

3-channel HART/ Modbus Serial Gateway GT200-3HT-RS

User Manual

V 1.1

REV A



SST Automation

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Catalog

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1 Product Overview

1.1 Product Function

GT200-3HT-RS gateway is designed to exchange data between multiple channel HART and Modbus. HART interface can be configured as a primary master or the secondary master. GT200-3HT-RS acts as slave at the Modbus side.

1.2 Product Features

- 3 independent HART channels with transformers-isolated;
- Supports interconnection between HART and Modbus, transparent transmission between HART and serial port data.
- Rich debugging functions: Visual display of data exchange, HART slave's command diagnosis and common debug features are greatly convenient to user's communication test.

1.3 Technical Specifications

- [1] HART interface can be used as a primary master or a secondary master;
- [2] Supports 3 independent HART-channels, under multi-point mode, each channel supports connecting at most 13 instruments with gateway internal resistor and supports connecting 15 instruments with an external resistor (250Ω/2W);
- [3] HART interface supports single-point and multi-point mode;
- [4] Under single-point mode, supports data burst operation;
- [5] Supports all commands of the HART protocol;
- [6] Each HART command can be configured for change-of-state output, polling output, initialization output or disable output;

- [7] Each channel of HART supports up to 100 HART commands, HART output buffer up to 2000 bytes, and the input buffer up to 3000 bytes;
- [8] Each channel can choose to use an internal or external HART sampling resistor;
- [9] Modbus interface is standard RS-485 port, baud rate: 300, 600, 1200, 2400, 9600, 19.2K, 38.4K, 57.6K, 115.2Kbps selectable;
- [10] Serial side can be configured as Modbus slave, support function code: 03H, 04H, 06H, 10H;
- [11] Modbus slave supports RTU and ASCII communication mode;
- [12] The RS-485 port can be configured as universal mode, transparent data transmission with one HART channel is available;
- [13] Power supply: 24VDC (9V~30V), <60mA (24VDC);
- [14] Working circumstance temperature: -4°F~140°F (-20°C~60°C), Humidity: 5%~95% (non-condensing);
- [15] External dimensions(W*H*D): 1.57 in*4.92 in *4.33 in(40mm*125mm*110mm);
- [16] Installation: 1.38 in (35mm) DIN RAIL;
- [17] Protection Level: IP20.

1.4 Safety and Explosion-proof Features

GT200-3HT-RS is not the product with the features of safety and explosion-proof, please put it in the control room when using.

1.5 Related Products

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

If you want to get more information about these products, please visit SSTCOMM website:

<http://www.sstcomm.com>.



1.6 Revision History

| Revision | Date | Chapter | Description |
|----------|-----------|-----------|------------------------------------------------------------------|
| REV A | 2/11/2017 | Chapter 4 | V1.1 new release, adding advanced option configuration function. |

2 Quick Start Guide

The following example introduces the use of the Gateway GT200-3HT-RS.

2.1 Configuration of Gateway parameters

2.1.1 Pre-configured Settings

1. Power on the gateway;
2. Connect the Gateway's RS232 interface and the serial port of the computer with a serial cable, wiring methods see section 3.4.3 of this manual;

2.1.2 Software Configuration

1. Open the SST-HE-CFG software installed on your computer.

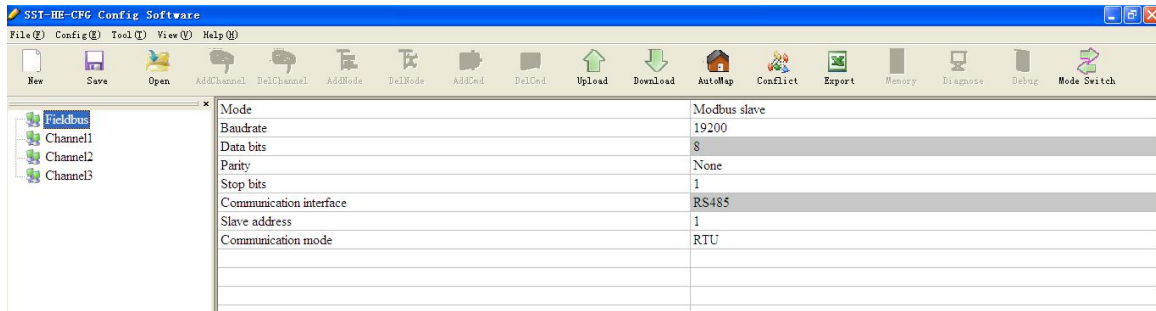


2. Choose "Config" in the pop-up mode selecting dialog box.



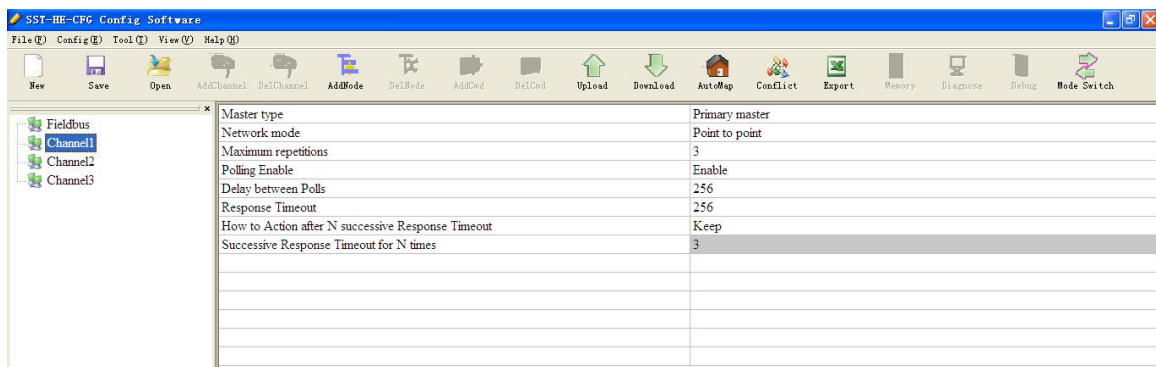
3. Click "Fieldbus" in the tree view on the left, the configuration table on the right is configured as below:

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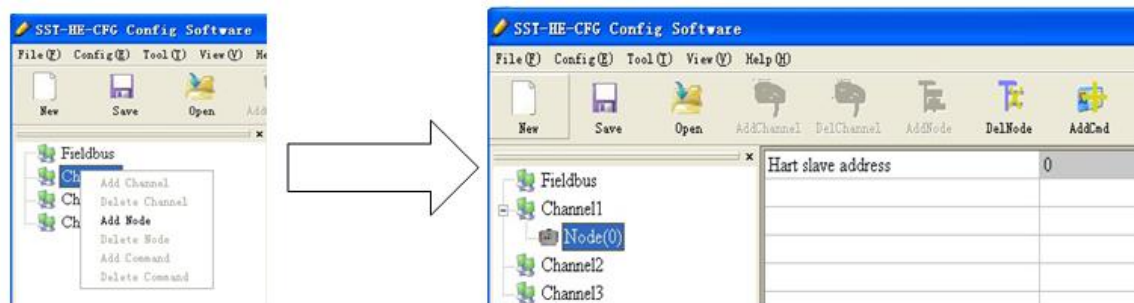
Press Enter to confirm when configuration is completed.

- Click “Channel1” in the tree view on the left, the configuration table on the right is configured as below:



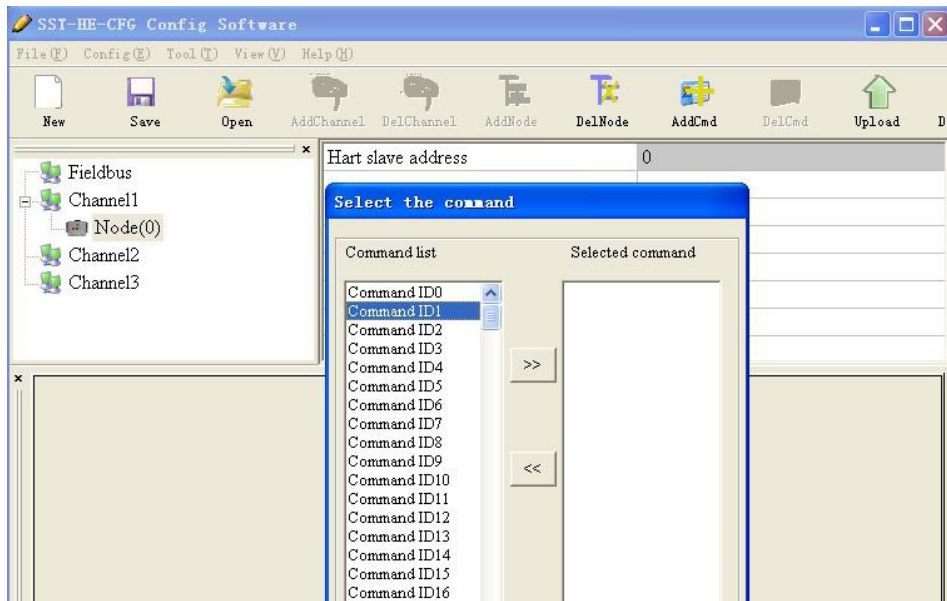
Press Enter to confirm when configuration is completed. Note: HART protocol specifies that the slave device which address is 0 must work in single-point mode, allows digital communication and analog communication to exist simultaneously. The device with address 1~15 works in multi-point mode, the analog output of the device is the minimum value (e.g. 4mA), only allows digital communication. The protocol also specifies that the fieldbus device default address is 0 before delivery.

- Right-click Channel1, in the pop-up menu, select “Add Node”, as shown below:



- Right-click “Node(0)”, in the pop-up menu selects “Add Command” to add a command (Command ID1) in the dialog box, and then click OK to return.

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7. Click the “Command ID1”, the configuration table on the right is configured as below:

| | |
|----------------------------------------------------|----------------|
| Mode of outputting commands | Polling output |
| Memory starting address of sending data | 3000 |
| Modbus register starting address of sending data | 0 |
| Sending data length (BYTE) | 0 |
| Sending data length (WORD) | 0 |
| Memory starting address of receiving data | 0 |
| Modbus register starting address of receiving data | 0 |
| Receiving data length (BYTE) | 7 |
| Receiving data length (WORD) | 4 |
| Command index | 0 |

Press Enter to confirm.



8. Click the icon  in the pop-up dialog box, select the serial port that gateway is connected to the computer, and then click Download:





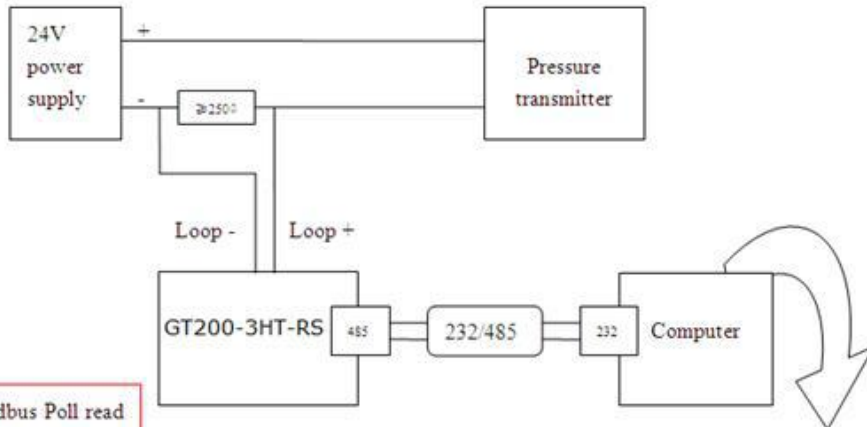
2.2 Function Demo

HART interface of the gateway connects with a 2-wire pressure transmitter with slave address 0, RS485 interface is connected to the computer through RS485/RS232 converter, and computer with configured Modbus POLL software can simulate to work as a Modbus master, then in data exchange window you can see the main variable value of the pressure transmitter:

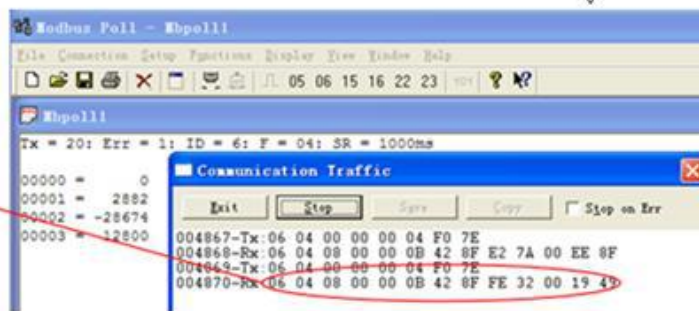
GT200-3HT-RS

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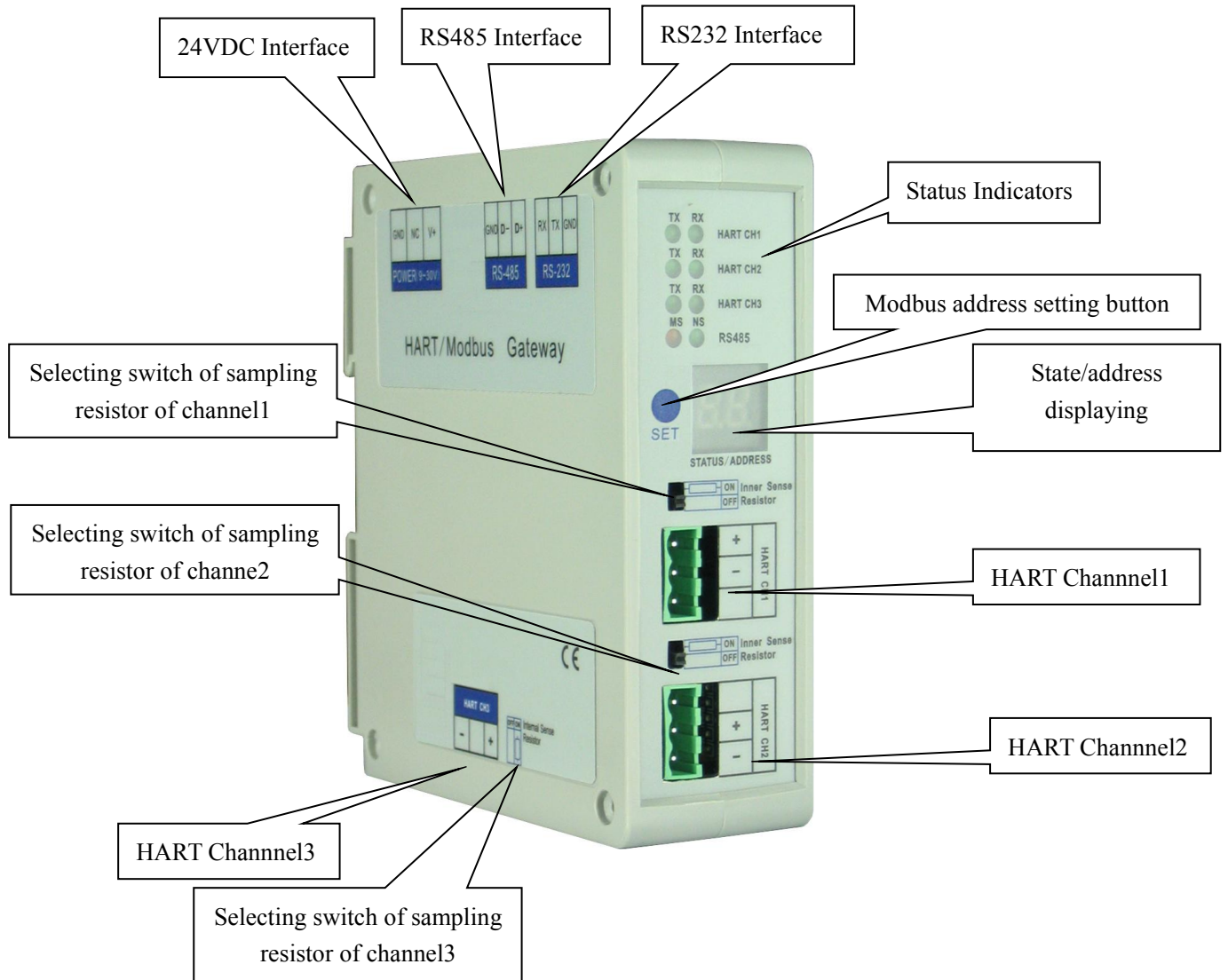


The Modbus Poll read the HART data "00,00,0B,42,8F,FE,32", where the front double "00" means that the device is in normal state, "0B" indicates that the pressure unit is PSI, "42, 8F, FE, 32" means the pressure value, the value is 71.9964752197266 (psi).



3 Hardware Descriptions

3.1 Product Appearance



Note: This picture is for reference only. Product appearance should refer to the real object.

3.2 Indicators

| Indicator | State | State Description |
|-----------|----------|----------------------------------------|
| TX | Blinking | HART Channel/485 bus data is sending |
| | OFF | No data is sending |
| RX | Blinking | HART Channel/485 bus data is receiving |
| | OFF | No data is receiving |

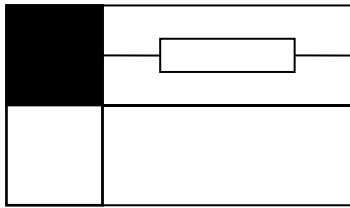
3.3 Configuration Switch/Button

3.3.1 Modbus Address Setting Button

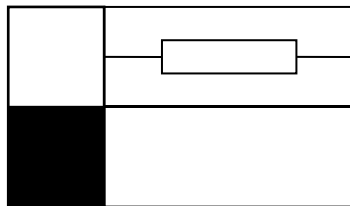
Under normal working condition of the GT200-3HT-RS, digital tube always displays the address of the current Modbus address. Quickly press (double-click) the button twice in succession, the high bit starts to blink, and the low bit is always on, click the button to add 1 to start setting the high bit of Modbus address. Long-press the button for 3 seconds, the high bit is always on, and the low bit starts to flash. Click the button to add 1 to start setting the low bit of Modbus address. At last, long-press the button again for 3 seconds, the address flashing three times shows that the address is set successfully. If no button action within ten seconds, GT200-3HT-RS exits the status of setting address and continue to display the original address. The configurable range of Modbus address is 0 to 99 (Decimal).

3.3.2 Internal / External Sampling Resistor Switch

GT200-3HT-RS can choose using the internal sampling resistor or external sampling resistor to get the HART signal. The specification of the internal resistor is 270Ω, 2W. When the power of the sampling resistor is exceeds 2W, you must use the external resistor.



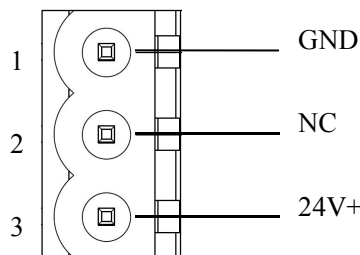
Switch to ON, using the internal sampling resistor



Switch to OFF, using the external sampling resistor

3.4 Interface

3.4.1 Power Interface



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

3.4.2 RS-485

The RS-485 characteristics of GT200-3HT-RS with standard RS-485 interfaces are shown as follows:

1. The basic characteristics of RS-485 transmission technology

- ① Network topology: Linear bus, there are active bus terminal resistors at both sides.
- ② Transmission rate: 1200 bps~115.2Kbps.

③ Media: Shielded twisted-pair cable and also can cancel the shielding, depending on environmental conditions (EMC).

④Site number: 32 stations per subsection (without repeater), and can increase up to 127 stations (with repeater).

⑤Plug connection: 3/5-pin pluggable terminal.

2. The main points on the installation of RS-485 transmission equipment

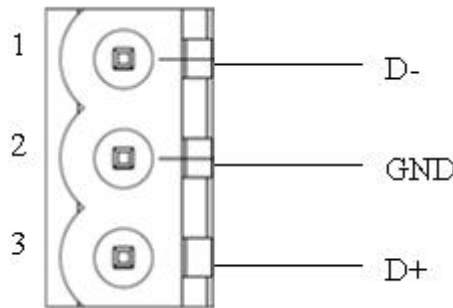
①All the equipment are connected with RS-485 bus;

②Each subsection can be connected up to 32 sites;

③The farthest two end of the bus has a terminal resistor—120Ω 1/2W to ensure reliable operation of the network.

Serial interface uses 3-pin pluggable open terminal and user can wire it according to the wiring instructions on the panel.

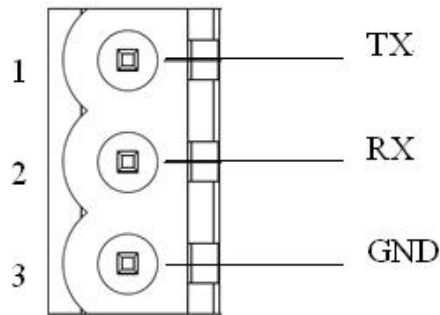
3-pin terminal:



| Pin | Function |
|-----|--------------------------|
| 1 | D-, RS-485 Data Negative |
| 2 | GND |
| 3 | D+, RS-422 Data Positive |

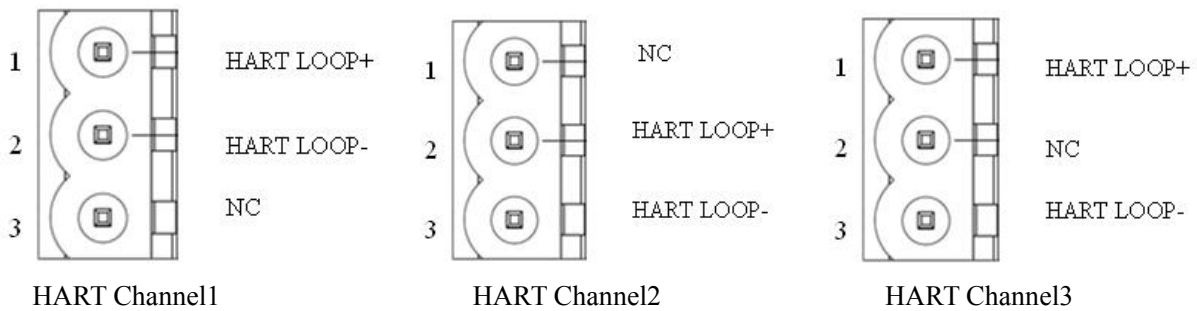
3.4.3 RS-232 Interface

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



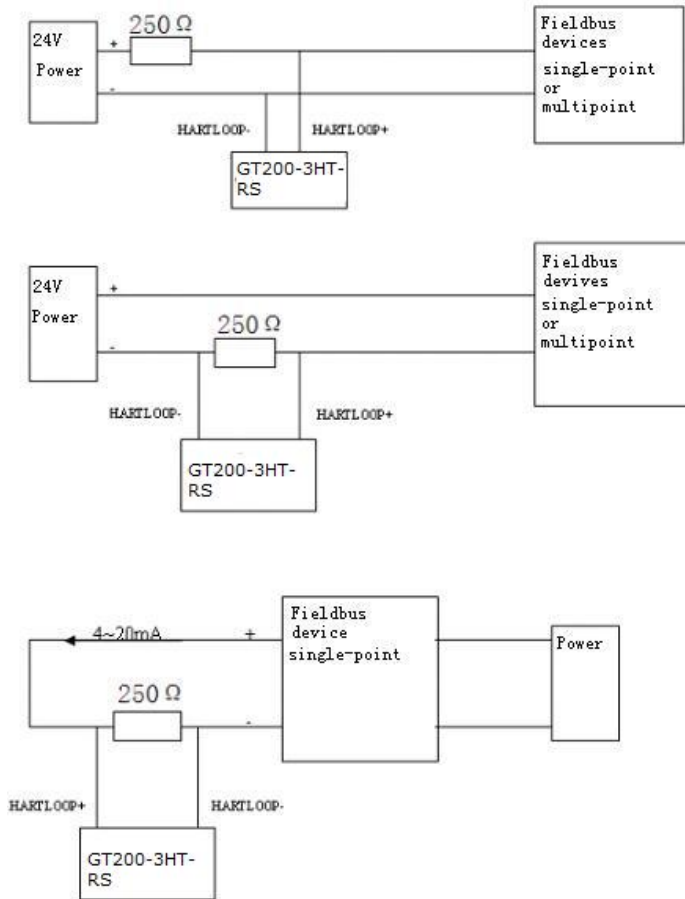
| Pin | Function |
|-----|-----------------------------------------|
| 1 | TX, Connect RS232's TX of user device |
| 2 | RX, Connect RS232's RX of user device |
| 3 | GND, Connect RS232's GND of user device |

3.4.4 HART Interface

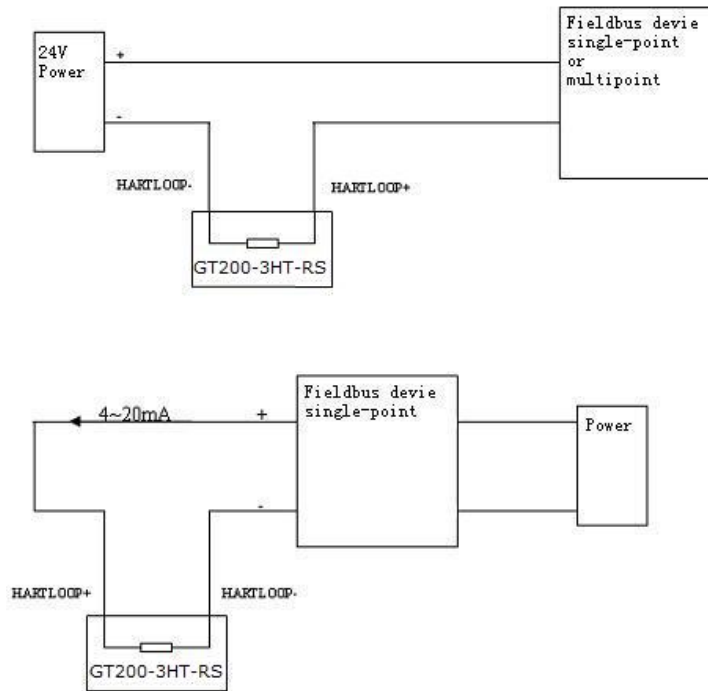


| Symbol | Function |
|------------|------------------------------|
| HART LOOP+ | Connect HART signal positive |
| HART LOOP- | Connect HART signal negative |
| NC | No connection |

3.5 Topology of GT200-3HT-RS and Fieldbus Devices



Not using the internal resistor!



