	Up to 1600 Bytes
Maximum HART Output Size	Up to 1000 Bytes

Electrical/Environmental	
Power Supply Input Voltage	24VDC (Range 9V to 30V)
Power Supply Current	80mA at 24VDC
Operating Temperature	-40°F to 158°F (-40°C to 70°C)
Relative Humidity	5% to 95% RH (non-condensing)
Certification	CE Compliant to EMC Test Standards
Hardware	
Dimensions (W × H × D)	0.98in × 3.94in × 3.54in (25mm × 100mm × 90mm)
Mounting	35mm DIN Rail
Enclosure Protection Rating	IP20
Power Interfaces	One (1) 3-Pin Terminal Block

1.4 Related Products

The related products include: GT200-HT-DP, GT200-DP-RS etc.

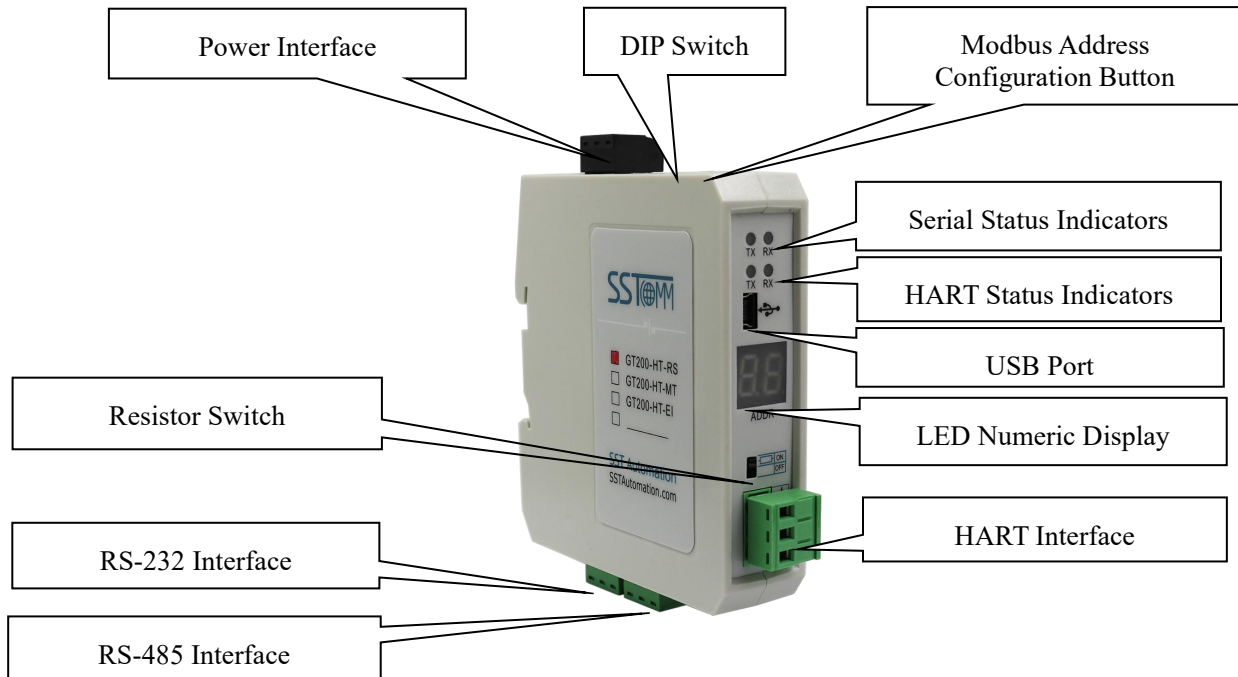
To get more information about related products, please visit SST Automation's website: www.sstautomation.com.

1.5 Revision History

Revision	Date	Chapter	Description
V4.1 Rev B	3/13/2026	All	Optimize document descriptions
V4.1 Rev A	10/28/2025	All	Update Format. Fixed the serial pin definitions in Chapter 2.6.2 and Chapter 2.6.3 Add Chapter 6.5: Troubleshooting (Common Technical Issues)
V4.1	03/24/2025	PART	Support HART 7 and HART communicator. Support Modbus FC03 or FC04 to read data.
V3.2	11/29/2023	1,2 and 7	Delete RS-422 Interface and baud rate:300 Add chapter 7: Modbus Master Communication
V2.5	11/05/2021	All	Update the format

2 Hardware Description

2.1 Product Appearance



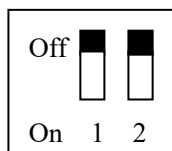
Note: This image is for reference only. The actual product may differ in appearance.

2.2 LED Status Indicators

Indicator Location	Indicator	State	State Description
Top Row Serial Indicators	TX	Flashing Green	Serial port is transmitting data .
		OFF	No serial data is being transmitted.
	RX	Flashing Green	Serial port is receiving data.
		OFF	No serial data is being received.
Bottom Row HART Indicators	TX	Flashing Green	HART Bus is transmitting data.
		OFF	No HART data is being transmitted.
	RX	Flashing Green	HART Bus is receiving data.
		OFF	No HART data is being received.
LCD Numeric Display		CF	Configuration Mode
		HC	HART Communicator Mode
		01-99	Run Mode The number indicates the gateway’s Modbus address.

2.3 DIP Switch

The DIP switch is located at the bottom of product. Bit 1 is the debug bit and bit 2 is the configuration bit.

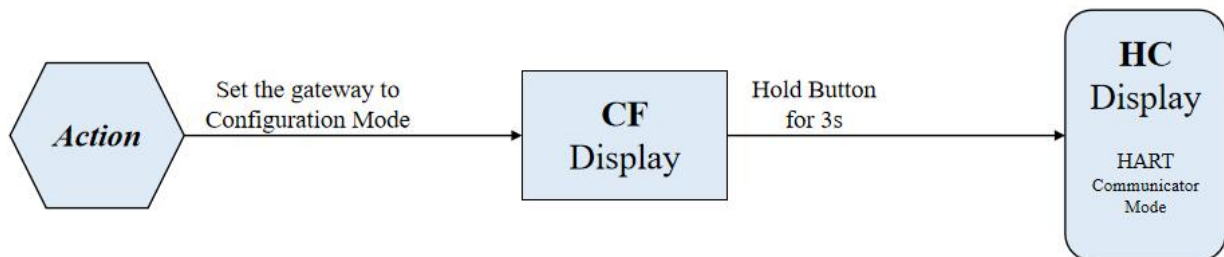


Debugging (Bit 1)	Configuration (Bit 2)	Description
Off	Off	Run Mode
Off	On	Configuration Mode
On	Off	Debug Mode
On	On	Configuration Mode

HART Communicator Mode:

To enter HART Communicator Mode, perform the following steps:

1. Set the gateway to Configuration Mode.
2. Press and hold the button for 3 seconds to enter the HART communicator mode. The LED numeric display will show "HC" to indicate that the gateway has entered HART Communicator Mode.



While the gateway is in HART Communicator Mode, use the USB interface to connect the gateway to the HART communicator software. For detailed connection instructions, please refer to [Chapter 5.3](#).

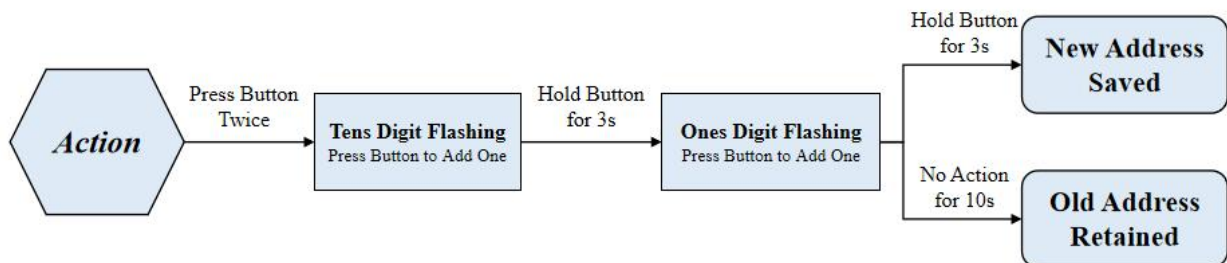
Notes:

1. After reconfiguring the DIP switch, you must power cycle the GT200-HT-RS for the settings to take effect! (Power OFF, then Power ON)
2. When set to the Debug Mode, the RS-485 interface is used as the communication interface, and the RS-232/USB interface is designated for debugging.
3. Configuration is performed through the RS-232/USB interface.

2.4 Modbus Address Configuration Button

In Run Mode, the LED numeric display continuously shows the current Modbus address of the GT200-HT-RS. To set a new Modbus address, perform the following steps:

1. Double-press the button to start the address configuration procedure. The tens digit will start flashing, and the ones digit will remain solid. Press the button to increment the tens digit by 1.
2. Press and hold the button for 3 seconds until the tens digit turns solid and the ones digit begins flashing. Press the button to increment the ones digit by 1.
3. Press and hold the button again for 3 seconds to save the new address. The LED numeric display will flash three times to confirm that the address has been successfully saved. If no button operation is detected within 10 seconds, the GT200-HT-RS automatically exits the address configuration procedure and retains the previous address.

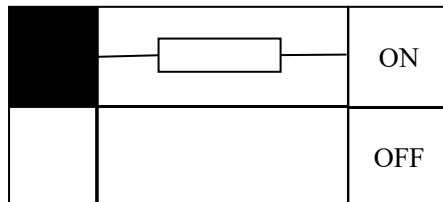


The configurable Modbus address range is 0 to 99 (decimal).

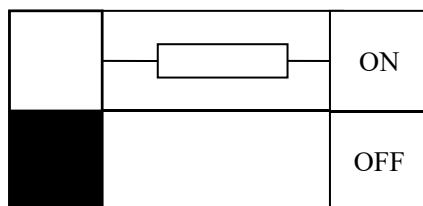


2.5 Internal/External Sampling Resistor Switch

The built-in internal sampling resistor (270Ω , 2W) can be enabled or disabled via the resistor switch. If the power going through the resistor exceeds 2W, disable the internal resistor switch and use an external resistor instead.



Switch to ON, using the internal sampling resistor

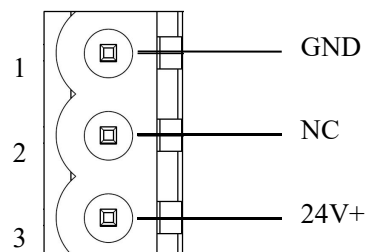


Switch to OFF, using the external sampling resistor

2.6 Interfaces

2.6.1 Power Interface

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



2.6.2 RS-485 Interface

The RS-485 interface of GT200-HT-RS complies with the standard RS-485 specification. The RS-485 characteristics are as follows:

RS-485 Serial Characteristics:

- Network topology: Linear bus with terminal resistors installed at both ends.
- Transmission rate: 300 bps–115.2 Kbps.
- Recommended Transmission Medium: Shielded twisted-pair cable (shielding optional depending on environmental EMC conditions).
- Number of Nodes: Up to 32 nodes per segment (without repeater), and expandable to 127 nodes through the use of an RS-485 repeater.
- Connector Type: 3-pin pluggable terminal block.

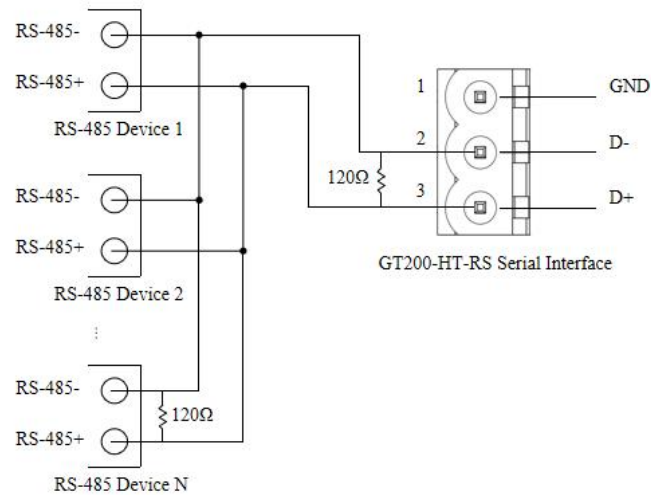
Key Points for RS-485 Equipment Installation:

- All devices must be connected to the RS-485 bus.
- Each segment can connect up to 32 devices.
- Install a 120Ω 1/2W terminal resistor at each end of the bus to ensure reliable network operation.

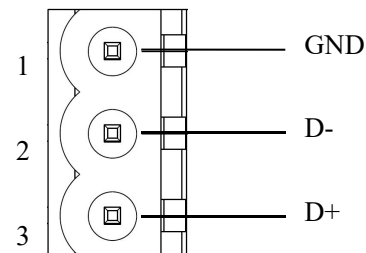
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- The serial interface uses a 3-pin pluggable terminal block. Wire the connections according to the wiring diagram shown below:



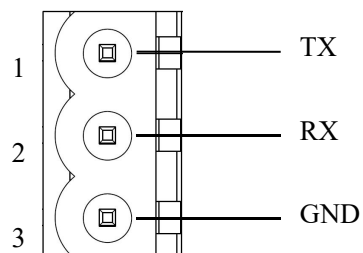
Pin	Function
1	GND
2	D(-), RS-485
3	D(+), RS-485



2.6.3 RS-232 Interface

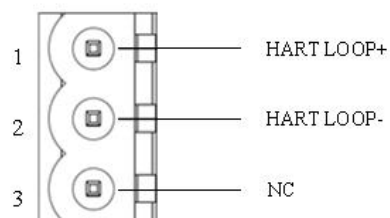
RS-232 interface uses a 3-pin pluggable terminal block, and its pin description is shown as follows:

Pin	Function
1	TX, Connect to RX of target device
2	RX, Connect to TX of target device
3	GND, Connect to GND of target device



2.6.4 HART Interface

Pin	Function
1	HART Signal +
2	HART Signal -
3	NC (Not Connected)

