I-7570

Serial To HART Converter

User's Manual

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year from the date of delivery to the original purchaser.

Warning

ICP DAS assumes no liability for damages resulting from the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, or for any infringements of patents or other rights of third parties resulting from its use.

Copyright

Copyright 2011 by ICP DAS. All rights are reserved.

Trademark

The names used for identification only may be registered trademarks of their respective companies.

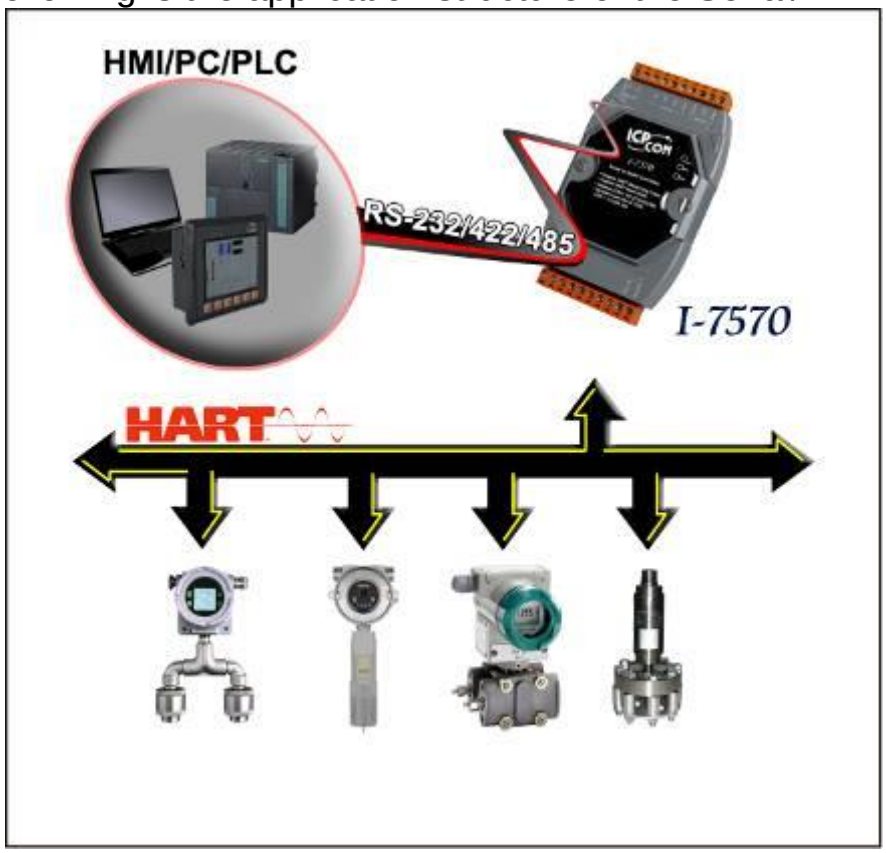
Table of Contents

1. Introduction 3
1.1 Features 3
1.2 Specifications 4
2. Hardware 6
2.1 Block Diagram 7
2.2 Pin Assignment of I-7570 8
2.2.1 Pin Function Description 8
2.2.2 Wiring of Serial Port 9
2.2.3 HART Connection 10
2.3 Terminator Resistor Settings 12
2.4 Default / Normal Dip-switch 13
2.4.1 Firmware Update Mode 13
2.4.2 Firmware Operation Mode 14
2.5 LED Indication 16
2.5.1 LED Function 16
2.5.2 LED Indication Table 17
2.6 Cable Selection 17
3. Reserved 19
4. HC_Tool Utility 20
4.1 Run Utility 20
4.2 Serial Port and HART Command Settings 20
4.2.1 Serial port settings 20
4.2.2 HART Frame Settings 21
4.3 Search HART devices 22
4.3.1 Search HART devices automatically 22
4.3.2 Search HART devices manually 23
4.3.3 Search HART devices 24
4.4 Send / Receive HART Frame (SRMsg) 26
4.5 HART Information Log (Data Log) 28
4.6 HART Configuration (HTCfg) 29
4.7 Module Configuration (ModCfg) 31
5. FAQ 34
Q01 : How to use I-7570 to communicate with HART devices ? 34
Q04 : Set HART device address by using HART converter ? 34
Q05 : How to send HART command for writing (Ex: CMD51)? 36
Q06 : How to connect with HART OPC server? 38
6. Version History 41

1. Introduction

I-7570 is a Serial to HART converter designed as the master device of HART protocol. It allows users to access the HART slaves by using RS-232 / RS-422 / RS-485. These HART slave devices may be a transmitter, actuator, current output device, and so forth. In addition, by using the I-7570 utility tool, users can configure module and test HART communication easily and quickly.

The following is the application structure of the Serial/HART module.



1.1 Features

- Support HART Short / Long frame.
- Support HART Burst mode.
- Support point-to-point or multi-drop HART mode.
- Support connecting up to 15 HART slave devices.

- Allow two HART masters.
- Provide utility tool for module configuration and HART communication.
- Support firmware update via serial port.
- Provide PWR / TxD / RxD indication LED
- Isolated COM 1**:** RS-232 / RS-422 / RS-485
- 4KV ESD Protection
- Built-in Watchdog
- Selectable 250Ω load resistor

1.2 Specifications

[Serial spec.]

- COM1 **:** RS-232 (Tx / Rx / GND) / RS-422 / RS-485
- Baud Rate **:**
  1200 bps (For FW_v1.1)
  1200 ~ **115200**bps (For FW_v1.1 / HW_v1.2)
- Data Format **:**
  O(odd parity), **8**(data bit), **1**(stop bit) (For FW_v1.1)
  N/**O**/**E**(parity), **8**(data bit), **1**/**2**(stop bit) (For FW_v1.1 / HW_v1.2)

[HART spec.]

- Channel **:** 1
- Connector **:** 2-pin screwed terminal block
- Network **:** Point to Point or Multi-drop
- Baud Rate **: 1200** bps
- Frame **:** Short or Long
- Operates as a HART Master and supports all HART commands
- Support up to 15 HART slave devices
- Isolation Voltage **:** 3KVdc on the HART side

[Power Requirement]

- Power **:** Unregulated +10 ~ +30 VDC
- Power reverse protection, Over-Voltage brown-out protection
- Power consumption **:** 1 W

[Module spec.]

- Dimensions **:** 121 mm x 72 mm x 35 mm (H x W x D)
- Operating temperature **:** -25 to 75°C (-13 to 167°F);
- Storage temperature **:** -30 to 85°C (-22 to 185°F);
- Humidity **:** 5 to 95%, non-condensing;
- Indication LED **:**
  PWR LED **:** Module power status
  TxD LED **:** Data received from Serial port
  RxD LED **:** Data received from HART port

[Utility Tool]

- Provide module configuration and HART communication easily and quickly.
- Provide HART devices search automatically.
- Provide diagnostic Information of HART device.
- Provide data logging for HART communication.

[Application]

- Current Measuring.
- Petrochemical Industry Application.
- Environment Monitoring.
- Tunnel Monitoring.
- Monitor system.
- Building Monitoring.

2. Hardware



Figure 2-1**:** Hardware externals of I-7570

2.1 Block Diagram

Figure 2-2 is a block diagram illustrating the functions on the I-7570 module. It provides the 3000Vrms Isolation in the HART interface.

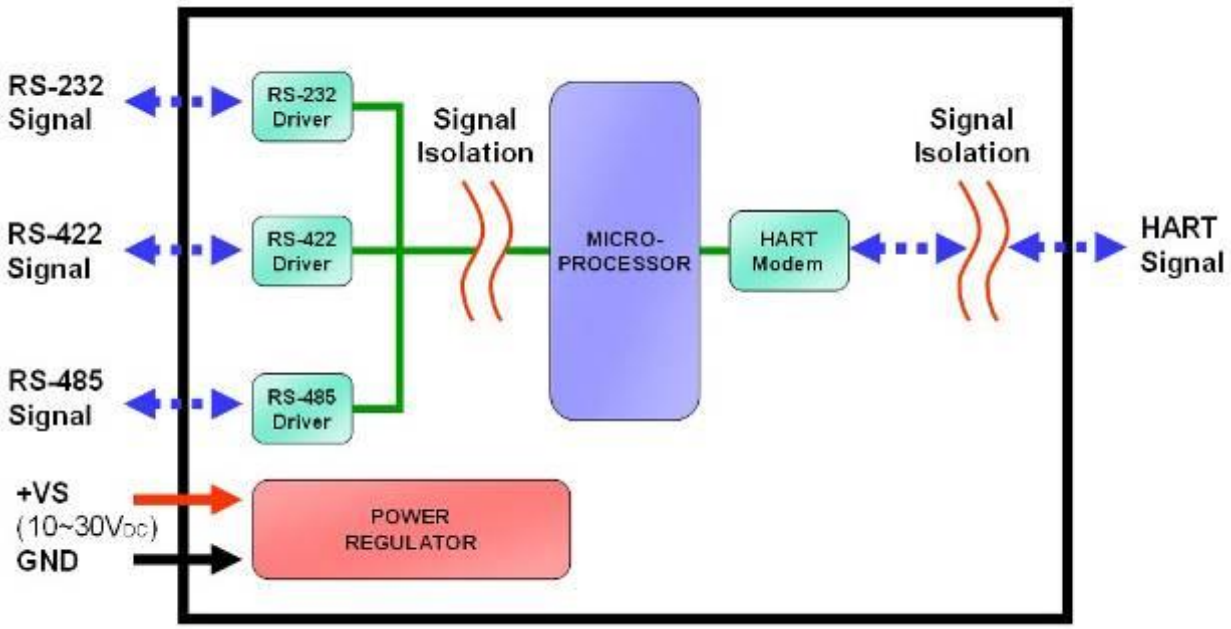


Figure 2-2**:** Block diagram of I-7570

2.2 Pin Assignment of I-7570

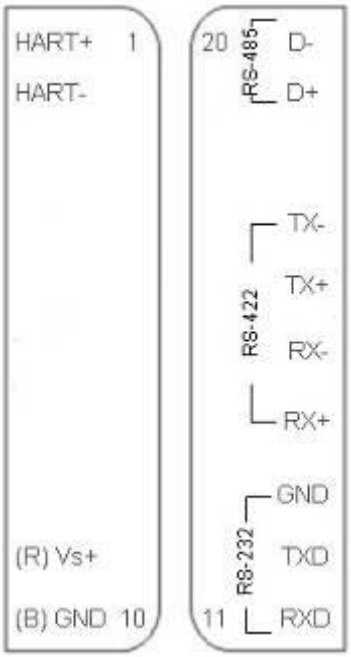


Figure 2-3**:** Pin Assignment of I-7570

2.2.1 Pin Function Description

Pin No.	Pin Name	Pin Function Description
1	HART+	HART+
2	HART-	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 (+10V~+30Vdc)
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

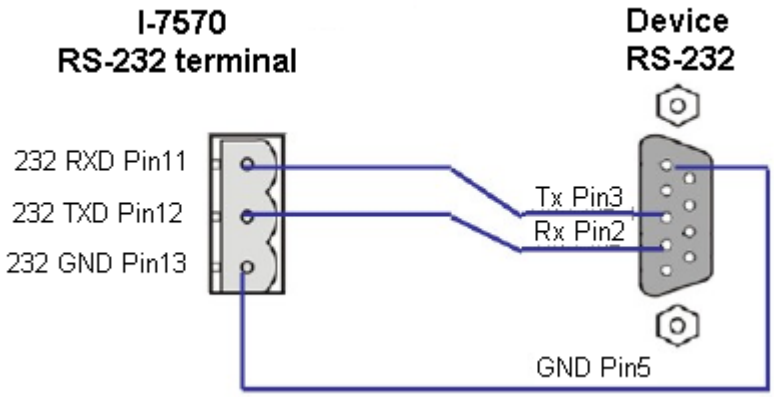
2.2.2 Wiring of Serial Port

(1) **RS-232** Wiring **:**

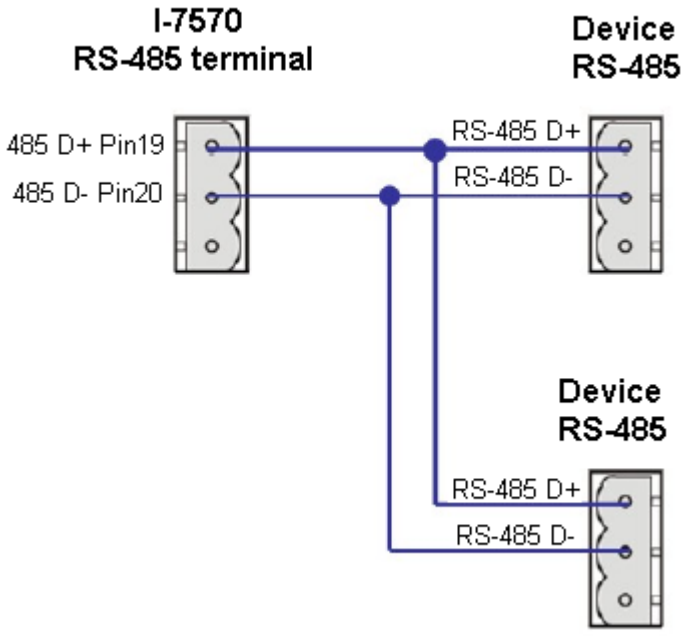
[1] I-7570 TXD pin connects to Rx pin of serial port.

[2] I-7570 RXD pin connects to Tx pin of serial port.

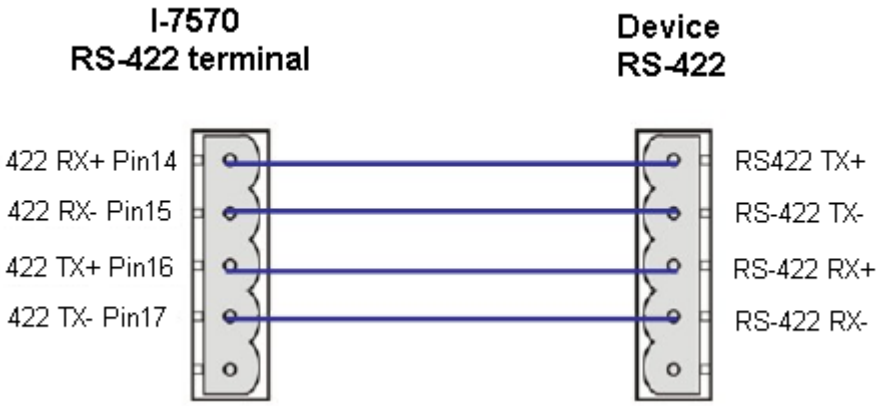
[3] I-7570 GND pin connects to GND pin of serial port.



