

User Manual

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HRT-711





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Important Information

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1. Introduction

Modbus and HART are two kinds of famous protocols and used wildly in the fields of factory and process automation. The HRT-711 module is a Modbus/TCP and Modbus/UDP to HART gateway. By using this module, users can integrate their HART devices into Modbus network easily. The below figure 1 shows an application example for the HRT-711 module.



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1.1 Features

- Support HART Short/Long frame
- Support HART Burst mode
- Allow two HART Masters
- Support Modbus/TCP and Modbus/UDP format
- Support Modbus Slave / HART Master Mode
- Support Firmware Update via Com Port
- Support On-line Replacement of HART Devices
- Support Acquire Long Frame Address Automatically
- Provide LED indicators
- Built-in Watchdog
- DIN-Rail or Wall Mounting

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1.2 Specification

ltem	Specification								
	RS-232(3 wire)								
Com Port	Screwed termi	nal block							
	Fixed baud rate 115200 bps								
	1 HART Mode	n							
	Screwed terminal block								
	Operates as a	HART Master station and	supports all HART commands						
HART	Support Short	and Long Frame							
	Support Point	to Point or Multi-drop							
	Max. 15 HART	modules							
	Max. 100 user commands and 32 default commands								
	1 x 10/100Base-TX Ethernet Controller								
	RJ-45								
Ethemet	Auto Negotiation								
	Auto MDIX								
	+10 ~ +30 VDC								
Power	Power reverse protection and Over-Voltage brown-out protection								
	Power Consumption : 2 W								
	Dimensions: 72 mm x 121 mm x 35 mm (W x L x H)								
	Operating temperature: -25 ~ 75 ºC								
	Storage temperature: -30 ~ 85 °C								
Madula	Humidity: 5 ~ 95% RH, non-condensing								
Module	3 x LED indicators								
	ETH LED	Network Status							
	HART LED	HART Status							
	ERR LED	Error							

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2. Hardware

2.1 Block Diagram



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2.2 Pin Assignment



Pin Name	Group Description							
HART+	ЦАРТ	Positive of HART						
HART-	HANT	Negative of HART						
+VS	Dowor Sourco	V+ of Power Supply(+10 ~ +30 VDC)						
GND	Power Source	GND of Power Supply						
TXD		Transmit Data of RS-232						
RXD	XD Configuration Receive Data of RS-232							
GND		GND of RS-232						
⊏1	Modbus/TCP	Ethernet RJ45 connector for Modbus/TCP and						
	Modbus/UDP	Modbus/UDP						

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2.3 Wiring

In this section, this user's manual will introduce the wiring for each interface.

2.3.1 RS-232

The RS-232 port of HRT-711 uses a 3-wire communication interface. It needs a unique cable, CA-0910, to wire from screwed terminal block to D-Sub 9pin connector. Users can choose between using CA-0910 for RS-232 wiring or directly connecting to D-Sub. 2.3.1.1 and 2.3.1.2 are the wiring for the RS-232 interface.

■ Without CA-0910

When users choose not to use CA-0910 for RS-232 wiring, users have to have a D-Sub 9pin connector to wire. The following figure is the wiring diagram for wiring without CA-0910.



With CA-0910

It is recommended that users use CA-0910 for wiring the RS-232 port. The wiring of CA-0910 and HRT-711 is shown as below.



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2.3.2 HART

The wiring of HART bus can be devided into two types. One is loop power (Passive Loop), and the other is external power (Active Loop). The following figures show the wiring for the HART bus.



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2.3.3 Ethernet

The wiring for Ethernet is directly connecting your RJ-45 Ethernet cable to the RJ-45 port on the HRT-711.

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2.4 LED Indicators

The HRT-711 provides three LED indicators to indicate the module status. The descriptions are shown as follow.

LED	Status	Description						
	Plink	Blink every 0.2 second : Receiving Ethernet packet						
ETH	DIIIK	Blink every 3 second : The network function is normal						
	Off	Ethernet Error						
		Blink every 1 second :						
		The HRT-711 is in the initialing procedure						
	Blink	Blink every 0.5 second :						
HART		The HRT-711 is handling the burst frame sent from HART device						
	Solid	The HRT-711 is in the normal status						
	Off	Firmware is not loaded						
EDD	Blink	HART communication error						
	Off	HART communication is good						



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2.5 DIP Switch

The DIP switch is used for switching the mode between Init and Normal. The switch is located on the back of the module. On the init side, the module can be configured through Utility. On the normal side, the module is a gateway between HART and Modbus/TCP, Modbus/UDP protocol. Users have to power cycle the module when switch to different mode.



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2.6 Jumpers

There are three jumpers for enabling/disabling function. The description for each jumper is shown as following table.

Jumper	Description							
	(1) Position 1 & 2 : Enable hardware WDT. (Default setting)							
JF2	(2) Position 2 & 3 : Firmware Update Mode. (JP3 should be also in the 2 & 3)							
	(1) Position 1 & 2 : Firmware Operation Mode. (Default setting)							
JP3	(2) Position 2 & 3 : Firmware Update Mode. (JP2 should be also in the 2 & 3)							
	=> The detailed steps of Firmware Update, please refer to the Q04 of FAQ.							
	The jumper can provide HART bus with 250 Ω (1/4 W) resistor. When the pin 1&2 of							
	of JP4 is closed, the resistor will connect to HART bus. When the pin 2&3 of JP4 is							
JF4	closed or JP4 without jumper connected, it will disconnect the resistor from HART							
	bus. By default, the pin1&2 of JP4 is closed. Please refer to section 2.3.2.							

2.7 Mounting



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3. HART Introduction

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.



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3.2 Topology

HART bus can operate in one of the two network configurartions, point to point and 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. Only one HART slave device can exist in HART bus and the polling address must be zero.



Multi-drop

In multi-drop mode, all process values are transmitted digitally. The polling address of all field devices must be bigger than 0 and between 1 ~ 15. The current through each device is fixed to a minimum value (typically 4 mA). The maximum HART device number in HART bus is up to 15.

NOTE : The built-in resistor in HRT-711 is 250 Ohm with 1/4W. Therefore, HRT-711 supports to connect the maximum 7 HART devices simultaneously. If the HART devices in multi-drop mode are more than 7, then users need to disconnect the built-in resistor in HRT-711 (prevent to burn down) and use an external 250 Ohm resistor with 1W.

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3.3 HART Frame

The HART frame format is shown as below.

Preamble	Delimiter	Address	Command	Byte Count	[Data]	Check Byte

Master to Slave Frame

Slave to Master Frame

|--|

Field	Description								
	All frames transmitted by HART master or slave devices are preceded by a specified								
Preamble	number of "0xFF" characters and they are called the preamble. The number of								
	preamb	ole can't	be less th	nan 5 a	nd more the	an 20			
Dolinsitor	This da	This data can indicate the frame is long or short frame and the frame is master frame,							
Delimiter	slave fr	ame or	burst fram	ne.					
Address	If the H	ART fra	me is sho	rt fram	e, the addre	ess fiel	d is only or	ne byte. If it	is long frame,
Address	the add	lress fiel	d are 5 by	ytes an	d include m	nanufa	cturer ID, d	evice type a	nd device ID.
	The H	ART coi	mmand s	et can	be devide	ed into	Universal	, Common	Practice and
	Device-Speific class. These three class shown as below :								
	Comm	nand Nu	mber	Comm	and Class				
Command	Unive	rsal		0~30, 3	31 is reserv	red .			
	Comm	non Prac	tice	32~120	6, 127 is re	served			
	Device	e-Specit	IC	128~2	53 255				
	Reser		A	204 œ	200			.1	
	Please refer to Appendix A for more detail of HAR I command								
Byte Count	It is the number of bytes between it and the check byte the end of the HART frame.						ART frame.		
	It includes two bytes of status. These bytes convey three types of information:								
	Commu	unicatior	n errors, C	Comma	ind respons	se prob	olems and	Field device	status. They
	are sho	wn as b	elow.						
Posponso	Respo	onse Co	de Data		Byte1		Byte0		
Codo	NOTE : When first byte shows the communication error, the value of the second byte is								
Code		0							
		Byt	e 0 repres	sents th	ne commun	ication	error or re	sponse cod	e
	This b	yte is us	ed for err	or statu	us when Bit	7 is 1.	The status	bits are sho	wn as follow
	Bit7	Bit6	Bit5	Bit4	Bit3	B	Bit2	Bit1	Bit0

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Field	Description											
	1	Parity Error	Overru n error	ru Framin or g Error		nin Checksu ror merror 0(Reserv		served)	RX buffer overflow	Over (Unc e)	rflow Jefin	
	This b	yte is us	sed for r	esponse	e cod	le when F	Bit7	' is 0.				
	Bit7	, E	3it6	Bit5		Bit4	В	Bit3	Bit2	Bit1	E	3itO
	0		I			Res	pon	ise Co	de	1		
	Response Co			Code				Desc	ription			
			0		No	comman	nd-s	specific	error			
			1		Und	defined						
			2		Inva	alid selec	ctior	n i i i i i i				
			3		Pas	ssed para	ame	eter too	o large			
	-		<u>4</u> 5		Toc	few data	a hi	tes re	ceived			
			6		Dev	vice-spec	cific	comm	and erro	or (rarely us	sed)	
	[7		In v	write-prot	ect	mode		\ ·	,	
			8~15		Multiple meanings							
			16		Access restricted							
			<u>∠ŏ</u> 32		Device is busy							
			64		Command not implemented							
		Buto			1 ind	licates fie	-Id (device	status			
		Bi	t 7	Field de	vice	malfuncti	ion	001.00	010100			
		Bi	t 6	Configu	ratior	n change	d					
		Bi	t 5 (Cold sta	art							
		Bi	t 4	More sta	atus a	available						
		Bi	t 3	Analog output current fixed								
		Bi	t 2	Analog output saturated								
		Bi	t 1	Non-primary variable out of limits								
		Bi	t 0	Primary variable out of limits								
Data	The co	ntents of	f the dat	ta are de	ecide	d by HA	RT	comm	and num	ıber.		
Check Byte	Every I	HART fr	ame ha	s a che	ck by	yte at the	e las	st data	a byte. H	ART device	e can	detect
Check Byte error frame by this byte.												

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4. Modbus Communication

4.1 Module Execution Process

When the HRT-711 module is started, it will perform the Initial mode first and then the Operation mode.

- (1) When HRT-711 runs under Initial mode, it will execute all initial command and the HART LED will flash.
- (2) When HRT-711 runs under Operation mode, it will execute all polling command automatically and the HART LED will always on.

4.2 Modbus / HART Mapping Table

Users can access the HART device by using these Modbus address defined by HRT-711 module. These Modbus address can be divided into two parts as below.

- (1) Input Data Area (FC04)
- (2) Output Data Area (FC06, FC16)

[Note]

The meaning of every Modbus address in the below table is based on the setting of SWAP Mode to be None. If the setting of SWAP Mode is Byte or WORD or W&B, then the meaning of every Modbus address in the below table will be moved one byte or word address

4.2.1 Input Data Area – User CMD Data

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description
0x0~1F3	0~499	User CMD Data

4.2.2 Input Data Area – Module State Data

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description	
0x1F4	500	High Byte Module request command count ⁽²⁾	Low Byte Module state machine ⁽¹⁾
0x1F5	501	High Byte Module receive error command count ⁽²⁾	Low Byte Module receive command count ⁽²⁾

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Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description	
0x1F6	502	High Byte	Low Byte
		Module error command index ⁽⁴⁾	Module error status ⁽³⁾
0x1F7~1F9	503~505	Reserved	

NOTE 1 : The module state machine represents current state of command handling. The meanings of the states are shown in the following table.

Value	Status	
0	Idle	
1	Waiting to send HART command	
2	Sending HART command.	
3	Waiting to receive HART data	
4	Receiving HART data.	

- NOTE 2 : In HRT-711, the module request and receive command and error count are used 1 byte respectively. Each request, receive or error will increase this byte until 256, then the value will start from 0 again.
- NOTE 3 : The module error status records the latest error status. The status is shown as following table.

Value	Error Status
0	No error
1	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 are recorded in the responses codes

NOTE 4 : The module command index records the latest command index. There is no error occur when this byte is 255.

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4.2.3 Input Data Area – Default CMD 0 Data

The HRT-711 will automatically add two default commands, CMD 0 and CMD 3, when add a HART device. The following table represents the default CMD 0 data Modbus address mapping.

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description
0x1FA~200	506~512	Default CMD 0 input data of Module 0
0x201~207	513~519	Default CMD 0 input data of Module 1
0x208~20E	520~526	Default CMD 0 input data of Module 2
0x20F~215	527~533	Default CMD 0 input data of Module 3
0x216~21C	534~540	Default CMD 0 input data of Module 4
0x21D~223	541~547	Default CMD 0 input data of Module 5
0x224~22A	548~554	Default CMD 0 input data of Module 6
0x22B~231	555~561	Default CMD 0 input data of Module 7
0x232~238	562~568	Default CMD 0 input data of Module 8
0x239~23F	569~575	Default CMD 0 input data of Module 9
0x240~246	576~582	Default CMD 0 input data of Module 10
0x247~24D	583~589	Default CMD 0 input data of Module 11
0x24E~254	590~596	Default CMD 0 input data of Module 12
0x255~25B	597~603	Default CMD 0 input data of Module 13
0x25C~262	604~610	Default CMD 0 input data of Module 14
0x263~269	611~617	Default CMD 0 input data of Module 15

4.2.4 Input Data Area – Default CMD 3 Normal Format Data

When configure HRT-711 default CMD 3 to normal format, the data of Modbus address for each HART device is shown as following table.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4
Unit	Primary Variable	Primary Variable of HART device (In IEEE 754 format)		
Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
Unit	Secondary Variable of HART device (In IEEE 754 format)			
Byte 10	Byte 11	Byte 12	Byte 13	Byte 14
Unit	Tertiary Variable of HART device (In IEEE 754 format)			
Byte 15	Byte 16	Byte 17	Byte 18	Byte 19
Unit	Quaternary Variable of HART device (In IEEE 754 format)			

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Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description
0x26A~276	618~630	Default CMD 3 Normal Format Data of Module 0
0x277~283	631~643	Default CMD 3 Normal Format Data of Module 1
0x284~290	644~656	Default CMD 3 Normal Format Data of Module 2
0x291~29D	657~669	Default CMD 3 Normal Format Data of Module 3
0x29E~2AA	670~682	Default CMD 3 Normal Format Data of Module 4
0x2AB~2B7	683~695	Default CMD 3 Normal Format Data of Module 5
0x2B8~2C4	696~708	Default CMD 3 Normal Format Data of Module 6
0x2C5~2D1	709~721	Default CMD 3 Normal Format Data of Module 7
0x2D2~2DE	722~734	Default CMD 3 Normal Format Data of Module 8
0x2DF~2EB	735~747	Default CMD 3 Normal Format Data of Module 9
0x2EC~2F8	748~760	Default CMD 3 Normal Format Data of Module 10
0x2F9~305	761~773	Default CMD 3 Normal Format Data of Module 11
0x306~312	774~786	Default CMD 3 Normal Format Data of Module 12
0x313~31F	787~799	Default CMD 3 Normal Format Data of Module 13
0x320~32C	800~812	Default CMD 3 Normal Format Data of Module 14
0x32D~339	813~825	Default CMD 3 Normal Format Data of Module 15

4.2.5 Input Data Area – Module Error Record Data

The HRT-711 records the latest 3 error when HART communication has error. These 3 records are put in the module error record. The format of each record is shown as following table.

Byte 0	The length of send data
Byte 1~53	The record of send data
Byte 54	The length of receive data
Byte 55~109	The record of receive data
Byte 110~113	The time stamp record
Byte 114~115	Reserved

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description
0x33A~373	826~883	Module Error Record 1
0x374~3AD	884~941	Module Error Record 2
0x3AE~3E7	942~999	Module Error Record 3

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4.2.6 Input Data Area – Default CMD 0&3 Status Data

It consists of two bytes. The first byte is the state of Default CMD 0 and the second byte is the state of Default CMD 3.

Ex: If the value is 0x0100 for the MB address 1000, then the low byte of the 1000 is 0x00 and the high byte of the 1000 is 0x01. It means the error status of Default CMD 0 is 0x00 and the error status of Default CMD 3 is 0x01 in Module 0.

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description
0x3E8	1000	Default CMD 0&3 status of Module 0
0x3E9	1001	Default CMD 0&3 status of Module 1
0x3EA	1002	Default CMD 0&3 status of Module 2
0x3EB	1003	Default CMD 0&3 status of Module 3
0x3EC	1004	Default CMD 0&3 status of Module 4
0x3ED	1005	Default CMD 0&3 status of Module 5
0x3EE	1006	Default CMD 0&3 status of Module 6
0x3EF	1007	Default CMD 0&3 status of Module 7
0x3F0	1008	Default CMD 0&3 status of Module 8
0x3F1	1009	Default CMD 0&3 status of Module 9
0x3F2	1010	Default CMD 0&3 status of Module 10
0x3F3	1011	Default CMD 0&3 status of Module 11
0x3F4	1012	Default CMD 0&3 status of Module 12
0x3F5	1013	Default CMD 0&3 status of Module 13
0x3F6	1014	Default CMD 0&3 status of Module 14
0x3F7	1015	Default CMD 0&3 status of Module 15
0x3F8~419	1016~1049	Reserved

High ByteLow ByteCMD 3 StatusCMD 0 Status

4.2.7 Input Data Area–User CMD Error Status

The HRT-711 supports maximum 100 User CMDs. The index of the User CMD is from 0 to 99. Each Modbus address represents two User CMD statuses.

Ex: If the value is 0x0200 for the MB address 1050, then the low byte of the 1050 is 0x00

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and the high byte of the 1050 is 0x02. It means the error status of User CMD Index 0 is 0x00 and the error status of User CMD Index 1 is 0x02.

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description
0x41A~44B	1050~1099	User CMD Index 0~99 error status

4.2.8 Input Data Area – Module Hardware Data

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description
0x44C~44D	1100~1101	Module ID (An ASCII value to represent HART)
0x44E~455	1102~1109	Module Name (An ASCII value to represent the
		16-byte module name)
0x456~459 1	1110~1113	Module Firmware Version (An ASCII value to
		represent the 8-byte firmware version)
0x45A~47D	1114~1149	Reserved

4.2.9 Input Data Area – Through Mode Data

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Desc	cription
		High Byte	Low Byte
0x47E	1150	Receive count in through mode	Send count in through mode
		High Byte	Low Byte
0x47F	1151	Reserved	Receive error count in through mode
0x480	1152	Receive length in throu	ıgh mode
0x481~50E	1153~1294	Receive data in throug	h mode
0x50F~513	1295~1299	Reserved	

4.2.10 Input Data Area – Default CMD 3 Simple Format Data

When configure HRT-711 default CMD 3 to simple format, the data of Modbus address for each HART device is shown as following table.