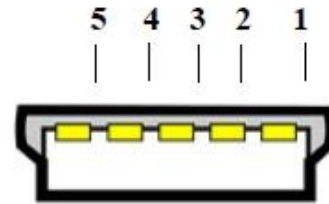




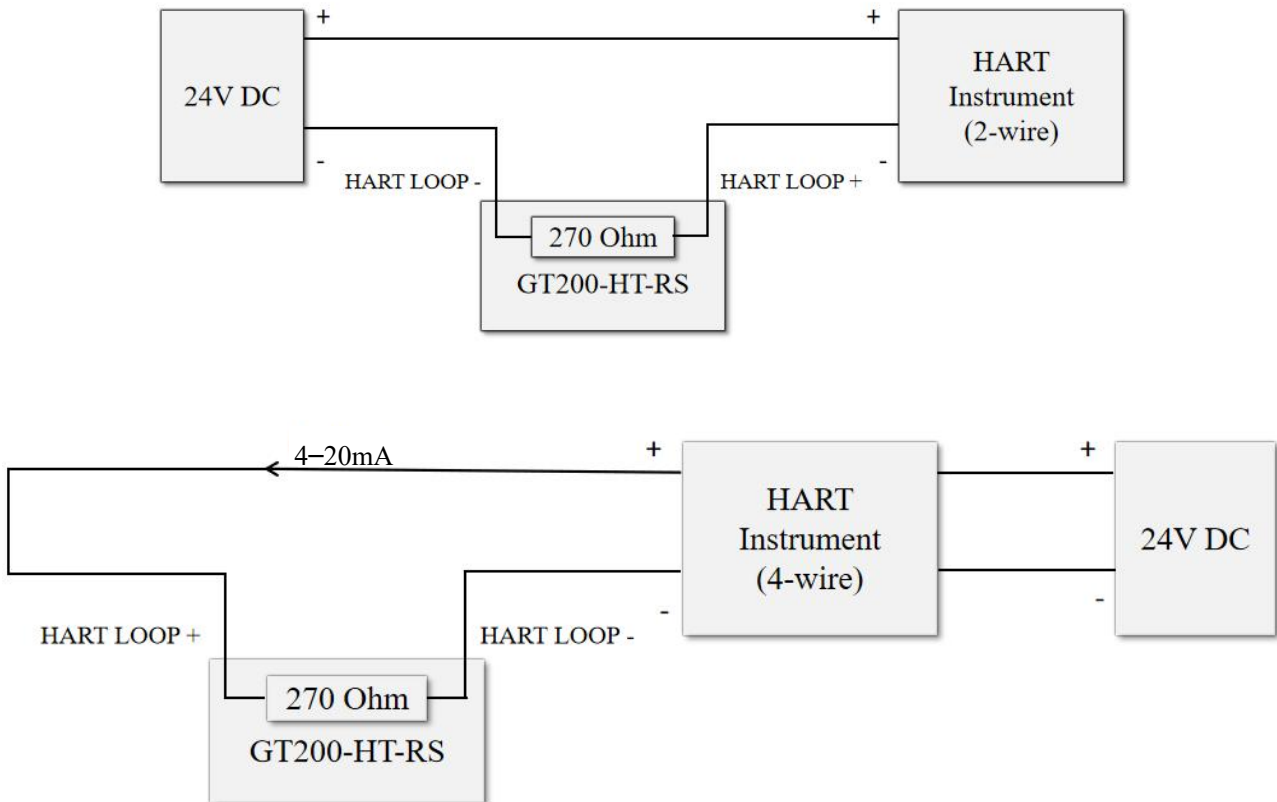
2.6.5 Mini B Type USB

Mini B type USB interface is defined as below:

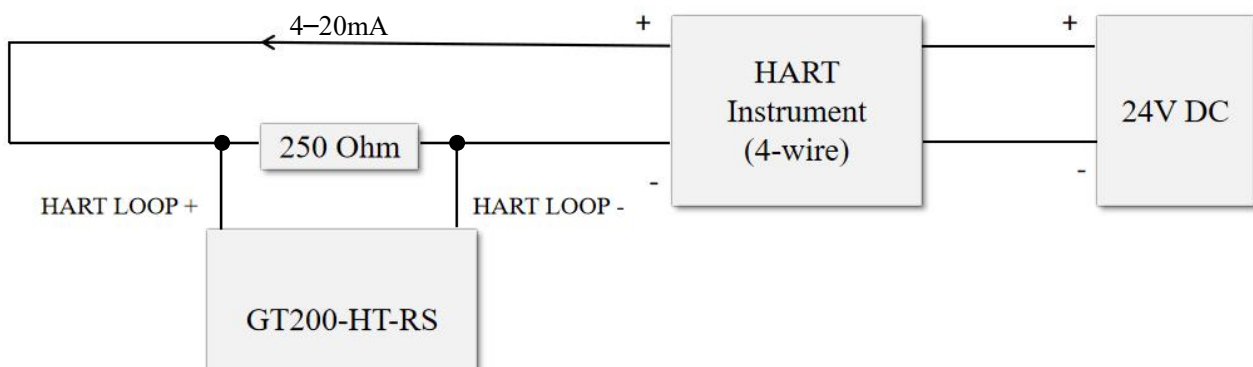
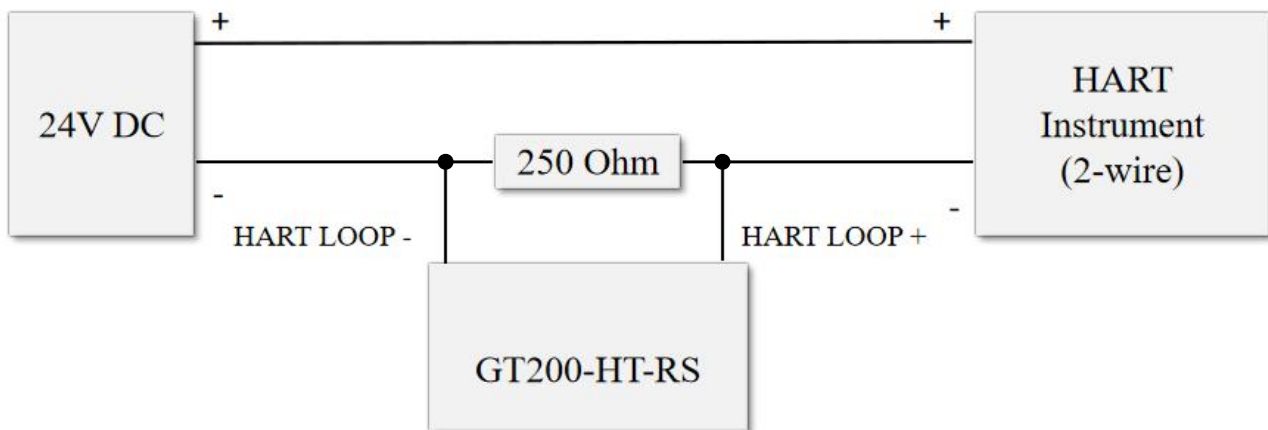
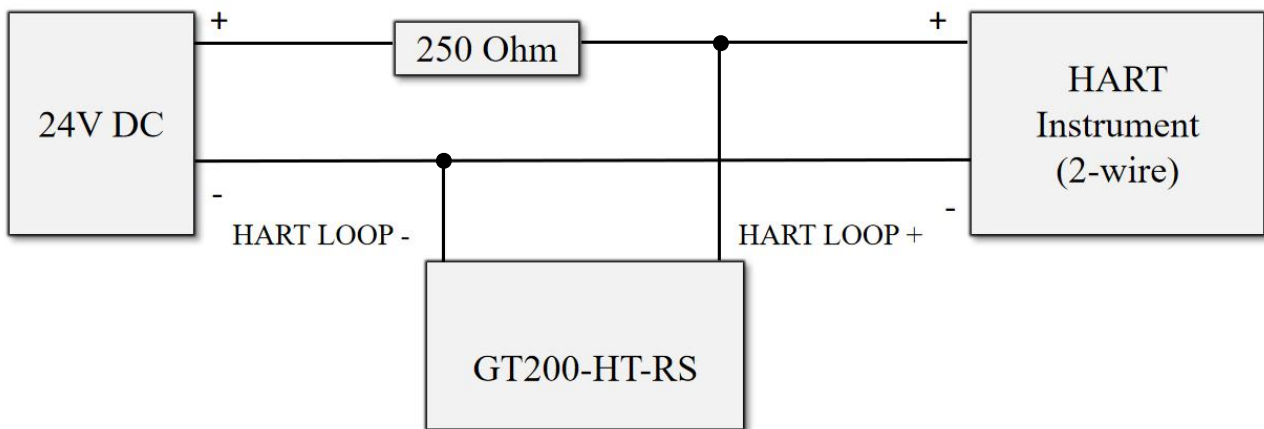
Pin	Name	Function
1	VBUS	+5V
2	D-	Data negative
3	D+	Data positive
4	IN	NC (Not Connected)
5	GND	Signal Ground



2.6.6 Topology of GT200-HT-RS and Fieldbus Devices



Available wiring options when using the internal resistor



Available wiring options when using the external resistor



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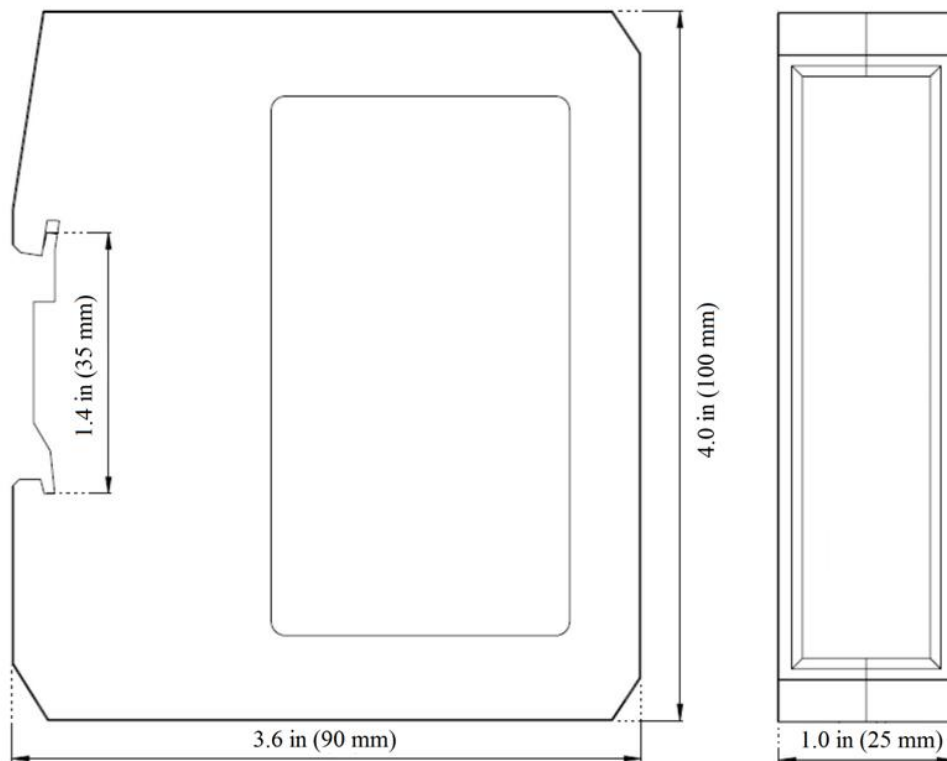
Notes:

1. Some HART slave instruments may need to perform self-tests or other internal operations during power on and may not immediately start HART communication. During this time, the gateway cannot receive response data from the instrument. It is recommended to power the HART slave instrument and gateway **separately** so that the gateway can establish communication as soon as the instrument becomes ready.
2. When configuring HART commands in the SST-HT-CFG software, configure the commands according to the actual application requirements. To improve the speed of the HART bus communication, it is recommended not to configure unused nodes (those without connected devices) or unnecessary commands.

3 Hardware Installation

3.1 Mechanical Dimensions

Size: 1.0 in (width)*4.0 in (height)*3.6 in (depth)

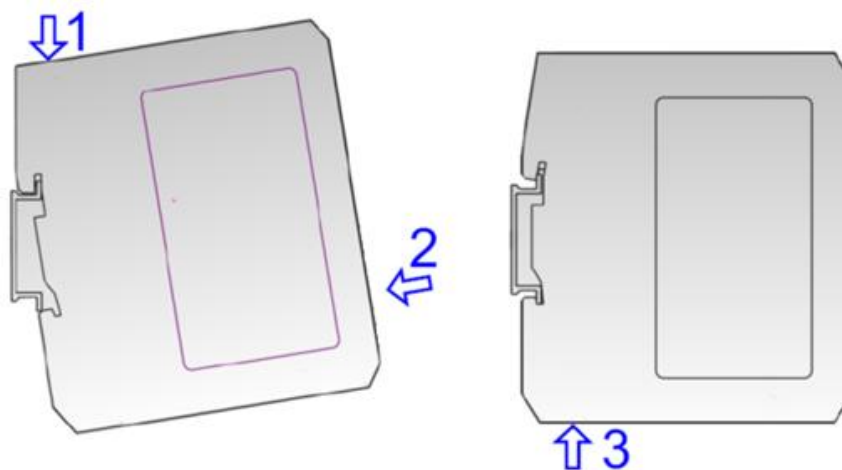


3.2 Installation Method

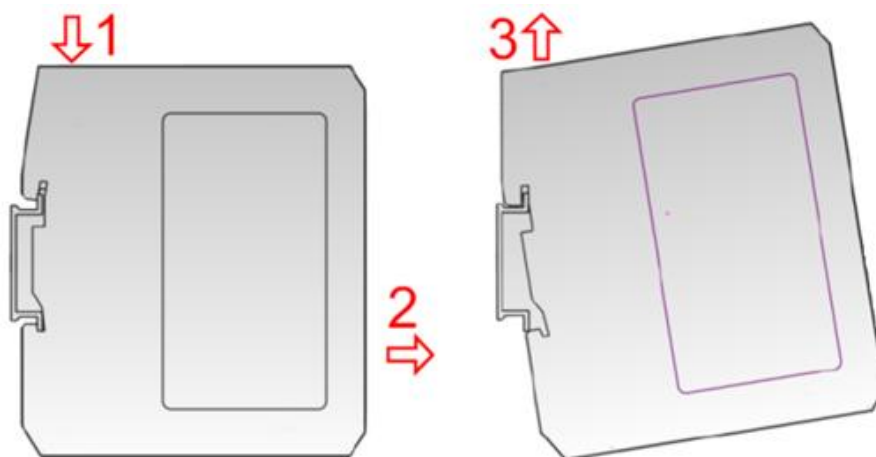
Mount the gateway to 1.4 in (35mm) DIN RAIL. Ensure adequate ventilation and secure mounting.

Safety Tip: Avoid installing the device near high electromagnetic interference (EMI) sources.

Install the gateway



Remove the gateway

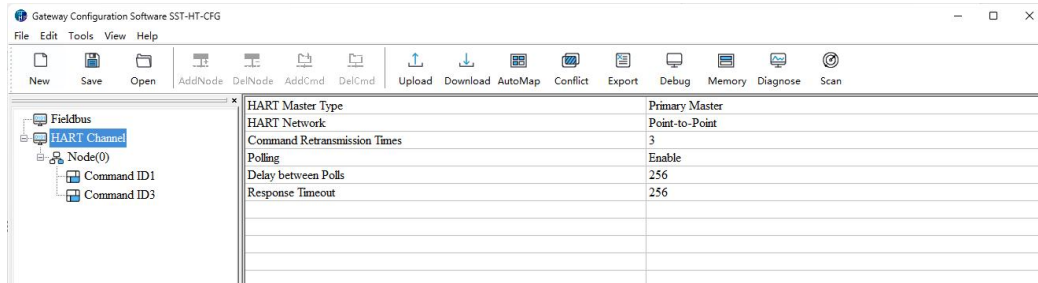


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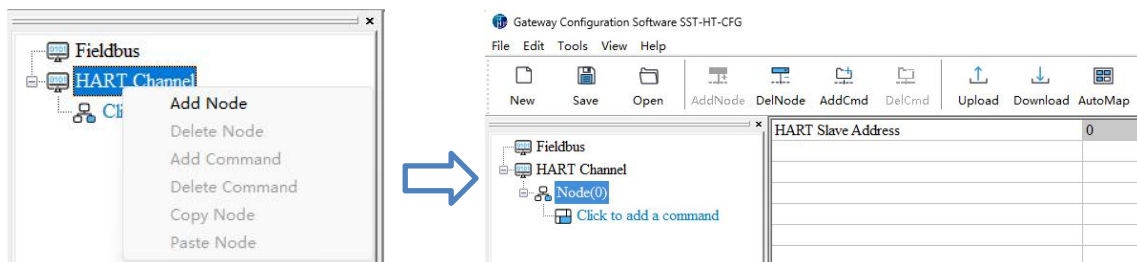
- In the tree view on the left, click "HART Channel" to open the configuration table on the right as shown below:



Note: The HART protocol specifies that:

- A slave device with address 0 operates in point-to-point mode. In this mode, digital and analog communication can coexist at the same time.
- Slave devices with addresses 1–63 operate in multi-drop mode. In this mode, the device's analog output is fixed at its minimum value (typically 4mA) and only allows digital communication.
- The protocol also specifies that the default factory address of field device is 0.

