HART-710

User's Manual

Version 1.00

Warranty

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List of Revision

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1. Introduction

Modbus and HART are two kinds of famous protocols and are wildly used in the fields of factory and process automation. The HART-710 module is a Modbus to HART gateway. By using this module, users can integrate their HART devices into Modbus network easily.

Figure 1 shows an application example for the HART-710 module.

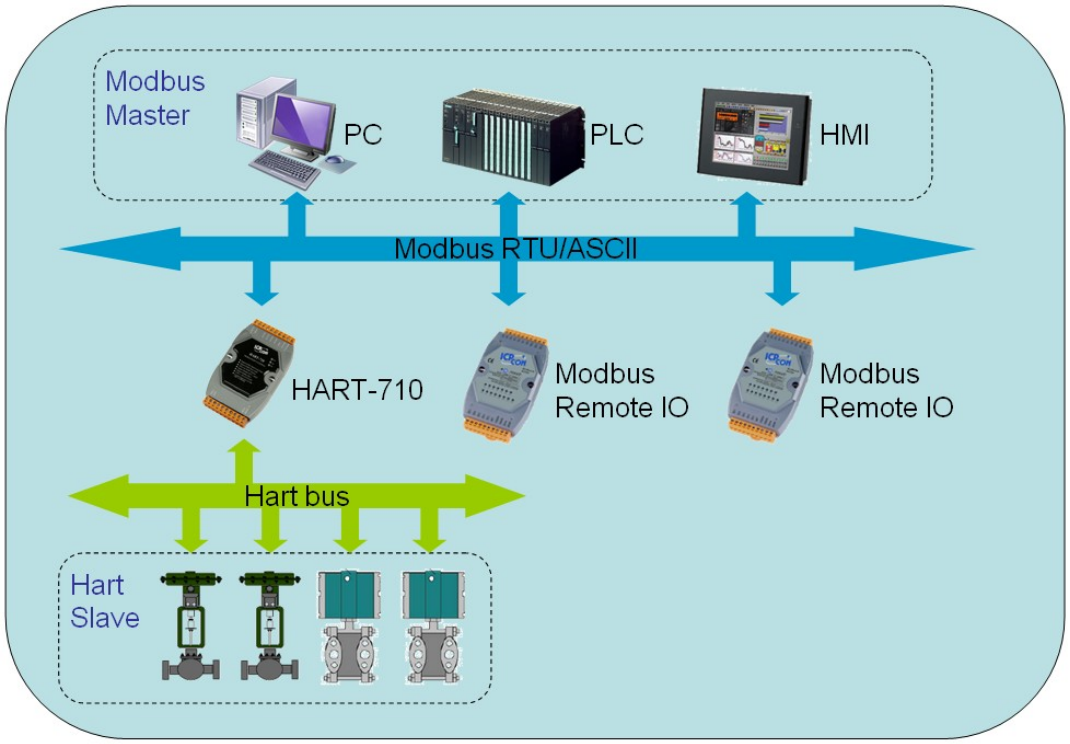


Figure 1: Application architecture of the HART-710 module

The main features and specification of HART-710 are described as below:

1.1 Features

- 32-bit Microprocessor inside with 100MHz
- Support HART Short/Long frame
- Support HART Burst mode
- Allow two HART Masters
- Support Modbus RTU and ASCII format
- Support Modbus Slave mode
- Isolated COM 1: RS-232/422/485

- Provide LED indicators
- Built-in Watchdog
- DIN-Rail or Wall Mounting

1.2 Modbus Support

Only the following Modbus commands are supported by the HART-710 module.

Table 1: Modbus function codes

Code	Name	Description
01	Read Coil Status	Read the ON/OFF status of discrete outputs in the slave
02	Read Input Status	Read the ON/OFF status of discrete inputs in the slave
03	Read Holding Registers	Read the binary contents of holding registers in the slave
04	Read Input Registers	Read the binary contents of input registers in the slave
05	Force Single Coil	Write a single output to either ON or OFF in the slave
06	Preset Single Register	Write an integer value into a single register in the slave
15	Force Multi. Coils	Write each coil in the sequence of coils to either ON or OFF in the slave
16	Preset Multi. Registers	Write a block of contiguous registers in the slave

1.3 Specifications

UART Specifications:

- COM1- RS-232(3 wire)/RS-422/RS-485
- COM1 interface: 9-pin screwed terminal block
- Baud Rate : 1200 ~ 115200 bps
- Data Format: 7/8 data bits, None/Odd/Even parity bit, 1/2 stop bit

HART Specifications:

- Channel number : 1
- Channel interface : 2-pin screwed terminal block
- Operates as a HART Master Station and supports all HART commands
- Frame : Short or Long
- Network : Point to Point or Multi-drop
- Max. 16 HART module
- Max. 100 user command + 32 default command

Power Requirement:

- Unregulated +10 ~ +30 V_{DC}
- Power reverse protection, Over-Voltage brown-out protection
- Power consumption : 1 W

Module Specifications:

- Dimensions: 72 mm x 33 mm x 122 mm (W x L x H) Detail
- Operating temperature: -25 ~ 75 ºC
- Storage temperature: -30 ~ 85 ºC
- Humidity：5 ~ 95% RH, non-condensing
- LED Status Indicators(*Table 2*)

Table 2: LED status indicator

PWR LED	– Show the power state
ERR LED	– Show error state
RUN LED	– Show communication state of HART

2. Hardware

2.1 Block Diagram of HART-710

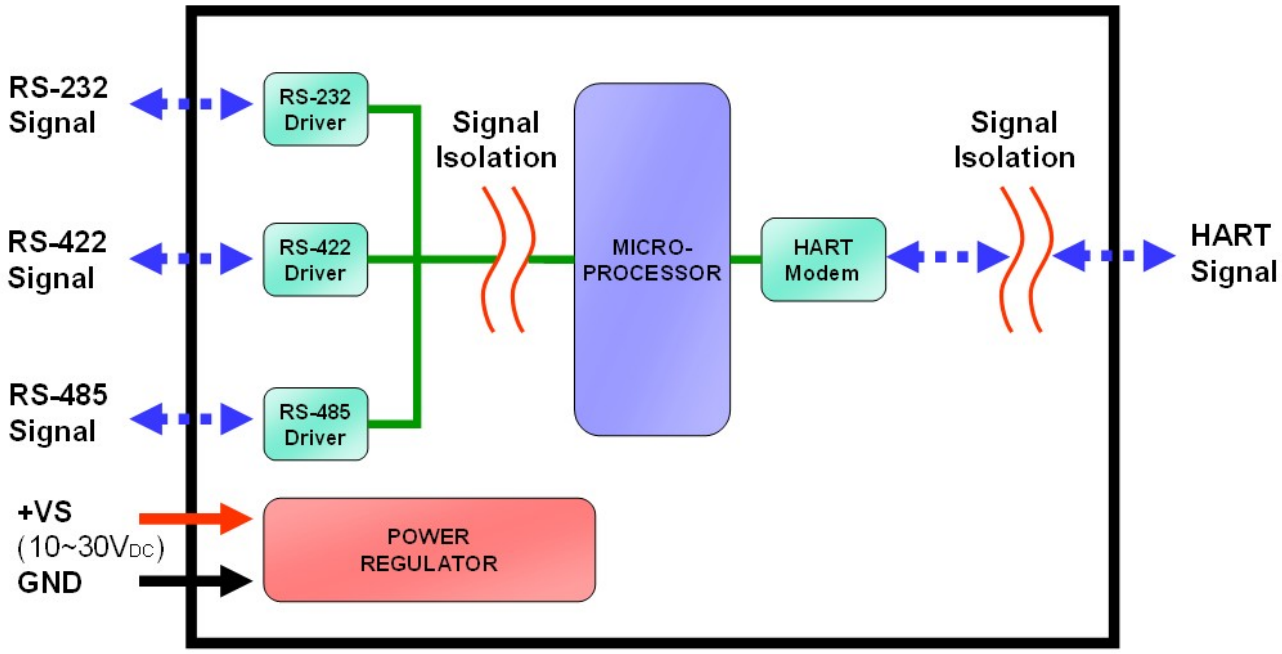


Figure 2: Block diagram of HART-710

2.2 Pin Assignment

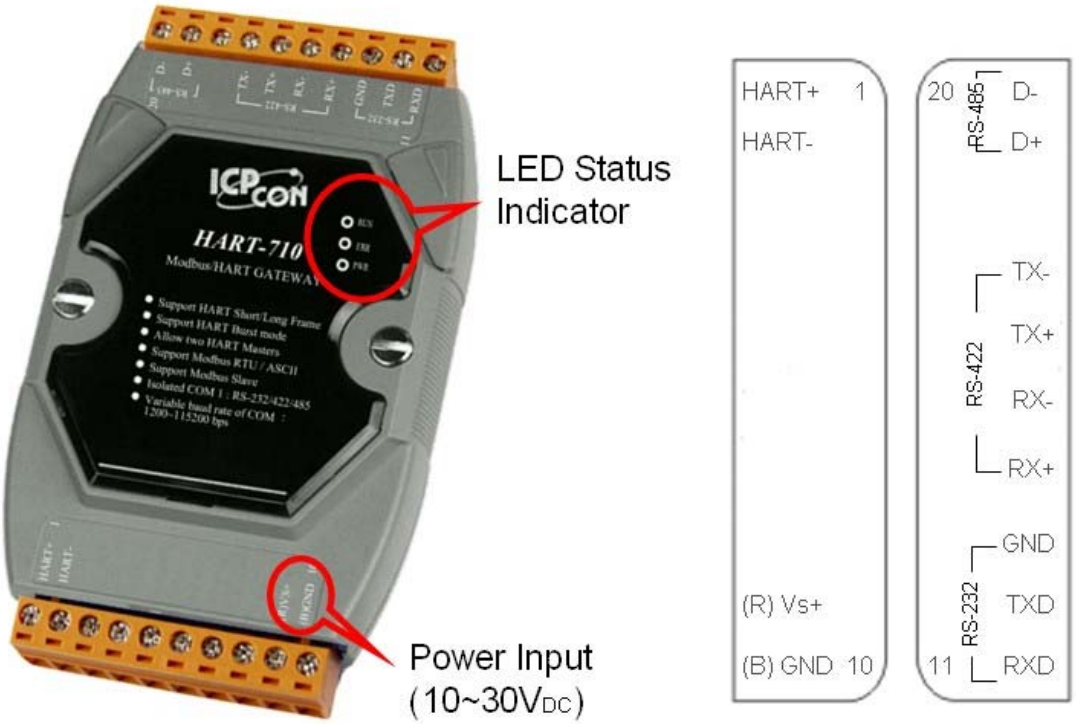


Figure 3: Pin assignment of HART-710

Table 3: Screw terminal block

Pin	Name	Description
1	HART+	Positive of HART
2	HART-	Negative of HART
3	-	N/A
4	-	N/A
5	-	N/A
6	-	N/A
7	-	N/A
8	-	N/A
9	+VS	V+ of Power Supply(+10 ~ +30 V_{DC})
10	GND	GND of Power Supply
11	RXD	Receive Data of RS-232
12	TXD	Transmit Data of RS-232
13	GND	GND of RS-232
14	RX+	Receive Data+ of RS-422
15	RX-	Receive Data- of RS-422
16	TX+	Transmit Data+ of RS-422
17	TX-	Transmit Data- of RS-422
18	-	N/A
19	D+	Data+ of RS-485
20	D-	Data- of RS-485

2.3 Wiring

It is recommended to use only one serial port (RS232, RS422 or RS485) of the HART-710 module at the same time. The following section describes the necessary steps to be taken to connect one of the three COM port types to a Modbus network.

2.3.1 RS-232 connection

The RS-232 port of the HART-710 module has got three pins. The wiring of the RS-232 device with the RS-232 port of the HART-710 module is shown in *figure 4*.

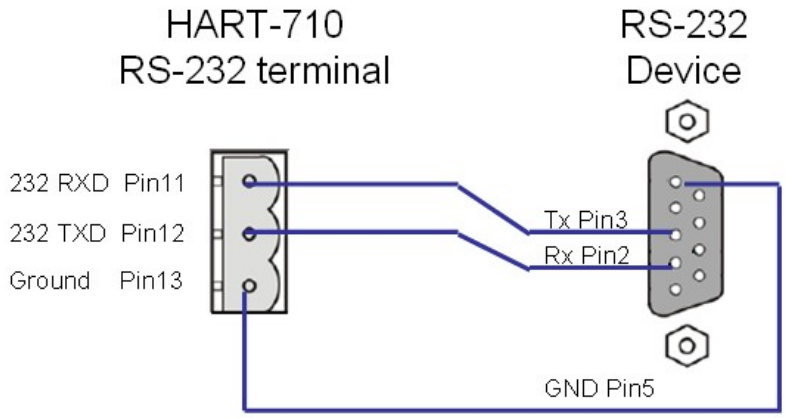


Figure 4: RS-232 wiring diagram

2.3.2 RS-485 connection

The RS-485 wiring diagram is shown in *figure 5*.

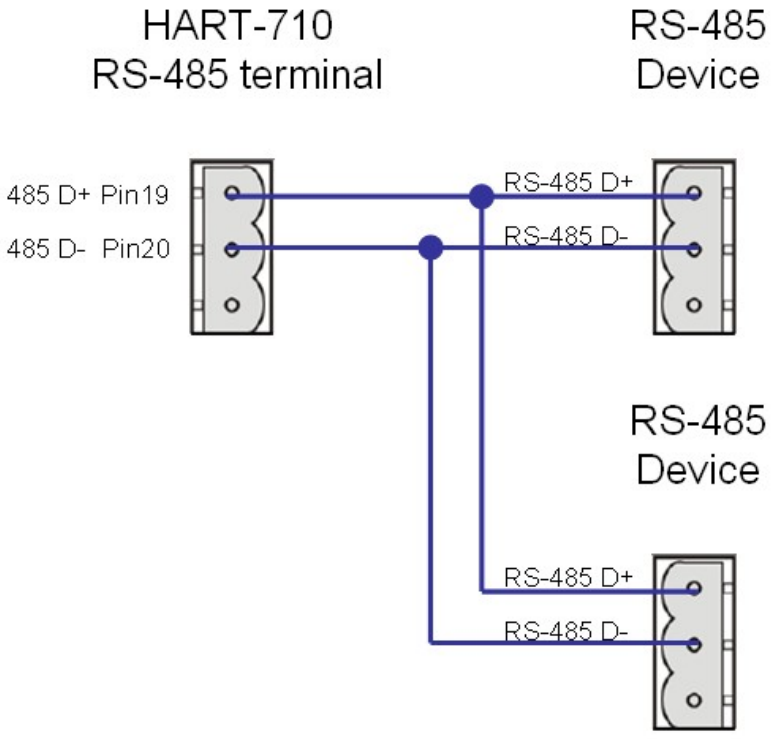


Figure 5: RS-485 wiring diagram

2.3.3 RS-422 connection

The RS-422 wiring connection is shown in *figure 6*.

