HART/ PROFIBUS-DP Gateway

HPM-610

User Manual

REV 1.5

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Catalog

1 Product Overview

1.1 Product Summary

HPM-610 is a gateway that can achieve interconnection between HART and PROFIBUS DP and MODBUS. HART side can be configured as a primary master or the secondary master. PROFIBUS-DP and MODBUS side can be a slave. The HPM-610's PROFIBUS DP and MODBUS functionality cannot work simultaneously.

1.2 Product Features

- Easy to use: The user simply refers to the product manuals and application examples, configures according to the requirements then it can achieve communication in a short period of time.
- Powerful function: Supports the interconnection between HART and PROFIBUS-DP/MODBUS, transparent transmission between HART and serial (RS232/RS485/RS422).
- Abundant debug function: Direct display of data exchange, command diagnosis of HART slave and common debugging, these function are very convenient for user's communication test job.

1.3 Technical Specifications

[1] HART can be used as a primary master or the secondary master.

[2] Support only one HART channel; in the multi-point mode, connects 13 devices when using internal register and 15 HART devices when using an external resistor (250Ω).

[3] Supports single-point and multi-points working mode of HART

[4] In single-point mode, supports data burst operation of slave device

[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] HART per channel supports up to 128 user commands, HART output data buffer up to 1000 bytes, and the

input data buffer up to 1600 bytes.

[8] Supports internal or external sampling resistor

[9] PROFIBUS side supports DP V0 and slave functionality according to IEC61158

[10] Adaptive baud rate on PROFIBUS-DP(9600 bit/s ~ 12 Mbit/s)

[11] Achieve largest input/output of PROFIBUS protocol: output data bytes ≤ 244 bytes, input data bytes≤244bytes, the sum of them≤488bytes

[12] Serial port side can be configured as MODBUS slave, supports function code: 03H, 04H, 06H, 10H.

[13] MODBUS slave supports RTU and ASCII mode

[14] The serial port can be configured as universal mode, and achieve transparent data transmission with HART slave devices.

[15] Power: 24VDC (9V~30V), 80mA（24VDC）;

[16] Operating Temp: -40°F to 158°F (-40 ºC to 70 ºC), Rel. Humidity: 5%-95% (non-condensing);

[17] External dimension(W*H*D): 40mm* 125mm * 110mm(1.6in*4.9in*4.5in);

[18] Installation: 35mm DIN RAIL;

[19] Protection Level: IP20;

1.4 Safety and explosion-proof features

HPM-610 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

Other related products in SiboTech: HTM-611, HTM-631, HME-615, HME-635, PM-160, EP-321MP and so on.

If you want to get instruction about these products, please visit SiboTech website: http://www.sibotech.net/en , or call the technical support phone number: +86-21-5102 8348 ext 8061.

2 Quick Start Guide

The following is an example for using HPM-610. PROFIBUS DP master read the present value of the main variables (PV) of the HART device which short address is 0.

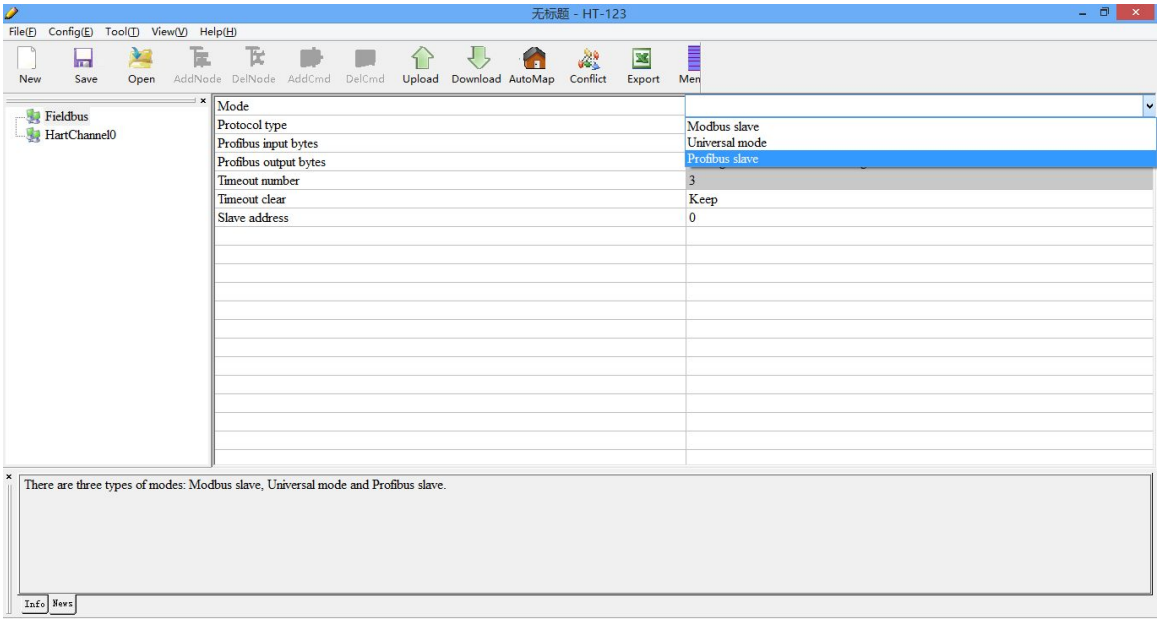
2.1 Configuration of Gateway

2.1.1 Pre-configured settings

1. Turn the configuration bit of DIP switch of gateway to “ON”;
2. Connect the RS232 interface of gateway and the serial port of the computer with the serial cable in the package box. Wiring methods refer to section 3.4.3 of this manual；
3. Install the configuration software HT-123.
4. Power it on, the digital Led displaying “CF” indicates that the gateway is in the configuring state. Double-click the installed software icon HT-123 to start the gateway configuration.

2.1.2 Software configuration

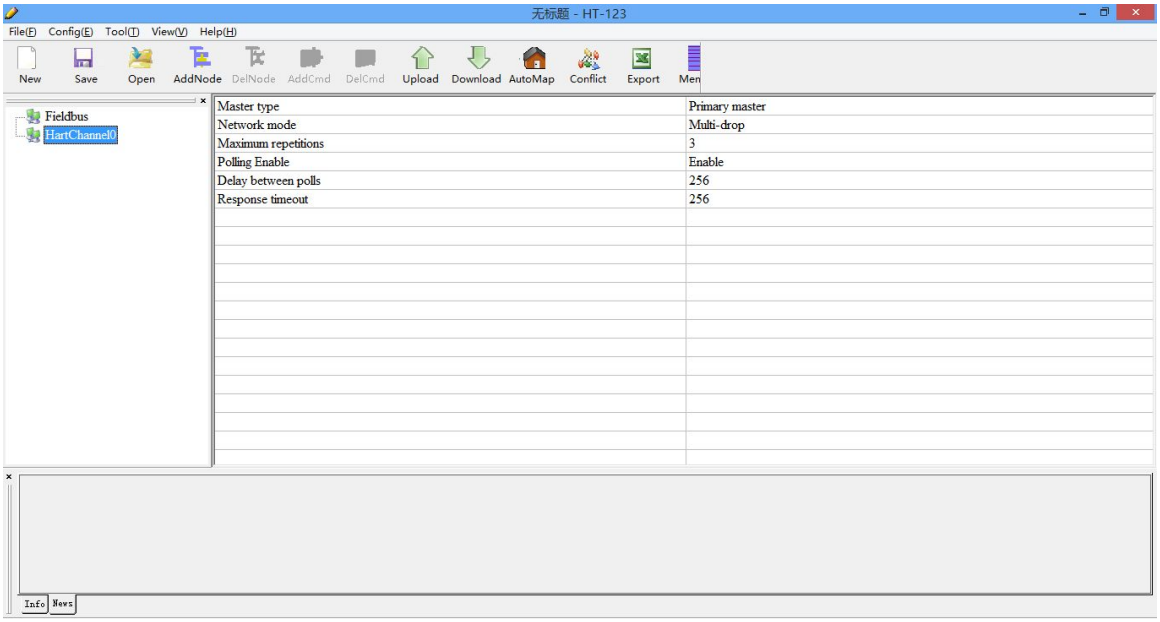
1. Open the HT-123 software installed on your computer.
2. Click “Fieldbus” in the tree view on the left, then the configuration table in the figure appears to the right:



In the first row of the table, Select “PROFIBUS SLAVE”.

When you completed to input the parameter, press “Enter” to confirm.

3. Click “HartChannel0” in the tree view on the left, with the configuration table in the figure appears to the right:

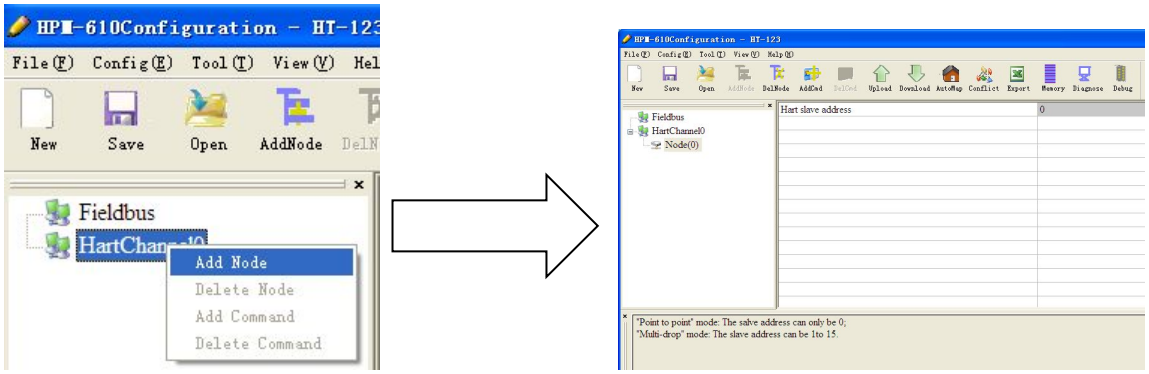


Then you can completed the configuration of HART network.

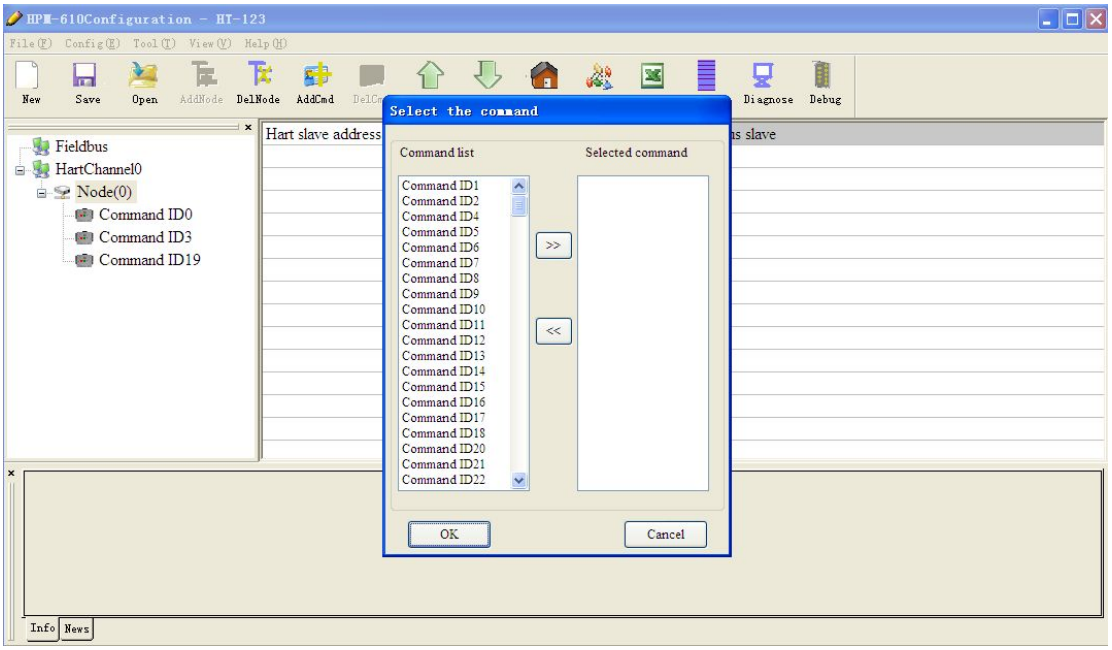
Notes: HART protocol specifies that the slave device which address is 0 must work in single-point mode, this allows digital communication and analog communication to exist at the same time. Slave address 1 to 15 of the device work in multi-point mode, the analog output of the device is at the minimum value (e.g. 4mA), only allows

digital communication. The protocol also specifies that the factory address of HART slave device is 0.

4. Right-click HartChannel0, in the pop-up menu, select “Add Node”, as shown below:



5. Right-click “Node (0)”, in the pop-up menu, select Add command to add a command (command 1), then press OK to return. The command ID you added will be shown in the left tree.