(2) **RS-485** Wiring **:**



(3) **RS-422** Wiring **:**

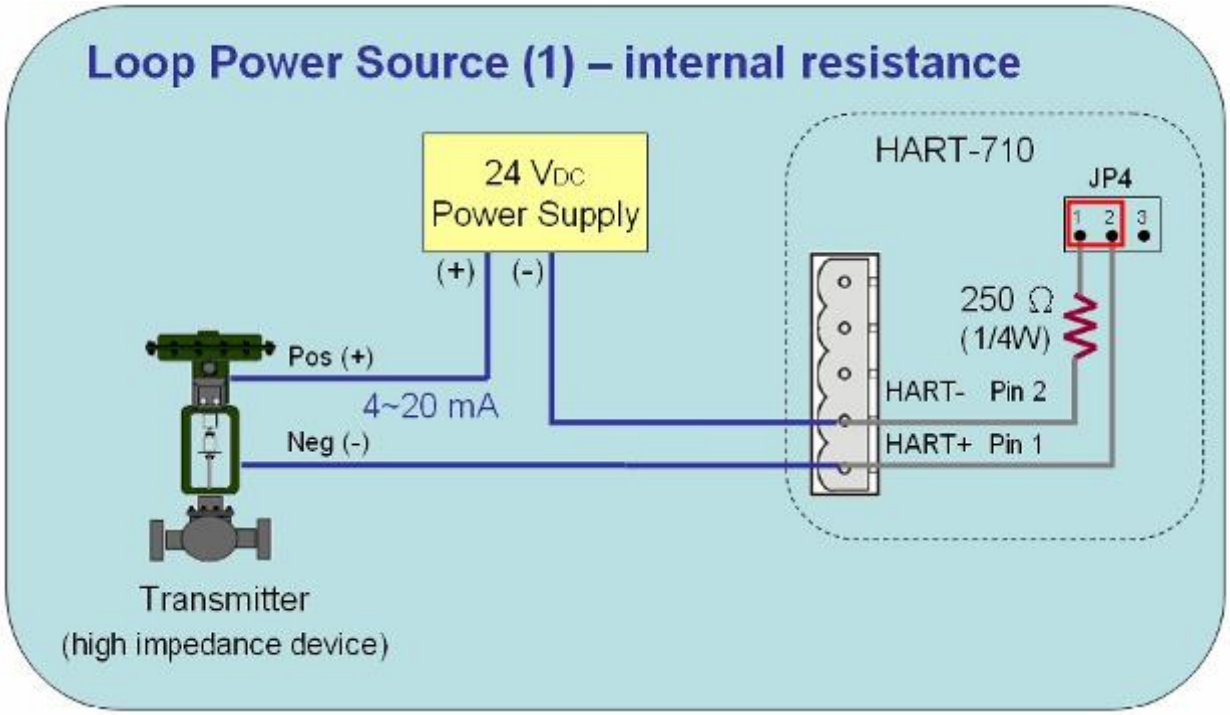


2.2.3 HART Connection

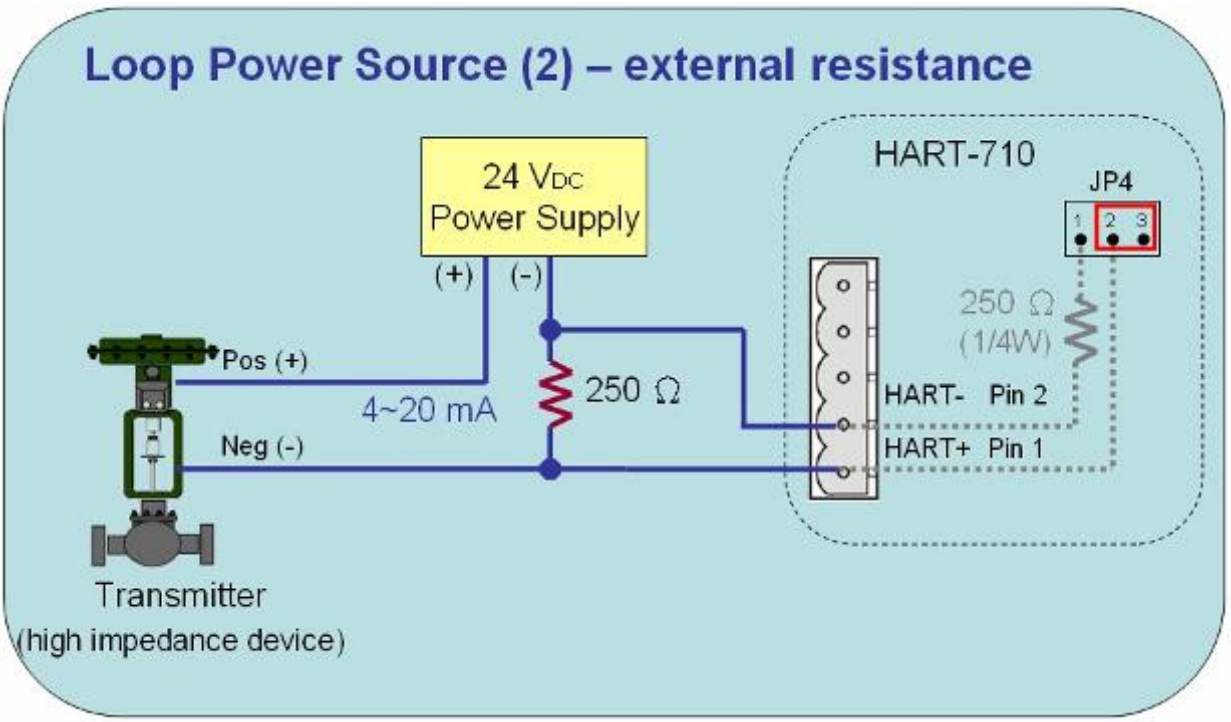
The HART connection can be divided into the following two types **:**

(1) “Loop Power Source” Mode.

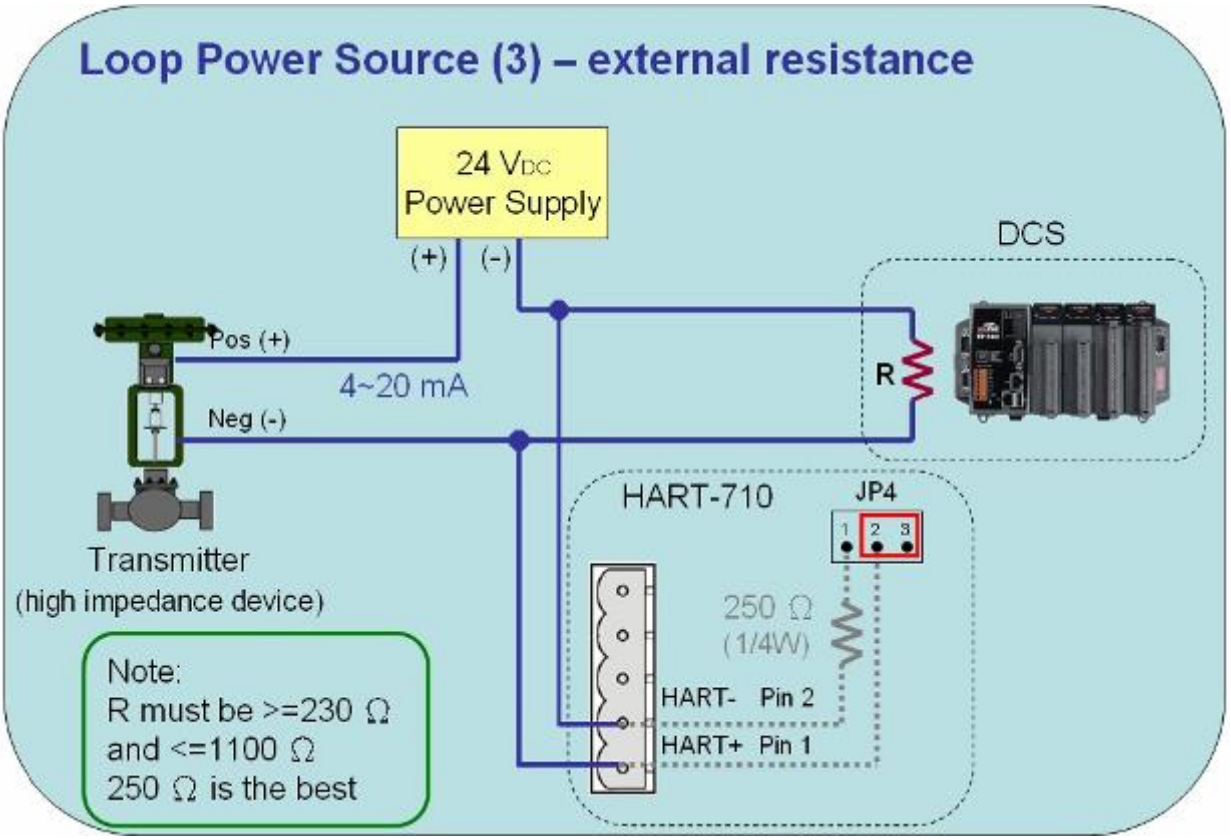
(2) “External Power Source” Mode.



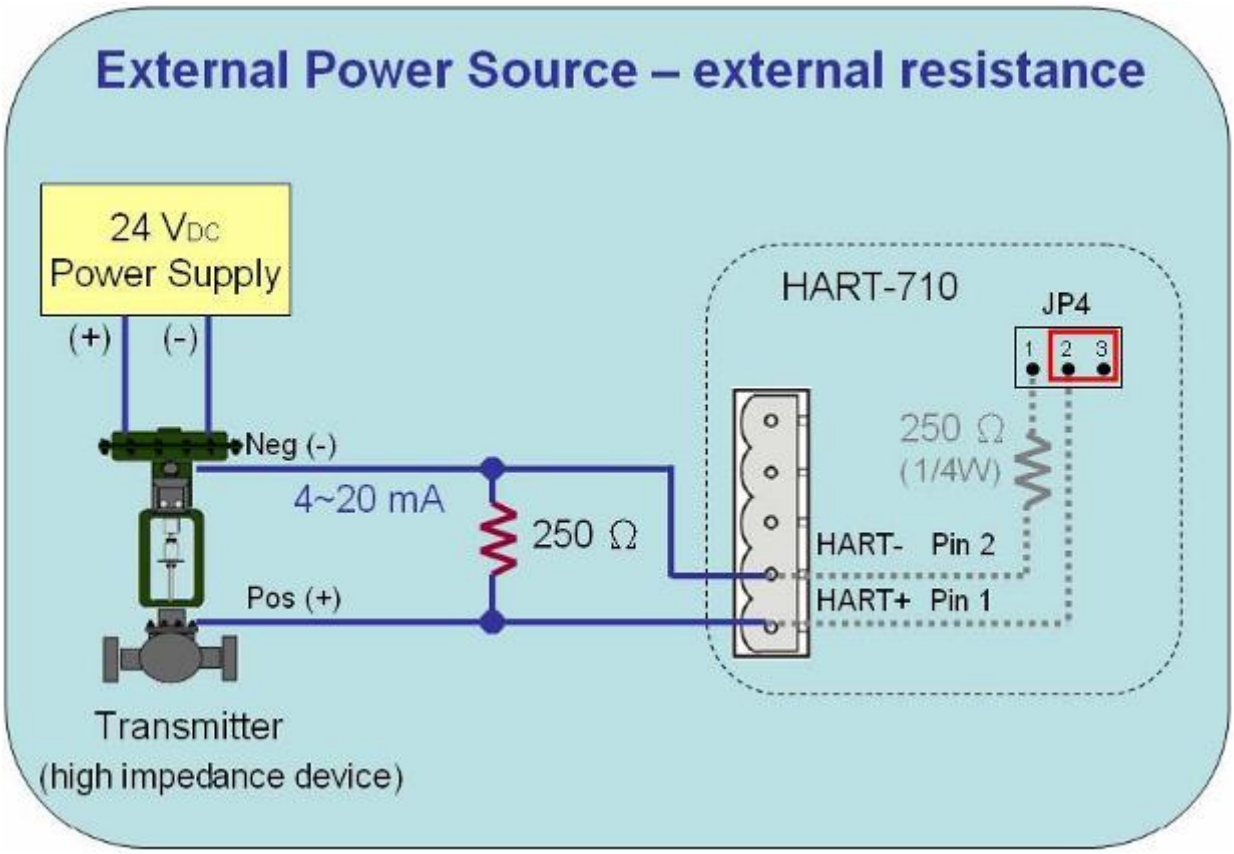
Ex1 **:** Loop Power Source (Internal Resistance)



Ex2 **:** Loop Power Source (External Resistance)



Ex3 **:** Loop Power Source (External Resistance)



Ex4 **:** External Power Source (Internal Resistance)

2.3 Terminator Resistor Settings

There is a Jumper (JP4) at the I-7570 module, shown in Figure 2-4. The jumper can provide HART network with 250 Ω (1/4 W) load resistor. When the pin 1&2 of JP4 is connected, the resistor will connect to HART network. When the pin 2&3 ofJP4 is connected, it will disconnect the resistor from HART network. By default, the pin1&2 of JP4 is connected.

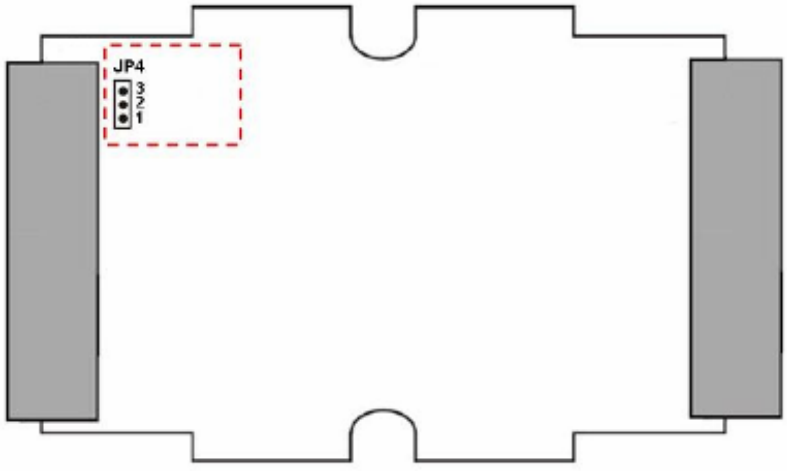


Figure 2-4**:** Internal Load Resistor

2.4 Default / Normal Dip-switch

There is a DIP switch on the back of the I-7570 module, as shown in Figure 2-5.

