# HART/ Modbus Serial Gateway HTM-611

User Manual REV 2.2



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# HTM-611

HART/Modbus Serial Gateway

User Manual

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# **1 Product Overview**

### **1.1 Product Function**

HTM-611 is a gateway that can provide a seamless connection between HART and Modbus. At HART side it can be configured as a primary master or the secondary master, and acts as slave at the Modbus side.

## **1.2 Product Features**

- Powerful Serial function: Support the interconnection between HART and Modbus, also support transparent transmission between HART and serial port.
- Multi debugging functions: It can display the exchanging data, and diagnosis the HART command

# **1.3 Technical Specifications**

- [1] Used as a primary or a secondary HART master;
- [2] Supports one HART-channel, under multi-point mode, support connecting at most 13 HART slaves with gateway internal resistor and support connecting 15 HART slaves with an external resistor (250Ω);
- [3] Supports single-point and multi-point mode at the HART side;
- [4] Under single-point mode, support 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] Supports up to 128 HART commands, HART output data buffer is up to 1000 bytes, and the input data buffer is up to 1600 bytes;
- [8] Supports an internal or external HART sampling resistor;
- [9] Supports serial RS-232, RS-485 and RS-422, baud rate supports: 300, 600, 1200, 2400, 4800, 9600, 19.2K,



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38.4K, 57.6K, 115.2Kbps;

- [10] The serial port can be configured as Modbus slave, supports modbus function code: 03H, 04H, 06H, 10H;
- [11] Modbus slave supports RTU and ASCII communication;
- [12] The serial port can be configured as universal mode, and achieve transparent data transmission with HART slave devices;
- [13] Power: 24VDC (9V~30V), 80mA (24VDC);
- [14] Working circumstance temperature: -4°F~140°F(-20°C~60°C), Humidity: 5%~ 95%;
- [15] External dimensions (W\*H\*D): 0.98 in\*3.94 in \*3.54 in (25mm\*100mm\*90mm);
- [16] Installation: 1.38 in (35mm) DIN RAIL;
- [17] Protection Level: IP20;

## **1.4 Safety and Explosion-Proof Features**

HTM-611 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.

# 2 Quick Start Guide

The following example introduces the use method of the Gateway.

# 2.1 Configuration of Gateway Parameters

# 2.1.1 Pre-configured Settings

- 1. Turn gateway's configuration bit of DIP switch(refer to chapter 3.3.1) to "ON";
- 2. Connect the Gateway's RS-232 interface and the serial port of the computer with a serial cable, wiring methods see chapter 3.4.3 of this manual;
- Power on the gateway, the LED display show "CF", indicates that the gateway is in the configuration mode. Run the HT-123 to start the gateway configuration.

# 2.1.2 Software Configuration

- 1. Run the HT-123 software installed on your computer.
- 2. Click "Fieldbus" in the tree view on the left, the configuration table is shown on the right as below:

✓ HT-123 Configuration Software					
File(F) Config(E) Tool(T) View(V) He	ւեթ (էլ)				
New Save Open AddNode Del	E         Image: Construction         Construction <th>Disgnose Debug</th>	Disgnose Debug			
i x	Mode	Modbus slave			
Fieldbus	Baudrate	19200			
	Data bits	8			
	Parity	None			
	Stop bits	1			
	Communication interface	RS485			
	Slave address	1			
	Communication mode	RTU			
	Timeout clear	Keep			
	Timeout number	3			



3. Click "HartChannel0" in the tree view on the left, the configuration table is shown on the right as below:

🌽 HT-123 Configurati	on Softwar	B							
File(F) Config(E) Tool(I)	∣ View(V) He	Լթ ( <u>H</u> )							
New Save Open	AddNode Dell	<b>k pb</b> Iode AddCmd	DelCmd Upload	Download Auto	ap Conflict	Export Memory	Di agnose	<b>D</b> ebug	
the Tradition	× 1	Master type					Primary	master	
TIEIddus		Network mo	de				Point to	point	
HartChannel		Maximum re	oetitions				3		
		Polling Enabl	e				Enable		
Delay between polls				256					
		Response tin	ieout				256		

Note: HART protocol specifies that the slave device which address is 0 must work in single-point mode. In single-point mode the digital communication and analog communication is allowed to exist at the same time. The Slave with address 1~15 works in multi-point mode. 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 default factory address of field 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 selects "Add Command" to add a command (Command ID1) in the dialog box, and then click OK to return.