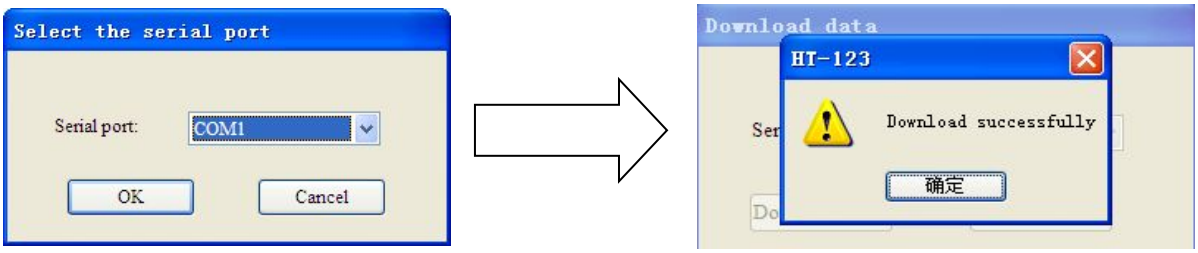
6. Click the “command ID1”, with the configuration table in the figure appears to the right:

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

Configure the parameters, then press Enter to confirm.

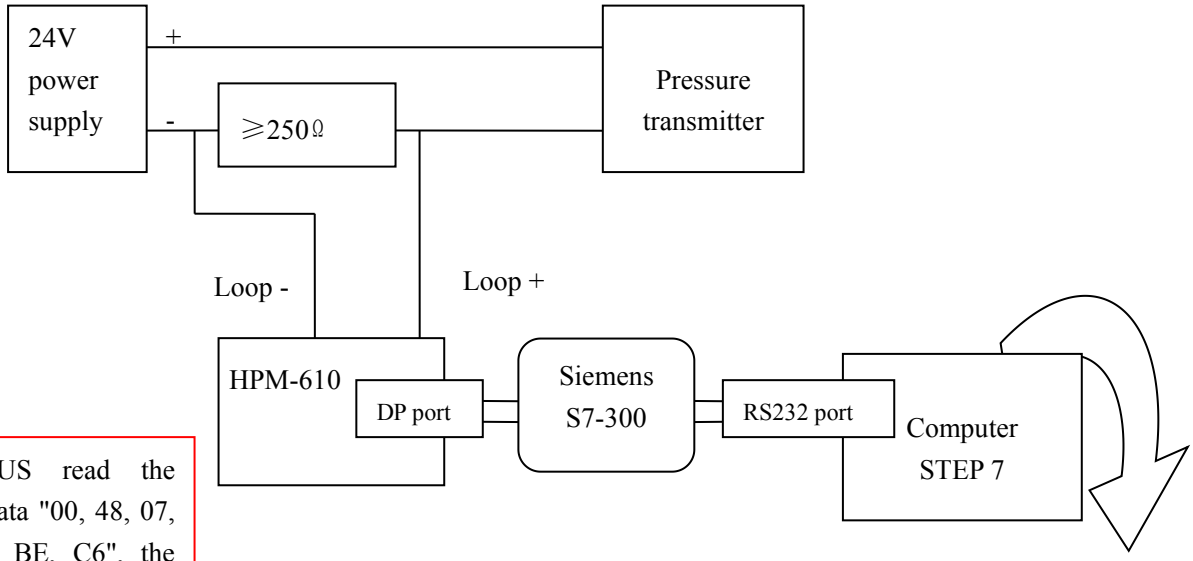
7． Click the icon 

label, select the serial port with which the gateway is connected to the computer, and then click Download:

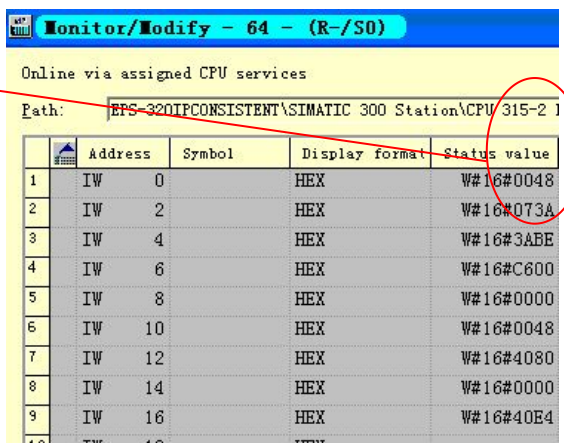


2.2 Function Demo

HART interface of the gateway connects with a 2-wire pressure transmitter with slave address 0; PROFIBUS-DP master uses Siemens S7-300 series PLC, the modeling software uses STEP7. In data exchange window, you can see the mainRS232 Interfacevariable value of the pressure transmitter:

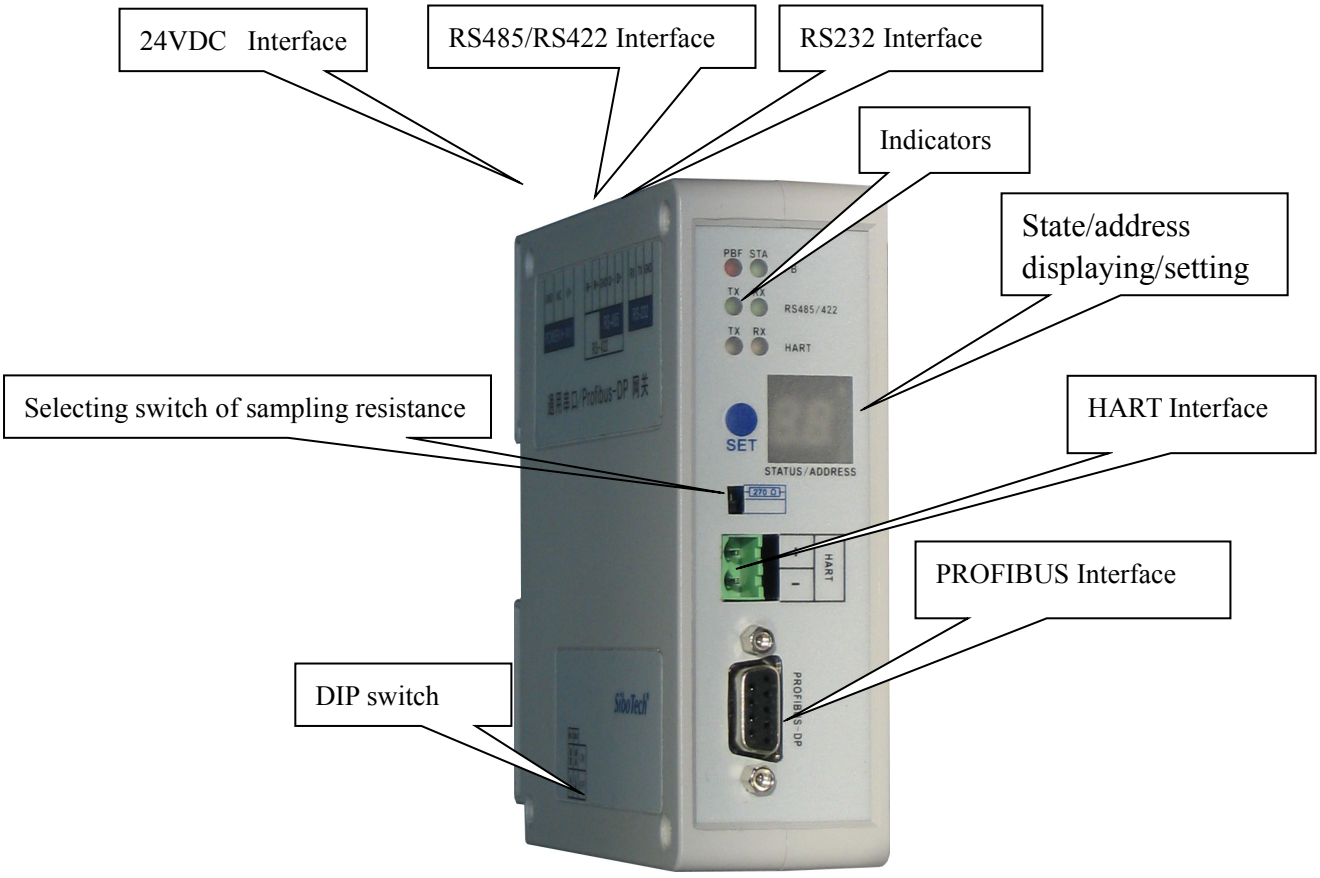


PROFIBUS read the HART data "00, 48, 07, 3A, 3A, BE, C6", the front two numbers mean the device state, "07" indicates that the pressure unit is bar, "3A, 3A, BE, C6" which means that the pressure value, the size is 0.000712376（bar）



3 Hardware Descriptions

3.1 Product Appearance



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

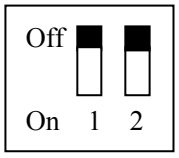
3.2 Indicator LED

Indicator LED	State	Status Description
PBF	Always Red	PROFIBUS DP communication fails
	Close	Communication is ok.
STA	Green Blinking	PROFIBUS DP bus data is communicating
	Close	No data is communicating.
TX	Blinking	Bus data is sending
	Close	No data is sending
RX	Blinking	Bus data is receiving
	Close	No data is receiving

3.3 Configuring Switch/button

3.3.1 Status setting switch

Configuration switch is located at the bottom of product, bit 1 is the debugging bit and bit 2 is the configuration bit.



The debugging (bit 1)	Configuration (bit 2)	Description
Off	Off	Running mode
Off	On	Configuration Mode
On	Off	Debugging mode
On	On	Configuration Mode

Note: ①After configuring the switch, you have to restart the HPM-610 to make the settings take effect!

②Set to debug mode, “MODBUS slave” or “common mode” will be compulsory to appoint RS485 interface acting as the communication port and RS232 interface acting as debugging interface.

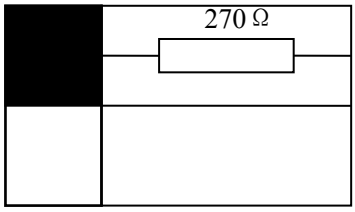
③Configuration interface uses the RS232 interface.

3.3.2 PROFIBUS-DP/ MODBUS address setting button

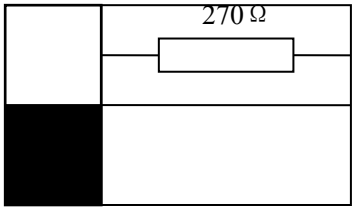
Under normal working condition of the HPM-610, press the button twice quickly, then the high bit of digital LED starts to flash, click the button can set the high bit of PROFIBUS/MODBUS address. Then keep pressing the button for about 3 seconds, the low bit of digital tube starts to flash, click the button can set the low bit of PROFIBUS/MODBUS address. Finally, keep pressing the button for about 3 seconds, the address flashing three times shows that the address was set successfully. After coming in the status of setting PROFIBUS/MODBUS address, if no button action within ten seconds, HPM-610 exits the status of setting address automatically and continues to display the original address. The settable range of PROFIBUS/ MODBUS address is 0 to 99 (decimal).

3.3.3 Internal / external sampling resistance switch

Users can choose to use 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 more than 2W, you must choose to use external resistance.



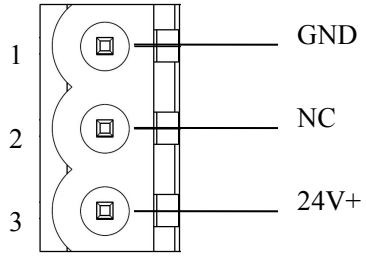
Switch to the top, using the internal sampling resistor



Switch to the bottom, using an external sampling resistor

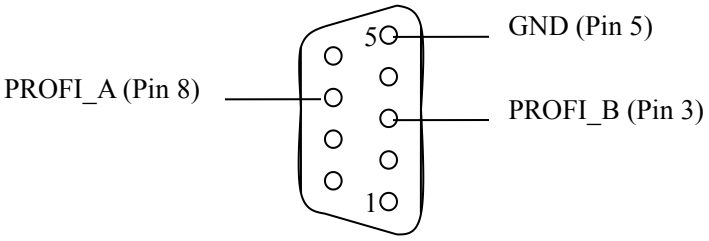
3.4 Interface

3.4.1 Power Interface



Pin	Function
1	GND
2	NC(No Connect)
3	24V+，DC (9-30V)

3.4.2 PROFIBUS-DP interface



PROFIBUS DP interface uses DB9 male-connector, and the pins are defined as follows:

Pin	Function
3	PROFI_B, Data positive
5	GND
8	PROFI_A, Data negative

3.4.3 RS485/RS422 interface

The RS-485/422 interface of HPM-610 is a standard RS485/422 compatible port, and this serial port characteristics of the product will be described as follows:

3.4.3.1. The basic characteristics of RS-485 transmission technology

① Network topology: Linear bus, there are active bus termination resistors at both sides.

② Transfer 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 to 127 stations (with repeater).

⑤Plug connection: 3-pin pluggable terminal.

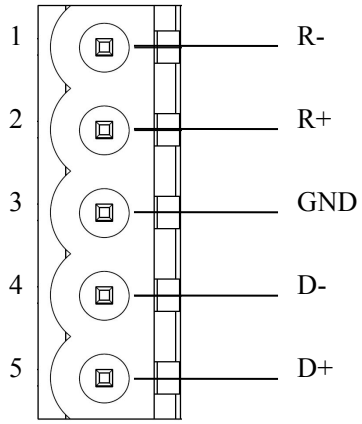
3.4.3.2. The main points on RS-485 transmission equipments installation

①All the devices are connected to the RS-485 bus;

②Each subsection can be connected up to 32 sites;

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

Serial interface uses 5-pin pluggable terminal and users can wire it according to the wiring instructions on the panel.

