
HDS

HART Device Simulator

User's Manual (v1.05)

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1. Introduction

HART Device Simulator (called HDS) is the HART device simulation software developed by ICP DAS. It can be used to simulate multi HART slave devices simultaneously to exchange data with HART master device by using ICP DAS HART converter (like: I-7567 / I-7570 / I-7547) connected to any COM port (USB / 232 / 485 / Ethernet). By this way, users can develop or verify the HART master program without any HART slave device. The below figure is the application of HDS.

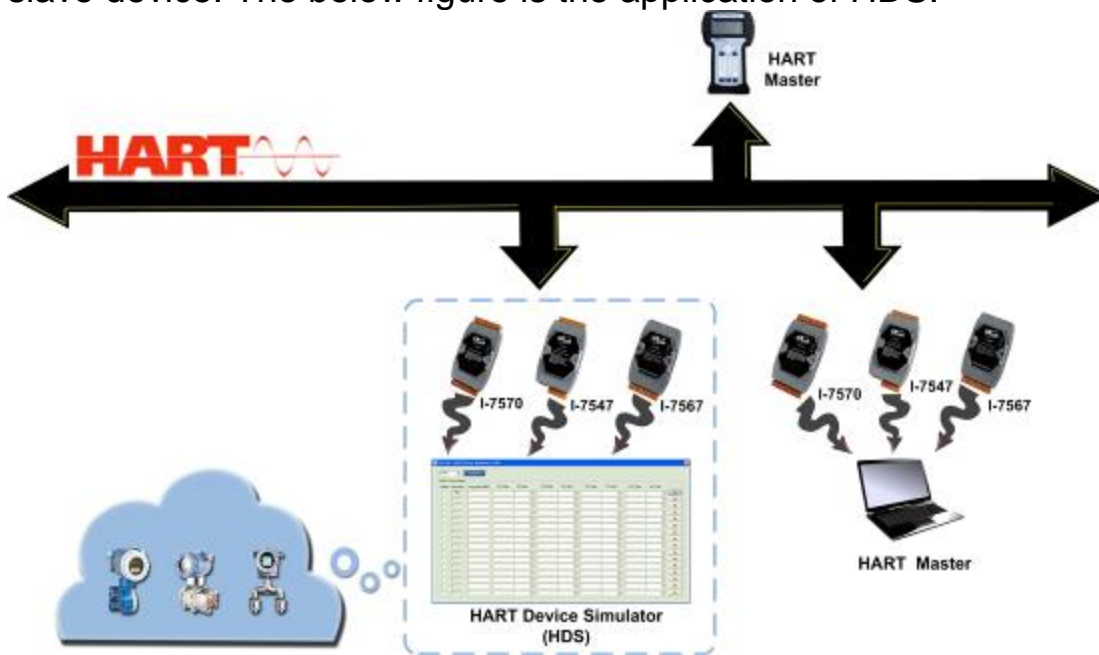


Figure 1-1 : HDS Application

1.1 HDS Features

- **Free** HART slave device simulation software (**must work with any ICP DAS converter**: I-7567 / I-7570 / I-7547)
- Support more than twenty HART commands (like: CMD0 / 1 / 2 / 3 ...)
- Provide the setting for the long frame address of HART device.
- Provide the setting for the value and unit of HART command 3.
- Support 16 HART devices simulation simultaneously (address 0 ~ 15).
- Exchange data with HART master device by using ICP DAS HART converter (like: I-7567 / I-7570 / I-7547)
- Support HART communication data log.

- Provide the “adjustable” HART device status bit

1.2 HDS Information

- Compatible with revision 5 and 6 of HART protocol.
- When the COM port is open, the HDS will listen for the incoming requests and response data.
- Only the HART simulation device with the “Enabled” option checked will response data.
- The field of the “Short Frame Address” is fixed.
- The field of the “Long Frame Address” with 5 bytes can be set to simulate the different HART manufacturer’s slave device.
- All the HART communication data can be logged to file.
- The four main values and units of PV / SV / TV /QV of HART command 3 can be set for every HART simulation device.

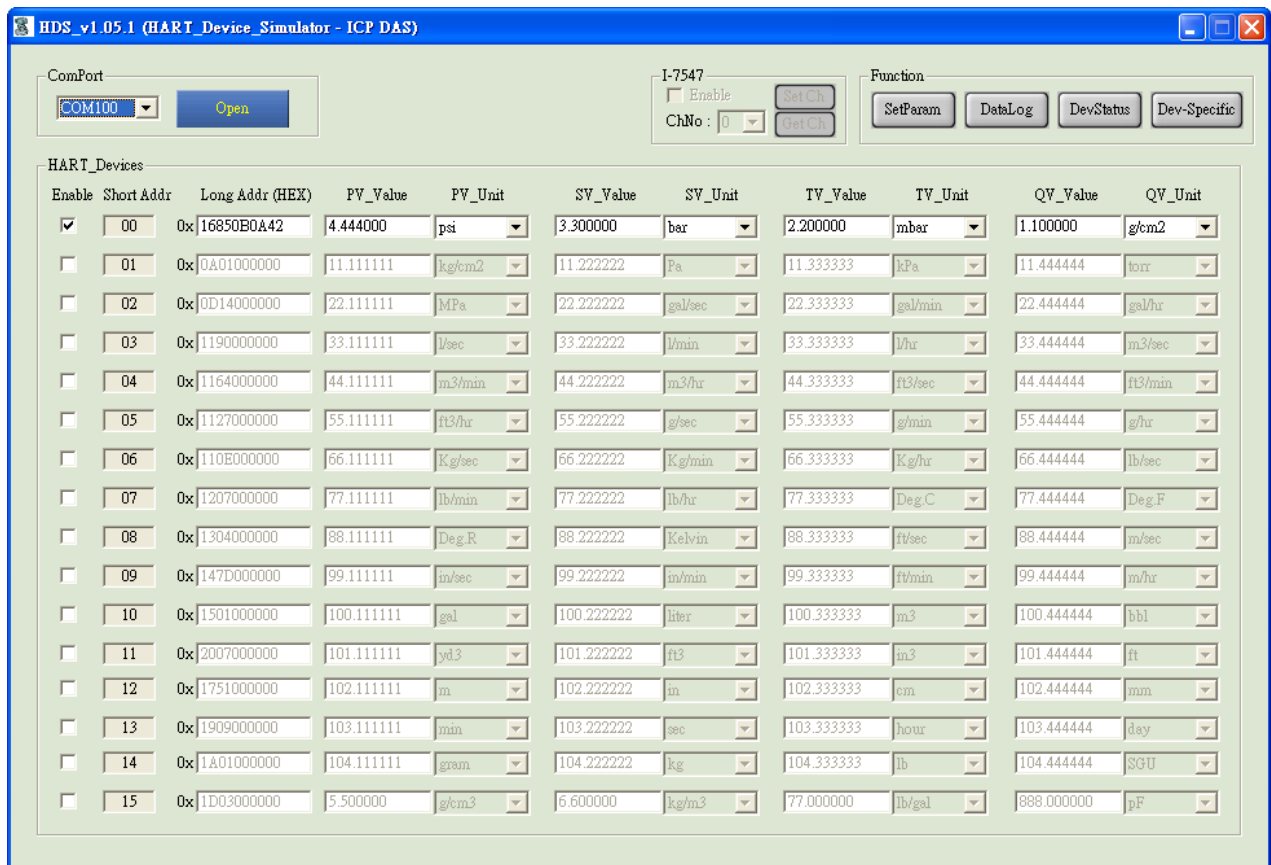


Figure 1-2 : HDS Tool

2. HDS Tool

The HDS software includes the below files.

- (1) **HDS.exe** => The main program.
 - (2) **HDS.ini** => The record file for parameters.
- => Users can execute the “HDS.exe” to run HDS program.
=> HDS software can be downloaded from :

http://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/converter/hds/software/.