Using the internal resistor!

Note:

1. Some HART slave instrument need to perform self-test and other internal work when power is on, they may not start HART communication, then gateway cannot receive the response data of the instrument right now. It is recommended the HART slave instrument and gateway uses separate power supply so that the gateway can immediately establish communication with instrument.
2. When configuring HART commands in the software SST-HE-CFG, the commands need to be configured according to the actual demands. To improve the speed of bus communication, it is recommended not to configure the empty node (in fact, not connected to the node) and empty commands (the actual unnecessary commands).

4 Software Instructions

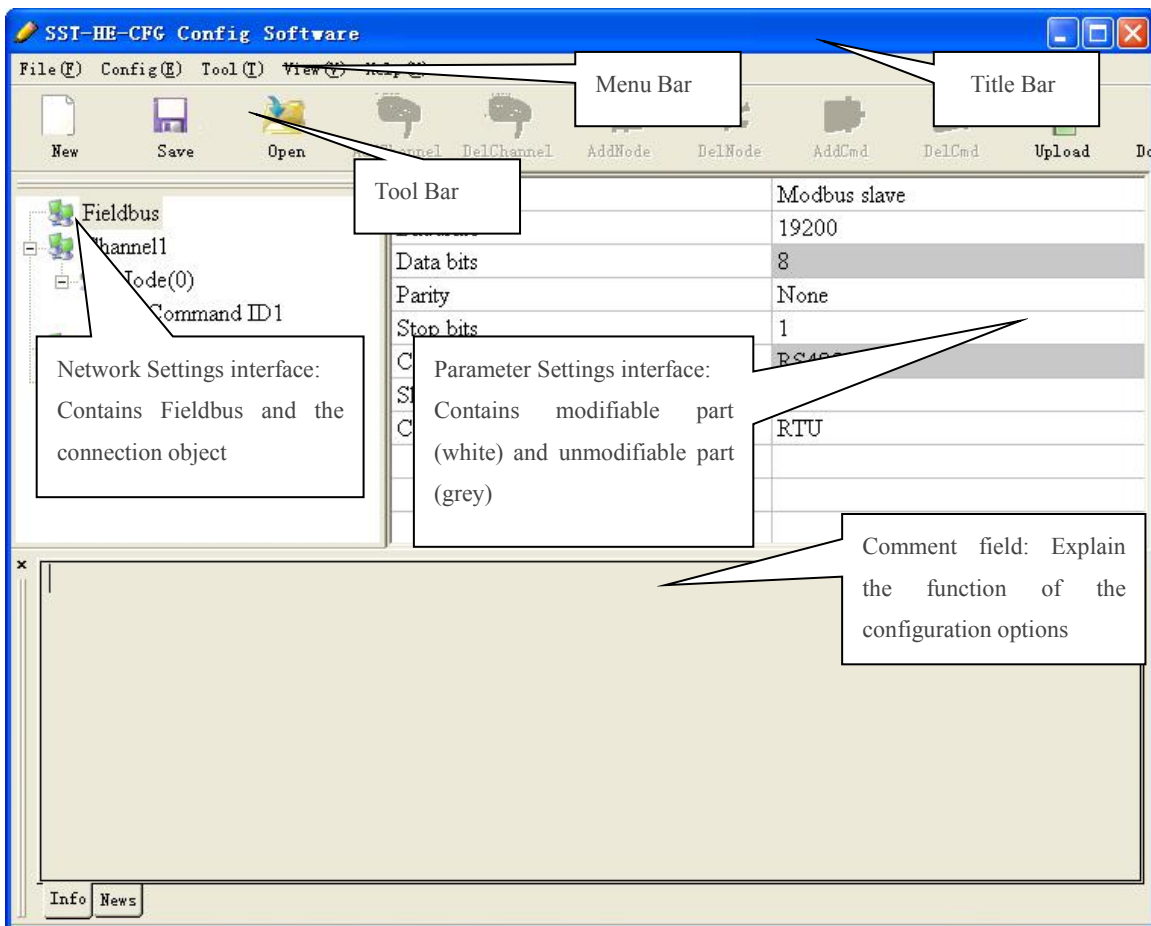
4.1 Software Interface Description

SST-HE-CFG is configuring software based on Windows platform, and used to configure HART series products.

The following describes how to use the software SST-HE-CFG to configure the product GT200-3HT-RS.



Double-click on the icon SST-HE-CFG to enter the main interface of software:



Tool Bar:

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Toolbar interface shown as follow:



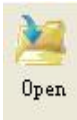
The function from left to right is: New, Save, Open, AddNode, DelNode, AddCmd, DelCmd, Upload, Download, Conflict, AutoMap, Export, Memory, Diagnose, Debug and Mode Switch.



New: Create a new configuration file



Save: Save the configuration file



Open: Open the configuration file



AddNode: Add a HART slave node



DelNode: Delete a HART slave node



AddCmd: Add a HART command



DelCmd: Delete a HART command



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



Download: Download the configuration file to the gateway



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



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



Export: Output current configuration to the local hard disk and saved as Excel spreadsheet form



Memory: Show the data exchange inside of the gateway



Diagnose: through this function the gateway could analyze operating condition of fieldbus device; also it can finish some certain analysis



Debug: through this function the gateway could send any request frame to Hart fieldbus and show the response information received in HART, convenient to debug




Mode switch: Specify that the operation of the gateway is debugging or configuring

4.2 Software Functional Specifications

4.2.1 Mode Selection


There are two ways to operate the gateway through configuration software, one is Config, the other is Debug.

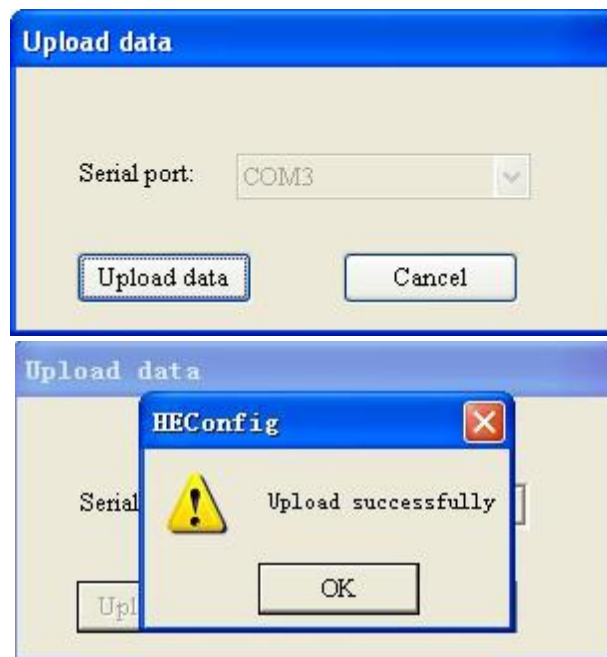


Opening the software will automatically pop up the mode selecting dialog box. When using, you can click  in the toolbar to choose the mode. In config mode, user can upload and download the configuration. After finishing the downloading for 3 seconds, the gateway will automatically reset and make the configuration take effect. In debug mode, user can use memory, diagnose and debug function of software to do some simple debugging task.

4.2.2 Upload Configuration



In config mode, click on the icon , Select the computer serial 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-HE-CFG.



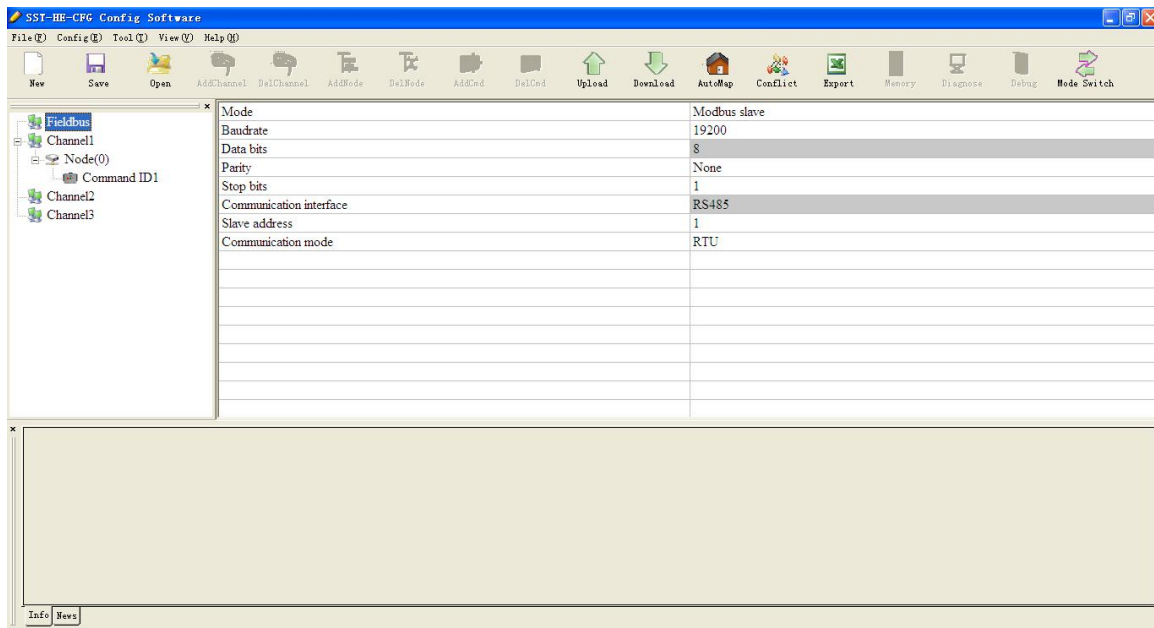
4.2.3 Configure the Fieldbus

4.2.3.1 Configure the fieldbus as modbus slave

Click the “Fieldbus” in the tree view, select mode as “Modbus slave” in the right configuration plate, and then press

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ENTER to confirm, you will see the interface as below:



In this interface you can set the parameters as shown:

Baud rate: 300, 600, 1200, 2400, 9600, 19200, 38400, 57600, 115200bps

Data bits: 8

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

Stop bits: 1, 2

Communication mode: RTU, ASIII

Slave address: 0~247

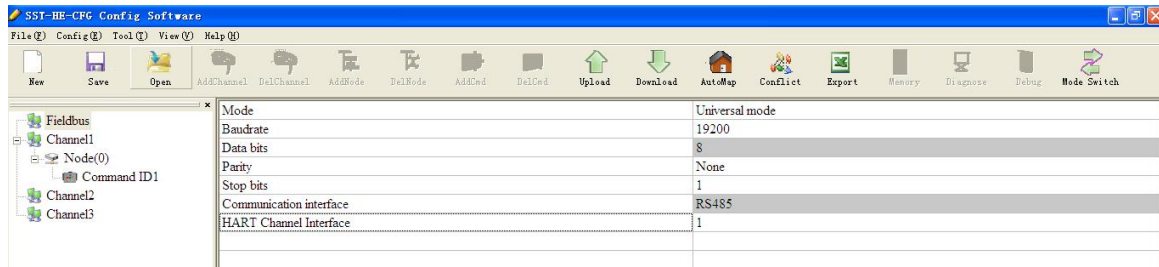
Communication interface: RS485 fixed

4.2.3.2 Configure the fieldbus as universal mode

The universal mode (transparent transmission mode) means that we can send HART frame directly from serial port (RS232/RS485/RS422) to HART fieldbus, meantime gateway also will send out the data received from HART bus through serial port. In this process, the data don't change.