(1) **Firmware Operation Mode :**

Set the DIP switch to the “Normal” position.

(2) **Firmware Update Mode :**

Set the DIP switch to the “Default” position.



Figure 2-5**:** Dip Switch

2.4.1 Firmware Update Mode

Please follow the steps below to complete the firmware update process of I-7570.

(1) Set the Dip-switch to the “Default” position and reboot I-7570. Then the I-7570 will work under the “Firmware Update Mode”. In this mode, users can update the firmware of I-7570 via RS-232.

(2) Execute the “**FW_Update_Tool**” utility. (Download from http://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/converter/i-7570/software/) and follow the steps below to complete the firmware updating process.

[1] Choose “**COM**” interface and “COM Port” number (like **: COM1**).

[2] Click “**Browser**” button to choose FW file. (like **: I7570_v1.00.fw**)

[3] Click “**Firmware Update**” button to start the FW update process. The result will show in “Firmware Update” field.

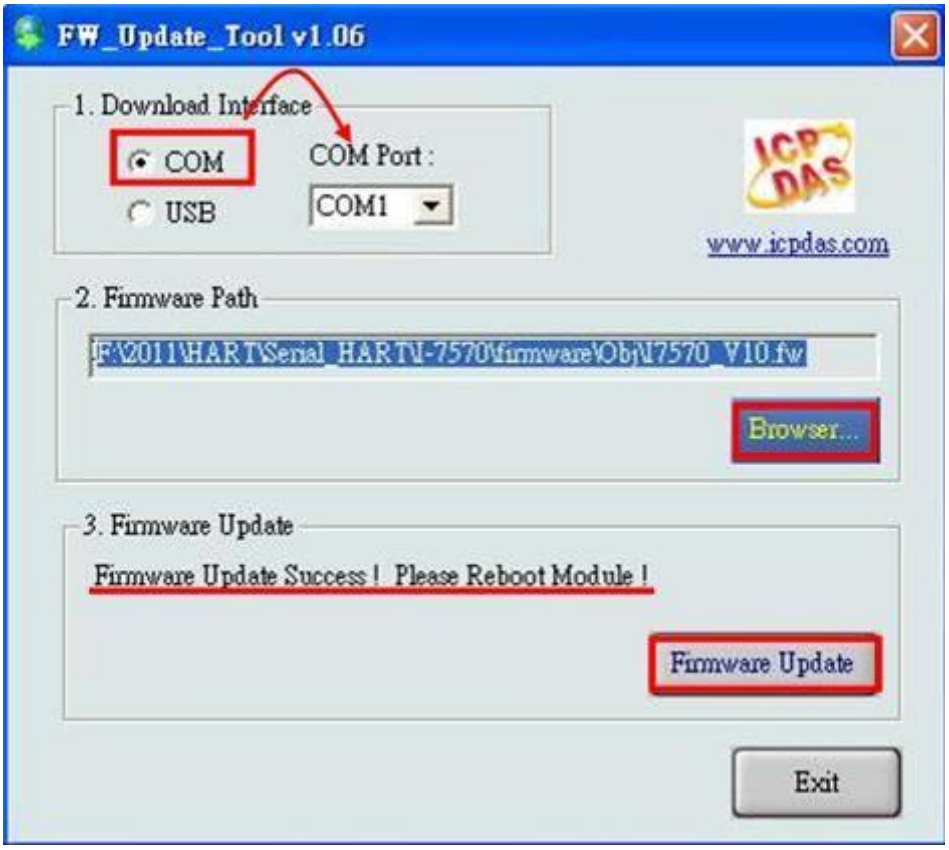


Figure 2-5.1**:** FW_Update_Tool

2.4.2 Firmware Operation Mode

In operation mode, users need to set the Dip-switch to the "Normal" position and then reboot I-7570. In this mode, users can send / receive HART command via serial port. In hardware v1.2 or newer (with firmware v1.1), JP5 is provided to run in "Communication" or "Configuration" mode.

(1) "**Comm.**" Mode **:**

[1] Connect pin 1&2 of JP5 like Figure 2-5.2 and then reboot I-7570.

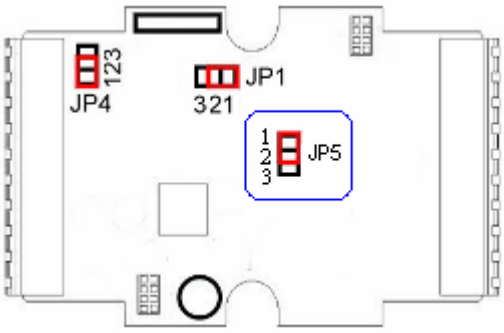


Figure 2-5.2**:** JP5 position of Comm. mode

[2] Used to send / receive HART command and communicate with HART slave devices.

[3] The default baud parameter is “**1200,O,8,1**” and can be modified in “Config.” mode.

(1) “**Config.**” Mode **:**

[1] Connect pin 2&3 of JP5 like Figure 2-5.3 and then reboot I-7570.

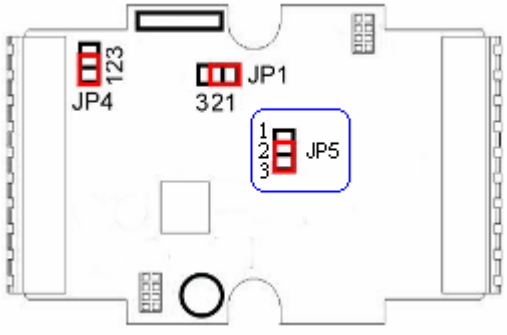


Figure 2-5.3**:** JP5 position of Config. mode

[2] Used to set / get module information.

[3] The baud parameter is fixed to be “**115200,N,8,1**”.

[4] The following is the command table for configuration.

Cmd No.	Function	Parameter	Return
$1	Set Serial Baud	B_D_P_S	!
$2	Get Serial Baud	None	>B_D_P_S
$3	Get Module Info	None	>(Data)
$4	Reset Module	None	!

[5] Example for Command 1 **:**

<1> B => **Baudrate (bps)**
(1200 / 2400 / 4800 / 9600 / 57600 / 38400 / 19200 / 115200)

<2> D => **DataBit** (5 / 6 / 7 / 8)

<3> P => **Parity** (None / Odd / Even)

<4> S => **StopBit** (1 / 2)

[Set serial port baud parameter to be “15200, 8, N, 1”]

Send => $17_3_0_0

Return => !(Success) , ?(Failure)

[6] Example for Command 2 **:**

[Get serial port baud parameter]

Send => $2

Return => >0_3_1_0 (1200, 8, O, 1)

[7] Example for Command 3 **:**

[Get Module Info]

Send => $3
Return => >0101 (The firmware version is v1.1)

[8] Example for Command 4 **:**

[Reset Module]
Send => $4
Return => !(Success) , ?(Failure)

2.5 LED Indication

There are three LEDs provided to indicate the status of I-7570. The Figure 2-6 is the illustration of these three LEDs.



Figure 2-6**:** LED position of I-7570

2.5.1 LED Function

(1) PWR LED :

When I-7570 turned on, if it is in the firmware operation mode, then the PWR LED will be on permanently in communication mode or flash per second in configuration mode. If I-7570 is in the firmware update mode, then the all LED will flash permanently.

(2) TxD LED :

When I-7570 is receiving data from serial port, then the TxD LED will

flash until the data transmission completed.

(3) RxD LED :

When I-7570 is receiving the HART frame from HART device, then the RxD LED will flash until the data transmission completed.

2.5.2 LED Indication Table

Mode / LED Name	Power off	FW Update	FW Operation	Serial Port Data Received	HART Port Data Received
PWR LED	off	flash	On (Comm.) Flash (Conf.)	on	on
TxD LED	off	flash	off	flash	off
RxD LED	off	flash	off	off	flash

2.6 Cable Selection

The HART bus is a balanced (differential) 2-wire interface running over a Shielded Twisted Pair (STP), Un-shielded Twisted Pair (UTP), or Ribbon cable. Please refer to the following table to decide what cable type, cable length, and terminator to use in the HART bus network.

No. Network Devices	Cable Capacitance – pf/ft (pf/m)			
	20 pf/ft (65 pf/m)	30 pf/ft (95 pf/m)	50 pf/ft (160 pf/m)	70 pf/ft (225 pf/m)
1	9,000 ft (2,769 m)	6,500 ft (2,000 m)	4,200 ft (1,292 m)	3,200 ft (985 m)
5	8,000 ft (2,462 m)	5,900 ft (1,815 m)	3,700 ft (1,138 m)	2,900 ft (892 m)
10	7,000 ft (2,154 m)	5,200 ft (1,600 m)	3,300 ft (1,015 m)	2,500 ft (769 m)
15	6,000 ft (1,846 m)	4,600 ft (1,415 m)	2,900 ft (892 m)	2,300 ft (708 m)

Allowable cable lengths for 1.0 mm (#18 AWG) shield twisted pair

Note: The AWG means a standard method used to measure wire. The numbering system works backwards from what people would think, the thicker (heavier) the wire, the lower the number.

3. Reserved

4. HC_Tool Utility

HC_Tool utility is provided to configure all ICP DAS's HART converter modules (like I-7567 / I-7570) and transmit / receive HART frame for HART communication easily and quickly. HC_Tool utility can be downloaded from the ICP DAS web site **:** http://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/converter/i-7567/software/.

4.1 Run Utility

Run the "**HC_Tool**", like Figure 4-1. If users can't run "HC_Tool", please install .NET Framework 3.5 first. (http://www.microsoft.com/downloads/details.aspx?familyid=333325FDAE52-4E35-B531-508D977D32A6&displaylang=en).

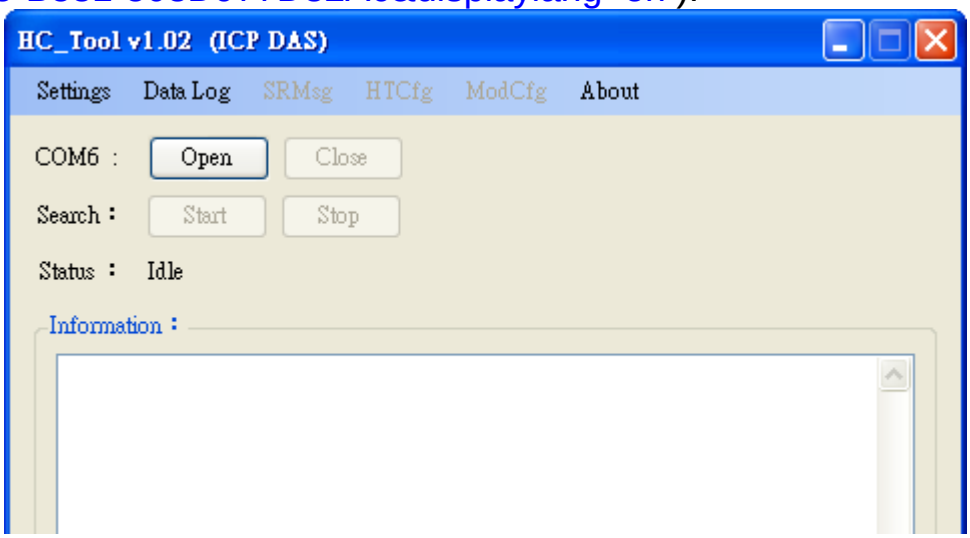


Figure 4-1**:** HC_Tool Utility

4.2 Serial Port and HART Command Settings

Please click "**Settings**" menu to open setting window of serial port and HART parameters like Figure 4-2.

4.2.1 Serial port settings

(1) Please select serial port no. of PC like Figure 4-2.

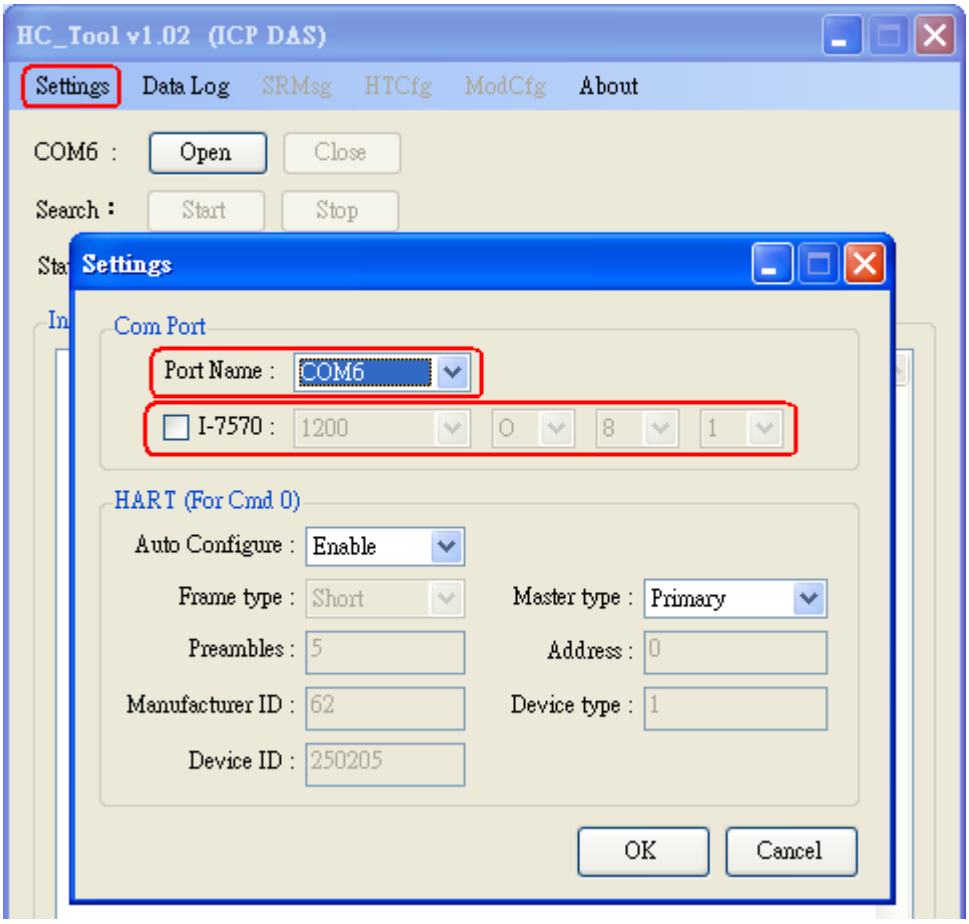


Figure 4-2**:** Set Serial Port No.