2.1 HDS Operation

Execute the **HDS** tool.

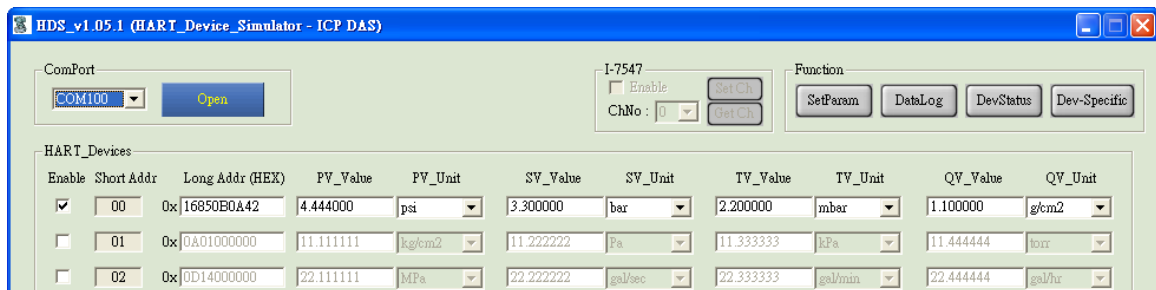


Figure 2-1: HDS Main Screen

2.1.1 ComPort

Choose the “ComPort” number and click the “Open” button.

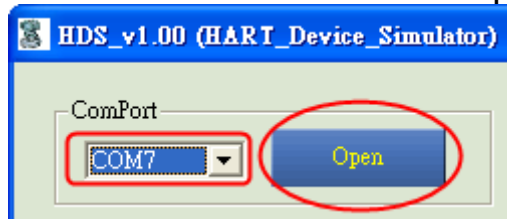


Figure 2-2: Open the “ComPort”

2.1.2 Parameter of HART Simulation Device

HART_Devices										
Enable	Short Addr	Long Addr (HEX)	PV_Value	PV_Unit	SV_Value	SV_Unit	TV_Value	TV_Unit	QV_Value	QV_Unit
<input checked="" type="checkbox"/>	00	0x16850B0A42	0.111111	psi	0.222222	bar	0.333333	mbar	0.444444	g/cm2
<input checked="" type="checkbox"/>	01	0x0A01000000	11.111111	kg/cm2	11.222222	Pa	11.333333	kPa	11.444444	torr
<input type="checkbox"/>	02	0x0D14000000	22.111111	MPa	22.222222	gal/sec	22.333333	gal/min	22.444444	gal/hr

(1) **“Enable”** option :



=> If checked, the corresponding HART simulation device will be enabled.

(2) **“Short Addr”** field : (fixed, decimal)

=> The Short Frame Address of HART simulation device.

(3) **“Long Addr (HEX)”** field : (can be set, hex)

=> The Long Frame Address of HART simulation device.

(4) **“PV_Value / PV_Unit”** field : (can be set)

=> The PV value and unit of HART simulation device.

(5) **“SV_Value / SV_Unit”** field : (can be set)

=> The SV value and unit of HART simulation device.

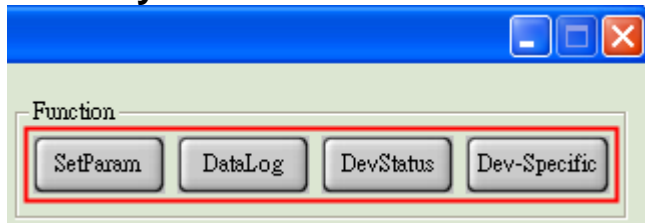
(6) **“TV_Value / TV_Unit”** field : (can be set)

=> The TV value and unit of HART simulation device.

(7) **“QV_Value / QV_Unit”** field : (can be set)

=> The QV value and unit of HART simulation device.

2.1.3 System Function



(1) **“SetParam”** button :

=> Set the current parameters of HART simulation device and save to the HDS.ini file. When executing the HDS tool next time, it will load the new settings.

(2) **“DataLog”** button :

=> It will open the HART communication screen.

<1> <== : HDS receive HART command.

<2> ==> : HDS send(response) HART command.



[1] **“Auto Scroll”** option :

=> If checked, it will show the latest HART communication data.

[2] **“RecvCnt”** field :

=> Show the total number of received HART command of HDS not including the response command.

[3] **“Save”** button :

=> Save all the HART communication data to file.

[4] **“Clear”** button :

=> Clear all the HART communication data.

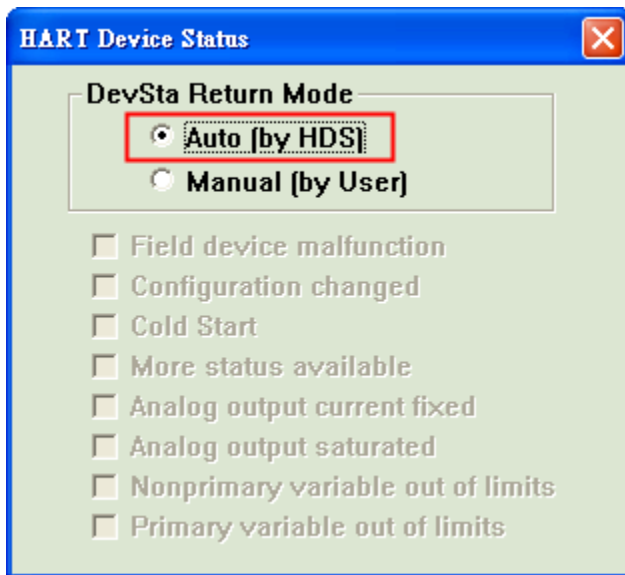
(3) **“DevStatus”** button : (Supported in v1.02)

The “DevSta Return Mode” option :

=> It is used to set the return mode of HART device status. (All the simulated HART devices use the same settings)

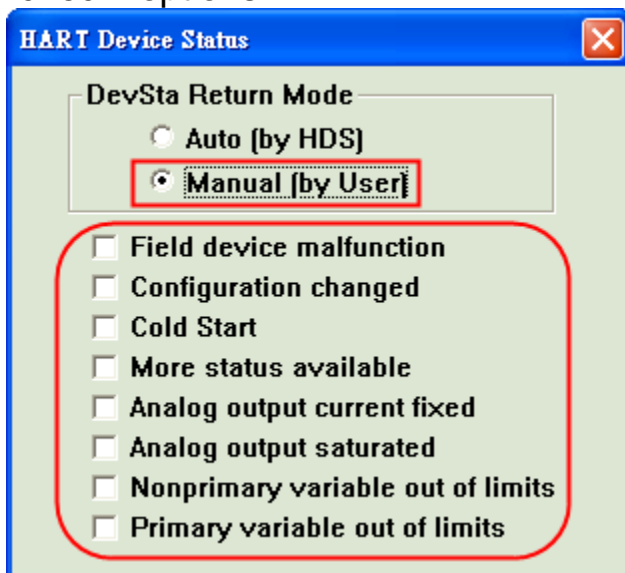
[1] **Auto Mode :**

The HART device status is decided by HDS software according to the current HART comm. status.



[2] Manual Mode :

The HART device status is decided by users according to the below “check” options.