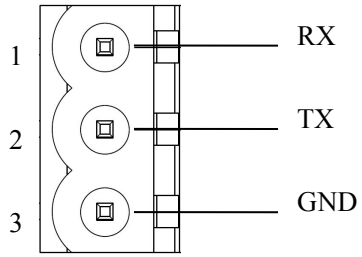


Pin	Function
1	R-, RS-422 Receive Negative
2	R+, RS-422 Receive Positive
3	GND
4	D-, RS-485/RS-422 Transmit Negative
5	D+, RS-485/RS-422Transmit Positive

When you use 2-wire RS485, just connects Pin D+ and D-. If you use 4-wire RS485 or RS422, connects D+/D- to TX+/TX-.

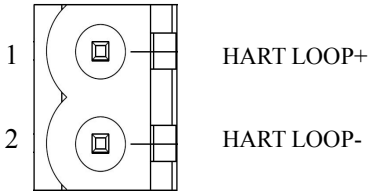
3.4.4 RS-232 interface

RS-232 interface of HPM-610 uses a open 3-pin pluggable terminal, and its pin description is shown as follows:



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

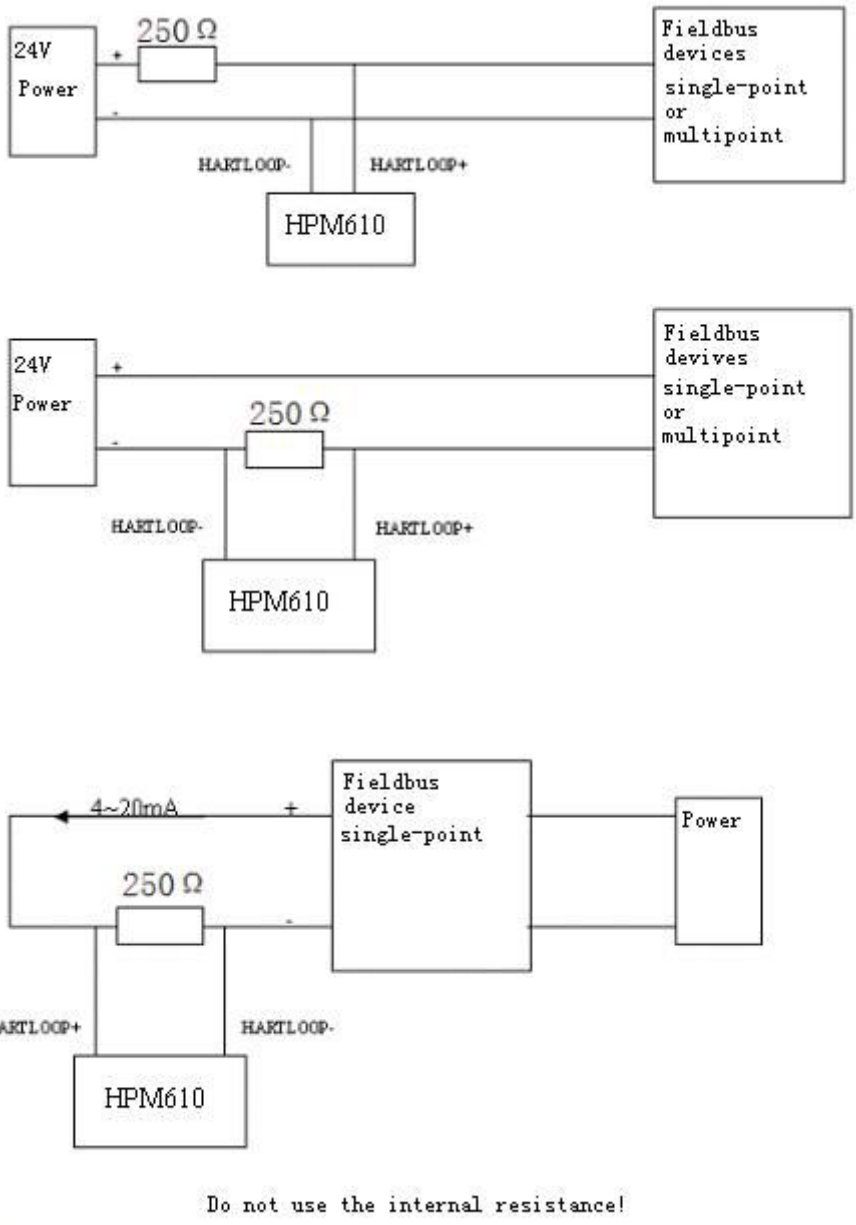
3.4.5 HART interface



Pin	Function
1	Connect HART signal positive
2	Connect HART signal negative

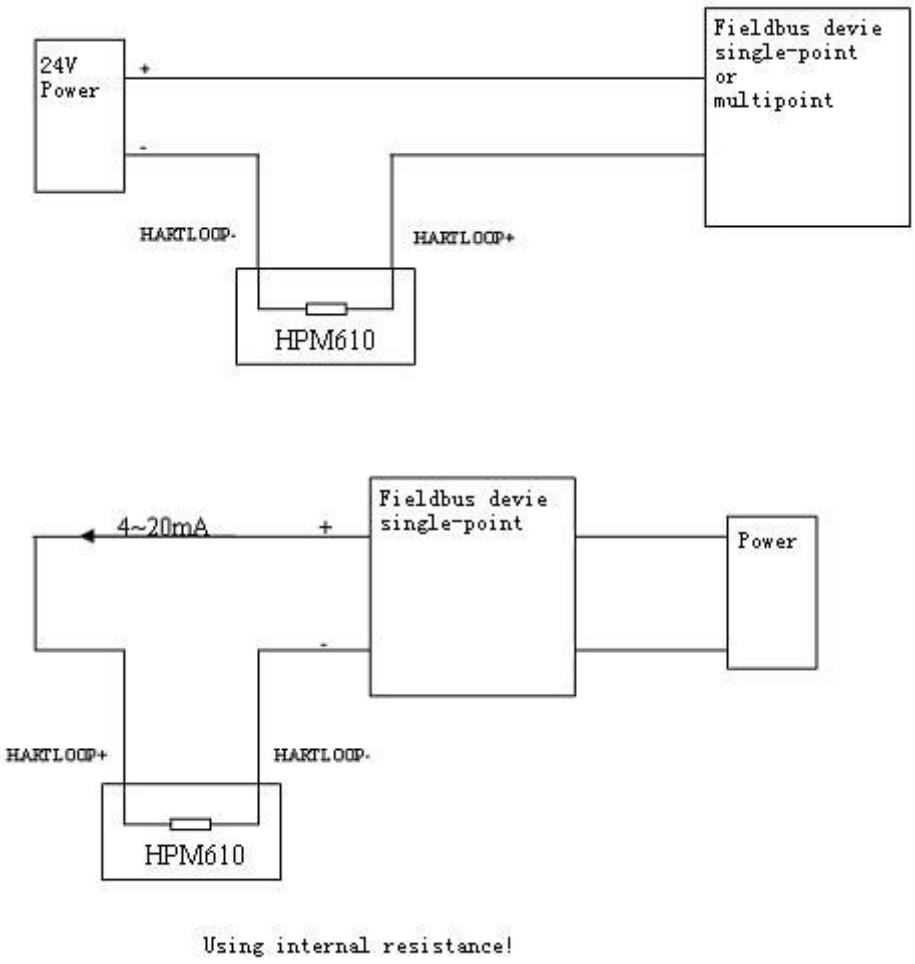
Notes: Actually, HART is an AC signal without +/-. Usually connects Loop+ closer to current loop high voltage side. But most time random connection works.

3.5 Topology of HPM-610 and fieldbus devices



Do not use the internal resistance!

These digrams show outside sampling resister used and the the system wiring. Use internal sampling resister just to replace the 250ohm to internal resister. You must select one from using internal sampling resistor or external resistor otherwise the HART will not work.



Note: 1. Some HART slave instrument need to perform self-test and other internal work when power is on, it may not proceed with HART communication, so gateway cannot receive the response or 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 read/write commands with HT-123, the commands need to be configured according to the actual situation. To increase the speed of bus communication, it is recommended not to configure the empty node (node is not really connected) and empty/dummy/wrong commands.

4 Software Instructions

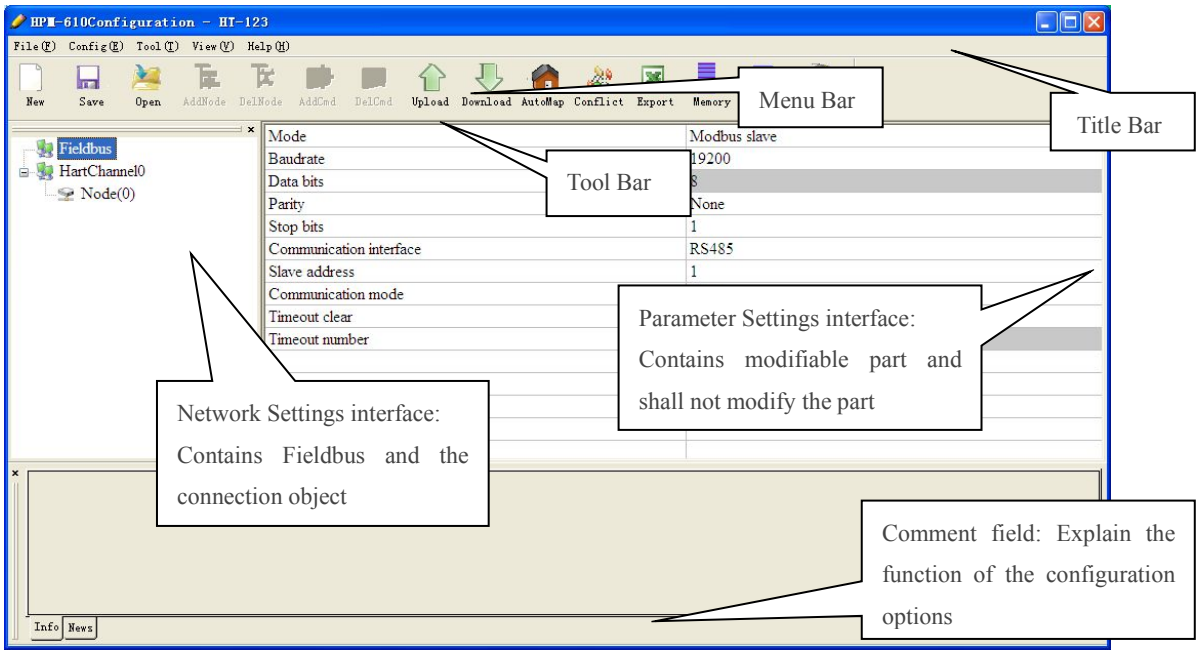
4.1 Software Interface Description

HT-123 a configuring software based on Windows 32bits platform, and used to configure HART series products.

The following describes how to use the software HT-123 and configure the HPM-610. You may also read the software user manual to get more detailed information.

Double-click on the icon 

to enter the main Window of software:



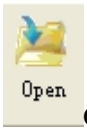
Tool Bar:

Toolbar interface shown as follow:

The function from left to right is: New, Save, Open, AddNode, DelNode, DelCmd, Upload, Download, AutoMap, Conflict, Excel configuring file output, Data Memory display, Diagnose and Debug.

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 module

AutoMap: Used to automatically calculate the mapped memory address with no confliction by each command

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

Export: Output current configuration to the local hard disk and saved as .xls file format

Memory: Show the internal data exchange of the gateway

Diagnose: Analyze operating condition of fieldbus device; also it can finish some certain analysis

Debug: Send any request frame to Hart fieldbus and show the response information received in HART, convenient to debug.

4.2 Software Usage

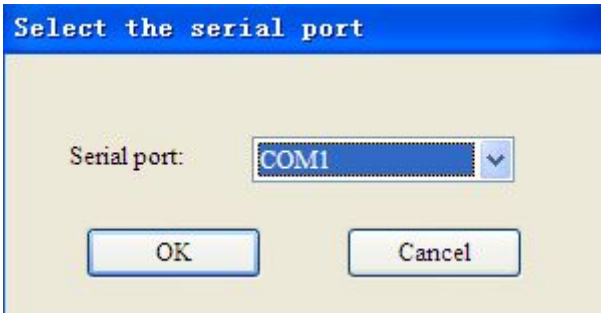
4.2.1 Connect to the hardware

Put the DIP switch of the gateway to “ON”， we use a serial port line to connect the gateway’s RS232 port and one of computer and power on the gateway . Its Digital tube which displays “CF” indicates it is in the state of configuration.