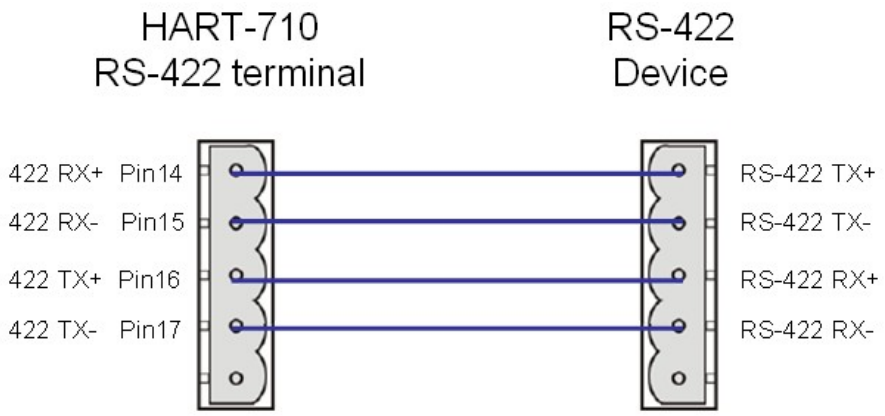


Figure 6: RS-422 wiring diagram

2.3.4 HART connection

The HART connection is divided into two types: “Loop Power Source” and “External Power Source”, as shown in the below:

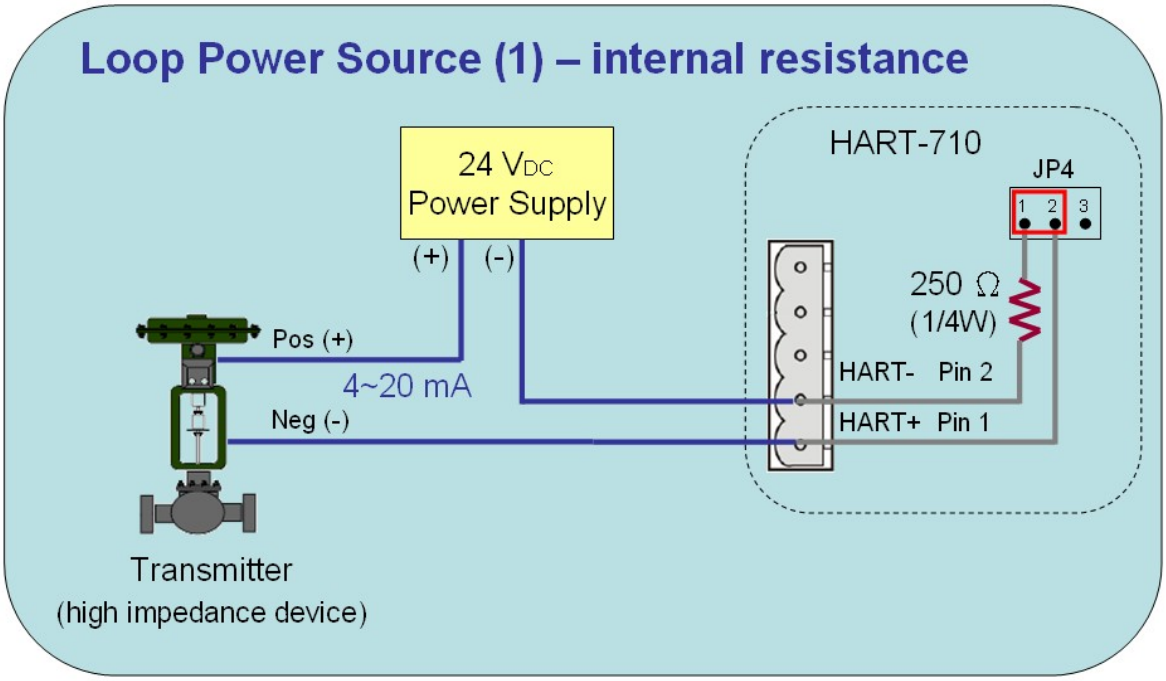


Figure 7: Example1—Loop Power Source

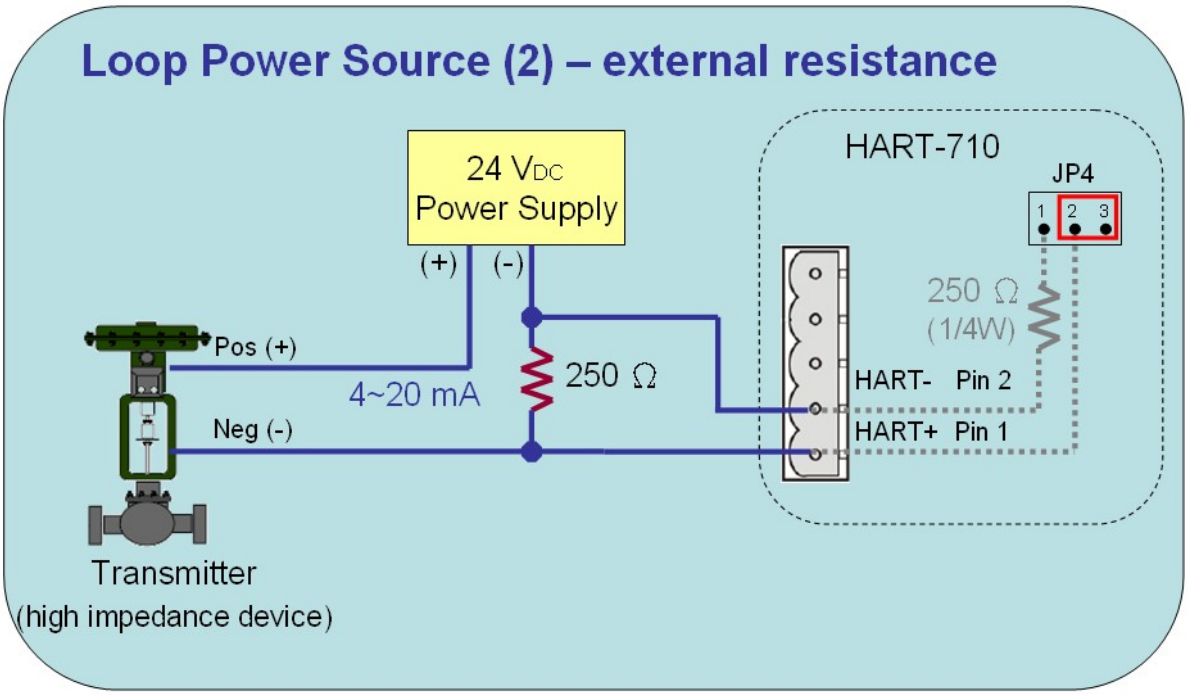


Figure 8: Example2—Loop Power Source

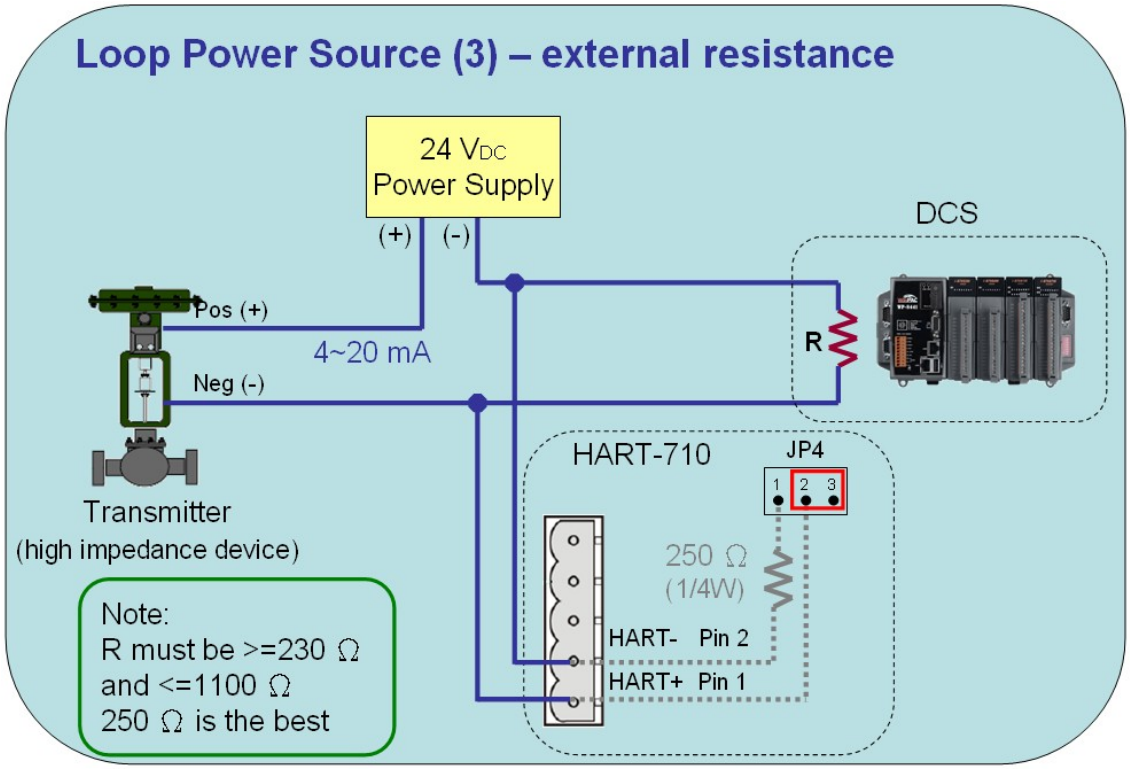


Figure 9: Example3—Loop Power Source

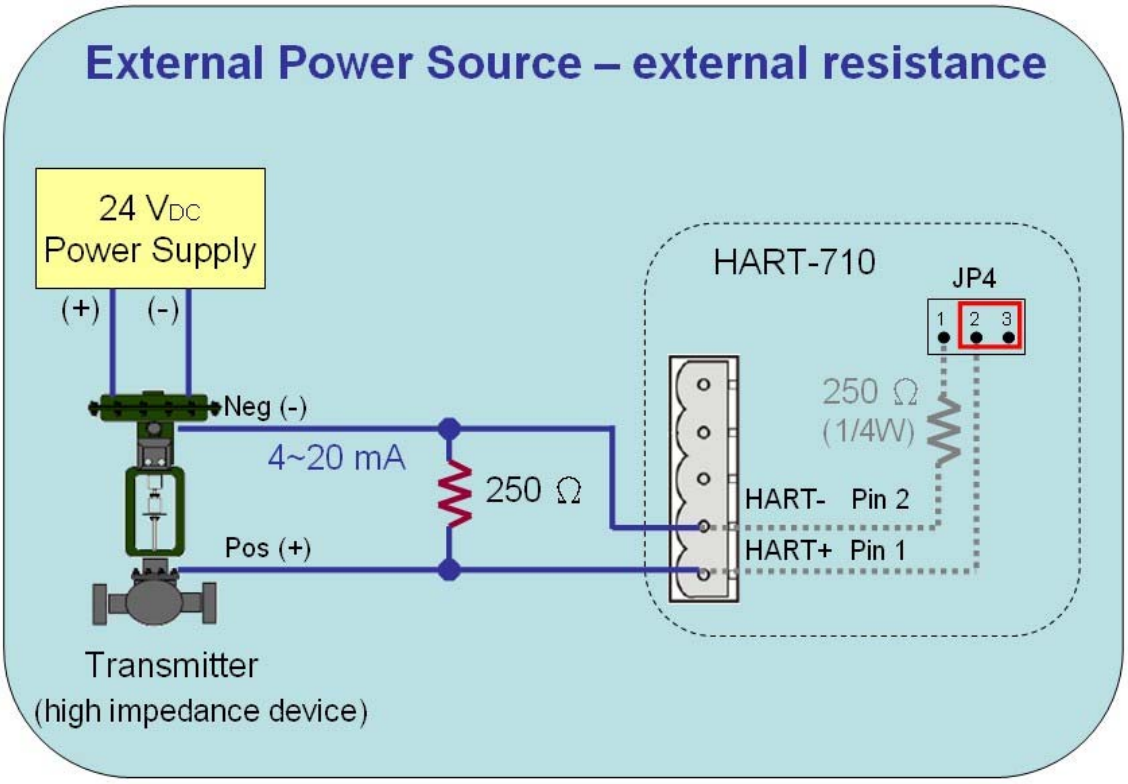


Figure 10: Example4—External Power Source

2.4 LED indicator

The HART-710 provides three LEDs to indicate the statuses of the HART-710 module. The position of LEDs and descriptions are shown in *table 4* and *figure 11*.

Table 4: LED status description

LED Name	Status	Description
PWR	on	Power supply is ok.
	off	Power supply has failed.
ERR	flash	Communication error
	off	No error
RUN	flash	Flash once a second: It is at initial mode. Flash once a half second: It had received the burst frame.
	on	It is at normal operation
	off	Firmware has not loaded yet

Figure 11: LED position

2.5 DIP Switch

There is a DIP Switch on the back of the HART-710 module, as shown in *Figure 12*. In the normal situation, it needs to set the DIP Switch to the "Normal" position. If the user forgets the setting of HART-710, the user can set the DIP Switch to the "Default" position; the HART-710 module will be started at default settings.

Figure 12: DIP Switch of the HART-710

Note:
About default system settings are shown in the below:
Command interval: 1000 ms
Timeout value: 1000 ms
Auto. Polling: Enable
Retry count: 3

For Modbus--
Baud rate: 115200 bps
Date bits: 8 bits
Stop bits: 1 bit
Parity: none
Net ID: 1
Protocol: Modbus RTU Slave
Swap mode: none

2.6 Jumper

There is a Jumper (JP4) at the HART-710 module, as shown in *Figure 13*. The jumper can provide HART network with 250 Ω (1/4 W) resistor. When the pin 1&2 of JP4 is closed, the resistor will connect to HART network. When the pin 2&3 of JP4 is closed, it will disconnect the resistor from HART network. By default, the pin1&2 of JP4 is closed. Please refer to section 2.3.4 HART connection for detail.

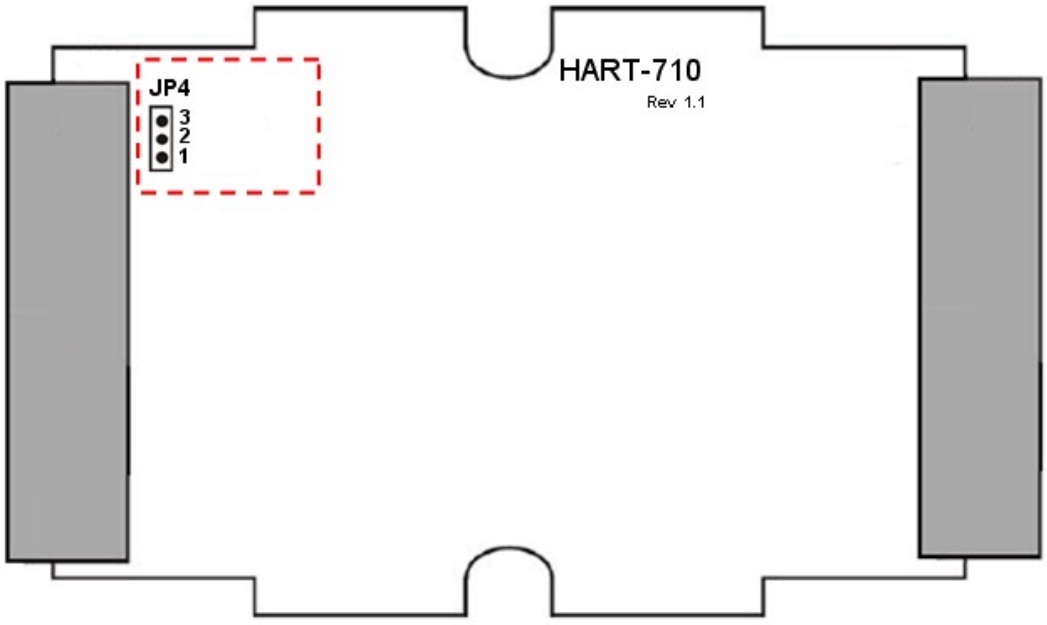


Figure 13: Jumper of the HART-710

3. HART protocol specification

3.1 Analog and Digital signal

The HART communication protocol is based on the Bell 202 telephone communication standard and operates using the frequency shift keying (FSK, Figure 14) principle. The digital signal is made up of two frequencies—1,200 Hz and 2,200 Hz representing bits 1 and 0, respectively. Sine waves of these two frequencies are superimposed on the direct current (dc) analog signal cables to provide simultaneous analog and digital communications (Figure 15).

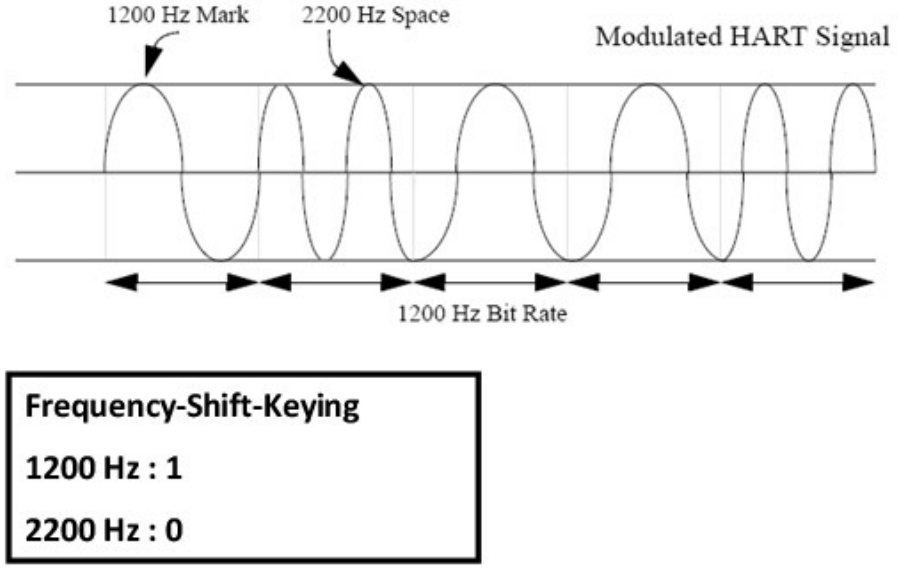


Figure 14: FSK signal

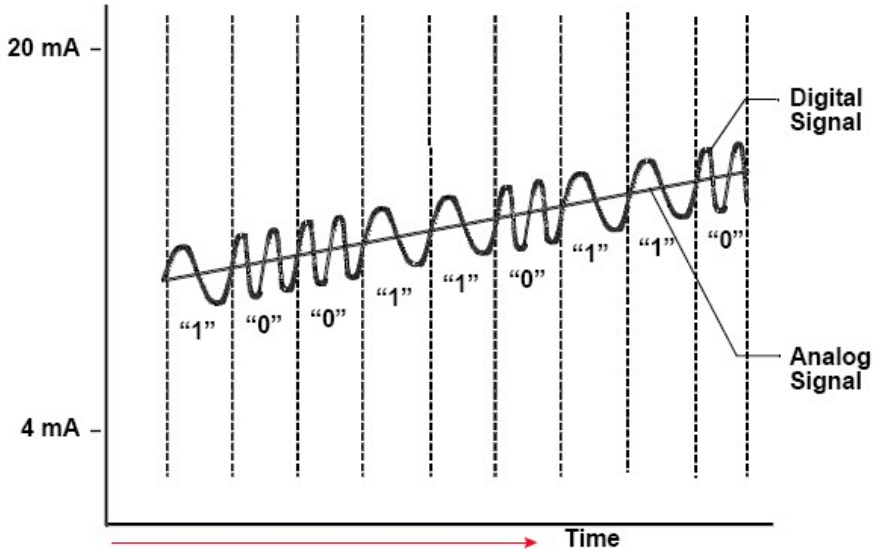


Figure 15: Analog and digital signals

3.2 Network topology

HART devices can operate in one of two network configurations—point to point or multi-drop.