Byte 0	Byte 1	Byte 2	Byte 3		
Primary Variable	e of HART device	(In IEEE 754 form	at)		
Byte 4Byte 5Byte 6Byte 7					
Secondary Variable of HART device (In IEEE 754 format)					

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Byte 8	Byte 9	Byte 10	Byte 11			
Tertiary Variable	of HART device (In IEEE 754 form	at)			
Byte 12Byte 13Byte 14Byte 15						
Quaternary Variable of HART device (In IEEE 754 format)						

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description
0x514~51D	1300~1309	Default CMD 3 Simple Format data of Module 0
0x51E~527	1310~1319	Default CMD 3 Simple Format data of Module 1
0x528~531	1320~1329	Default CMD 3 Simple Format data of Module 2
0x532~53B	1330~1339	Default CMD 3 Simple Format data of Module 3
0x53C~545	1340~1349	Default CMD 3 Simple Format data of Module 4
0x546~54F	1350~1359	Default CMD 3 Simple Format data of Module 5
0x550~559	1360~1369	Default CMD 3 Simple Format data of Module 6
0x55A~563	1370~1379	Default CMD 3 Simple Format data of Module 7
0x564~56D	1380~1389	Default CMD 3 Simple Format data of Module 8
0x56E~577	1390~1399	Default CMD 3 Simple Format data of Module 9
0x578~581	1400~1409	Default CMD 3 Simple Format data of Module 10
0x582~58B	1410~1419	Default CMD 3 Simple Format data of Module 11
0x58C~595	1420~1429	Default CMD 3 Simple Format data of Module 12
0x596~59F	1430~1439	Default CMD 3 Simple Format data of Module 13
0x5A0~5A9	1440~1449	Default CMD 3 Simple Format data of Module 14
0x5AA~5B3	1450~1459	Default CMD 3 Simple Format data of Module 15

4.2.11 Output Data Area

Modbus Addr (Hexadecimal)	Modbus Addr (Decimal)	Description	
0x0~1F3	0~499	User command	
0x1F4	500	High Byte Reserved	Low Byte Reset module state function ⁽¹⁾
0x1F5	501	High Byte Reserved	Low Byte Auto Polling function ⁽²⁾

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0x1F6	502	High Byte The index of trigger command ⁽³⁾	Low Byte Output Trigger function ⁽³⁾
0x1F7~1F9	503~505	Reserved	
0x1FA~76B	506~1899	Reserved (For Module	Configuration)
0x76C	1900	High Byte C Reserved ir	Low Byte Channel selection In through mode
0x76D	1901	Send data length in thr	ough mode
0x76E~7FB	1902~2043	Send data in through n	node

- NOTE 1 : When write the value greater than zero, the module will clear module request count, module response count, module error count, module error status and set module error command index to 255. To complete reset procedure, user has to write 0 to this field.
- NOTE 2 : When set the value to be 1, the module will execute all HART polling commands automatically.
- NOTE 3 : If change the value, the module will refer to the index value (0~99, 255 is for through mode) of trigger command to execute the corresponding user command.
 Ex: If the index of trigger command is 0 and the output trigger function value is 1, when change the value of output trigger function from 1 to 2, the module will execute the user command (index = 0).

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4.3 Through Mode

In this mode, users can send and receive the HART command directly. Please refer to the below steps.

- Step 1 : Set the Channel to 0. (Through Mode just support channel 0) [Address : 1900, Low Byte]
- Step 2 : Set the Send length [Address : 1901]
- **Step 3**: Set the HART command data. [Address : 1902~2043] Ex: 0xFF 0xFF 0xFF 0xFF 0xFF 0x02 0x80 0x00 0x00 0x82
- Step 4 : Set the Auto Polling to 0. (In this mode, Auto Polling function can not be enabled.) [Address : 501, Low Byte]
- Step 5: Set the The index of trigger command to 255. [Address : 502, High Byte]
- **Step 6**: Get the receive count from Receive count in through mode [Address : 1150, High Byte] and error count from Error count in through mode [Address : 1151, Low Byte].
- Step 7 : Change the Output Trigger function value. [Address : 502, Low Byte]
- **Step 8**: Get the value of Receive count in through mode and Error count in through mode until one of them is different than the last value.
- Step 9: If the Receive count in through mode is different than the last value, the user can get the receive length from Receive length in through mode and the user can get receive data from Receive data in through mode [Address : 1153 ~] according to receive data length. [Address : 1152]

(If the Error count in through mode is different than the last value, it means it can not receive any data.)

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5. Utility

5.1 .NET Framework Installation

The Utility for HRT-711 needs .NET Framework to run. The version of .NET Framework to execute Utility has to greater than 2.0. If users do have this, please ignore this section and jump to section 5.2.

Microsoft .Net Framework Version 2.0 :

http://www.microsoft.com/downloads/details.aspx?FamilyID=0856eacb-4362-4b0d-8edd-aa b15c5e04f5&DisplayLang=en

The .NET Framework install steps are shown in the below :

Step 1 : Press the Next button.



Step 2: Check the "I accept the terms of the License Agreement" and click Install button.



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Step 3 : After finishing the installation, press Finish button to exit.



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5.2 Install HRT-711 Utility

- Step 1 : Download the installation file of HRT-711 Utility from the CD-ROM disk (CD:\hart\gateway\hrt-711\utilities\) or the web site (ftp://ftp.icpdas.com.tw/pub/cd/fieldbus_cd/hart/gateway/hrt-711/utilities/)
- Step 2 : Execute the HRT-711 Utility x.x.x.exe (x.x.x.x is the version of the install package) file to install the Utility, and then click Next button.



Step 3: Click the Next button to continue. If you want to change the installation destination, click Browse button to select the installation path.



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Step 4 : Choose the name and the path to install in the Start Menu, and then click Next.



Step 5 : Click Install to start installation

😰 Setup - ICP DAS HRT-711 Utility 🕞	
Ready to Install Setup is now ready to begin installing ICP DAS HRT-711 Utility on your computer.	
Click Install to continue with the installation, or click Back if you want to review or change any settings.	,
Destination location: C:\ICPDAS\HART\HRT-711 Utilty Start Menu folder: ICPDAS	X I
	Σ
< Back [Instal]	Cancel

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Step 6: Wait the installation finish, then check "View Patch Note.txt" if you want and click Finish to complete the installation.



Step 7: Users can execute the Utility in the following path.

Windows XP



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5.3 Introduction of Utility

The HRT-711 has, Ethenet and HART, two interfaces. The Utility can configure these two interfaces. Users have to choose which interface to configure in the first form of the Utility. User can click the figure to choose interface. The detail of the configuration of these two interfaces will be discuss in the following section.

ľ		
	Please click t	he following figure for related configuration
	Ethernet	
	HART	HART

5.4 Configuration of Ethernet

The Ethernet interface of HRT-711 handles the Modbus/TCP and Modbus/UDP protocol. Users have to configure the interface for appropriate configuration (IP, Sub-net mask····etc) for using. Click Search Servers in this form to search all ICPDAS devices.



The HRT-711 will list in this form after searching. If the HRT-711 does not list in this form, please check the network connection or the power of the HRT-711.

Name	Alias	IP Address	Sub-net M	Gateway	MAC Address
HRT-711	HRT-711	192,168,255,1	255.255.0.0	192.168.0.1	00:0d:e0:8f:ff:ff
< A	reh Conuere	Carliauratia	, (ID2)	Web	Evit

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Users can configure the network parameters by double clicking HRT-711 in the list. Users can modify the parameters to appropriate setting for users' application, then click OK button to apply the new setting.

Configure Server (I	mn)					×
Server Name :	HRT-711					
DHCP:	0: OFF	•	Alias:	HRT-711	[7 Chars]	
IP Address :	192.168.255.1	_	MAC:	00:0d:e0:88.8	EN .	
Sub-net Mask :	255.255.0.0	_	Warning!	and Mathematic Ad	ministrator to our	
Gateway :	192.168.0.1		correct o	onfiguration be	fore any changing	ngt
				ок	Cance	

After assigning parameter, user can click Exit to exit the Network Configuration form.

5.5 Configuration of Modbus to HART

The HRT-711 is the Modbus/TCP and Modbus/UDP to HART gateway. It not only has to configure the Ethernet but also the HART interface.

NOTE : Before configuring HART interface, users have to switch the Init Mode switch to Init then power cycle the HRT-711.



The HART configuration form can devide into 5 parts. These 5 parts are Traffic Light, Current Config Module Name, Connection Status, Connection Controll and Tools. The following section will describe each part and functionalities.

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5.5.1 Traffic Light

Sign	Status
-	The Com port of PC has not opened yet
-	The Com port of PC has opened and tried to connect to the module
1	The PC connects to module successfully

5.5.2 Current Config Module Name

The Current Config Module Name displaies the current module name to configure. This Utility also supports HRT-711. So, the Current Config Module Name helps users to know what module is under configuring.

5.5.3 Connection Status

Figure	Status
®, -⊖- 8	The Com port of PC has not opened
	The Com port of PC has opened and tried to connect to the module
N8	The PC connects to the module successfully

5.5.4 Connection Control

Button	Function
S Connect	When clicks this button, the PC will open the Com port
Connect	and try to connect to the module.
Disconnect	When clicks this button, the PC will break the connection
S Disconnect	of the module and close the Com port.

5.5.5 Tools

The Utility contains many tools for configuration and debug. The following table lists all tools and its functionalities.

ΤοοΙ	Functionality
Communication	Communication Setting
Settings	The Com Port setting for the PC

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ΤοοΙ	Functionality
Device	Device Information
Information	Display the configuration of the device
Device	Device Configuration
Configuration	Change the configuration
Default Output Data	Default Output Data The configuration for boot-up default output of User CMD
Address	Address Map
Map	Display the Modbus Address mapping of User CMD
Device	Device Diagnostic
Disgnostic	Display current status of HART command of the module
Through	Through Mode
Mode	Send/Receive the HART command
Format	Format Translation
Translation	Translate Packed ASCII and IEEE 754 format

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5.5.5.1 Communication Settings

User can choose what device to configure. In this manual, please select HRT-711 in the dropdown list, and then select the Com Port number connected to HRT-711.

Com Port Se	tting		
Device : Setting Port N	HRT-710/310 HRT-710/310 HRT-711 ium : COM13		
		OK	Cancel

5.5.5.2 Device Information

Device Information			+	
 HRT-711 → HART Device 0 → Default CMD(0) → Default CMD(2) → User CMD(1) → User CMD(2) → User CMD(12) → User CMD(13) → User CMD(14) → User CMD(15) → User CMD(16) → User CMD(16) → User CMD(17) → User CMD(18) → User CMD(19) 	Item Module Name [System Info] HART Device Count User Crud Count Crud Interval (ms) Crud Timeout (ms) Auto Polling Retry Count [Modbus Info] Swap Mode	Value System 1 11 1000 1000 Enable 3 None		

It shows the configuration of the module. When clicking the left item, it will show the item data in the right side. About the data of these items is shown as following table.

Node	Mouse	Behavior		
HRT-711	Left Click	Display configuration		
Queters	Left Click	Display configuration		
System	Right Click ⁽¹⁾	Generate Pop-up menu Basic Operation and Advanced		

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Node	Mouse	Behavior	
		Operation	
HART Device N	Left Click	Display configuration	
Default	Left Click	Display configuration	
CMD (N)	Right Click ⁽²⁾	Generate Pop-up menu Basic Operation and Advanced Operation	
User	Left Click	Display configuration	
CMD (N)	Right Click ⁽²⁾	Generate Pop-up menu Basic Operation and Advanced Operation	

- (1) When right clicking the item of System, it will generate a pop-up menu. The functionalities of the menu will describe below :
 - Basic Operation

System IO Data		
System Output status reset : auto polling : manual trigger :	Disable Enable Disable Construction Disable Construction Disable Construction Construction	
System Input	or commune (0~255).	Send Data
State Machine : I Request Count : Response Count Error Count : 0 Error Status : No Error index of us	DIDLE 160 160 error er command : 255	X
		Update

System Output				
	When set the item to Enable, the module will clear module request count,			
status reset	module response count, module error count, module error status and set			
	module error command index to 255			
	When set the item to Enable, the module will execute all HART polling			
	commands automatically			
manual	When set the item to Enable, the module will execute the user command			
trigger	once according to the value of trigger index of user command field			
trigger index	If users want to execute user command by manual mode, users must set			
command	the index value first			
Send Data	When click the button, it will update data in the System Output area to			
button	module			
System Input				

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	System Output					
State Machine	It will show the state machine of module					
Request Count	It will show the request count of HART UserCmd					
Response Count	It will show the response count of HART UserCmd					
Error Count	It will show the response error count of HART UserCmd					
Error Status	It will show the error status of HART UserCmd					
Error index of user command	It will show the latest HART UserCmd that has error happened. If the index value is 255, it means no error happened					
Update button	When click the button, it will update System Input data from the module					

Advanced Operation

0 Data											
Module name : System Color available unavailable selected											
Output Da	ta.										
Addr	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^
0~9	0	0	1	0	0	0	0	0	0	0	
10~19	0	0	0	0	0	0	0	0	0	0	
20~29	0	0	0	0	0	0	0	0	0	0	
30~39	0	0	0	0	0	0	0	0	0	0	
40~49	0	0	0	0	0	0	0	0	0	0	~
<	Image: A state of the state										
									Se	nd Data	
Input Dat	a										
Addr	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^
0~9	4	6	5	0	0	255	0	0	0	0	
10~19	0	0	0	0	0	0	0	0	0	0	
20~29	0	0	0	0	0	0	0	0	0	0	
30~39	0	0	0	0	0	0	0	0	0	0	
40~49	0	0	0	0	0	0	0	0	0	0	~
<	_	_			Ш	_	_)>	
										Ipdate	

Output Data

It has 6 bytes data. When click the Send Data button, it will send the output data to module. (Modbus Address: 500~502 in Output Data Area)

Input Data

It has 6 bytes data. When click the Update button, it will update the data from module. (Modbus Address: 500~502 in Input Data Area)

(2) When right clicking the item of Default or User CMD, it will generate a pop-up menu. The functionalities of the menu will describe below :

Basic Operation

In this function, only supports HART command 0, 1, 2, 3, 6, 11, 12, 13, 14, 15, 16, 17, 18, 19 and the different HART command will show the different user command

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С	ommand 0 IO Data				Command 6 IO Data	
	Information : Read Uniq Manufacturer : Preambles Number : Transmitter Revision : Hardware Revision : Device ID :	ue Identifier Hartmann_and_Braun(22) 7 2 8 723522	Device Type Code : Command Set Revision : Software Revision : Flag :	133 5 11 2	Information : Write Polling Address-Request Polling address (0~15) : D Information : Write Polling Address-Response Polling address : 0	Send
		Sho	w Long Frame Address	Update	- unity water.	Update

window (EX: The window of HART command 0 and 6 is shown as below).

Advanced Operation

Users can wirte/read HART command/response via this form. In this form, there are two buttons Send Data and Update. When click the Send Data button, it will send the output data to the module. And when click this button, it will update the input and output data from the module.

NOTE : About the Input data area of user command, the first 2 bytes are response code1 and code2 of HART command and the left bytes are the HART command data.

e	u	navaila	able		selecte	d				
-1										
D1 I	_									
-1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	~
			1						>	
								Se	nd Dat	a
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^
0	0	254	22	133	7	5	2	11	8	
2	11	10	66	0	0	0	0	0	0	
•	0	0	0	0	0	0	0	0	0	
U							-			
0	0	0	0	0	0	0	0	U	U	
	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 11	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 254 2 11 10	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 1 0 0 0 25 21 133 1 10 66 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 7 2 11 10 66 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 254 22 133 7 5 1 10 66 0 0 0 0	0 0	0 0	0 0

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5.5.5.3 Device Configuration

Device Configuration		
 □ HRT-711 □ System □ HART Device 0 □ Default CMD(0) □ Default CMD(3) □ User CMD(1) □ User CMD(2) □ User CMD(2) □ User CMD(12) □ User CMD(13) □ User CMD(14) □ User CMD(15) □ User CMD(16) □ User CMD(16) □ User CMD(17) □ User CMD(18) □ User CMD(19) 	Item Module Name [System Info] HART Device Count User Cmd Count Cmd Interval (ms) Auto Polling Auto Polling Retry Count [Modbus Info] Swap Mode	Value System 1 11 1000 1000 Enable 3 None
	Operation Load From File Load Save to File Sa	A From Device Load Default Setting

It will show the system configuration of HRT-711 and users can also configure HRT-711 here. When clicking the left items, it will show the corresponding item information in the right side of window. The following is detailed description.

Node	Mouse	Behavior			
HRT-711	Left Click	Display configuration			
Sustam	Left Click	Display configuration			
System	Right Click ⁽¹⁾	Generate Pop-up menu Edit and Add Module			
HART Device N	Left Click	Display configuration			
Default	Left Click	Display configuration			
CMD (N) Right Clicl		Generate Pop-up menu Edit Delete and Add Command			
User	Left Click	Display configuration			
CMD (N)	Right Click ⁽³⁾	Generate Pop-up menu Edit and Delete			

- (1) When right clicking the item of System, it will generate a pop-up menu. The functionalities of the menu will describe below :
 - Edit

System Edit	
System Cmd Interval (75~65535 ms) : 1000 Auto Polling : Enable Modbus Setting Swap Mode : None	Timeout Value (305~65535 ms) : 1000 Retry Count (0~5) : 3
	OK Cancel

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It is used to set the communicating parameters of HART and Modbus and described as below.