4.2.2 Upload the configuration file in the gateway

Open the software “HT-123”, click on the icon 

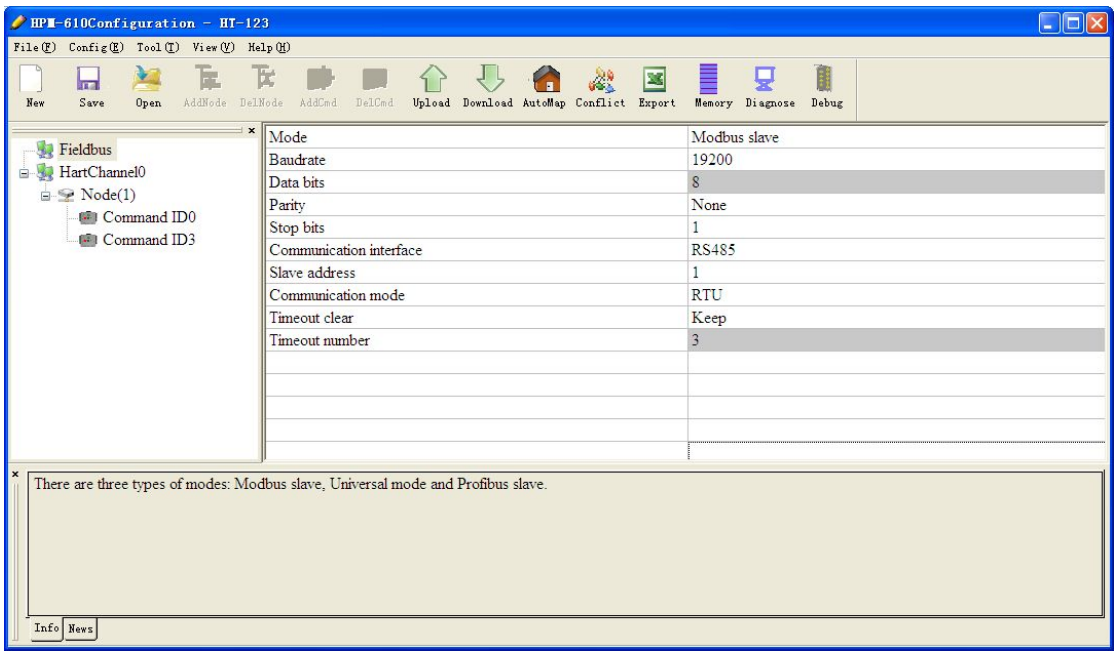
, firstly, select the computer port connected to the gateway and then click “upload date”,. If it shows “upload successfully”, it indicates that configuration file had been uploaded to the HT-123..



4.2.3 Configure Fieldbus

4.2.3.1 Configure the fieldbus as Modbus slave

If you want to use the functionality of Modbus slave, click the "Fieldbus" in the tree view, select mode as "Modbus slave" in the right configuration plate, and then press ENTER to confirm, you will see the interface as below:



In this interface you can set the parameters of slave:

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

Data bits: 8

Parity: None、Odd, Even, Mark, Space

Stop bits: 1, 2

Communication mode: RTU, ACSII

Slave address: 0~247

Communication interface: RS485, RS232. When the serial need to communicate with RS422 , please choose "RS485"

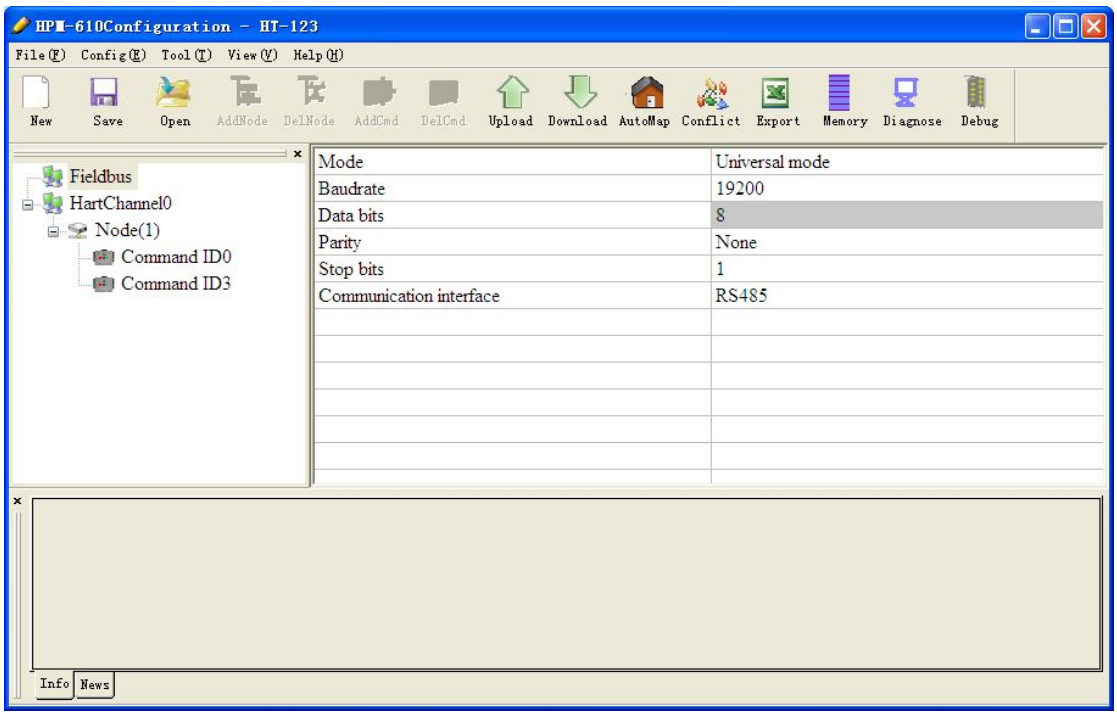
Input data timeout clear/Keep: When the HART commands exceed the no-reply times, whether or not to clear the HART input data buffer.

Timeout number: set the timeout/clear times

4.2.3.2 Configure the fieldbus as universal mode

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

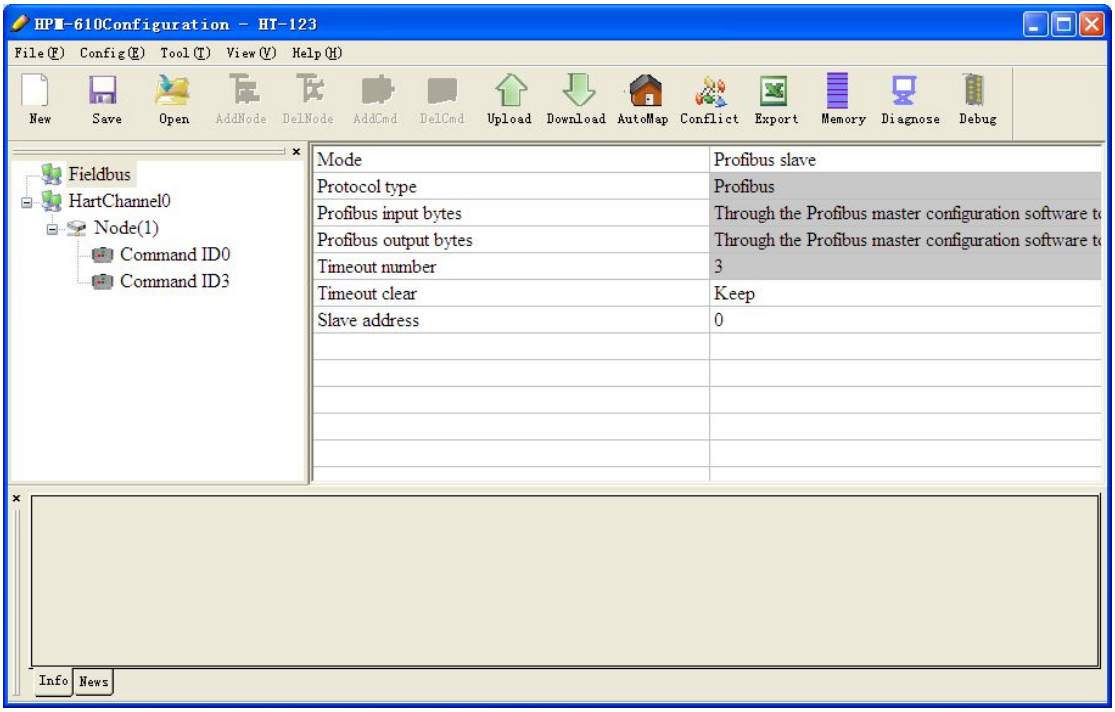
Click the "Fieldbus" in the tree view, select mode "Modbus slave" in the right configuration plate, and then press ENTER to confirm, you will see the interface as below:



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

4.2.3.3 Configure the fieldbus as PROFIBUS slave

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



Numbers of input bytes: setting through the modeling software of PROFIBUS master, it can’t be changed;

Numbers of output bytes: setting by the configuration software of PROFIBUS master, it can’t be changed;

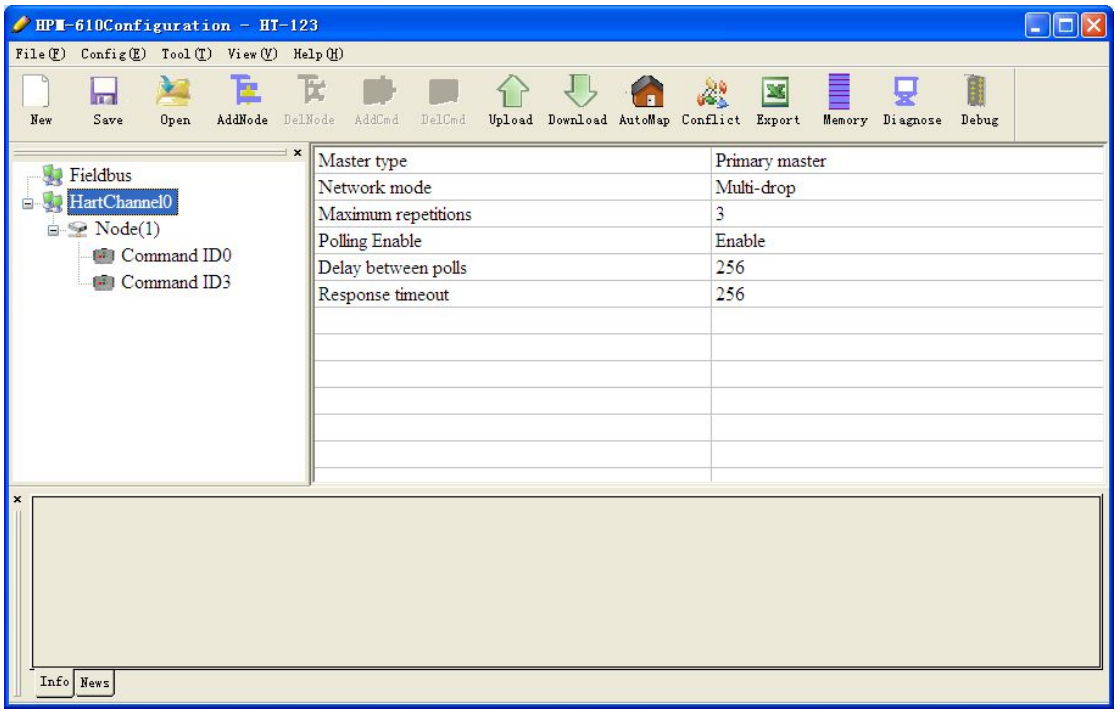
Timeout clear/keep of input data: the meaning is the same as “Modbus slave”;

Slave address: PROFIBUS-DP slave address (When the gateway works properly, the address can be changed by the configuring button)

4.2.4 Configure the HART network

4.2.4.1 Set the parameters of HART Channel

Click the HartChannel0 in the tree view, in the right place will show the configuration plate:



Master type: Primary master, Secondary master

Network mode: Select the networks 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 the timeout numbers, range is 0~5

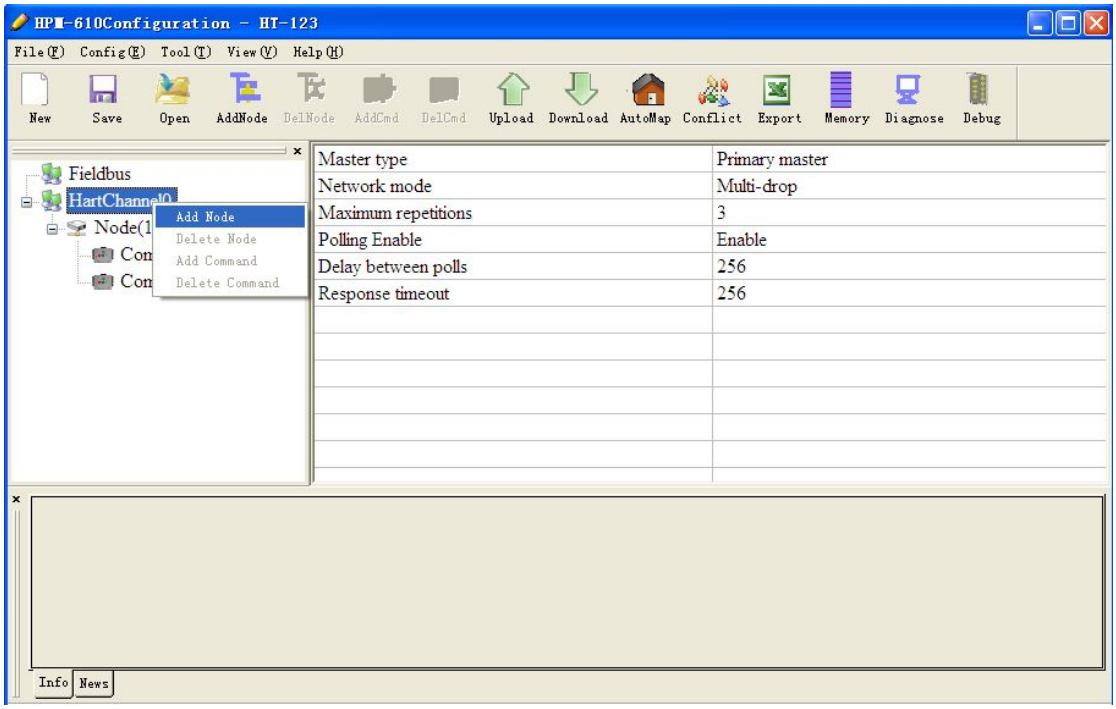
Polling Enable: Whether to use polling function, “Enable” means to use polling function;

Polling circle time: Set the polling circle time (time interval between starting to send one order and starting to send next order, ranged in 500~65535ms;

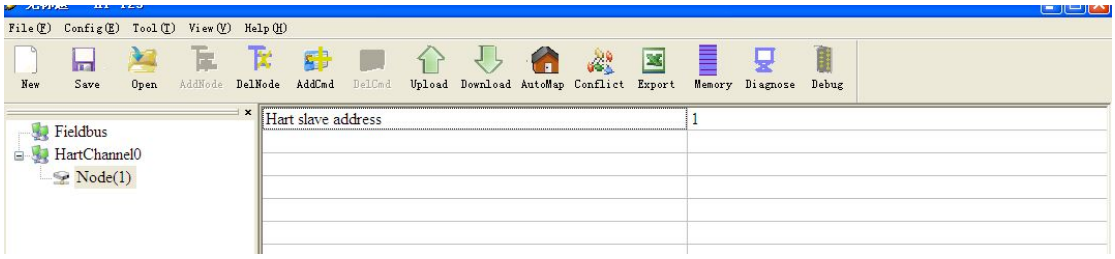
Response waiting time: Set the maximum time gateway wait to response from slave, ranged in 256~65535ms

4.2.4.2 Add one slave node

Select “HartChannel()” , Right click the mouse and click ”Add Node” in the popup menu.