POINT to POINT:
In point to point mode, the analog signal is used to communicate one process variable and the digital signal gives access to secondary variables and other data that can be used for operations, commissioning, maintenance and diagnostic purposes. There is an only HART slave device at a HART bus.

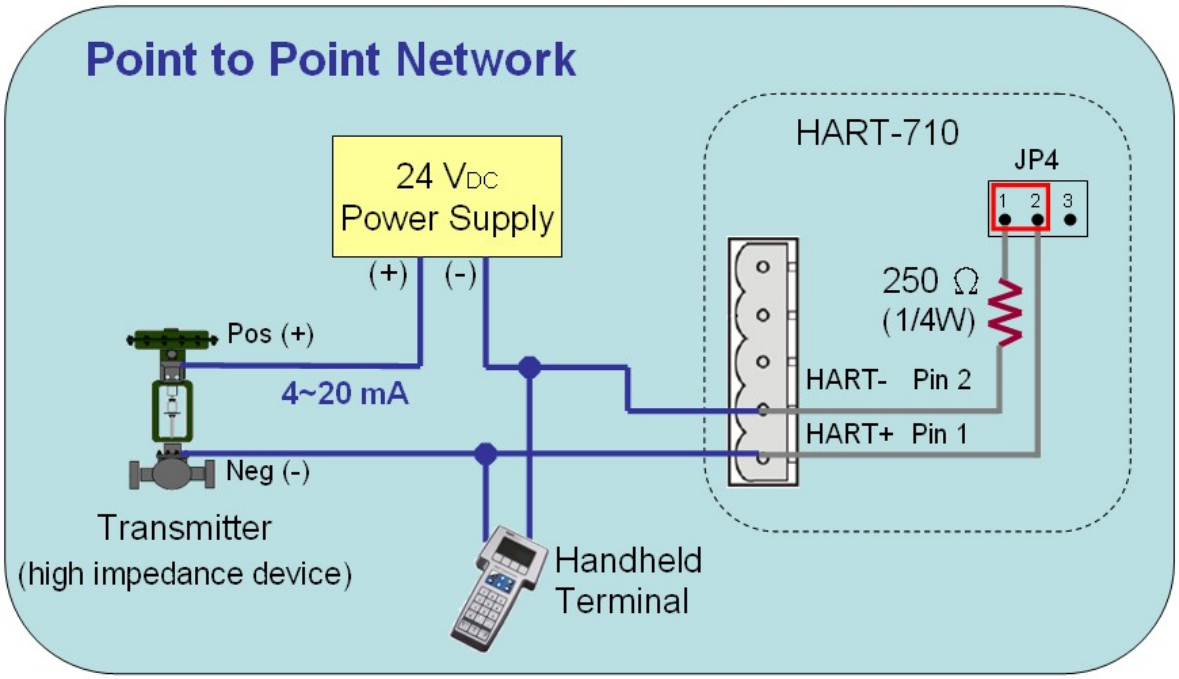


Figure 16: Point to point topology

Multi-drop:
In multi-drop mode, all process values are transmitted digitally. All field device polling address are >0, and the current through each device is fixed to a minimum value (typically 4 mA). There is up to 15 field device at a HART bus.

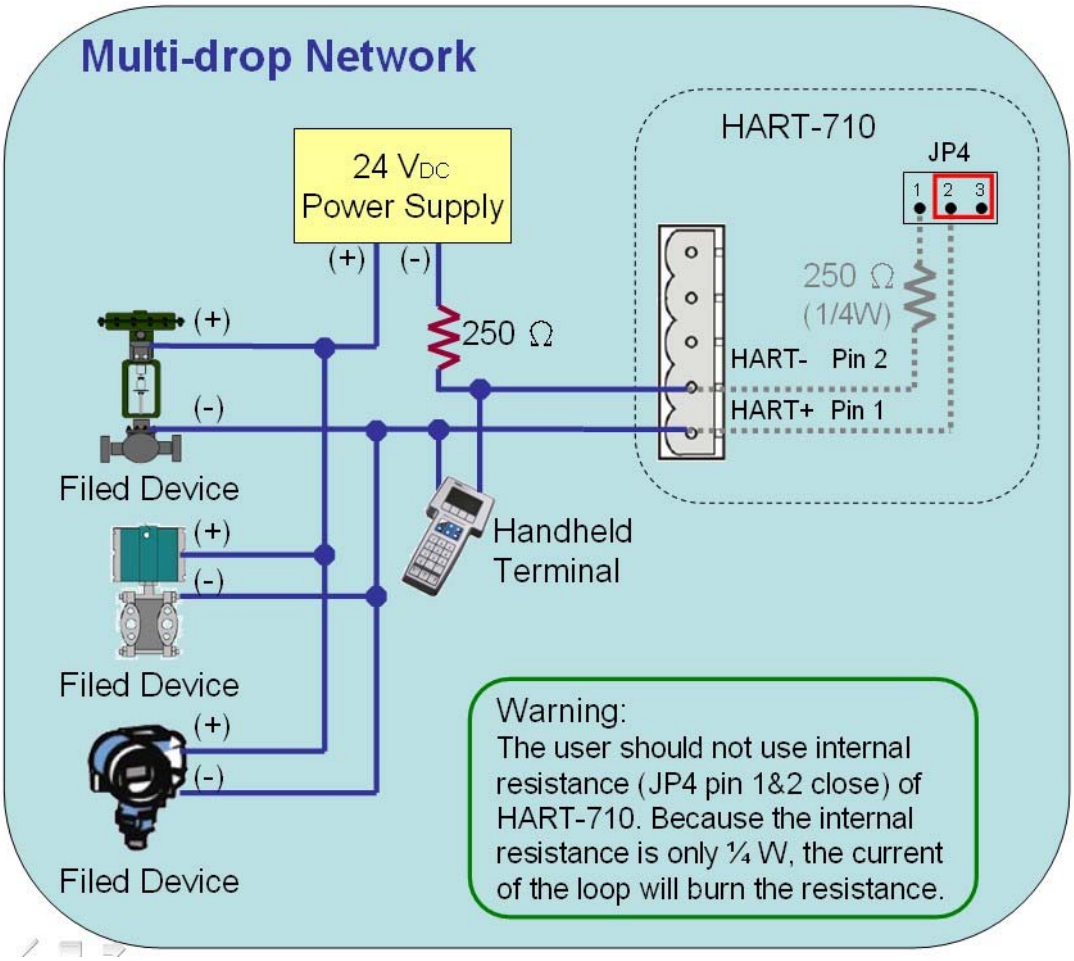


Figure 17: Multi-drop topology

3.3 HART Frame

The HART frame format is shown in the below:

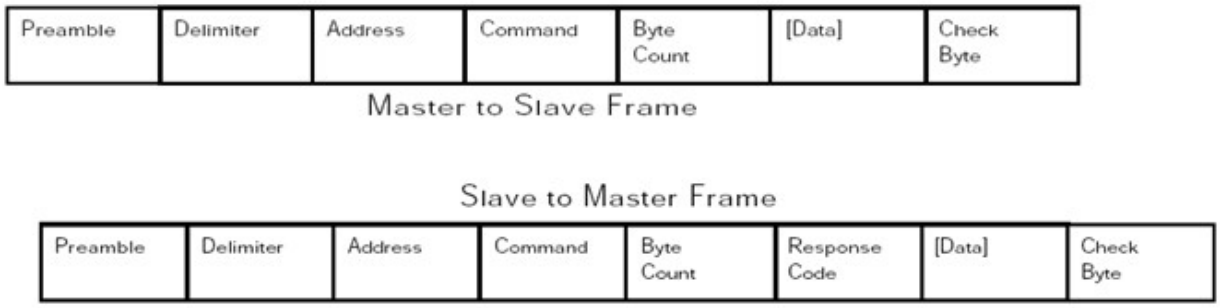


Figure 18: HART frame format

3.3.1 Preamble

All frames transmitted by HART master or slave devices are preceded by a specified number of hexadecimal "FF" characters. These characters are called

the preamble to the frame. HART device should not transmit less than 5 preambles and send more than 20 preambles.

3.3.2 Delimiter

This data can indicate the frame is long frame or short frame and the frame is master frame, slave frame or burst frame.

3.3.3 Address

Hart frame can be short frame or long frame. About short frame, it is only a byte data. If the frame is long frame, it has 5 bytes data, and these data include manufacturer ID, device type and device ID.

3.3.4 Command

The HART command set includes three classes: universal, Common Practice and Transmitter-Specific. Host applications may implement any of the necessary commands for a particular application.

Command Number	***Command Class***
0	Universal
•	•
•	•
•	•
30	Universal
31	Reserved
32	Common Practice
•	•
•	•
•	•
127	Reserved
128	Transmitters-Specific
•	•
•	•
•	•
253	Transmitters-Specific
254	Reserved
255	Reserved

About some often used command, please refer to “Appendix A: HART

command".

3.3.5 Byte Count

This is set to the number of bytes between it and the check byte at the end of the message.

3.3.6 Response Codes

Response codes have two bytes of status. These bytes convey three types of information: Communication errors, Command response problems and Field device status.

These response codes are shown in the below:

First Byte:

Bit 7: 1 (communication error)
Bit 6: Parity error
Bit 5: Overrun error
Bit 4: Framing error
Bit 3: Checksum error
Bit 2: 0(reserved)
Bit 1: Rx buffer overflow
Bit 0: Overflow (undefined)

Bit 7: 0 (Command response)
Bit 0~6: decoded as an integer, not bit-mapped
0: No command-specific error
1: (undefined)
2: Invalid selection
3: Passed parameter too large
4: Passed parameter too small
5: Too few data bytes received
6: Device-specific command error (rarely used)
7: In write-protect mode
8-15: Multiple meanings
16: Access restricted
28: Multiple meanings
32: Device is busy
64: Command not implemented

Second Byte:

Field device status

Bit 7: Field device malfunction
Bit 6: Configuration changed
Bit 5: Cold start
Bit 4: More status available
Bit 3: Analog output current fixed
Bit 2: Analog output saturated
Bit 1: Non-primary variable out of limits
Bit 0: Primary variable out of limits.

Note: when a communication error is reported in the first byte, all bits = 0.

3.3.7 Data

The contents of the data are decided by command number.

3.3.8 Check Byte

Every HART frame has a check byte at the last data byte. HART device can detect error frame by this byte.

4. Communication

4.1 Data exchange

The HART-710 module is built-in a database. The HART information and Modbus data can be exchanged by this database. The HART kernel will send and receive HART data and save to database according to configuration table.

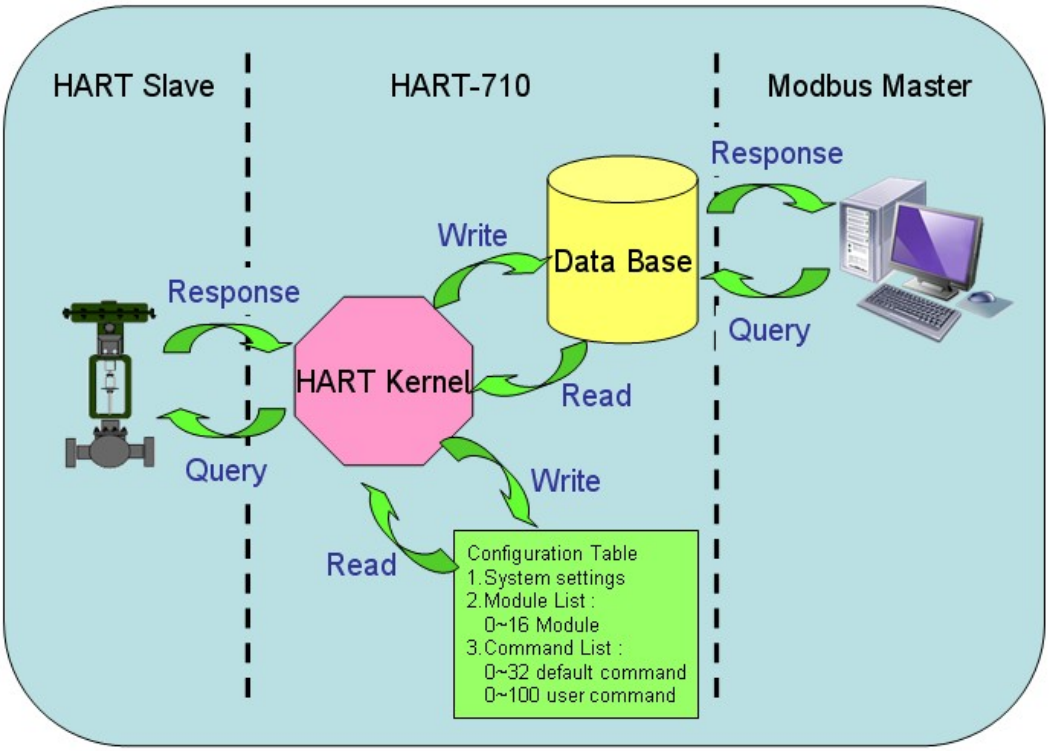


Figure 19: Data exchange between HART device and Modbus device

4.2 System flow chart

After the HART-710 module is started, it will enter the initial mode and then enter the run mode. When the module is at initial mode, it will execute all initial command and the “RUN” led will flash. When the module is at run mode, it will execute all polling command or manual command and the “RUN” led will always on.

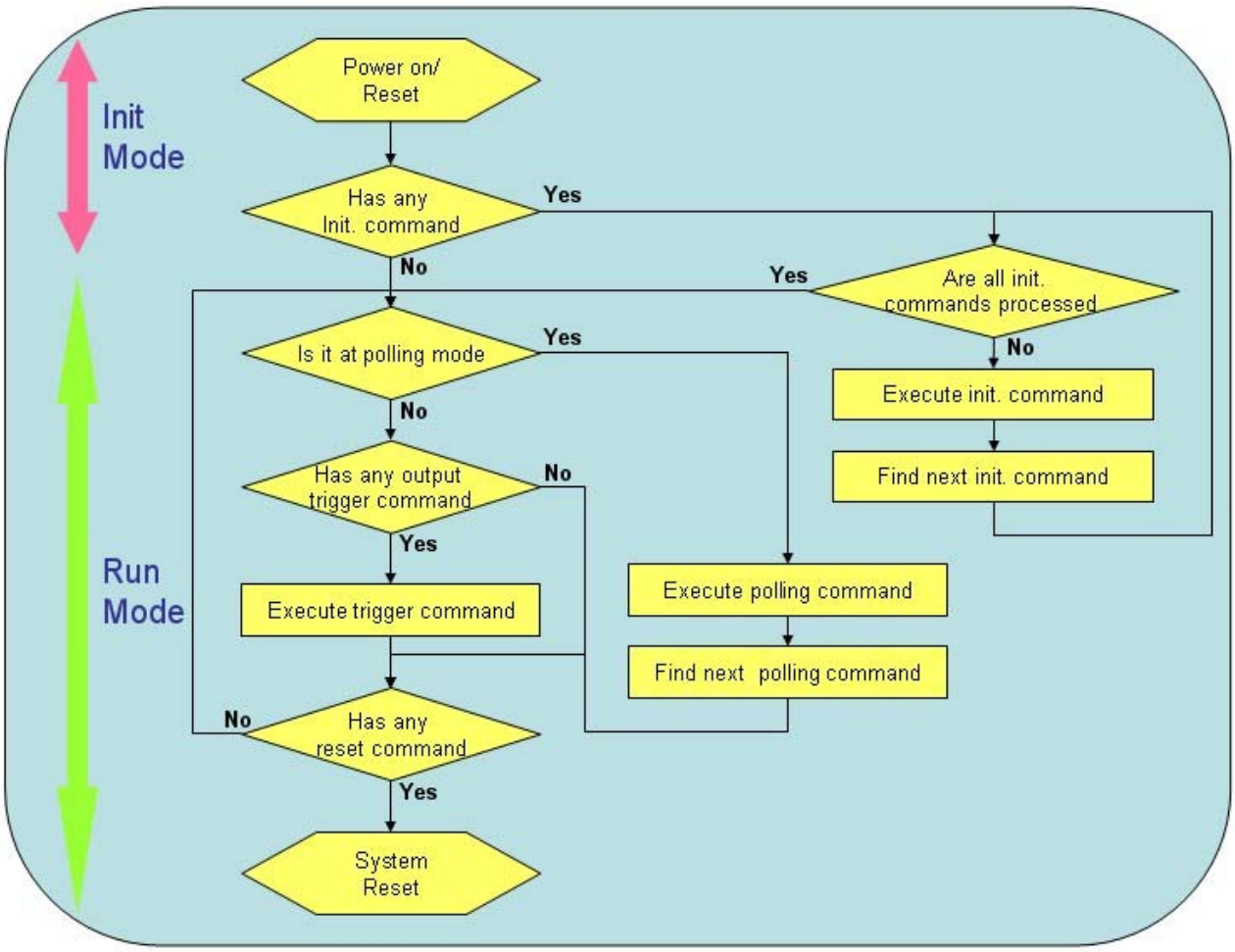


Figure 20: Flow chart of the HART-710

4.3 Database address

The user can operate the HART-710 module by the database or the utility. About the database, please refer to the follow table.