System							
Cmd Interval	The polling interv	The polling interval of HART Cmd					
Timeout Value	The timeout value	The timeout value of HART Cmd.					
	If the function is enabled, the HRT-711 will execute all HART polling						
Auto Polling	Cmd automatically.						
Dotry Count	When HART cor	nm. error happ	ened, the	e HRT-711	will re-send the		
Retry Count	HART Cmd for Re	etry count times					
Modbus Setting							
It is used for the format of the word data in Modbus. The optio					s. The option are		
	None / Byte / Word / W&B.						
	Ex : 2 words data (0x1234, 0x5678) from HRT-711. Users can set the						
	swap mode for different data format.						
Swap Mode		Swap Mode	D	ata			
		None	0x1234	0x5678			
		Byte	0x3412	0x7856			
		Word	0x5678	0x1234			
		W&B	0x7856	0x3412			

Add Module

Module	0	(572)	Auto Confirment	Diviti	00782	Environment	Long	-
Channel :	U	*	Auto Configure :	Disable	~	Frame type :	POILS	×
Master type	Primary Master	*	Network mode :	Multidrop	*	Address :	0	
Preambles :	5		Cmd 0 mode :	Initial	~	Cmd 3 mode :	Polling	~
Unique Ide	entifier ntifier automaticall	XI						
Manufactu	rer ID : 22		Device type :	133		Device ID :	723522	

It is used to set the communicating mode for HART devices and described as below.

	Module
Channel	0~7. (Only channel 0 supports now)
Auto	If enables this function, the HRT-711 will detect the frame type,
Configure	address, preambles, manufacturer ID, device type and device ID of

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	HART device automatically
	Warning:If enables this function, just supports HART Point to Point
	mode
Frame type	Short or Long frame
Mastar type	Primary or Secondary Master
Master type	Warning : In general, the HRT-711 should set to the Primary Master
	Point to Point or Multi-drop mode.
Network mode	Point to Point : Only one HART slave device in HART bus
	Multi-drop : More than one HART devices can be in HART bus
	0~15 °
Address	Warning: If the address of HART device is 0, it means in Point to
	Point mode
Preambles	5~20
Cmd 0 Mdoe	Disable(1) / Initial(2) / Polling(3)
Cmd 3 Mdoe	Disable(1) / Initial(2) / Polling(3)
	Unique Identifier
	If the frame type of HART slave device is long frame, users can
Auto Get Unique ID	enable this function to get unique ID automatically by short frame
•••••	address
Manufacturer	Users can set the manufacturer ID for HART device. If the frame type
ID	is short, users can omit this setting
	Users can set the device type for HART device. If the frame type is
Device Type	short, users can omit this setting
	Users can set the device ID for HART device. If the fram type is
	short,users can omit this setting

- 1. Disable : The HRT-711 will not execute the default HART Cmd
- 2. Initial : The HRT-711 will execute the default HART Cmd automatically when in Initial mode.
- 3. Polling: The HRT-711 will execute the default HART Cmd automatically when in Operation mode.
- (2) When right clicking the item of HART Device N, it will generate a pop-up menu.The functionalities of the menu will describe below :
 - Edit

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Same as the selection Add Command in the pop-up menu when right click System, please refer to that section.

Delete

Delete current selected module

Add Command

Command Edit		
Command Command Num. : 158 In Size : 6 In Offset : 3	Mode : Polling 💌 Out Size : 0	Format : Normal 💌
		OK Cancel

It is used to set the communicating parameter for HART User CMD. The details are described as below :

	Command
Command Num	Set the HART command number
Mode	Initial ⁽¹⁾ / Polling ⁽²⁾ / Manual ⁽³⁾
Format	Normal ⁽⁴⁾ / Simple ⁽⁵⁾ (Data exchange format between HART and
Format	Modbus)
	Set the input data length of HART command.
In Sizo	Note: The size includes 2 bytes response code and data size of
	HART command. (Ex: HART Cmd 0 = 2(response code) +12
	=14)
Out Size	Set the output data length of HART command.
In Offect	Set the input offset of HART returned command data.
	(HG_Tool v1.5.0 or newer supported, refer to example FAQ26)

- 1. Initial : The module will run this command in initial mode
- 2. Polling : The module will run this command in operation mode
- 3. Manual : The module will run this command by manual
- 4. Normal : When read / write HART data by Modbus, the data format is HART standard command format

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- 5. Simple : When read / write HART data by Modbus, the data format is simple format defined by HRT-711. The detailed description, please refer to the Appendix B. (In this mode, the HMI or SCADA software can read or write HART data and don't need to process any data. Now, it is only supported HART command number: 1, 2 and 3.)
- (3) When right clicking the item of User CMD (N), it will generate a pop-up menu. The functionalities of the menu will describe below :
 - Edit

Same as the selection Add Command in the pop-up menu when right click HART Device N, please refer to that section.

Delete

Delete current selected User CMD (N)

5.5.5.4 Default Output Data

It is used to set the default value for all UserCMD output data.

- (1) Click the left User CMD item and if the output length of the User CMD is not zero, then the occupied address will be blue in the right window.
- (2) Double click the address field and it will show the Data Edit window to set the default value.

When finished all configuration, click Save to Device button to apply all settings. (The module will reboot when click Save to Device button)

Default Output Data (For User CMD) 😝 🗐 🔂												
☐ HRT-711 — System — HART Device 0 — User CMD(1)	Color Default V	Availa alue	able	Uns	wailab	le	For (Curren	t Cmd	. S	Selected	1
User CMD(2) User CMD(6)	Addr	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^
User CMD(12)	0~9	0	0	0	0	0	0	0	0	0	0	
User CMD(13)	10~19	0	0	0	X	0	0	0	0	0	0	
User CMD(15)	20~29	0	0	0	0	0	0	0	0	0	0	
User CMD(17)	30~39	0	0	0	0	0	0	0	0	0	0	
User CMD(19)	4(5) Dat < F Ope Load Fro	a Edi lease i m File	t nput t	the nur Q	nber (m Dev	(0~25 DK vice Sav	5): 	Cau	ncel	ve to I	0 0 Reset	

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5.5.5.5 Address Map

It is used to show the MB address for all User CMD.

- (1) Click the left User CMD item and the occupied address of the User CMD will be blue in the right Modbus AO or Modbus AI table.
- (2) The data of Modbus AI table can be read by Modbus Function Code 4.
- (3) The data of Modbus AO table can be read by Modbus Function Code 3 and written by Modbus Function Code 6 or 16.
- NOTE : The Modbus address of the default command is fixed, so users can refer to section 4.2 to get the address.

Address Map (For User CMD)			
 HRT-711 System HART Device 0 User CMD(1) User CMD(2) User CMD(1) User CMD(12) User CMD(13) User CMD(13) User CMD(14) User CMD(15) User CMD(17) User CMD(17) User CMD(18) User CMD(19) 	Addr LB HB 0 0 1 0 1 0 2 0 3 0 4 0 5 0 6 0 7 0 8 0 9 0 10 0	xilable for current cmd Modbus AI Addr Li 0 1 2 3 4 5 6 7 8 9 10 11	

5.5.5.6 Device Diagnostic

It is used to show the status of HART command in the HRT-711.

(1) Click the left User CMD item and the icon of the item will show the status described as below :

Figure	Status
	It means no error
1	It means the command has never been executed
2	It means the command has error and the error
3	status shows at the right side of the window
H	It means the item is selected

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- (2) Status Update button : Refresh the status of HART Cmd
- (3) Record button : The HRT-711 records the latest error command and saves to Record 1~3. Users can get these records by click Record 1, Record 2 and Record 3 button.

Device Diagnostic			
HRT-711 HART Device 0 Oefault CMD(0) Default CMD(3) User CMD(1) User CMD(2) User CMD(2) User CMD(12) User CMD(12) User CMD(13) User CMD(14) User CMD(15) User CMD(16) User CMD(17) User CMD(18) User CMD(19)	Item Module Name State Machine [User CMD] Request Count Response Count Error Count Latest Error Status Error Index of Command	Value System Wait to Receive 0 0 No Error No Error No Error	
Operation Auto Status Update	Error Record Record 1	Record 2	Record 3

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5.5.5.7 Through Mode

It is used to send / receive HART command directly. Users have to check the items below before using through mode function.

(1) The RUN LED is always on.

(2) The auto polling function is disabled.

Here is an example to send / receive HART command 0 :

Step 1 In Send field, fill in the data"0xFF 0xFF 0xFF 0xFF 0xFF 0xO2 0x80 0x00 0x00" and then click Send button to send HART Cmd.

Step 2 Click Update button to show the response of HART device.

Through Mode	
Send Data Channel : 0	Send
With Parity Check	
FF FF FF FF FF 02 80 00 00 82	
	~
	Clear
Receive Data	
Receive Count : 1 Error Count : 0 Receive Length : 24 Receive Data : 0xFF 0xFF 0xFF 0xFF 0x06 0x80 0x00 0x0E 0x00 0x00 0xFE 0x16 0x85 0x07 0x05 0x02 0x0B 0x08 0x02 0x0B 0x0A 0x42 0xA7	
	Update

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5.5.5.8 Format Translation

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.

Features	Description
	It can be used to convert between Packed ASCII and ASCII format Packed ASCII Translate Packed ASCII 3 Packed ASCII 6 Packed ASCII 12 Packed ASCII 24
Packed ASCII Translate	Message Packed ASCII data mSG ⇒ format: • decimal #0: 53 #0: 53 #1: 49 #2: 224 #3: 0 #4: 0 #5: 0 #6: 1 #12: 0 #13: 0 #14: 0 #16: 0 #18: 1 #19: 1 #20: 1 #21: 0 #22: 0
IEEE 754 Translate	It can be used to convert between IEEE754 and DWORD format IEEE754 Translate IEEE 754 float Byte data format : decimal 100.78 #0: 42 #1: C9 #2: 8F #3: 5C

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6. FAQ

Q01 : How to add HART devices to HRT-711 ?

- 1. Add first HART device: (Ex: Add <u>ABB AS800</u> HART device)
 - [Step 1] Connect to HRT-711 and use "HRT-711 Utility" to start configuration
 - (1) Select HART in the first page of the Utility and switch operation mode to Init.



- (2) Selecting device to HRT-711 and switching to appropriate com port in the Communication Setting, and then click OK
- (3) Click the "Connect" button to connect HRT-711 module

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*	Communication Settings	Device Information	Device Configuration
Com Port Setting Device : HRT-711 Setting Port Num : COM1			Cancel
Connect	Through Mode	Format Translation	
Supported Modules: HRT-710), HRT-711	by ICP DAS	

[Step 2] Deleting the default HART device setting in HRT-711

Once successfully connected to HRT-711, the traffic light indicator will change to green (\clubsuit) to indicate that the Utility can start configuring HRT-711. Now, users will need to delete the default configuration by clicking Device Configuration option on the right side of the Utility. Follow the figure below to delete the default configuration for preparing add a new HART device.



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[Step 3] Add the new HART device setting

Users can now adding new HART device by right clicking System item.

						1
			System Ed	it		
			Ad	d Module		
v Module						
🗸 Easy Mode						
Module						
HART Ch. :	0	-	Auto Configure :	Enable	-	Frame Type : Long
Master Type :	Primary Master	•	Network Mode :	Point to Point	•	Address : 0
Preambles :	5		Cmd 0 Mode :	Initial	~	Cmd 3 Mode : Polling
Unique Identi	ifier					
📃 Auto Get	Unique ID					
	r ID : 22		Device Type : 1	33		Device ID : 723522
Manufacture						

[Step 4] Save the HART device setting to HRT-711

(1) Click the "Save to Device" button to save the new HART device setting to HRT-711

	\bigcirc	
Item	Value	
Module Name	HRT-711	
Firmware Version	¥1.01	
Operation		
Load From File Loa	d From Device	oad Default Setting
Save to File Sa	ve to Device	
	Item Module Name Firmware Version	Item Value Module Name HR T-711 Firmware Version V1.01 Operation Load From File Load From File Load From Device Save to File Save to Device

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2. Add more than one HART devices : (Ex : Add ABB AS800 (Addr=2) and Foxboro I/A Pressure (Addr=1) HART devices)

[Step 1] Follow the previous step to delete default configuration

[Step 2] Add two new HART device setting

The following figures are the settings for these two HART devices.

w Module				_	
🔽 Easy Mode					
Module					
HART Ch. :	0	Auto Configure :	Disable	-	Frame Type : Long 👻
Master Type :	Primary Master	✓ Network Mode : [Multidrop	•	Address : 1
Preambles :	5	Cmd 0 Mode :	Initial	*	Cmd 3 Mode : Polling 🛛 👻
Unique Identi	ifier				
📝 Auto Get	Unique ID				
Manufacture	r ID : 22	Device Type : 13	3		Device ID: 723522
					OK Cancel
			-		
w Module		-	-		
w Module				-	
w Module			-	-	
w Module V Easy Mode Module	~				
w Module Easy Mode Module HART Ch. :	0	- Auto Configure : [Disable	*	Frame Type : Long
w Module Easy Mode Module HART Ch. : Master Type :	0 Primary Master	 Auto Configure : [Network Mode : [Disable Multidrop	-	Frame Type : Long Address : 2
W Module Easy Mode Module HART Ch. : Master Type : Preambles :	0 Primary Master 5	 Auto Configure : Network Mode : Cmd 0 Mode : 	Disable Multidrop Initial	-	Frame Type : Long Address : 2 Cmd 3 Mode : Polling
W Module Easy Mode Module HART Ch. : Master Type : Preambles : Unique Ident	0 Primary Master 5 ifier	 Auto Configure : Network Mode : Cmd 0 Mode : 	Disable Multidrop Initial	* * *	Frame Type : Long Address : 2 Cmd 3 Mode : Polling
w Module Easy Mode Module HART Ch. : Master Type : Preambles : Unique Identi Auto Get	0 Primary Master 5 ifier Unique ID	 Auto Configure : Network Mode : Cmd 0 Mode : 	Disable Multidrop Initial	*	Frame Type : Long Address : 2 Cmd 3 Mode : Polling
w Module Easy Mode Module HART Ch. : Master Type : Preambles : Unique Identi Auto Get Manufacture	0 Primary Master 5 ifier Unique ID r ID : 22	 Auto Configure : Network Mode : Cmd 0 Mode : Device Type : 13. 	Disable Multidrop Initial	•	Frame Type : Long Address : 2 Cmd 3 Mode : Polling
w Module Easy Mode Module HART Ch. : Master Type : Preambles : Unique Ident Auto Get Manufacture	0 Primary Master 5 ifier Unique ID r ID : 22	 Auto Configure : [Network Mode : [Cmd 0 Mode : [Device Type : 13 	Disable Multidrop Initial	•	Frame Type : Long Address : 2 Cmd 3 Mode : Polling ~

[Step 3] Save the HART device setting to HRT-711

(1) Click the "Save to Device" button to save the new HART device setting to HRT-711

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Q02 : How to make sure that HRT-711 gets the HART device data correctly ?

After adding HART device setting to HRT-711 module (refer to Q01), then users can follow the following steps.

(1) Make sure HRT-711 and Utility are well connected and then click "Device Information" button

	Device Information		
	HRT-711	Item	Value
D	HART Device 0	Module Name Firmware Version	HRT-711 V1 01
Device Information	Default CMD(3)		

[Check I/O Data of the Default CMD(0)]

(2) Right click the button on the "Default CMD(0)" item and choose the "Basic operation" option to open the "I/O Data" screen of the "Default CMD(0)"

Device Information			
HRT-711		Item	Value
HART Device 0	00	Commnad Name HART Device Index	Default CM 0
Default CMI	Basic op	peration	0
	Advance	ed operation	Initial Normal
		Cmd In Size	14
		Cmd Out Size Cmd In Address Cmd Out Address	0 1012 0

(3) The following figure shows I/O Data of the "Default CMD(0)" is OK and NG

C	ommand 0 IO Data	i for head		
	Information : Read Uniqu	e Identifier		
	Manufacturer ID Code :	Hartmann_and_Braun(22)	Device Type Code :	133
	Preambles Number :	7	Universal Cmd Revision :	5
	Device Cmd Revision :	2	Software Revision :	11
	Hardware Revision :	8	Flags :	2
	Device ID :	723522		
		Sho	w Long Frame Address	Update

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Co	mmand 0 IO Data	-		• X
	Information : Read Uniqu	e Identifier		
	Manufacturer ID Code :		Device Type Code :	0
	Preambles Number :	0	Universal Cmd Revision :	0
	Device Cmd Revision :	0	Software Revision :	0
	Hardware Revision :	0	Flags :	0
	Device ID :	0		
			Show Long Frame Address	Update

[Check I/O Data of the Default CMD(3)]

(4) Right click the button on the "Default CMD(3)" item and choose the "Basic operation" option to open the "I/O Data" screen of the "Default CMD(3)"

Device Informati	ion			
HRT-711		Item		Value
HART De	evice 0	Commnad	l Name	Default Cl
Defai	ult CMD(0)	HART De	vice Index	0
Defat	Defar		<u>р.</u>	
	Basic operation	on	ode	Polling
	Advanced op	peration	umat	Normal
		Cma in Si	ze	26
		Cmd Out	Size	0
		Cmd In A	ddress	1236
		Cmd Out	Address	0

(5) The following figure shows I/O Data of the "Default CMD(3)" is OK and NG

Con	nmand 3 IC	Data	Ľ		X
	Information :	Read Dynamic Variable	s and PV Cu	ment	
	PV Current	4.00070190429688	PV 1 Unit	kPA	
	PV 1 Value	0.000595808029174	PV 2 Unit	degC	
	PV 2 Value	26.091739654541	PV 3 Unit	Percent	
	PV 3 Value	0.004386901855468	PV 4 Unit	???	
	PV 4 Value	0			
	Auto Update				
	Start	Stop Inte	rval (s) : 1		Update

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Command 3 IC) Data	\Leftrightarrow	
Information :	Read Dynamic Variable	es and PV Current	
PV Current	0	PV 1 Unit ???	
PV 1 Value	0	PV 2 Unit - ???	
PV 2 Value	0	PV 3 Unit - ???	
PV 3 Value	0	PV 4 Unit - ???	
PV 4 Value	0		
Auto Update			
Start	Stop Inte	erval (s) : 1	Update

(6) After testing the I/O data of the "Default CMD(0)" and "Default CMD(3)", when the result is ok, it means that the communication between HRT-711 and HART devices is ok.

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Q03 : How to map HART device CMD(3) data directly to SCADA or HMI ?