(2) If using I-7570 module, please check “I-7570” item and select the communication parameters of PC serial port. Note, the settings of the communication parameters must be the same with those in I-7570.

4.2.2 HART Frame Settings

The following are the descriptions of HART command fields.

Auto Configure **:** (1) Enable **:** search HART devices automatically.
(2) Disable **:** search HART devices according to manual parameters.

Frame type **:** Select HART frame format (Short/Long).

Master type **:** Select Primary master or Secondary master.

Preambles **:** Select 5~20 bytes (0xFF) number.

Address **:** Select HART Polling Address (0~15).

Manufacturer ID**:** Manufacturer Identification Code

Device type **:** Manufacturer Device Type Code

Device ID **:** Manufacturer Device Identification Code.

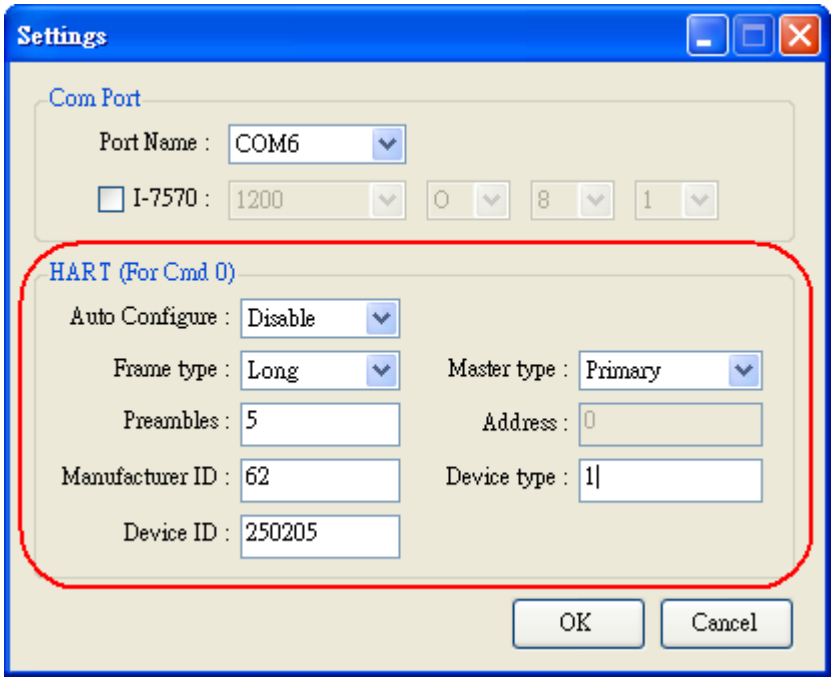


Figure 4-3**:** Set HART Frame Format

4.3 Search HART devices

4.3.1 Search HART devices automatically

Set the option of “Auto Configure” field to be “Enable” and the option of “Master type” field to be “Secondary” like Figure 4-4. Then HC_Tool utility will automatically search all HART devices by using HART short frame with “Secondary Master” identity.

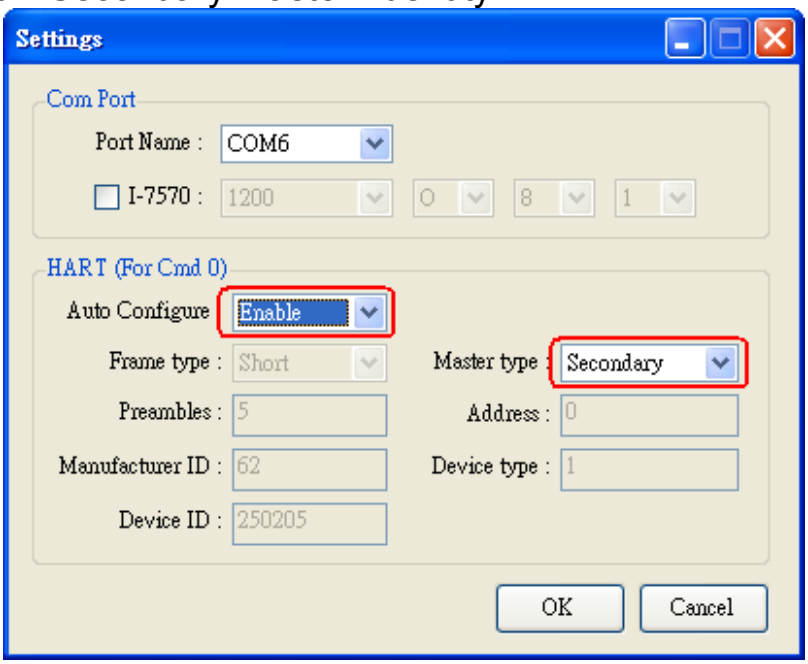


Figure 4-4**:** Auto Configure - Enable

4.3.2 Search HART devices manually

Set the option of “Auto Configure” field to be “Disable” and then users can set the HART frame manually to search HART devices.

(1) If the option of “Frame type” field is “Short”, then “Master type”, “Preambles”, “Address” fields need to be configured like Figure 4-5.

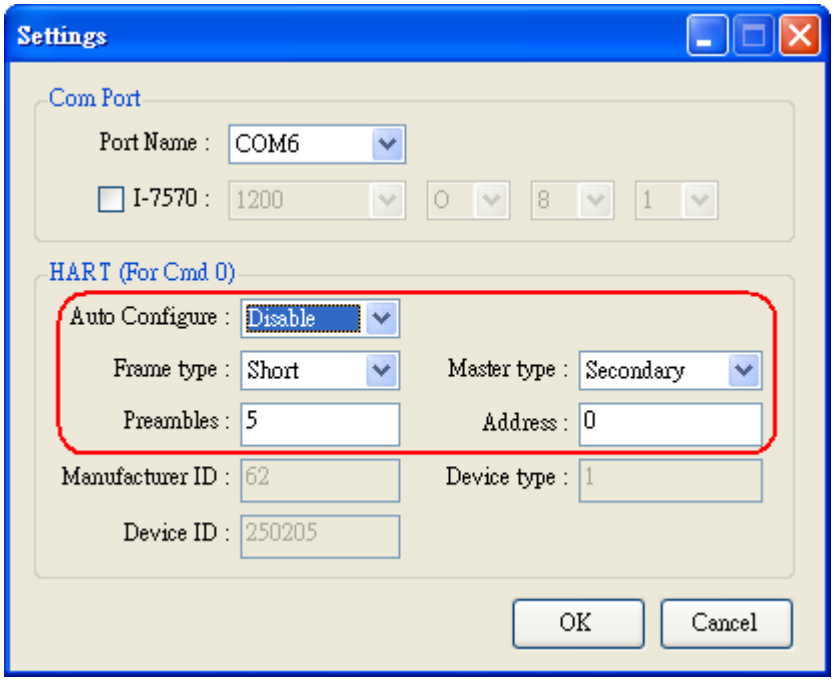


Figure 4-5: Short frame settings

(2) If the option of “Frame type” field is “Long”, then “Master type”, Preambles”, “Manufacturer ID”, “Device type”, “Device ID” fields need to be configured like Figure 4-6.

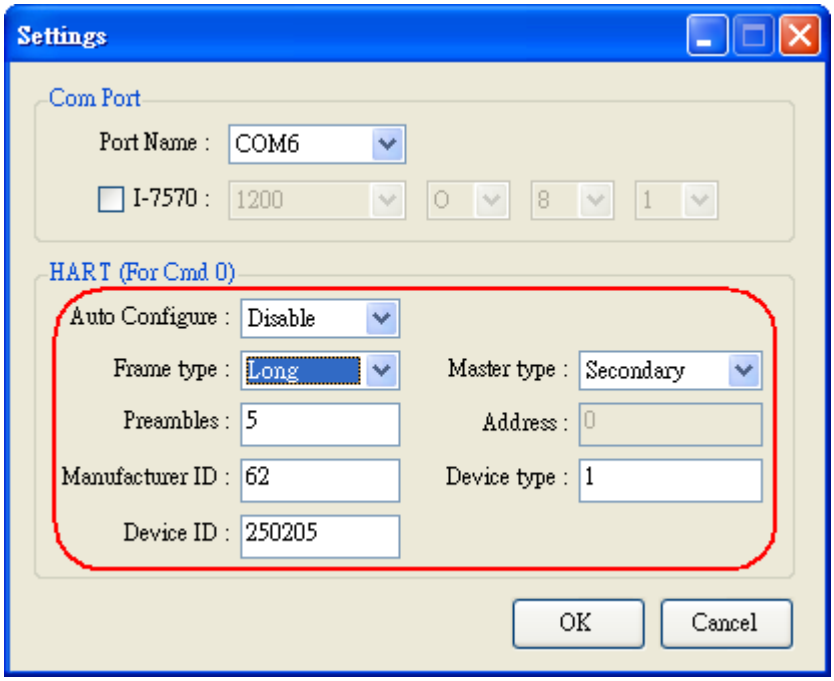


Figure 4-6**:** Long frame settings

If the setting of serial port and HART frame format is finished, please click the “OK” button. Then users can test the HART communication.

4.3.3 Search HART devices

(1) Click “**Open**” button to open the com port of PC like Figure 4-7. If com port open failed, please check the com port setting.

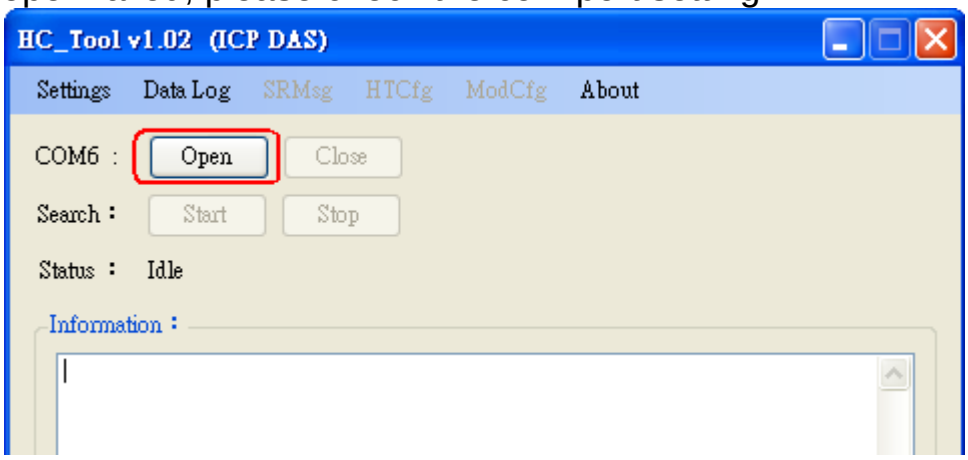


Figure 4-7**:** Click “Open” button

(2) Click “**Start**” button to search all HART devices and the result will be shown in the “Information” field like Figure 4-8.

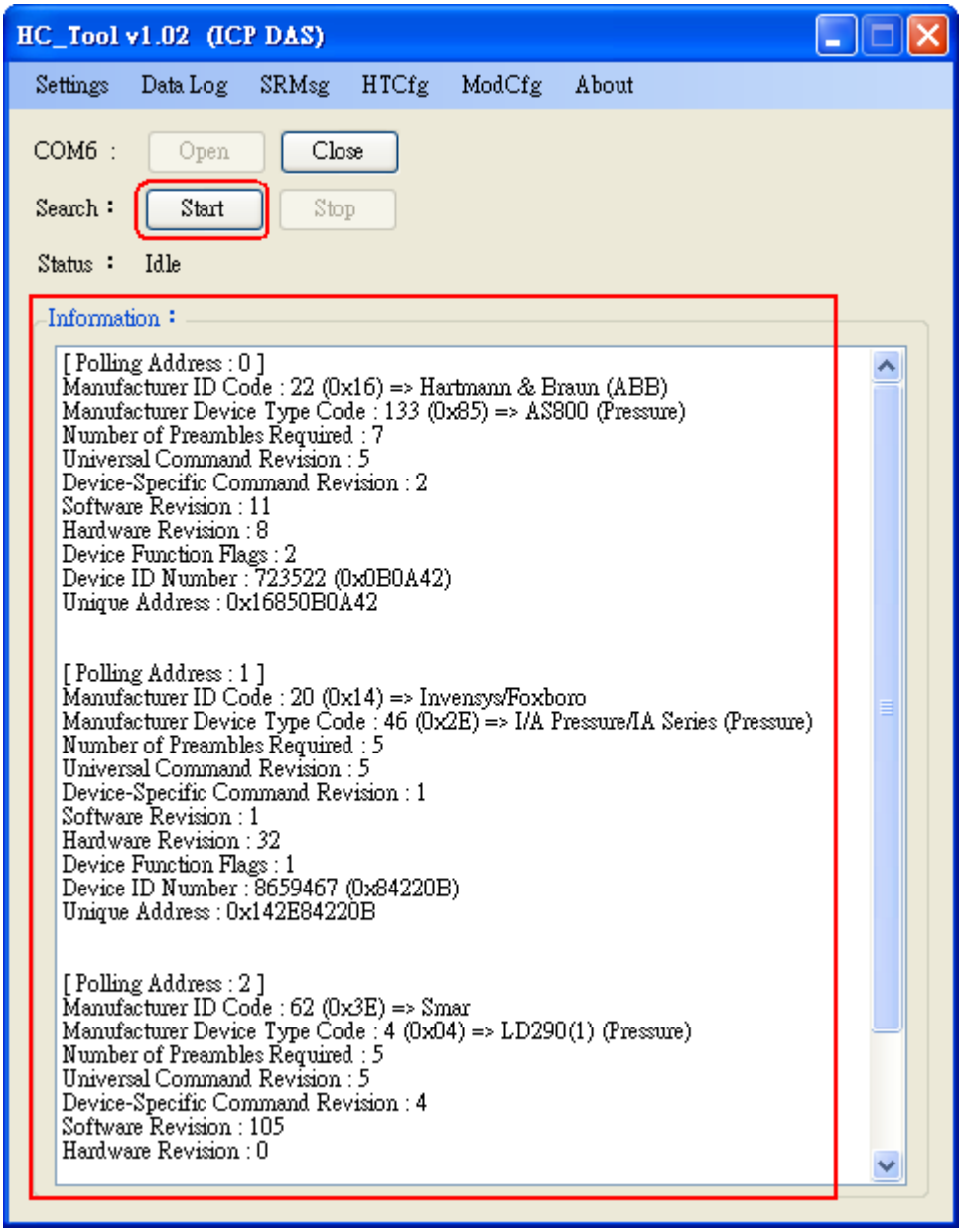


Figure 4-8**:** HART device Information

If the error message - “Search Device Failed !!” shows like Figure 4-9, please check HART network status and HART command format.