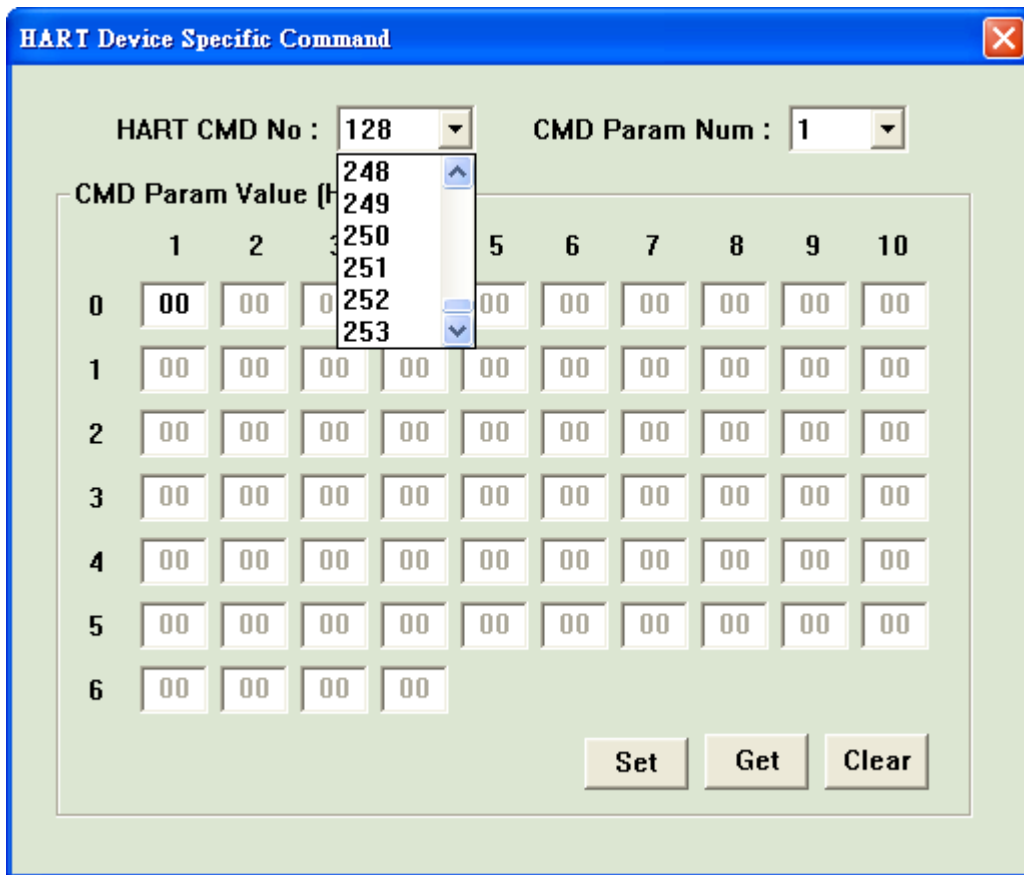


(4) “Dev-Specific” button : (Supported in v1.05.1)

[1] It is used to set the parameters of the device-specific command. (All the simulated HART devices use the same settings)

[2] It supports 64 parameters for every device-specific command.

[3] It supports device-specific command from 128 ~ 253.



[1] **“HART CMD No”** option :

=> Choose HART device-specific command no.

[2] **“CMD Param Num”** field :

=> Choose the amount of parameters for the chosen HART device-specific command no.

[3] **“CMD Param Value (Hex)”** field :

=> Set the parameter value with Hexadecimal format.

[4] **“Set”** button :

=> Save the settings of the screen to the HDS.ini file.

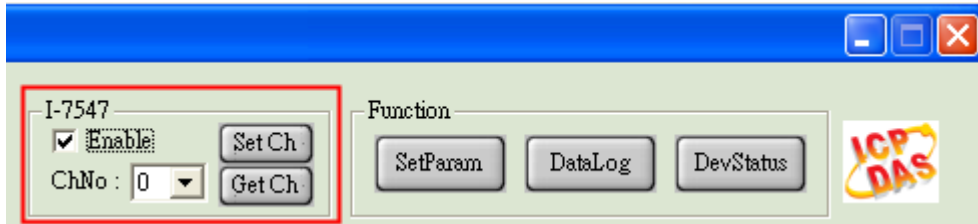
[5] **“Get”** button :

=> Get the settings from the HDS.ini file and show them to the screen.

[6] **“Clear”** button :

=> Set all the parameter value to be zero.

2.1.4 I-7547 Function



(1) “Enable” checkbox :

=> When checked, the HART channel setting of I-7547 will be enabled.

(2) “ChNo” combobox :

=> It is used to choose the HART channel no. of I-7547.

(3) “SetCh” button :

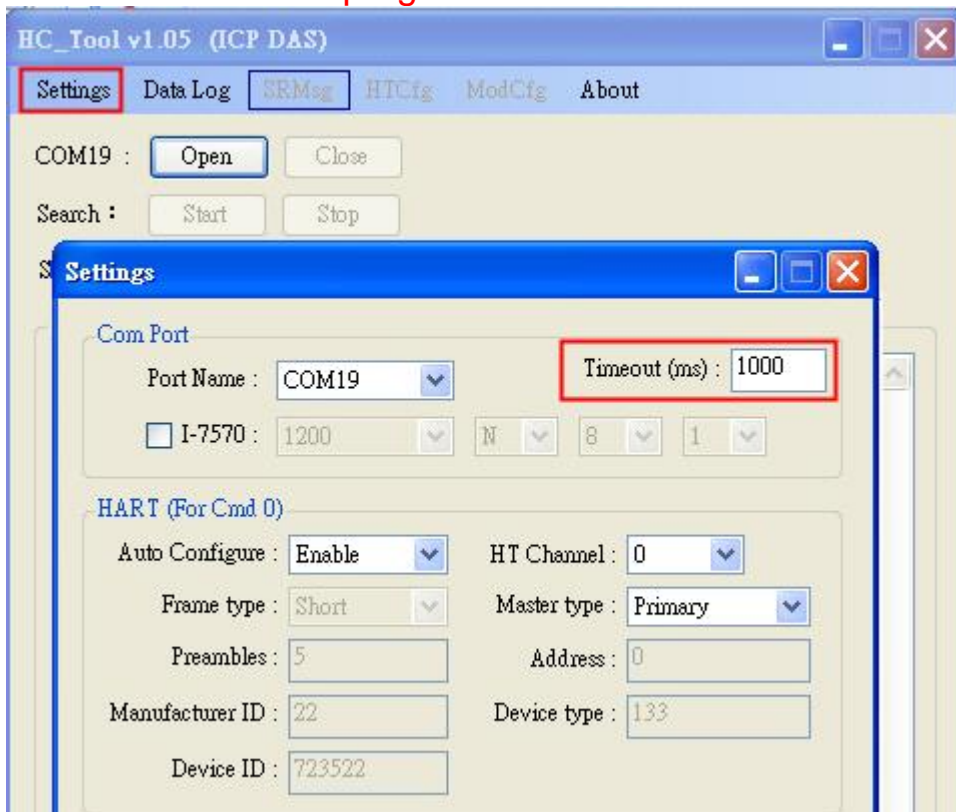
=> It is used to set the HART communication channel of I-7547.

(4) “GetCh” button :

=> It is used to get the current HART communication channel of I-7547.

[Note]

1. When using I-7547, the timeout value should be more than 1000ms in the HART master program for stable HART communication.



2.2 HDS Other Function

2.2.1 HART Supported Command

HDS supports more than twenty HART command as below:

1. Universal command :

=> 00, 01, 02, 03, 07, 12, 13, 14, 15, 16, 17, 18, 19

2. Common-Practice command :

=> 34, 35, 36, 37, 38, 40, 41, 42, **48**, 49, 59, 108, 109

3. Device-Specific command :

=> **128 ~ 253**

3. FAQ

Q01. Run the HDS tool step by step?