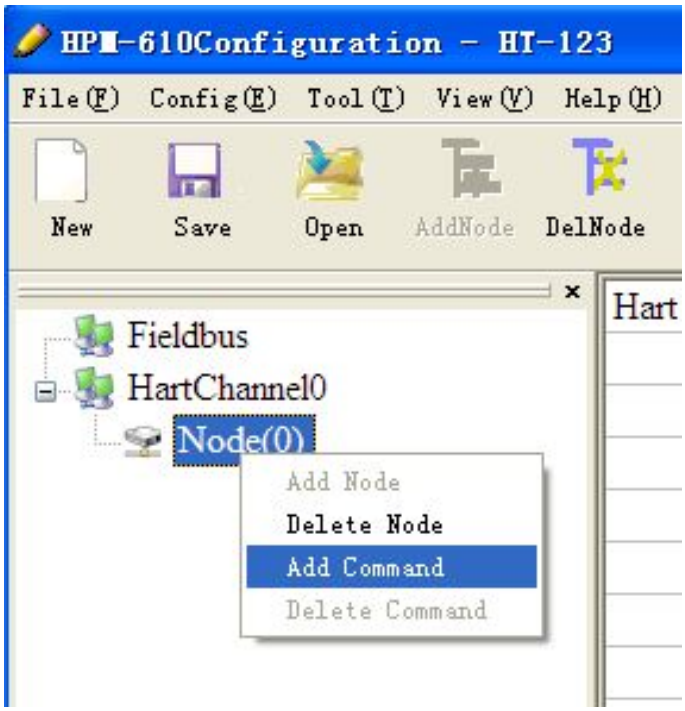
Click the added node, set slave address in the right configuration plate, please notice that HART channel can only be equipped with one slave node when configured in the single point mode.



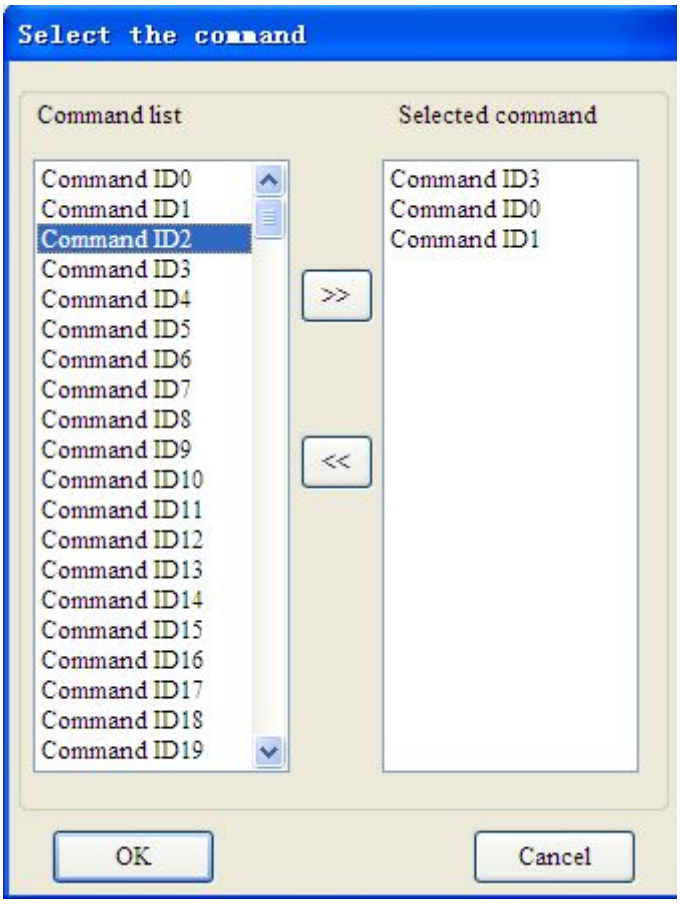
Note: When configured node numbers are more than the actual connected devices, the redundant node will lead to the longer time of polling circle; So, it is recommended that configured node numbers should be the same as actual devices.

4.2.4.3 Add HART Commands

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



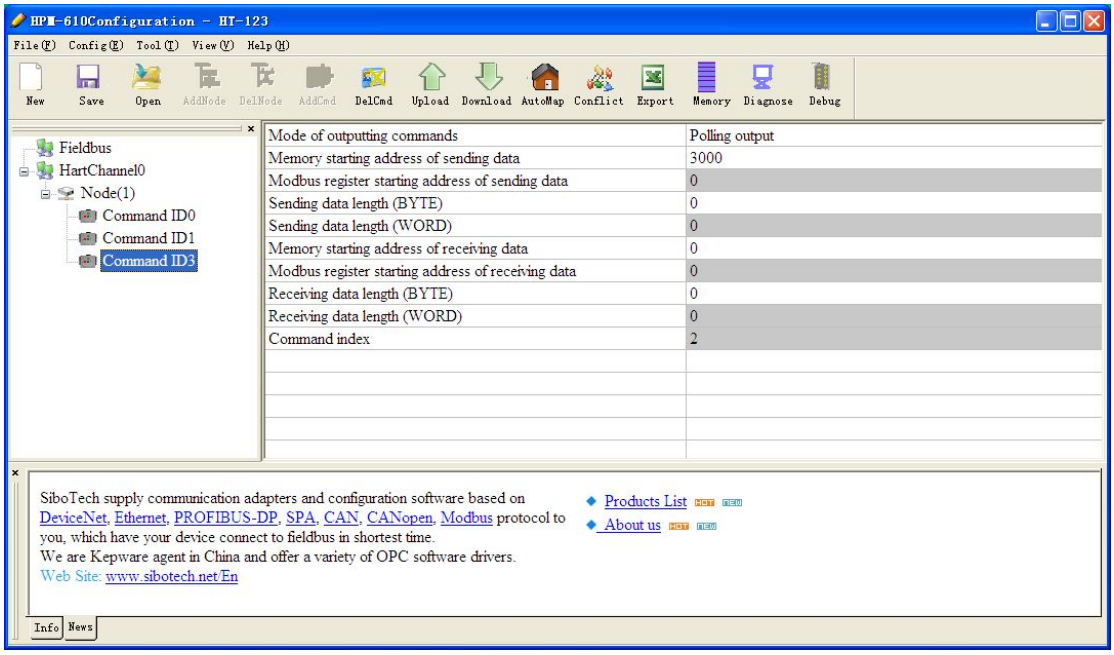
Choose the command you want in the popup menu, then click "OK" to exit:



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

4.2.4.4 Configure HART Commands

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



Mode of outputting command: You can use the execution way of the command, change-of-state, polling output, Initialization output and disable output are 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 generate output data.

Set starting address of sending data: 3000~3999

Modbus register starting address of sending data: 0~499

Sending data length (BYTE): 0~255

Sending data length (WORD): 0~127

Memory starting address of receiving data: 0~1599

Modbus register starting address of receiving data: 0~799

Receiving data length (BYTE): 0~255

Receiving data length (WORD): 0~127

Command index: The index of the command in the configured commands list

4.2.4.5 Delete a command

Select the command needed to deleted, right click the mouse and click “Delete Command”. Through the menu command you can execute the same action.

4.2.4.6 Delete a node

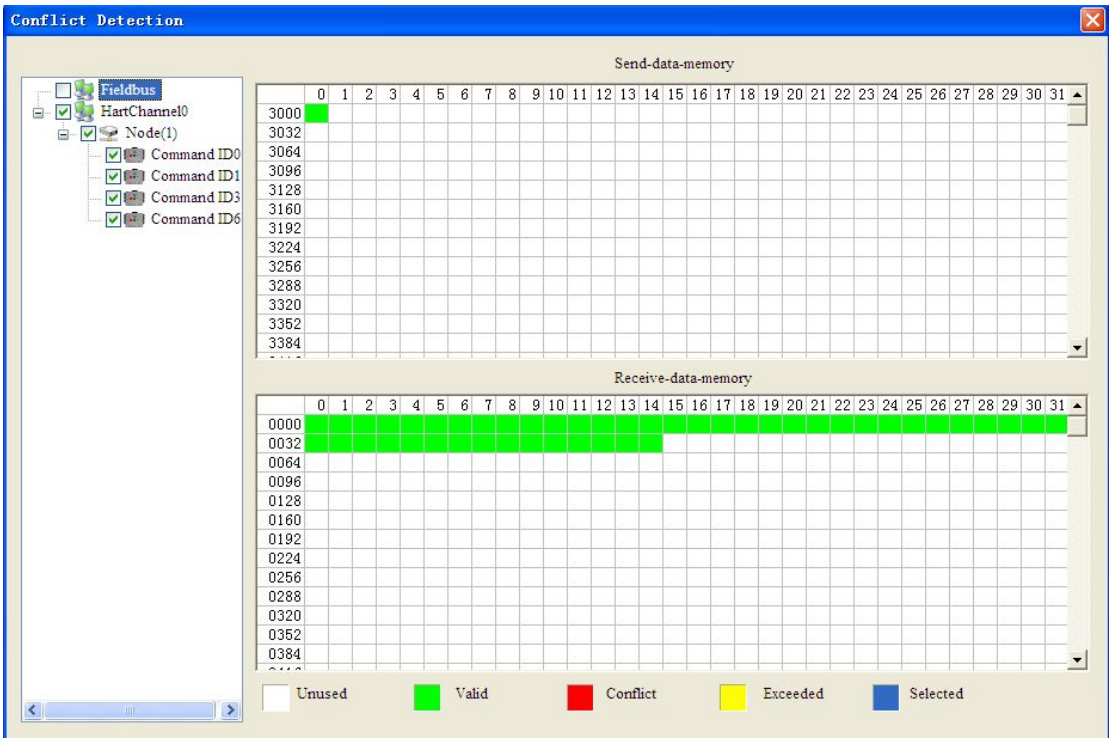
Select the node needed to deleted, right click the mouse and click “Delete Note”. Through the menu command you can execute the same action.

4.2.5 Conflict detection

The conflict detection function can view the usage of input/output data in the memory.