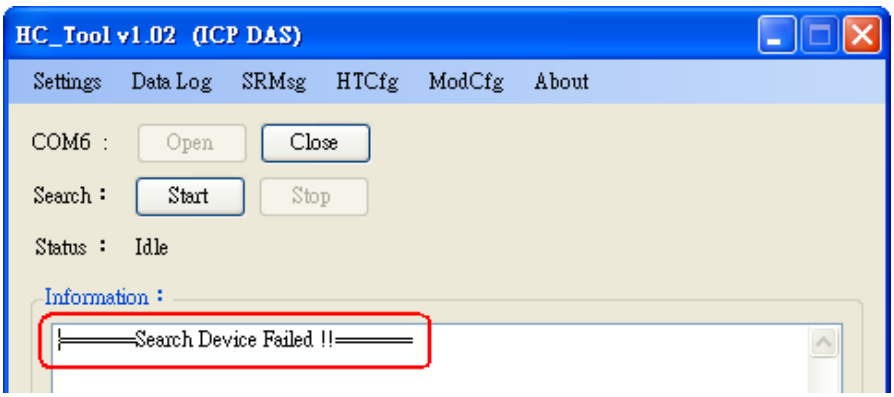


Figure 4-9**:** Search Device Failed

4.4 Send / Receive HART Frame (SRMsg)

(1) Click “**SRMsg**” menu and it will open the HART command function window for HART communication like Figure 4-10.

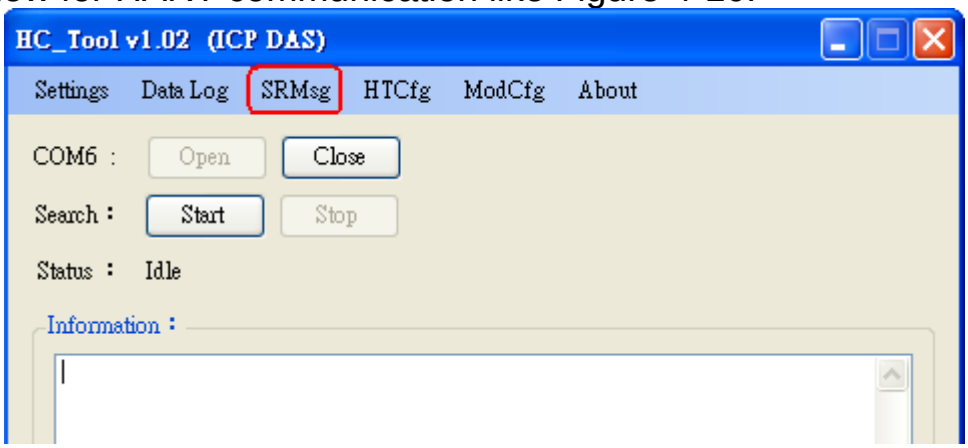


Figure 4-10**:** SRMsg Function

(2) Please type the HART command in the ”Send Data” filed and click ”Send” button to send out the HART command like Figure 4-11.

[1] “**With Parity Check**” item **:**

When check the item, it will add the “check byte” automatically while sending the HART frame.

[2] “**Auto Scroll**” item **:**

When check the item, it will scroll the HART message field automatically to show the latest HART message information.

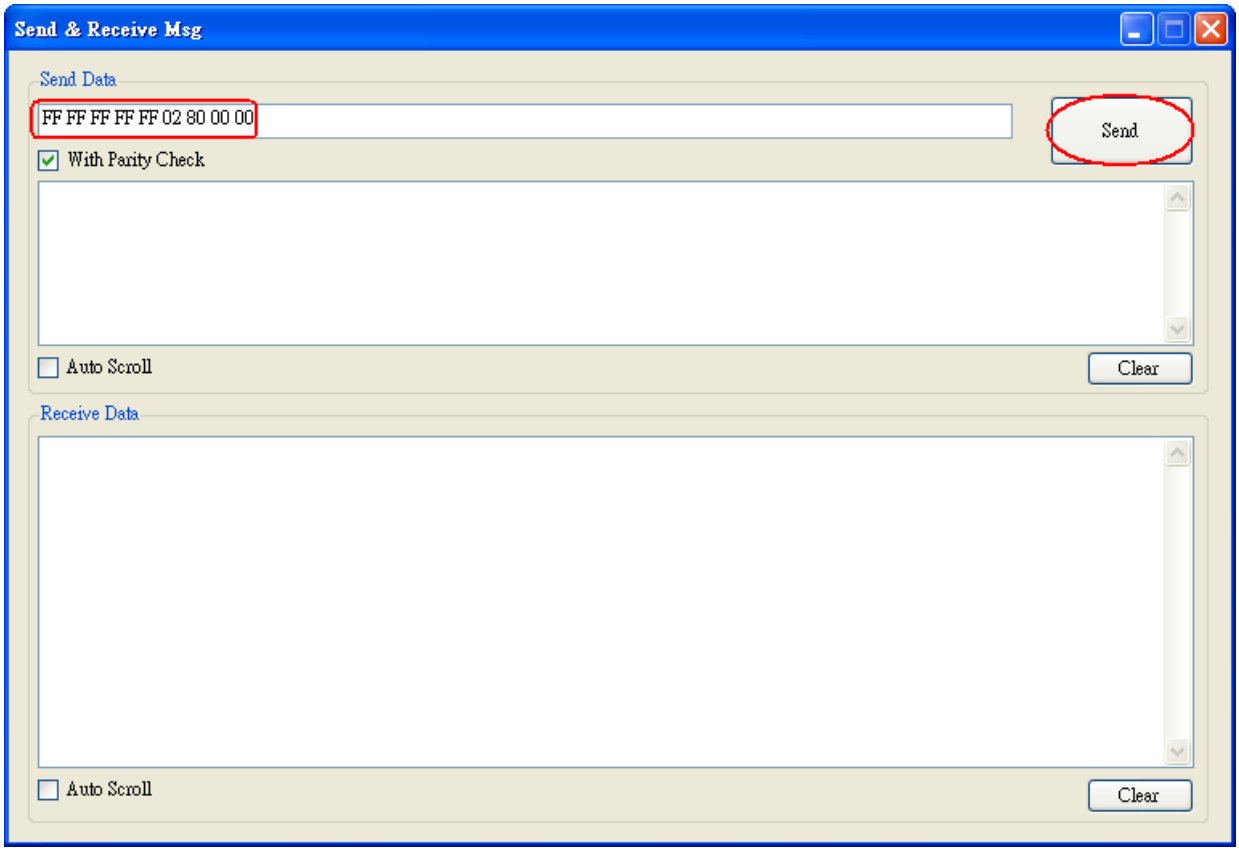


Figure 4-11: Send HART Command

(3) When HART device responses the HART information, it will show in the “Receive Data” field like Figure 4-12. If error happened in HART communication, it will not show any message in the “Receive Data” field. Please check the HART command in the “Send Data” field if it is correct.

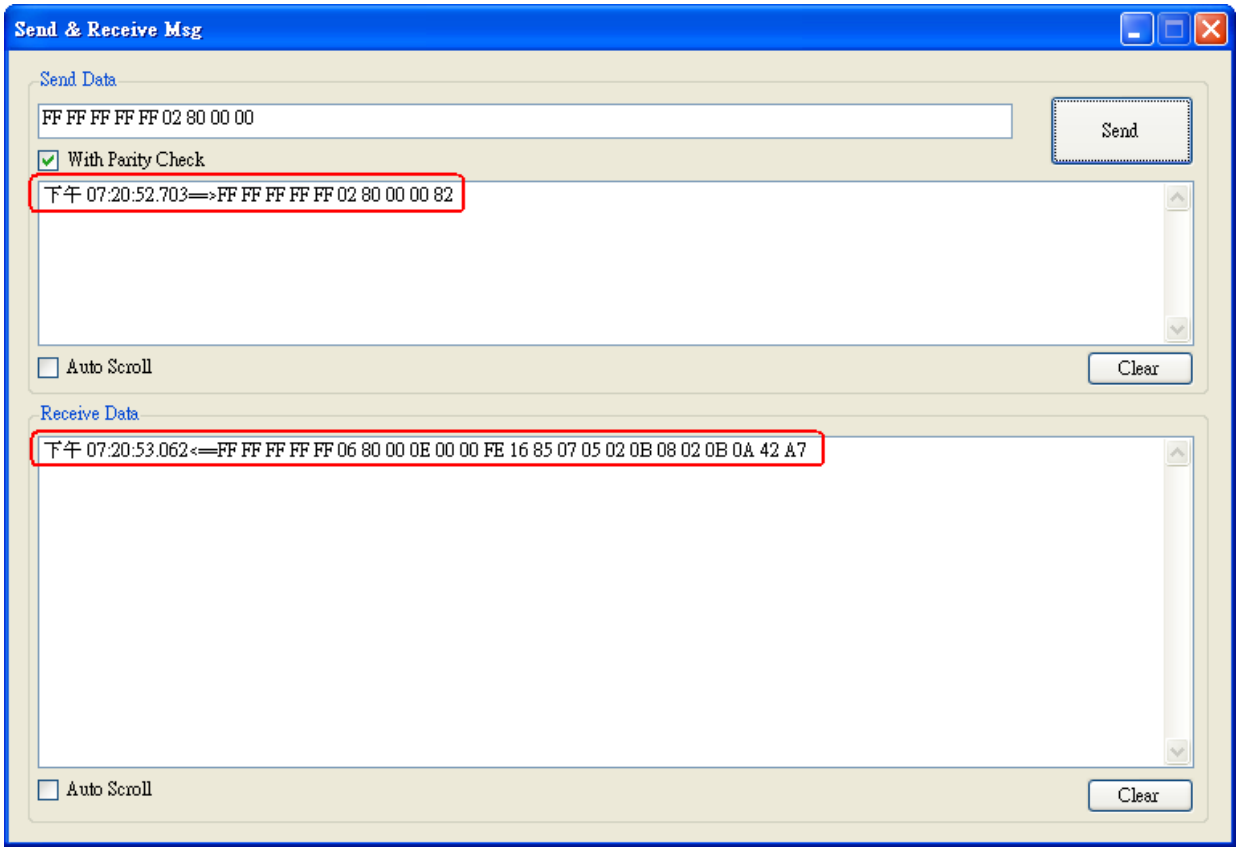


Figure 4-12**:** Receive HART Command

4.5 HART Information Log (Data Log)

When using “SRMsg” or “Start” function for HART communication, all the HART command information will be logged in the “Data Log” function. Users can click “**Data Log**” item and all the HART communication information will be shown in “Log” field like Figure 4-13.

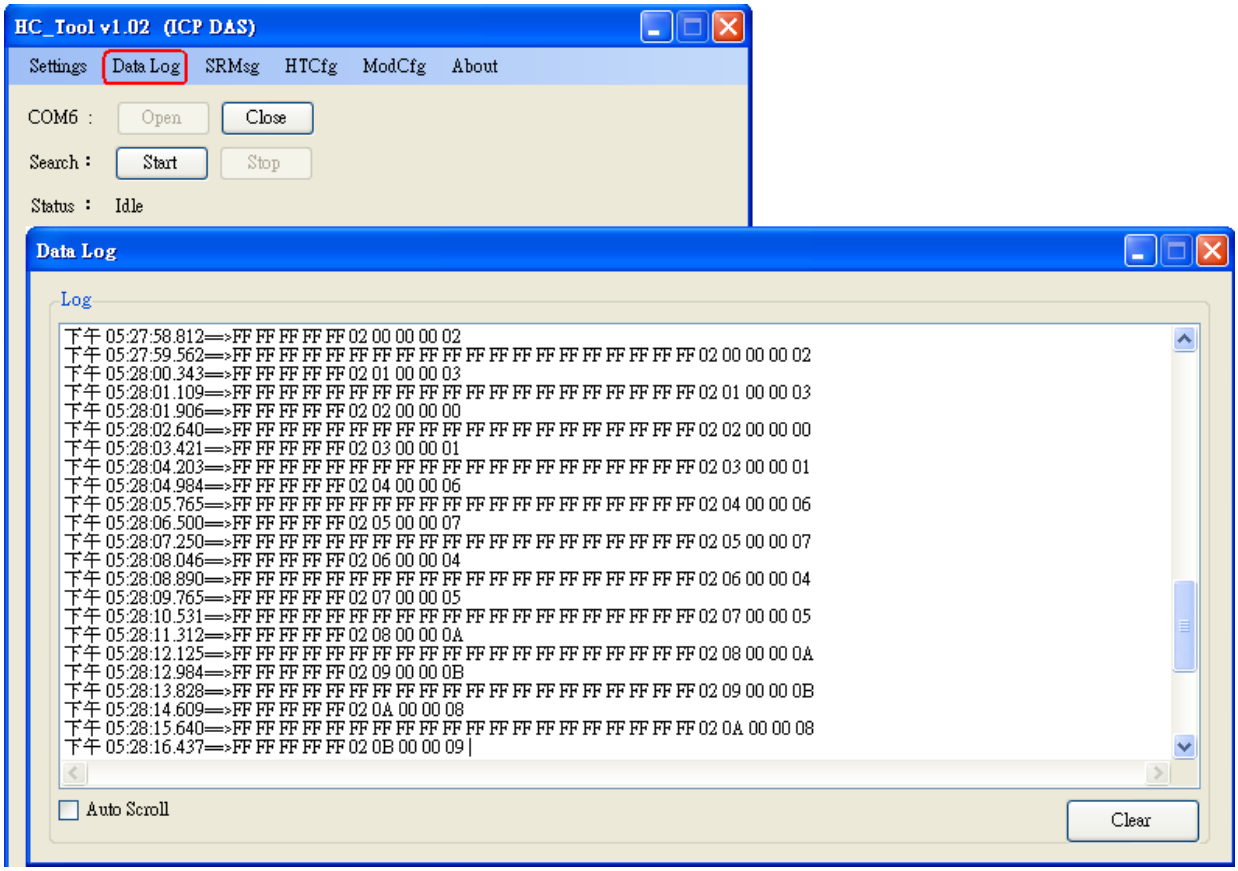


Figure 4-13**:** HART Information Log

4.6 HART Configuration (HTCfg)

When HART devices are searched in HC_Tool, then users can use "**HTCfg**" function to configure HART devices like Figure 4-14. (Supported by HC_Tool v1.02 or newer)