- (1) Make sure that the connection between HRT-711 and HART device is good. (Refer to Q02)
- (2) Set "Swap Mode" of system setting in HRT-711 to be "W&B".
 - [1] In "Device Configuration" screen, right click the button of mouse on "System" item and click the "Edit" option to open "System Edit" screen like Figure 3-1

Device Configuration
HRT-711 Item Value Add Module Module Name System HART Device Count 1 User Cmd Count 0 Cmd Interval (ms) 1000 Cmd Interval (ms) 1000 Auto Polling Enable Retry Count 3 [Modbus Info] Swap Mode None Operation Load From File Load Default Setting Save to File Save to Device Load Default Setting

Figure 3-1 Open "System Edit" screen

[2] Set the "Swap mode" item to be "W&B" and click "OK" button like Figure 3-2

stem Edit	
System	1000
Cmd Interval (75~65535 ms) : 1000	Timeout Value (305~65535 ms) : 1000
Auto Polling : Enable 🔹	Retry Count (0~5) : 3
Modbus Setting	
Swap Mode : 🛛 🛛 👻 👻	
	OK Cancel



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[3] Click the "Save to Device" button to save the new system setting to HRT-711 like Figure 3-3

Device Configuration		\Leftrightarrow	
HRT-711	Item Module Name [System Info] HART Device Count User Cmd Count Cmd Interval (ms) Auto Polling Retry Count [Modbus Info] Swap Mode	Value System 1 0 1000 1000 Enable 3 Word & Byte	ed Default Setting
	Save to File	we to Device	

Figure 3-3 "Save to Device" function

- (3) Read HART data by Modbus TCP from HRT-711.
 - [1] The HRT-711 provides the MB Address 1300 ~ 1459 (Default CMD(3)(S) Data for Module 0 ~ 15 in HRT-711 => The detailed information refers to the sector 4.3 of users' manual) and users can map the CMD(3) data of HART device to SCADA directly with these Modbus address 1300 ~ 1459.
 - [2] For the "Default CMD(3)(S) data of Module 0" in HRT-711, the mapped MB address is 1300 ~ 1309. The below MB/RTU client will use the "Modscan" and "Modbus Poll" tool to show the CMD(3) data of HART device by polling Modbus address 1300 ~ 1309.
 - <1> Confirm the connection between Utility and HRT-711 is disconnected.
 - <2> Make sure the HRT-711 is in the Normal operation. (Set the "Dip Switch" on the back of HRT-711 to be "Normal" and reboot HRT-711.)
 - <3> Set the "Display" mode to be "Float" format as Figure 3-4

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🕶 ModScan32 - ModSca	a1			
File Connection Setu	ip <u>V</u> iew <u>W</u> indow <u>H</u> e	elp		
	Data Definition			1
	Display Options	\checkmark	Show Data	
	Extended •		Show Traffic	
Address: 13	Text Capture Dbase Capture		Binary Hex Unsigned Decimal	ls: 430
Length: 10	Reset Ctrs		Integer	Reset Ctrs
			Floating Point	Most Significant Register First
			Double Float 🔸	✓ Least Significant Register First
			Hex Addresses	

Figure 3-4 Modbus display format

<4> Fill the "IP Address" & "Port Number" and click "OK" button to connect to HRT-711, e.g. Figure 3-5

Connection Details		×
Connect Jsing: Remo Configuration Baud Rate: 115 Word Length: 8 Parity: NON Stop Bits: 1	te modbusTCP Service Port:	ver 192.168.255.3 502 Hardware Flow Control Wait for DSR from slave Wait for CTS from slave Wait for CTS from slave DTR Control: Disable Play ms after RTS before transmitting first character Delay ms after last character before releasing RTS
	 OK	rotocol Selections Cancel

Figure 3-5 Connection parameters

<5> The CMD(3) data of HART device is successfully read, e.g. Figure 3-6

	ModScar	32 - ModScal		201	a sure the second of the second second
1	File Comm	ation Cature	View Mindew Hele		
	rie <u>c</u> onne	ection <u>s</u> etup			
		🚺 🖬 🖗	₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽		
	<u>öi</u> 10 Io	× 32 ×	EA EA		
	💼 ModSc	al			
	Address	: 1301	Device Id: 1 MODBUS Point Type	e	Number of Polls: 27 Valid Slave Responses: 27
	Length:	10	04: INPUT REGISTER	•	Reset Ctrs
	31301: 31302:	3.9988			
	31303:	-0.0013			
	31304: 31305:	25.7611			
	31306: 31307:	-0.0074			
	31308: 31309: 31310:	0.0000			

Figure 3-6 The CMD(3) data of HART device

[Note] ModScan designed to use PLC address (Base 1), so the polling address entered needs to be 1301. Users can make sure the actual polling address is [05][14] (1300) by selecting "Show Traffic" of the "Display Option" within "Setup" menu after successful connected, shown as Figure 3-7

ModScan32 - ModSca1
<u>File Connection Setup View Window H</u> elp
🖿 ModSca1
Address: 1301 Device Id: 1 MODBUS Point Type Valid Slave Responses: 413
Length: 20 04: INPUT REGISTER Reset Ctrs
[33][d1][4e][4b][2a][d0][8f][4b][2a][b9][bb][01][04][05][14][00][14][b0][cd][01][[3f][1e][61][17][3f][1e][fa][49][4c][43][ac][68][4c][52][00][00][40][80][5d][79] [4b][2a][d0][8f][4b][2a][b9][bb][01][04][05][14][00][14][b0][cd][01][04][28][53]]

Figure 3-7 The actual polling Modbus address

<6> Check and modify Modbus Poll Address Base types and display formats like Figure 3-8.

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D 🚅 I		⊟≜Inlo	15	Signed	Alt+Shift+S				
			-	Unsigned	Alt+Shift+U				
, Mbp	oll1			Hex	Alt+Shift+H				
Tx = 0: No coni	Err = 0: ID = 1: nection	F = 03: SR = 1	10	Binary	Alt+Shift+B				
	Alias	01300		Long AB CD					
0	1	0		Long CD AB					
1				Long BA DC					
2	0			Long DC BA					
3		0		Float AB CD					
4		0	~	Float CD AB					
5		0		Float BA DC					
6		0		Float DC BA					
7		0		Double AB CD EF GH					
8		0		Double GH EF CD AB					
9		0		Double BA DC FE HG					
_				Double HG FE DC BA					
				PLC Addresses (Base 1)					
			1	Protocol Addresses (Base 0)					
				Error Counters	F11				

Figure 3-8 Address Base types and display formats

<7> Set the "Read/Write Definition" of Modbus Poll like Figure 3-9.

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號 Modbus Poll - Mbpoll1	
File Edit Connection Setup Function	ons Display View Window Help
🗅 🗳 🖬 🎒 🗙 🛅 🗒 🖕 🗖	05 06 15 16 17 22 23 TC 🖭 💡 🌾
Mbpoll1	
Tx = 0: Err = 0: ID = 1: F = 03: SR = No connection	Read/Write Definition
Alias 00000	Slave ID: 1 OK
	Function: 04 Read Input Registers (3x) Cancel
2 0	Address: 1300 Protocol address. E.g. 30011 -> 10
3 0	Quantity: 10
4 0	Scan Rate: 1000 [ms]
5 0	Disable
6 0	Read/Write Disabled
7 0	Disable on error <u>Head/Write Unce</u>
8 0	View
9 0	● 10 ○ 20 ○ 50 ○ 100 ○ Fit to Quantity
	Hide Alias Columns PLC Addresses (Base 1)
	Address in Cell Enron/Daniel Mode

Figure 3-9 "Read/Write Definition" of Modbus Poll tool

[Note] The polling address is 1300 in this case because "Protocal Address (Base 0)" has been selected for Modbus Poll. If "PLC Address Poll (Base 1)" has been selected instead, then the address needs to be set as 1301. Users can make sure the actual polling address is [05][14] (1300) by checking the "Communication" dialog from "Display" menu after successful connected, shown as Figure 3-10

1	Modbus Poll -	Mbpoll1					- 1						_	
	File Edit Con	nection	Setup	Functio	ons (Display	Viev	v V	Vindo	wc	Help			
1.1.1	D 🖻 🖥 🎒	X 🗆	<u>₽</u> @	Л.	05	D6 15	16 1	72	2 23	3 T	c 🖻	🤋	?	
	👺 Mbpoll1								-		X			
	Tx = 60: Err =	0: ID =	1: F = 0	4: SR	l = 10	00ms							_	
1	Communica	tion Traff	ìc	-	_	_	_	-	_	_				
l	Exit	Continu		Clear		Save			Сору			Log		
I	Tx:000-01	04 05	14 00	0A	30 C	:5								
I	Rx:001-01	04 14	00 00	40	80 3	3 33	42	8C	00	00	42	8C	00	C
1	Tx:002-01	04 05	14 00	A 0	30 C	:5								
1	Rx:003-01	04 14	00 00	40	80 3	3 33	42	8C	00	00	42	8C	00	C
		04 OF	14 00	07	30 0	5								
I	Tx:004-01	04 05	14 00	UA	30 0									

Figure 3-10 Polling address from "Communication Traffic"

<8> Set the "Com Port" parameters and click "OK" button to connect to HRT-711 like Figure 3-11.

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뭡 Modbus Poll - Mbpoll1	age as the ad street	
<u>File Edit</u> <u>Connection</u> <u>Setup</u>	F <u>u</u> nctions <u>D</u> isplay <u>V</u> iew <u>W</u> indow <u>H</u> elp	
🖸 🖻 🖶 🎒 🗙 🗖 🗒 🕯	🛓 🕮 🛛 05 06 15 16 17 22 23 TC 🗵	% № ?
💬 Mbpoll1		
Tx = 0: Err = 0: ID = 1: F = 0	3: SR = 1000ms	
No connection	onnection Setup	
Alias		
0	Connection	ОК
1	Serial Port 🔹	Carred
2	Serial Settings	Lancei
3	Prolific USB-to-Serial Comm Port (COM32)	Mode
4	115200 Baud 🔻	💿 RTU 💿 ASCII
5		Response Timeout
6	8 Data bits 👻	1000 [ms]
7	None Parity 🔻	- Delau Between Polls
8	1 Stop Bit	20 [ms]
9		[ma]
	Remote Modbus Server	
	IP Address or Node Name	
	Server Part Connect Timeout	
P	502 3000 [ms]	IPv4
		O IPv6

Figure 3-11 Com Port Parameters of "Modbus Poll" tool

<9> The CMD(3) data of HART device is shown like Figure 3-12.

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쏷	l N	1odbus Poll - Mbp	oll1	-
F	ile	<u>E</u> dit <u>C</u> onnectio	on <u>S</u> etup F <u>u</u> ncti	ons <u>D</u> isplay <u>\</u>
	D	🖻 🖶 🎒 🗙	🔲 🗒 🚊 Гл	05 06 15 16
ſ	<u>19</u>	Mbpoll1		
	Тх	= 746: Err = 0: I	D = 1: F = 04: S	R = 1000ms
L				
L	L	Alias	01300	
L	0		4	
L	1			
L	2		70.1	
L	3			
L	4		70	
L	5			
L	6		70	
L	7			
	8		70	
	9			

Figure 3-12 The CMD(3) data of HART device

[Note] The simple CMD(3) data format and value are shown as below.

Byte Index	Format	Description
00~03	Float	Primary Variable Current
04~07	Float	Primary Variable
08~11	Float	Secondary Variable
12~15	Float	Tertiary Variable
16~19	Float	Quaternary Variable

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Q04 : How to update the firmware of HRT-711 ?

A04: (2018/05/22)

HRT-711 allows user to update firmware of TCP and HART separately. To update firmware please follow the below steps:

[HART Firmware Update]

(1) Download the newest firmware of HRT-711.

(Download from: http://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/gateway/hrt-711/firmware/)

(2) Turn off the power. Set HRT-711 to be "Init" mode and open the upper chassis of HRT-711. Then switch jumper to pin 2 & 3 for JP2 and JP3.



- (3) Using RS-232 cable to connect PC and HRT-711, and then turn on the power. (All LEDs will be off)
- (4) Run "FW_Update_Tool"

(Download from: http://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/gateway/hrt-711/utilities)

- [1] Choose "COM" option and select "Com Port number".
- [2] Click "Browser" button to choose the firmware of HRT-711.
- [3] Click "Firmware Update" button to start firmware update process.
- [4] Wait for "Firmware Update Success" message.

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FW_Update_Tool v1.06	×
1. Download Interface COM COM Port : C USB COM1	www.icpdas.com
2. Firmware Path D:\Work\HART\Product\HRT-711\Firmwar	e\Firmware\H711v101.fw Browser
- 3. Firmware Update Click "Firmware Update" button to start fin	mware updating !! Firmware Update
	Exit

(5) Turn off the power and switch JP2 and JP3 back to pin 1 & 2.



(6) Close the shell and turn on the power of HRT-711. Then users can check the firmware version of HRT-711 by using "HRT-711 Utility".

Device Information		
E-HRT-711	Item	Value
HART Device 0 Default CMD(0) Default CMD(3)	Module Name Firmware Version	HRT-711 V1.01

[TCP Firmware Update]

(1)Download the latest version of eSearch Utility:

http://ftp.icpdas.com/pub/cd/tinymodules/napdos/software/esearch/

(2) Download the latest version of HRT-711 TCP firmware

ftp://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/gateway/hrt-711/firmware/TCP/

(3)Switch the dip-switch of HRT-711 to "Init" Mode

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Please make sure you have switch to "Init Mode"
Then power cycle the HRT-711.

(4)Run eSearch Utility:

<u>File</u> <u>S</u> erver <u>T</u> ools						
Name	Alias	IP Address	Sub-net	Mask	Gateway	MAC Ac
HRT-711	HRT-711	192.168.255.1	255.255	nn	192 168 0 1	UU-U4-6
				9	Ping Server	
				¢	Configure Server (UDP)	
				Ľ	Firmware Update	
					Locate	+
				Ē	Copy to Clipboard	
				_		
∢		III				•
AA				F		

- [1] Select "Search Server"
- [2] Right click "HRT-711"
- [3] Select "Firmware Update"

(5) Choose TCP firmware file (.dat)

檔案名稱(N):	HRT-711_TCP_FWv101.dat	-	firmware file (*.dat)	
			開啟舊檔(O) ▼	取消

(6)Reboot HRT-711 when the following dialog shows

C:\Windows\system32\cmd.exe	
ARP 項目刪除失敗: 要求的作業需要提升的權限。 Waiting request from MAC 00-0d-e0-8f-ff-ff <ip:192.168.255.1></ip:192.168.255.1>	
Starting BOOTP/TFTP Server % Complete: 0%	

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(7)Firmware update failure



(8)Firmware update success

C:\Windows\system32\cmd.exe				x	
ARP 項目刪除失敗: 要求的作詞	\$P\$需要提升的權限。	0		<u>^</u>	
Waiting request from MAC 00-	∂d-e0-8f-ff-ff <	(IP:192.168.255.1)		=	
Starting BOOTP/TFTP Server .					
BOOTPREQ from MAC: 00-0D-E0-	3F-FF-FF				
x Complete: 100x					
請按任意鍵繼續---					

(9)"Search Server" again and check HRT-711 firmware version

🥩 eSearch Utility [v1.1.19, May.09, 2018]								
<u>File</u> <u>Server</u> <u>T</u> ools								
Name	Alias	IP Address	Sub-net Mask	Gateway	MAC Address	DHCP	Version	
HRT-711	HRT-711	192.168.255.1	255.255.0.0	192.168.0.1	00:0d:e0:8f:ff:ff	OFF	v1.0.1 [2018/05/17]	

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Q05 : How to read HART device command 1 data with standard format by Modbus ?

(1) By using "HRT-711 Utility" to add "User CMD(1)" of HART device and save settings to HRT-711. The Modbus start address and length of the "User CMD(1)" will show in the "Cmd In address" and "Cmd In size" field. In the example they are 0 and 7 (byte count=7 => word count=4).

HRT-7	11		Item		Value
	stem r Ja		HART Devi	ce Name	HART De
	Edit		HART Cha	nnel	0
	Delete		Auto Confi;	guration	Enable
	Add Comn	nand	Network		Point to P
			Default Con	amand (O)	Initial
			Default Con	amand (3)	Polling
		and success	-		
w Command					
w Command Command Command Num. :	1	Mode	: Polling 💌	Format :	Normal 🗸

Device Configuration		\Leftrightarrow	
HRT-711 System HART Device 0 Default CMD(0) Default CMD(3) User CMD(1)	Item Commad Name HART Device Index User Command Index Command No. Command Mode Command Format Cmd In Size Cmd Out Size Cmd Out Size Cmd Out Address Cmd Out Address Cmd Out Address Cmd Out Address	Value User CMD(1) 0 1 Polling Normal 7 0 0 0 0 0 0 ve to Device	ad Default Setting

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(2) The below demo will use the free MBTCP tool provided by ICP DAS to show HART command 1 data. (Download from

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

- (3) Run "MBTCP" tool. Fill the settings (IP and Port) and then click "Open" button to connect to HRT-711.
- (4) Input "1 4 0 0 0 4" in "Command" field and click "Send Command" button to send the modbus command. The HART command 1 data will be received in "Responses" field => "01 04 08 0C BA 00 10 00 00 D5 F0".

Send Modbus Command : 01 04 00 00 00 04

Get Response : 01 04 08 0C BA 00 10 00 00 D5 F0

5. MBTCP Ver. 1.1.5	
ModbusTCP IP 192.168.255.3 Port 502 Connect Disconnect Data Log	Protocol Description FC1 Read multiple coils status (0xxxx) for D0 [Prefixed 6 bytes for Modbus/TCP protocol] Byte 0: Transaction identifier - copied by server - usually 0 Byte 1: Transaction identifier - copied by server - usually 0 Byte 2: Protocol identifier=0 Byte 3: Protocol identifier=0 Byte 4: Field Length (upper byte)=0
Polling Mode (No Waiting) Start Stop Timer Mode (Fixed Period) Interval 100 Mass Start Stop	Statistic Difference in Packet Clear Statistic Commands In Packet Responses Total Packet Size (Bytes) 12 Total Packet Size (Bytes) 17 Packet Quantity Sent 1 0 Packet Quantity Received 1 Polling or Timer Mode (Date/Time) Polling Mode Timing (ms) Max 0 Average Stop Time Stop Time Stop Time Min 1000 000
[Byte0] [Byte1] [Byte2] [Byte3] [Byte4] [By 1 2 0 0 0 6 1 4 0 0 0 4 [Byte0] [Byte1] [Byte2] [Byte3] [Byte4] [By 01 02 00 00 00 06 -> 01 04 00 00 00 04	te5] [Byte0] [Byte1] [Byte2] [Byte3] 01 02 00 00 00 08 -> 01 04 08 0C BA 00 10 00 00 D5 F0
Clear	r Lists EXIT Program

(5) Parse the Modbus response data.

Response Data => 01 04 08 0C BA 00 10 00 00 D5 F0

Register data => <u>0C BA 00 10 00 00 D5 F0</u>

Because the unit of HART-711's database is byte and the unit of Modbus register is word and the Modbus register is composed of database's byte and the order is low byte first.