Click the "Fieldbus" in the tree view, select mode "Universal mode" in the right configuration plate, and then press ENTER to confirm, you will see the interface as below:

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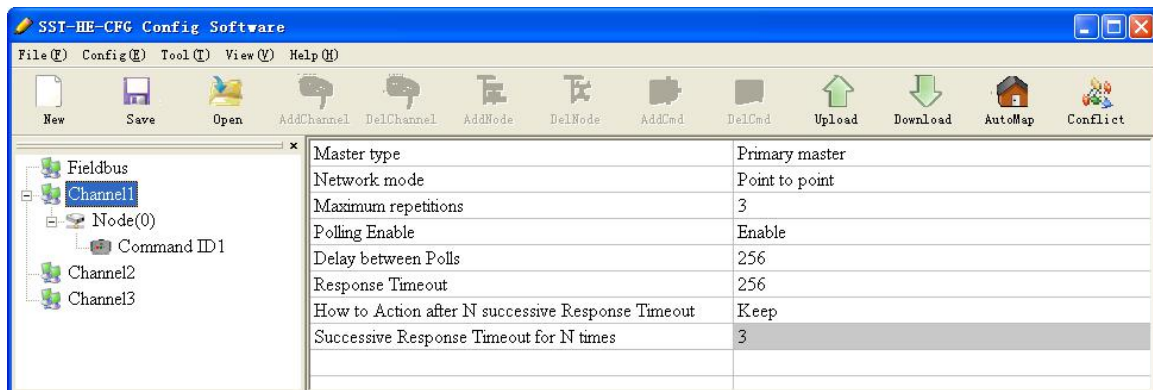


The range and meaning of general mode are the same as “Modbus Slave”.

4.2.4 Configure the HART Fieldbus

4.2.4.1 Set the parameters of HART channel

Click the ChannelX in the tree view, in the right place will show the configuration plate:



Master type: Primary master, Secondary master;

Network mode: Select the network link as single or multiple points, in the single point the gateway can only communicate with the slave device whose address is 0;

Maximum repetitions: Select times of command resending, range: 0~5;

Polling Enable: Enable, Disable

Delay between polls: Set the time of polling command (the interval between starting to send one command and sending next command), range: 256~65535ms

Response timeout: Set the longest time of the gateway waiting for the slave device’s response, range: 256~65535ms

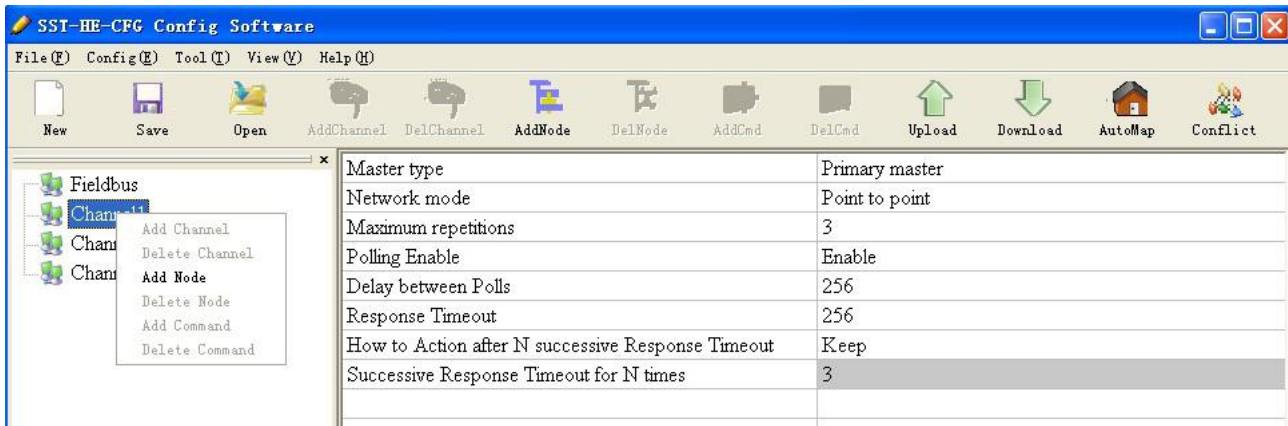
Input data timeout clear/keep: After HART command exceeds the setting no-reply times, whether to clear HART input data buffer;

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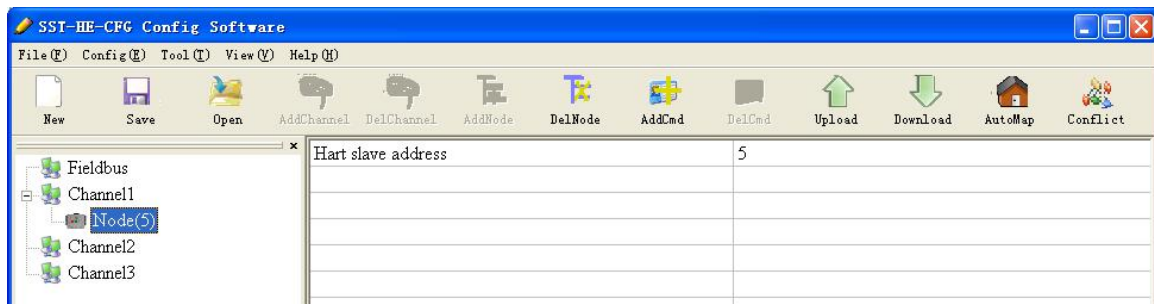
Timeout times: Set the times of timeout clear.

4.2.4.2 Add Slave Nodes

Select the selected the HART Channel, Right click the mouse and click “Add Node” in the pop-up menu.



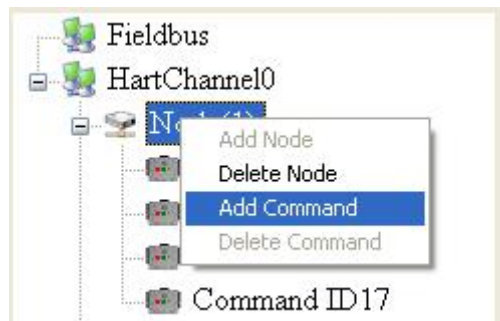
Click the added node, set slave address in the right configuration plate, and please notice that HART channel can only be equipped with one slave node which address is 0 when configured in the single point mode.



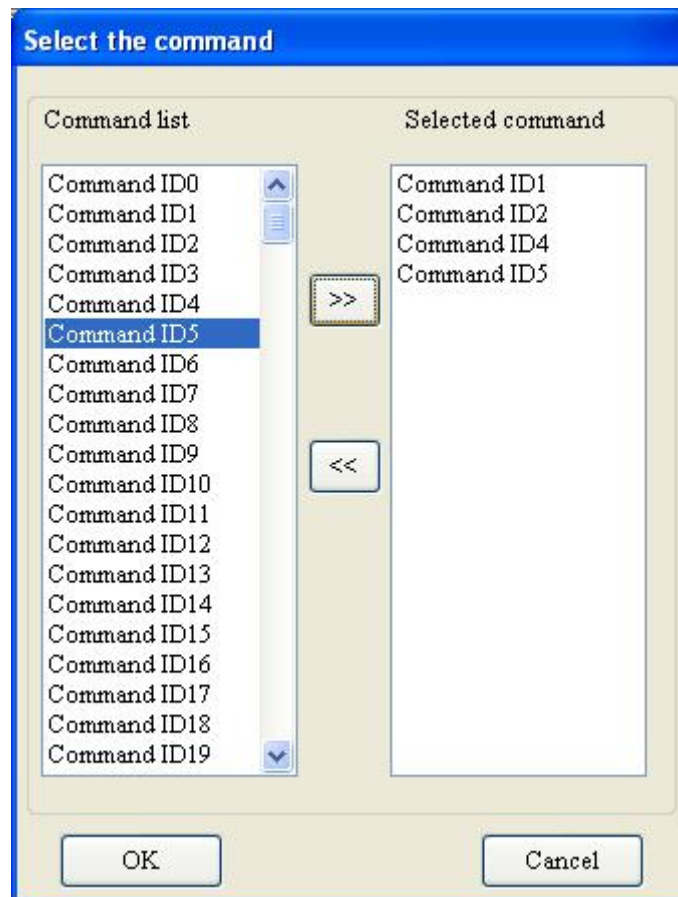
Note: When configured node numbers are more than the actual connected devices, the redundant node will lead to the longer time of polling circle; so, it is recommended that configured node numbers should be the same as actual devices.

4.2.4.3 Add HART Commands

Select the “Node ()”, Right click the mouse and click “Add Command”



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

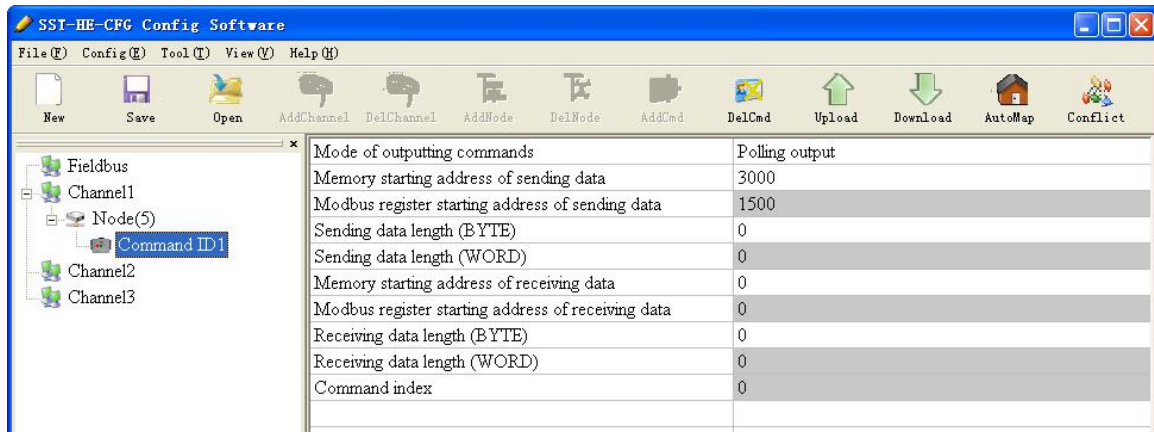


Note: the same command can only be configured once in one node.

4.2.4.4 Configure Slave Commands

Click the command number in the tree view; you will see the configuration plate in the right place:

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Mode of outputting command: You can use the execution way of the command, change-of-state, polling output, Initialization output and disable output optional;

- ✓ Change-of-state output: Execute this command once s data buffer of HART 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.

Set starting address of sending data: 3000~4999;

The 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. The range is 0~2999. Response data only includes data area of HART frame;

The 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, 1 word=2 byte;

Command index: the property is automatically calculated by gateway, it indicates the index in the configured

command list this command belongs to.