Configuration interface as shown below:

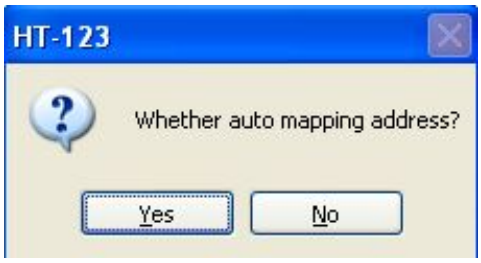
The left side is configuration commands, the right side is data memory address including receive data storage address and send data storage. Upper side is memory distribution of the HART’s sending data, lower side is memory distribution of the HART’s receiving data. When one memory unit is occupied by 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 S



4.2.6 AutoMap

Automap will automatically distribute the memory with no confliction according to the input/output bytes number by users' 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 file

Click the icon 

, it will download the configuration into the gateway. Before downloading the file, please

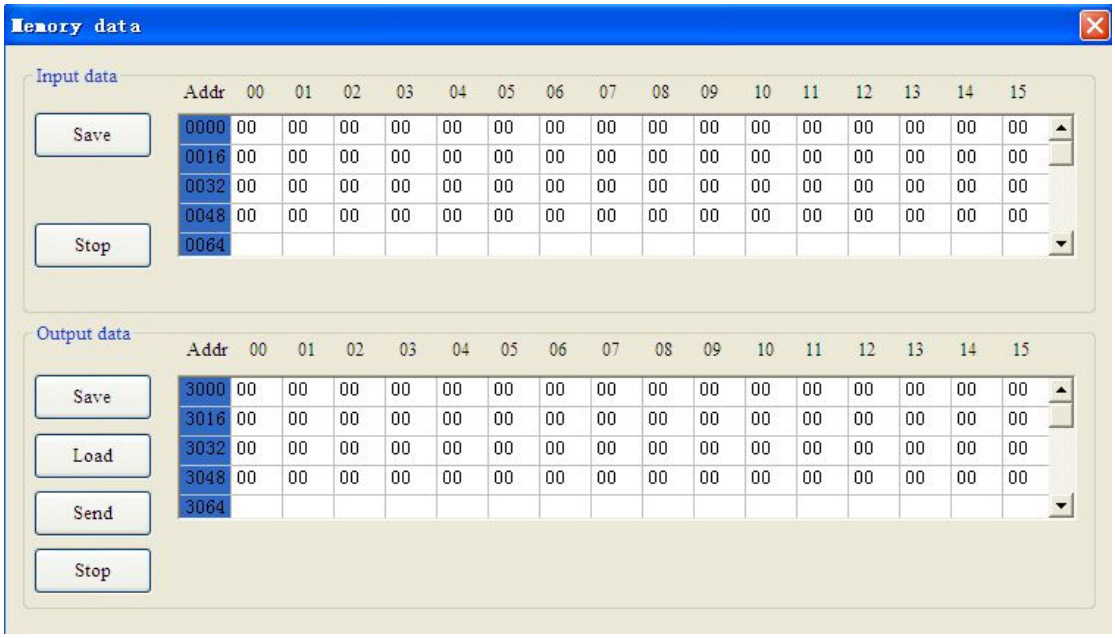
check that whether all the configuration parameters are right or not.

4.2.8 Memory

It shows the data exchange inside of the gateway, users can use this function to debug the HART fieldbus in the absence of the PROFIBUS or Modbus master station. Steps are as follows:

1) Firstly put the debugging DIP switch to “ON”, then regain the power. Now, HPM-610 is in the debugging mode.
2) Use a serial port line to connect the gateway’s RS232 port and computer RS232 serial port, open the software “HT-123”, click “Config—serial setting”, Select the correct serial port
3) Click ”Tool—Show Memory Data” or click on the icon 

, Interface is as follows：



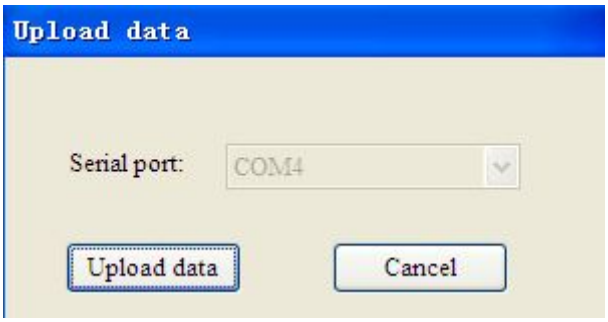
As is shown in the table, upper table shows the memory distribution of HART input data, lower table shows the output data. When you need to change the output data, click the “stop” button firstly, then change the related data or load the already saved data table, at last, click the “sending data”.

4.2.9 Diagnose

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

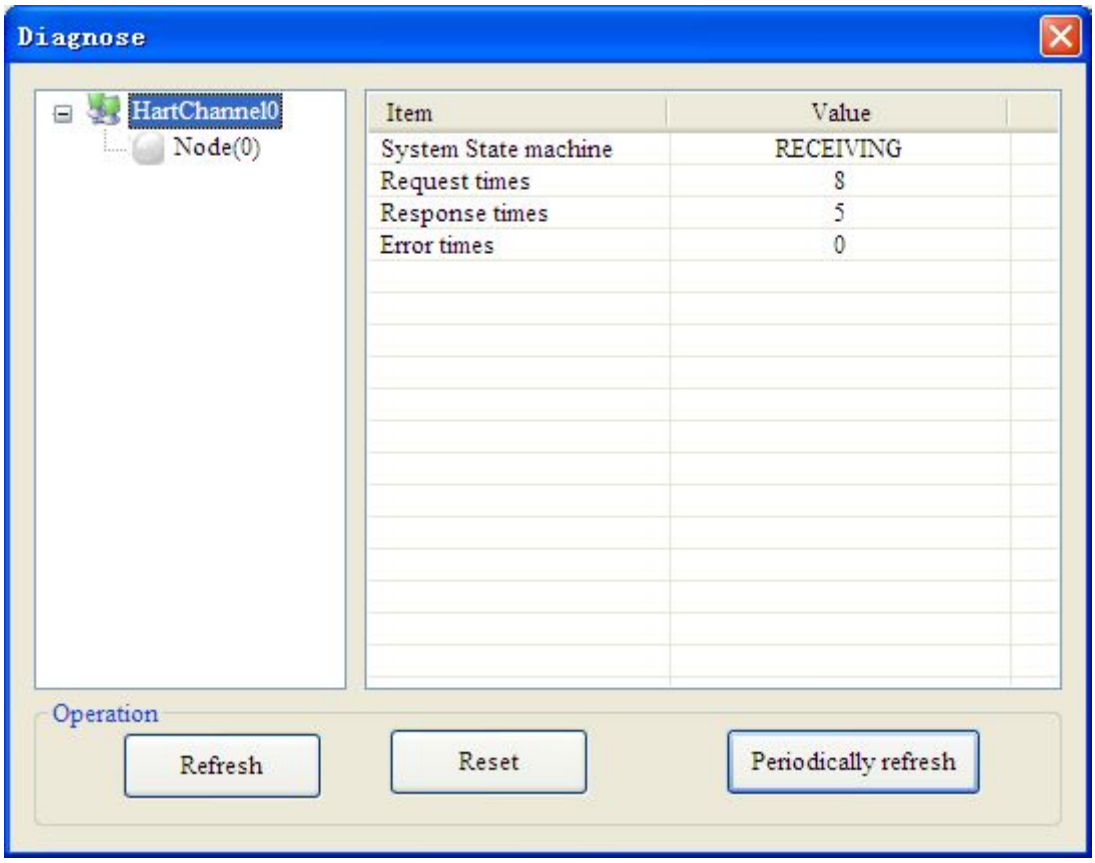
1. Ensure that the gateway's debug switch is in the ON state, and then regain the power, HPM-610 is in the debugging mode.
2. Use a serial port line connected to the gateway's RS232 port and computer RS232 serial port, Open the software "HT-123", Click "Config—serial setting", Select the correct serial port
3. Click "Tool—Diagnose" or click on the icon 

, Interface is as follows:



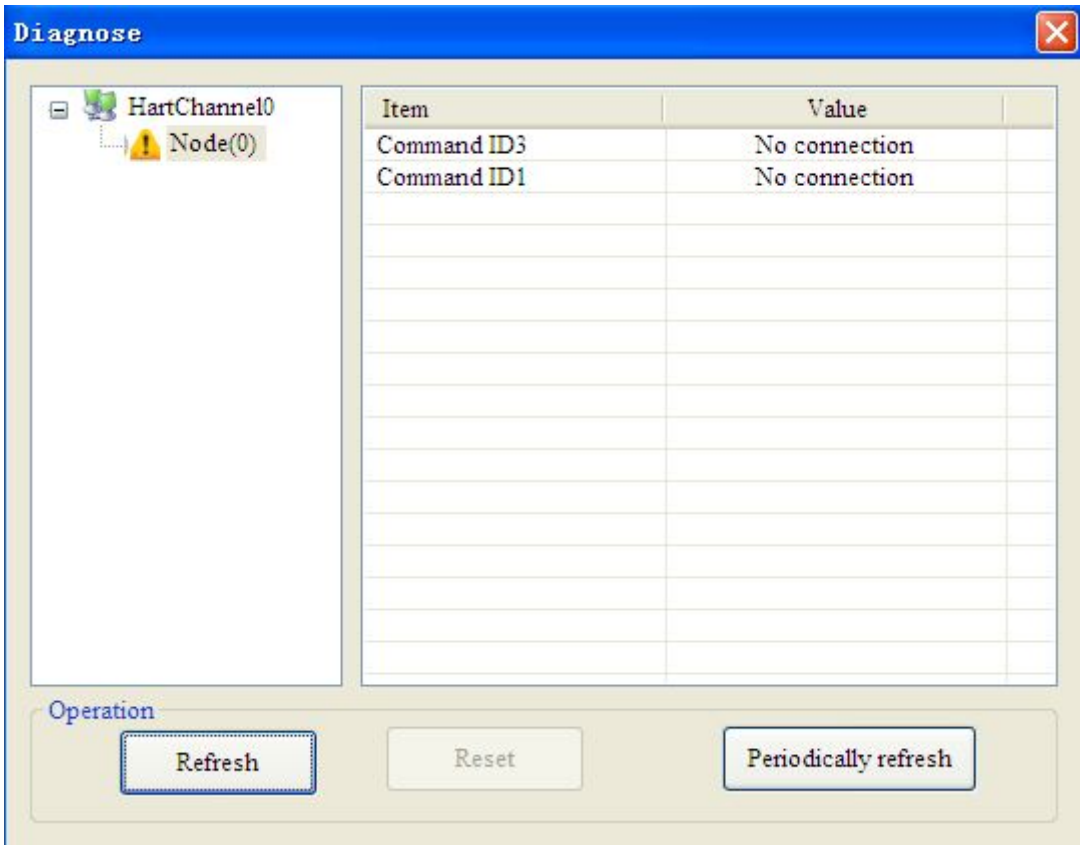
4. click "upload data" will see a picture as below

5.Press "confirm"button to get in the interface of diagnosis



Click on “HartChannel0” 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.

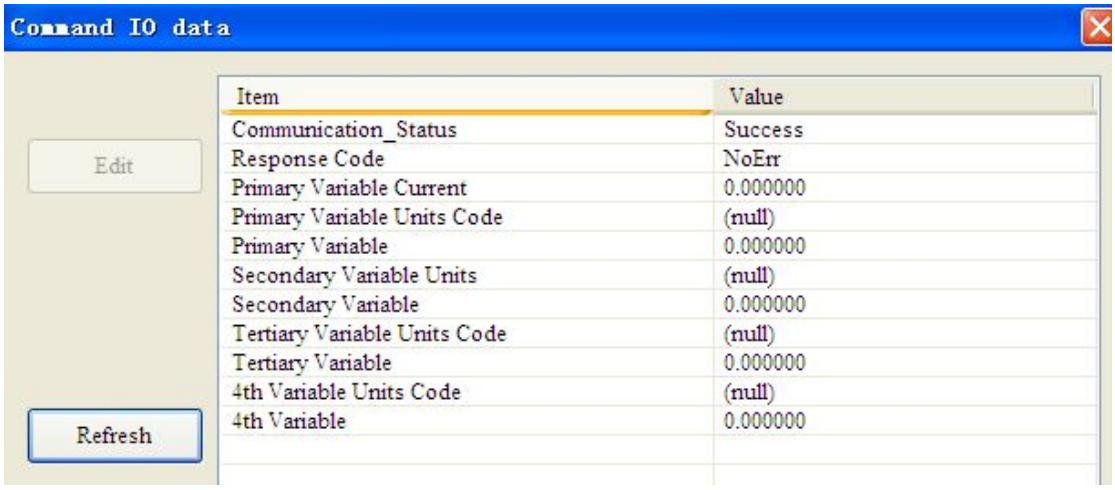
6.Click Node(x), it is shown as below



It shows the response status of configured commands.

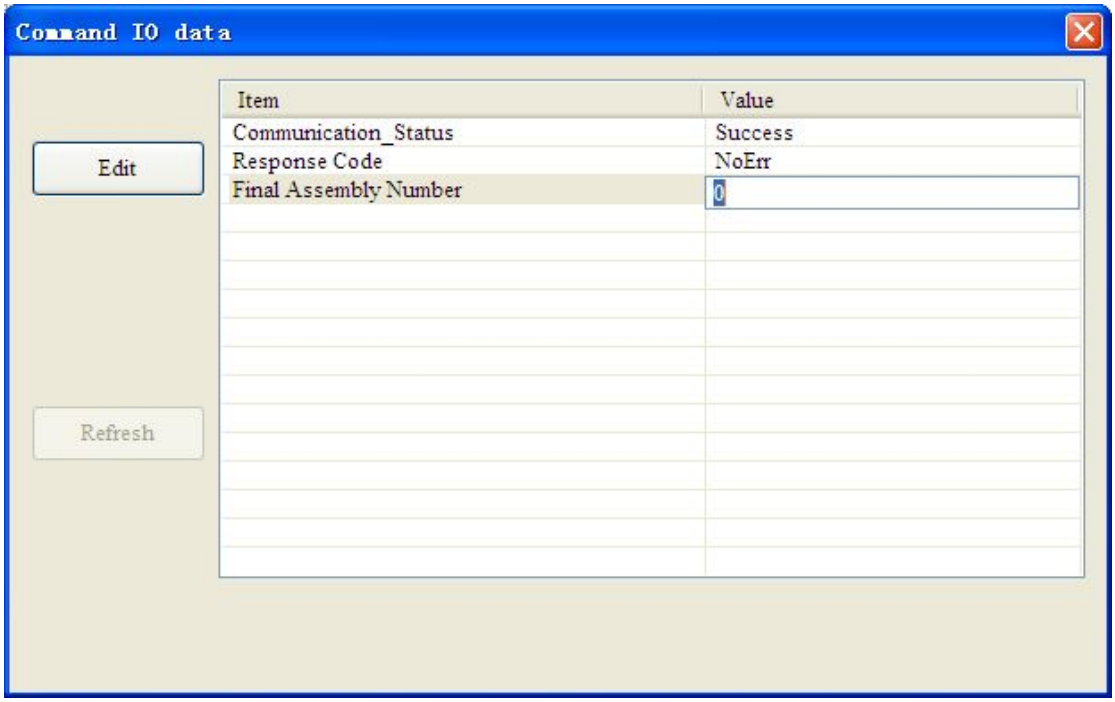
Click on “Refresh” will fresh these command status, “Periodically refresh” will fresh command status once.