- Right-click HART Channel, then in the pop-up menu select "Add Node" as shown below:

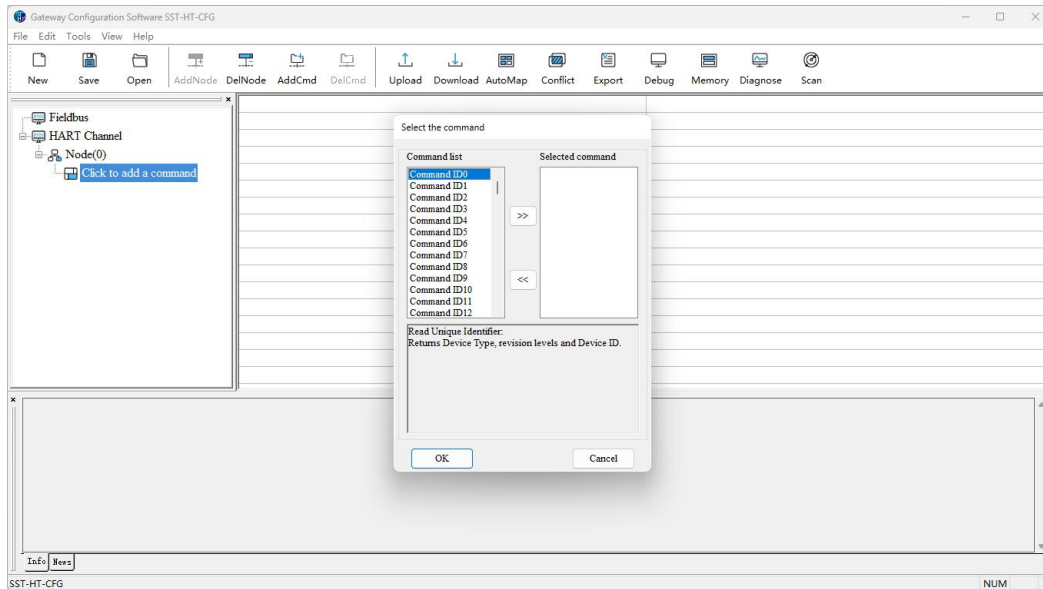


GT200-HT-RS

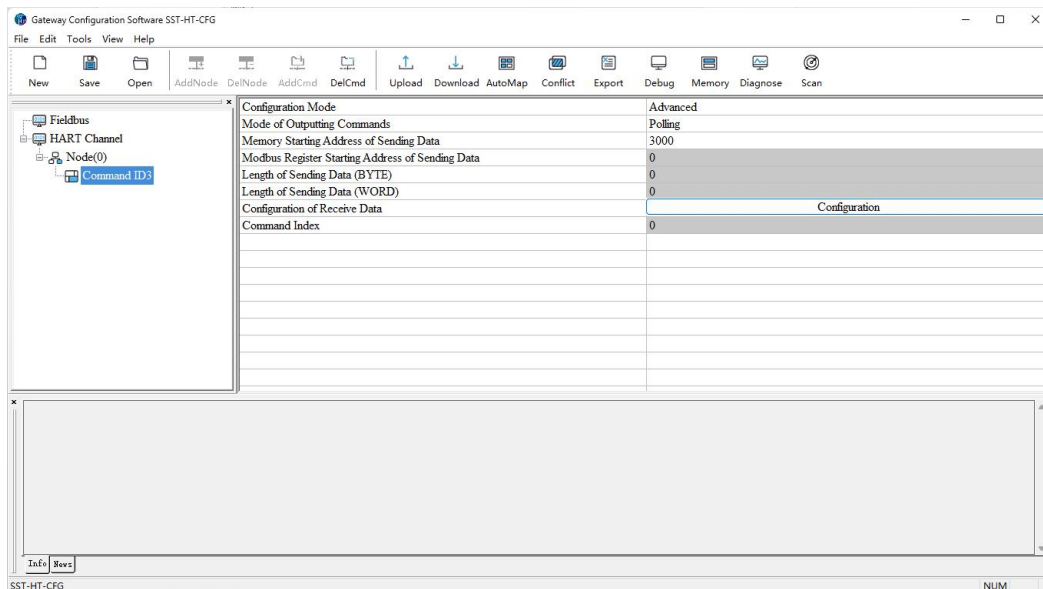
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5. Right-click "Node(0)", then in the pop-up menu select "Add Command". In the dialog box that appears, add a command (for example Command ID3), and then click OK to return.



6. Click "Command ID3". The configuration table on the right will appear as shown below:

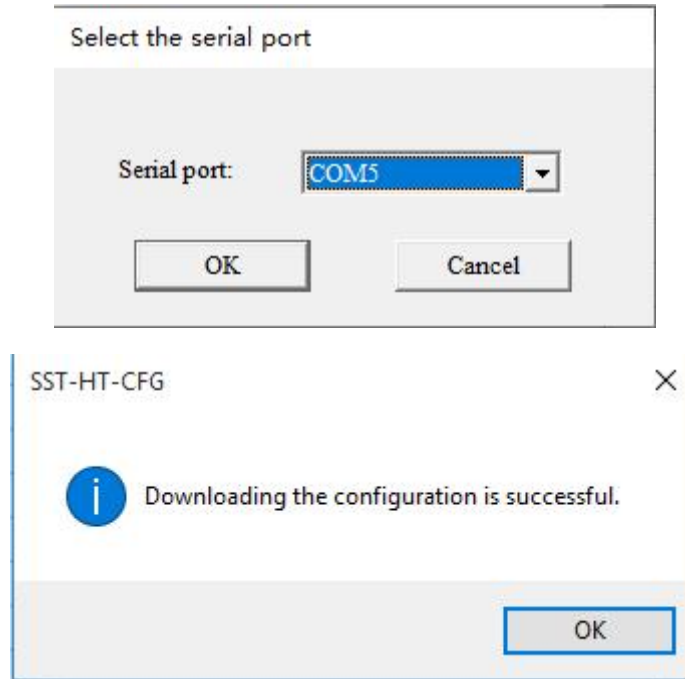


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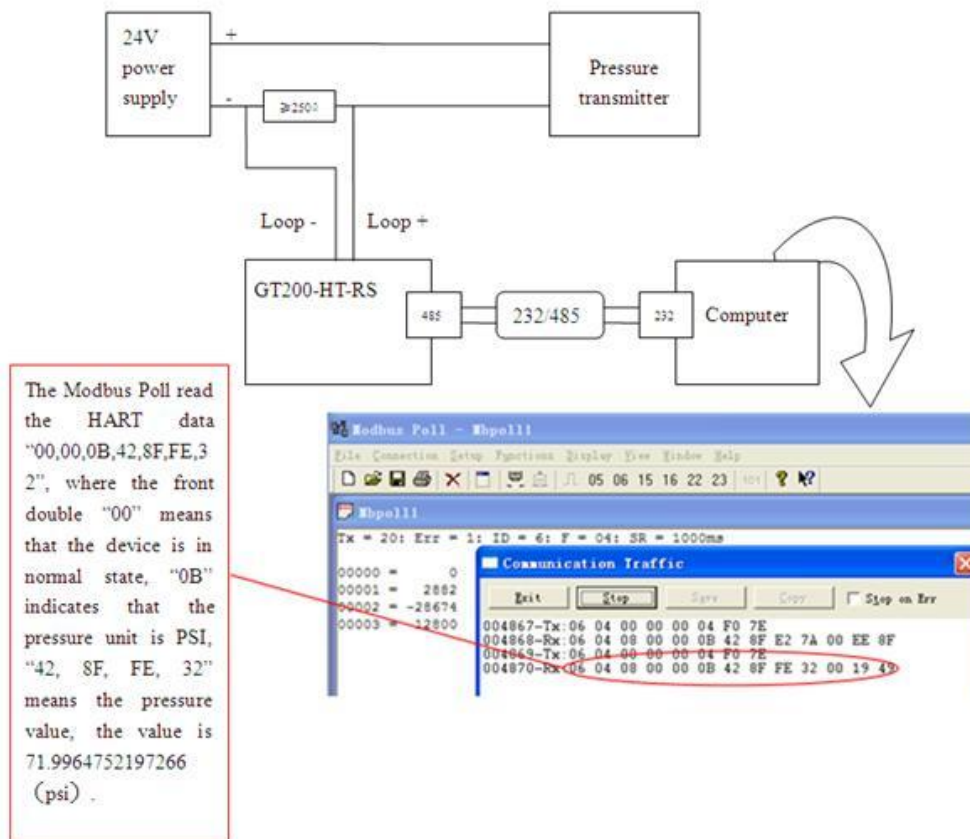
7. Click the "Download" button . In the pop-up dialog box, select the serial port connected to the gateway, click OK, and then click "Download Data":



4.2 Communication Test Example

In this example, the gateway's HART interface is connected to a 2-wire pressure transmitter with slave address 0, while the RS-485 interface is connected to a computer through an RS-485/RS-232 converter.

The computer runs Modbus POLL software to simulate a Modbus master. In the software window, the primary variable value of the pressure transmitter is displayed as shown below:



5 Software Instructions

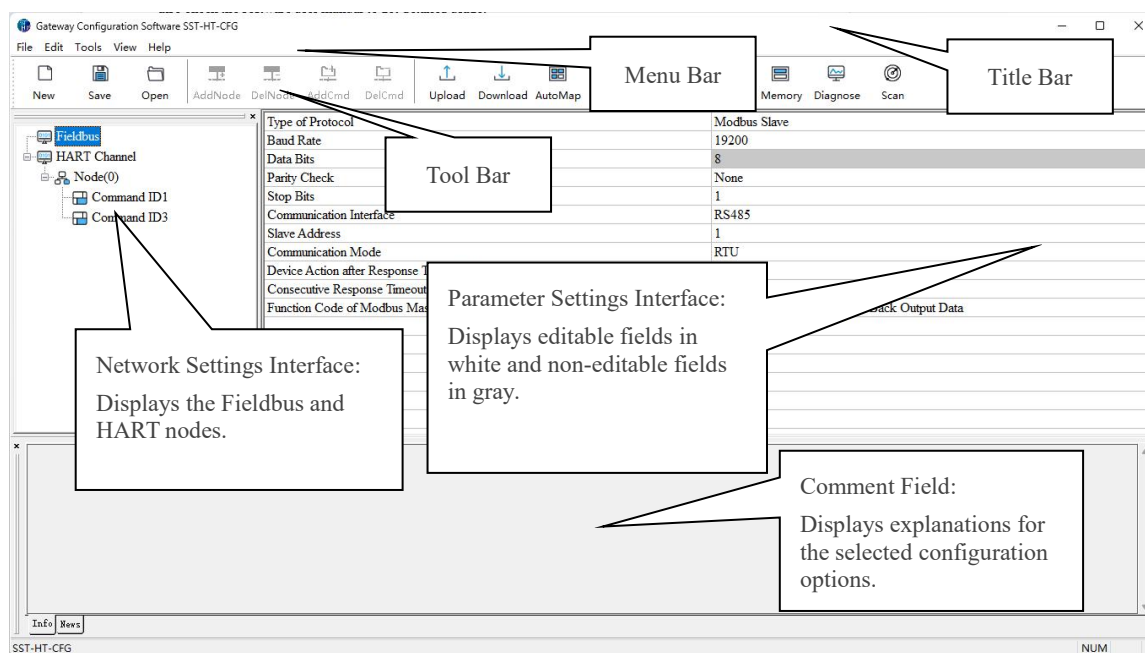
5.1 Software Interface Description

SST-HT-CFG is Windows-based configuration software used to configure HART series products. The following section describes how to use SST-HT-CFG to configure the GT200-HT-RS gateway.

For additional information, please also refer to the software user manual for more details.



Double-click the icon to open the software's main interface:



Tool Bar:

Toolbar interface is shown below:



The functions from left to right are: New, Save, Open, AddNode, DelNode, AddCmd, DelCmd, Upload, Download, AutoMap, Conflict, Export, Memory, Diagnose, Debug and Scan.

	New: Create a new configuration project.
	Save: Save the current configuration.
	Open: Open an existing configuration project.
	Add Node: Add a HART node.
	Delete Node: Delete a HART node.
	Add Command: Add a HART command.
	Delete Command: Delete a HART command.
	Upload: Upload the configuration from the gateway.
	Download: Download the configuration to the gateway.
	Auto Map: Automatically calculate the mapped data address for each command.
	Conflict: Check for mapping address conflicts in the Conflict Detection window.
	Export Excel: Export the current configuration as a table and save it as *.xls file.
	Debug: Send a custom request frame to the HART fieldbus and display the received response, allowing convenient debugging.
	Memory: Displays the internal data exchange within the gateway.
	Diagnose: Read live data and operating status of HART slave devices.
	Slave Scan: Scan and identifies connected slave devices and their addresses. Also supports modifying slave addresses.

5.2 Software Function Description

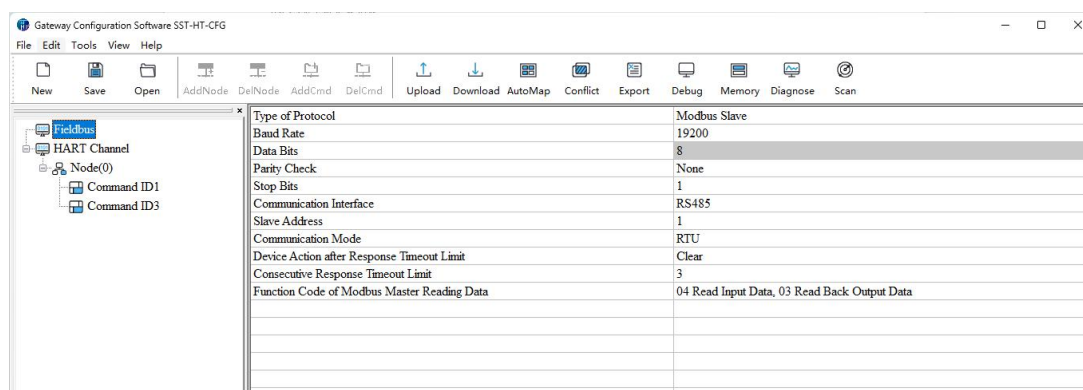
5.2.1 Connecting to the Hardware

Set the gateway's configuration DIP switch (Bit 2) to "ON". Then use a serial cable to connect the gateway's RS-232 port to the computer, or use a USB cable to connect the gateway's USB port to the computer. After making the connections, power on the gateway. The LED numeric display will show "CF" to indicate that the gateway is in the Configuration Mode.