4.2.4.5 Delete Commands

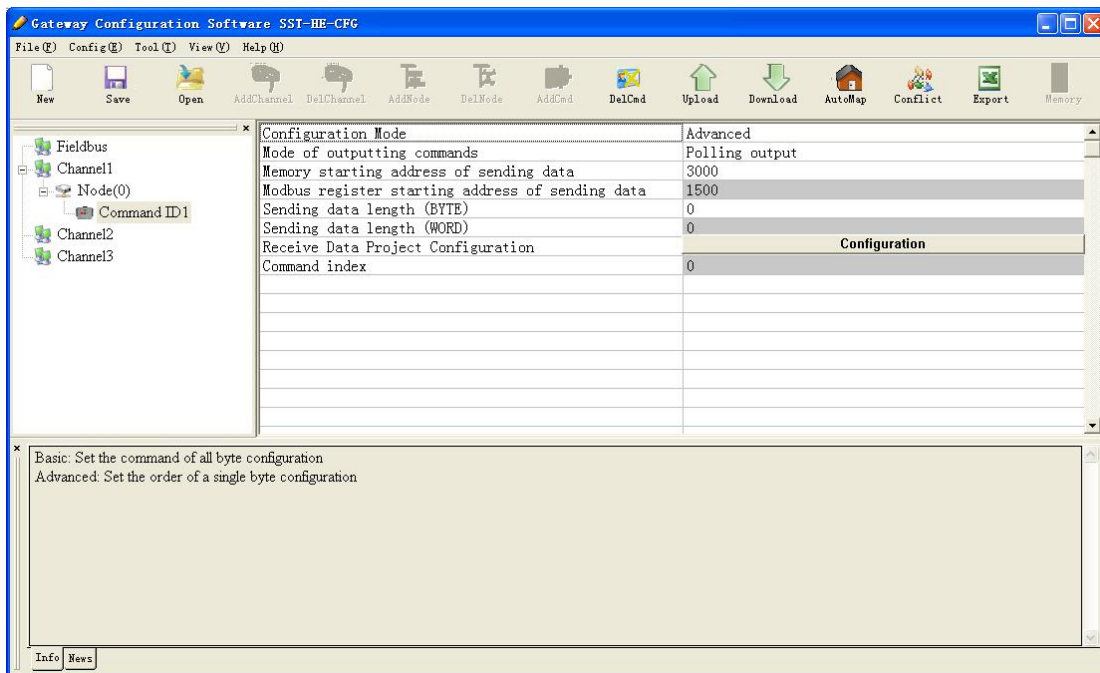
Select the command need to be deleted, Right click the mouse and click “Delete Command”. Through the menu command can also be the same action.

4.2.4.6 Delete Nodes

Select the node needed to be deleted, Right click the mouse and click “Delete Node”. Through the menu command can also be the same action. When deleting nodes, all command under the node will be deleted.

4.2.4.7 Advanced Options to Configure Slave Commands

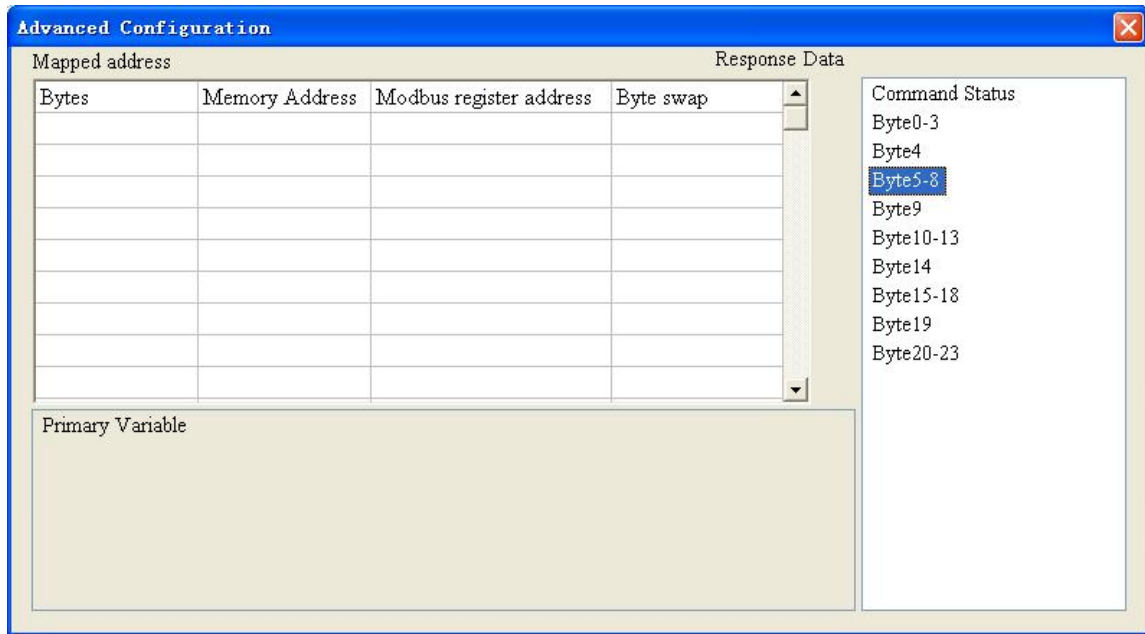
When using HART command configuration, sometimes users want to get one part data of one command. For example, No.1 HART command. The float value of main variable is only needed, no need to get unit of main variable, this is why advanced option exists. Advanced options is actually the execution of “segment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



This interface details is described in chapter 4.2.4.4, so here we don't describe it. The below is the example of

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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:



There are many parts in “Response Data”. 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”;

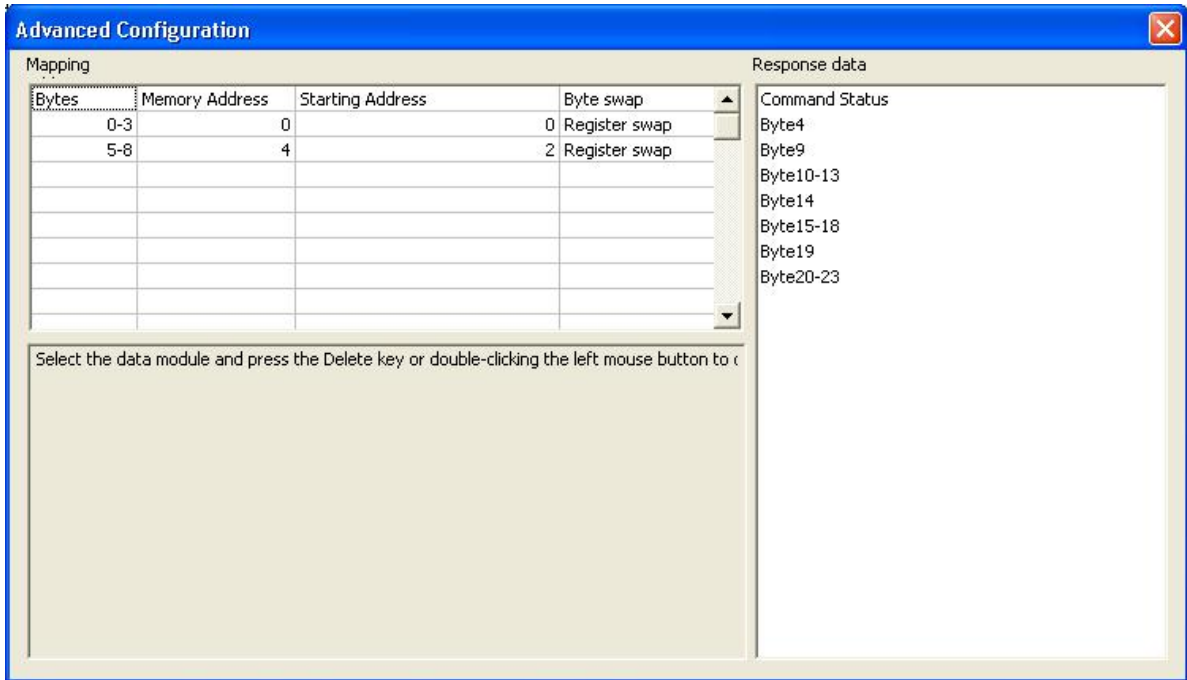
Memory Address: assigned memory address which this byte is located in memory buffer area of GT200-3HT-RS;

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”.

Choose “Byte0-3” and “Byte5-8”, click auto mapping, as shown below:




Close the dialog box, download the configuration into GT200-3HT-RS.

Others are the same with “Basic Mode”.

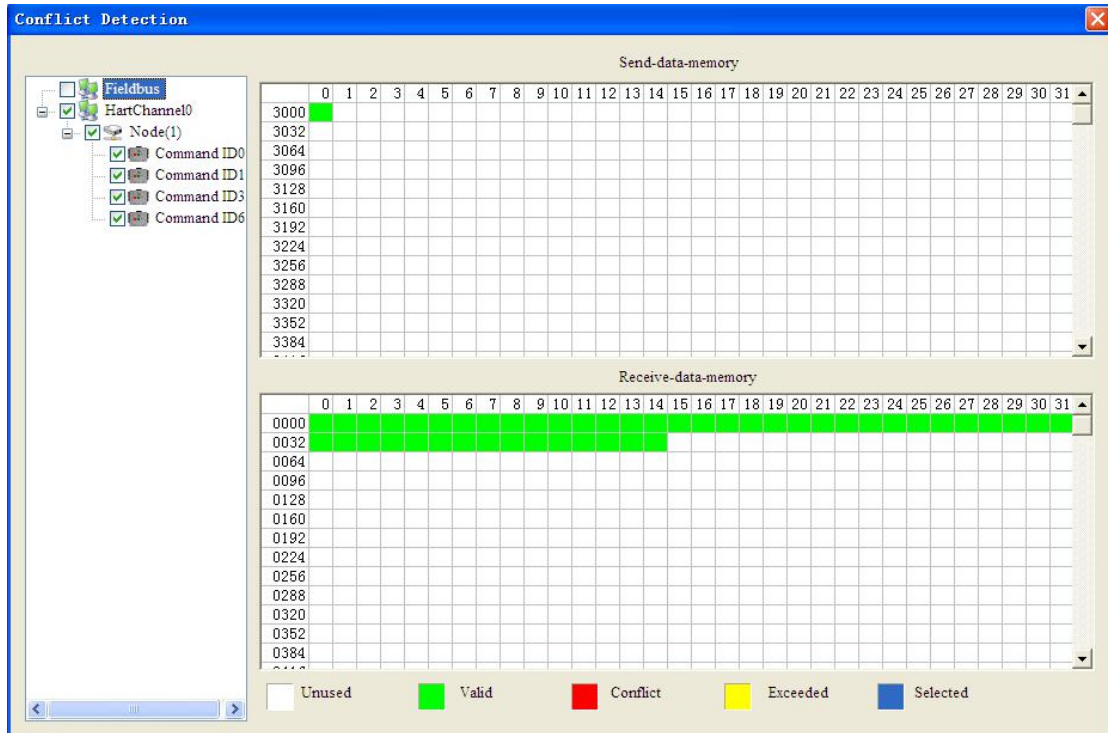
4.2.5 Conflict Detection

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



Click  icon will show the conflict detection interface as follow:

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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 chart shown in blue will show the storage location of input/output data.

4.2.6 AutoMap

Automap will automatically distribute the memory with no confliction according to the input/output bytes number by user's commands.



You should set the correct input/output bytes for each commands, then click  label, select "Yes" in the



popup menu.

4.2.7 Download Configuration



Click the icon ; it will download the configuration into the gateway.

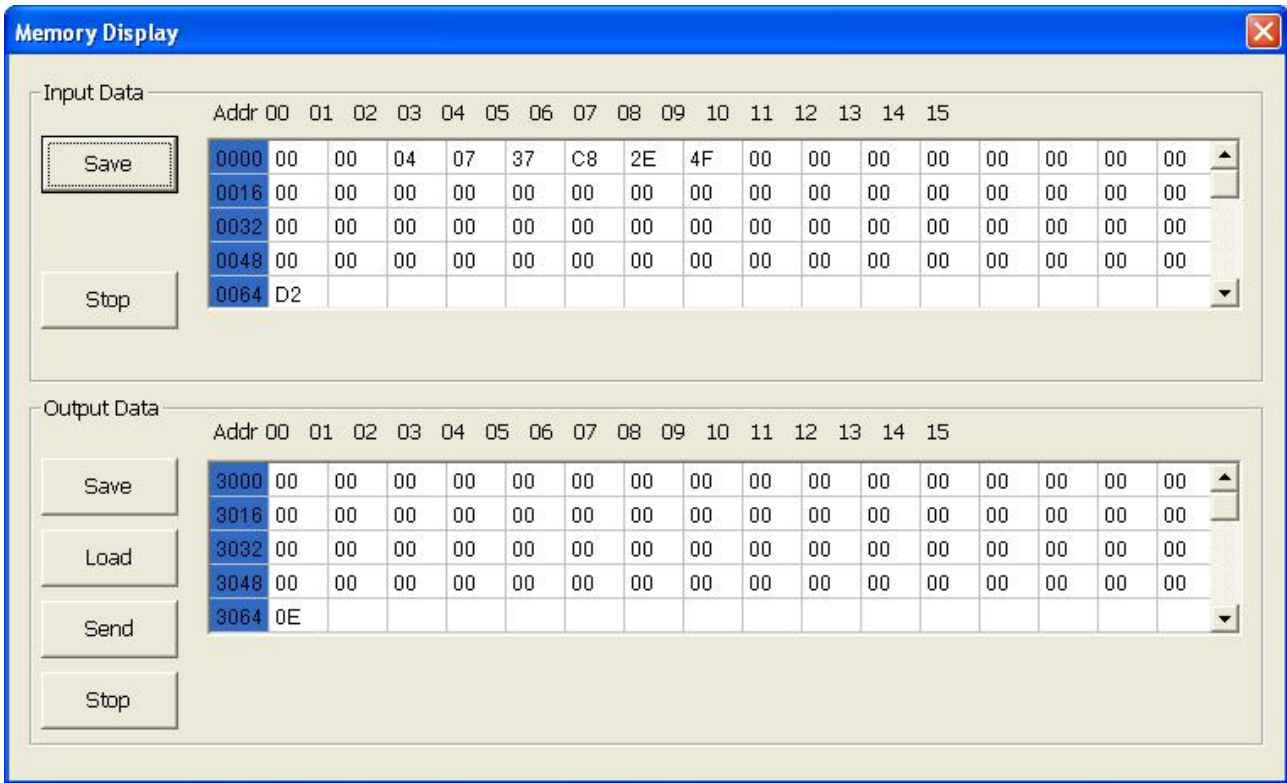
4.2.8 Memory Data Display

Show the data exchange inside of the gateway, user can use this function to debug the HART fieldbus in the absence of the Modbus master station. Steps are as follows:

1. Firstly, ensure that the software is in the debug mode. You can refer to 4.2.1 for detail.
2. Connect the GT200-3HT-RS's RS232 port and computer RS232 serial port, open the software "SST-HE-CFG", Click "Config—serial setting", Select the correct serial port



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




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”.