A01 : (2015/12/17)

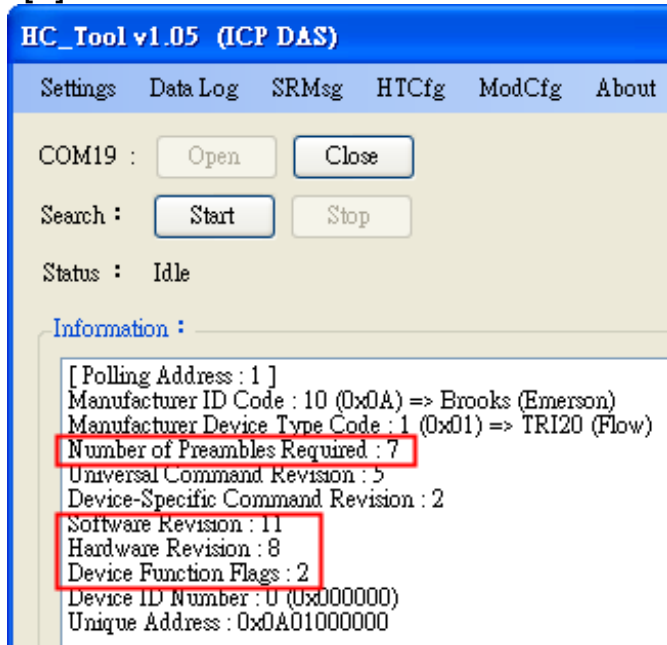
- (1) Connect ICPDAS HART converter to PC. The supported HART converters are as below.
 - [1] I-7567 : USB to HART
 - [2] I-7570 : Serial (RS-232/422/485) to HART
 - [3] I-7547 : Ethernet to HART
 - (2) Run HDS tool.
 - (3) Choose the ComPort number and click the “Open” button.
 - (4) Check the “Enable” option.
 - (5) Set the value of the “Long Addr” and “PV/SV/TV/QV” fields.
 - (6) Click the “SetParam” button to save the settings.
- => Then users can run HART master program for HART communication for testing.

Q02. How to modify the parameters for HART simulated device?

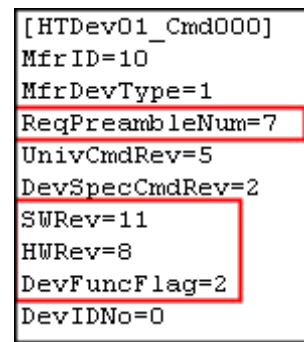
A02 : (2016/10/03)

(1) Modify the hardware parameters.

[1] Via the “HDS.ini” file.



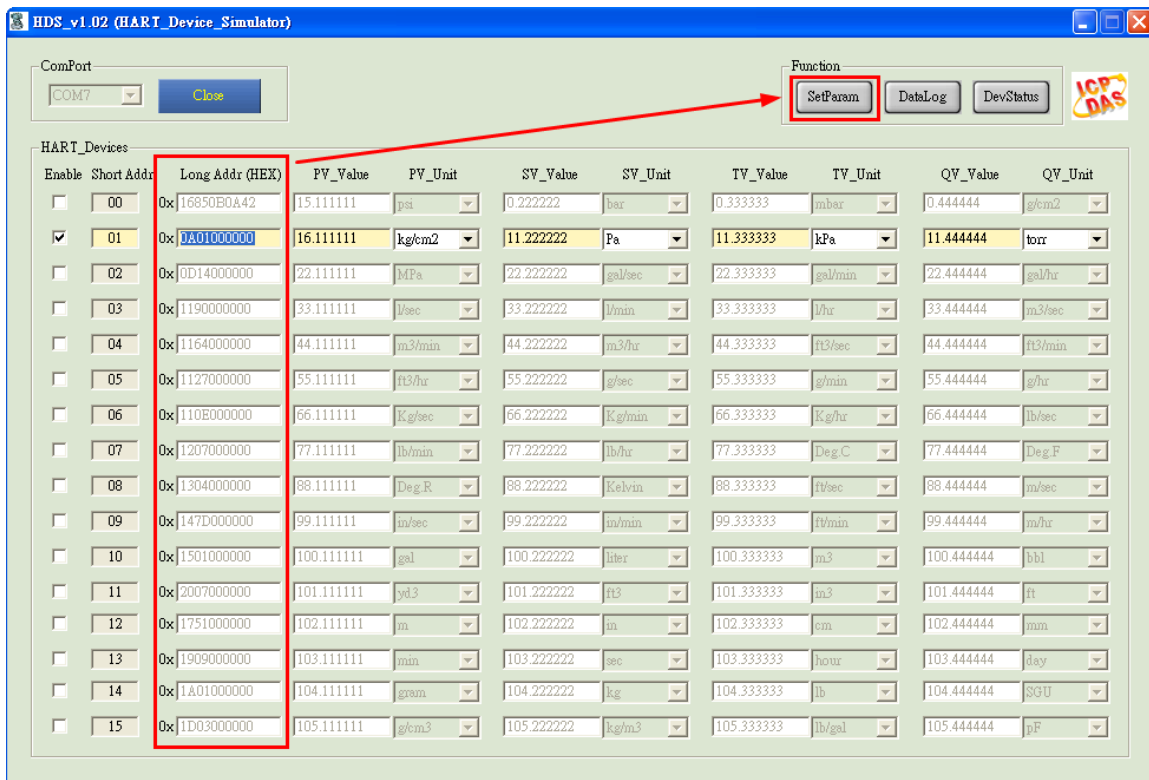
(HC_Tool)



(HDS.ini)

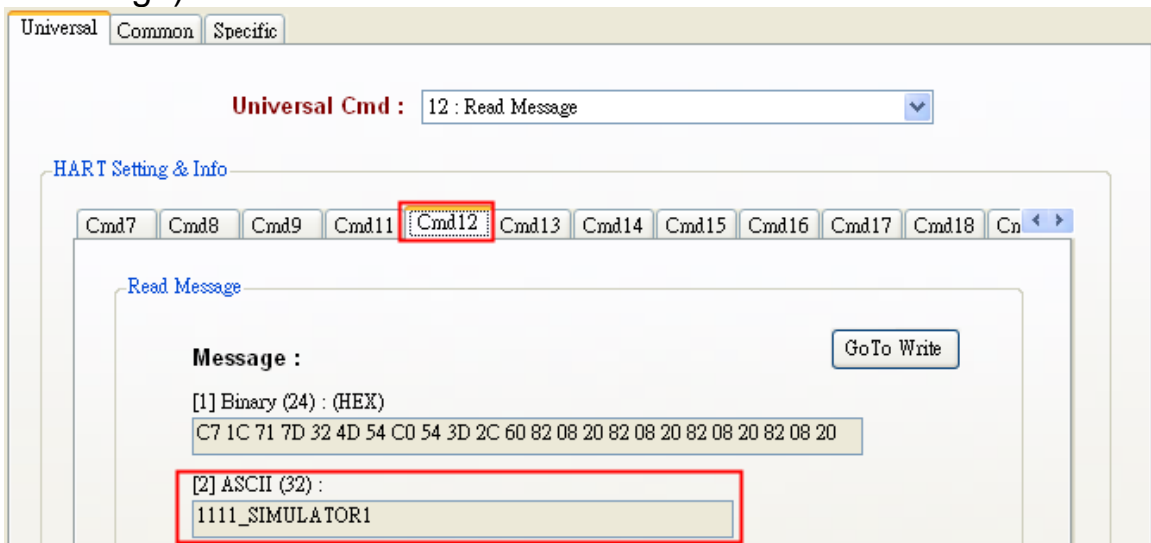
(2) Modify the “Long Frame Address”.

[1] Modify the value in the “Long Addr (HEX)” field of the HDS software and then click the “SetParam” button.