Table 5: Database address

	DB address	MB address	Description
	0~999	0~499	For user command
	1000	500L	System state machine
	1001	500H	System request count
	1002	501L	System response count
	1003	501H	System error count
	1004	502L	System error status
	1005	502H	System error command index
	1006~1011	503~505	Reserve

INPUT DATA	1012~1025	506~512	For input data of “Default CMD(0)” of “MOD 0”
	1026~1039	513~519	For input data of “Default CMD(0)” of “MOD 1”
	1040~1053	520~526	For input data of “Default CMD(0)” of “MOD 2”
	1054~1067	527~533	For input data of “Default CMD(0)” of “MOD 3”
	1068~1081	534~540	For input data of “Default CMD(0)” of “MOD 4”
	1082~1095	541~547	For input data of “Default CMD(0)” of “MOD 5”
	1096~1109	548~554	For input data of “Default CMD(0)” of “MOD 6”
	1110~1123	555~561	For input data of “Default CMD(0)” of “MOD 7”
	1124~1137	562~568	For input data of “Default CMD(0)” of “MOD 8”
	1138~1151	569~575	For input data of “Default CMD(0)” of “MOD 9”
	1152~1165	576~582	For input data of “Default CMD(0)” of “MOD 10”
	1166~1179	583~589	For input data of “Default CMD(0)” of “MOD 11”
	1180~1193	590~596	For input data of “Default CMD(0)” of “MOD 12”
	1194~1207	597~603	For input data of “Default CMD(0)” of “MOD 13”
	1208~1221	604~610	For input data of “Default CMD(0)” of “MOD 14”
	1222~1235	611~617	For input data of “Default CMD(0)” of “MOD 15”
	1236~1261	618~630	For input data of “Default CMD(3)” of “MOD 0”
	1262~1287	631~643	For input data of “Default CMD(3)” of “MOD 1”
	1288~1313	644~656	For input data of “Default CMD(3)” of “MOD 2”
	1314~1339	657~669	For input data of “Default CMD(3)” of “MOD 3”
	1340~1365	670~682	For input data of “Default CMD(3)” of “MOD 4”
	1366~1391	683~695	For input data of “Default CMD(3)” of “MOD 5”
	1392~1417	696~708	For input data of “Default CMD(3)” of “MOD 6”
	1418~1443	709~721	For input data of “Default CMD(3)” of “MOD 7”
	1444~1469	722~734	For input data of “Default CMD(3)” of “MOD 8”
	1470~1495	735~747	For input data of “Default CMD(3)” of “MOD 9”
	1496~1521	748~760	For input data of “Default CMD(3)” of “MOD 10”
	1522~1547	761~773	For input data of “Default CMD(3)” of “MOD 11”
	1548~1573	774~786	For input data of “Default CMD(3)” of “MOD 12”
	1574~1599	787~799	For input data of “Default CMD(3)” of “MOD 13”
	1600~1625	800~812	For input data of “Default CMD(3)” of “MOD 14”
	1626~1651	813~825	For input data of “Default CMD(3)” of “MOD 15”
	1652~1767	826~883	For System error record 1
	1768~1883	884~941	For System error record 2
	1884~1999	942~999	For System error record 3
	2000~2001	1000	For error status of “Default CMD (0 & 3)” of “MOD 0”
	2002~2003	1001	For error status of “Default CMD (0 & 3)” of “MOD 1”
	2004~2005	1002	For error status of “Default CMD (0 & 3)” of

INPUT DATA			“MOD 2”
	2006~2007	1003	For error status of “Default CMD (0 & 3)” of “MOD 3”
	2008~2009	1004	For error status of “Default CMD (0 & 3)” of “MOD 4”
	2010~2011	1005	For error status of “Default CMD (0 & 3)” of “MOD 5”
	2012~2013	1006	For error status of “Default CMD (0 & 3)” of “MOD 6”
	2014~2015	1007	For error status of “Default CMD (0 & 3)” of “MOD 7”
	2016~2017	1008	For error status of “Default CMD (0 & 3)” of “MOD 8”
	2018~2019	1009	For error status of “Default CMD (0 & 3)” of “MOD 9”
	2020~2021	1010	For error status of “Default CMD (0 & 3)3” of “MOD 10”
	2022~2023	1011	For error status of “Default CMD (0 & 3)” of “MOD 11”
	2024~2025	1012	For error status of “Default CMD (0 & 3)” of “MOD 12”
	2026~2027	1013	For error status of “Default CMD (0 & 3)” of “MOD 13”
	2028~2029	1014	For error status of “Default CMD (0 & 3)” of “MOD 14”
	2030~2031	1015	For error status of “Default CMD (0 & 3)” of “MOD 15”
	2032~2099	1016~1049	Reserve
	2100~2199	1050~1099	For error status of user CMD 0~99
	2200~2203	1100~1101	Device type ID (“HART”)
	2204~2219	1102~1109	Device name (16 Bytes)
	2220~2227	1110~1113	Firmware version (8 Bytes)
	2228~2299	1114~1149	Reserve
	2300	1150L	Send count for through mode
	2301	1150H	Receive count for through mode
	2302	1151L	Error count for through mode
	2303	1151H	Reserve
	2304~2305	1152	Receive length for through mode
	2306~2589	1153~1294	Receive data for through mode
	DB address	MB address	Description
	0~999	0~499	For user command

OUTPUT DATA	1000	500L	Status reset function
	1001	500H	Reserve
	1002	501L	Auto Polling function
	1003	501H	Reserve
	1004	502L	Output trigger function
	1005	502H	The index of trigger command
	1006~1011	503~505	Reserve
	1012~3799	506~1899	System Reserve (It is about system configuration)
	3800	1900L	Channel select for through mode
	3801	1900H	Reserve
	3802~3803	1901	Send length for through mode
	3804~4087	1902~2043	Send data for through mode

Note:

一、DB=Database, MB=Modbus, CMD=Command, MOD=Module

二、MD address: 500L—means Modbus address 500 and read/write the data from low byte, 500H—means Modbus address 500 and read/write the data from high byte.

About the input data, the user can use Modbus function code “04” and refer to the MD address to read the data.

About the output data the, the user can use Modbus function code “16” and refer to the MD address to write the data.

三、Default CMD(num):

Num: means the number of HART command.

There are two default commands every module. These commands are ‘command (0)’ and ‘command (3)’.

The total length of status of “Default CMD(0 & 3)” is two bytes (a word). The first byte is belong “Default CMD(0)”, the second byte is belong “Default CMD(3)”.

Ex: If the data of DB address 2000 (MB address 1000L) is 0x00 and the data of DB address 2001 (MB address 1000H) is 0x01. It means the error status of “Default CMD(0)” of “MOD 0” is 0x00, the error status of “Default CMD(3)” of “MOD 0” is 0x01

四、User CMD:

The maximum number of user command is 100, so the index of user

command is 0~99.

五、System state machine:

0—IDLE
1—waits to send HART command
2—it is sending HART command
3—waits to receive HART data
4—it is reading HART data

六、(System) error status:

0—no error
1—means the command has never be executed
2—receive timeout, can't receive any HART data
3—receive HART data is too short
4—the delimiter of HART data has some error
5—the address (the bit of master type) of HART data has some error
6—the address (the bit of burst mode) of HART data has some error
7—the command of HART data has some error
8—the parity of HART data has error.
9—the communication with HART slave device has some error and the error messages record at the responses codes

七、System error command index:

This data will show which recent user command has error. If the data is 255, it means no error command.

八、System error record :

When the HART communication has error, the system will record the send and receive data at the record. The system can provide 3 records. The content of record is shown in the below:
Byte 0: the length of send data (1 Byte)
Byte 1~53: the record of send data (Max. 53 Bytes)
Byte 54: the length of receive data (1 Byte)
Byte 55~109: the record of receive data (Max. 55 Bytes)
Byte 110~113: the time stamp record (4 Bytes)
Byte 114~115: reserve (2 Bytes)

九、Status reset function:

When the user sets this function to bigger than zero, the system will clear "System request count", "System response count", "System error count", "System error status" and set "System error command index" to 255.

十、Auto Polling function:

When the user sets this function to 1, the system will execute all polling commands automatically.

十一、Output trigger function:

If the user changes the value of this function, the system will refer to the index of trigger command to execute the user command.
The index of trigger command: 0~99—for user command, 255—for through mode.

Ex: If the index of trigger command is 0 and output trigger function is 1, the user can change the value of output trigger function from 1 to 2. The system will execute the first user command (index = 0).

4.4 Diagnostic messages

The user can get the system state and the command state and error records from database (please refer to section 4.3 Database Address for detail), as shown in the below.

DB address (Input data)	Description
a. 1000~1005	System state
b. 1652~1999	System error record 1~3
c. 2000~2031	Status of “Default CMD (0 & 3)” of MOD 0~15
d. 2100~2199	Status of user CMD 0~99

4.5 Through mode

At this mode the user can send and receive the frame of HART command directly. The user can use the HART-710 module at this mode by follow step.

Step 1: Set the “Channel select for through mode” to “0”.
The HART-710 module only support channel 0.
Step 2: Set the “Send length for through mode” to the data length (ex: 10).
Step 3: Put your HART command to “Send data for through mode” (ex: 0xFF 0xFF 0xFF 0xFF 0xFF 0x02 0x80 0x00 0x00 0x82).
Step 4: Set the “Auto Polling function” to “0”
In this mode, “Auto Polling function” can’t be enabled.
Step 5: Set the “The index of trigger command” to 255.
Step 6: Get the receive count from “Receive count for through mode” and error count from “Error count for through mode”.

Step 7: Change the “Output trigger function” to trigger the command output.
Step 8: Get the value of “Receive count for through mode” and “Error count for through mode” until one of them is different than last value.
Step 9: If the “Receive count for through mode” is different than last value, the user can get the receive length from “Receive length for through mode” and the user can get receive data from “Receive data for through mode” according to receive length.
If the “Error count for through mode” is different than last value, it means it can’t receive any data.

About “Channel select for through mode”, “Send length for through mode”, “Send data for through mode”, “Auto Polling function”, “The index of trigger command”, “Receive count for through mode”, “Error count for through mode”, “Output trigger function”, “Receive length for through mode” and “Receive data for through mode”, please refer to section 4.3 Database Address for detail.

4.6 Data exchange example

In this example a Modbus Master device simulated by a PC program sends query message and receives response message from a HART slave via the HART-710 gateway.

Step 1: Please connect the PC、HART-710 and HART Slave device.

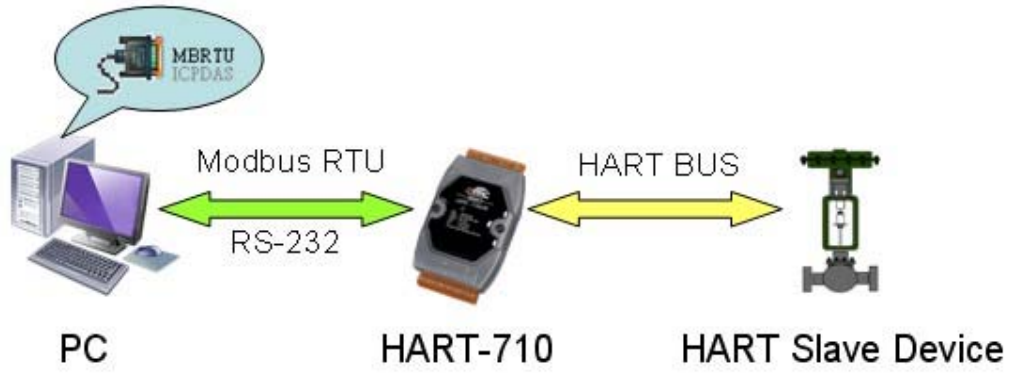


Figure 21: Hardware connection

Step 2: Set the DIP switch at the back of the module to “default” position. It will set the HART-710 module to default settings.
The default settings:
Protocol: Modbus RTU Slave
Net ID: 1
Baud Rate: 115200
Data Bits: 8

Stop Bit: 1
Parity: None

Step 3: Turn the power on.

Step 4: Check the HART-710 module's "RUN" led is always on. If the "RUN" led is flash, please wait a moment.

Step 5: Start the test utility "MBRTU" (figure 22) on the PC.

This utility simulates a Modbus master device and is on the web site in the following directory:

http://ftp.icpdas.com.tw/pub/cd/8000cd/napdos/modbus/modbus_utility/

(1) Set the COM port number of the PC
(2) Set the Baud rate to 115200
(3) Set the Line control to N,8,1
(4)Open the connection

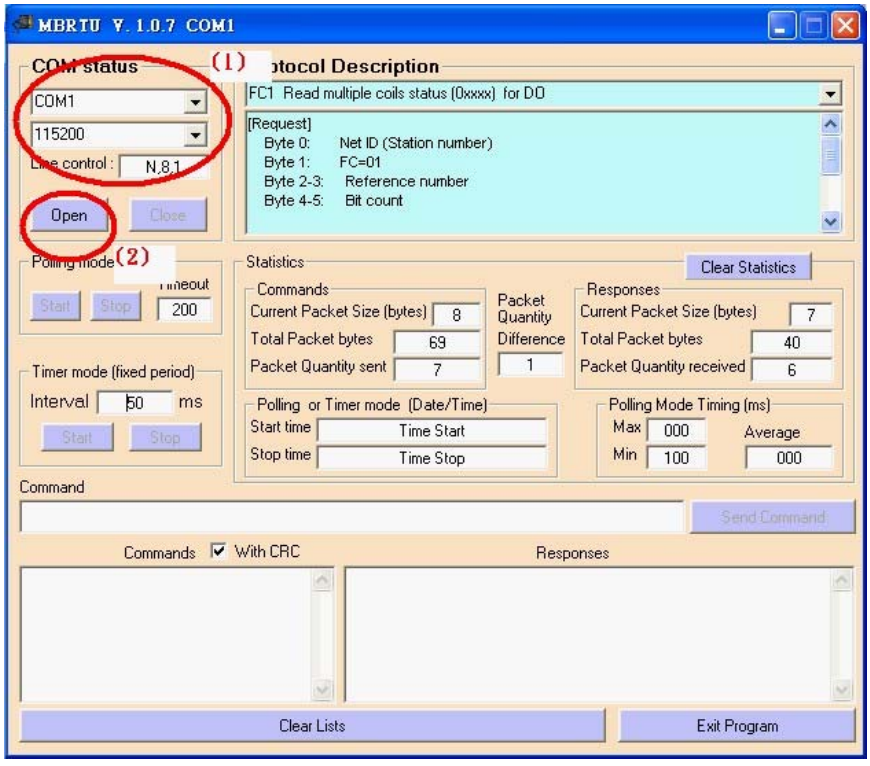


Figure 22: MBRTU Utility

Step 6: Send command to read unique identifier of the HART slave device.

If the user wants to read unique identifier of the HART slave device, the user must use HART command 0.

About HART command 0, the user can read the data at Modbus address

506 (0x01 0xFA, please refer to section 4.3 Database address). Here the user can send Modbus command: 0x01 0x04 0x01 0xFA 0x00 0x07 0x90 0x05 to get the data.

Step 7: Receive and analyze the data.

Here we receive Modbus response data: 0x01 0x04 0x0E 0x10 0x00 0x3F 0xFE 0x08 0x04 0x01 0x05 0x1B 0x10 0x1B 0x00 0xE8 0x97 0x33 0xCC.

According to the data, we can know the data have 7 Words (14 Bytes).
Word 0: 0x10 (Byte 1) 0x00 (Byte 0)
Word 1: 0x3F (Byte 3) 0xFE (Byte 2)
Word 2: 0x08 (Byte 5) 0x04 (Byte 4)
Word 3: 0x01 (Byte 7) 0x05 (Byte 6)
Word 4: 0x1B (Byte 9) 0x10 (Byte 8)
Word 5: 0x1B (Byte 11) 0x00 (Byte 10)
Word 6: 0xE8 (Byte 13) 0x97 (Byte 12)

According to HART protocol, HART command 0 has 2 bytes response code and 12 bytes data.