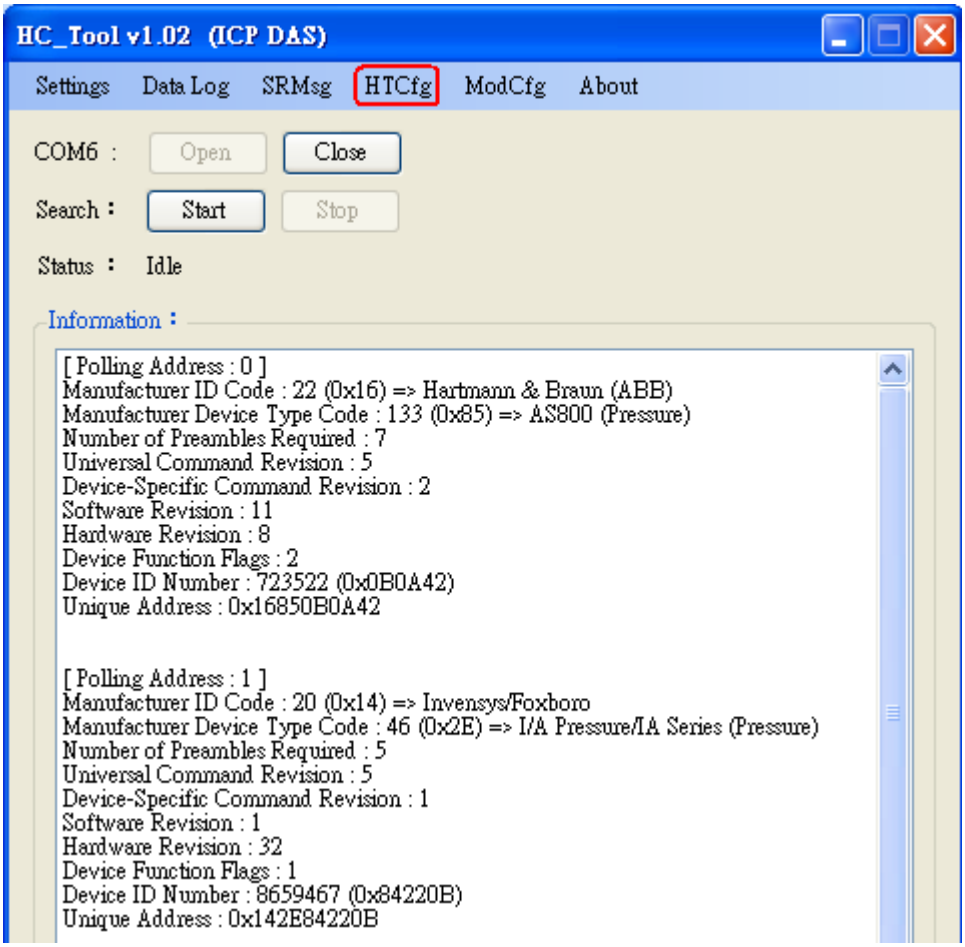


Figure 4-14**:** HTCfg Item

The following are the function descriptions of “HTCfg” screen. (Like Figure 4-15)

(1) “**DevAddr**” Field**:** Assign the HART device for configuration.

(2) “**Response**” Field**:** Show the response message of HART configuration command.

(3) “**Universal**” Page**:** Choose the “Universal” command for configuration. (Support HART Command version v6.0)

(4) “**Common**” Page**:** Choose the “Common-Practice” for configuration. (Support HART Command version v6.0)

(5) “**Start**” Button**:** Trig to send the HART configuration command.

(6) “**Listen Mode**” item**:** Check it and click the “Start” button, HC_Tool will listen HART bus and show the received HART message information.

(7) “**HART RecvMsg Count**” Area**:** Show the total count of the received HART messages. (Including Master sending message and Slave response message)

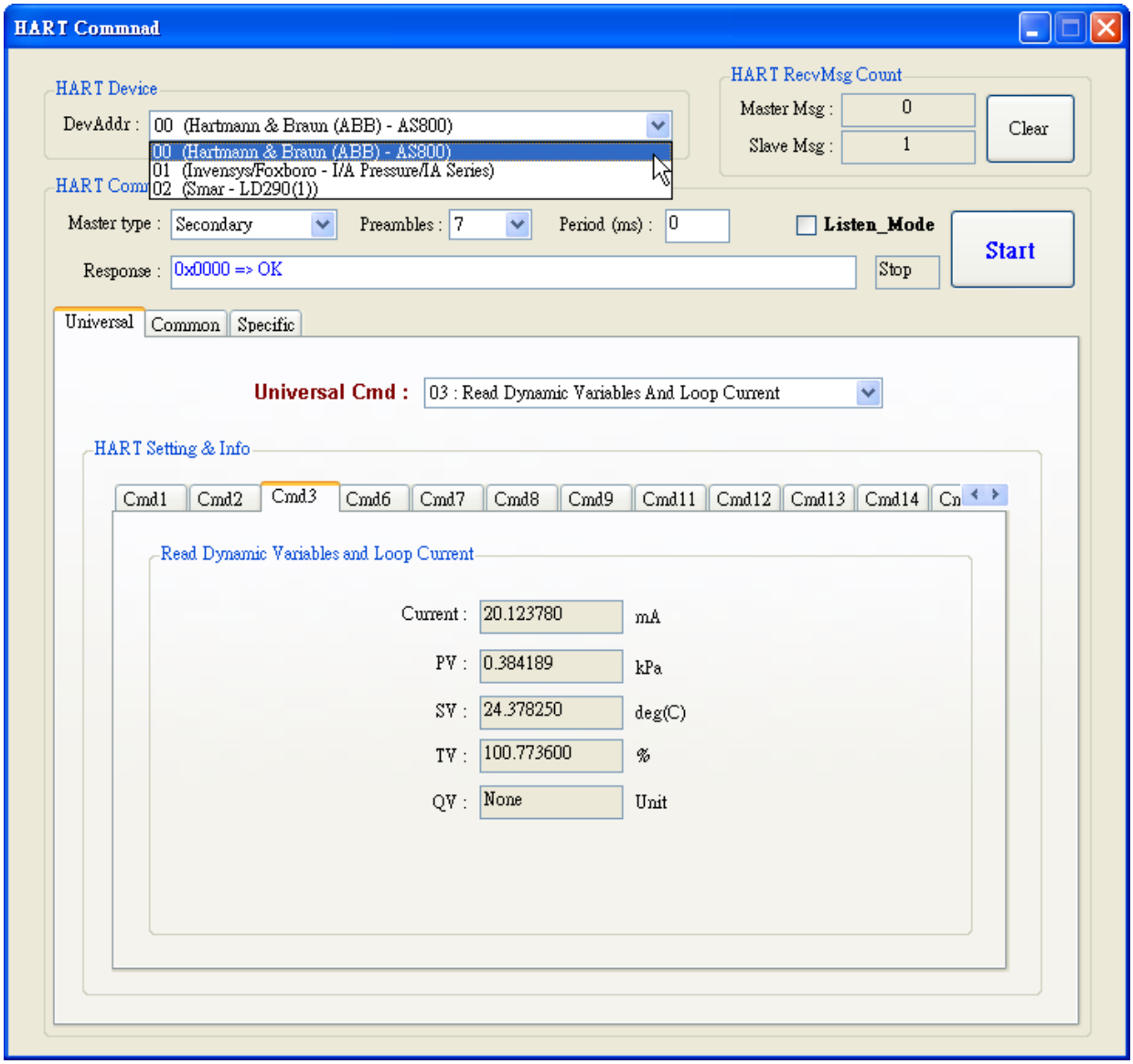


Figure 4-15**:** HTCfg Screen

4.7 Module Configuration (ModCfg)

Click "**ModCfg**" item, it will show the below two options to open the module configuration screen of HART Converter like Figure 4-16.

(1) HC_Tool **:** v1.02 or newer supported.

(2) I-7567 **:** FW_v1.5 or newer supported.

(3) I-7570 **:** FW_v1.4 or newer supported

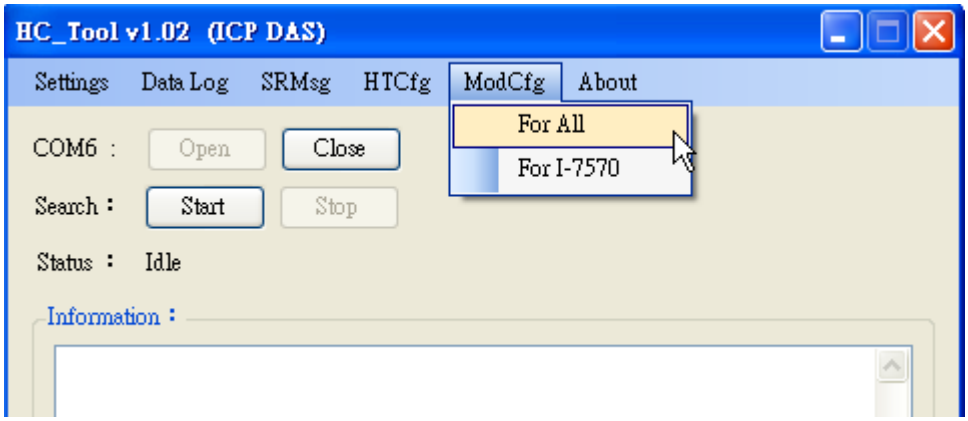


Figure 4-16: ModCfg Item

The following is the function description of “ModCfg”.

1. “For All” Option : (Like Figure 4-17)

Note : It is used for all HART Converter modules

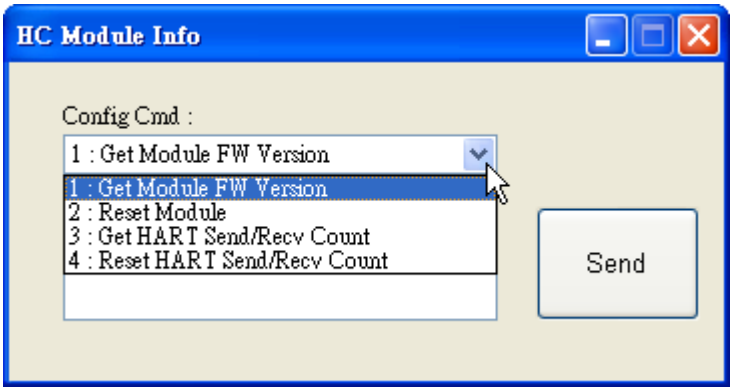


Figure 4-17: “For All” Option - Configuration Screen

(1) “Get Module FW Version”:

=> Return the firmware version of HART converter module.

(2) “Reset Module”:

=> Reset HART converter module.

(3) “Get HART Send/Recv Count”:

=> Return the total count of the sending and receiving HART messages in HART converter module.

(4) “Reset HART Send/Recv Count”:

=> Reset the total count of the sending and receiving HART messages in HART converter module.

2. “For I-7570” Option : (Like Figure 4-18)

Note : It is just used to I-7570 module and make sure the I-7570 must run in “Config Mode” first.

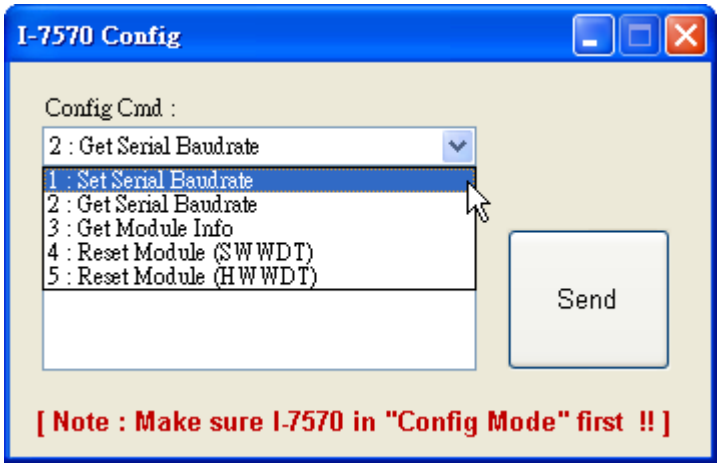


Figure 4-18**:** "For I-7570" Option - Configuration Screen

(1) "Set Serial Baudrate":

=> Set the baudrate parameters of the serial port in I-7570.

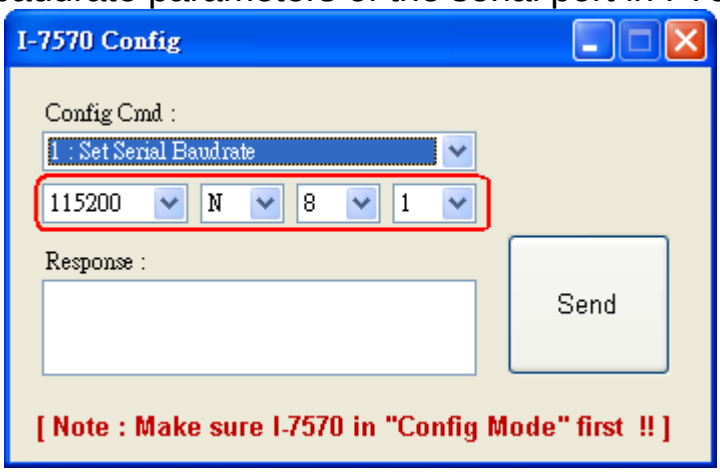


Figure 4-19**:** "Set Serial Baudrate" Function

(2) "Get Serial Baudrate":

=> Get the baudrate parameters of the serial port in I-7570.