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Prise (P) Control (P) Tool (P) Vree (P) Help (R) New Save Open AddNode DelNede AddEnd DelCed Upload	V 💼 💸 🗷 📕 👤	Debug
<ul> <li>K</li> <li>SiboTech supply communication adapters and configuration softw DeviceNet, Ethernet, PROFIBUS-DP, SPA, CAN, CANopen, Y</li> </ul>	Command list Selected command Command D1 Command D1 Command D2 Command D3 Command D3 Command D4 Command D5 Command D6 Command D7 Command D9 Command D10 Command D11 Command D11 Command D12 Command D13 Command D14 Command D15 Command D16 Command D17 Command D19 Command D10 Command D14 Command D15 Command D14 Command D15 Command D14 Command D15 Command D14 Command D15 Command D16 Command D19 Command D19 Command D19 Command D19 Command D14 Command D15 Command D14 Command D15 Command D16 Command D17 Command D18 Command D19 Command D1	
We are Kepware agent in China and offer a variety of OPC software web Site: www.sibotech.net/En	are unvers.	l

6. Click the "Command ID1", the configuration table on the right is configured as below:

Configuration Mode	Basic	
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	



7. Click the tool Download, in the pop-up dialog box, select the serial port that gateway is connected to the computer,

click OK and then click Download data:

Select the serial	port
Serial port:	СОМЗ
OK	Cancel



<i>HTM-611</i> HART/Modbus Serial Gateway				
User Manu	ıal			
	Download data			
	Serial port: COM3			
	Download data			
	HT-123       Serial por       Download successfully       Downloa			

# **2.2 Function Demo**

HART interface of the gateway connects with a 2-wire pressure transmitter with slave address 0, RS-485 interface is connected to the computer through RS-485/RS-232 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:

**User Manual** 





# **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**

<b>Indicator location</b>	Indicator	State	State Description
Row 1	$\mathbf{T}\mathbf{V}$	Blinking	Serial port data sending
	IЛ	OFF	No data is sending
	DV	Blinking	Serial port data receiving
	КА	OFF	No data is receiving
Row 2	$\mathbf{T}\mathbf{V}$	Blinking	HART Bus data sending
	IЛ	OFF	No data is sending
	DV	Blinking	HART Bus data receiving
	KΛ	OFF	No data is receiving

# **3.3 DIP Switch/Button**

# 3.3.1 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

Note: ①After re-configuring the switch, you have to restart the HTM-611 to make the settings take effect! (Power off then Power On)

②Set to the debug mode, it will be compulsory to appoint RS-485 interface as communication interface, RS-232 interface as debugging interface.

③Configuration interface uses the RS-232 interface.





### 3.3.2 Modbus Address Setting Button

Under run mode of the HTM-611, LED display always displays the address of the current Modbus address. Quickly press (double-click) the button twice in succession, the high bit starts to flash, 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, HTM-611 exits the status of setting address and continue to display the original address. The configurable range of Modbus address is 0 to 99 (Decimal).

## 3.3.3 Internal/External Sampling Resistor Switch

HTM-611 can choose using the internal sampling resistor or external sampling resistor to get the HART signal. The specification of the internal resistor is  $270\Omega$ , 2W. When the power of the sampling resistor is more than 2W, you must use an external 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/RS-422 Interface

The RS-485 interface of HTM-611 is a standard one, and the RS-485 characteristics of the product 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).

<sup>(5)</sup>Plug connection: 3/5-pin pluggable terminal.

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

(1)All 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—120 $\Omega$  1/2W to ensure reliable operation of the network.

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

5-pin terminal:



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		

## 3.4.3 RS-232 Interface

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







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Pin	Function	
1	RX, Connect RS-232's RX of user device	
2	TX, Connect RS-232's TX of user device	
2	GND, Connect RS-232's GND of user	
3	device	

# 3.4.4 HART Interface



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

# 3.4.5 Mini B Type USB



Mini B type USB interface is defined as below:

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Pin	Name	Function
1	VBUS	+5V
2	D-	Data negative
3	D+	Data positive
4	IN	NC
5	GND	Signal Ground

# **3.5 Topology of HTM-611 and Fieldbus Devices**



Not using the internal resistor!





HARTLOOP+



HARTLOOP-

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 HT-123, 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

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

The following describes how to use the software HT-123 to configure the product HTM-611. You may also check the software user manual to get detailed usage.