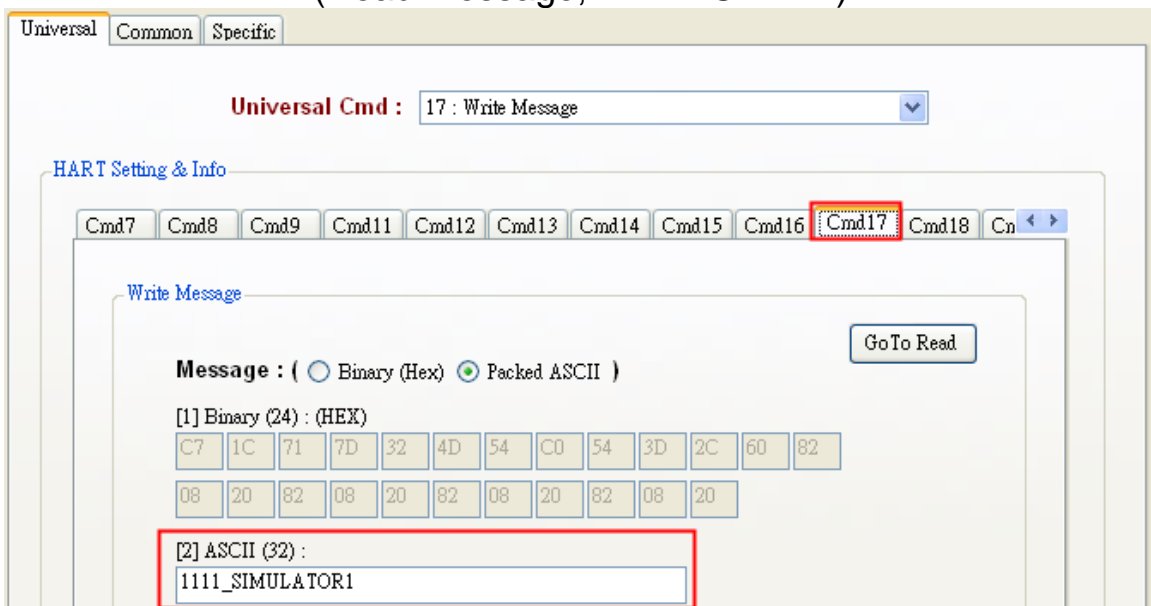


(3) Modify the value of “HART CMD12” (Read Message) ?

[1] In HC_Tool (HART Master), send the “HART CMD17” (Write Message).



(Read Message, HART CMD12)



(Write Message, HART CMD17)

(4) Modify the current value ?

[1] “Point to Point”模式:

HART device address must be 0. The current will vary depending on the PV value.

[Ex1 : PV=0.11111 => Current=-11.868970]

HART_Devices			
Enable	Short Addr	Long Addr (HEX)	PV_Value
<input checked="" type="checkbox"/>	00	0x16850B0A42	0.111111

Cmd3 Cmd6 Cmd7 Cmd8 Cmd9 Cmd11

Variables and Loop Current

Current :	-11.868970	mA
PV :	0.111111	psi
SV :	0.222222	bar
TV :	0.333333	mbar
QV :	0.444444	g/cm2

[Ex2 : PV=15.11111 => Current=5.819850]

HART_Devices			
Enable	Short Addr	Long Addr (HEX)	PV_Value
<input checked="" type="checkbox"/>	00	0x16850B0A42	15.111111

Cmd3 Cmd6 Cmd7 Cmd8 Cmd9 Cmd11

Variables and Loop Current

Current :	5.819850	mA
PV :	15.111110	psi
SV :	0.222222	bar
TV :	0.333333	mbar
QV :	0.444444	g/cm2

[2] “Multi-Drop”模式:

HART device address should be between 01 and 15. The current will be fixed to be 4 mA.

[Ex1 : PV=0.11111 => Current=4.00000]

HART_Devices			
Enable	Short Addr	Long Addr (HEX)	PV_Value
<input type="checkbox"/>	00	0x16850B0A42	15.111111
<input checked="" type="checkbox"/>	01	0x0A01000000	11.111111

Cmd3 Cmd6 Cmd7 Cmd8 Cmd9 Cmd11

Variables and Loop Current

Current :	4.000000	mA
PV :	11.111110	kg/cm2
SV :	11.222220	Pa
TV :	11.333330	kPa
QV :	11.444440	torr

[Ex2 : PV=16.11111 => Current=4.00000]

HART_Devices			
Enable	Short Addr	Long Addr (HEX)	PV_Value
<input type="checkbox"/>	00	0x16850B0A42	15.111111
<input checked="" type="checkbox"/>	01	0x0A01000000	16.111111

Cmd3 Cmd6 Cmd7 Cmd8 Cmd9 Cmd11

: Variables and Loop Current

Current :	4.000000	mA
PV :	16.111110	kg/cm2
SV :	11.222220	Pa
TV :	11.333330	kPa
QV :	11.444440	torr

Q03. How to use HDS to virtually transfer Modbus device to HART device?

A03 : (2018/11/08)

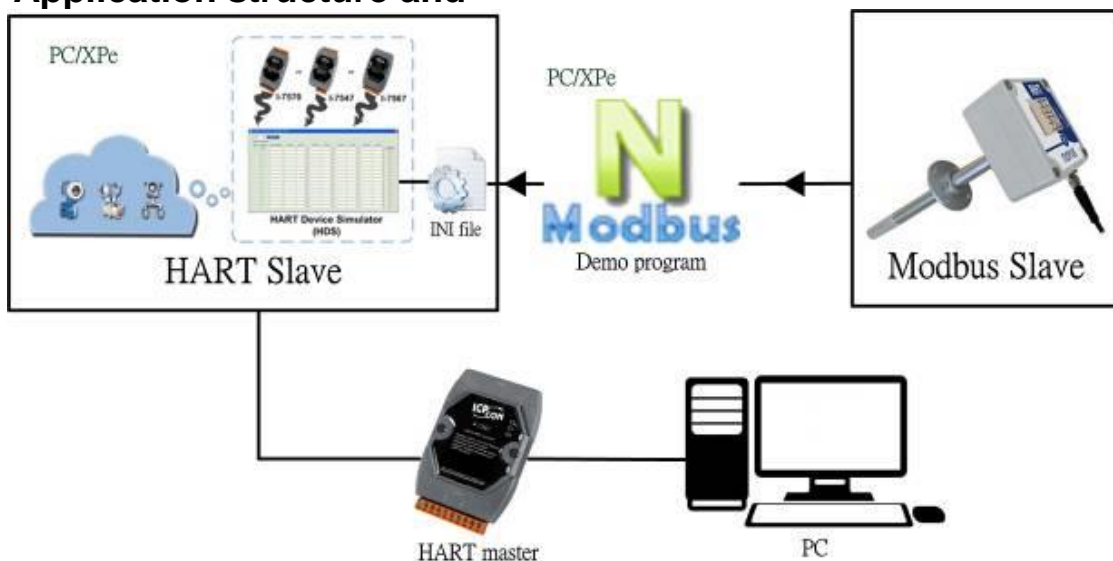
(1) Hardware required:

- [1]. HART converter * 1 (I-7567/7570/7547)
 - <1> work with HDS software => simulate HART Slave device
- [2]. Modbus instrument
- [3]. PC * 1
 - <1> Need to write an nModbus program with following functions:
 - [1] Collect Modbus device data
 - [2] Keep updating the Modbus device data to HDS.ini file
 - <2> Execute HDS.exe software

(2) Software required

- [1]. HDS (HART Device Simulator), Download from:
ftp://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/converter/hds/software/
- [2]. HC_Tool (converter utility), Download from:
ftp://ftp.icpdas.com.tw/pub/cd/fieldbus_cd/hart/converter/i-7547/software/
- [3]. nModbus relative information:
 - <1> introduction / example
<http://www.icpdas.com/products/PAC/i-8000/modbus.htm>
 - <2> nModbus_Demo program:
Reads AI data from Modbus device and modify HDS.ini file,
download from:
ftp://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/converter/hds/software/demo/