(3) "Get Module Info":

=> Return the hardware information of I-7570. (Like**:** Firmware Version)

(4) "Reset Modue (SWWDT)":

=> Reset I-7570. (Using Software WDT)。

(5) "Reset Modue (HWWDT)":

=> Reset I-7570. (Using Hardware WDT)。

5. FAQ

Q01 : How to use I-7570 to communicate with HART devices ?

A01:

1. Install I-7570 “USB Driver” and it will create the virtual com port. (refer to chapter 3)
2. Run “HC_Tool” utility to communicate with HART devices. (refer to chapter 4)

Q04 : Set HART device address by using HART converter ?

A04: (2016/03/17)

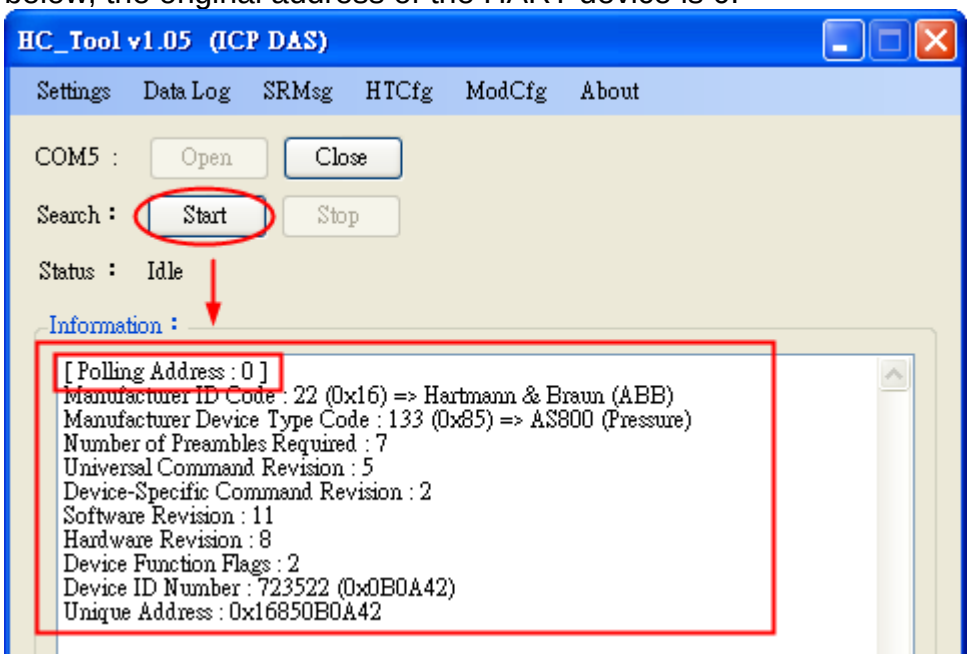
Please follow the steps below.

(1) Just connect one HART device to one HART converter (like：I-7567 / I-7570 / I-7547).

(2) Run “HC_Tool” software.

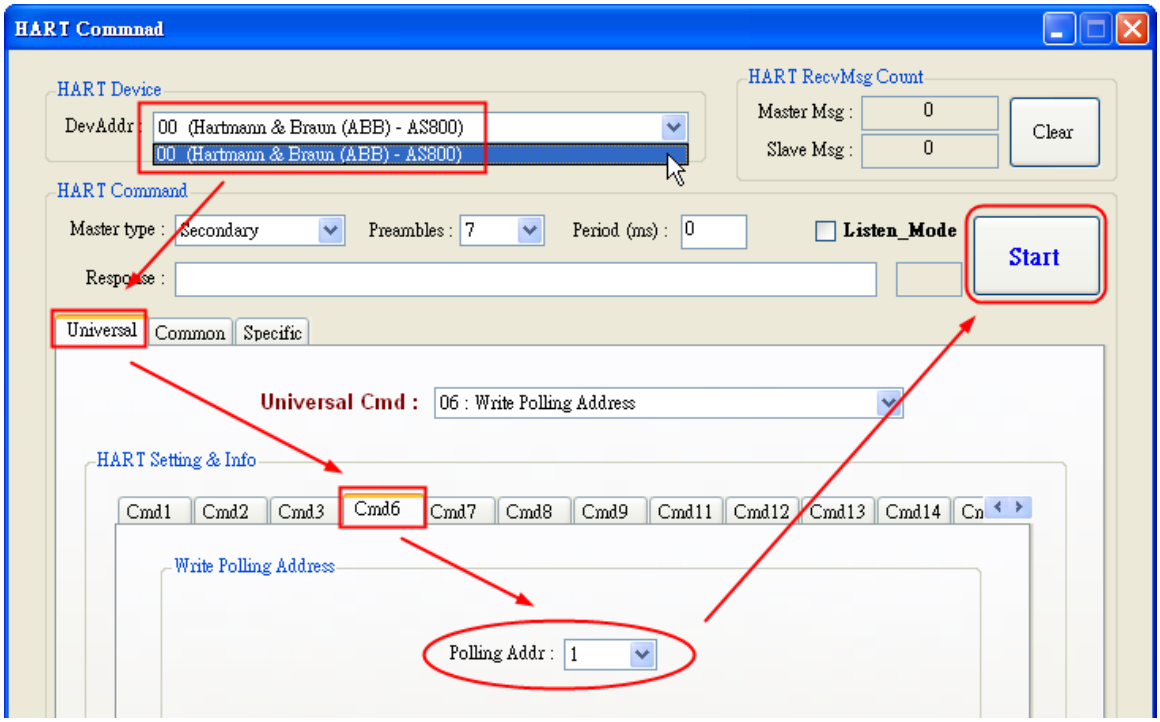
[1] Open the ComPort。

[2] Click the “Start” button to search HART device automatically. As the figure below, the original address of the HART device is 0.



[3] Click the “HTCfg” button to open HART configuration page.

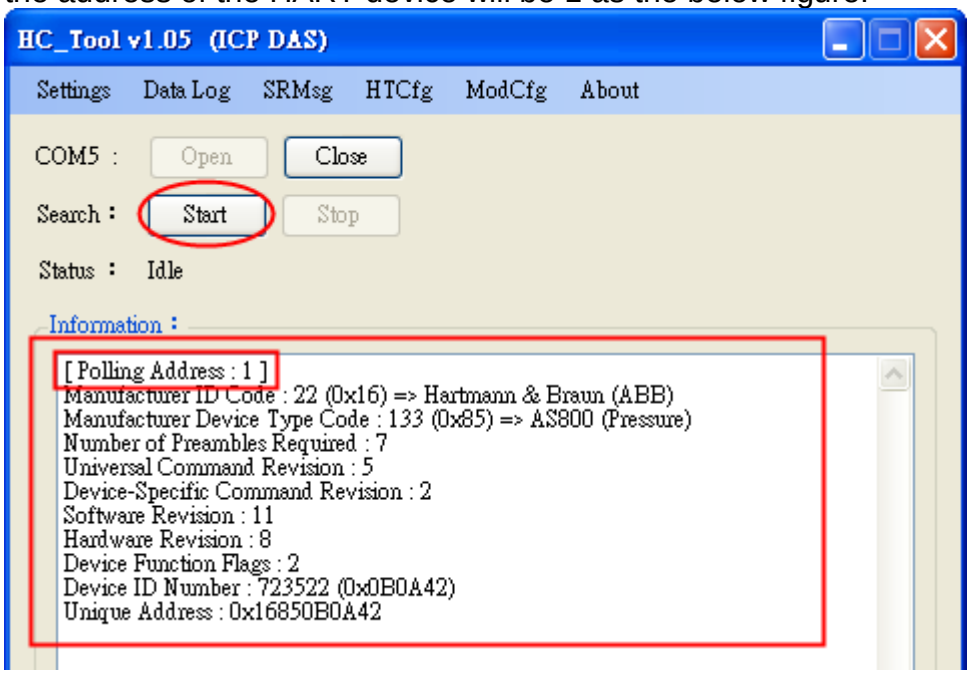
[4] Choose the “HART device” for configuration. In the “Universal” page, click the “Cmd6” option and users can choose the new address of HART device (Example：set to 1). Then click the “Start” button to set the new address.



[5] After the setting for the new address is successful, the below message will show.



[6] Click the “Start” button in the main page to search HART device again. Then the address of the HART device will be 1 as the below figure.



Q05 : How to send HART command for writing (Ex: CMD51)?

A05: (2017/04/05)

Please follow the steps below.

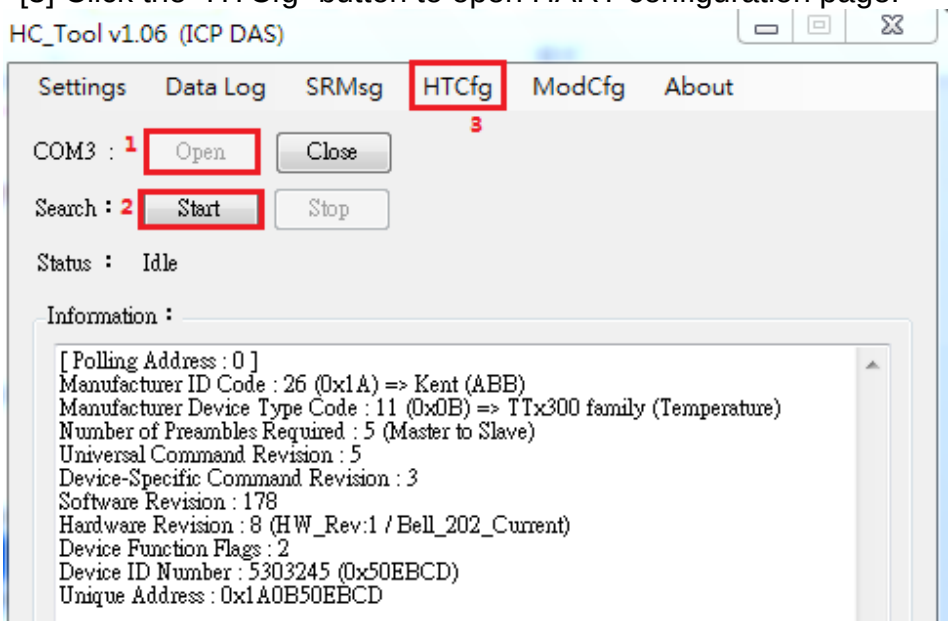
(1) Just connect one HART device to I-7570

(2) Run “HC_Tool” software.

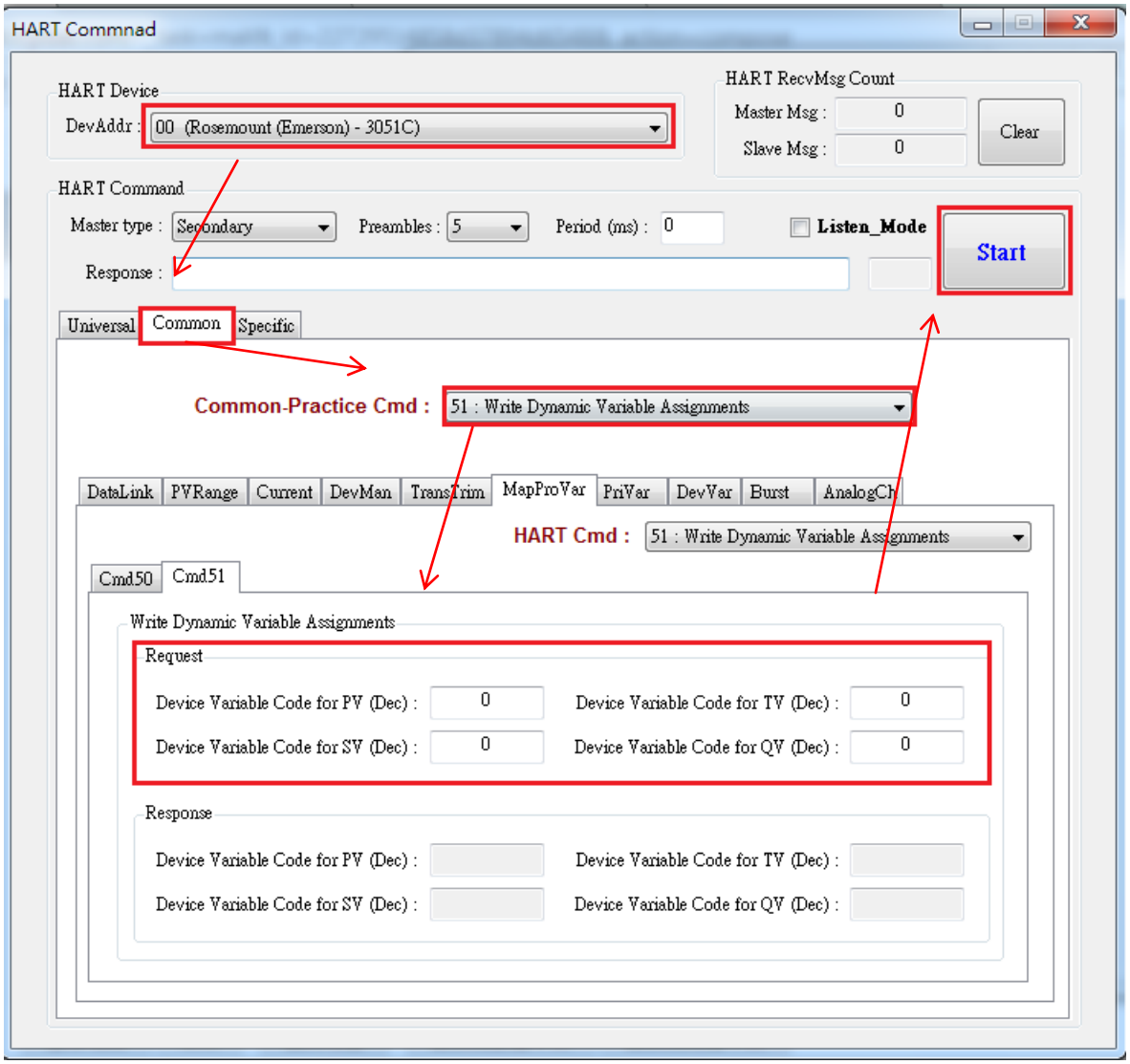
[1] Open the ComPort。

[2] Click the “Start” button to search HART device automatically.