5.2.2 Configuring the Fieldbus

5.2.2.1 Configuring the Fieldbus as a Modbus Slave

To configure the gateway as a Modbus slave, click the "Fieldbus" in the tree view. In the configuration panel on the right, set the protocol mode to "Modbus slave", then press ENTER to confirm. The configuration interface will appear as shown below:



In this interface you can set the parameters as shown:

Baud Rate: 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200bps

Data Bits: 8

Parity: None, Odd, Even, Mark, or Space.

Stop Bits: 1 or 2

Communication Interface: RS-485 or RS-232

Slave Address: 1-247

Communication Mode: RTU or ASCII

Device Action after Response Timeout Limit: Defines whether to clear or retain the HART input data buffer when the number of response timeouts exceeds the "Consecutive Response Timeout Limit" value.

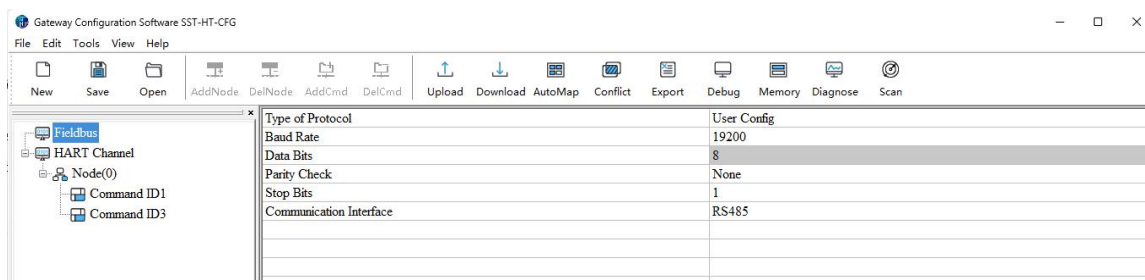
Consecutive Response Timeout Limit: Sets the number of consecutive response timeouts required before the HART input data buffer is cleared.

Function Code of Modbus Master Reading Data: Specifies whether the Modbus Master uses Function Code 03 or 04 to read the HART input data collected through the gateway.

5.2.2.2 Configuring the Fieldbus in Universal Mode

The Universal Mode (also called transparent or pass-through transmission mode) allows direct transmission of raw HART frames through serial port (RS-232/RS-485). In this mode, the gateway sends and receives raw HART data through the serial port without any modification.

To configure this mode, first click the "Fieldbus" in the tree view. In the configuration panel on the right, set the protocol mode to "User Config", then press ENTER to confirm. The configuration interface will appear as shown below:

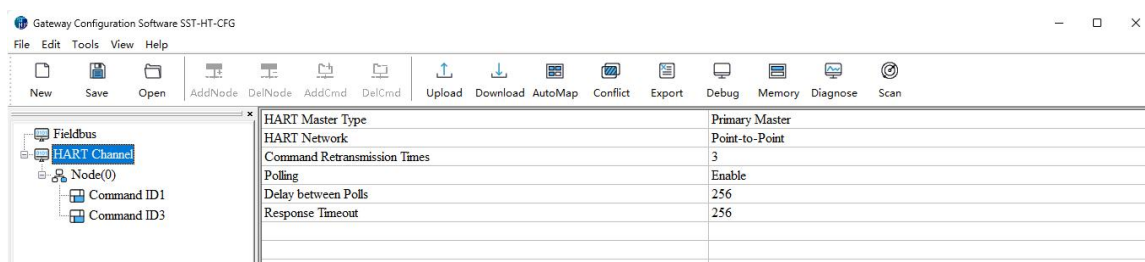


The range and meaning of general mode are the same as "Modbus Slave".

5.2.3 Configure the HART Fieldbus

5.2.3.1 Set the Parameters of HART Channel

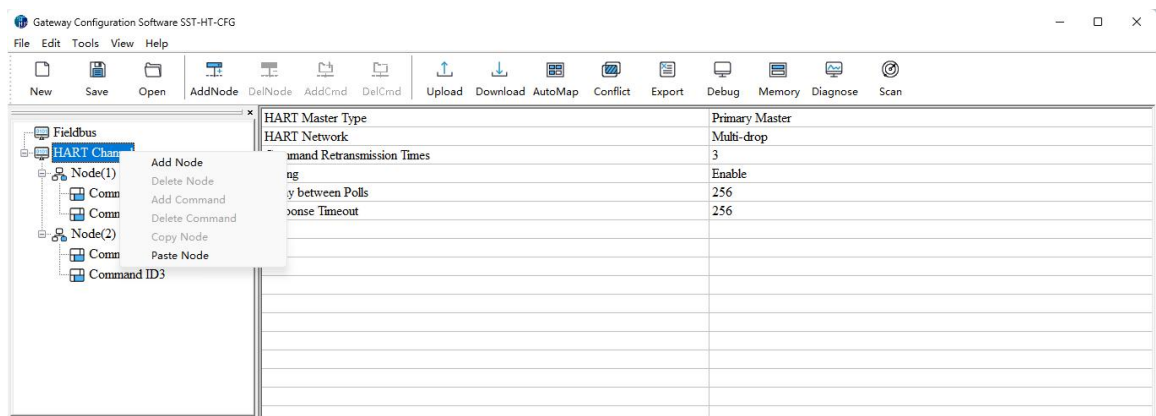
Click the HART Channel in the tree view, the configuration panel will appear on the right:



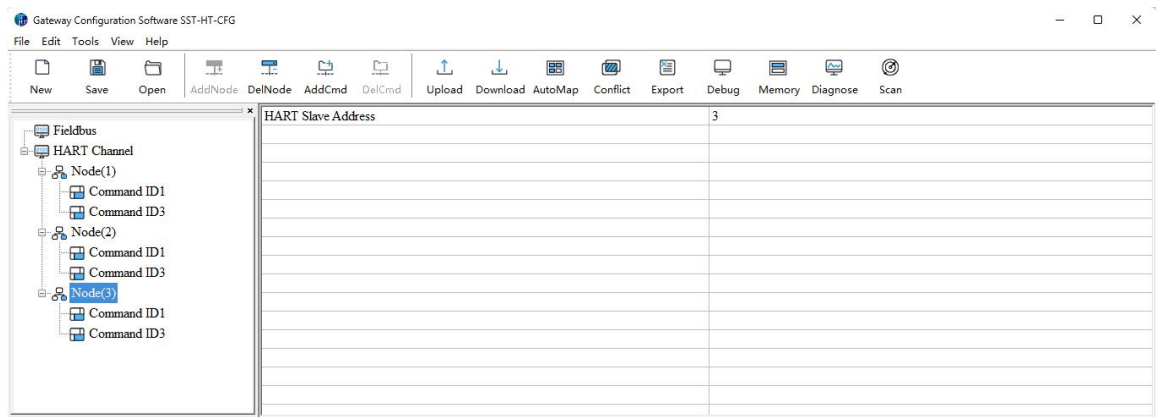
Master Type:	Primary master, Secondary master.
Network Mode:	Select the networks link as point to point or multi-drop, in the point to point the gateway can only communicate with the slave device whose address is 0.
Number of Retries:	0–5.
Polling:	Enable, Disable.
Delay between Polls:	256–65535ms.
Response Timeout:	256–65535ms.

5.2.3.2 Add Slave Nodes

Select the"HART Channel", Right-click and select "Add Node".



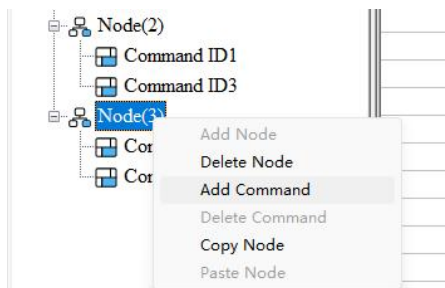
Click the added node, set slave address in the right configuration plate, and please notice that HART channel can only be equipped with one slave node when configured in the single point mode.



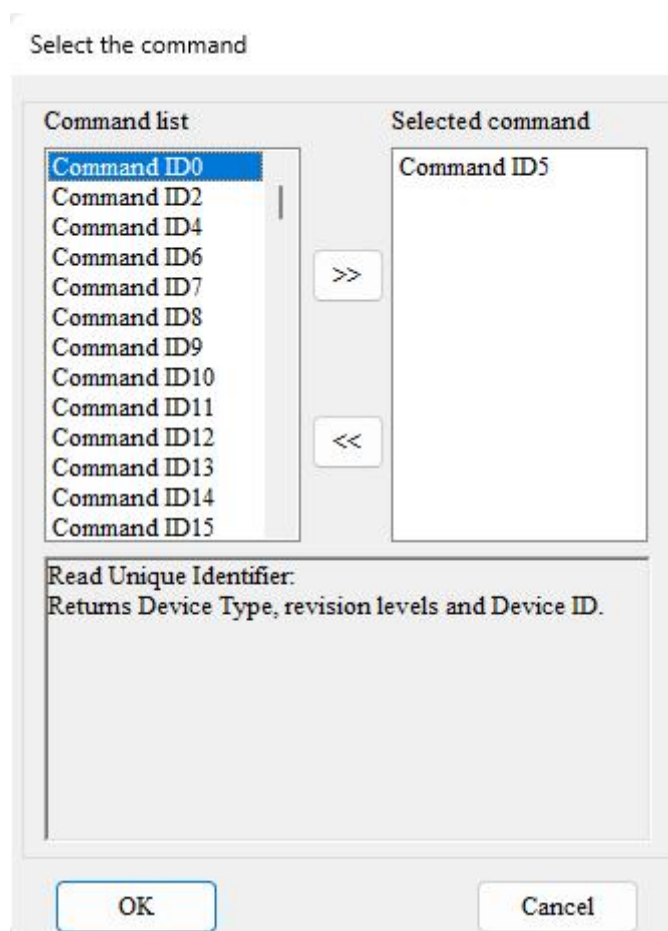
Note: Configuring more nodes than the actual number of connected devices will unnecessarily increase the polling cycle time. Therefore, it is recommended to configure only the exact number of connected devices.

5.2.3.3 Add HART Commands

Select the "Node (x)", right-click and select "Add Command".



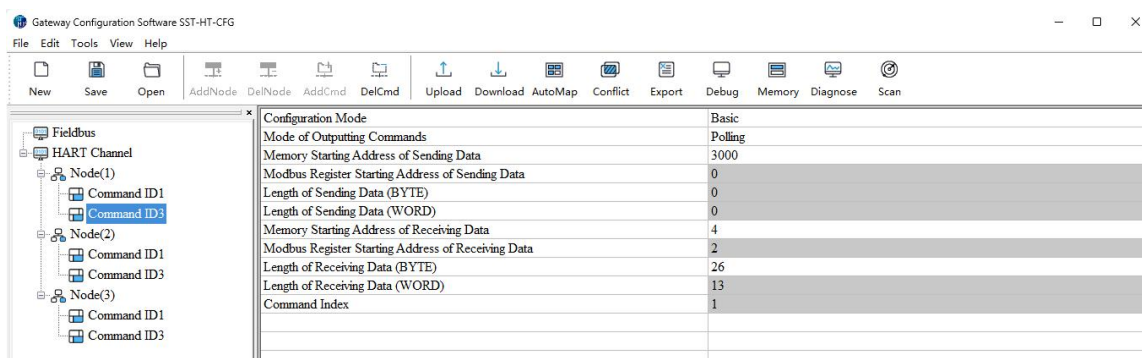
Choose the command you want in the popup menu, and then click "OK" to exit:



Note: The same command can only be configured once in one node.

5.2.3.4 Configure HART Commands

Click the command number in the tree view. You will see the configuration plate in the right place:



Configuration Mode: Basic and advanced optional, "basic" is shown as above, "advanced" configuration can refer to [chapter 5.2.3.7](#).

Command output mode: You can select the command execution mode, change-of-state output, polling output, Initialization output and disable output optional:

Change-of-state output: Executes the command once when the HART data buffer changes.

Polling output: This order is put in the polling list, executed periodically.

Initialization output: Execute the command only once when power is on.

Disable output: The command will not be sent.

Memory starting address of sending data: Set the memory starting address of output data by this command, the range is 3000~3999.

Modbus register starting address of sending data: The property is automatically calculated by gateway, used for register addressing.

Sending data length (BYTE): Used to set the length of output data by this command.

Sending data length (WORD): The property is automatically calculated by gateway, used for user checking output data length, 1 word=2 byte.

Memory starting address of receiving data: Set the memory address of input data by this command. Response data only includes data area of HART frame.

Modbus register starting address of receiving data: The property is automatically calculated by gateway, used for register addressing.

Receiving data length (BYTE): Set the length of input data by this command.

Receiving data length (WORD): The property is automatically calculated by gateway, used for user checking output data length conveniently, 1 word=2 byte.

Command index: The property is automatically calculated by the configuration software, it indicates the index in the configured command list this command belongs to.

5.2.3.5 Delete Commands

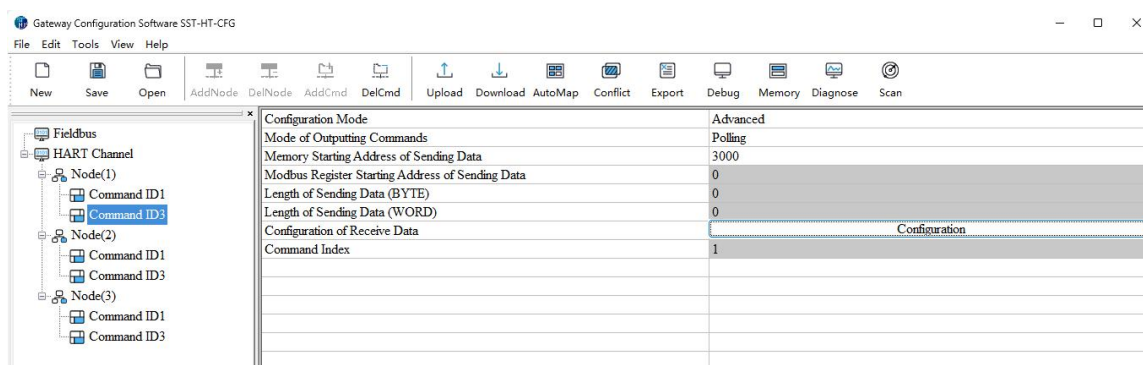
Select the command, right-click and select "Delete Command". Through the menu command can also be the same action.

5.2.3.6 Delete Nodes

Select the node needed to be deleted, right-click and select "Delete Node". You can also perform this action via the menu bar.