(For example: Modbus register0 = 0x3412, database byte0 = 0x12, byte1 = 0x34).

So we need to change the byte order.

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So the data will be <u>BA 0C 10 00 00 00 F0 D5</u>.

And we have set the swap mode to Word & Byte, so the data transform into <u>00 10 0C BA D5 F0</u> <u>00 00</u>.

According to the data count is 7, so the actual data will be <u>00 10 0C BA D5 F0 00</u> About the format of HART Command 1, it is shown as the table below.

Request Da	ta Bytes	0	
Response Data Bytes 2 + 5		2 + 5	5 = 7
Byte Index	Forma	ıt	Description
0	Uint8		Response Code 1
1	Uint8		Response Code 2
2	Uint8		Unit code
3~6 Float			Primary Variable

So the data of HART command 1 is parsed as below.

Response code1 = 0x00

Response code2 = 0x10

Primary Variable Unit code = 0x0C (kPA)

Primary Variable = 0xB5 0xD5 0xF0 0x00 (-0.001632 => IEEE754)

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Q06 : How to read HART device command 3 data with standard format by Modbus ?

(1) When adding a new HART device to HRT-711, the "Default CMD(3)" will be added automatically. The Modbus start address and length of the "Default CMD(3)" will show in the "Cmd In address" and "Cmd In size" field. In the example they are 1236 (For MB Addr = 618 = 0x026A) and 26 (byte count=26 => word count=13).

Device Configuration		
→ HRT-711 → System → HART Device 0 → Default CMD(0) → Default CMD(3) → User CMD(1)	Item Commnad Name HART Device Index Command No. Command Mode Command Format Cmd In Size Cmd Out Size Cmd Out Size Cmd Out Address Cmd Out Address Cmd Out Address Cmd Out Address Cmd Out Address Save to File Save to File Save to File	Value Default CMD(3) 0 3 Polling Normal 26 0 1236 0 4 From Device Load Default Setting we to Device

(2) The below demo will use the free MBTCP tool provided by ICP DAS to show HART command 1 data. (Download from

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

- (3) Run "MBTCP" tool. Fill the settings (IP and Port) and then click "Open" button to connect to HRT-711
- (4) Input "01 04 02 6A 00 0D" in "Command" field and click "Send Command" button to send the modbus command. The HART command 3 data will be received in "Responses" field => "01 04 1A 10 00 7F 40 A0 E7 BB 0C F4 00 20 00 CE 41 E8 2D BC 39 58 18 00 00 00 00 00 00"

Send Modbus Command : 01 04 02 6A 00 0D 10 6B

Get Response : 01 04 1A 40 7F 00 10 0C BB E6 64 00 20 03 94 FA 51 41 CD 20 0F 39 BC 00 00 00 00 00 00

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B. MBTCP Ver. 1.1.5	×
ModbusTCP IP 192.168.255.3 Port 502 Connect Disconnect Data Log	Protocol Description FC1 Read multiple coils status (0xxxx) for D0 [Prefixed 6 bytes for Modbus/TCP protocol] Byte 0: Transaction identifier - copied by server - usually 0 Byte 1: Transaction identifier=0 Byte 2: Protocol identifier=0 Byte 3: Protocol identifier=0 Byte 4: Field Length (upper byte)=0
Polling Mode (No Waiting) Start Stop Timer Mode (Fixed Period) Interval 100 Start Stop	Statistic Clear Statistic Commands Difference Responses Total Packet Size (Bytes) 12 0.00 % Packet Quantity Sent 1 0 Polling or Timer Mode (Date/Time) Polling Mode Timing (ms) Start Time Start Time Stop Time Stop Time
[Byte0] [Byte1] [Byte2] [Byte3] [Byte4] [By [1 2 0 0 0 6 1 4 2 6a 0 0d [Byte0] [Byte1] [Byte2] [Byte3] [Byte4] [By 01 02 00 00 00 06 → 01 04 02 6A 00 00	e5] Send Command e5] [Byte0] [Byte1] [Byte2] [Byte3] 01 02 00 00 00 1D -> 01 04 1A 40 7F 00 10 0C BB E6 64 00 20 03 94 FA 51 41 CD 20 0F 39 BC 00 00 00 00 00 00
Clear	Lists EXIT Program

(5) Parse the Modbus response data.

Response Data => 01 04 1A 40 7F 00 10 0C BB E6 64 00 20 03 94 FA 51 41 CD 20 0F 39 BC 00 00 00 00 00 00 00

Register data => <u>40 7F 00 10 0C BB E6 64 00 20 03 94 FA 51 41 CD 20 0F 39 BC 00 00 00</u> <u>00 00 00</u>

Because the unit of HART-711's database is byte and the unit of Modbus register is word and the Modbus register is composed of database's byte and the order is low byte first.

(For example: Modbus register0 = 0x3412, database byte0 = 0x12, byte1 = 0x34).

So we need to change the byte order. So the data will be as below.

7F 40 10 00 BB 0C 64 E6 20 00 94 03 51 FA CD 41 0F 20 BC 39 00 00 00 00 00 00 00

According to the swap setting, we set the Word and Byte swap in this example, so the data will be transformed into.

<u>00 10 40 7F E6 64 0C BB 03 94 00 20 41 CD FA 51 39 BC 20 0F 00 00 00 00 00 00 00</u> About the format of HART Command 3, it is shown as the table below.

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Request Data Bytes		0			
Response Data Bytes		2 + 24 = 26			
Byte Index	Forma	t	Description		
0	Uint8		Response Code 1		
1	Uint8		Response Code 2		
2~5	Float		Primary Variable Current		
6	Uint8		Primary Variable Unit code		
7~10	Float		Primary Variable		
11	Uint8		Secondary Variable Unit code		
12~15	Float		Secondary Variable		
16	Uint8		Tertiary Variable Unit code		
17~20	Float		Tertiary Variable		
21	Uint8		Quaternary Variable Unit code		
22~25	Float		Quaternary Variable		

So the data of HART command 3 is parsed as below.

Response code1 = 0x00

Response code2 = 0x10

Primary Variable Current = 0x40 0x7F 0xE6 0x64 (3.998437)

Primary Variable Unit code = 0x0C (kPA)

Primary Variable = 0xBB 0x03 0x94 0x00 (-0.0020077229)

Secondary Variable Unit code = 0x20 (degC)

Secondary Variable = 0x41 0xCD 0xFA 0x51 (25.747225)

Tertiary Variable Unit code = 0x39 (Percent)

Tertiary Variable = 0xBC 0x20 0x0F 0x00 (-0.009769201)

Quaternary Variable Unit code = 0x00 (???)

Quaternary Variable = 0x00 0x00 0x00 0x00 (0)

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Q07 : How to know the connection status between HRT-711 and HART devices ?

Value	Error Status
0	No error
1	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
0	The communication with HART slave device has some error and the
9	error messages are recorded in the responses codes

The communication status description of HART command in HRT-711 is as below.

[Ex1 => The Default CMD(3) of "HART Device 0 & 1" in HRT-711 is Polling Mode]

< 1. The setting of SWAP Mode is "None" (without Byte and WORD swap) >

(1) Address 1000 (Unit: WORD) : Show the comm. status of "Device 0".

[1] High Byte : "The comm. status of Default CMD(3) in device 0.

[2] Low Byte : "The comm. status of Default CMD(0) in device 0.

(2) Address 1001 (Unit: WORD) : Show the comm. status of "Device 1".

[1] High Byte : "The comm. status of Default CMD(3) in device 1.

[2] Low Byte : "The comm. status of Default CMD(0) in device 1.



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- < 2. The setting of SWAP Mode is "W&B" (with Byte and WORD swap) >
- (1) Address 1001 (Unit: WORD) : Show the comm. status of "Device 0".
 - [1] High Byte : "The comm. status of Default CMD(0) in device 0.
 - [2] Low Byte : "The comm. status of Default CMD(3) in device 0.
- (2) Address 1000 (Unit: WORD) : Show the comm. status of "Device 1".
 - [1] High Byte : "The comm. status of Default CMD(0) in device 1.
 - [2] Low Byte : "The comm. status of Default CMD(3) in device 1.



Figure 7-1.2 The status of Default CMD(0&3) in Device 0 and Device 1

In the Figure 7-1, the status of the Default CMD(3) in device 0 is 0x02 and it means that the HART device for the Default CMD(3) is disconnected from HRT-711. (In the Figure 7-1, the status of the Default CMD(0) is 0x02, too.)

[Ex2 => The User CMD Index = 0 is Polling Mode]

By using the low and high byte value of MB address 1050 (unit: WORD) (refer to sector 4.2 - Modbus / HART Mapping Table), users can get the communication status of the User CMD Index = 0 and 1.

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ſ	🖶 ModSca1				
	Address:	1050	Device Id: 1 MODBUS Point Type		Number of Polls: 90 Valid Slave Responses: 90
	Length:	10	04: INPUT REGISTER	•	Reset Ctr
		/			
I					
l	31050: <02 31051: <00	02H>			
	31052: <00 31053: <00	00H> 00H>			
	31054: <00 31055: <00	00H> 00H>			
	31056: <00 31057: <00	00H> 00H>			
	31058: <00 31059: <00	00H> 00H>			

The status of the User CMD Index = 0 and 1 are 0x02. It means that the HART device for the User CMD Index = 0 and 1 is disconnected from HRT-711.

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Q08 : How to integrate Active and Passive HART devices in multi-drop network ?

- 1. If there are more than 7 HART devices in the HART network, users need to disable the internal resistor (250 Ohm, 1/4W) of HRT-711 (adjust JP4 to be pin2 and pin3, refer to the section 2.6 for detailed). Then add the external resistor (250 Ohm, 1W) in HART network.
- 2. The HART wiring of the Active and Passive HART devices, please refer the following figure.



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Q09 : How to integrate multiple HRT-711 modules in the same project ?

[Case Example]

1. A user wants to integrate 20 HART devices (Ultrasonic Water Level) in the same project via Modbus/TCP or Modbus/UDP communication and HART wiring will be point to point.

[Solution]

< Hardware >

1. We suggest the user to use 20 HRT-711 modules to connect to 20 HART devices with point to point wiring.

< Software >

1. The HRT-711 is a Modbus/TCP and Modbus/UDP server, if users need to multiple HRT-711, users follow section 5.4 to configure the Ethernet. After configuring HRT-711's Ethernet and connecting to Ethernet switch, all HRT-711 can be identified by the IP address.

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Q10 : How to integrate HART communication device with RS-232 hardware interface ?

[Case Example]

1. A user wants to integrate HART communication device (Flowmeter, Mobrey MCU900) with RS-232 hardware interface.

[Solution]

< Hardware >

1. We suggest the user to use HRT-711 and I-7570 to do that and the wiring for this case.



< Software >

1. Please refer to the steps in the Q01, Q02 and Q03 of HRT-711 FAQ to integrate HART device information to SCADA.

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Q11 : How to add the HART Device-Specific command to HRT-711 ?

[Case Example]

1. An user wants to get the HART command No.149 data from Emerson 8800D HART device.

[Solution]

< Software >

1. Users must get the HART Device-Specific command first. The HART command No.149 format of Emerson 8800D.

Command 149 - R	ead Fixed Process Density
REQUEST DATA BYTES NONE	
RESPONSE DATA BYTES BYTE O 1-4	, 8-bit unsigned integer.

2. Add the HART command No.149 to HRT-711.

evice Configura	tion	_	
⊡-HRT-711 System Defau Defau	Edit Delete Add Command	Item UADT Device Name Channel nfiguration Command (0) Default Command (3)	Value HART Device 0 O Enable Point to Point Initial Polling
New Comma Comma	mand nd nd Num. : 149 In Size : 5	Mode : Polling Out Size : 0 🗲	g - Format : Normal - OK Cancel

3. After the setting is finished, in the Device Configuration screen, please click the Save to Device button to save the parameters to HRT-711.

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Device Configuration	Contract of Contract		
- HRT-711 	Item Module Name Firmware Version	Value HRT-711 V1.01	
	Operation Load From File Load Save to File Sa	l From Device Lo	bad Default Setting

- 4. Get the Modbus address for the HART command No.149 data.
- (1) Open the "Address Map" screen and click the "UserCMD(149)" item.
 - [1] In the Modbus AO area, the light blue grid means the Modbus address for data sending.
 - [2] In the "Modbus AI" area, the light blue grid means the Modbus address for data receiving.
 - => In the case, the HART command No.149 is used for reading data. Therefore, the light blue grid just show in "Modbus AI" area and the Modbus address for receiving data is from 0 to 2.

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Address Map (For User CMD)		x
HRT-711	Color	
System	available unavailable for current cmd 🧧 s	elected
User CMD(149)	Modbus AO Modbus AI	
	Addr LB HB ^ Addr LB HH	3 🔺
	0	
	1 1	
	2 2	
	3 3	
	4 4	
	5 5	
	6 6	
	7 7	
	8 8	
	9 9	
	10 10	
	11 - 11	-

(2) Users can use the Modbus Function Code 4 and address from 0 to 2 to get the HART command No.149 data. (Ex: Request Cmd => 0x01 0x04 0x00 0x00 0x00 0x03)

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Q12 : How to set HART device address by HRT-711 utility?

1. Add the UserCMD(6) to HRT-711 :

- (1) Run HRT-711 Utility and connect to HRT-711.
- (2) Open the Device Configuration page.
- (3) Add UserCMD(6) and choose Manual option in Mode field.
- (4) Click Save to Device button.

New Command	
Command	
Command Num. : 6	Mode : Manual 👻 Format : Normal 👻
In Size : 3	Out Size : 1
	OK Cancel
Device Configuration	
 HRT-711 System HART Device 0 □ Default CMD(0) □ Default CMD(3) □ User CMD(6) 	Item Value Module Name HR T-711 Firmware Version V1.01
	Operation Load From File Load From Device Load Default Setting
	Save to File Save to Device

- 2. Set HART device address and send the UserCMD(6) :
 - (1) Open Device Information page.
 - (2) Right click on the UserCMD(6) item and choose the Basic Operation.

(In the demo, the command index is 0 for the UserCMD(6).

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(3) Input the HART device address value and click the Send button.

(In the demo, HART device address will be set to be 2. Now the setting value is just saved in HRT-711 not sent out yet.)

Device Information			
HRT-711	Item	Value	
HART Device 0	Commnad Name	User CMD(6)	
Default CMD(0)	HART Device Ind	lex O	
Default CMD(3)	User Command In	ndex O	
Basic operation	No.	6	
	Mode	Manual	
Advanced opera	tion Forma	t Normal	
	Cmd In Size	3	
	Cmd Out Size	1	
	Cmd In Address	0	
	Cmd Out Address	: 0	
Command 6 IO Data			
Information : Write Polling Address-	-Request		
Polling Address (0~15) : 2			
		Send	
Information : Write Polling Address-	-Response		
Polling Address : 0			
		Update	

- (4) Right click on the System item and choose the Basic Operation.
- (5) After finishing the below settings, click Send Data button to send the UserCMD(6) to HART device.
 - [1] Auto Polling field => Disable
 - [2] Manual Trigger field => Enable
 - [3] Trigger Index of User Command field => Input 0 (UserCMD(6) Index)

Device Info	ormation			
🖃 - HR T-7	'11	Item	_	Value
	Basic operation		le Name	System
	Advanced operation	n	ystem Info]	
	- User CMD(6)	HAR	T Device Count	1
		User	Cmd Count	1

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System IO Data
System Output Status Reset : Disable - Auto Polling : Disable - Manual Trigger : Enable -
Trigger Index of User Command (0~255) : 0 Send Data
State Machine : IO IDLE [For UserCmd] User Cmd Request Count : 0 User Cmd Response Count : 0 User Cmd Error Count : 0 User Cmd Error Status : No Error User Cmd Error Index : 255
Auto Update

 Now the HART device address should be set to be 2. Then please reboot HRT-711. (After changing device address, please also remember to modify the device address in the Device Configuration)

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Q13 : All kinds of HART network wiring ?

A13: (2015/10/26)

1. The wiring of "Point to Point" :



Figure 13-1 HART_P2P_Network_Passive (In-Resistor)





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Figure 13-3 HART_P2P_Network_Active (In-Resistor)

2. The wiring of "Multi-Drop":



Figure 13-4 HART_Multi-Drop_Network_Passive.jpg

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Figure 13-6 HART_Multi-Drop_Network_Active&Passive

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Q14 : Apply the same settings to the other HRT-711 rapidly ?

A14: (2015/12/21)

- 1. Save HRT-711 settings to file.
 - (1) Run the HRT-711 utility, HG_Tool.
 - (2) In the "Device Configuration" page, click the "Save to File" button to save the current settings of HRT-711 to file.

Device Configuration		
HRT-710 System HART Device 0 Default CMD(0) Default CMD(3)	Item Value Module Name HRT-710 Firmware Version V01.6	
	Operation	
	Load From File Load From Device Load Defau	t Setting
	Save to File Save to Device	

- 2. Load the settings from HRT-711 file to the other HRT-711 module.
 - (1) In the "Device Configuration", click the "Load From File" button and choose the setting file of HRT-711. Then it will show all the settings in the HG_Tool.

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Device Configuration			
HRT-710 System HART Device 0 Default CMD(0) Default CMD(3)	Item Module Name Firmware Version	Value HRT-710 V01.6	
	Operation Load From File Lo Save to File	ad From Device Load De Save to Device	fault Setting

(2) Click the "Save to Device" button to set the settings to HRT-711 module.

Device Configuration			
 HRT-710 System HAR T Device 0 Default CMD(0) Default CMD(3) 	Item [Module Name Firmware Version	Value HRT-710 V01.6	
	Operation —		
	Load From File Loa	d From Device Load Defa	ult Setting
	Save to File Sa	ve to Device	

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Q15 : How to send HART command for writing ? (Ex: CMD19)

A15: (2015/12/23)

1. Add the HART command for writing in HRT-711.

(The HART cmd 19 is used in the below example => Final Assembly Number)

(1) In the "Device Configuration" page, click the right button of mouse on the "HART Device 0" item and choose the "Add Command" option.

Device Configuration			
 HRT-710 System HART Device 0 Default CMI Default CMI Default CMI Delete Add Comm 	Item HART Device Name annel figuration pmmand (0) pmmand (3)	Value HART Device 0 O Enable Point to Point Initial Initial	

(2) Input the value "19" in the "Command Num" field and choose the "Manual" option in the "Mode" field. Click the "OK" button to add the HART command 19 (Now the User Command Index is 0) and click the "Save to Device" button to save the current settings to HRT-711.