[3] Click the “HTCfg” button to open HART configuration page.



[4] Choose the “HART device” for configuration. In the “Common” tab, select no.51 from the “Common-Practice Cmd” dropdown menu and users can enter dynamic variable assignments. Then click the “Start” button and check the responses.


HART Commnad
HART Device
DevAddr :
00 (Rosemount (Emerson) - 3051C)
HART RecvMsg Count
Master Msg :
0
Slave Msg :
0
Clear
HART Command
Master type :
Secondary
Preambles :
5
Period (ms) :
0
Listen_Mode
Start
Response :
Universal
Common
Specific
Common-Practice Cmd :
51 : Write Dynamic Variable Assignments
DataLink
PVRange
Current
DevMan
TransTrim
MapProVar
PriVar
DevVar
Burst
AnalogCh
HART Cmd :
51 : Write Dynamic Variable Assignments
Cmd50
Cmd51
Write Dynamic Variable Assignments
Request
Device Variable Code for PV (Dec) :
0
Device Variable Code for TV (Dec) :
0
Device Variable Code for SV (Dec) :
0
Device Variable Code for QV (Dec) :
0
Response
Device Variable Code for PV (Dec) :
Device Variable Code for TV (Dec) :
Device Variable Code for SV (Dec) :
Device Variable Code for QV (Dec) :

Q06 : How to connect with HART OPC server?

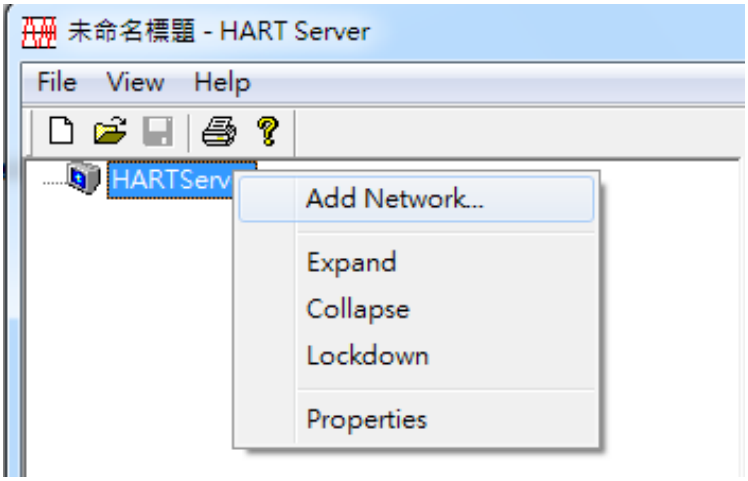
A06: (2017/06/22)

HART OPC server provided by HCF can be downloaded from the following link:

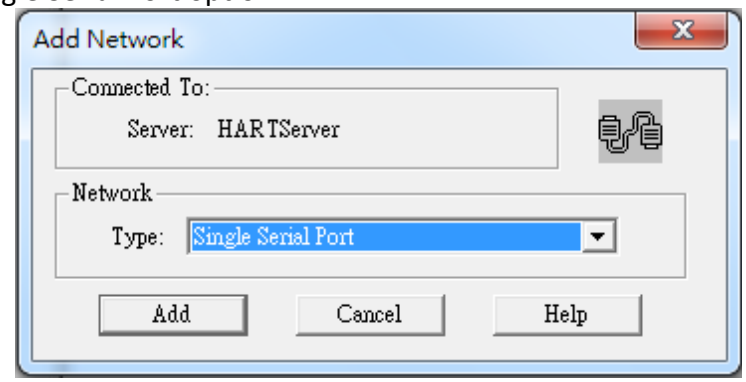
https://fieldcommgroup.org/hart-server

After installation finished, open the HART OPC server and follow the steps below:

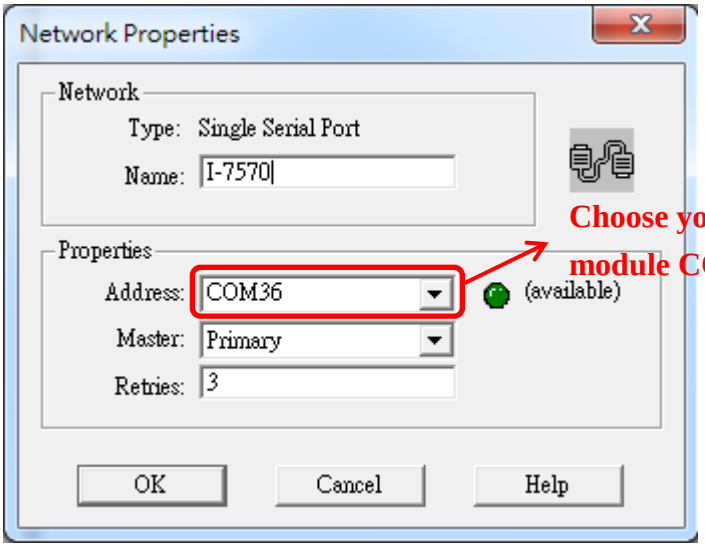
(1) Right click the HARTServer icon and choose Add Network



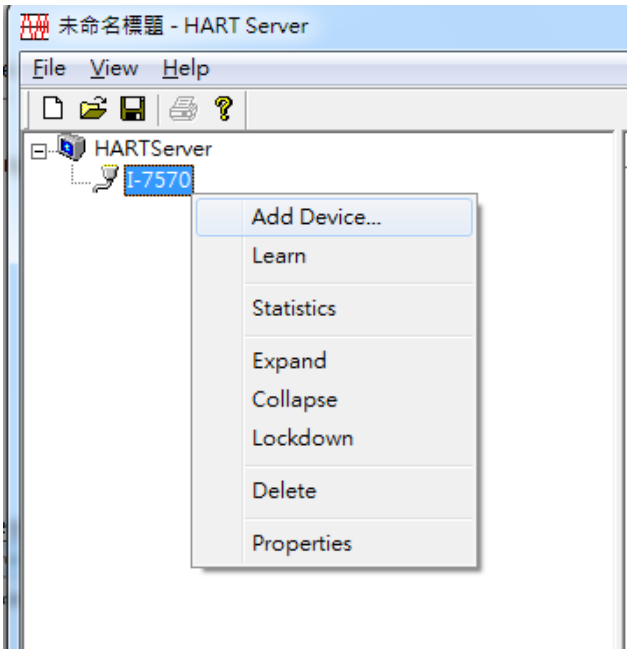
(2) Choose Single Serial Port option



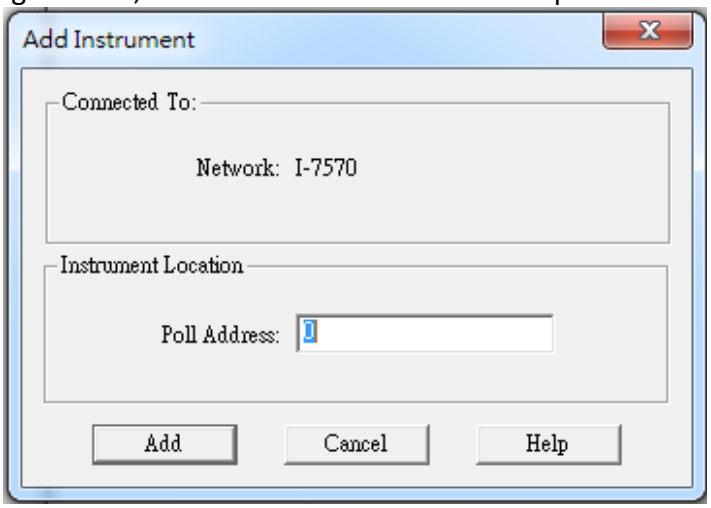
(3) Open COM Port

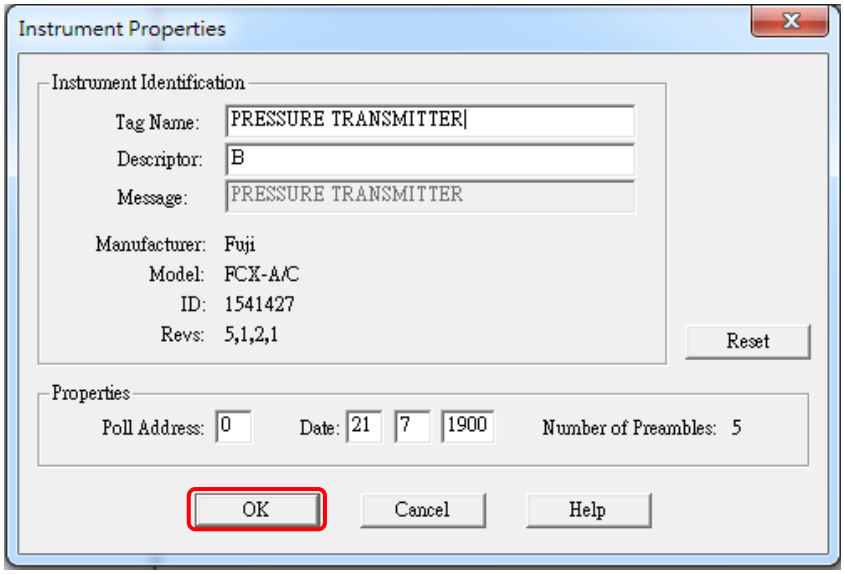


(4) After module added to the server successful, right click on the module icon and choose Add Device

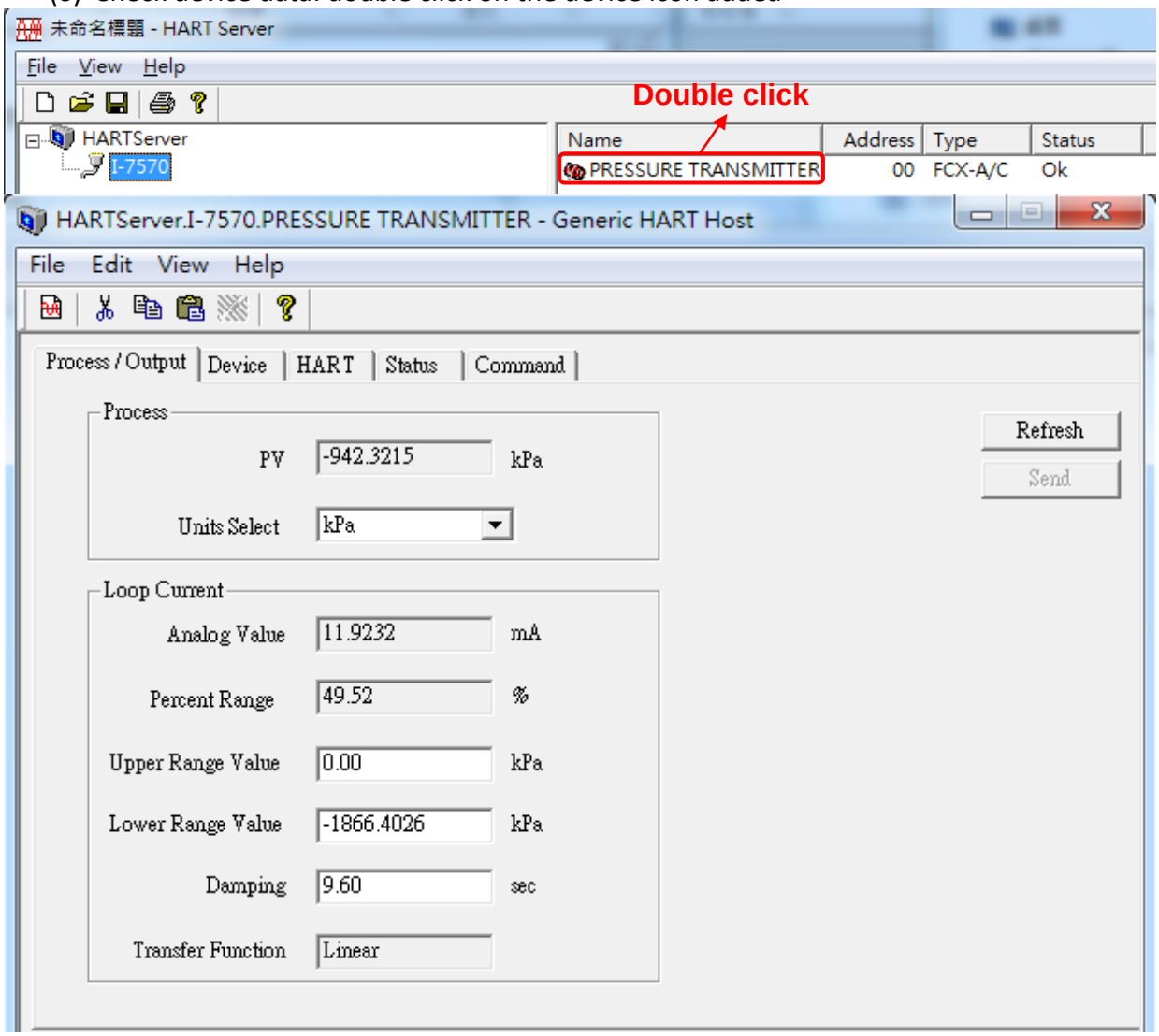


(5) Choose polling address, and click OK for Instrument Properties window





(6) Check device data: double click on the device icon added



6.Version History

Ver.	Author	Date	Description
1.0	Bill	2011/07/29	1. First version
1.1	Edward	2012/03/02	1. Update content.
1.2	Edward	2012/10/04	1. **FW update to v1.3 :** (1) Solve HART data losing when receiving. (2) Add module configuration mode. (2.4.2) 2. **HC_Tool update to v1.01 :** (1) Solve the Auto-Search HART device function failed problem.
1.3	Edward	2012/12/20	1. Update FW to v1.4 [1] Add “Config” Function. 2. Update HC_Tool to v1.02 [1] Add “Config” screen. [2] Add HART v6.0 Universal and Common-Practice Command. [3] Add “Listen” HART communication Function.
1.4	Peter	2017/6/22	**1. Add FAQ Q05** [1] how to send command for writing **2. Add FAQ Q06** [2] how to connect HART OPC server