Response code1:
Byte 0: 0x00➔ means “no error”

Response code2:
Byte 1: 0x10➔ means “more status available”

Response data bytes of command 0:
Byte 2: 0xFE ➔Constant value
Byte 3: 0x3F ➔Manufacturer ID, 0x3F = “Eckardt”
Byte 4: 0x04 ➔Manufacturer’s device ID
Byte 5: 0x08 ➔Number of preambles needed in the request
Byte 6: 0x05 ➔Command set revision number
Byte 7: 0x01 ➔Transmitter specific revision code
Byte 8: 0x10 ➔Software revision
Byte 9: 0x1B ➔Hardware revision
Byte 10: 0x00 ➔Flags
Byte 11~13: 0x1B 0x97 0xE8 ➔Device ID number

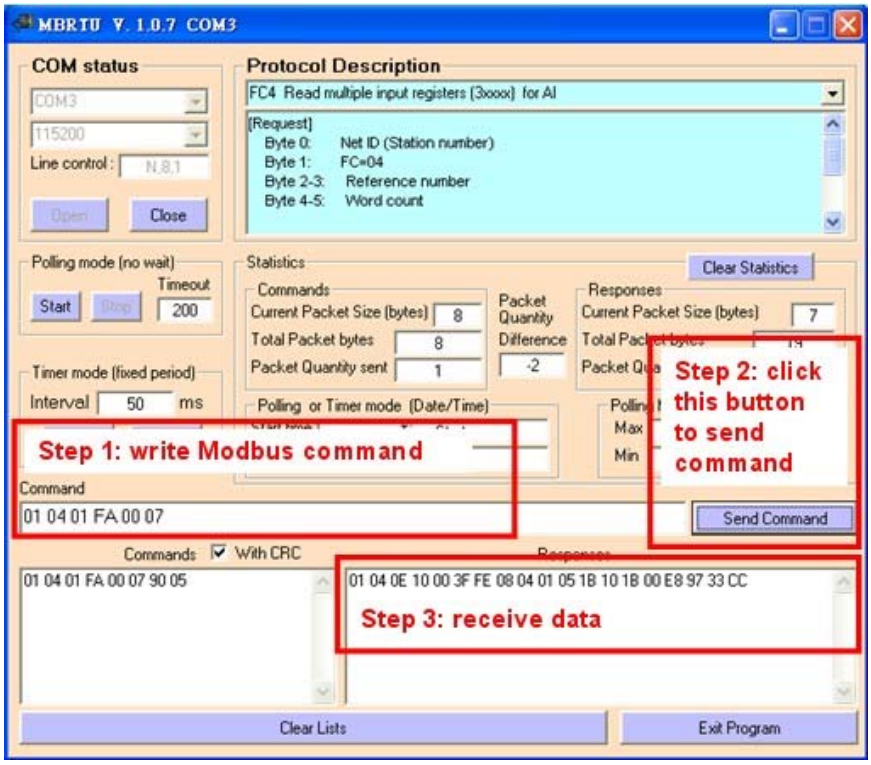


Figure 23: MBRTU send and receive data

5. Application of Utility

5.1 Install .NET Compact Framework

It needs the runtime environment with .NET Framework 2.0 or above to execute the utility in the PC. If there has .NET Framework 2.0 or above in the PC, the section 5.1 can be omitted.

◆ Microsoft .Net Framework Version 2.0:
http://www.microsoft.com/downloads/details.aspx?FamilyID=0856eacb-4362-4b0d-8edd-aab15c5e04f5&DisplayLang=en

◆ Microsoft .Net Framework Version 3.5:
http://www.microsoft.com/downloads/details.aspx?familyid=333325FD-AE52-4E35-B531-508D977D32A6&displaylang=en

The install steps are shown in the below:

◆ Press “Next” to the next step.

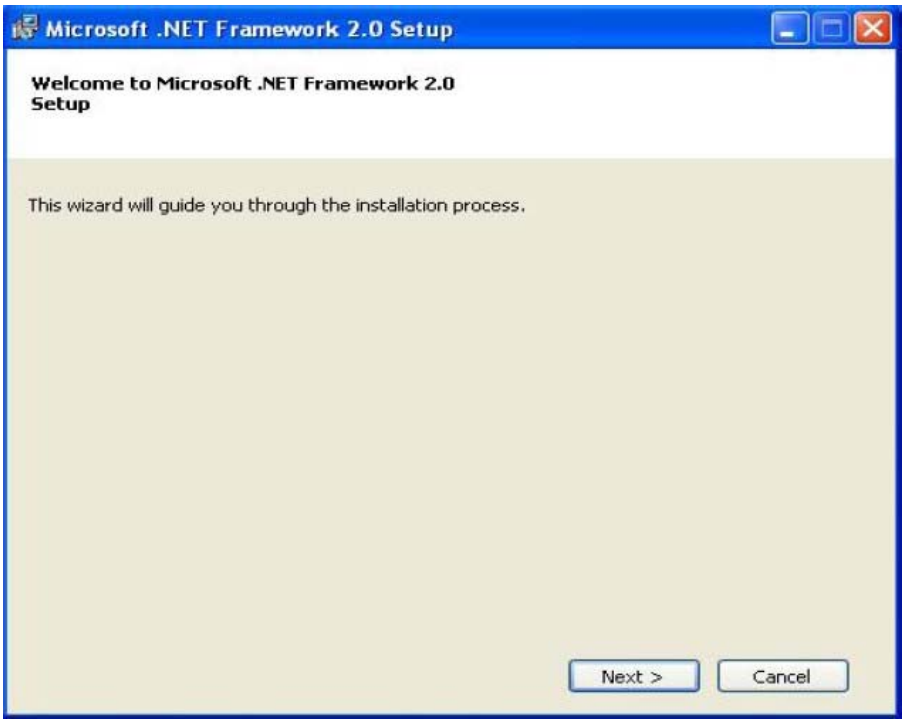


Figure 24: Install .NET Framework—Step1

◆ Select the “I accept the terms of the License Agreement” and “Install” to the next step.

Figure 25:Install .NET Framework—Step2

◆ After finishing the installation, press “Finish” to exit the program.

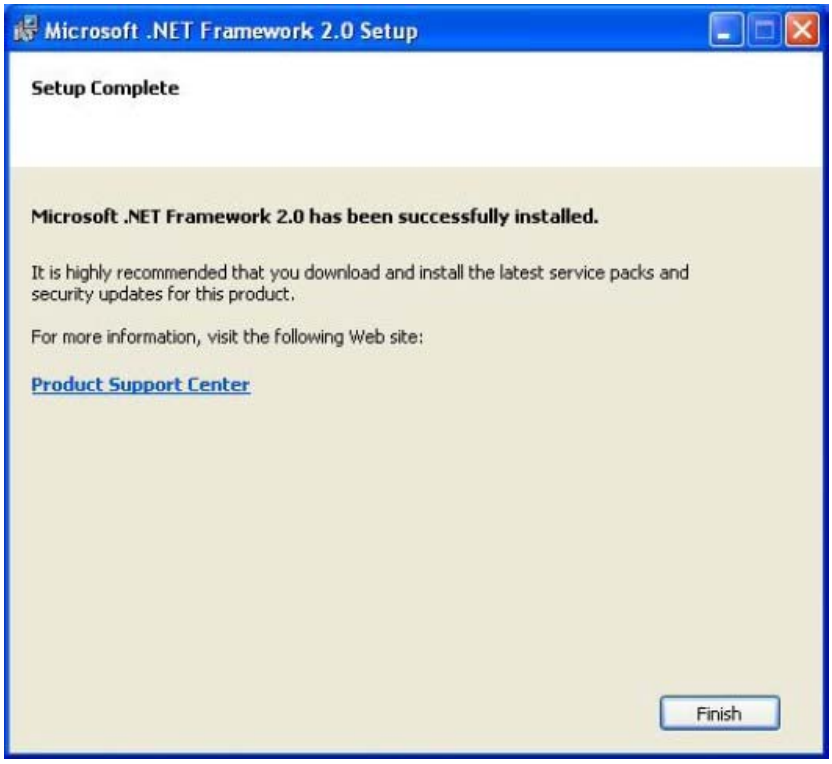


Figure 26: Install .NET Framework—Step3

5.2 Install Utility

Step 1：

Download the setup file of “HG_Tool” from the CD-ROM disk following the path of “CD:\hart\gateway\utilities\hg_tool\” or the web site “ftp://ftp.icpdas.com.tw/pub/cd/fieldbus_cd/hart/gateway/utilities/hg_tool/ ”

Step 2：

Execute the Setup.exe file to install the “HG_Tool” Utility.

Figure 27: Install the utility

Step 3：

Click the “Next” button to continue. If you want to change the installation destination, click “Browse” button to set the installation path.

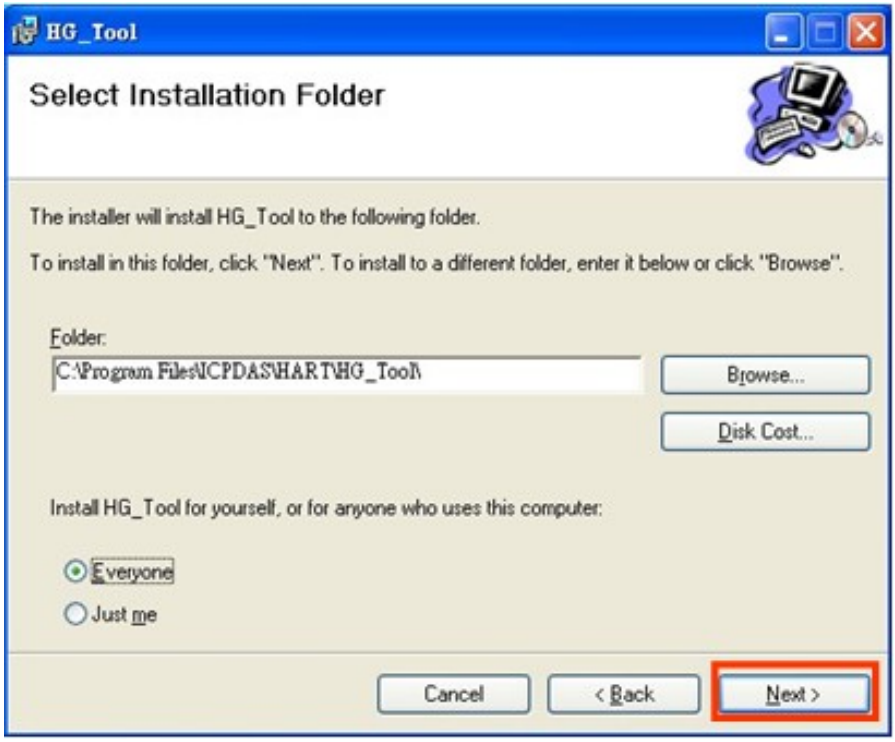


Figure 28: Set the installation path

Step 4：

Click the “Next” button to confirm installation

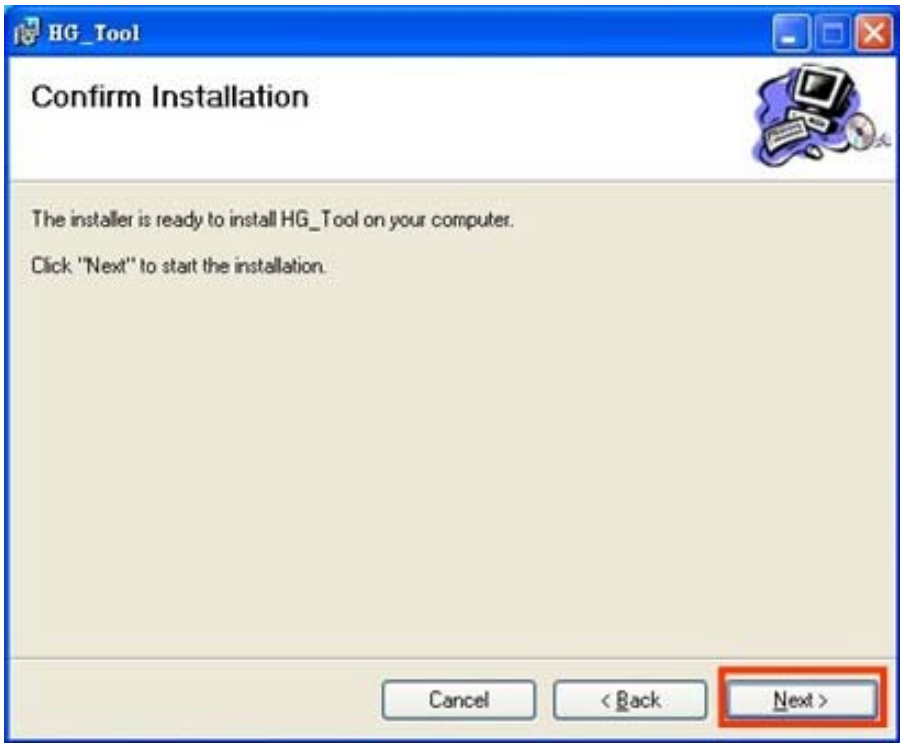


Figure 29: Confirm installation

Step 5：

Click the “Close” button to finish and exit the installation program

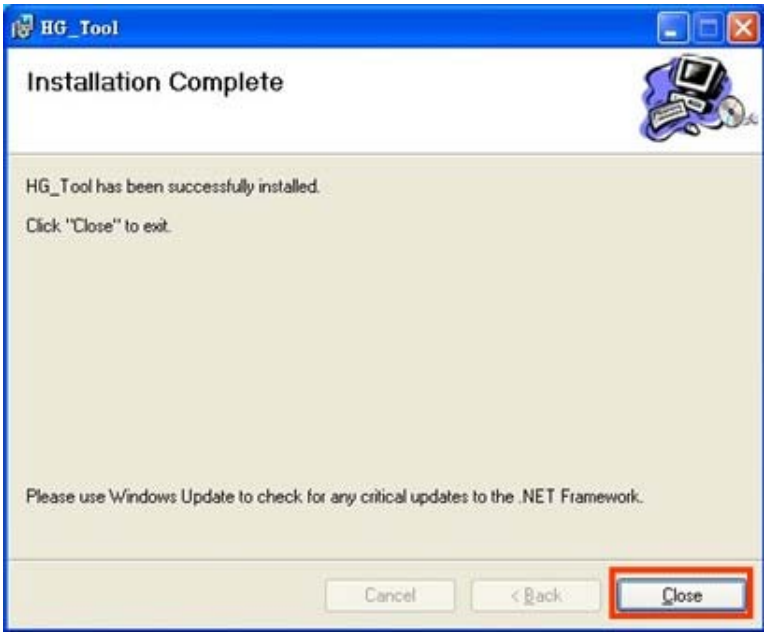


Figure 30: Installation complete

Step 6：

After finishing the installation of the HG_Tool, users can find the utility as shown in the following screen shot.

Figure 31: The path of utility

5.3 Utility introduction

It introduces main window of the utility first, as shown in *figure 32*.

Figure 32: Main window of the utility

Main window of the utility has 4 parts, they are (1)Traffic Light、(2)Connection Status、(3)Connection Control、(4)Tools, as shown in the below.

5.3.1 Traffic Light：

1.  => It means the com port of PC has not be opened yet.
2.  => It means the com port of PC is open and trying to connect with the HART-710.
3.  => It means the PC connect with the HART-710 successfully.

5.3.2 Connection Status：

1.  => It means the com port of PC has not be opened yet.

2.  => It means the com port of PC is open and trying to connect with the HART-710.

3.  => It means the PC connect with the HART-710 successfully.

5.3.3 Connection Control：

1. Connect button:
   When the user clicks this button, the PC will open the com port and try to connect the HART-710 module.
2. Disconnect button:
   When the user clicks this button, the PC will break the connection of the HART-710 and close the com port.

5.3.4 Tools：

It has 9 parts, they are (1)Communication Settings、(2)Device Information、(3)Device Configuration、(4)Default Output Data、(5)Address Map、(6)Device Diagnostic、(7)Through Mode、(8)Format Translation、(9)About, as shown in the below.

5.3.4.1 Communication Settings

Figure 33: The window of communication settings

The user can set the communication settings by this window. These settings must be the same with HART-710 module else the connection will be failed.

Port Num: Com 1~ Com 8
Protocol: MB RTU or MB ASCII (MB = Modbus)
Net ID: 1~247

Baud Rate: 1200~115200 bps
Data Bits: 7/8 bits
Stop Bits: 1/2 bits
Parity: None/Odd/Even

5.3.4.2 Device Information

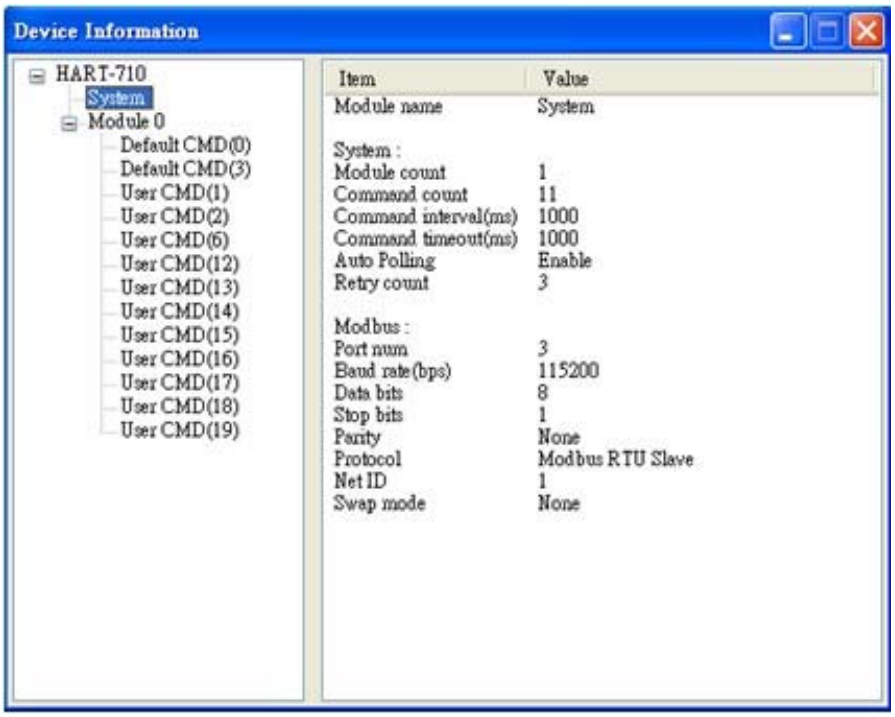


Figure 34: The window of device information

In this window, it will show the configuration of the HART-710 module. When the user selects the node at the left side of window, it will show the data of the node at the right side of window. About the data of these nodes is shown in the below.