5.2.3.7 Advanced Options to Configure Slave Commands

When using HART command configuration, sometimes users want to get one part data of one command. For example, No.1 HART command. The float value of main variable is only needed, no need to get unit of main variable, this is why advanced option exists. Advanced options is actually the execution of "segment mapping function", which parses the HART command response data and extracts specific byte segments. Users can get any part data they want. Below is the interface of Advanced Options:

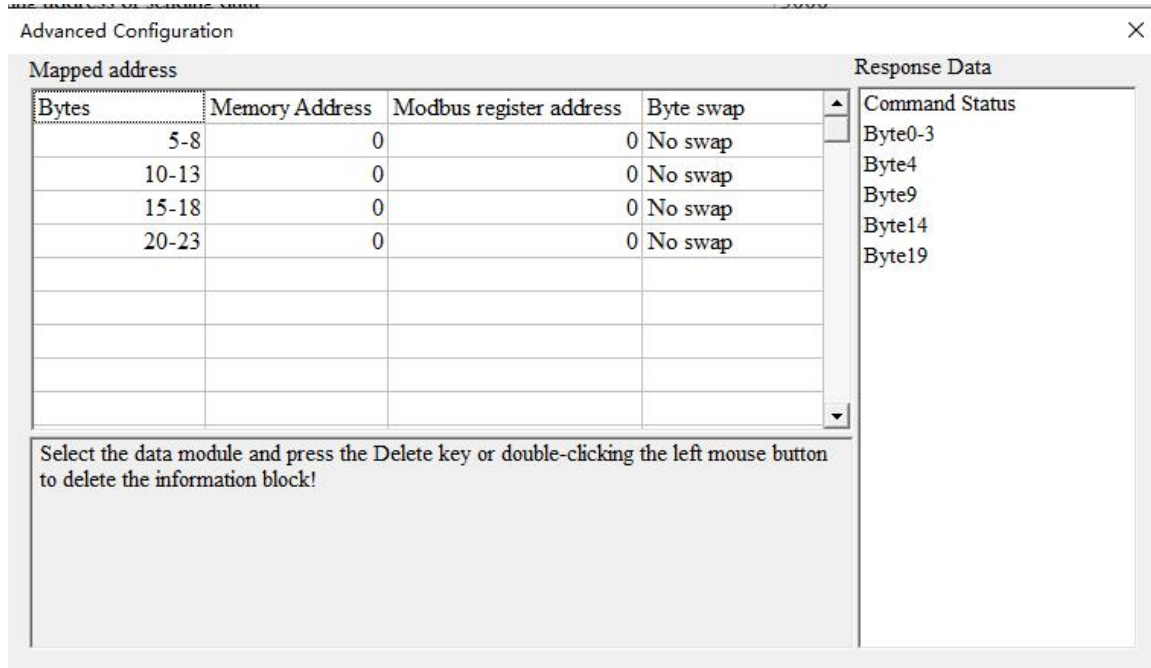


This interface details is described in [chapter 5.2.3.4](#), so here we don't describe it. The below is the example of No.3 HART command, to show how to use "Segment Mapping" function, we can see one "configuration" button after the "receive data project configuration" option, click it:

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There are many parts in "Bytes". For example, "Command Status" means the communication status and relevant code of HART response command, "Byte0-3" means byte 0 to 3 of data area of HART response command, and so on.

In the above example, click "Byte5-8" will show the Primary Variable in the left bottom area. Other column have the relevant explanation.

First to explain the "Mapped Address":

Bytes: Response bytes of "Response Data".

Memory Address: Assigned memory address which this byte is located in memory buffer area of GT200-HT-RS.

Modbus register address: The relevant Modbus register address of "Memory Address". Note: this address is not a single address, that is the same memory area which it occupied.

Byte swap: There are two options, "no swap" and "register swap", swap option is only valid to float type data. When using "no swap", the byte order is byte1, byte2, byte3 and byte4. After using "register swap", the byte order will be byte3, byte4, byte1 and byte2. For example, the original data is 0x12345678, it will be 0x56781234 after using "register swap".

Close the dialog box, download the configuration into GT200-HT-RS.

Others are the same with "Basic Mode".

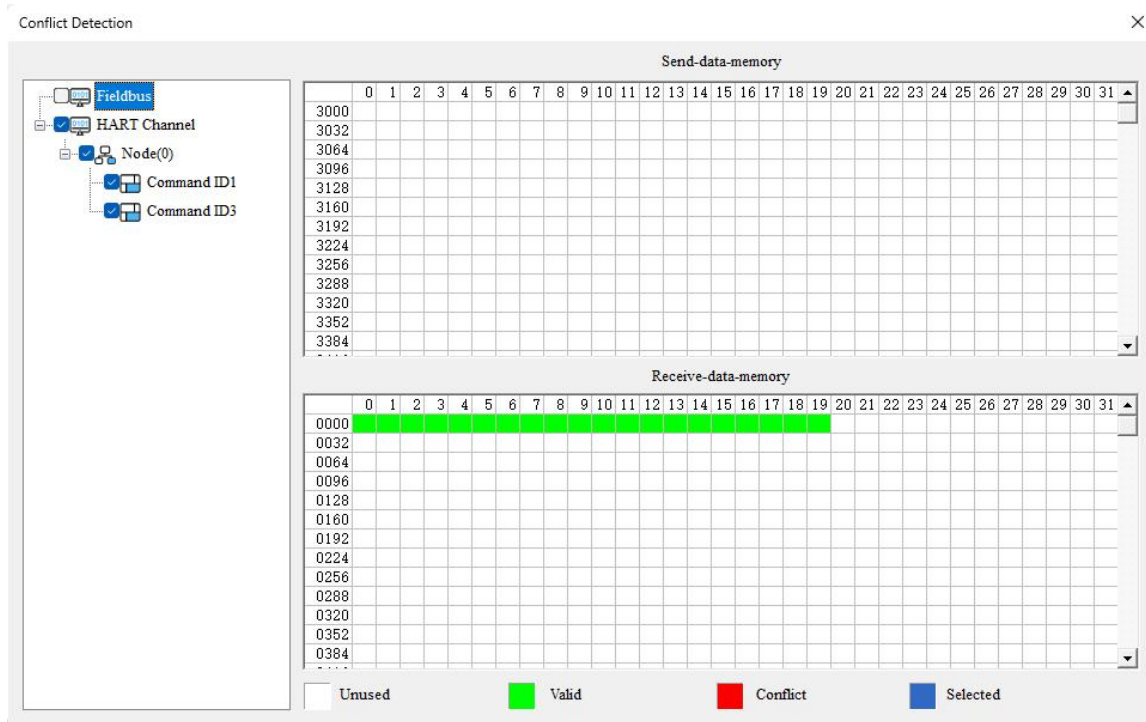
5.2.4 Conflict Detection

Conflict detection is used to check the distribution condition of the input and output data of all commands stored in the memory.

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Click **Conflict** icon will show the conflict detection interface as follow:



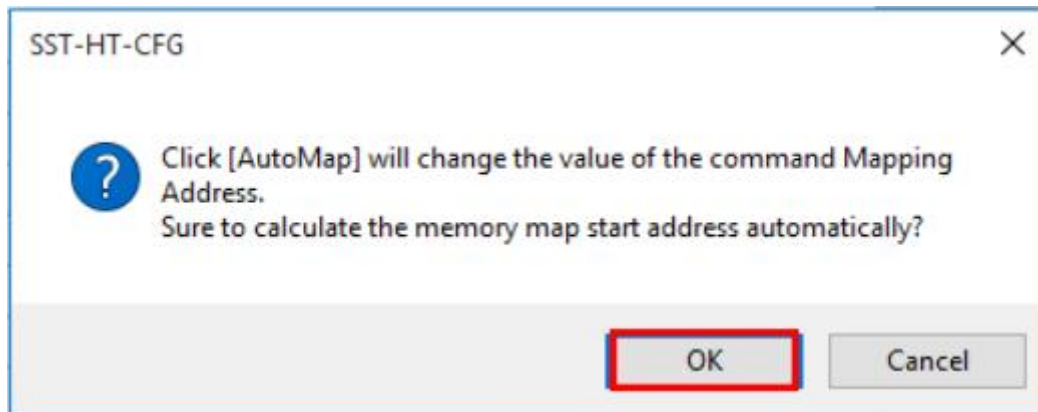
The left side is configuration commands, the right side is data memory address including receive data storage address and send data storage. Upper side is memory distribution of the HART's sending data. lower side is memory distribution of the HART's receiving data. When one memory unit is configured with two commands or more, the memory unit will display red color. When the distributed memory exceeds the defined scale of gateway, the exceeding part will display yellow color. White color area shows the usable memory. Green color area indicates occupied memory. Clicking one command, the distribution shown in blue will show the storage location of input/output data.

5.2.5 Auto Mapping

Automap allocates conflict-free memory addresses based on the input/output bytes number by users' commands.



You should set the correct input/output bytes for each commands, then click **AutoMap** label, select "OK" in the popup menu.

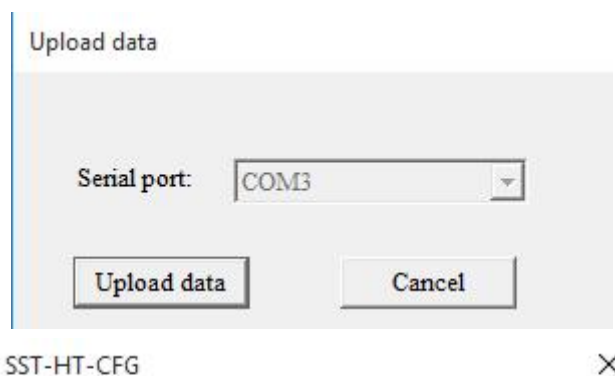


5.2.6 Upload configuration

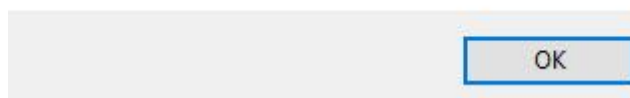


Upload

Open the software "SST-HT-CFG", Click on the icon **Upload**, Select the computer port connected to the gateway and then click "upload data", If it shows "upload successfully", which indicates that configuration file had been uploaded to the SST-HT-CFG.



Uploading the configuration is successful.



5.2.7 Download Configuration



Click the icon **Download** . it will download the configuration into the gateway.

5.2.8 Memory Data Display

This feature displays the internal data exchange of the gateway, allowing users to use this function to debug the HART fieldbus in the absence of the Modbus master station. Steps are as follows:

1. Set the DIP switch’s debug bit to ON state and the configuration bit to OFF state, restart the gateway.
GT200-HT-RS is in the debug mode.
2. Use a serial port line to connect the GT200-HT-RS’s RS-232 port and computer RS-232 serial port or use USB way to connect it, open the software "SST-HT-CFG", Click "Config—Serial Connection", Select the correct serial port



3. Click "Tool—Show Memory Data" or click on the icon **Memory** , Interface is as follows:

Memory data

Input data

Save

Stop

Addr	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
0000	C0	40	44	69	BF	FF	44	69	00	00	41	B8	00	00	42	C8
0016	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0032	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0048	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0064																

Output data

Save

Load

Send

Stop

Addr	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
3000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
3016	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
3032	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
3048	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
3064																

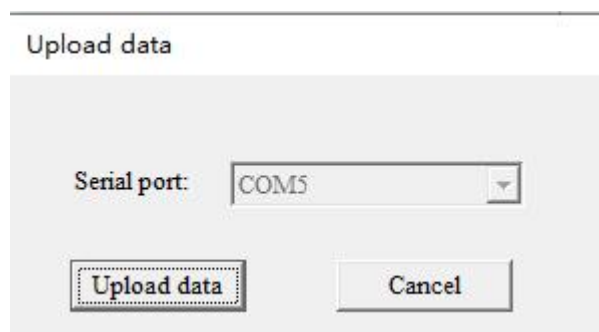
As is shown in the table, upper table shows the memory distribution of HART input data, lower table shows the output data. When you need to change the output data, click the "stop" button firstly, then change the related data or load the already saved data table, at last, click the "sending data".

5.2.9 Diagnose

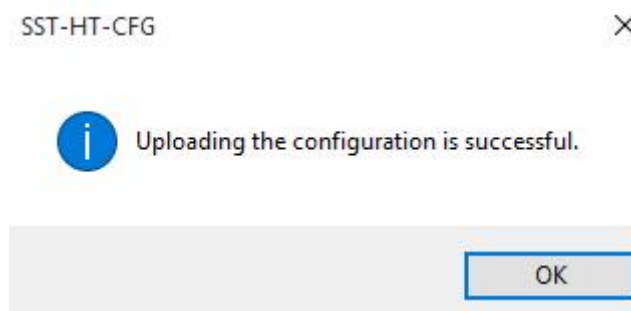
Through this function users will know which device is not communicating, execution condition of configured commands, data transmit of gateway and displays of certain command, operating steps are as follows:

1. Set the DIP switch's debug bit to ON state and the configuration bit to OFF state, back online.
GT200-HT-RS is in the debug mode.
2. Use a serial port line to connect the GT200-HT-RS's RS-232 port and computer RS-232 serial port or use USB way to connect it, open the software "SST-HT-CFG", Click "Config—Serial Connection", Select the correct serial port

3. Click "Tool—Diagnose" or click on the icon  **Diagnose**, Interface is as follows:



4. Click "Upload data" will see a picture as below:

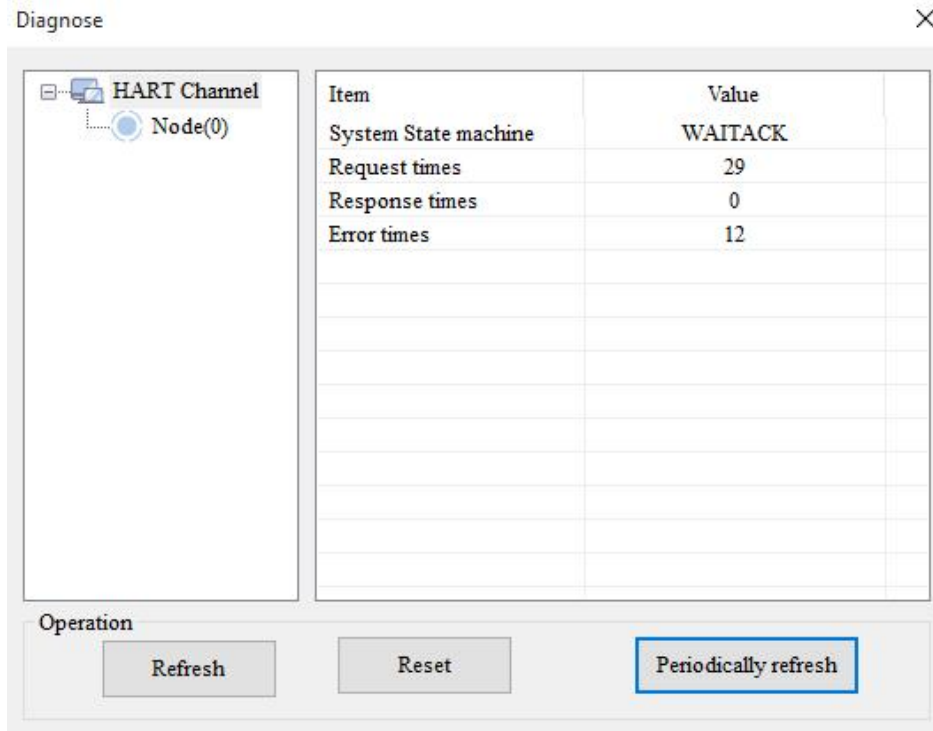


5. Click "OK" button to get in the interface of diagnose:

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Click on "HART Channel" in this interface, it will show the status of HART fieldbus part in the right place, press "Refresh" button will update the data once, click on "Periodically refresh", the software will update the data every 500ms.