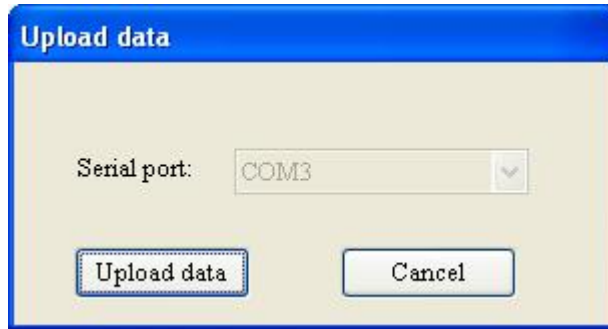
4.2.9 Diagnose

Through this function user 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. Firstly, ensure that the software is in the debug mode. You can refer to 4.2.1 for detail.
2. Connect the GT200-3HT-RS’s RS232 port and computer RS232 serial port, Open the software “SST-HE-CFG”, Click “Config—serial setting”, Select the correct serial port



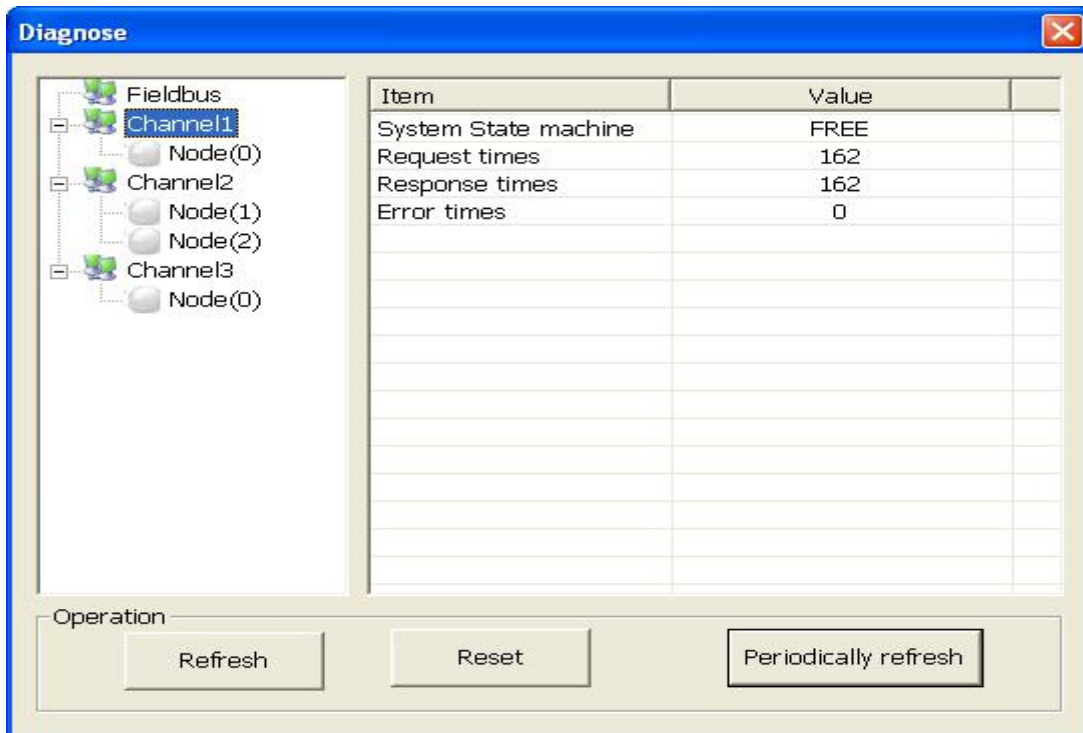
3. Click “Tool—Diagnose” or click on the icon , Interface is as follows:



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



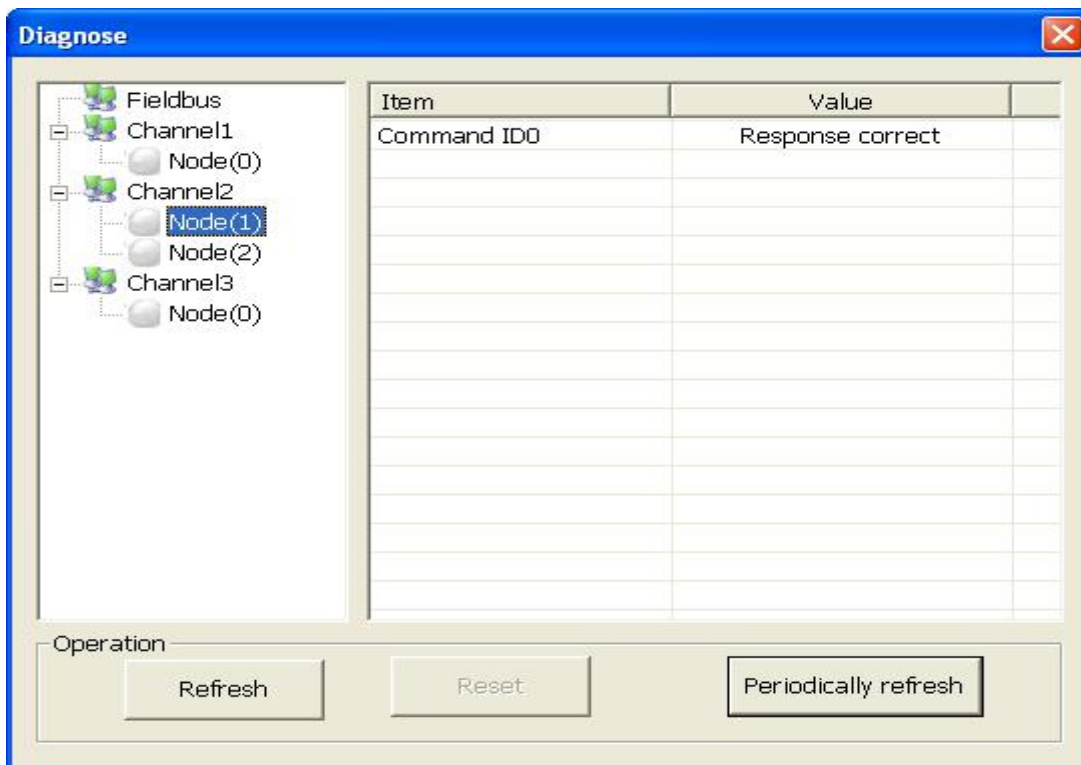
5. Click "confirm" button to get in the interface of diagnose



Click on "Channel1" 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



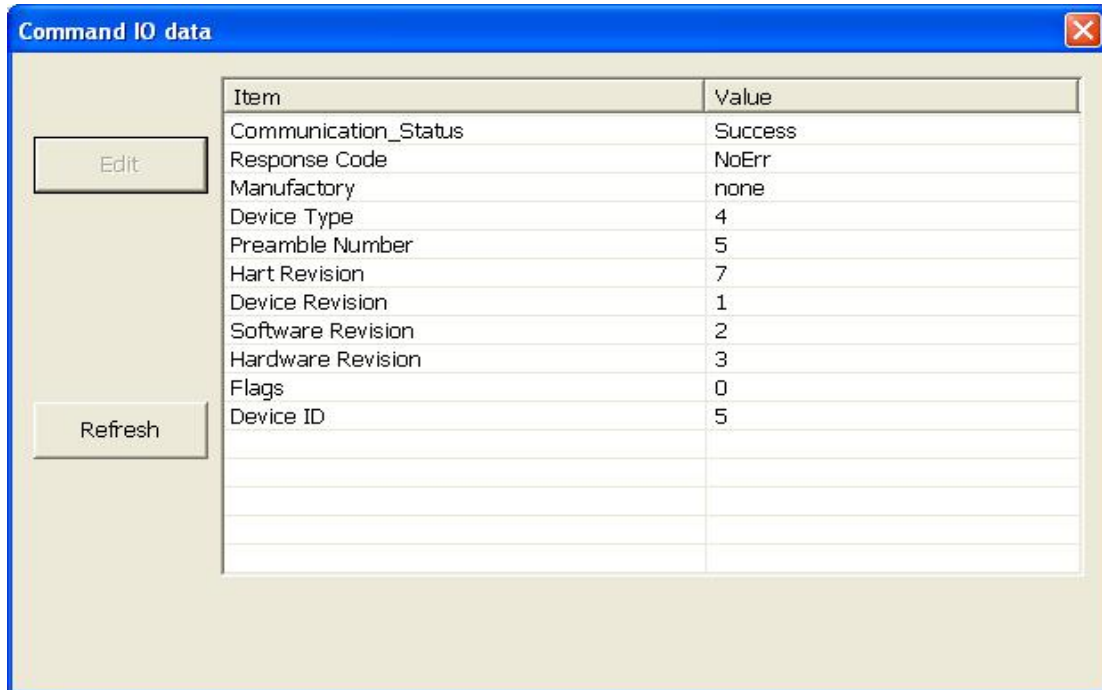
It shows the response status of configured commands.

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

7. Double click command 0,1,2,3,6,11,12,13,14,15,16,17,18,19 will show their command information, command 6, 17, 18 and 19 can start data input.

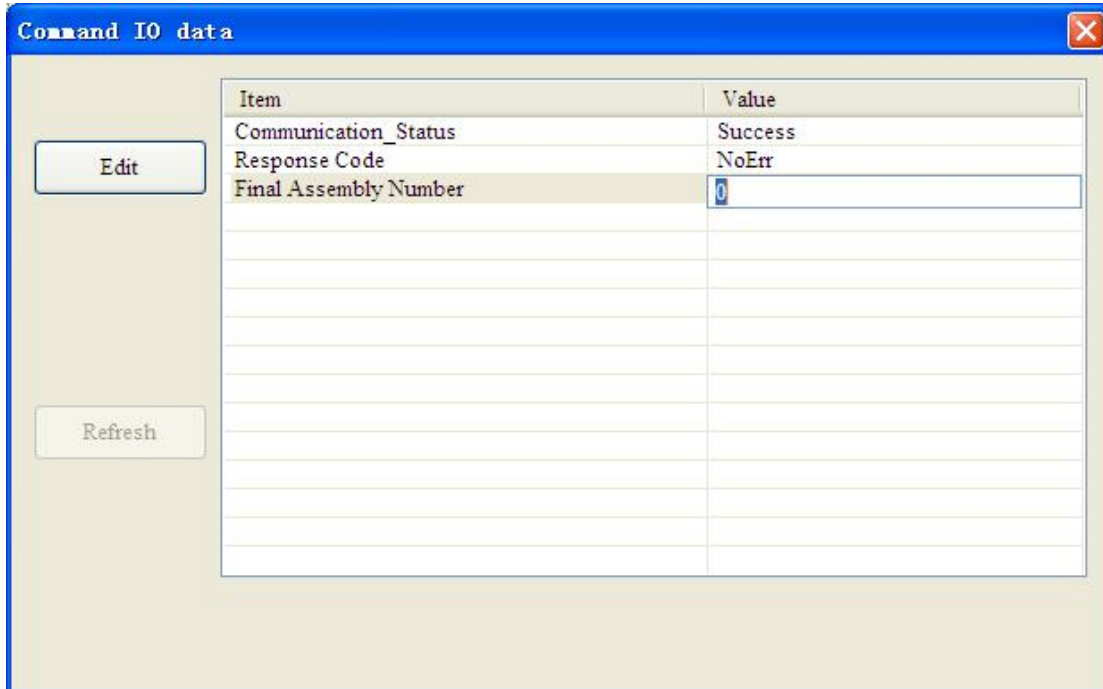
For example, double click "Command ID0" will pop up the following window:

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Click the "Refresh" button will update the data, click the "Edit" button doesn't work in the read-only command.