New Command	
Command Command Num. : 19 In Size : 5	Mode Manual V Format : Normal V Out Size : 3
Device Configuration	
HRT-710 System HART Device 0 Default CMD(0) Default CMD(3) User CMD(19)	Item Value Commnad Name User CMD(19) HAR T Device Index 0 User Command Index 0 Command Mode Manual Command Format Normal Cmd In Size 5 Cmd Out Size 3 Cmd In Address 0 Cmd Out Address 0

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- 2. Set the value for the HART writing command. (HART command not yet sent)
 - (1) There are three bytes parameters for HART command 19.
 - (2) For example, the value for these three bytes parameters is 11(0x0B), 22(0x16), 33(0x21) for writing, and the Modbus command will be as below.
 - => <u>01</u> <u>06</u> <u>00 00</u> <u>0B 16</u> <u>0F 34</u>
 - => <u>01</u> <u>06</u> <u>00 01</u> <u>21 00</u> <u>C0 5A</u>
 - (3) The below figure is the assigned value for writing in HART command 19 by using ModScan software for testing.

ModScan32 - [ModScal]	
File Connection Setup View Window Help File Connection Help File Connection Setup View Window Help File Connection Setup Vi	
Address: 0001 Device Id: 1 MODBUS Point Type Length: 4 03: HOLDING REGISTER	Number of Polls: 98 Valid Slave Responses: 98 Reset Ctrs
40001: <2100H> 40002: <0B16H> 40003: <0000H> 40004: <0000H>	

- (4) After sending the above Modbus command, users can check if these values have been set successfully via HG_Tool.
 - [1] In the "Device Information" page, click the right button of mouse on the "User CMD(19)" item and choose the "Advanced operation" option.

Device Information		
 HRT-710 System HART Device 0 Default CMD(0 Default CMD(3) User CMD(19) 	Item Value Commnad Name User CMD(19) HART Device Index 0 User Command Index 0 Command No. 19 Command Mode Manual Basic operation 5 Advanced operation 3 Cnut m Audress 0 Cnut Out Address 0	

[2] In the "I/O Data" page, click the "Update" button and it will show the value for sending of UserCMD in the corresponding byte address in the "Output Data" area. Users can see these values of "11", "22" and "33" been set successfully.

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dodule na	me: 1	User C	MD(19))									
Color avails Output Da	able ta	u	navaila	able	•	selecte	d						
Addr	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^		
0~9	11	22	33	0	0	0	0	0	0	0			
10~19	0	0	0	0	0	0	0	0	0	0			
20~29	0	0	0	0	0	0	0	0	0	0			
30~39	0	0	0	0	0	0	0	0	0	0			
40~49	0	0	0	0	0	0	0	0	0	0	¥		
<													
Send Data													
									Se	nd Dat	ta		
Input Dat	a								Se:	nd Dat	ba.		
Input Data Addr	C1	C2	C3	C4	C5	C6	C7	C8	Se: C9	nd Dat	ba.		
Input Data Addr 0~9	C1 0	C2 0	C3 0	C4 0	C5 0	C6 0	C7 0	C8 0	Se: C9 0	nd Dat C10	ha		
Input Data Addr 0~9 10~19	C1 0 0	C2 0	C3 0 0	C4 0	C5 0	C6 0 0	C7 0 0	C8 0 0	Se: C9 0 0	C10 0	ta		
Input Data Addr 0~9 10~19 20~29	C1 0 0 0	C2 0 0 0	C3 0 0	C4 0 0	C5 0 0	C6 0 0	C7 0 0	C8 0 0 0	Se: C9 0 0 0	C10 0 0	ta		
Input Date Addr 0~9 10~19 20~29 30~39	C1 0 0 0 0	C2 0 0 0 0	C3 0 0 0 0	C4 0 0 0 0	C5 0 0 0	C6 0 0 0	C7 0 0 0	C8 0 0 0 0	Se: C9 0 0 0 0	C10 C10 0 0 0 0 0 0 0	ta.		
Input Data Addr 0~9 10~19 20~29 30~39 40~49	C1 0 0 0 0	C2 0 0 0 0 0 0 0	C3 0 0 0 0	C4 0 0 0 0	C5 0 0 0 0	C6 0 0 0 0	C7 0 0 0	C8 0 0 0 0	Se: C9 0 0 0 0 0 0	C10 C0			
Input Date Addr 0~9 10~19 20~29 30~39 40~49	C1 0 0 0 0	C2 0 0 0 0	C3 0 0 0 0	C4 0 0 0 0 0	C5 0 0 0 0 0	C6 0 0 0 0	C7 0 0 0 0	C8 0 0 0 0 0	Se: C9 0 0 0 0 0 0 0	C10 C10 O O O O O O O O O O O O O O O O O O O	ta		

- 3. Trig the HRT-711 to send the UserCMD0 (HART command 19).
 - (1) Stop the original HART polling command and send the UserCMD0.

The Modbus command will be as below.

- => 01 06 01 F5 00 00 98 04
- => 01 06 <u>01 F6 <u>01 00</u> 69 94</u>
 - [1] <u>00</u> : Stop all the original HART polling command.
 - [2] 00 : Set the no. of UserCMD for sending.
 - [3] <u>01</u>: Trig to send the UserCMD and it needs the different value every time.
 - (Ex: the next value will be 2, 3, 4 ...)
 - => Now the UserCMD0 (HART command 19) has been sent.
- (2) Recover the original HART polling command.

The Modbus command will be as below.

- => 01 06 <u>01 F5 01 00 99 94</u>
 - [1] <u>01</u> : recover all the original HART polling command.

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Q17 : How to get HART command 48 information ?

A17: (2016/10/07)

1. Add HART CMD 48 to HRT-711.

Device Configuration		
 ☐ HRT-710 ☐ System ☐ HART Device 0 ☐ Default 0 Edit Default 0 Delete Add Comma 	Item HART Device Name Channel onfiguration ik Command (0) t Command (3)	Value HART Device 0 0 Enable Point to Point Initial Polling
New Command		
Command Command Num. :	Mode : Polling	g 💽 Format : Normal 👻
In Size : 27	Out Size : 0	OK

Figure 17-1 Add HART CMD 48 to HRT-711

2. In the "**Device Configuration**" screen, click the "**Save to Device**" button to save the settings to HRT-711.

Device Configuration			
 □ HRT-710 □ System □ HART Device 0 □ Default CMD(0) □ Default CMD(3) □ User CMD(48) 	Item Module Name Firmware Version	Value HRT-710 V01.6	
	Operation Load From File	Load From Device	Load Default Setting

Figure 17-2 Save the settings to HRT-711

- 3. Get HART CMD48 data via Modbus.
 - (1) Open the "Address Map" screen and click the "UserCMD(48)" item. In the "Modbus AI" area, it will show the Modbus data address of UserCMD(48) with blue grid.

=> The response data length of HART CMD 48 will be 27Bytes (ResCode(2) and

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ResData(25)). Therefore, it will occupy 14 WORD Modbus address as below address 0~13.

Address Map (For User CMD)									
😑 HRT-710	Color								
System	availal	ble	unavaila	able	for current cmd 📃 selected				
User CMD(48)	-Modbus AC		-Modbus AI						
	Addr	LB H	в 🔼		Addr	LB	HB	<u> </u>	
	0				0				
	1				1				
	2				2				
	3				3				
	4				4				
	5				5				
	6				6				
	7				7				
	8				8				
	9				9				
	10				10				
	11		~		11			~	

Figure 17-3 The modbus address occpied by UserCMD(48)

(2) Using Modbus Function Code 4 and address 0~13 to get the data of HART CMD 48.

ModScan32 - [ModSca1]	
🚘 File Connection Setup <u>V</u> iew <u>W</u> indow <u>H</u> elp	_ 8 ×
다 🚅 🖶 🗉 😝 🖗 🐺 💭 🚭 🤋 😢	
Address: 0001 Device Id: 1 MODBUS Point Type	Number of Polls: 206 Valid Slave Responses: 206
Length: 14 04: INPUT REGISTER 🔽	Reset Ctrs
30001: <0000H> 30008: <0000H> 30002: <0000H> 30009: <0000H> 30003: <0000H> 30010: <0000H> 30004: <0000H> 30011: <0000H> 30005: <0000H> 30012: <0000H> 30006: <0000H> 30013: <0000H> 30007: <0000H> 30014: <0000H>	
	>
ModScan32 - (COMM1)	Polls: 206 Resps: 206 🥢

Figure 17-4 Get the HART CMD 48 data by using "ModScan"

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Master type : Response :	Secondary Preambles : 5 Period (ms) : 0 Listen_Mode 0x0000 => OK / Pri-Master_Addr=0_Cmd=48
- Universal	common Specific
	Common-Practice Cmd: 48 : Read Additional Device Status
DataLink	PVRange Current DevMan TransTrim MapProVar PriVar DevVar Burst AnalogCh
	HART Cmd: 48 : Read Additional Device Status
Cmd38	Cmd41 Cmd42 Cmd48 Cmd71 Cmd76
Rea	d Additional Device Status
	Device-Specific Status : 0x00 00 00 00 00 00 00
	Extended Device Status :
	Durine Ocumente a Mada a
	Device Operating Mode :
	Analog Channel Saturated :
	Analog Channel Saturated :

Figure 17-5 Get the HART CMD 48 data by using "HC_Tool (HART Master)"

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Q18 : How to send HART "Burst Mode" CMD? (CMD108/109)

A18: (2017/01/09)

1. The below is the description for HART burst command function.

(1) HART CMD 108 (Write Burst Mode Command Number)

=>Used to set the response HART command no. when HART device burst mode is enabled.

(2) HART CMD 109 (Burst Mode Control)

=>Used to set HART device burst mode enabled or disabled.

2. Add HART CMD 108 and 109 to HRT-711

(1) In the "Device Configuration" page, click the right button of mouse on the "HART Device0" item and choose the "Add Command" option.

Device Configuration		
HRT-710	Item HART Device Name	Value HART Device 0
Default CMI Edit	annel figuration	0 Enable
Default CMI Delete	- mmand (II)	Point to Point Initial
Add Com	mand pmmand (3)	Initial

(2)[1] Input the value "108" in the "Command Num" field and choose the "Manual" option in the "Mode" field. Click the "OK" button to add the HART command 108 (Now the User Command Index is 0)

[2] Input the value "**109**" in the "**Command Num**" field and choose the "**Manual**" option in the "**Mode**" field. Click the "**OK**" button to add the HART command 109 (Now the User Command Index is 1)

[3] Click the "Save to Device" button to save the current settings to HRT-711.

Command	-	-		1	
Command Num.	108	Mode	Manual 💌	Format :	Normal 💌
In Size :	3	Out Size :	1		
	<u> </u>		1		

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New Command	
Command Command Num. : 109 In Size : 3	Mode : Manual V Format : Normal V Out Size : 1
	OK Cancel
Device Configuration	
HRT-710 System HART Device 0 Default CMD(0) Default CMD(3) User CMD(108) User CMD(109)	Item Value Commnad Name User CMD(109) HART Device Index 0 User Command Index 1 Command No. 109 Command Mode Manual Command Format Normal Cmd In Size 3 Cmd Out Size 1 Cmd Out Address 4 Cmd Out Address 2
	Operation Load From File Load From Device Load Default Setting
	Save to File Save to Device

3. Set the value for the HART CMD 108. (HART CMD 108 sent not yet)

(1) There are one byte parameter in HART CMD 108.

(Ex: The writing value 3(0x03)=> It means that when HART device is in the burst mode,

HART CMD 3 data will be sent from HART device automatically and periodically.

(2) Modbus command for the function is as below.

=> <u>01</u> <u>06</u> <u>00 00</u> <u>03 00</u> <u>89 3A</u>

- (3) After sending the above Modbus command, users can check if these values have been set successfully via HG_Tool..
 - [1] In the "Device Information" page, click the right button of mouse on the "User CMD(108)" item and choose the "Advanced operation" option.

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Device Information			
 □ HRT-710 □ System □ HART Device 0 □ Default CMD(0) □ Default CMD(3) □ User CMD(108) □ User CMD(109) □ Basis 	Item Commad Name HART Device Index User Command Index Command No. Command Mode c operation anced operation Cmu In Audress Cmd Out Address	Value User CMD(108) 0 108 Manual Normal 3 1 0 0	

[2] In the "I/O Data" page, click the "Update" button and it will show the value for sending of UserCMD in the corresponding byte address in the "Output Data" area. Users can see the value of "3" been set successfully.

IC) Data											
1	viodule na Color	me :	Uær C	MD(1	08)							
	availa	able	υ	navaik	able		selecte	ed				
	Output Da	ta.										
	Addr	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^
	0~9	3	0	0	0	0	0	0	0	0	0	
	10~19	0	0	0	0	0	0	0	0	0	0	
	20~29	0	0	0	0	0	0	0	0	0	0	
	30~39	0	0	0	0	0	0	0	0	0	0	
	40~49	0	0	0	0	0	0	0	0	0	0	~
	<				1						>	
										Se	nd Dai	ta

4. Trig the HRT-711 to send the UserCMD0 (HART command 108)

(1) Stop the original HART polling command and send the UserCMD0.

The Modbus command will be as below.

- => 01 06 <u>01 F5 00 00 98 04</u>
- => 01 06 01 F6 01 00 69 94
- [1] <u>00</u> : Stop all the original HART polling command.
- [2] 00 : Set the UserCMD no. for sending.
- [3] <u>01</u>: Trig to send the UserCMD and it needs the different value every time.
 (Ex: the next value will be 2, 3, 4 ...)
- => Now the UserCMD0 (HART command 108) has been sent.

5. Set the value for the HART CMD 109. (HART CMD 109 sent not yet)

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- (1) There are one byte parameter in HART CMD 109.
 - [1] The writing value 1(0x01)=> It means HART device burst mode will be enabled.
 - [2] The writing value $0(0\times00)$ => It means HART device burst mode will be disabled.
- (2) Modbus command for the function is as below.

[1]Enable Burst mode => 01 06 00 01 01 00 D9 9A

[2]Disable Burst mode => <u>01</u> <u>06</u> <u>00 01</u> <u>00</u> <u>00</u> <u>D8 0A</u>

- (3) After sending the above Modbus command, users can check if these values have been set successfully via HG_Tool..
 - [1] In the "Device Information" page, click the right button of mouse on the "User CMD(109)" item and choose the "Advanced operation" option.



[2] In the "I/O Data" page, click the "Update" button and it will show the value for sending of UserCMD in the corresponding byte address in the "Output Data" area. Users can see the value of "1" been set successfully.

lO Data									. (10
Module na Color avail	me : [able ata	User C	MD(1) navail:	09) able	-	selecte	ed				
Addr	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^
0~9	1	0	0	0	0	0	0	0	0	0	
10~19	0	0	0	0	0	0	0	0	0	0	
20~29	0	0	0	0	0	0	0	0	0	0	
30~39	0	0	0	0	0	0	0	0	0	0	
40~49	0	0	0	0	0	0	0	0	0	0	~
<					Ш						
									Se	nd Dat	a

6. Trig the HRT-711 to send the UserCMD1 (HART command 109)

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(1) Stop the original HART polling command and send the UserCMD1.

The Modbus command will be as below.

- => 01 06 <u>01 F5 00 00 98 04</u>
- => 01 06 01 F6 02 01 A8 A4
- [1] <u>00</u> : Stop all the original HART polling command.
- [2] <u>01</u> : Set the UserCMD no. for sending.
- [3] <u>02</u>: Trig to send the UserCMD and it needs the different value every time.(Ex: the next value will be 3, 4, 5 ...)
- => Now the UserCMD1 (HART command 109) has been sent.

7. Recover the original HART polling command.

- (1) The Modbus command will be as below.
 - => 01 06 <u>01 F5</u> <u>01</u> <u>00</u> <u>99 94</u>
 - [1] <u>01</u> : recover all the original HART polling command.

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Q19 : How to reset totalizer value by sending Device-Specific command?

A19: (2017/11/28)

[Case Example]

1. A user wants to use HRT-711 to reset the totalizer value from instrument KROHNE ESK4 by sending HART command 137.

[Solution]

1. Users must get the HART Device-Specific command first. The HART command No.137 format of KROHNE ESK4

Command #137: Reset Totalizer							
Request Data Bytes							
Byte	Format	Description					
None		Resets the Totalizer Value to Zero					
Response Data Bytes							
Byte	Format	Description					
None							

Figure 19-1 CMD137's frame format of KROHNE ESK

2. Add UserCMD CMD137 of ROHNE ESK4 to HRT-711:

Device Config	guration		
⊟ HRT-710		Item	Value
⊢ Syster ⊢ HAR I	em T Device 0 Edit Delete Add Command	HART Device Name RT Channel to Configuration work ault Command (0) Default Command (3)	HART Device 0 0 Enable Point to Point Initial Polling
Command Edit	133	in i	
Command Command Nur In Siz	n. : [137] ze : [2] Or	Mode : Manual 🔸 Fo ut Size : 🕛 🗲	rmat : Normal 👻
	1		OK Cancel

Figure19-2 Add HART command 137 to HRT-711

3. After finished settings, click "**Save to Device**" button in Device Configuration to save all the settings.

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Device Configuration			X
 HRT-710 System HART Device 0 Default CMD(0) Default CMD(3) User CMD(137) 	Item Commnad Name HART Device Index User Command Index Command No. Command Mode Command Format Cmd In Size Cmd Out Size Cmd Out Size Cmd In Address Cmd Out Address	Value User CMD(137) 0 137 Polling Normal 2 0 0 0	
	Operation Load From File Loa Save to File Sa	d From Device Load Default Settin we to Device	rg

Figure19-3 Save settings to HRT-711

- 4. Trig the HRT-711 to send UserCMD0 (HART command 137) .
 - (1) Stop the original HART polling command and send UserCMD0
 - (2) The Modbus command will be as below:
 - => 01 06 <u>01 F5</u> <u>00 00</u> <u>98 04</u>
 - => 01 10 <u>01 F6</u> <u>01 00</u> <u>69 94</u>
 - [1] 00 : Stop all the original HART polling command
 - [2] 00 : Set the no. of UserCMD for sending
 - [3] <u>01</u>: Trig to send the UserCMD and it needs the different value every time. (Ex: the next value will be 2,3,4 ...)
 - => Now the UserCMD0 (HART command 137)
- 5. Recover the original HART polling command
- (1) The Modbus command will be as below:
 - => 01 06 <u>01 F5</u> <u>01 00</u> <u>99 94</u>
 - [1] 01 : recover all the original HART polling command

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Q20 : How to read total-flow data from flow-meter?