Table 6: The data of the node

Node	Behavior	Data
HART-710	click	Module name Firmware version
System	click	Module name: System System: Module count: 0~16 Command count: 0~100 Command interval (ms): 75~65535 Command timeout (ms): 305~65535

		Auto Polling : Enable/Disable Retry count: 0~5 Modbus: Port num: 0~3 Baud rate (bps): 1200~115200 Data bits: 7/8 Stop bits: 1/2 Parity: None/Odd/Even Protocol: Modbus RTU Slave/Modbus ASCII Slave Net ID: 1~247 Swap mode: None, Byte, Word, W&B
System	right click	It will pop a menu. The menu includes “Basic operation” and “Advanced operation”. Basic Operation: The user can operate the system and get system information by the window. Advanced Operation: The user can read and write system data to operate the system by the database.
Module	click	Module name: Module Channel: 0 Auto Configuration : Enable/Disable Network: Point to Point / Multi-drop (Preamble length: 5~20) (Master type: Primary/Secondary Master) (Frame type: Short/Long Frame) (Module address: 0~15) (Manufacturer ID: 1 byte) (Device type: 1 byte) (Device ID: 3 bytes) Default Command(0): Disable/Initial/Polling Default Command(3): Disable/Initial/Polling
Default CMD	click	Module name: Default CMD Module index: 0~15 Command num: 0~255 Command mode: Initial/Polling Command in size: 2~255 Command out size: 0~255

		Command in address Command out address
Default CMD	right click	It will pop a menu. The menu includes “Basic operation” and “Advanced operation”. Basic Operation: The user can read and write the data of the command relatively simple by the window. Advanced Operation: The user can read and write the data of the command by the database.
User CMD	click	Module name: User CMD Module index: 0~15 User command index: 0~99 Command num: 0~255 Command mode: Initial/Polling/Manual Command in size: 2~255 Command out size: 0~255 Command in address Command out address
User CMD	right click	It will pop a menu. The menu includes “Basic operation” and “Advanced operation”. Basic Operation: The user can read and write the data of the command relatively simple by the window. Advanced Operation: The user can read and write the data of the command by the database.

Note: CMD = Command

About the system window of basic operation:

System Output:

1. status reset:

   When the user sets this item to enable, the system will clear “System request count”, “System response count”, “System error count”, “System error status” and set “System error command index” to 255.

2. auto polling:

When the user sets this item to enable, the system will execute all polling commands automatically.

3. manual trigger:
   When the user sets this item to enable, the system will execute the user command once according to trigger index of user command.

4. trigger index of user command:
   If the user wants to execute user command by manual mode, the user must set this index firstly to appoint the user command.

5. “Send Data” button:
   When the user clicks this button, it will update system output data to the HART-710 module.

System Input:

1. State Machine:
   It will show the state machine of the HART-710 module.

2. Request Count (0~255):
   It will show request count of HART command.

3. Response Count (0~255):
   It will show response count of HART command.

4. Error Count (0~255):
   It will show error count of HART command.

5. Error Status:
   It will show error status of HART command.

6. Error index of user command:
   This item will show which last user command is error. If the index is 255, it means no error.

“Update” button:
When the user clicks this button, it will update system output data and system input data from the HART-710 module.

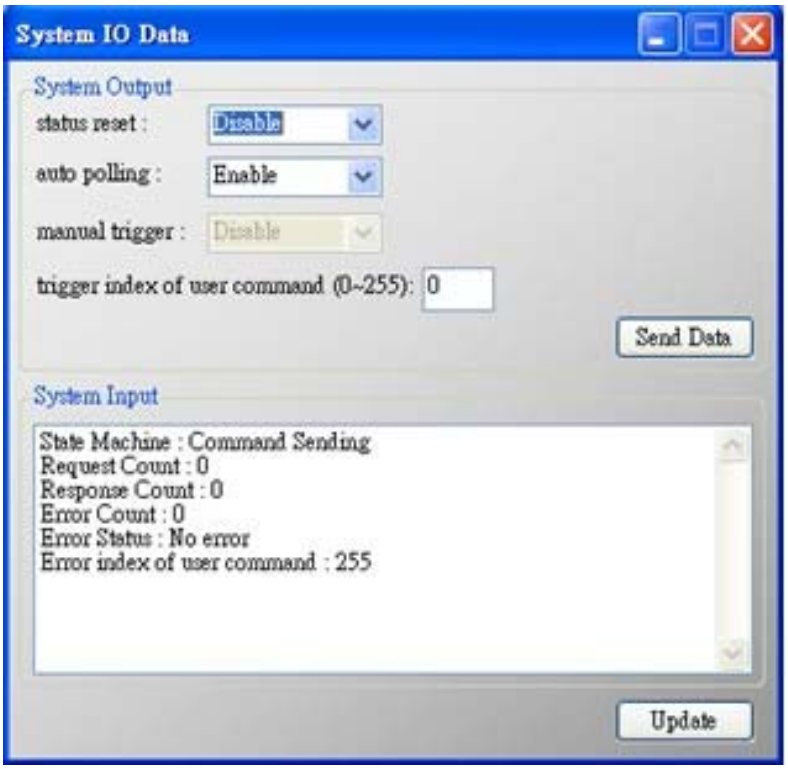


Figure 35: The system window of basic operation

About the system window of advanced operation:
Output Data:
It has 6 bytes data at output data. When the user clicks “Send Data” button, it will send these data to output address 1000~1005 of database.

Input Data:
It has 6 bytes data at input data.

When the user clicks “Update” button, it will get the output data from output address 1000~1005 of database and input data from input address 1000~1005 of database.

About the database, please refer to section 4.3 Database Address for detail.

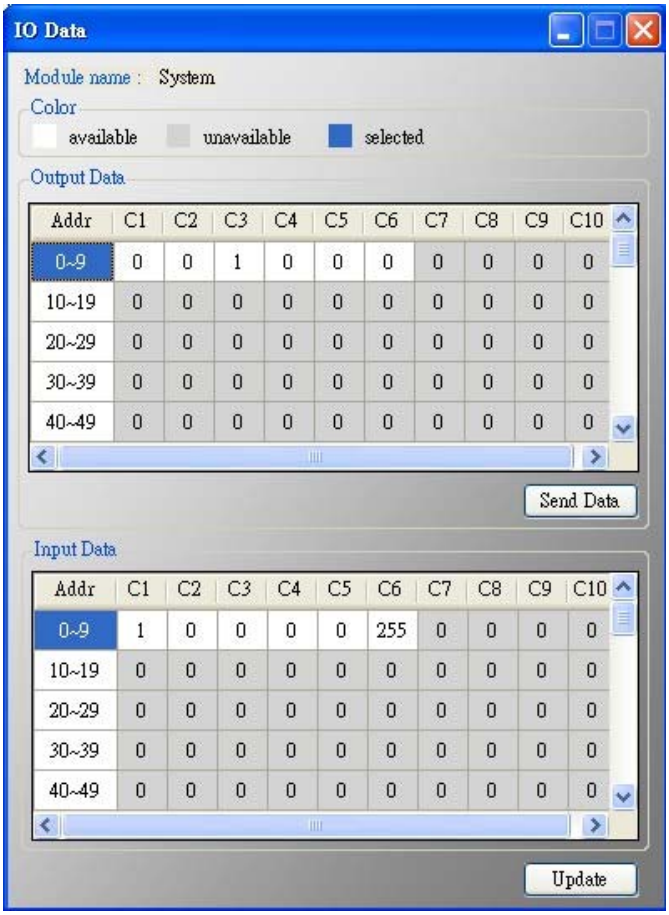


Figure 36: The system window of advanced operation

About the user command window of basic operation:
The basic operation only supports HART command 0, 1, 2, 3, 6, 11, 12, 13, 14, 15, 16, 17, 18, 19 and different command will have different user command window (ex: the window of HART command 0 is shown in the below).

"Send Data" button:
When the user clicks this button, it will send output data of user command to the HART-710 module.

"Update" button:
When the user clicks this button, it will update input and output data of user command from the HART-710 module.

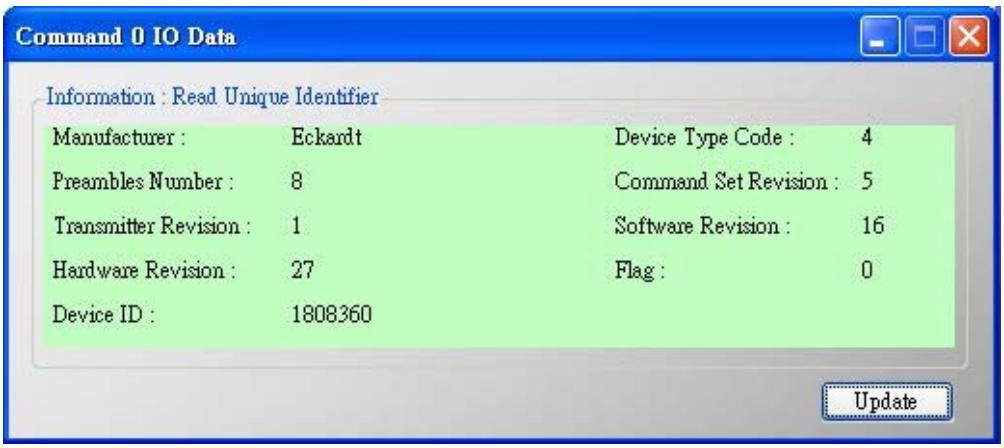


Figure 37: The user command window of basic operation

About the user command window of advanced operation:
The user can read/write the data of HART command at this window.
About the input data of user command, the first 2 bytes are response code1 and response code2 of HART command and the leave bytes belong to input data of HART command.

"Send Data" button:
When the user clicks this button, it will send output data of user command to the HART-710 module.

"Update" button:
When the user clicks this button, it will update input and output data of user command from the HART-710 module.

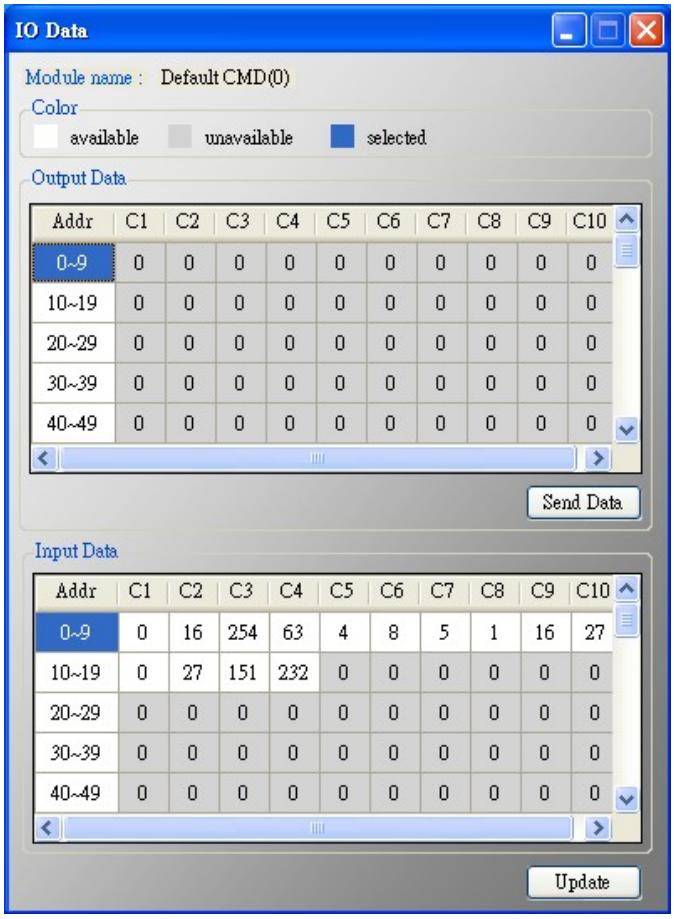


Figure 38: The user command window of advanced operation

5.3.4.3 Device Configuration

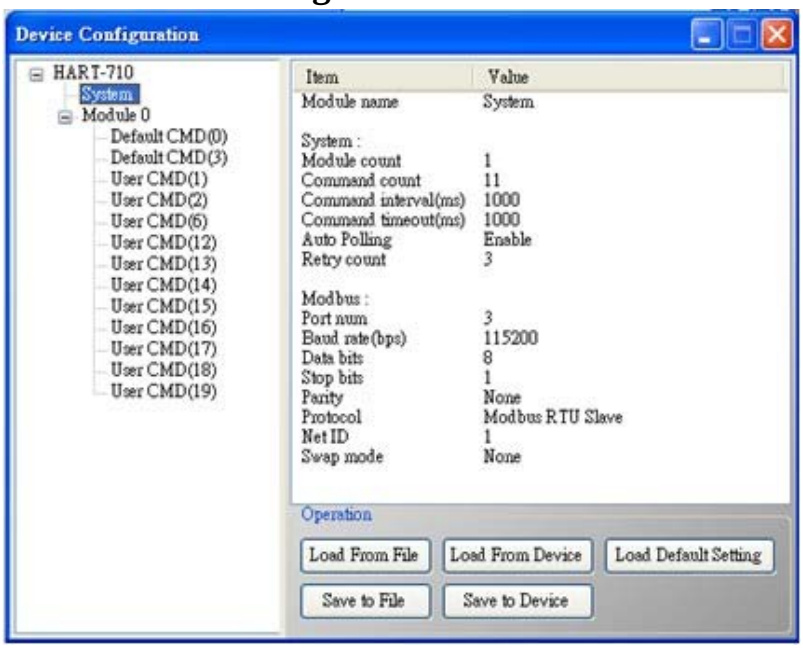


Figure 39: The window of device configuration

In this window, it will show the configuration of the HART-710 module. The user can setup the configuration of the HART-710 module here. When the user selects the node at the left side of window, it will show the data of the node at the right side of window. About the data of these nodes is shown in the below.

Table 6: The data of the node

Node	Behavior	Data
HART-710	click	Module name Firmware version
System	click	Module name: System System: Module count: 0~16 Command count: 0~100 Command interval (ms): 75~65535 Command timeout (ms): 305~65535 Auto Polling : Enable/Disable Retry count: 0~5 Modbus: Port num: 0~3 Baud rate (bps): 1200~115200 Data bits: 7/8 Stop bits: 1/2 Parity: None/Odd/Even Protocol: Modbus RTU Slave/Modbus ASCII Slave Net ID: 1~247 Swap mode: None, Byte, Word, W&B
System	right click	It will pop a menu. The menu includes “Edit” and “Add Module”. Edit: The user can edit the system settings by the window. Add Module: The user can add new HART module by the window.
Module	click	Module name: Module Channel: 0

		Auto Configuration : Enable/Disable Network: Point to Point / Multi-drop (Preamble length: 5~20) (Master type: Primary/Secondary Master) (Frame type: Short/Long Frame) (Module address: 0~15) (Manufacturer ID: 1 byte) (Device type: 1 byte) (Device ID: 3 bytes) Default Command(0): Disable/Initial/Polling Default Command(3): Disable/Initial/Polling
Module	right click	It will pop a menu. The menu includes “Edit” , “Delete” and “Add Command”. Edit: The user can edit the module settings by the window. Delete: The user can delete the HART module here. Add Command: The user can add a new HART command by the window.
Default CMD	click	Module name: Default CMD Module index: 0~15 Command num: 0~255 Command mode: Initial/Polling Command in size: 2~255 Command out size: 0~255 Command in address Command out address
User CMD	click	Module name: User CMD Module index: 0~15 User command index: 0~99 Command num: 0~255 Command mode: Initial/Polling/Manual Command in size: 2~255 Command out size: 0~255 Command in address Command out address

User CMD	right click	It will pop a menu. The menu includes “Edit” and “Delete”. Edit: The user can edit the command settings by the window. Delete: The user can delete the command here.

Note: CMD = Command

About the system window:

a. cmd interval (75~65535 ms): This setting will decide the polling interval of HART command.
   EX: HART command 1 query ➔ HART command 1 response ➔ wait (cmd interval) ➔ HART command 2 query ➔ HART command 2 response ➔ wait (cmd interval) ➔ …

b. timeout value (305~65535 ms): This setting is about the time out value of HART command.

c. Auto polling: The user can enable or disable this function. If the function enable, the system will execute HART command automatically.

d. Retry count (0~5): If the HART communication has error, the system will retry. About the times it is according to this item.

e. Port Num: It is a default value. The user can’t fix it.

f. Baud Rate: The user can select the baud rate for Modbus communication. The range is 1200~115200 bps.

g. Data Bits: The user can select the data bits for Modbus communication. The range is 7~8 data bits.

h. Stop Bits: The user can select the stop bits for Modbus communication. The range is 1~2 stop bits.

i. Parity: The user can select the parity for Modbus communication. The option is None/Odd/Even.

j. Net ID: The user can set the device ID for Modbus communication. The range is 1~247.

k. Protocol: The user can set the protocol for Modbus communication. The option is MB RTU Slave/MB ASCII Slave.

l. Swap mode: The user can set the swap mode for Modbus communication. The option is None/Byte/Word/W&B.

EX: Suppose we get 2 words data (0x1234, 0x5678) from HART-710 module. We can set the swap mode for different format.