6. Click Node(x), it is shown as below:



Click "Refresh" will fresh these command status, "Periodically refresh" will fresh command status once.

- [illegible]

Double click "CMD19" will show the window as below:

[illegible]

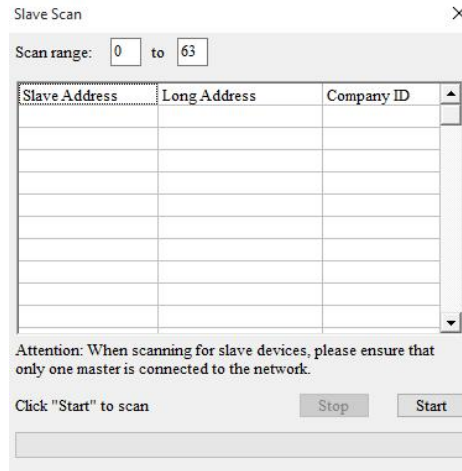
Click the value or attribute you want to change, like "Final Assembly Number", change relevant values, and click "Modify" can execute this operation of write command.

5.2.10 Scan

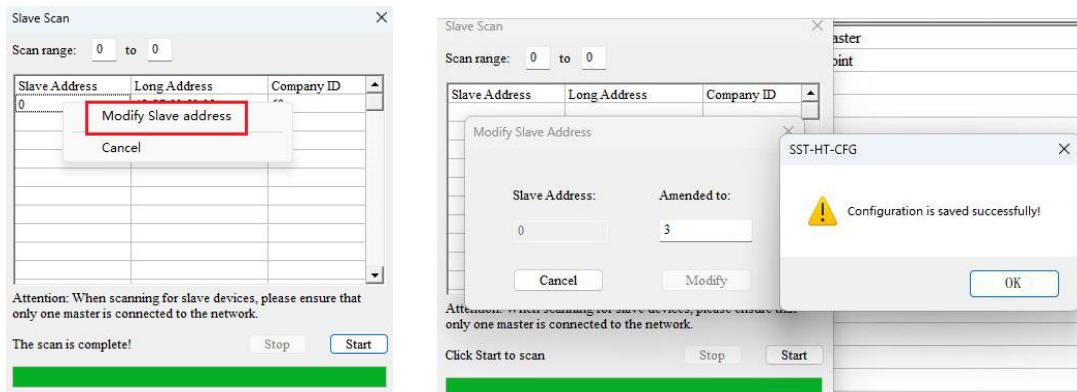
The 'Scan' function allows users to easily view the address of the HART slave device and modify the slave address. To use this feature, follow these steps:

- (1) Set the DIP switch on the GT200-HT-RS to '1ON2OFF', then power it up again. The GT200-HT-RS will now operate in debug mode.
- (2) Connect the GT200-HT-RS's USB to the computer, open the SST-HT-CFG software. Click the 'Menu Bar - Tools - Serial Connection' and select the correct COM port.
- (3) Click the 'Menu Bar-Tools -Scan' / 'Toolbar-Scan' button, the Slave Scan will pop up:

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In the 'Slave Scan' interface, click 'Start'. The interface will display the HART Slave Address, Long Address, and Company ID of the HART slaves connected to the gateway on this channel. Right-click on the corresponding device and click 'Modify Slave Address' to open the 'Modify Slave Address' window. In the text box, enter the new address you want to change to, and click 'Modify'. After the modification is successful, the gateway needs to be powered off and restarted.



5.2.11 Serial Debug

This function allows you to send any request message to HART instruments and record the response information. Steps are as follows:

1. Set the DIP switch's debug bit to ON state and the configuration bit to OFF state, restart the gateway. Now GT200-HT-RS is in the debug mode.
2. Use a serial port line to connect the GT200-HT-RS's RS-232 port and computer RS-232 serial port or use USB way to connect it, open the software "SST-HT-CFG", Click "Config—Serial Connection", Select the correct serial port.



Debug

3. Click "Tool—Serial Debugging Assistant" or click on the icon , Interface is as follows:

Serial Debug

Head:

Data:

Check:

☐ Auto-send

Auto-send period(ms)

FF FF FF FF FF 86 11 0A 00 09 26 01 07 00 00 20 44 69 C0 2E 57

In this interface, click "Auto-send" or "Send" combines the header, data, and checksum into a single frame and transmits it. The data that the gateway received from HART fieldbus will be shown in the blank place below. The "Checksum" button only checks part of the data. Here is an example.

The Serial Debug window contains the following fields and controls:

- Head:** A text box containing "FF FF FF FF FF".
- Data:** A large text box containing "02 01 00 00".
- Check:** A text box containing "03", with a "Checksum" button next to it.
- Auto-send:** A checkbox that is currently unchecked.
- Auto-send period(ms):** A text box containing "500", with a "Clear" button next to it.
- Buttons:** "Send" and "Pause show" buttons.
- Output Area:** A large empty text area at the bottom for displaying received data.

In this example, command ID0 is composed of data head, data and check code. It uses short address. when you click "Send", you will get the response data.

Note: Under this function, gateway will stop to execute the configured command. Turn off this function, gateway will return to execute the configured command.

5.2.12 Useful Tools

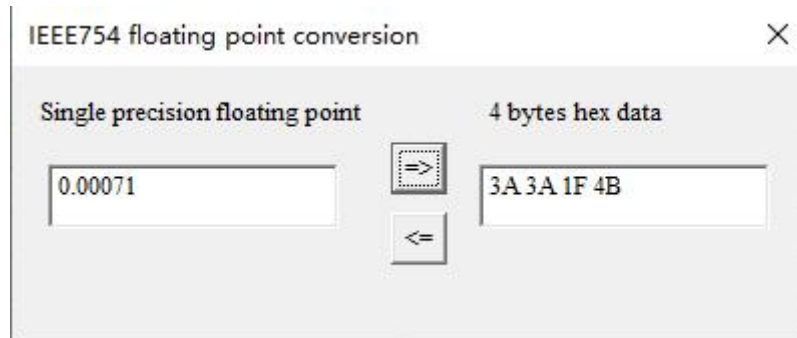
In the "Tools" menu, there are two useful tools: They are used to finish data conversion.

PACKED ASCII conversion:

The Packed ASCII Translate window shows the conversion of ASCII data to Hex:

- Uncompressed data (ASCII):** A text box containing "TECH".
- Compressed data (Hex):** A text box containing "50 50 C8".
- Buttons:** "<=" and ">=" buttons between the two text boxes.

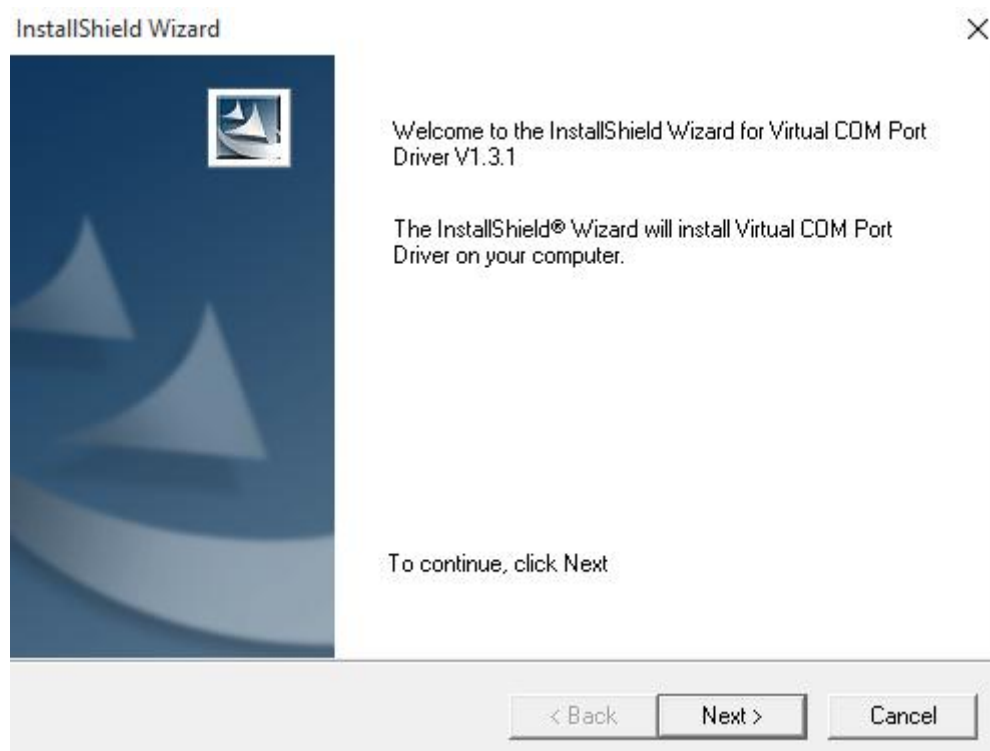
IEEE 754 conversion:



5.2.13 Use USB Port

For now, USB port is only used for debugging and configuration. Its function is the same as RS-232 under configuration and debug. After installing USB driver, this USB driver will generate a virtual COM port on PC, GT200-HT-RS can communicate with PC through this virtual COM port. Please ensure that this USB driver is installed before using this function.

Installing driver, as show below:



Click "Next",

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Device Driver Installation Wizard



Click "Next",

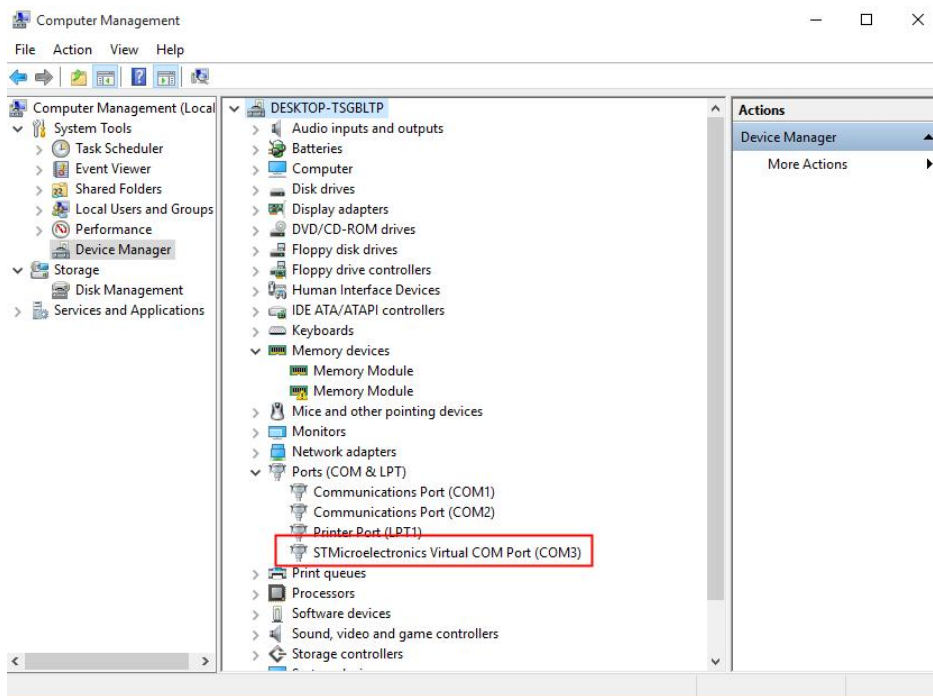


Click "Finish", to finish the installation of USB driver.

How to find this virtual COM port? Use USB cable line to connect GT200-HT-RS and PC, set bit 2 of DIP switch

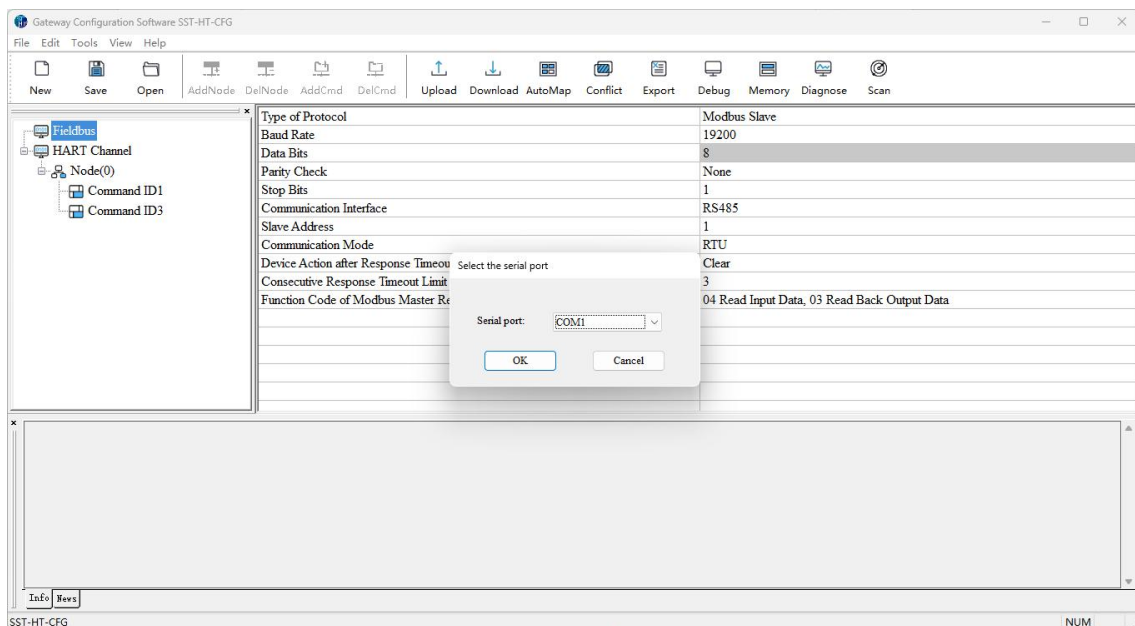
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to ON, and power on the product. Open the "Computer Management" of PC, you will find there is one new COM port under "Port (COM&LPT)", as shown "STMicroelectronics Virtual COM Port (COM3)", that is the virtual COM Port:



Noted: Different computer, the serial number will be different.