Double click "Command ID19" will show the window as below:




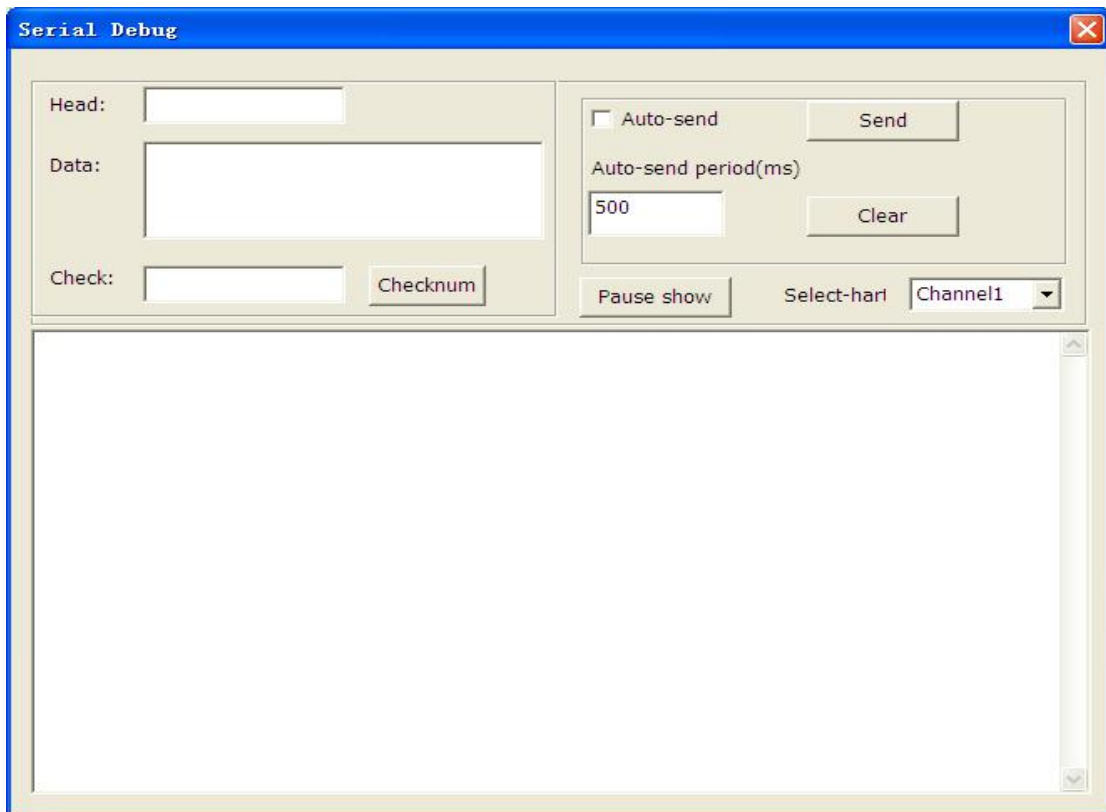
Click the value or attribute you want to change, like "Final Assembly Number", change relevant values, and click "Edit" can execute this operation of write command.

4.2.10 Serial Debug

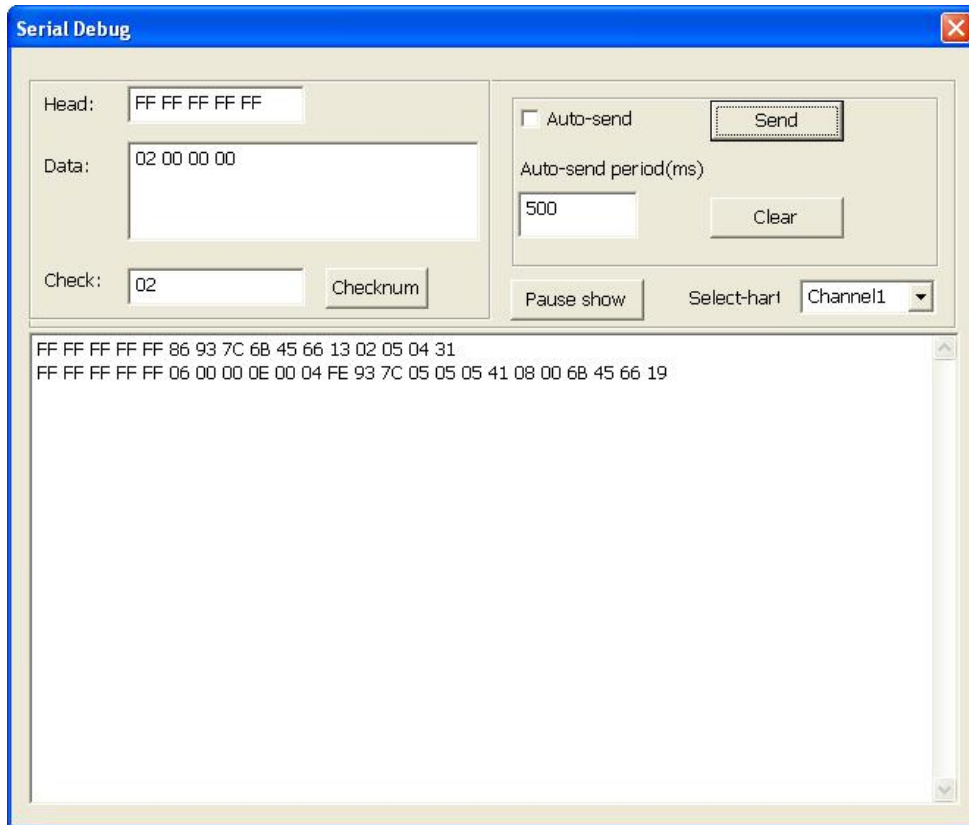
Through this function could send any message to Hart bus and monitor the response information which the gateway received from HART bus. Steps are as follows:

1. Ensure that the GT200-3HT-RS is in the debug mode.
2. Use a serial port line to connect the GT200-3HT-RS's RS232 port and computer RS232 serial port, Open the software "SST-HE-CFG", Click "Config—serial setting", Select the correct serial port

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



In this interface, click "Auto-send" or "Send" will combine data head, data, and check code into one frame and send out 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.



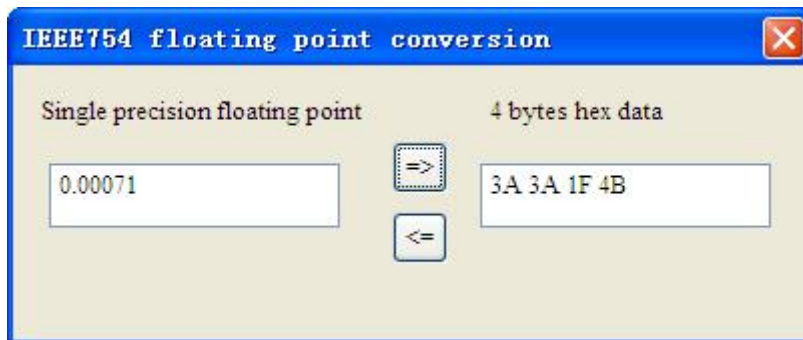
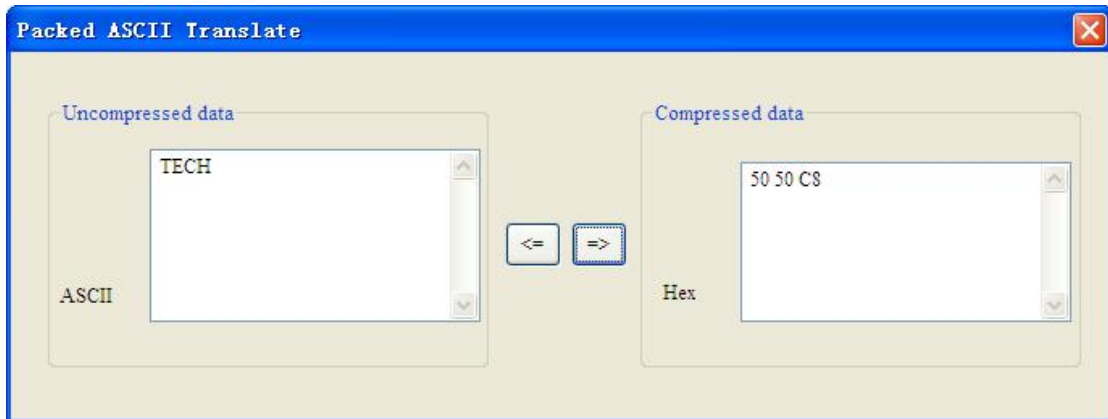
In this example, command 0 is composed of data head, data and check code. It uses short address; when you click “Send”, you will get the response data.

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

4.2.11 Switching Tools

In the “Tools” menu, there are two practical tools: They are used to switch between IEEE754 and PACKED ASCII conveniently.

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5 Working Principle

The gateway internally opens up a length of 8156 bytes of memory as input and output buffers which exchange data. 0~4999 memory is used as the storage area of the HART input data and output data. 5000~8155 memory is used as the storage area of the status of three HART channel and control variables. The specific assignment is shown in the table below:

| | Gateway memory address | Corresponding Modbus register address | Data shift offset in channel | Modbus Read/write permission | Description |
|-----------------------------------|------------------------|---------------------------------------|------------------------------|------------------------------|-------------------------------------------|
| Three HART channel sharing memory | 0-2999 | 0-1499 | | readable | The HART data input area |
| | 3000-4999 | 1500-2499 | | readable, writable | The HART data output area |
| HART channel 1 | 5000-5019 | 2500-2509 | 0-19 | readable | Device 0_cmd0 data |
| | 5020-5039 | 2510-2519 | 20-39 | | Device 1_cmd0 data |
| | | | | |Device 15_cmd0 data |
| | 5320 | 2660H | 320 | | Gateway status |
| | 5321 | 2660L | 321 | | Gateway HART port sending times |
| | 5322 | 2661H | 322 | | Gateway HART port receiving times |
| | 5323 | 2661L | 323 | | HART communication error times |
| | 5324 | 2662H | 324 | | Device 0_cmd0 response status |
| | 5325 | 2662L | 325 | | Device 1_cmd0 response status |
| | | | | |Device15_cmd0 response status |
| | 5340-5439 | 2670-2719 | 340-439 | | The response status of user command |
| | 5440 | 2720H | 440 | | Universal receiving label |
| | 5441 | 2720L | 441 | | Universal receiving error counter |
| | 5442 | 2721H | 442 | | Universal receiving data length low byte |
| | 5443 | 2721L | 443 | | Universal receiving data length high byte |
| | 5444-5743 | 2722-2871 | 444-743 | | Universal receiving data |

| | | | | | |
|---------------|-----------|-----------|----------|-----------------------|---------------------------------------------------------|
| | 5744 | 2872H | 744 | readable, writable | Reset to send, receive, error counter |
| | 5745 | 2872L | 745 | | Polling enabled |
| | 5746 | 2873H | 746 | | Trigger label |
| | 5747 | 2873L | 747 | | Trigger command number |
| | 5748 | 2874H | 748 | | Universal sending label |
| | 5749 | 2874L | 749 | | Universal mode enabled |
| | 5750 | 2875H | 750 | | Universal sending data length low byte |
| | 5751 | 2875L | 751 | | Universal sending data length high byte |
| | 5752-6051 | 2876-3025 | 752-1051 | | Universal sending data |
| HART channel2 | 6052-7103 | | | Same as HART 1 | HART channel2 status/control variable, same as channel1 |
| HART channel3 | 7104-8155 | | | Same as HART 1 | HART channel3 status/control variable, same as channel1 |