(3) Application structure and

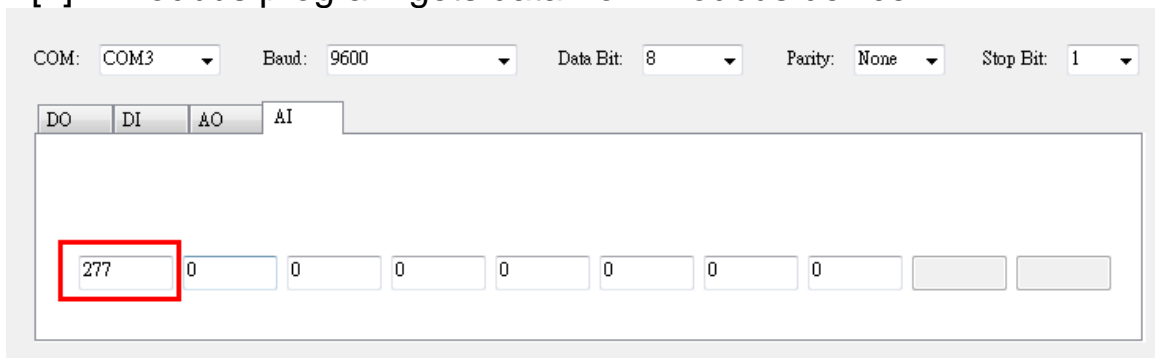


(4) Procedures:

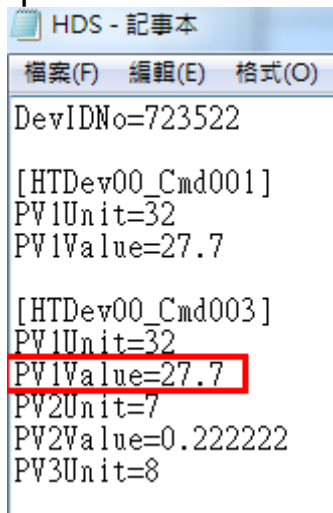
- [1]. Write an nModbus program to read Modbus device data
(Please save the program to the same folder with HDS program)
- [2]. nModbus program updating the HDS.ini file with the Modbus device data simultaneously.
- [3]. Use a HART converter with HDS to simulate HART device
(The simulated HART device shares the same data with Modbus slave as the program keeps updating the HDS.ini file)

(5) Application function test:

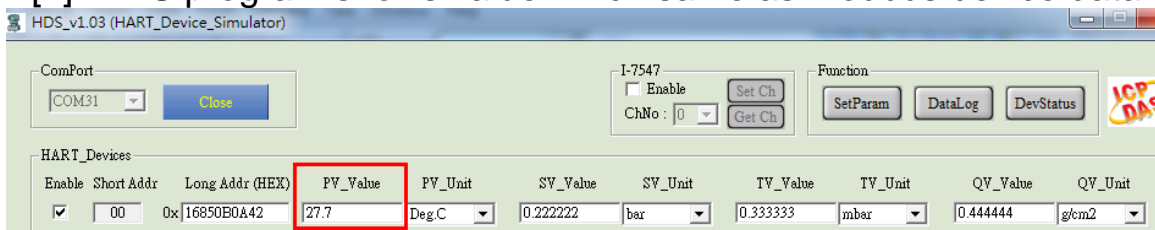
- [1]. HART Master setup:
 - <1> HART converter * 1 (I-7567/7570/7547)
 - <2> work with HC_Tool software => HART Master functions
- [2]. nModbus program gets data from Modbus device



- [3]. nModbus program updates the Modbus device data to HDS.ini file



- [4]. HDS program shows value which same as Modbus device data



- [5]. HC_Tool utility reads data from HDS Cmd3 values

HART Setting & Info

Cmd1 Cmd2 Cmd3 Cmd6 Cmd7 Cmd8 Cmd9 Cmd11 C

Read Dynamic Variables and Loop Current

Current : 20.665360 mA

PV : 27.700000 deg (C)

SV : 0.222222 bar

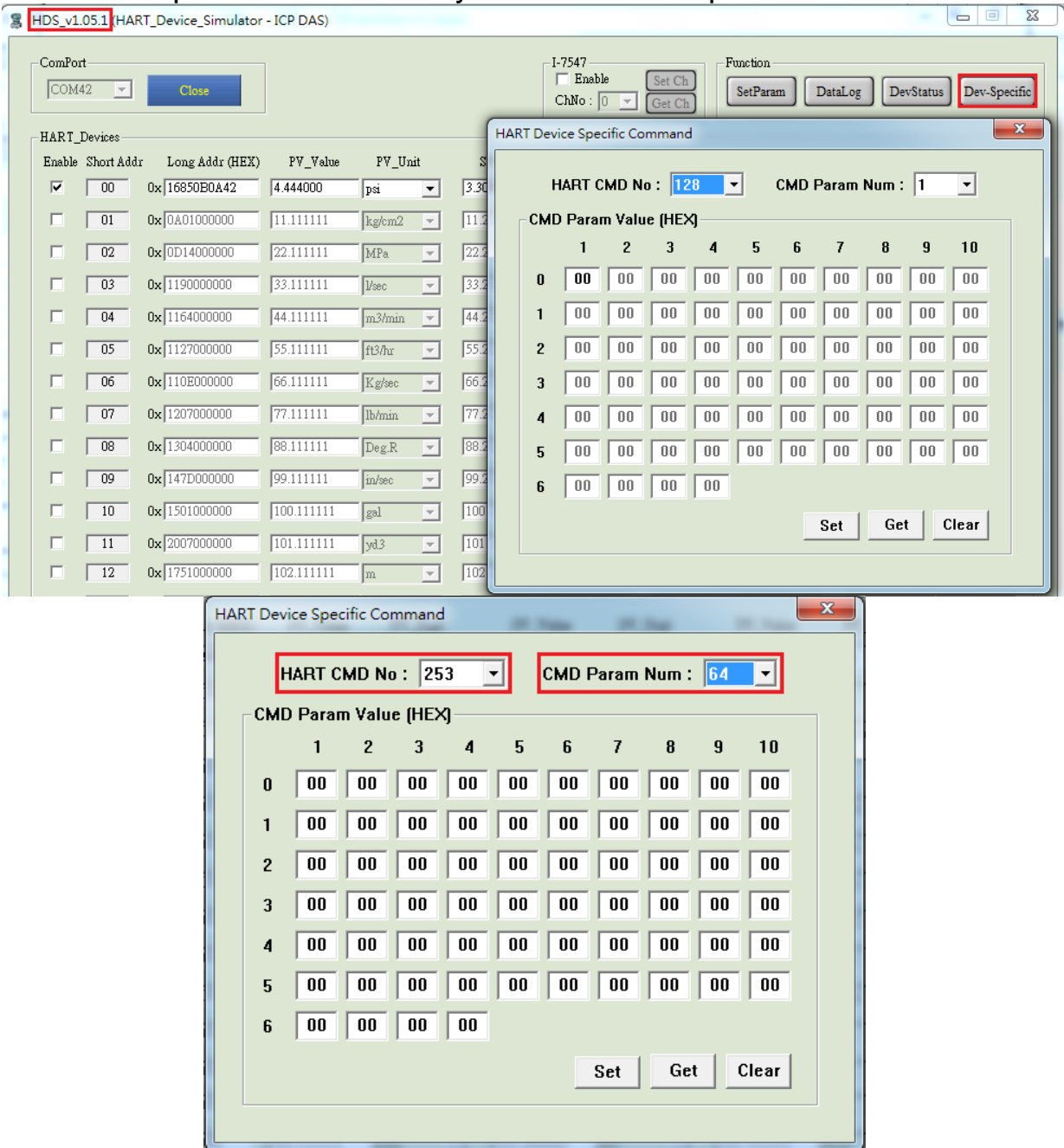
TV : 0.333333 mbar

QV : 0.444444 g/cm2

Q04. How to use HART Device-Specific commands

A04 : (2018/05/15)

HDS_v1.05.1 supports HART Device-Specific command from 128 to 253 and 64 parameters for every HART Device-Specific command.