Open SST-HT-CFG software, click "Config" and choose Serial port, here choose COM3, as shown below:

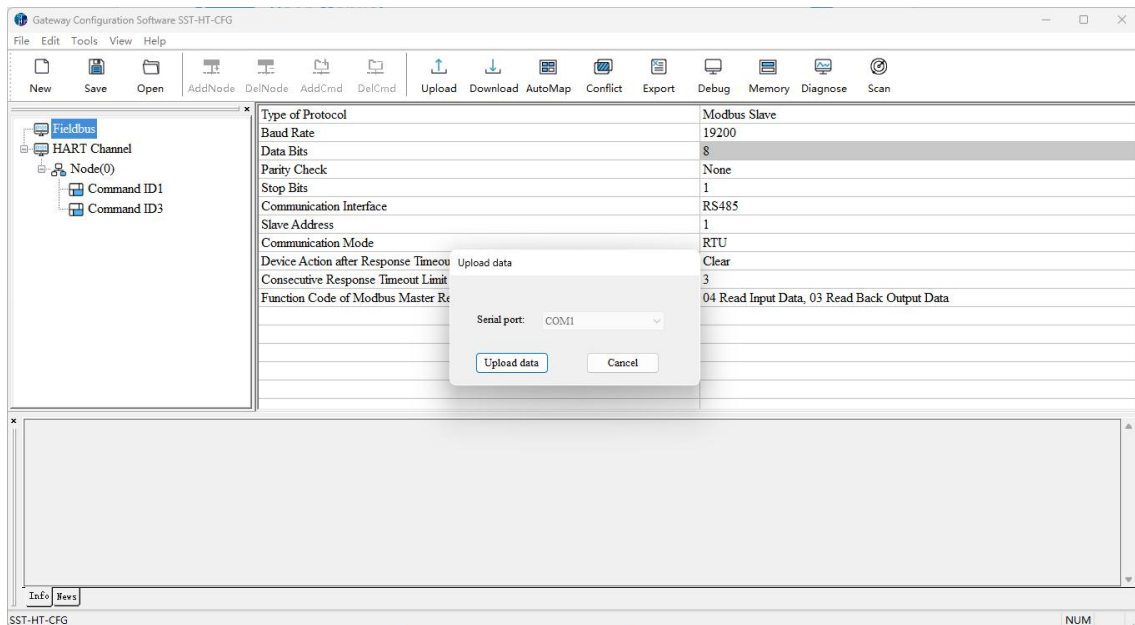


After choosing serial port, click "Upload" on the toolbar:

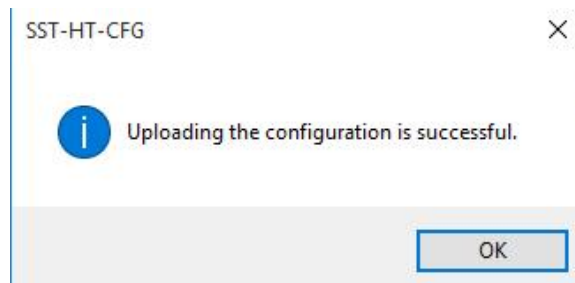
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After clicking Upload data, it will show uploading succeeded:



5.3 HART Communicator Description

When the gateway is in configuration mode, the LED digital tube displays "CF". Press and hold the button for 3 seconds, and the digital tube will display "HC". At this time, the gateway enters the HART communicator mode. In the HART communicator mode, it can be connected to the configuration software to configure the HART devices on the line. After testing, this product is compatible with most HART configuration software on the market.

Note that after switching the mode, if the original USB port is in use, it will be disconnected. The system will generate a virtual serial port named 'STMicroelectronics Virtual COM'. This serial port is the channel for data transmission between the gateway and the configuration software. After opening the HART configuration software, you need to accurately find this port in the port settings option of the software.

Connection process:

1. Open the configuration software and select the port where the connected virtual serial port is located. The name is "STMicroelectronics Virtual COM".
2. Complete the configuration settings and successfully connect to the HART device. The configuration



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software can also be used for advanced functions such as device status monitoring, data acquisition and analysis, and remote control. For specific operations, please refer to the official documentation of the configuration software.

Note:

1. When the GT200-HT-RS product is used as a HART communicator, please pay attention to whether there is a sampling resistor on the line. If not, you can use the sampling resistor built in the device. Otherwise, turn the sampling resistor DIP switch to the off position.
2. If the virtual serial port with this name is not found in the port list, first check whether the gateway has correctly entered the HART communicator mode (which can be confirmed by the digital tube displaying 'HC') and whether the USB interface is well connected. You can also try restarting the configuration software and the computer and then check the port list again.

6 Working Principle

The gateway allocates 5,000 bytes of internal memory to serve as input and output data exchange buffers. Memory of 0 to 2999 acts as the storage area of the HART input data and device status. Memory of 3000 to 4999 acts as storage area of the HART output data and control variables. The specific assignment shown in the table below:

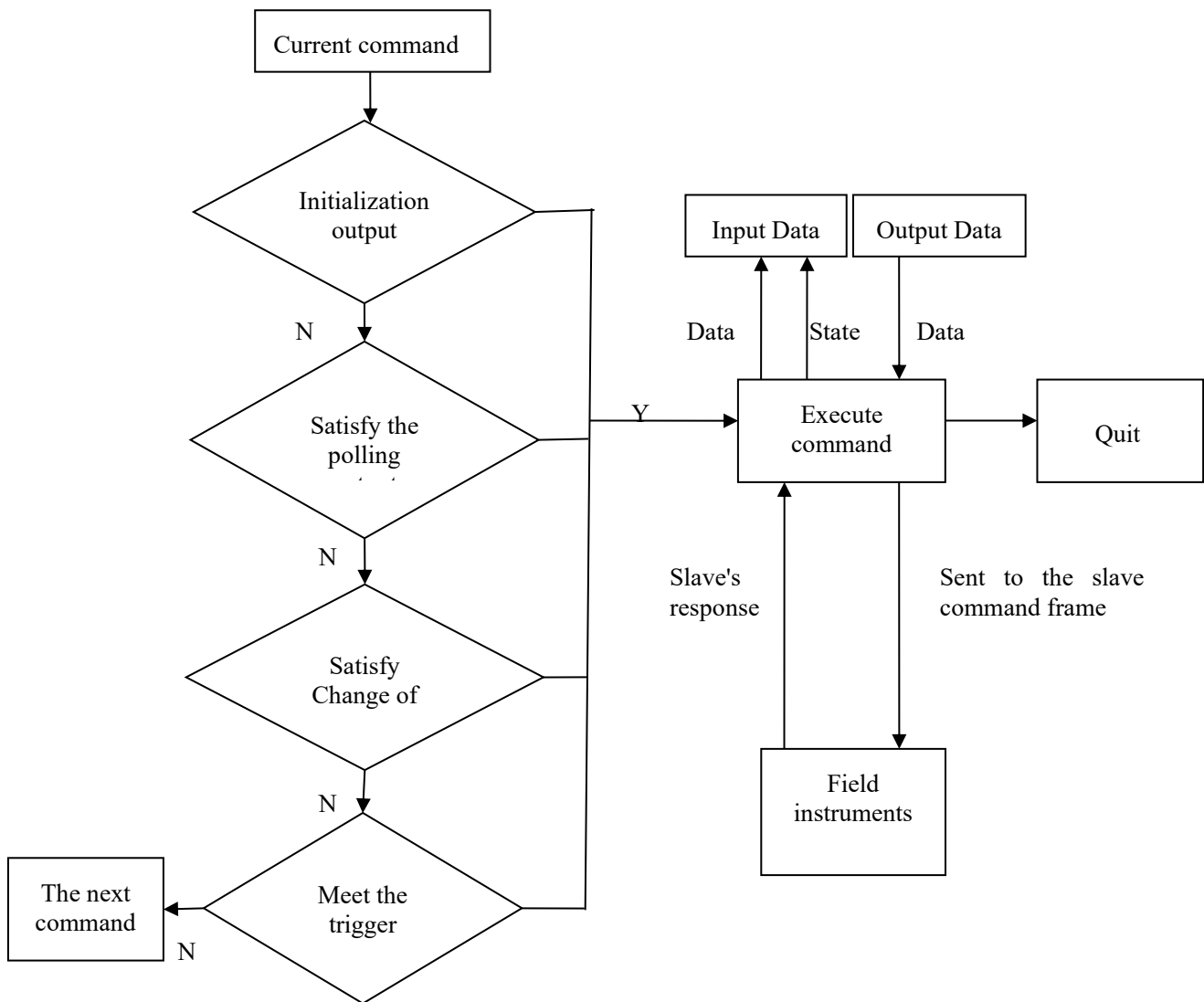
	Gateway memory address	Corresponding Modbus register address	Description
Read-only part	0-1599	0-799	The HART data input area
	1600-1619	800-809	Device 0_cmd0 data
	1620-1639	810-819	Device 1_cmd0 data
			Device 15_cmd0 data
	1920	960H	Gateway status
	1921	960L	Send times of Gateway's HART port
	1922	961H	Receive times of Gateway's HART port
	1923	961L	HART communication error times
	1924-1943	962-971	Reserved
	1944	972H	Device 0_cmd0's response status
	1945	972L	Device 1_cmd0's response status
			Device15_cmd0's response status
	1960-2119	980-1059	The response status of the user command
	2120-2391	1060-1195	Reserved
	2392	1196H	Universal Receive Flag
	2393	1196L	Universal receive Error Counter
	2394-2395	1197	Universal receive data length
	2396-2695	1198-1347	Universal receive data
	2696-2999		Reserved
Readable and writable part	3000-3999	0000-0499	The HART data output area
	4000	0500H	Reset Send/Receive/Error Counters
	4001	0500L	Polling enabled
	4002	0501H	Trigger label
	4003	0501L	Trigger command number

	4004-4269	0502-0634	Reserved
	4270	0635H	Universal send label
	4271	0635L	Universal mode enabled
	4272-4273	0636	Universal send data length
	4274-4573	0637-0786	Universal to send data

- The HART data input area: Store the data that HART slave device sends to gateway.
- The HART data output area: Store the data that the gateway sends to the HART slave device.
- Device 0_cmd0~ Device 15_cmd0: When operating a slave command for the first time, the gateway internal will automatically execute the No. 0 command to obtain the device information (to obtain the long address). The response data of this internal command is stored in this area.
- Gateway status: The gateway status indicates what the gateway state is in the HART network, defined as:
 - 0---- No HART communication
 - 1----sending
 - 2---- Waiting for a response
 - 3---- Handling a response
- Send times of HART port on gateway: The HART send counter.
- Receive times of HART port on gateway: The HART receive counter.
- HART communication error times: The HART Receive error counter.
- The response status of Device 0_cmd0~ Device 15_cmd0: Show that the response status of the internal command.
- The response status of user command: Show that the response status of the user command.
 - Command state is defined:
 - 0---- Not executed
 - 1---- Correct response
 - 2---- Parity error
 - 3---- No answer
 - 4---- Error defined in agreement
 - 5---- Not connected
- Universal Receive Flag: The receive flag under the universal mode, a change in this value indicates that the HART interface has received a new frame.
- Universal receive data length: Indicating the received data length under the universal mode.

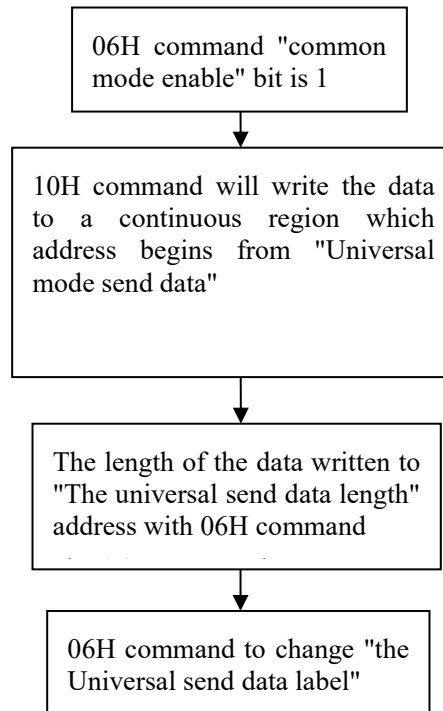
- Universal Receive Error Counter: Indicate the universal receive error number.
- Universal receive data: Store the received data at HART side under the universal mode.
- Reset Send/Receive/Error Counters: The gateway's control signal, changing this memory value resets all communication counters to 0.
- Polling is enabled: This bit is readable and writable, writing 1 enables the polling output, writing 0 disables polling output. Reading 1 indicates that the polling state is enabled, 0 indicates that the polling is in the disabled state.
- Trigger label: Change the value will result in a trigger operation.
- Trigger command number: Command number executed by trigger operation.
- Universal mode enabled: The value of 1 indicates a universal transfer function is enabled, otherwise disables universal transport function.
- Universal send flag: The send label under the universal mode, this value changes in time will lead to send a HART frame.
- The universal send data length: The length of send data under the universal mode.
- Universal to send data: Data needs to send under the universal mode.

6.1 Flow chart of Executing One HART Command



6.2 Universal Send and Receive Data

There are two universal ways for user to select: One is that fieldbus is defined as universal mode. The gateway frames incoming serial data using a 3.5-character timeout mechanism and send out the data unmodified from the HART interface. Gateway sends data out from serial which is received from HART interface without modification. The character timeout is determined by baud rate, such as 19200, Character timeout is considered to be $(1/19200) * 10 * 3.5 \approx 2\text{ms}$. The other is to start transmit-receive of HART common frame of HART indirectly through Modbus command, here is an example:



The gateway will store the received HART frame in a continuous region within "the Universal receive data" as a starting address and write the length of the received data in the "Universal received data length". Then change the value of the Universal receive label". If no data is received within the response waiting time, the gateway will order "universal receive error counter" to plus 1. Before sending the general frame, user should read the universal receive label and the error counter. After transmitting the general frame, it needs to read these two values continuously until one of them changes.

6.3 Trigger Command

Users can use Modbus command to trigger any HART command which is configured by gateway. The specific approach is: using command ID6 of Modbus to write the user command number which needs to be triggered (when SST-HT-CFG configures commands, the software will automatically calculate and display) to the "trigger command number". Then rewriting "the trigger label" can trigger the value to change and trigger the gateway to finish a trigger operation. Parts of response data in the device will be stored to "the receive data memory" which specified by this command number.

6.4 Data Exchange with Modbus

When fieldbus is configured as "Modbus slave", user can exchange data, inquire about the status of gateway and

manage according to the corresponding address of gateway in the internal input and output buffer. Also you can do some trigger operation and transmission of common frame.

6.5 Troubleshooting (Common Technical Issues)

Issue	Possible Cause	Solution
No HART response	Incorrect Slave Address	● Use the SST-HT-CFG configuration tool and verify that the HART Slave Address matches the address of the HART devices. Refer to 4.1.2 Configuration. ● If connecting multiple HART slave devices, ensure the HART Network is on Multi-drop mode. Refer to 4.1.2 Configuration.
LED not blinking	Incorrect DIP mode Resistor Issue	● Ensure that the gateway is on appropriate mode (i.e. Run Mode or Configuration mode). Refer to 2.3 DIP Switch. ● The internal resistor can support up to 13 HART devices. If connecting up to 13 HART devices, it is recommended to use internal resistor (270Ω) and ensure to "Enable" the internal resistor. If connecting up to 15 HART devices, an external resistor is required (250Ω) to be used and ensure to "Disable" the internal resistor. Refer to 2.5 Internal/External Sampling Resistor Switch.
Configuration failed	Wrong COM port Incorrect DIP mode	● Ensure that the correct port is being used. Refer to 4.1.2 Configuration. ● Ensure that the gateway is on CF mode (Configuration Mode). The LED display the current mode of the gateway. Refer to 4.1.1 Connection.