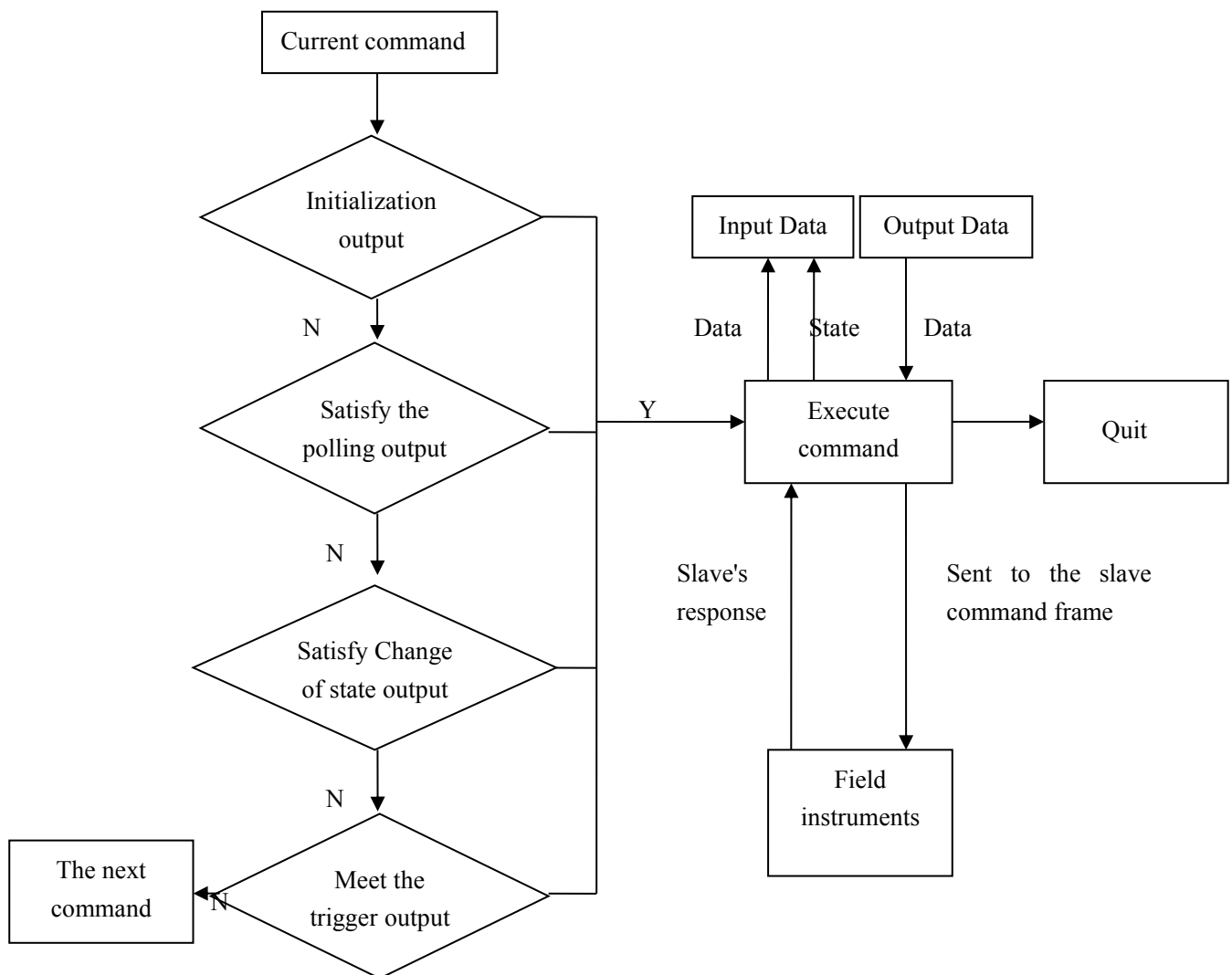
- The HART data input area: Store the data that HART slave device sends to gateway. All command response data of HART channel will be mapped here.
- The HART data output area: Store the data that the gateway sends to the HART slave device. All HART command will get the output data here.
- Device 0_cmd0~ 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
- Sending 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 Receiving label: The receive label under the universal mode, this value which changes one time indicates that HART end receives a HART frame
- Universal receiving data length: Indicating the received data length under the universal mode
- Universal Receiving Error Counter: Indicate the universal receive error number
- Universal receiving data: Store the received data at HART side under the universal mode
- Reset send, receive, error counter: The gateway's control signal, when the value of memory changes, gateway causes all the counter to 0
- Polling 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: Changing 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 label: 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 sending data: Data need to send under the universal mode
- Register address calculation formula: Memory address=the original memory address of HART channel+The offset of register; Modbus register address=Memory address/2 (integral part of the result indicates register

address, the remainder indicates the low bit of register address, otherwise it is the high bit). For example, the memory address of No.2 HART channel status is: $6052+320=6372$. Relative Modbus register address is: $6372/2=3186H$

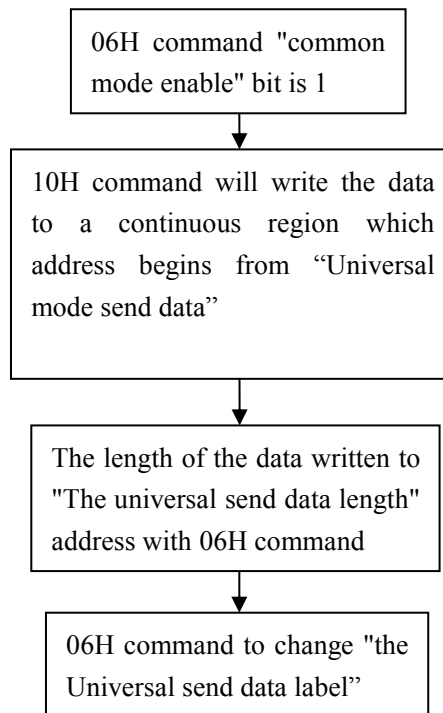
5.1 Flowchart of Executing One HART Command



5.2 Universal Sending and Receiving Data

There are two universal ways for user to select: One is that fieldbus is defined as universal mode. The

gateway will receive the serial data in the way of 3.5 character timeout broken frame from 485 port and send out the data unmodified from the HART interface. Gateway sends data out from 485 port without modification which is received from HART interface. 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 receiving data" as a starting address and write the length of the received data in the "Universal receiving data length". Then change the value of the Universal receiving label". If no data is received within the response waiting time, the gateway will order "universal receiving error counter" to plus 1. Before sending the general frame, user should read the universal receiving label and the error counter. After transmitting the general frame, it needs to read these two values continuously until one of them changes.

5.3 Trigger Command

User can use Modbus command to trigger any HART command which is configured by gateway. The specific approach is: appoint Modbus register as "trigger command number" of one channel; use command ID6 of

Modbus to write the user command number which needs to be triggered (when SST-HE-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.

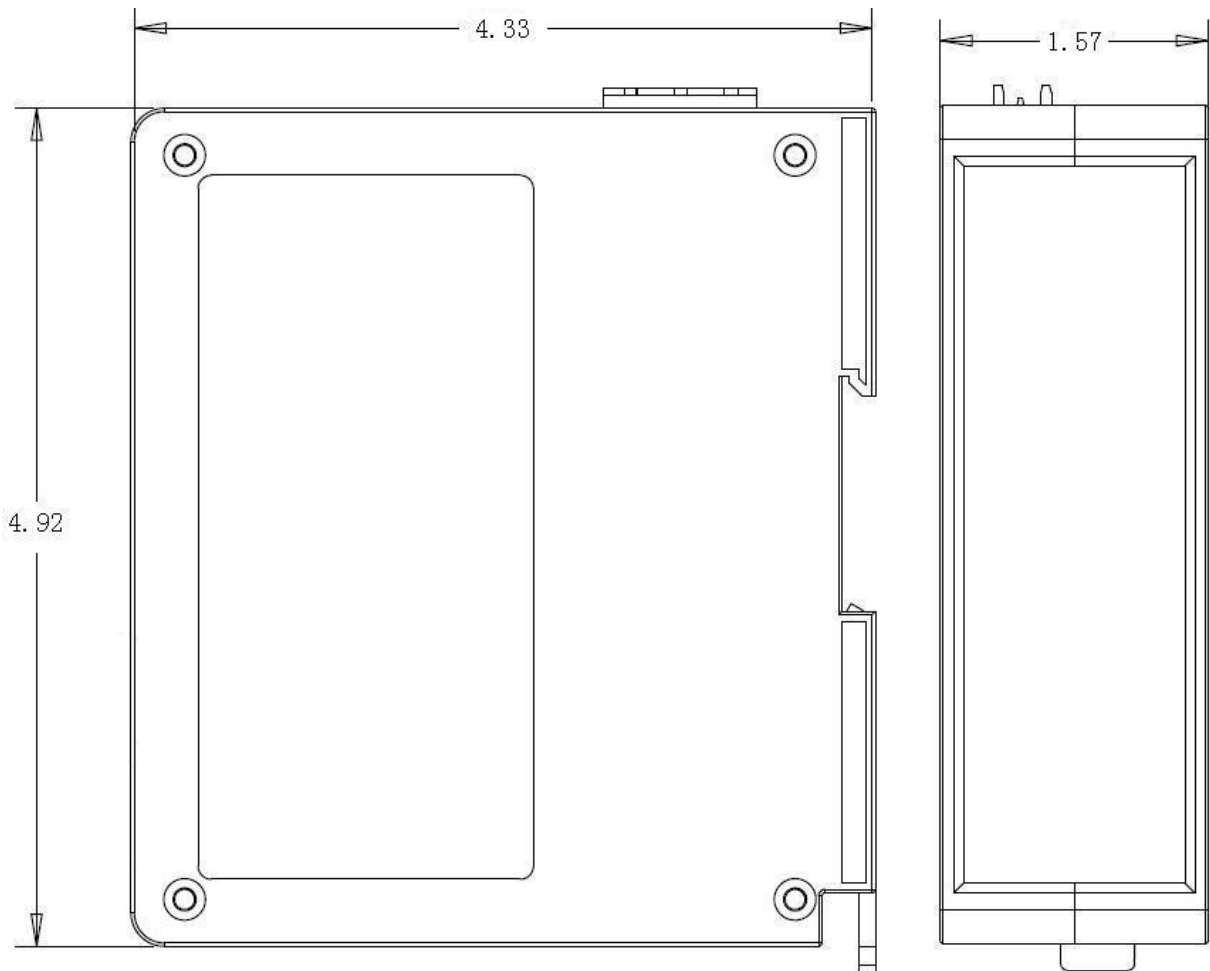
5.4 Data Exchange with Modbus

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 Installation

6.1 Machine Dimension

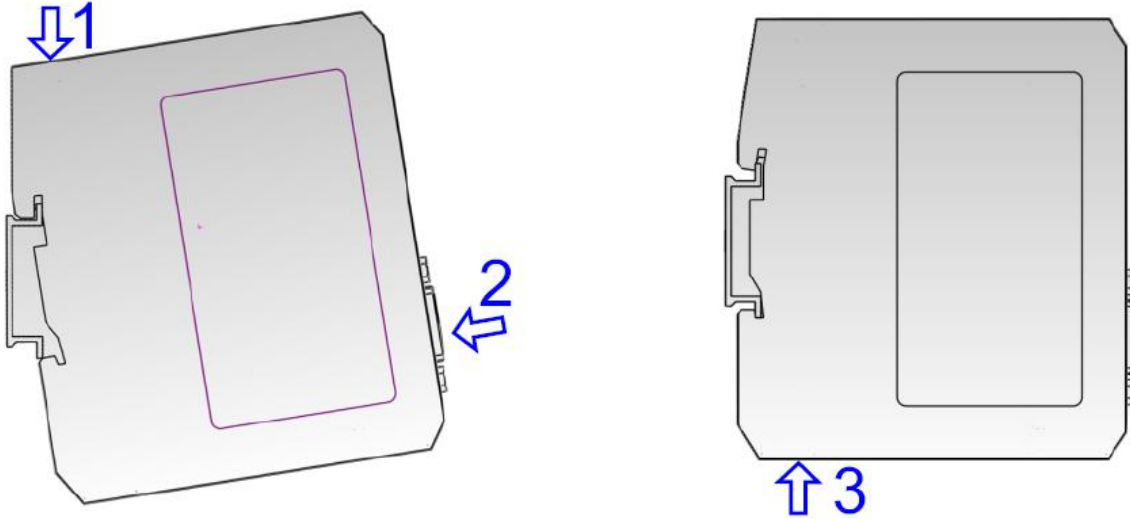
Size: 1.57 in (width)*4.92 in (height)*4.33 in (depth)



6.2 Installation Method

Using 1.38 in (35mm) DIN RAIL

Installing the gateway



Unloading the gateway