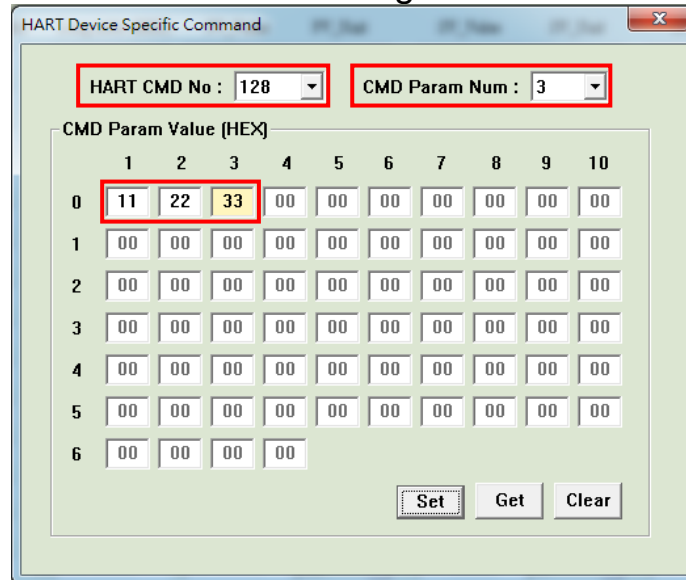


[For Example]

The user wants HDS to response HART device-specific command 128 with 3 parameters and these value are 0x11, 0x22 and 0x33. Please follow the below steps:

(1)Set the parameter of HART device-specific CMD 128 for HDS.

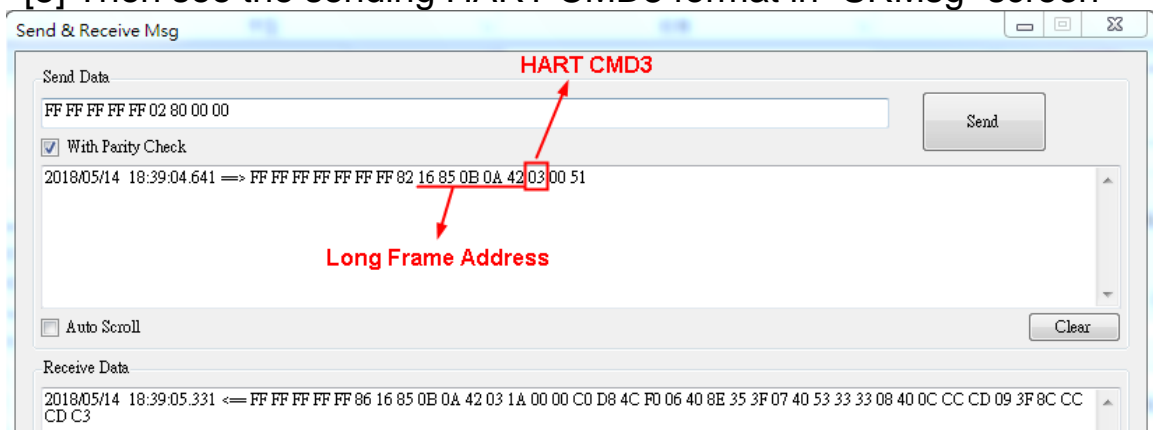
- [1] Open “HART Device Specific Command” screen.
- [2] Choose “**128**” in the “HART CMD No” option.
- [3] Choose “**3**” in the “CMD Param Num” option.
- [4] Type “**11**”, “**22**” and “**33**” in the “CMD Param Value (HEX)” field.
- [5] Click “Set” button to save the settings to HDS.ini.



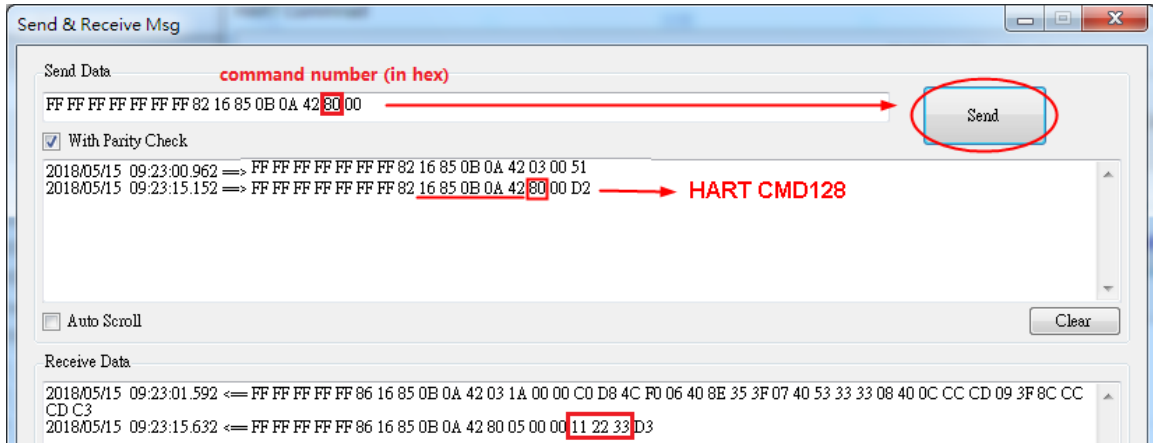
(2) Send HART master command 128.

[Method 1: Using ICP DAS HART converters with HC_Tool]

- [1] By using ICP DAS HART converters (I-7567, I-7547 or I-7570) with HC_Tool.
- [2] Click “SRMsg” option to open “Send & Receive Msg” screen.
- [3] Search the HART device.
- [4] Open “HTCfg” screen to send HART command 3.
- [5] Then see the sending HART CMD3 format in “SRMsg” screen