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



Press the “Refresh” button will update the data, click the “Edit” button doesn’t work in the Read-only command.

Double click “CMD19” will show the window as below:



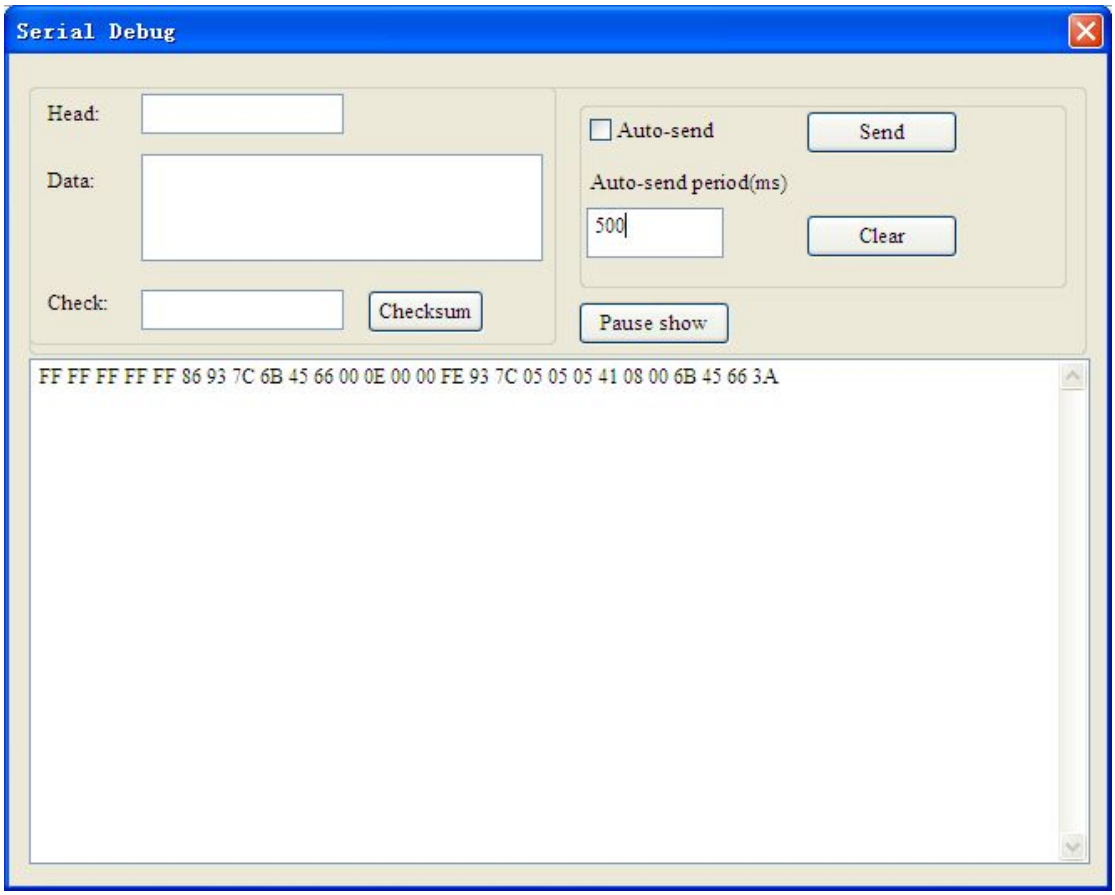
Click the value or attribute you want to change, like “Final Assembly Number”, change relevant values, and click “Modify” can execute this operation of write command.

4.2.10 Serial debug

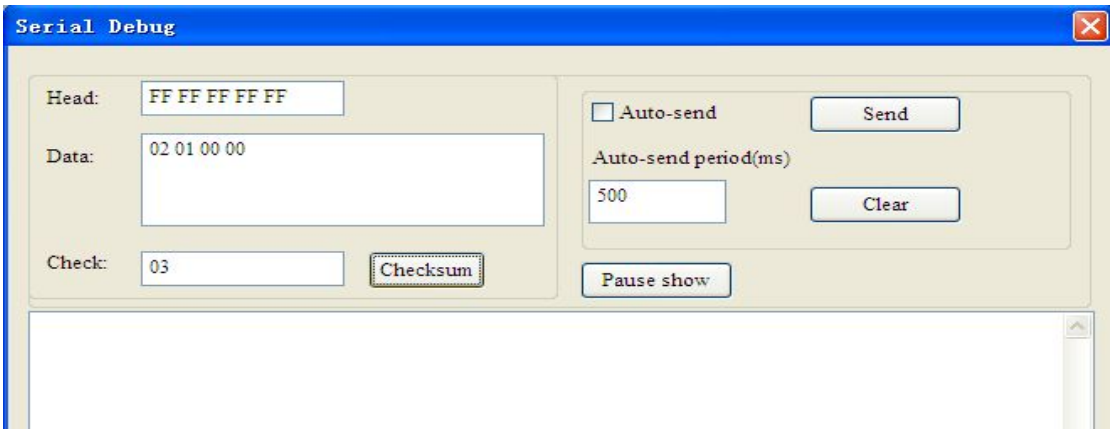
Through this function you could send any request message to Hart fieldbus and monitor the data that are received in HART fieldbus, concrete operations are as follows:

1) Firstly put the gateway’s debug DIP switch to “ON” state and power on again. Now, HPM-610 is in the debugging mode.
2) Connect the RS232 interface of HPM-610 with computer and open the software “HT-123”; click “Config—serial setting” and select the correct serial port.
3) Click “Tool—Serial debugging assistant” or click on the icon 

,it will pop the serial debugging assistant interface::



In this interface, click “Auto-send” or “Send” will combinate 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:



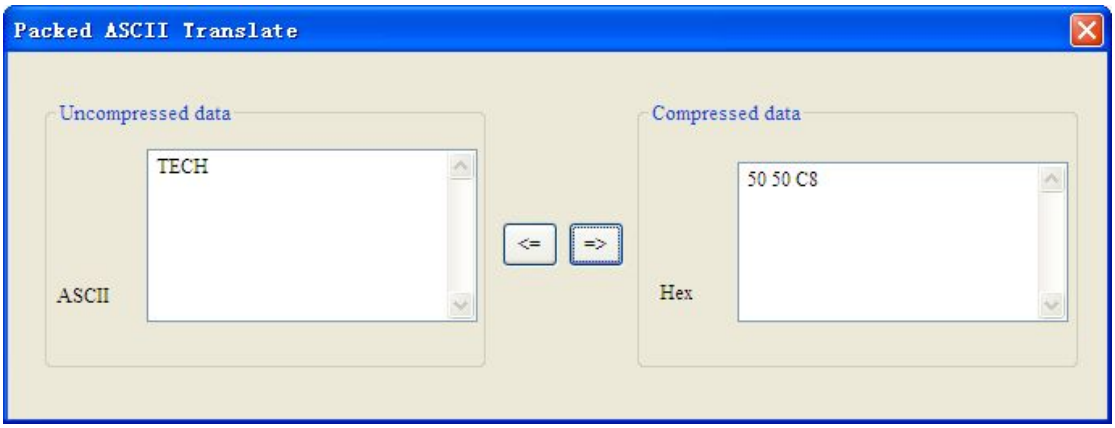
In this example, command 0 is composed of data head, data and check code. It uses short address; When you click “Send” , you will get the response data.

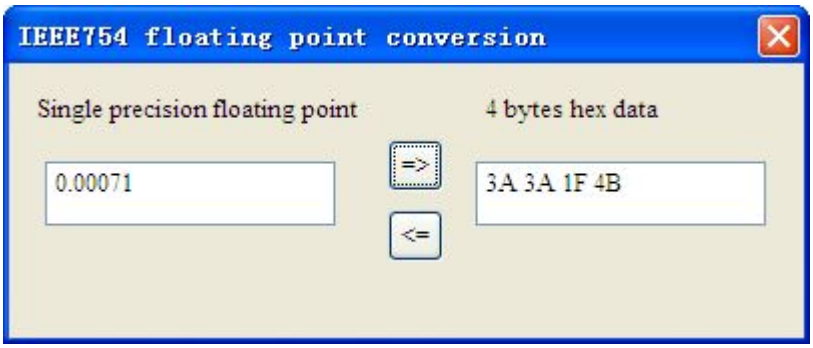
Note: Under this function, gateway will stop to execute the configured command; Turn off this function, gateway

will return to execute the configured command.

4.2.11 Switching tools

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





5 Working principle

The interior of the gateway opens up a memory block of 5000 bytes, and these 5000 bytes are considered as input and output buffers of data exchange area. Among them 0 ~ 2999 memory area acts as the storage area of the HART input data and device status. 3000 ~ 4999 memory area acts as the storage area of HART output data and control variables. The specific assignment is shown in the table below:

	Gateway memory address	Corresponding register address	Corresponding PROFIBUS input and output buffers	Description

Read-only part	0-1599	0-799	Address 0-243 corresponds input buffer area of PROFIBUS	The HART data input area
	1600-1619	800-809	no meaning to PROFIBUS	Device 0_cmd0 data
	1620-1639	810-819		Device 1_cmd0 data
	……	……		……Device 15_cmd0 data
	1920	960H		Gateway status
	1921	960L		Gateway HART port send times
	1922	961H		Gateway HART port receive times
	1923	961L		HART communication error times
	1924-1943	962-971		Reserve
	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		Reserve
	2392	1196H		Universal Receive label
	2393	1196L		Universal Receive Error Counter
	2394-2395	1197		Universal Receive data length
	2396-2695	1198-1347		Universal receive data
	2696-2999			Reserve
Readable and writable part	3000-3999	0000-0499	3000~3243 corresponds PROFIBUS output buffer	The HART data output area
	4000	0500H	no meaning to PROFIBUS	Reset send, receive, error counter
	4001	0500L		Polling is enabled
	4002	0501H		Trigger label
	4003	0501L		Trigger command number
	4004-4269	0502-0634		Reserve
	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 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 these internal commands is stored in this area.
- Gateway status: The gateway status indicates that what the gateway state is in the HART network, Defined as:

  0---- There are no HART communications.

  1----Sending

  2---- Waiting for a response

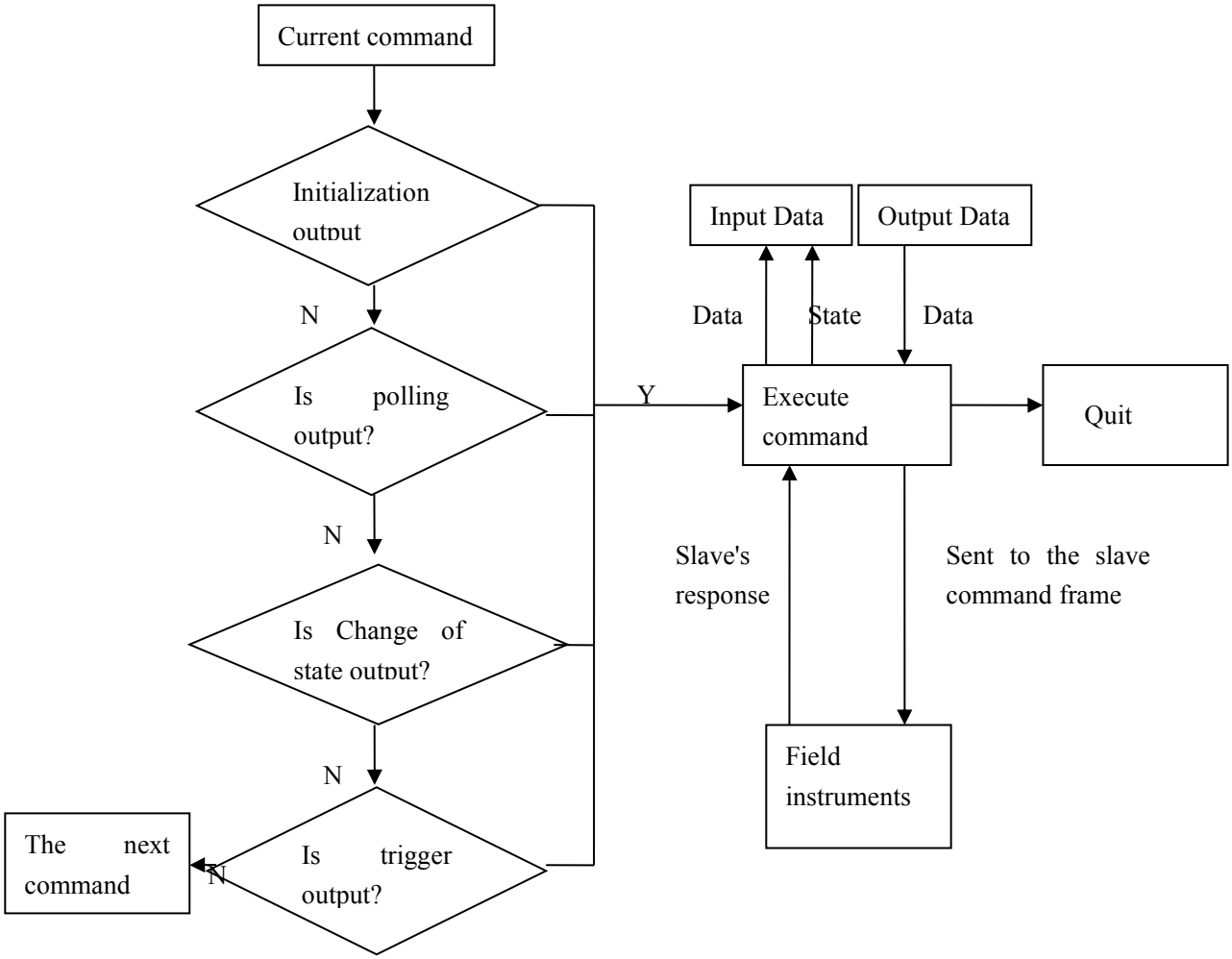
  3---- Handing a response
- send times of gateway HART port : The HART Sending counter
- receive times of gateway HART port : The HART Receive counter
- HART communication error times: The HART Receive Error counter
- Device 0_cmd0~ Device 15_cmd0's response status: Show the response status of internal commands
- The response status of the user command: Show the response status of the user commands