A20: (2018/04/10)

[Case Example]

1. A user wants to use HRT-711 to read the total-flow value from SIEMENS instrument FUS060.

[Solution]

1. According to the user manual of FUS060, device specific CMD130 is for reading total value and there are 3 values with 4 bytes length each, so the total data length is $3^{*}4 = 12$ bytes

HART command list							
Command #	Name	Operation	Parameters	Туре	Bytes		
130	read_HART_dynamic_variables	read	func6_TOT_total_value, func7_TOT_total_value,	FLOAT FLOAT	4		
			func3_TOT_total_value	FLOAT	4		

Adding device specific command to HG_Tool requires to enter in and out data bytes, the in and out data here should include a 2 bytes response code.

lew Command	
Command	
Command Num. : 130	Mode : Polling - Format : Normal -
In Size : 14	Out Size : 0
2 bytes response code	
+ 12 bytes data length	OK Cancel

2. After adding the CMD130, please check whether it works properly by checking from the Advanced operation from Device Information and analyse with the IEEE754 Converter provided by HG_Tool Format Translation function.

Device Information		
HRT-310	Item	Value
HART Device 0	Commnad Name	User CMD(130)
Default CMD(0)	HART Device Index	0
Default CMD(3)	User Command Index	0
User CMD(130)	Commend No.	130
Basic operation	d Mode	Polling
Advanced opera	tion d Format	Normal
	- Cma in Size	14
	Cmd Out Size	0
	Cmd In Address	0
	Cmd Out Address	0

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3. After making sure the settings in HG_Tool are all properly done, Modbus tools can be used to testify. ModScan has been used as an example here:

(1) HRT-711 records device specific command data from Modbus address 0~499

MB_Addr (HEX)	MB_Addr (Decimal)	Description					
[User CMD Data]							
0~1F3	0~499	"User CMD" data					

(2) Because ModScan is a 1-based (instead of starting from 0) software, so the address should be from 1~500

ModSce	1		
Address Length:	: 0001 14	Device Id: 1 MODBUS Point Type 04: INPUT REGISTER	T
30001: 30002: 30003: 30004: 30005: 30006: 30007: 30008: 30009: 30010: 30011: 30012:	<0040H> <4948H> <a4f2h> <bed6h> <4948H> <a4e3h> <0000H> <0000H> <0000H> <4147H> <c803h></c803h></a4e3h></bed6h></a4f2h>	30013: <461DH> 30014: <7613H>	

(3) The first 2 Bytes are response code, so the data starts from address 2

nodSca	1		
Address Length:	: 0002 14	Device Id: 1 MODBUS Point Type 04: INPUT REGISTER	¥
30002: 30003: 30004: 30005: 30006: 30007: 30008: 30009: 30010: 30011: 300112: 30013:	<4948H> <9EE0H> <bed6h> <4948H> <9ECFH> <0000H> <0000H> <0000H> <413DH> <aef8h> <4611H></aef8h></bed6h>	30014: <c048h> 30015: <44B8H></c048h>	

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Q21 : HART communication update period calculation and adjustment

A21: (2018/08/02)

1. HART communications update period calculation :

Settings shown as below will be used as example: (HRT-310 with 2 HART devices)

- 1) HRT-310 parameters setting as below:
 - [1] HRT-310 sends CMD0 and CMD3 to both HART instruments
 - [2] CMD0 sets as Init mode, CMD3 sets as Polling mode
 - [3] Cmd Interval sets as 1000 ms

- UDT 210					
HR I-310					
HART Devic	:e 0				
🗍 🔤 Default (CMD(0)				
Default (CMD(3)				
HART Devic	el MD/0				
Default (CMD(0)				
	(-)				
dule Edit	-	Contra 1		1.0	
		and the second		-	
🔄 Easy Mode					
Module					C 1
Module HART Ch. : 0	•	Auto Configure : Disable	•	Frame Type :	Long •
Module HART Ch. : 0 Master Type : Primary M	▼ aster ▼	Auto Configure : Disable Network Mode : Multidrop	• •	Frame Type : Address :	Long I
Module HART Ch. : 0 Master Type : Primary M Preambles : 5	▼ aster ▼	Auto Configure : Disable Network Mode : Multidrop Cmd 0 Mode : Initial	~ ~	Frame Type : Address : Cmd 3 Mode :	Long - 1 Polling -
Module HART Ch. : 0 Master Type : Primary M Preambles : 5	▼ aster ▼	Auto Configure : Disable Network Mode : Multidrop Cmd 0 Mode : Initial	•	Frame Type : Address : Cmd 3 Mode :	Long - 1 Polling -
Module HART Ch. : 0 Master Type : Primary M Preambles : 5	▼ aster ▼	Auto Configure : Disable Network Mode : Multidrop Cmd 0 Mode : Initial	- -	Frame Type : Address : Cmd 3 Mode :	Long - 1 Polling -
Module HART Ch. : 0 Master Type : Primary M Preambles : 5 stem Edit	▼ aster ▼	Auto Configure : Disable Network Mode : Multidrop Cmd 0 Mode : Initial	•	Frame Type : Address : Cmd 3 Mode :	Long - 1 Polling -

2) The HRT-310's update period of all HART instruments' data is:

[1] Init commands (CMD0) communication time:

Auto Polling : Enable

HRT-310 will send CMD0 to short frame address from 0 and stops until finds all devices. As the settings shown above, Device 0 and 1 has short frame address of 1 and 2, so CMD0 will be sent **3** times. Communication time is:

Retry Count (0~5) : 3

3*1000 = 3000 ms

Note: Because CMD0 is Init command, it will only be executed when HRT-310 booted up, so it **does not affect HART communication update period**.

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[2] Polling commands (e.g. CMD3) communication time:

HRT-310 will sends Polling commands to each HART device sequentially. As the settings shown above, there are total of 2 HART instruments and only 1 Polling command (CMD3) is required to be sent for each device. Therefore communication time is:

2(Devices) * 1(Polling CMD) * 1000(ms) = 2000 ms =>Conclusion: HART communication update period is the total time taken to send

all Polling commands. So the update period here is 2000 ms

2. HART communication update period adjustment :

1) Shorten HART communication update period

[1] Delete unnecessary HART polling commands

The default settings of HART gateway contains 1 HART device and multiple HART commands, shown as below

Device Configuration			23
HRT-310 System	Item	Value	
HART Device 0 Default CMD(0) Default CMD(3)	Module Name	System	
User CMD(1) User CMD(2)	HART Device Count User Cmd Count	1 11	
User CMD(6) User CMD(12) User CMD(13)	Cmd Interval (ms) Cmd Timeout (ms)	1000 1000	E
	Auto Polling Retry Count	Enable 3	
User CMD(16) User CMD(17)	[Modbus Info]		
User CMD(18) User CMD(19)	Port No. Baud Rate(bps)	1 115200	

In order to shorten HART device update period, it is recommended to delete the whole device and then add a new device setting. (Refer to FAQ Q01)

[2] Shorten HART command interval

Right click on the System item and select Edit, reduce the time for Cmd Interval, 500 ms is suggested to be the minimum command interval.

ystem Edit	
System	
Cmd Interval (75~65535 ms) : 500	Timeout Value (305~65535 ms) : 1000
Auto Polling : Enable 🗾	Retry Count (0~5) : 3

2) The communication update period for HRT-310 to collect all devices data is:

2(Devices) * 1(Polling CMD) * 500(ms) = 1000 ms

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Q22 : Integrate HART communication to traditional AI structure

A22: (2018/10/29)

1. The existing AI loop system:

1) Device analog signal collected by AI module



2. Integrating HART communication to collect more HART device information:

1) Integrating HART Gateway to the existing system, new system as follow:

2) Switch off HART Gateway built-in resistor and parallel connecting to AI module

=> Additional HART communication function integrated to existing system



3. If AI readings of the initial system get disturbed after HART gateway added:

1) Using HART Filter (HRT-370) to split HART digital signal and AI analog signal



=> new system as follow:

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Q23 : HART Multi-drop mode precautions

A23: (2018/10/29)

Hardware:

1. HART devices address must set in between 1~15 and no repeated.

- 1) Please first set the HART address for each HART device one by one, then adding all to the HART Multi-drop loop.
- 2. Wiring for HART Multi-drop mode is as follow:



3. Start building structure from 2 HART devices

 To avoid situation that when error occurs and not knowing how to debug, it is recommended to start building structure with only 2 devices and adding 1 more device at a time if no error occurs until all devices been added.

4. Make sure the HART loop resistance is 250 Ω

1) Please measure if the resistance is around 250 Ω in between Module's (ex. HRT-710) HART+ / HART-

5. Choose HART loop resistor when connecting to 7 or more HART devices

1) HRT-710 and HRT-711 with hardware version earlier than V1.30:

When connecting more than 7 HART devices, built-in resistor (250 Ω , 1/4W) may be burned, therefore suggesting use an external resistor (250 Ω , 1W)

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2) HRT-710 and HRT-711 with hardware version from V1.30 and later:

Module upgraded built-in resistor to 250 Ω (2W), therefore no need to worry

=> HRT-310 designed to use built-in resistor of 250Ω (2W) at first place, therefore no need to worry about this issue

6. Check the voltage in between HART device (Be aware of voltage drop)

When connecting more HART devices, the voltage available between devices + / - drops and devices may not be able to turned on. Example as follow:

In Multi-drop mode, every HART device provides extra 4mA to HART loop, if customer uses a 24V power supply, the voltage between HART devices should be as follow:

1) Connecting 1 HART device:

Loop current: **4mA**; Loop resistance: **250** Ω => Voltage drop between resistor: **1V**; therefore voltage left for devices: 24V-1V=**23V**

2) Connecting 10 HART devices:

Loop current: **40mA**; Loop resistance: **250** Ω => Voltage drop between resistor: **10V**; therefore voltage left for devices: **24V-10V=14V**

3) Connecting 11 HART devices:

Loop current: **44mA**; Loop resistance: **250** Ω => Voltage drop between resistor: **11V**; therefore voltage left for devices: **24V-1V=13V**

(If device needs 14V or above voltage in order to be turned on, then HART communication failed)

Software (HG_Tool):

1. Set Module Address between 1~15 in Module Configuration

Module								
HART Ch. :	0	Ŧ	Auto Configure :	Disable	•	Frame Type :	Long	Ŧ
Master Type :	Primary Master	•	Network Mode :	Multidrop	•	Address :	1	
Preambles :	5		Cmd 0 Mode :	Initial	-	Cmd 3 Mode :	Polling	-

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Q24 : HART communication distance issues

A24: (2019/02/23)

1. When installing HART network, communication distance needs to be considered. Please refer to below table for information about cable capacitance and length

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

Source:

https://www.fieldcommgroup.org/sites/default/files/technologies/hart/ApplicationGuide_r7.1.p df

2. If communication distance needs to be extended, please try following methods:

(1) Use Fiber to extend HART communication distance

HRT-227CS is HART to Single-Mode Fiber converter, specially designed to extend HART communication distance.



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For more information, please refer to:

HRT-227CS user manual:

ftp://ftp.icpdas.com/pub/cd/fieldbus_cd/hart/converter/hrt-227cs/manual/

(2) Use Fiber to extend RS-485 communication distance

I-2541 and **I-2542 series** are RS-232/ 422/ 485 to Single-Mode Fiber converters, specially designed to extend Serial communication distance.



For more information, please refer to:

I-2541 user manual:

http://www.icpdas.com/download/converter/manual/net-i2541.pdf

I-2542 series user manual:

http://www.icpdas.com/root/product/solutions/datasheet/industrial_communication/I-2542 -Release%20Note_V1%2000.pdf

(3) Use Fiber to extend Ethernet communication distance

ICP DAS provides various Ethernet to Fiber switch, below is an example of using **NS-205F** and **NS-209F** Ethernet switch to extend communication distance

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To find suitable Ethernet & Fiber switch, please check from:

http://www.icpdas.com/root/product/solutions/industrial_ethernet_switch/switch_selection .html#a

(4) Use Ethernet Switch to extend Ethernet communication distance

Similar to previous method, instead of using Fiber, simple Ethernet switch can also extend the communication distance

To find suitable Ethernet switch, please check from:

http://www.icpdas.com/root/product/solutions/industrial_ethernet_switch/switch_selection .html#a

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Q25: Using Through Mode of HG_Tool to Stop Burst Mode of HART Device

A25: (2019/08/28)

- 1. Run the HG_Tool and connect to HRT-711.
 - (1) Disable all the Polling command.



(2) Open the "<u>Through Mode</u>" and send HART CMD0 to get the "<u>Long Frame Address</u>" of HART device.

[1] HART CMD0 : FF FF FF FF FF 02 80 00 00

[2] Long Frame Address : <u>1A 0B 50 EB CD</u> (As the below figure)

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Through Mode	
Send Data Channel : • FF FF FF FF 02 80 00 00 •	
With Parity Check	
FF FF FF FF 02 80 00 00 82	
	Clear
Receive Data	
Send Count : 1 Receive Count : 1 Error Count : 0 Receive Length : 24 Receive Data : (Hex) FF FF FF FF FF 06 80 00 0E 00 50 FE <u>1A 0B</u> 05 05 02 12 80 01 <u>50 EB CD</u> D0	
	~
	ear Update

(3) Configure HART command 109 and send it to disable the burst mode of HART device.

[1] HART CMD 109 => Ex : FF FF FF FF FF 82 DA 0B 50 EB CD 6D 01 00

<1> FF FF FF FF FF : Preamble

<2> 82 : Delimiter (0x02 need to add **0x80** = 0x82)

<3> DA 0B 50 EB CD : Long Frame Address (Different from every HART device)

(0x1A need to add 0xC0 = 0xDA)

<4> 6D : HART command no. (0x6D = 109)

<5> 01 : Byte Count (HART command parameter byte)

<6> 00 : Data (HART command parameter content. 00 for)

Q26 : How to use the In_Offset field of the UserCMD ?

A25: (2020/08/19)

[Example]

2. A user wants to use HRT-711 to read the float data from instrument Endress-Hauser

Promass F300 by sending HART command 158. (The float data doesn't arranged in two

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WORD of Modbus address) •

[Solution]

3. Run the example, users need to update the firmware of HRT-711 to be v1.03 and use

HG_Tool_v1.5.0.



- 4. The format of HART command 158 is as below.
 - (1) The start byte of the response float data is in byte3.

Byte	Format	Description		
0-1	Unsigned-16	Parameter HART Index		Parameter HART Index
2	Unsigned-8	Parameter Instance		
Data	Dutoe			
Byte	Format	Description		
Byte 0-1	Format Unsigned-16	Description Parameter HART Index		
Byte 0-1 2	Format Unsigned-16 Unsigned-8	Description Parameter HART Index Parameter Instance		

Fig 26-1 HART 158 format of Endress-Hauser Promass F300

5. Add the UserCMD of HART command 158 to HRT-711.

Device Configuration		
HRT-711	Item Value	ice D
HART Edit	IART Channel 0 Luto Configuration Enable	
- Use Delete - Use Add Comman	d Pefault Command (0) Initial Default Command (3) Polling	nt

(1) Owing to the start byte of the response float data is byte3, so in the "In_Offset" field,

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users can fill with 3 to ignore HART response data byte0, 1, and 2. Then the response float data can be shown in the Modbus address easily.

Device Configuration						
HRT-711 System HART Device 0 Default CMD(0) Default CMD(3) User CMD(158)	Item Commnad Name HART Device Index User Command Index Command No. Command Mode Command Format Cmd In Size Cmd Out Size	Value User CMD(158) 0 0 158 Polling Normal 9 0				
Command Edit						
Command Command Num. : 158 In Size : 6 In Offset : 3	Command Command Num. : 158 Mode : Polling V Format : Normal V In Size : 6 Out Size : 3 In Offset : 3 OK Cancel					
	Save to File Sa	ave to Device				
Input Data	byte0,1,2 float	data (2+4)				
Addr C1 C2	C3 C4 C5 C6	C7 C8 C9 6 Bytes				
0~9 0 64	0 174 0 65	157 142 134				

Fig 26-2 Add the UserCMD of HART command 158 to HRT-711

(2) In "System Edit" page, please set the "W&B" in the Swap Mode field.

Cmd Interval (75~65535 ms) : 1000	Timeout Value (305~65535 ms) : 1000
Auto Polling : Enable	Retry Count (0~5) : 3
Modbus Setting	
Swap Mode : 🛛 🛛 🛛 🛛 🛛 🕅	

6. After finished the settings, click "**Save to Device**" button in Device Configuration to save all the settings.

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7. Trig the HRT-711 to send UserCMD0 (HART command 158). (refer to the steps of FAQ15)8. Get the response data of HART command 158 via HG_Tool.

Device Informati	ion												-	×
HRT-711	HRT-711 				nad N Devi omma and N and N and N Add out Ad	lame ce Ind and In lo. fode prma prma loress ldress æt	lex ndex t		Value Jser C) 58 'olling Vorms i))	MD()	158)			
	IO Data											×		
	Module nar Color availa	me : Able ta	User C	MD(1. navails	58) able	•	selecte	d						
	Addr	C1	C2	C3	C4	C5	C6	C7	C8	С9	C10	^		
	0~9	0	0	0	0	0	0	0	0	0	0			
	10~19	0	0	0	0	0	0	0	0	0	0			
	20~29	0	0	0	0	0	0	0	0	0	0			
	30~39	0	0	0	0	0	0	0	0	0	0			
	40~49	0	0	0	0	0	0	0	0	0	0	~		
	<				I						>	4		
										Sei	nd Dat	a.		
	Input Data	a												
	Addr	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	^		
	0~9	0	0	65	157	142	134	0	0	0	0			
	10~19	0	0	0	0	0	0	0	0	0	0			
	20~29	0	0	0	0	0	0	0	0	0	0			
	30~39	0	0	0	0	0	0	0	0	0	0			
	40~49	0	0	0	0	0	0	0	0	0	0	~		
	<				1									
										U	Ípdate			

Fig 26-3 The response data of HART command 158

- 9. Get the response data of HART command 158 via modscan tool.
 - (1) The Modbus first WORD data: the response code of HART command 158.
 - (2) The Modbus second and third WORD data: the float data of HART command 158.