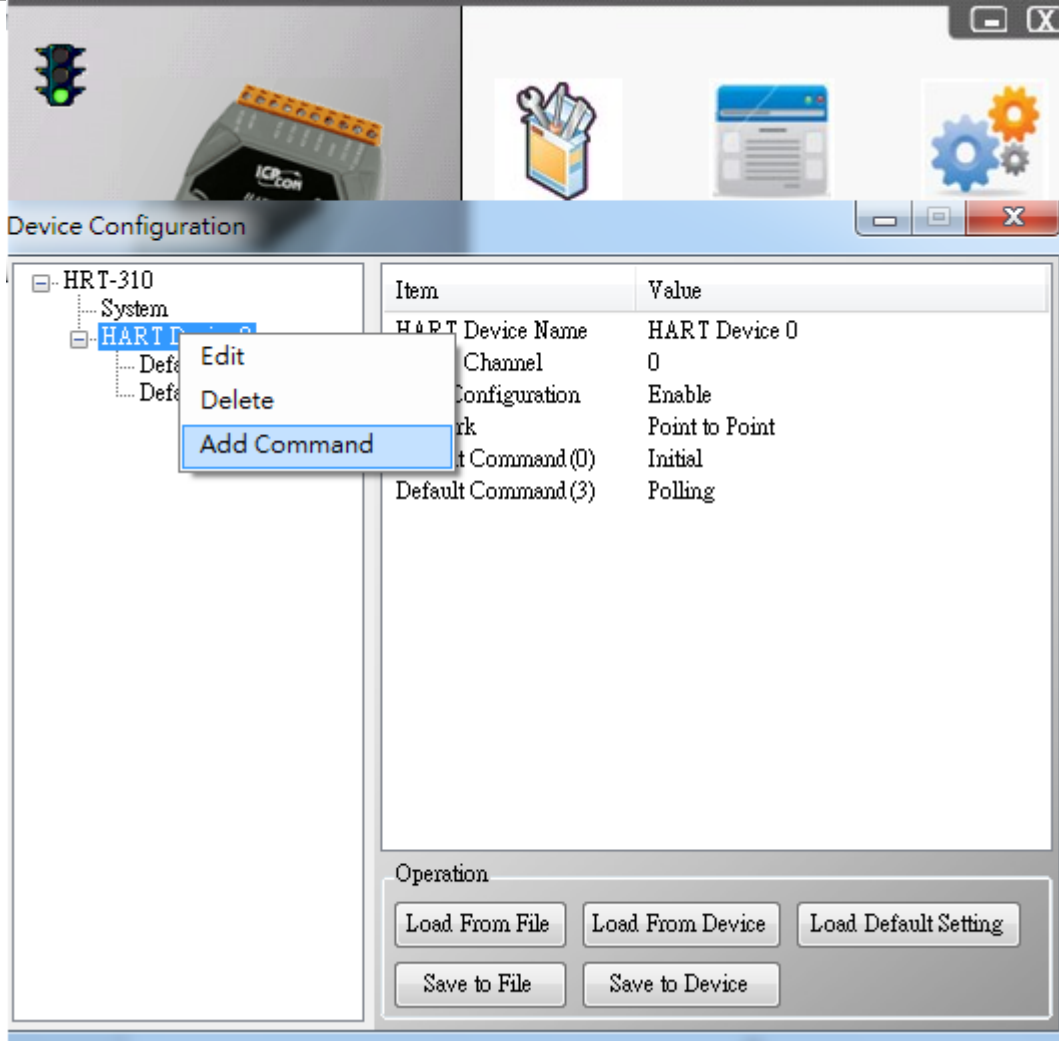


- [6] Send the HART command 128 with the same long frame address.
- [7] In the “Receive Data” field, it will show the HART CMD128 response from HDS with 0x11, 0x22, 0x33 data.



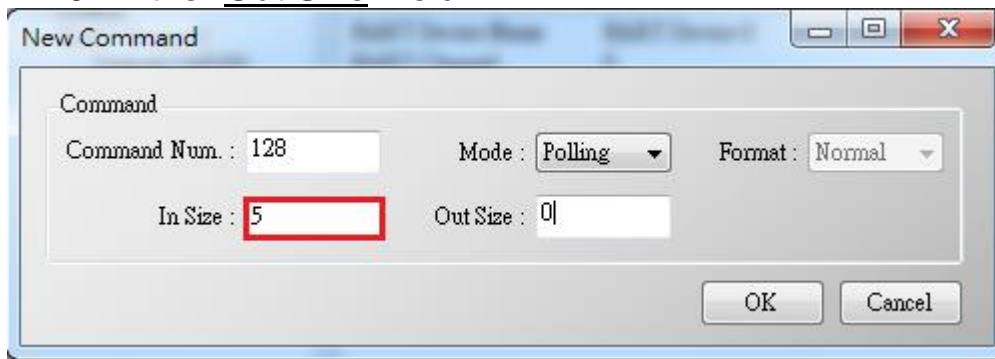
[Method 2: Using ICP DAS HART gateway with HG_Tool]

- [1] By using ICP DAS HART gateway (HRT-710, HRT-310 or HRT-711) with HG_Tool.
- [2] Run the HG_Tool and connect to the HART gateway.
- [3] Add a new command in the “Device Configuration” screen.



- [4] Type “128” in the “Command Num” field and “5” in the “In Size” field (Response Code(2 bytes) + CMD128 Param Number (3 bytes)) and

“0” in the “Out Size” field.



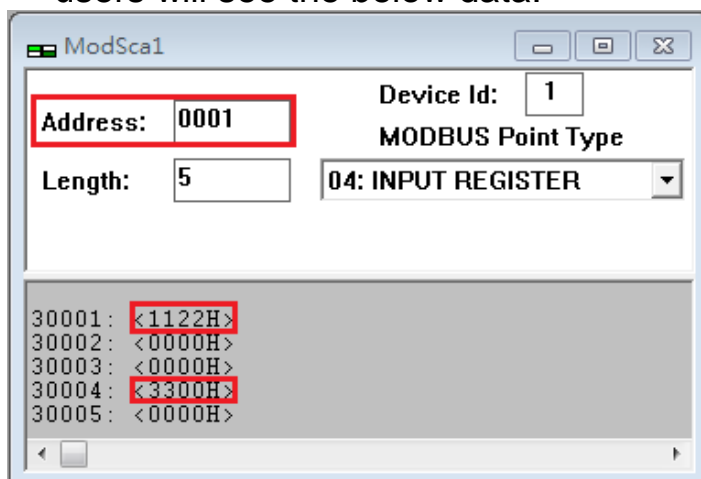
[5] Click “Save to Device” button.

[6] Using Modbus master tool (ModScan) to get the HART CMD 128 response data from HART gateway.

<1> The response data of HART CMD 128 will be as below.

=> 0x00 0x00 (Response Code) 0x11 0x22 0x33 (Data).

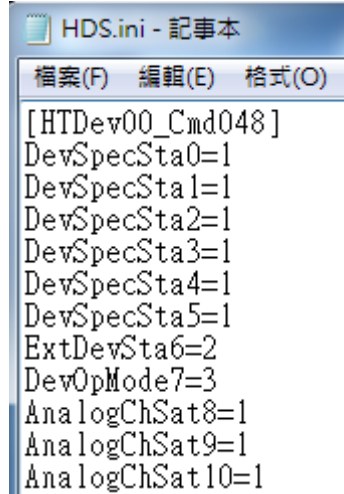
<2> Because the gateway has set the “WORD & BYTE” swap, so users will see the below data.



Q05. How to change CMD48 parameters setting

A05 : (2018/07/10)

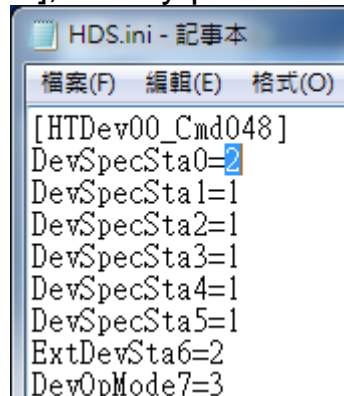
HDS_v1.05.1 supports HART command 48, all parameters setting stored in the .ini file of HDS.



```
HDS.ini - 記事本
檔案(F) 編輯(E) 格式(O)
[HTDev00_Cmd048]
DevSpecSta0=1
DevSpecSta1=1
DevSpecSta2=1
DevSpecSta3=1
DevSpecSta4=1
DevSpecSta5=1
ExtDevSta6=2
DevOpMode7=3
AnalogChSat8=1
AnalogChSat9=1
AnalogChSat10=1
```

[Example: modify the CMD48 parameter of HART Device00]

- (1) Open the HDS.ini file
- (2) Find [HTDev00_Cmd048], modify parameter value and save (as below)



```
HDS.ini - 記事本
檔案(F) 編輯(E) 格式(O)
[HTDev00_Cmd048]
DevSpecSta0=2
DevSpecSta1=1
DevSpecSta2=1
DevSpecSta3=1
DevSpecSta4=1
DevSpecSta5=1
ExtDevSta6=2
DevOpMode7=3
```

Send CMD48 to corresponding device, you can see the saved changes

HART Cmd : 48 : Read Additional Device Status

Cmd38 Cmd41 Cmd42 **Cmd48** Cmd71 Cmd76

Read Additional Device Status

Device-Specific Status :	0x02 01 01 01 01 01
Extended Device Status :	0x02 => Device Variable Alert
Device Operating Mode :	0x03 =>
Analog Channel Saturated :	0x01 01 01
Analog Channel Fixed :	0x01 01 01
Device-Specific Status :	0x01 01 01 01 01 01 01 01 01 01 01

4. Version History

Ver.	Author	Date	Description
1.00	Edward	2015/12/17	1. First version.
1.01	Edward	2016/07/28	1. Add the “DevStatus” button to set the status of the simulated HART device.
1.02	Edward	2016/11/10	1. Add the Q02 in FAQ. 2. Add the section 2.1.4 (I-7547 Function)
1.03	Peter	2017/06/30	1. Add the Q03 in FAQ
1.04	Peter	2018/05/15	1. Add the Q04 in FAQ 2. HDS_1.05.1 version new function: [1] New supported command (48, 128~253)
1.05	Peter	2018/11/01	1. Add the Q05 in FAQ