				.1

Double-click on the icon ITT-123 to enter the main interface of software:

File (P) Config (P) Tool (T) View (V) Help (H)	Download Autolisp	Di agnose Debug	
Fieldbus HartChannel0	l Bar		
Network Settings interface: Contains Fieldbus and the connection object	Parameter Settings interface: Contains modifiable part (white) and unmodifiable part (grey)		
Info News		Comment field: Explain the function of the configuration options	

#### Tool Bar:

Toolbar interface shown as follow:



The function from left to right is: New, Save, Open, AddNode, DelNode, AddCmd, DelCmd, Upload,





Download, AutoMap, Conflict, Export, Memory, Diagnose and Debug.

New

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 could analyze operating condition of fieldbus device; also it can finish some certain analysis



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

# 4.2 Software Functional Specifications

# 4.2.1 Connect with the Hardware

Put the gateway configuration switch to "ON", use a serial port line to connect the gateway RS-232 port and that of computer. Power on the gateway and its LED display displaying "CF" indicates it is in the configuration mode.



# 4.2.2 Upload configuration

Open the software "HT-123", Click on the icon 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 HT-123.

Upload data		
Serial port:	COM3	
Upload dat	ta Cancel	
Upload data		
Serial port:	Upload successfully	
Upload c		

# 4.2.3 Configure the 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:

### User Manual

🖉 HT-123 Configuration Software						
File (F) Config (E) Tool (T) View (V) Help (H)						
	Te 💼 💼 🏠 🥼 🦀 🗶					
New Save Open AddNode D	elNode AddCmd DelCmd Upload Download AutoMap Conflict	Export Memory Diagnose Debug				
-						
Tieldhus	Mode	Modbus slave				
HartChannel0	Baudrate	19200				
Node(0)	Data bits	8				
Command ID1	Parity	None				
Command ID3	Stop bits	1				
Command ID6	Communication interface	RS485				
Command 120	Slave address	1				
	Communication mode	RTU				
	Timeout clear	Keep				
	Timeout number	3				
×						
Info News						

In this interface you can set the parameters as shown:

Baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200bps

Data bits: 8

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

Stop bits: 1, 2

Communication mode: RTU, ASCII

Slave address: 0~247

Communication interface: RS-485, RS-232 optional. When the serial need to communicate with RS-422,

#### please choose "RS-485"

Timeout clear: 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

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#### 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 (RS-232/RS-485/RS-422), 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:

🖉 HT-123 Configuration Software					
File(F) Config(E) Tool(T) View(V) H	(elp (t)				
New Save Open AddNode Del	🔀 💼 🔲 🏠 Upload Download AutoMap Conflict Export Memory Diagnose Debug				
× Fieldbus HartChannel0 Solde(0) Command ID1 Command ID3 Command ID6	Mode     Universal mode       Baudrate     19200       Data bits     8       Parity     None       Stop bits     1       Communication interface     RS485				
There are three types of modes: Modbus slave, Universal mode and Profibus slave.           Info         News					

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

### User Manual

	HI-123 Configuration Software						
File(F) Config(E) Tool(T) View(V) H	elp (H)						
🗅 🗖 🙀 🔚 1	Fer 💼 💼 🏠 📜 🌰 🗶						
New Save Open AddNode Del	LNode AddCmd DelCmd Upload Download AutoMap Conflict	Export Memory Diagnose Debug					
		-					
	Master type	Primary master					
⊨ 🐙 HartChannel0	Network mode	Point to point					
- Se Node(0)	Maximum repetitions	3					
Command ID1	Poling Enable	Enable					
Command ID3	Delay between polls	256					
Command ID6	Response timeout	256					
×	JI						
Î							
Info News	Info News						

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: 0~5

Polling Enable: Enable, Disable

Delay between polls: 256~65535ms

Response timeout: 256~65535ms

#### 4.2.4.2 Add Slave Nodes

Select the"HartChannel0", Right click the mouse and click "AddNode".

USE	er Manu	al	
HT-123 Config	uration Softwa	re	
.e(E) Config(E) 1	Tool(I) View(V) H	elp (H)	
New Save C	ipen AddNode De	Image: Node AddCmd         DelCmd         Upload         Download         AutoMap         Conflict	t Export Memory Diagnose Debug
Tialdhua	· · ·	Master type	Primary master
HertChannel		Network mode	Multi-drop
	Add Node	Maximum repetitions	3
	Delete Node	Polling Enable	Enable
	Add Command	Data tata and	256
- Com	D.J. C. J	Delay between polls	250

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.