  Command status is defined:
  0---- Not performed
  1---- The correct response
  2---- Parity error
  3---- No Answer
  4---- defined error in agreement
  5----no connecting
- Universal Receiveing label: The receiving label under the generic mode, this value which changes one time indicates that HART end receives a HART frame
- The Generic Receive data length: Indicating the received data length in the common mode
- Universal Receive Error Counter: Indicate universal receiving error times
- Universal receive data: Store the received data from HART under generic mode
- Reset send, receive, error counter: Gateway's control signal; When the value of memory changes , gateway

causes all counters value to 0

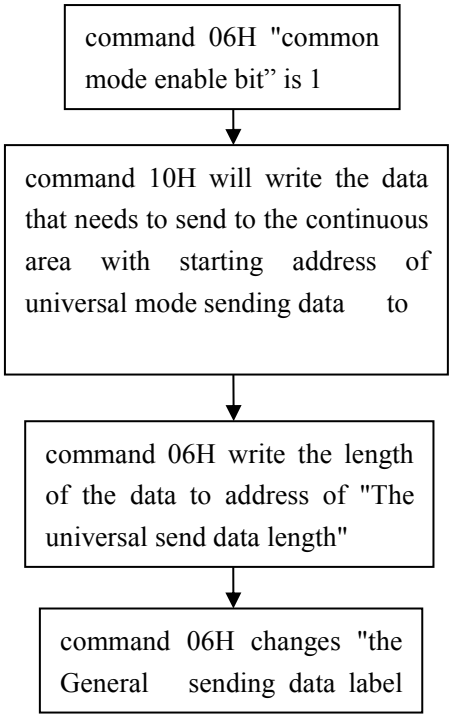
- Polling is enabled: This bit is readable and writable, when this bit is written 1 enables the polling output, writing 0 disables polling output; Reading 1 indicates that the polling state is enabled, 0 indicates that the polling is in the disabled state
- Trigger label: Change the value will result in one trigger operation
- Trigger command number: Trigger command number operation executed
- Universal mode enabled: The value of 1 indicates a general transfer function is enabled, otherwise prohibits this function
- Universal send label: The sending label under the generic mode, this value will lead to sending a HART frame when it changes one time
- Universal sending data length: The length of the transmission data under the universal mode
- Universal sending data: the transmission data under the universal mode

5.1 Flowchart when performing one HART Command



5.2 General Sending and Receiving Data

There are two common ways for users to choose: One is that fieldbus is defined as common mode. The gateway will receive serial data in the way of 3.5 character timeout broken frame, and send out the data unmodified from the HART interface. Gateway sends data from serial which is received from HART interface without modification. The character timeout time is determined by baud rate, such as baud rate of 19200, Character timeout time is considered to be (1/19200) * 10 * 3.5 ≈ 2ms. The other is to carry out the transmission of HART universal frame indirectly with MODBUS command , Examples as follows:



The gateway will store the received HART frame in a continuous region started in the address of "universal receiving data" and write the length of received data in the "Universal received data length"; Then, change the value of universal receive label ". If no data is received within the response waiting time, the gateway will order "universal reception error counter" to plus 1. Before sending the general frame, all users should read the universal receive label and the error counter; After finishing to send 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: using command 6 of MODBUS to write to the "trigger command number" with wanted trigger user command number (when configuring commands with HT-123, the software will automatically calculate and display it) ; Then rewriting "the trigger label" to let the value change can trigger the gateway to finish one trigger operation; The response data block in the device will be stored to "the reception data memory" which specified by this command number.

5.4 Data Exchange with PROFIBUS-DP

When fieldbus is configured as “PROFIBUS slave”, the input buffer of PROFIBUS will be mapped to the memory unit began with 0 in the interior of gateway. The memory unit began with 3000 of interior of gateway will be mapped to output buffer of PROFIBUS. PRODIBUS can read the field device data in the input buffer and can write the data to the field device in the output buffer. The maximum input/output bytes of PROFUBUS that HPM-610 supports is 244 bytes.

5.5 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 In STEP7: Access Data of Gateway and Select Data Module

6.1 How STEP7 access data of gateway

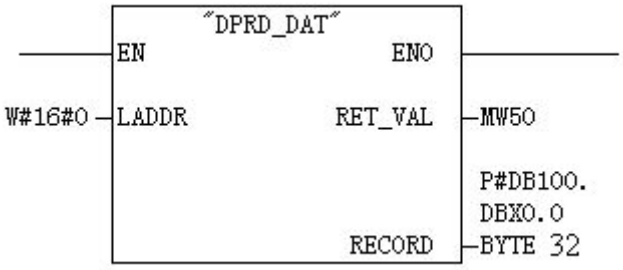
HPM-610 provides Modules shown as follow. The maximum allowed number of modules is 64 in Step7. The maximum allowed number of input bytes is 244, the max number of output bytes is 244 and the aggregate of maximum number of input bytes and output bytes is 488.

Module	Integrity
4 Words Input, 4 Words Output	Word
8 Words Input, 8 Words Output	Word
24 Words Input, 24 Words Output	Word
56 Words Input, 56 Words Output	Word
1 Byte Input	Byte
1 Word Input	Word
2 Words Input	Word
4 Words Input	Word
8 Words Input	Word
16 Words Input	Word
32 Words Input	Word
64 Words Input	Word
2 Words Input Consistent	Length
4 Words Input Consistent	Length
8 Words Input Consistent	Length
16 Words Input Consistent	Length
1 Byte Output	Byte
1 Word Output	Word
2 Words Output	Word
4 Words Output	Word
8 Words Output	Word
16 Words Output	Word
32 Words Output	Word
64 Words Output	Word
2 Words Output Consistent	Length
4 Words Output Consistent	Length
8 Words Output Consistent	Length
16 Words Output Consistent	Length

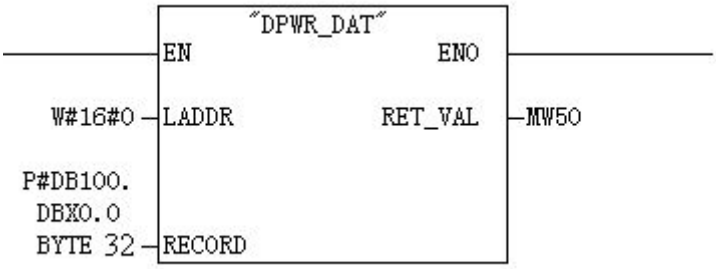
Above, the data modules which HPM-610 supports include: Word integrity, Byte integrity and length integrity.

For the data modules that support Word and Byte integrity, you can use command “MOVE” to access the data during STEP7 programing.

For the data modules that support length integrity, user can take compression way to send and receive data. The compression way mainly uses “SFC 15” and receiving uses “SFC 14”



SFC14



SFC15

6.2 How STEP7 select data module

Generally, when the data modules include “Consistent”, this means this data module is is length integrity, Take “2 words Input Consistent” as an example, when you choose the module, you must use “SFC 14” access the data address. When some data of Modbus slave is two-word data, and needs high accuracy and real-time, user generally select “2 words Input Consistent”, and not to select “2 words Input”.So, PLC can access the whole data module during reading data, and it can also prevent data from changing (last word data and next word data

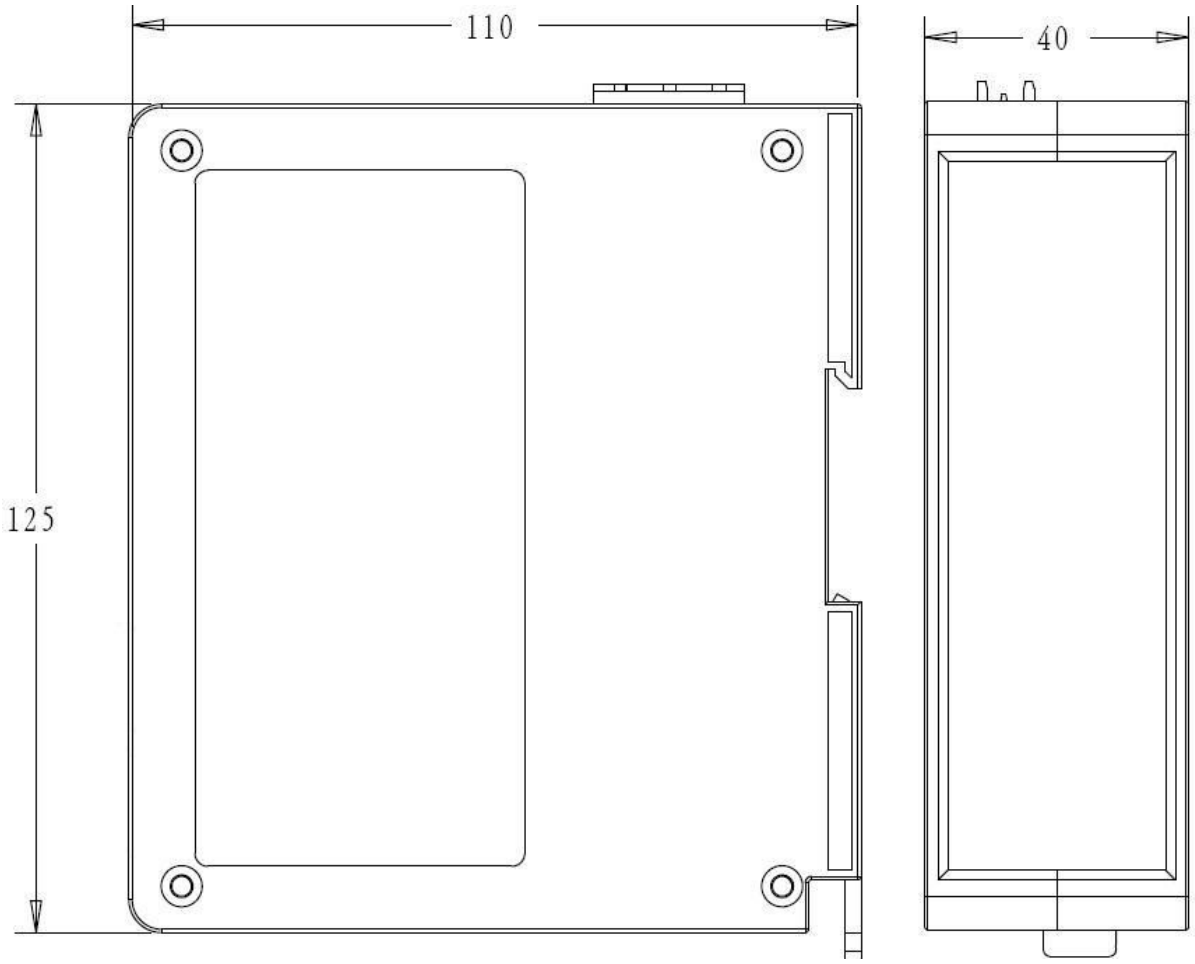
are not read in the same time).and causing incorrect data.

According to user's demand of input/output bytes, there are so many alternatives of the selection of data modules. For example: When user needs 20-word's input (The data number reading form Modbus slave through PLC is 20 words), user can directly select modules no less than 20 word's input (32words Input、64words Input…) or input one input/output modules no less than 20 word's input (56 words Input， 56words Output…).

7 Installation

7.1 Machine Dimension

Dimension: 40mm (width)*125mm (height)*110mm (depth)



7.2 Installation Method

Using 35mm DIN RAIL INSTALLATION