Swap mode:	Data
None-	0x1234 0x5678
Byte -	0x3412 0x7856
Word -	0x5678 0x1234
W&B -	0x7856 0x3412

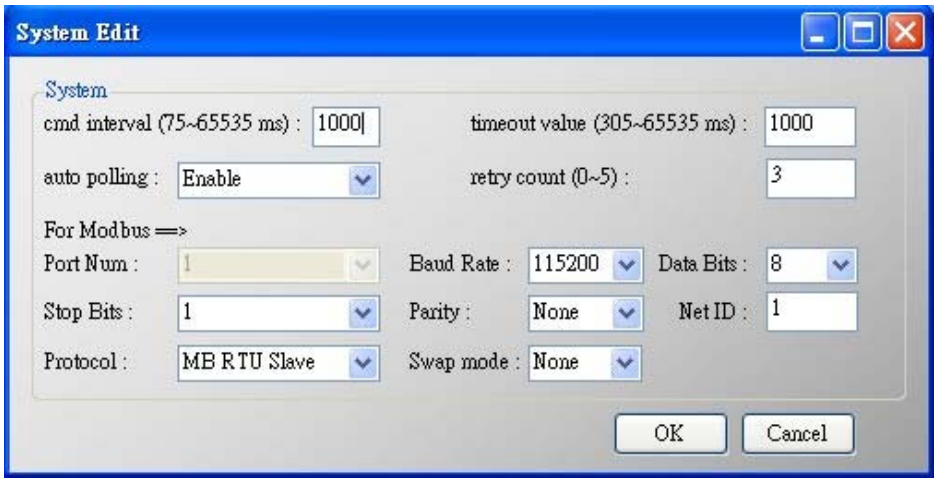


Figure 40: The system window

About the module window:

a. Channel: The user can select the channel that the HART slave device connect. The range is 0~7.

Warning: The HART-710 module only supports channel 0.

b. Auto Configure: If the user enables this function, the system will detect HART frame type, address, preambles, manufacturer ID, device type and device ID automatically.

Warning: Before the user enables this function, the user must confirm the address of HART slave device is unique at the HART bus. If the address is the same with the other HART slave device, this function will be failed.

c. Frame type: The user can set the frame type for HART slave device. The option is Short/Long.

d. Master type: The user can set the master type for HART slave device. The option is Primary/Secondary Master.

   This function will decide the HART frame and minimum timeout value. We suggest setting the master type to Primary Master in the general situation.

e. Network mode: The user can set the network mode for HART slave device. The option is Point to Point/Multi-drop.

   If the network mode is “Point to Point”, it means it has only one HART slave device at the HART bus.
   If the network mode is “Multi-drop”, it means it has more than one HART slave device at the HART bus.

f. Address: The user can set the address for HART slave device. The range is 0~15. If the frame type is “Long”, the user can omits this setting.

g. Preambles: The user can set the preambles for HART slave device. The range is 5~20.

h. Manufacturer ID: The user can set the manufacturer ID for HART slave device. If the frame type is “Short”, the user can omits this setting.

i. Device type: The user can set the device type for HART slave device. If the frame type is “Short”, the user can omits this setting.

j. Device ID: The user can set the device ID for HART slave device. If the frame type is “Short”, the user can omits this setting.

k. Cmd 0 mode: The option is Disable/Initial/Polling.
   Disable: The module will not create HART command 0.
   Initial: The module will create HART command 0 automatically and run

this command at initial mode.
Polling: The module will create HART command 0 automatically and run this command at polling mode.

l. Cmd 3 mode: The option is Disable/Initial/Polling.
Disable: The module will not create HART command 3.
Initial: The module will create HART command 3 automatically and run this command at initial mode.
Polling: The module will create HART command 3 automatically and run this command at polling mode.

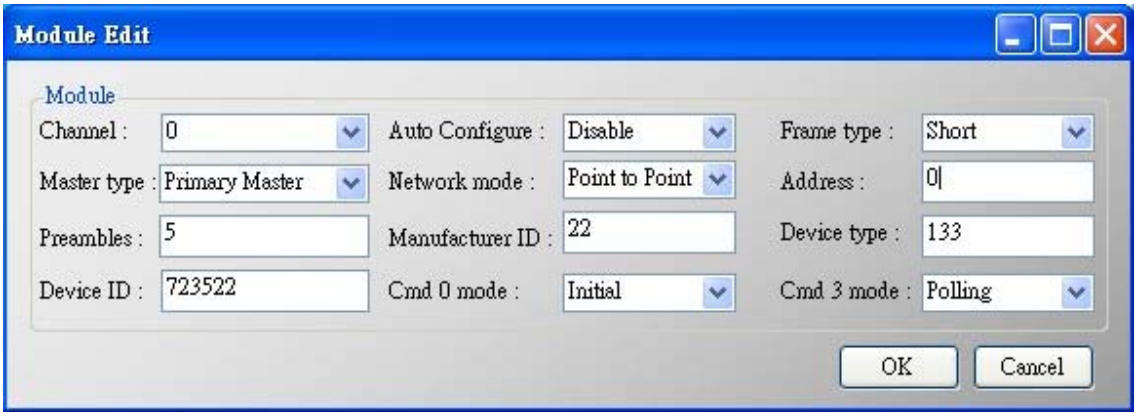


Figure 41: The module window

About the command window:

a. Command Num.: The user can set the number of HART command for HART communication.

b. Mode: The option is Initial/Polling/Manual.
Initial: The system will run this command at initial mode.
Polling: The system will run this command at polling mode.
Manual: The system will run this command by manual.

c. In Size: The user can set the input size of HART command.
Note: The size includes 2 bytes response code and data size of HART command. Ex: HART command 0 = 2(response code) +12 =14

d. Out Size: The user can set the output size of HART command. Ex: HART command 0 = 0, HART command 6 = 1.

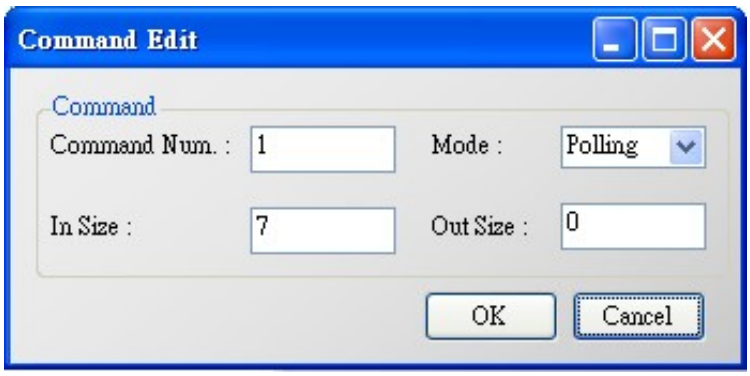


Figure 42: The command window

5.3.4.4 Default Output Data

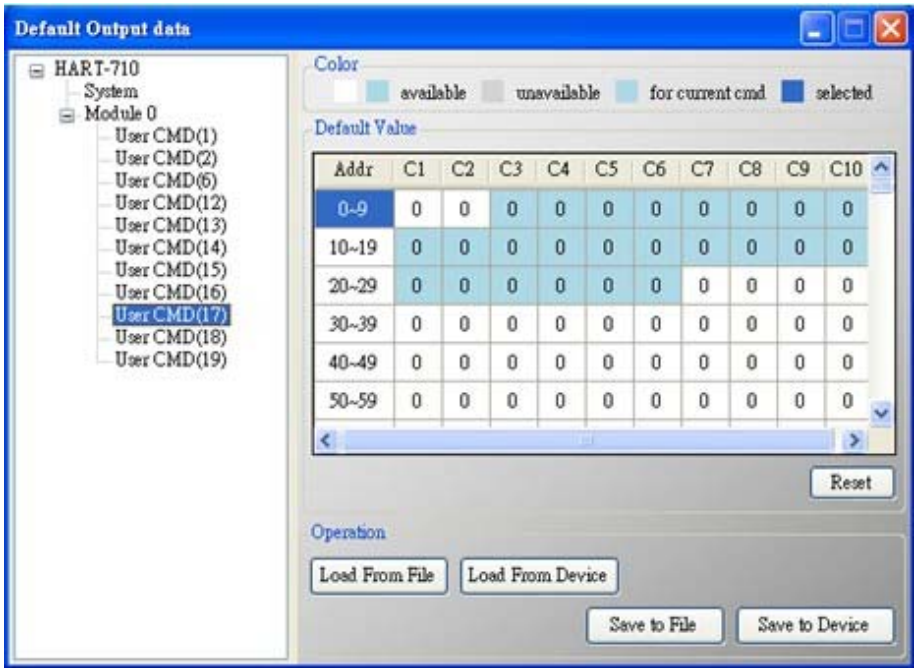


Figure 43: The window of default output data

The user can set the default value for user command by this window. When the HART-710 starts, it will set the output data of user command from default value. When the user selects the node of command and the output length of the command isn't zero, the table will indicate which data belongs to the command.

5.3.4.5 Address Map

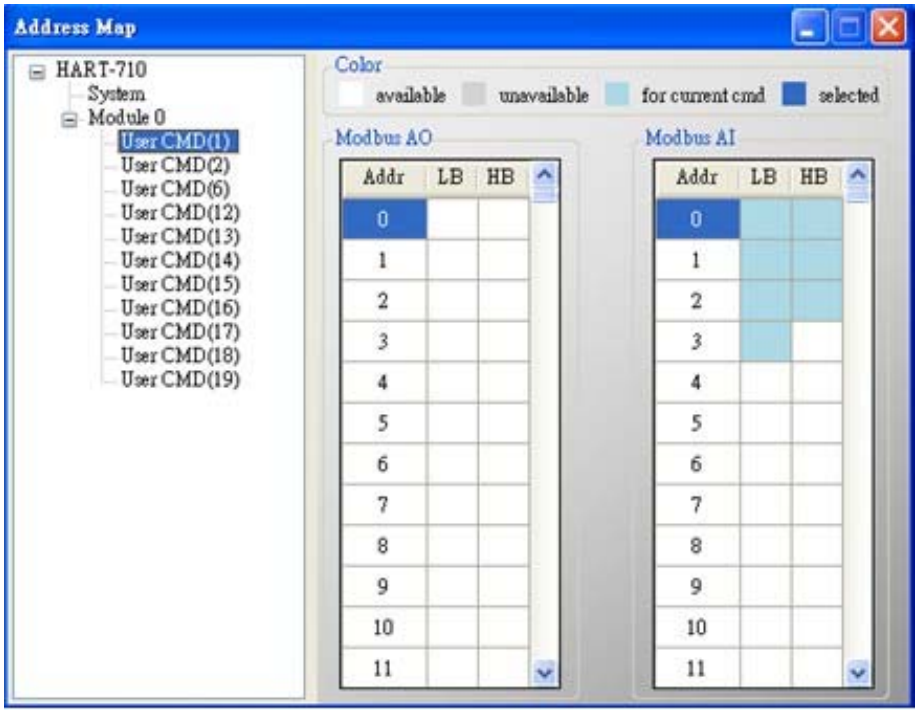


Figure 44: The window of address map

The user will know the Modbus address of the user command by this window. When the user selects the node of command, it will indicate the address at “Modbus AI” table and “Modbus AO” table. About the “Modbus AI” table, it means the user can read the data by Modbus function code 4. About the “Modbus AO” table, it means the user can read the data by Modbus function code 3 and write the data by Modbus function code 6/16.

Note:
About the Modbus address of the default command is fixed, so the user can refer to section 4.3 Database address to get the address.

5.3.4.6 Device Diagnostic

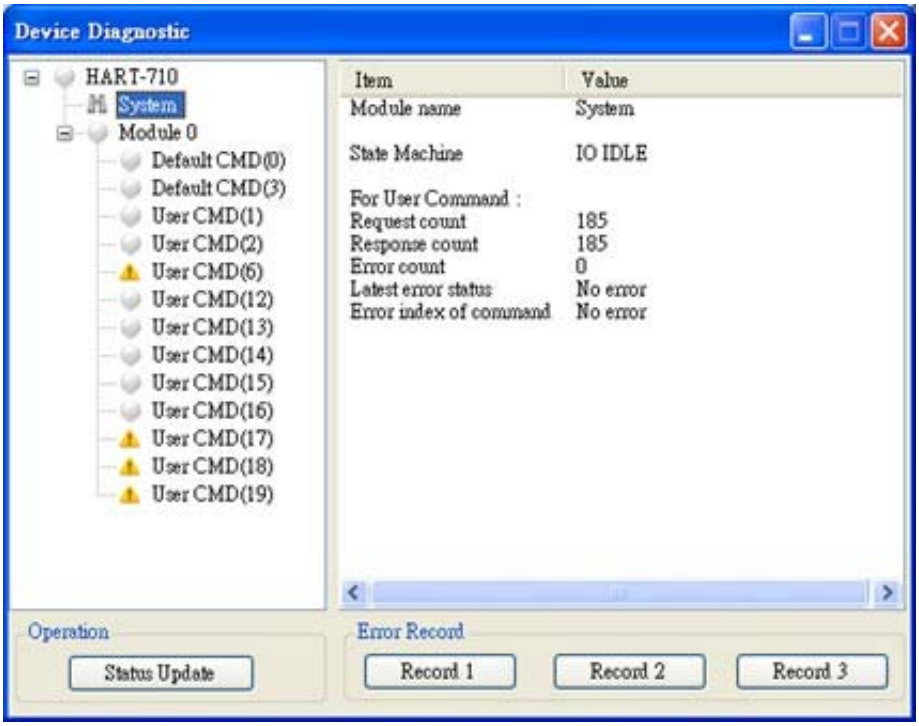


Figure 45: The window of device diagnostic

The user can check the status of command by this window. The user can click "Status Update" button to refresh the status. When the user selects the node, it will show the status of the node at the right side of the window.

The icon of the node at the left side of the window is shown in the below:

1.  ➔ It means no error.
2.  ➔ It means the command has never be executed
3.  ➔ It means the command has error and error status will show at the right side of the window.
4.  ➔ It means the node is selected.

The HART-710 module will record the last error command and save to "Record 1~3". The user can get these record by click "Record 1" / "Record 2" / "Record 3" button.

5.3.4.7 Through Mode

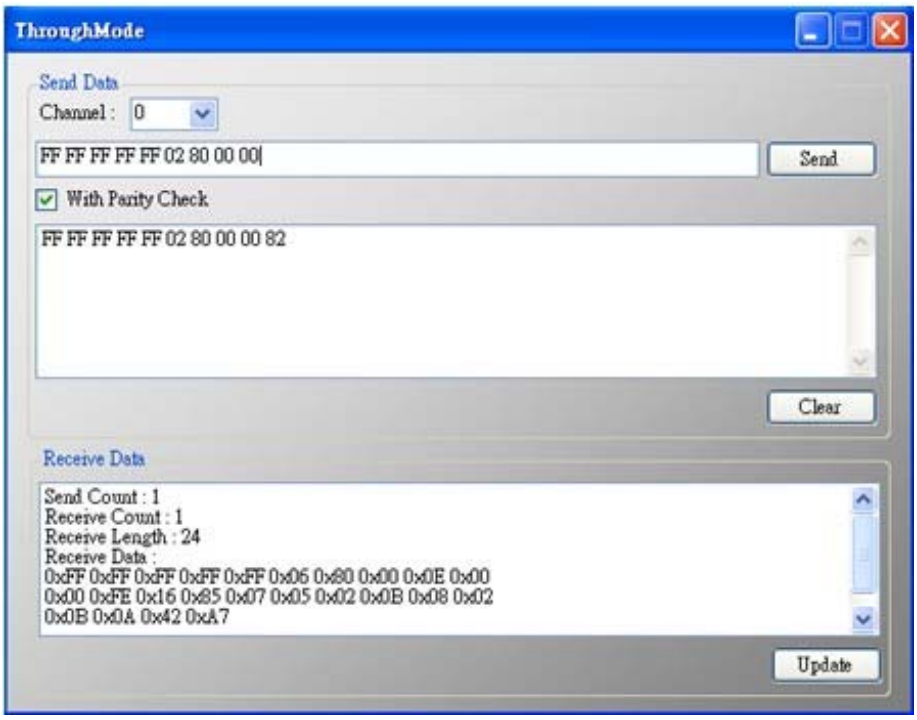


Figure 46: The window of through mode

The user can send and receive frame of HART command directly by this window. For example: If you want to send a HART command 0 by short frame, you can send “0xFF 0xFF 0xFF 0xFF 0xFF 0x02 0x80 0x00 0x00 0x 82” and then you will receive the response frame by click “Update” button.

Warning: Before send the frame, the user should check the “RUN” led is always on and set “auto polling” function to disable firstly. About the “auto polling” function, please refer to section 5.3.4.2 Device Information (About the system window of basic operation).

5.3.4.8 Format Translation

Figure 47: The window of format translate

Here we provide some tools for HART communication. “Packed ASCII

Translate” tool can convert “Packed ASCII” into ASCII format. “IEEE754 Translate” tool can convert “IEEE754” into byte format.