	2	
File(F) Config(E) Tool(I) View(V) He	lp H	
New Save Open AddNode Dell	k 🗊 🔲 🏠 🦣 🎉	ict Export Memory Diagnose Debug
Fieldbus HartChannel0 Node(1) Command ID1 Command ID3 Node(2) Command ID1	Hart slave address	
× Info News		

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 (x)", Right click the mouse and click "Add Command".



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

elect the comma	nd
Command list	Selected command
Command ID0 Command ID1 Command ID2 Command ID3 Command ID4 Command ID5 Command ID6 Command ID7 Command ID7 Command ID9 Command ID10 Command ID10 Command ID11 Command ID12 Command ID13 Command ID13 Command ID15 Command ID15 Command ID16 Command ID17 Command ID17 Command ID18 Command ID18 Command ID19	Command ID1 Command ID2 Command ID4 Command ID5
Command ID19	Cancel

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:



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	re	
File(F) Config(E) Tool(T) View(V) H	elp (H)	
New Save Open AddNode Del	Fi 📄 🔯 🏠 Upload Download AutoMap Conflict	Export Memory Disgnose Debug
Fieldbus HartChannel0 Node(1) Command ID1 Command ID3 Node(2) Mode(2)	Mode of outputting commands Memory starting address of sending data Modbus register starting address of sending data Sending data length (BYTE) Sending data length (WORD) Memory starting address of receiving data Modbus register starting address of receiving data Receiving data length (BYTE) Receiving data length (WORD) Command index	Polling output 3000 0 0 0 0 0 0 0 0 0 0 0
X		

Configuration Mode: basic and advanced optional, "basic" is shown as above, "advanced" configuration can refer to chapter 4.2.4.7;

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
- $\checkmark$  Initialization output: Execute the command only once when power is on
- $\checkmark$  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



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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.

#### 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.

#### 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:

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✔ HT-123 Configuration Software		
File(F) Config(E) Tool(T) View(V) Hel	lp (£)	
New Save Open AddNode DelN	Các phát San Charles Conflict Export Memory	Di agnose Debug
	Configuration Mode	Advanced
Fieldbus	Mode of outputting commands	Polling output
HartChannel	Memory starting address of sending data	3000
	Modbus register starting address of sending data	0
Command ID1	Sending data length (BYTE)	0
Command ID3	Sending data length (WORD)	0
	Receive Data Project Configuration	Configuration
	Command index	0

This interface details is described in chapter 4.2.4.4, 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:

ped address		Res	oonse Data	
es Memory Address	Modbus register address	Byte swap		Command Status Byte0-3 Byte4 Byte5-8 Byte9 Byte10-13 Byte14 Byte15-18 Byte19 Byte20-23

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":

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Bytes: response bytes of "Response Data";

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

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".

Bytes	Memory Address	Modbus register address	Byte swap		Command Status
0-3	0	0	Register swap		Byte4
5-8	0	0	Register swap		Byte9
					Byte10-13
					Byte14
				-	Byte15-18
				-	Byte19
S	<u></u>				Dyte20-25
				-	
				-	
				_	

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

Close the dialog box, download the configuration into HTM-611.

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.

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 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 conflict according to the input/output bytes number by users' commands.





Yes

No

### 4.2.7 Download Configuration

Click the icon<sup>Download</sup>; it will download the configuration into the gateway.

### 4.2.8 Memory Data Display

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

- Set the DIP switch's debug bit to ON state and the configuration bit to OFF state, restart the gateway. HTM-611 is in the debug mode.
- Use a serial port line to connect the HTM-611's RS-232 port and computer RS-232 serial port, Open the software "HT-123", 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:

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Parauta	Addr	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	
Save	0000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
	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	
1.1																		
Stop	Addr	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	-
Stop	Addr	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	-
Stop utput data Save	Addr 3000 3016	00 00 00	01 00 00	02 00 00	03 00 00	04 00 00	05 00 00	06 00 00	07 00 00	08	09 00 00	10 00 00	11 00 00	12 00 00	13 00 00	14 00 00	15 00 00	-
Stop utput data Save	Addr 3000 3016 3032	00 00 00 00	01 00 00 00	02 00 00 00 00	03 00 00 00	04 00 00 00	05 00 00 00	06 00 00 00	07 00 00 00	08 00 00 00	09 00 00 00	10 00 00 00	11 00 00 00	12 00 00 00	13 00 00 00	14 00 00 00	15 00 00 00	
Stop utput data Save Load	Addr 3000 3016 3032 3048	00 00 00 00 00	01 00 00 00 00	02 00 00 00 00 00	03 00 00 00 00	04 00 00 00 00	05 00 00 00 00	06 00 00 00 00	07 00 00 00 00	08 00 00 00 00 00	09 00 00 00 00	10 00 00 00 00	11 00 00 00 00	12 00 00 00 00	13 00 00 00 00	14 00 00 00 00	15 00 00 00 00	