7 Modbus Master Communication

GT200-HT-RS Gateway provides a solution for HART instruments to communicate with Modbus master through RS-485 or RS-232 interface. The gateway acts as a slave. The following example illustrates how the gateway communicates with Modbus Poll (Modbus RTU/ASCII master emulation software).

1. Configure point-to-point mode (HART address is 0) with HART Commands ID1, ID3 and ID6. The common HART command format can be found in Appendix B, and the configuration is as follows:

- (1) When configuring HART Command ID1, the response is 2 bytes more than the actual one (command state) because HART Command ID1 is without request. In the command state, byte 0 (primary variable unit) and the primary variable are 7 bytes in total, and after mapping to 4 Modbus register addresses, there will be 1 byte extra, resulting in the last 3 bytes of the primary variable being placed in the last 2 Modbus registers, and the actual primary variable value cannot be read. So it should be configured to advanced mode to extract the primary variable for direct acquisition.

Command ID1: Read primary variable (PV)

Returns the value of the primary variable as a floating-point type

Request: None

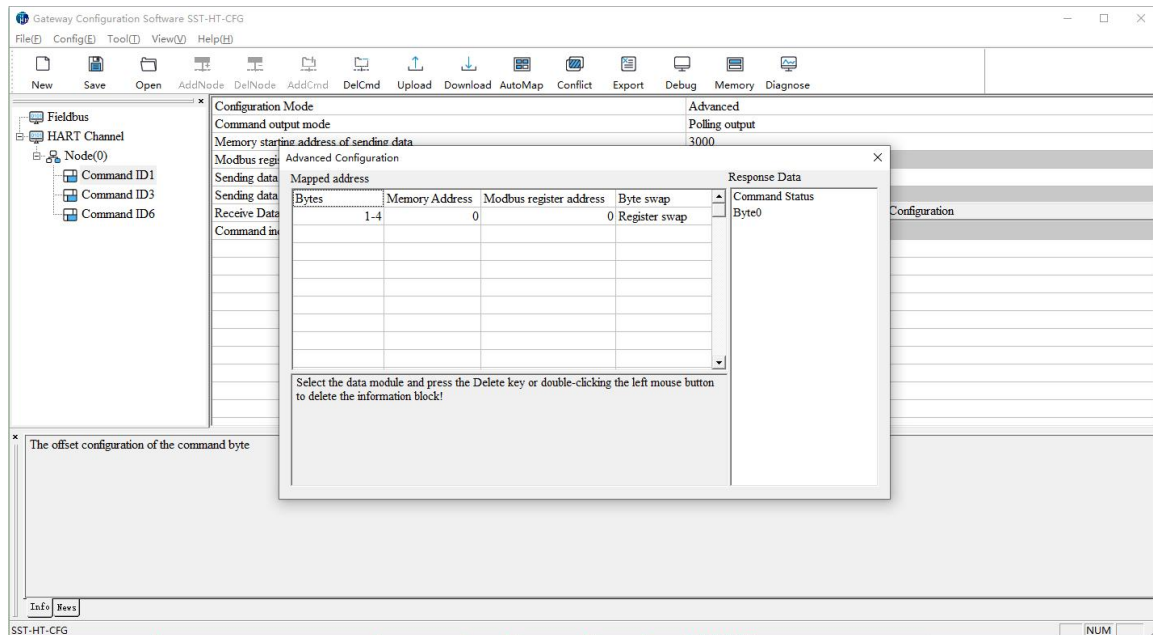
Response:

Byte	Description
Byte 0	Primary Variable Units
Byte 1-4	Primary Variable

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(2) When configuring HART command ID3, use the advanced function to configure the primary variable (PV), the secondary variable (SV), and the tertiary variable (TV).

Command ID3: Reads four (predefined) dynamic variables and the primary variable current

Reads the primary variable current and 4 (at most) pre-defined dynamic variables, the primary variable current always matches the device's AO output current. primary, secondary, tertiary and quaternary variables defined for each device type.

Request: None

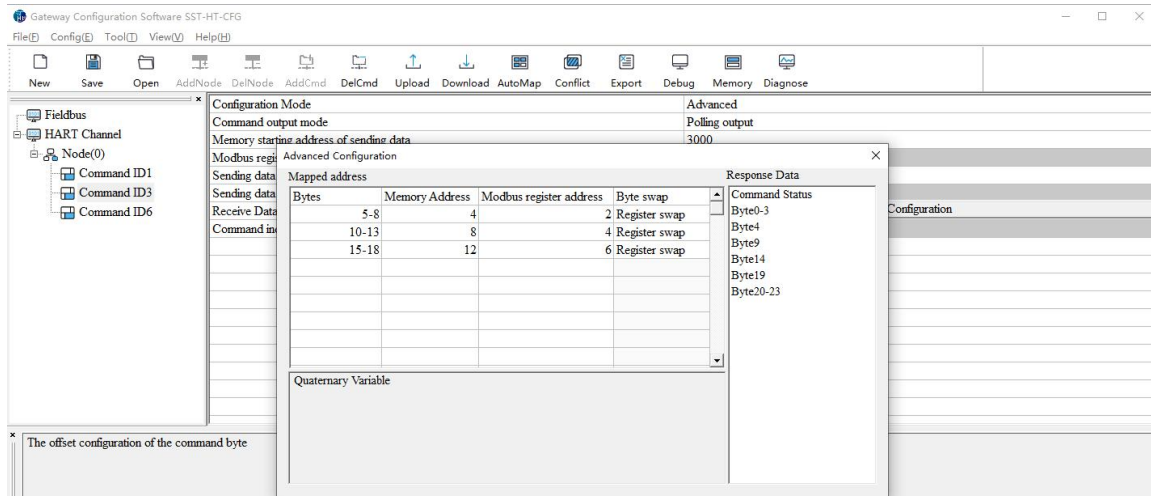
Response:

Byte	Description
Byte 0-3	Primary Variable Loop Current (units of milli-amperes)
Byte 4	Primary Variable Units Code
Byte 5-8	Primary Variable
Byte 9	Secondary Variable Units Code
Byte 10-13	Secondary Variable
Byte 14	Tertiary Variable Units Code
Byte 15-18	Tertiary Variable
Byte 19	Quaternary Variable Units Code
Byte 20-23	Quaternary Variable

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(3) The configuration of HART Command ID6 is used to modify the address of the HART device.

Command ID6: Write POLLING address

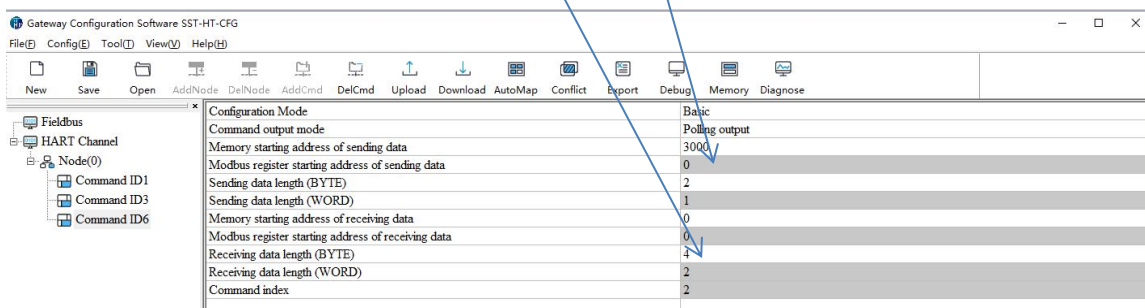
This is the data link layer management command. This command writes the Polling address and loop current mode to the field device.

Request:

Bytes	Description
Byte 0	Polling Address (Between 0-15)
Byte 1 (Only on supported HART devices)	Loop Current Mode (0=Disabled, 1=Enabled)

Response:

Bytes	Description
Byte 0	Polling Address (Between 0-15)
Byte 1 (Only on supported HART devices)	Loop Current Mode (0=Disabled, 1=Enabled)



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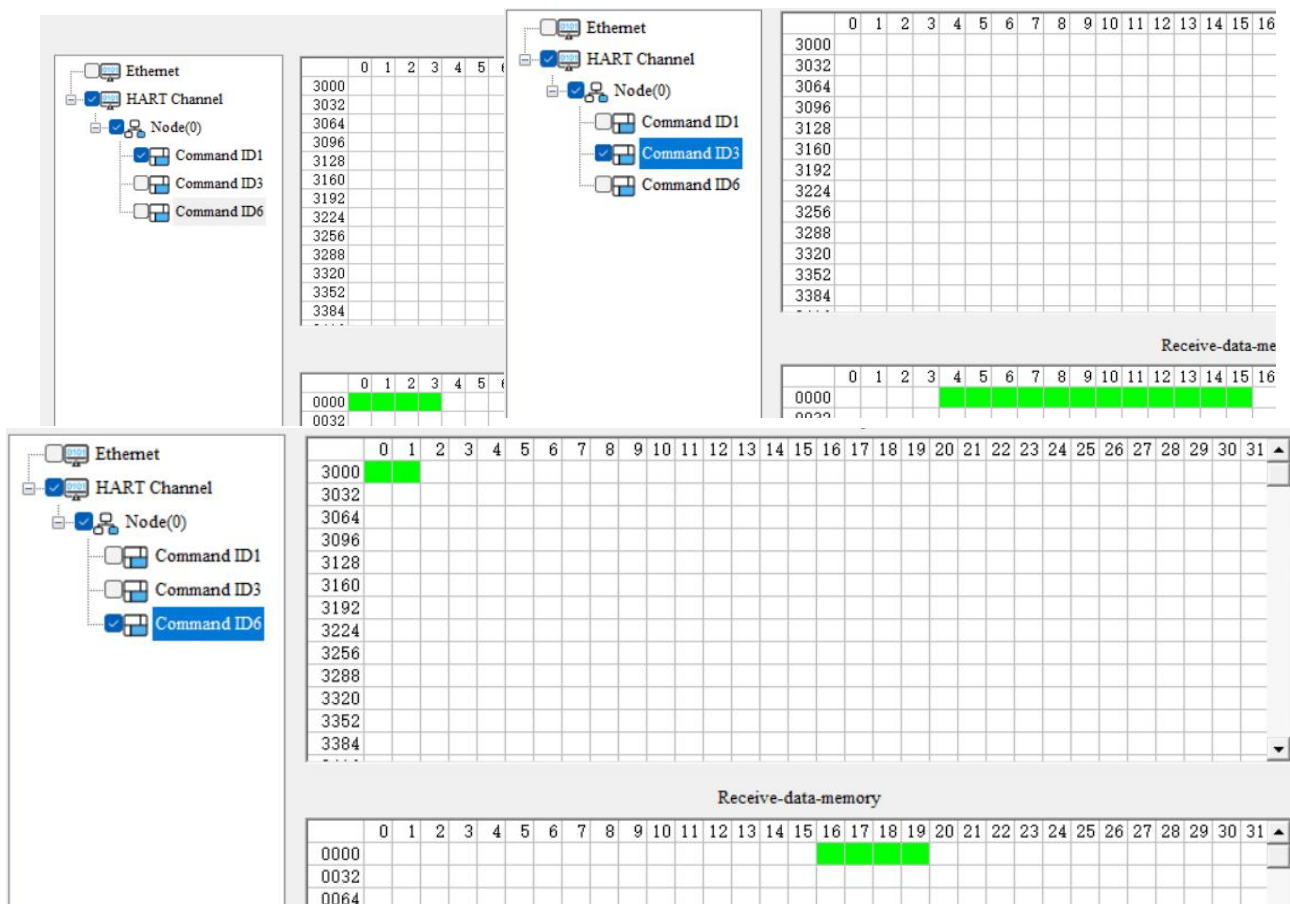
Conflict



AutoMap

- Click **Conflict**, through **AutoMap**, to view the mapping address of the command in the gateway buffer. The primary variable of HART Command ID1 corresponds to gateway input buffer 0-3, Command ID3 corresponds to 4-15, Command ID6 request corresponds to output buffer 3000-3001, and response corresponds to 16-19. as follows:

Modbus RTU/ASCII Master uses 04 function code, using 3x0001-3x0002 corresponding to the primary variable of HART Command ID1, 3x0003-3x0008 corresponding to the primary variable of HART Command ID3, the secondary and tertiary variables. 3x0009-3x0010 corresponds to the command status of HART Command ID6, the Polling address and loop current mode of the device with the 06/16 function code. The use of 4x0001 should correspond to the Polling address and loop current mode of the requested device of HART Command ID6.



- Use Modbus Poll and the gateway to connect and read/write data with the following configuration:

Connection Setup

Connection: OK Cancel

Serial Port:

Serial Settings: COM3 Mode: ☒ RTU ☐ ASCII

19200 Baud Response Timeout: 1000 [ms]

8 Data bits Delay Between Polls: 10 [ms]

None Parity Advanced...

1 Stop Bit

Remote Modbus Server

IP Address or Node Name: 192.168.0.86

Server Port: 502 Connect Timeout: 3000 [ms] ☒ IPv4 ☐ IPv6

Read/Write Definition

Slave ID: OK Cancel

Function: 04 Read Input Registers (3x) Address mode: ☒ Dec ☐ Hex

Address: 0 PLC address = 30001

Quantity: 10

Scan Rate: 1000 [ms] Apply

Disable: ☐ Read/Write Disabled ☐ Disable on error Read/Write Once

View: Rows: ☒ 10 ☐ 20 ☐ 50 ☐ 100 ☐ Fit to Quantity

☒ Hide Name Columns ☐ PLC Addresses (Base 1)

☐ Address in Cell ☐ Enron/Daniel Mode

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4. Use Modbus POLL to read data (3x0001-3x0010) and write data via 4x0001. The data in the gateway buffer can be viewed in **Memory**) and the actual floating-point data of the HART device can be viewed via **Diagnose**

The screenshot displays the Gateway Configuration Software SST-HT-CFG interface, showing the Modbus Poll configuration, Memory data, and Command IO data.

Modbus Poll - Mbpoll2 Configuration:

Alias	Value
0	0x0000
1	0xBFD8
2	0x4469
3	0x3333
4	0x4073
5	0x20BF
6	0xD844
7	0x6920
8	0x0000
9	0x41C0

Memory data:

Addr	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
0000	BF	D8	44	69	33	33	40	73	20	BF	D8	44	69	20	00	00
0010	41	C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Command IO data:

Item	Value
Primary Variable	935.002869
Primary Variable Units Code	(null)
Secondary Variable Units	(null)
Tertiary Variable Units Code	(null)
4th Variable Units Code	(null)
4th Variable	0.000000

Modbus Poll - Mbpoll1 Data:

Alias	Value
0	0x0000
1	934.998

Command IO data (Detailed):

Item	Value
Primary Variable Current	3.800000
Primary Variable Units Code	(null)
Primary Variable	934.997009
Secondary Variable Units	(null)
Secondary Variable	24.000000
Tertiary Variable Units Code	(null)
Tertiary Variable	0.000000
4th Variable Units Code	(null)
4th Variable	0.000000