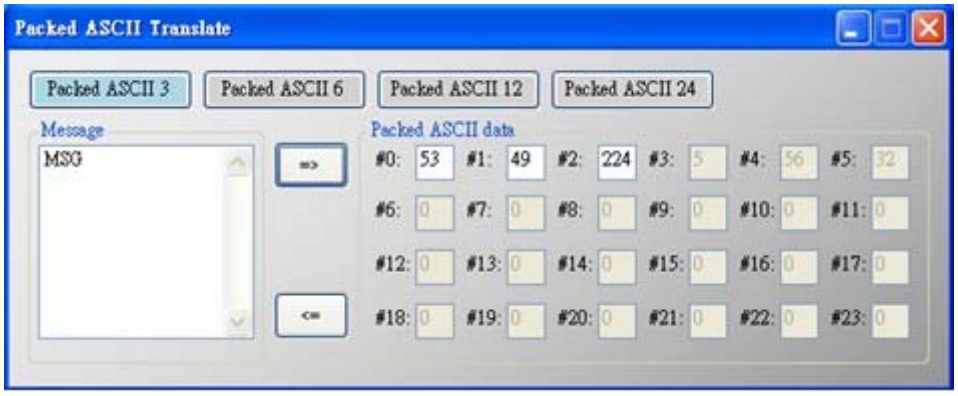


Figure 48: The window of packed ASCII translate

Figure 49: The window of IEEE754 translate

5.3.4.9 About

Figure 50: The window of about

The utility version will show in this window.

5.4 Establish connection with HART-710

The connection of Utility and HART-710 is shown in *figure 51*. Please follow the steps to establish connection.

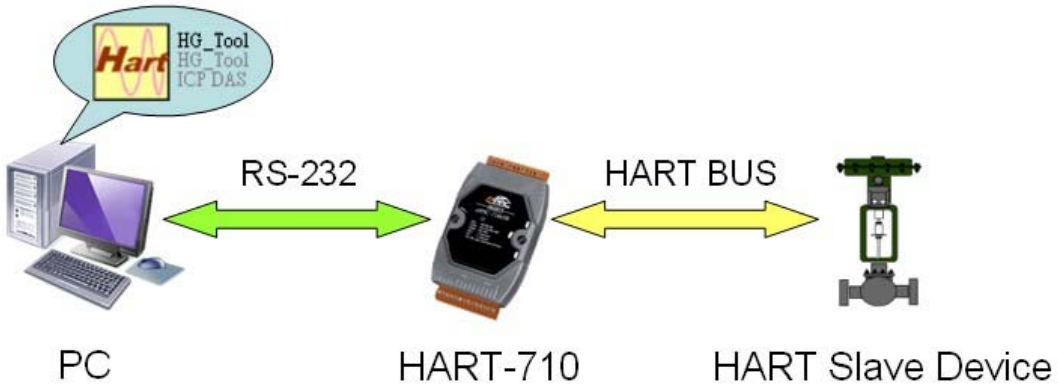


Figure 51: The connection of Utility and HART-710

Step 1:

Wire COM Port of PC to RS-232 port of HART-710

Step 2:

Open HG_Tool.exe on PC.

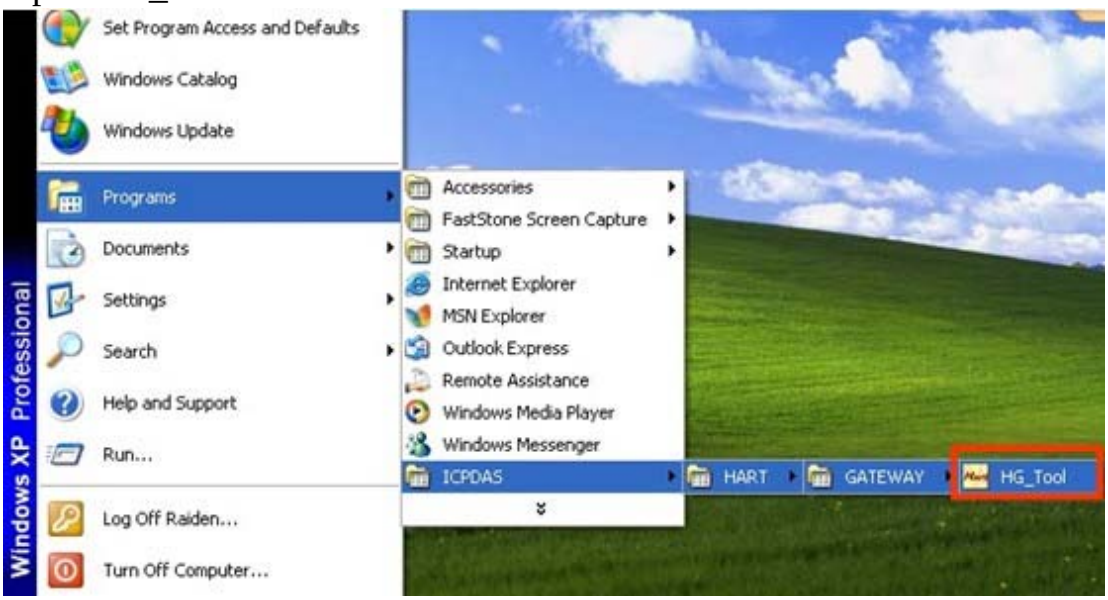


Figure 52: Open Utility

Step 3:

Set COM Port communication setting of utility the same as COM Port setting of HART-710

The default settings of HART-710 are protocol: MB RTU, Net ID: 1, baud rate: 115200 bps, data bits: 8 bits, stop bits: 1 bit, parity: none.

Figure 53: Com Port settings of the utility

Step 4:

Click “Connect” button.

Figure 54: Click “Connect” button

Step 5:

Traffic light shows green in the utility now; it means the connection is successful.

Figure 55: Connection status

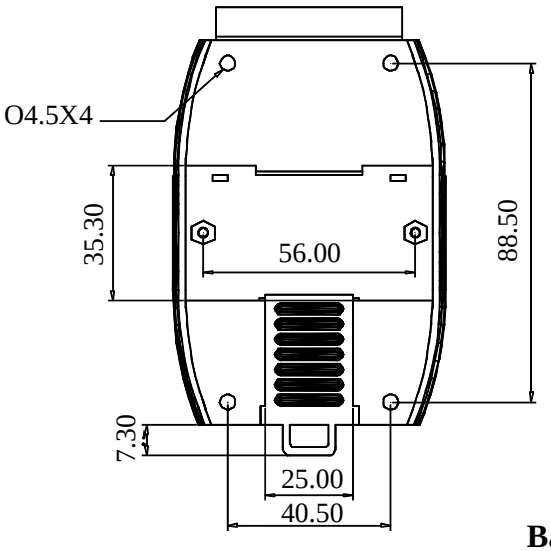
6. Troubleshooting

The troubleshooting list can help users to resolve the problems when using the HART-710. If the problem still can't be solved, please contact with technical staff of ICP DAS.

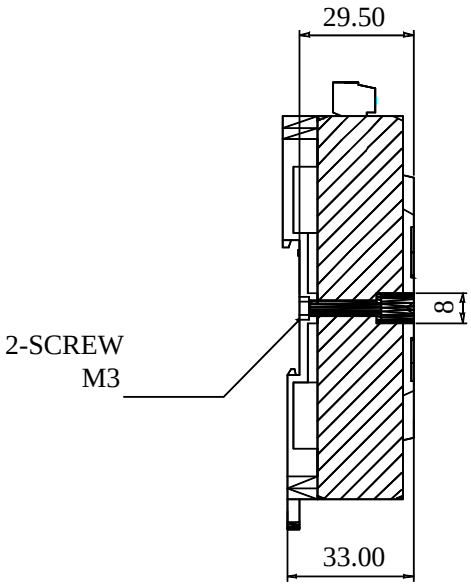
Table 7: Errors and solutions

Item	Trouble state	Solution
1	'PWR' LED indication of the HART-710 is always turned off	The power supply of HART-710 has some problems. Please check the wire connection of the power and the voltage is between 10~30VDC.
2	'RUN' LED indication of the HART-710 is always flash.	Flash once a second: It is at initial mode. If it is always at initial mode, it means it can't connect to the HART slave device. Please recheck the hardware connection and module configuration. If the problem is still, please set the DIP switch to default and connect a HART slave device to HART-710 and then turn the power on. If it is OK, it means your module configuration has some errors. If it isn't OK, it means your hardware connection has error. Flash once a half second: It had received the burst frame. At the burst mode, the HART-710 module must work at the Point to Point network and should not enable the auto polling function.
3	'ERR' LED indication of the HART-710 is always flash.	It means the user command has some errors. Please connect the utility (HG_Tool.exe) and the HART-710 module to get the error status by "Device Diagnostic" icon of HG_Tool.exe.

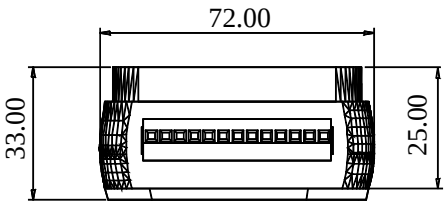
7. Dimensions



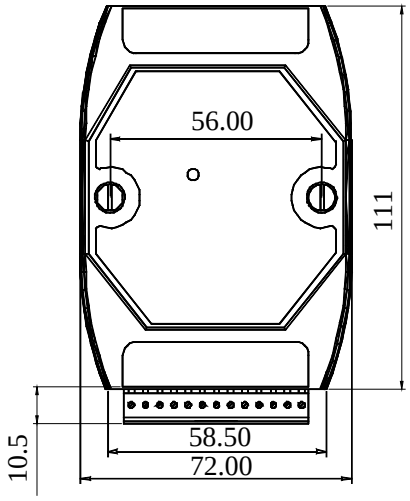
Back View



Side View

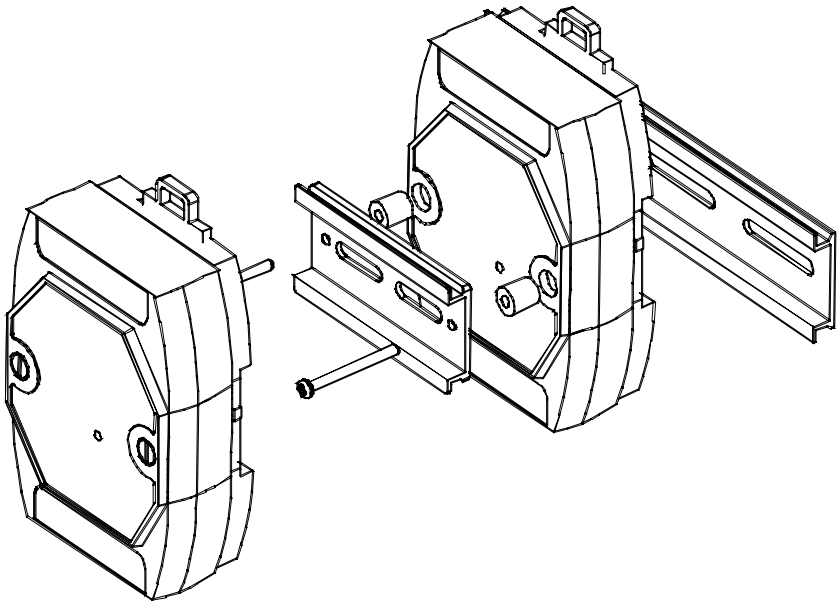


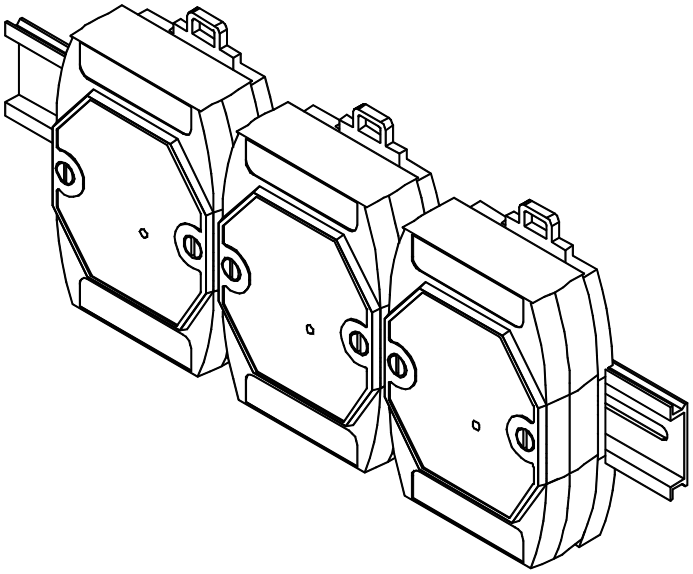
Top View



From View

Unit : mm





Appendix A: HART Command

We extracted parts of the HART universal command here.

Command 0: Read Unique Identifier

Request data bytes: none
Response data bytes: 2+12 = 14

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2:	uint8	254
Byte 3:	uint8	Manufacturer ID
Byte 4:	uint8	Manufacturer's device ID
Byte 5:	uint8	Number of preambles needed in the request
Byte 6:	uint8	Command set revision number
Byte 7:	uint8	Transmitter specific revision code
Byte 8:	uint8	Software revision
Byte 9:	uint8	Hardware revision
Byte 10:	uint8	Flags
Byte 11~13:	uint24	Device ID number (MSB first)

Command 1: Read Primary Variable

Request data bytes: none
Response data bytes: 2+5 = 7

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2:	uint8	Unit code
Byte 3~6:	float	Primary Variable

Command 2: Read P.V. Current and Percentage of Range

Request data bytes: none
Response data bytes: 2+8 = 10

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2~5:	float	Primary Variable Current
Byte 6~9:	float	Primary Variable Percentage of Range

Command 3: Read Dynamic Variables and P.V. Current

Request data bytes: none

Response data bytes: 2+24 = 26

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2~5:	float	Primary Variable Current
Byte 6:	uint8	Primary Variable Unit code
Byte 7~10:	float	Primary Variable
Byte 11:	uint8	Secondary Variable Unit code
Byte 12~15:	float	Secondary Variable
Byte 16:	uint8	Tertiary Variable Unit code
Byte 17~20:	float	Tertiary Variable
Byte 21:	uint8	4th Variable Unit code
Byte 22~25:	float	4th Variable

Command 6: Write Polling Address

Request data bytes: 1

Index	format	description
Byte 0:	uint8	Polling Address

Response data bytes: 2+1 = 3

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2:	uint8	Polling Address

Command 11: Read Unique Identifier Associated with TAG

Request data bytes: 6

Index	format	description
Byte 0~5:	PA6	TAG Name

Response data bytes: 2+12 = 14

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2:	uint8	254
Byte 3:	uint8	Manufacturer ID
Byte 4:	uint8	Manufacturer’s device ID
Byte 5:	uint8	Number of preambles needed in the request
Byte 6:	uint8	Command set revision number
Byte 7:	uint8	Transmitter specific revision code
Byte 8:	uint8	Software revision

Byte 9:	uint8	Hardware revision
Byte 10:	uint8	Flags
Byte 11~13:	uint24	Device ID number (MSB first)

Command 12: Read Message

Request data bytes: none
Response data bytes: 2+24 = 26

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2~25:	PA24	Message

Command 13: Read Tag, Descriptor, Date

Request data bytes: none
Response data bytes: 2+21 = 23

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2~7:	PA6	TAG Name
Byte 8~19:	PA12	Descriptor
Byte 20:	uint8	Day of month
Byte 21:	uint8	Month of year
Byte 22:	uint8	Year as offset to 1900

Command 14: Read Primary Variable Sensor Information

Request data bytes: none
Response data bytes: 2+16 = 18

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2~4:	uint24	Sensor Serial Number (MSB first)
Byte 5:	uint8	Sensor limits unit
Byte 6~9:	float	Upper sensor limit
Byte 10~13:	float	Lower sensor limit
Byte 14~17:	float	Minimum span

Command 15: Read Primary Variable Output Information

Request data bytes: none
Response data bytes: 2+17 = 19

Index	format	description
Byte 0:	uint8	Response code 1

Byte 1:	uint8	Response code 2
Byte 2:	uint8	Alarm select code
Byte 3:	uint8	Transfer function code
Byte 4:	uint8	PV range value unit code
Byte 5~8:	float	Upper range value
Byte 9~12:	float	Lower range value
Byte 13~16:	float	Damping value
Byte 17:	uint8	Write protect code
Byte 18:	uint8	Private label distribution code

Command 16: Read Final Assembly Number

Request data bytes: none

Response data bytes: 2+3 = 5

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2~4:	uint24	Final assembly number (MSB first)

Command 17: Write Message

Request data bytes: 24

Index	format	description
Byte 0~23:	PA24	Message

Response data bytes: 2+24 = 26

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2~25:	PA24	Message

Command 18: Write Tag, Descriptor, Date

Request data bytes: 21

Index	format	description
Byte 0~5:	PA6	TAG Name
Byte 6~17:	PA12	Descriptor
Byte 18:	uint8	Day of month
Byte 19:	uint8	Month of year
Byte 20:	uint8	Year as offset to 1900

Response data bytes: 2+21 = 23

Index	format	description
Byte 0:	uint8	Response code 1

Byte 1:	uint8	Response code 2
Byte 2~7:	PA6	TAG Name
Byte 8~19:	PA12	Descriptor
Byte 20:	uint8	Day of month
Byte 21:	uint8	Month of year
Byte 22:	uint8	Year as offset to 1900

Command 19: Write Final Assembly Number

Request data bytes: 3

Index	format	description
Byte 0~2:	uint24	Final assembly number (MSB first)

Response data bytes: 2+3 = 5

Index	format	description
Byte 0:	uint8	Response code 1
Byte 1:	uint8	Response code 2
Byte 2~4:	uint24	Final assembly number (MSB first)

Note:
Uint8: 8-bit unsigned integer
Uint24: 24-bit unsigned integer
Float: IEEE 754 format
PA6: Packed-ASCII 6 octets = 8 characters
PA12: Packed-ASCII 12 octets = 16 characters
PA24: Packed-ASCII 24 octets = 32 characters