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 displays of certain command, operating steps are as follows:

- Set the DIP switch's debug bit to ON state and the configuration bit to OFF state, back online. HTM-611 is in the debug mode.
- Use a serial port line to connect the HTM-611's RS-232 port and computer RS-232 serial port, Open the software "HT-123", Click "Config—Serial Connection", Select the correct serial port



3. Click "Tool—Diagnose" or click on the icon

Diagnose, Interface is as follows:



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Upload data Serial port: COM3	
Upload data Cancel	

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

	HT-123	
Serial port:		Upload successfu
	C	ОК

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

👯 HartChannel0	Item	Value
Node(0)	System State machine	RECEIVING
	Request times	8
	Response times	5
	Error times	0
ration		

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.



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

Diagnose			×
HartChannel0	Item Command ID0 Command ID1 Command ID3	Value Response correct Response correct	
Operation Refresh	Reset	Stop up dating	

It shows the response status of configured commands.

Click "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, 14, 15, 16, 17, 18, 19 will show their command information, command 6, 17, 18 and 19 can start data input.



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	Item	Value	
	Communication Status	Success	
Edit	Response Code	NoErr	
0.000	Primary Variable Current	0.000000	
	Primary Variable Units Code	(null)	
	Primary Variable	0.000000	
	Secondary Variable Units	(null)	
	Secondary Variable	0.000000	
	Tertiary Variable Units Code	(null)	
	Tertiary Variable	0.000000	
	4th Variable Units Code	(null)	
	4th Variable	0.000000	

Click 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:

	Item	Value	
	_ Communication_Status	Success	
dit	Response Code	NoErr	
	Final Assembly Number	0	
200 (2011)			
resh			

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 could send any request message to Hart instruments and record the response

information. Steps are as follows:

- Set the DIP switch's debug bit to ON state and the configuration bit to OFF state, restart the gateway. Now HTM-611 is in the debug mode.
- Use a serial port line to connect the HTM-611's RS-232 port and computer RS-232 serial port, Open the software "HT-123", Click "Config—Serial Connection", Select the correct serial port

Data: Auto-send period(ms) 500 Clear Check: Checking	Auto-send period(ms) 500 Clear Pause show
Check:	500     Clear       Checksum     Pause show
Check:	Checksum Pause show
Pause show	

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.



Use	r Manual	
erial D	ebug	
Head:	FF FF FF FF FF	Auto-send Send
Data:	02 01 00 00	Auto-send period(ms) 500 Clear
Check:	03 Checksum	Pause show

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.

# 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.

	TECH	_	50 50 C8	
		< >		
ASCII			Hex	
	IEEE75	4 floating point	conversion	X
	IIIIII 754	4 floating point of precision floating point	conversion 4 bytes hex data	
	THEFT 50 Single p	4 floating point of precision floating point	4 bytes hex data	
	Single p	4 floating point of precision floating point	4 bytes hex data	



# **5** Working Principle

Inside the gateway it opens up a length of 5000 bytes of memory as the data exchange of input and output 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	Corresponding	Description
	memory	Modbus register	
	address	address	
	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
Read	1924-1943	962-971	Reserved
1-onl	1944	972H	Device 0_cmd0's response status
y pai	1945	972L	Device 1_cmd0's response status
<b>H</b>			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 label
	2393	1196L	Universal receive Error Counter
	2394-2395	1197	Universal receive data length
	2396-2695	1198-1347	Universal receive data
	2696-2999		Reserved
Re	3000-3999	0000-0499	The HART data output area
adable and itable part	4000	0500H	Reset to send, receive, error counter



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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 label: The receive label under the universal mode, this value which changes one time indicates that HART end receives a HART 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 counter: The gateway's control signal, when the value of memory changes, gateway causes all the counter 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 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 to send data: Data needs to send under the universal mode



### 5.1 Flowchart of Executing One HART Command



### 5.2 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 will receive the 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 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



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considered to be (1/19200) \* 10 \* 3.5  $\approx$  2ms. 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.

# 5.3 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 HT-123 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: 0.98 in (width)\*3.94 in (height)\*3.54 in (depth)



# **6.2 Installation Method**

Using 1.38 in (35mm) DIN RAIL

User Manual

# Installing the gateway





Uninstalling the gateway