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🎫 ModScan32 - ModScal							
<u>File Connection S</u> etup <u>V</u> iew <u>W</u> indow <u>H</u> elp							
01 10 IO 00 22 22 64 64							
ModScal							
Address: 0002 Device I MODBU	d: 1 Number of Polls: 175 S Point Type Valid Slave Responses: 171						
Length: 10 04: INPUT R	Display Definition						
30002: <8E86H> 30003: <419DH> 30004: <0000H> 30005: <0000H> 30006: <0000H> 30007: <0000H> 30007: <0000H>	Scan Rate: 1000 • Milliseconds Scan Rate: 1000 • Milliseconds Modbus Data Slave Address: 1 Point Type: 04 INPUT REGISTER • Point Address: 2 Length: 10 OK Cancel						

Fig 26-4 The response data of HART command 158 (Hex format)

ModScan32 - ModSca1						
File Connection Setup View Window	w <u>H</u> elp					
Data Definition Display Options	✓ Show Data Show Traffic					
Address: Capture Off Length: TU	Binary Hex Unsigned Degimal Integer Long Integer Floating Point Most Significant Register First Double Float Hex Addresses					
30002: 19.6946 30003: 30009: 30004: 0.0000 30010: 30005: 30011: 30006: 0.0000 30007: <	0.0000 0.0000					



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Q27: How to use "Listen Only" function to get HART data?

A27: (2020/08/20)

[Example]

A user wants to get HART device data (like HART command3) in another PC via Modbus/TCP via the original HART network without interfering the original HART communication.

[Solution]

1. The HART "Listen Only" function had been supported in HRT-711 firmware v1.03. It means that HRT-711 doesn't send any HART command and just receive HART communication and then can get HART device data via Modbus.

2. Example-1: (There is just only one HART device in HART network)

(1) Using HDS (HART Device Simulator) software to set HART command 3 and 158 data as the below figure for HART device.

HDS_v1.U7 (HART_Device_Simulat						
ComPort COM9 Close I-7547 Function Function SetParam DataLog DevStatus Dev-Specific						
HART_Devices	HART_Devices HART v70 C GetCMD3Param (Auto)					
Enable Short Addr Long Addr (hex)	MfrID (v7) PV_Value PV_Unit SV_Value SV_Unit IV_Value TV_Unit QV_Value QV_Unit					
✓ 00 0x E28D990328	[6084] [11.142500] g/sec ▼ 2.942500 N ▼ 3.942500] deg ▼ 27.695000 rad ▼					
01 0x 0A01000000	11.444444 torr					
02 0x 0A14000000						
03 0x 1190000000	10016 HART CMD No : 158 CMD Param Num : 7 💌 33.44444 m3/sec 💌					
04 0x 1164000000	0016 CMD Param Value (HEX)					
05 0x 1127112233	0016 1 2 3 4 5 6 7 8 9 10 V 55.44444 ghr					
06 0x 110E000000	0016 0 11 22 33 41 9D 8E 86 00 00 00 00 66.444444 lb/sec -					
07 0x 1207000000	0016 1 00 00 00 00 00 00 00 00 00 00 00 00 V 77.444444 Deg.F V					

Fig 27-1 Set HART command 3 and 158 data in the HDS

(2) Add HART command 3 and 158 to HRT-711.

lodule Edit					
Basy Mode Module					
HART Ch. :	0	🖌 Auto Configure : 🖪	nable 🔽	Frame Type : Long	2
Master Type :	Primary Master	Network Mode : P	oint to Point 💌	Address : 0	
Preambles :	5	Cmd 0 Mode : In	nitiəl 💌	Cmd 3 Mode : Initial	~
Unique Identi Auto Get Manufacture	ifier Unique ID r ID : 22	Device Type : 133		Device ID : 723522	
				OK	Cancel

Fig 27-2 HART command 3 setting

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Command Num. : 158	Mode : Manual 💉	Format : Normal 💌
In Size : 6	Out Size : 0	
In Offset : 3		

Fig 27-3 Add HART command 158 (UserCMD)

(2) In the "System Edit" page, Set "Auto Polling" to be "Disable" (HRT-711 will not send HART command) and set the "Swap Mode" to be "W&B".

ystem Edit	
System Cmd Interval (75~65535 ms) : Auto Polling : Disable Modbus Setting Swap Mode : W&B	Timeout Value (305~65535 ms) : 1000 Retry Count (0~5) : 3
	OK Cancel

Fig 27-4 Set "Auto Polling" to be "Disable"

(3) After finished the settings, click "**Save to Device**" button in Device Configuration to save all the settings.

(4) Get the response data of HART command 3 and 158 via Modscan tool.

💶 ModScal	🖬 ModSca2
Address:1301Device Id:1Address:1301MODBUS Point TypeLength:1004: INPUT REGISTER	Address:0002Device Id:1Address:0002MODBUS Point TypeLength:204: INPUT REGISTER🔽
HART Command 3 Data	HART Command 158 Data
31301: 9.9427 31307: 3.9425 31302: 31308: 31303: 11.1425 31309: 27.6950 31304: 31310: 31305: 2.9425 31306:	30002: 19.6946 30003:



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3. Example-2: (There two HART devices in HART network)

(1) Using HDS (HART Device Simulator) software to set HART device address 1 and address3 and HART command 3 data as the below figure for these two HART devices.

81	HDS_v	1.07 (HA)	RT_Device_Simulat	or - ICP D	AS)											
	ComPo	nt 19 💌	Close					I-7547 Enable ChNo : 0	Set Get	Ch Ch	Function SetParam	DataLog		evStatus Dev-Sj	pecific	
	HARI_	_Devices —										Γ	HARI	v7.0	D3Param (,	Auto)
	Enable	Short Ad	dr 🛛 Long Addr (hex)	MfrID (v7)	PV_Value	PV_Un	uit	SV_Value	SV_U	Init	TV_Value	TV_U:	nit	QV_Value	QV_U	Init
		00	0x E28D990328	6084	11.142500	g/sec	-	2.942500	N	-	3.942500	deg	-	27.695000	rad	-
		01	0x 0A01000000	0016	11.111111	kg/cm2	•	11.222222	Pa	•	11.333333	kPa	-	11.444444	torr	-
	Γ	02	0x 0A14000000	0016	22.111111	MPa	-	222.222222	gal/sec	-	222.333333	gal/min	-	22.444444	gal/hr	-
		03	0x 1190112233	0016	33.111111	1/sec	•	33.222222	1/min	-	33.333333	l/hr	•	33.44444	m3/sec	•

Fig 27-6 Set HART device address and command 3 data in HDS

- (2) Add HART device with address 1 and address 3 to HRT-711.
 - [1] Users need to un-check the "Auto Get Unique ID" checkbox and fill with the long frame address of HART device.

odule Edit							
🔄 Easy Mode Module							
HART Ch. :	0	💉 Auto Configure :	Disable	~	Frame Type :	Long	~
Master Type :	Primary Master	Network Mode :	Multidrop	~	Address :	1	
Preambles :	5	Cmd 0 Mode :	Initial	~	Cmd 3 Mode :	Initial	~
Unique Ident	ifier Unique ID Lor	ng Frame Addro	ess must	mat	ch with HA	ART de	vice
Manufacture	riD: 10	Device Type : 1	2		Device ID : 0		
						ж	Cancel

Fig 27-7-1 Add HART device with address 1 (0x0A01000000)

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] Easy Mode Iodule								
HART Ch. :	0	~	Auto Configure :	Disable	~	Frame Type :	Long	~
Master Type :	Primary Master	~	Network Mode :	Multidrop	*	Address :	3	
Preambles :	5		Cmd 0 Mode :	Initial	~	Cmd 3 Mode :	Initial	*
Unique Ident	tifier t Unique ID Lor	ng F	rame Addre	ss must	mat	ch with HA	RT dev	ice
Manufacture	er ID : 17		Device Type : 1	44	2	Device ID : 1	122007	

Fig 27-7-1 Add HART device with address 3 (0x1190112233)

(2) In the "System Edit" page, Set "Auto Polling" to be "Disable" (HRT-711 will not send HART command) and set the "Swap Mode" to be "W&B".

ystem Edit	
System Cmd Interval (75~65535 ms) : IIII Auto Polling : Disable Modbus Setting Swap Mode : W&B	Timeout Value (305~65535 ms) : 1000 Retry Count (0~5) : 3
	OK Cancel

Fig 27-8 Set "Auto Polling" to be "Disable"

- (3) After finished the settings, click "**Save to Device**" button in Device Configuration to save all the settings.
- (4) Get the response data of HART command 3 of these two HART devices via Modscan tool.

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- ModScal	- ModSca2
Address:1301Device Id:1Address:1301MODBUS Point TypeLength:1004: INPUT REGISTER	Address: 1311 Device Id: 1 Address: 1311 MODBUS Point Type Length: 10 04: INPUT REGISTER
CMD3_Data for HART Device Address=1	CMD3_Data for HART Device Address=3
31301: 4.0000 31307: 11.3333 31302: 31308: 31303: 11.1111 31309: 11.4444 31304: 31310: 31305: 11.2222 31306:	31311: 4.0000 31317: 33.3333 31312: 31318: 31313: 33.1111 31319: 33.4444 31314: 31320: 31315: 33.2222 31316:

Fig 27-9 HART command 3 data of HART device address 1 and 3 shown in Modscan

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Q101 : The whole configuration process of HRT-711 ?

A101: (2016/02/19)

1. Set the network parameters of HRT-711 (Ex : IP / Mask / Gateway) ${\scriptstyle \circ}$

- (1) Connect the Ethernet port between PC and HRT-711.
- (2) Run the "HRT-711 Utility" and click the "Ethernet" item.



(3) Click the "Search Servers" button and it will search all the HRT-711 modules automatically.

🎺 eSearch Utility [v1.0.9, Oct.24, 2013]									
<u>File S</u> erver <u>T</u> ools									
Name	Alias	IP Address	Sub-net Mask	Gateway	MAC Ad				
HRT-711	HRT-711	192.168.255.1	255.255.0.0	192.168.0.1	00:0d:e				
<					>				
Status	vers Configu	ration (UDP)	Web	Exit					

(4) Choose the "HRT-711" item and click the "Configuratino (UDP)" button and users can set the network parameters of HRT-711. Then click the "OK" button to save the settings.

1	Search Utility [v1.0	.9, Oct.24, 2013]		K					
File	Configure Server (I	IDP)							
N	Server Name :	HRT-711	A						
1.	DHCP:	0: OFF 🗾	Alias: HRT-711 (7 Chars)						
	IP Address :	192.168.255.1	MAC: 00:0d:e0:8f:ff:ff						
	Sub-net Mask :	255.255.0.0	Warning!!						
	Gateway :	192.168.0.1	correct configuration before any changing!						
<	Cancel								
Statu	Search Servers Configuration (UDP) Web Exit								

- 2. Run the HRT-711 utility to connect to HRT-711 via RS-232 for HART configuration.
 - (1) Using the CA-0910 cable (3 pin RS-232, TxD/RxD/GND) included in the HRT-711 product. Connect the TXD / RXD / GND pins between CA-0910 and HRT-711. (Wiring : TXD to TXD, RXD to RXD, GND to GND)

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(Note : The RS-232 pin assignment of HRT-711, the left pin1 is reserved and then the left pin2, 3 and 4 will be TXD, RxD and GND.)



(2) Run the "HRT-711 Utility" and click the "HART" item.



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(3) Follow the instruction of the figure to set the "Dip Switch" in the back of HRT-711 to be "Init" and then reboot HRT-711.



- (4) Click the "Communication Settings" item.
 - [1] Device : choose the "HRT-711".
 - [2] Port Num : choose the ComPort no. of PC.
 - => After finish, click the "OK" button.

*	Communication Settings	Device Information	Device Configuration
Com Port Setting Device : HRT-711 Setting Port Num : COM1	ComPort N	No. in PC	ice ostic
Connect	Through Mode	Format	
HG_Tool Version 1.6.0 Copyr Supported Modules: HRT-710	ight (C) 2012 I), HRT-711	by ICP DAS	

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(5) Click the "Connect" button. After about 5 seconds, if the green light is "ON" of the traffic light in the left-top corner of HRT-711 utility, it means the connection is successful. Then users can configure the HRT-711 for HART devices.



- 1. Add the HART devices to HRT-711.
 - (1) The detailed steps, please refer to the "Q01 : How to add HART devices to HRT-711 ?" of FAQ.
- 2. Check if HRT-711 gets the HART device data correctly.
 - (1) The detailed steps, please refer to the "Q02 : How to make sure that HRT-711 gets the HART device data correctly ?" of FAQ.

=> If the communication between HRT-711 and HART devices is failed, the ERR LED will flash. If the communication is ok, the ERR LED will be OFF.

- 3. Get the HART device data via Modbus/TCP or Modbus/UDP.
 - (1) Set the "Dip Switch" in the back of HRT-711 to be "Normal" and then reboot HRT-711.
 - (2) Refer to the detailed steps of the "Q03 : How to map HART device CMD(3) data directly to SCADA or HMI ?" of FAQ.

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Appendix A HART Command

In this chapter, the following lists are the HART universal command format.

Request Data Bytes		0	0		
Response D	Response Data Bytes		2 = 14		
Byte Index	Format		Desciption		
0	Uint8		Response Code 1		
1	Uint8		Response Code 2		
2	Uint8		254		
3	Uint8		Manufacturer ID		
4	Uint8		Manufacturer's device ID		
5	Uint8		Number of preambles needed in the request		
6	Uint8		Command set revision number		
7	Uint8		Transmitter specific revision code		
8	Uint8		Software revision		
9	Uint8		Hardware revision		
10	Uint8		Flags		
11~13 Uint24			Device ID number (MSB first)		

Command 0 : Read Unique Identifier

Command 1 : Read Primary Variable

Request Data Bytes		0	0		
Response Data Bytes		2 + 5	5 = 7		
Byte Index	Format		Desciption		
0	Uint8		Response Code 1		
1	Uint8		Response Code 2		
2	Uint8		Unit code		
3~6 Float			Primary Variable		

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Request Data Bytes		0	0		
Response Data Bytes		2 + 8	3 = 10		
Byte Index	Format		Desciption		
0	Uint8		Response Code 1		
1	Uint8		Response Code 2		
2~5	Float		Primary Variable Current		
6~9	6~9 Float		Primary Variable Percentage of Range		

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

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

Request Data Bytes		0	0		
Response D	Response Data Bytes		24 = 26		
Byte Index	Format		Desciption		
0	Uint8		Response Code 1		
1	Uint8		Response Code 2		
2~5	Float		Primary Variable Current		
6	Uint8		Primary Variable Unit code		
7~10	Float		Primary Variable		
11	Uint8		Secondary Variable Unit code		
12~15	Float		Secondary Variable		
16	Uint8		Tertiary Variable Unit code		
17~20	7~20 Float		Tertiary Variable		
21	Uint8		Quaternary Variable Unit code		
22~25	22~25 Float		Quaternary Variable		

Command 6 : Write Polling Address

Request Data Bytes		1	
Byte Index	Format		Desciption
0	Uint8		Polling Address
Response Data Bytes 2 +		2 + 1	1 = 3
Byte Index	Format		Desciption
0	Uint8		Response Code 1
1	Uint8		Response Code 2
2	Uint8		Polling Address

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Request Da	ta Bytes 6		
Byte Index	Format		Desciption
0~5	PA6		TAG Name
Response D	ata Bytes	2 + 1	2 = 14
Byte Index	Format		Desciption
0	Uint8		Response Code 1
1	Uint8		Response Code 2
2	Uint8		254
3	Uint8		Manufacturer ID
4	Uint8		Manufacturer's device ID
5	Uint8		Number of preambles needed in the request
6	Uint8		Command set revision number
7	Uint8		Transmitter specific revision code
8	Uint8		Software revision
9	Uint8		Hardware revision
10	Uint8		Flags
11~13	Uint24		Device ID number (MSB first)

Command 11 : Read Unique Identifier Associated with TAG

Command 12 : Read Message

Request Data Bytes 0		0	
Response Data Bytes		2 + 24 = 26	
Byte Index	Format		Desciption
0	Uint8		Response Code 1
1	Uint8		Response Code 2
2~25	PA24		Message

Command 13 : Read Tag, Descriptor, Date

Request Data Bytes 0		0		
Response Data Bytes 2		2 + 2	2 + 21 = 23	
Byte Index	Format		Desciption	
0	Uint8		Response Code 1	
1	Uint8		Response Code 2	
2~7	PA6		TAG Name	

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8~19	PA12	Descriptor
20	Uint8	Day of month
21	Uint8	Month of year
22	Uint8	Year as offset to 1900

Command 14 : Read Primary Variable Sensor Information

Request Data Bytes 0		0		
Response Data Bytes		2 + 1	2 + 16 = 18	
Byte Index	Format		Desciption	
0	Uint8		Response Code 1	
1	Uint8		Response Code 2	
2~4	Uint24		Sensor Serial Number (MSB first)	
5	Uint8		Sensor limits unit	
6~9	Float		Upper sensor limit	
10~13	Float		Lower sensor limit	
14~17	Float		Minimum span	

Command 15 : Read Primary Variable Output Information

Request Data Bytes		0	
Response Data Bytes		2 + 1	17 = 19
Byte Index	Format		Desciption
0	Uint8		Response Code 1
1	Uint8		Response Code 2
2	Uint8		Alarm select code
3	Uint8		Transfer function code
4	Uint8		PV range value unit code
5~8	Float		Upper range value
9~12	Float		Lower range value
13~16	Float		Damping value
17	Uint8		Write protect code
18	Uint8		Private label distribution code

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Command 16 : Read Final Assembly Number

Request Data Bytes 0		0	
Response Data Bytes		2 + 3 = 5	
Byte Index	Format		Desciption
0	Uint8		Response Code 1
1	Uint8		Response Code 2
2~4	Uint24		Final assembly number (MSB first)

Command 17 : Write Message

Request Data Bytes		24	24	
Byte Index	Format		Desciption	
0~23	PA24		Message	
Response Data Bytes 2 + 2		2 + 2	24 = 26	
Byte Index	Format		Desciption	
0	Uint8		Response Code 1	
1	Uint8		Response Code 2	
2~25	PA24		Message	

Command 18 : Write Tag, Descriptor, Date

Request Da	est Data Bytes 21		
Byte Index	Format		Desciption
0~5	PA6		TAG Name
6~17	PA12		Descriptor
18	Uint8		Day of month
19	Uint8		Month of year
20	Uint8		Year as offset to 1900
Response Data Bytes 2 + 2		2 + 2	21 = 23
Byte Index	Format		Desciption
0	Uint8		Response Code 1
1	Uint8		Response Code 2
2~7	PA6		TAG Name
8~19	PA12		Descriptor
20	Uint8		Day of month

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21	Uint8	Month of year
22	Uint8	Year as offset to 1900

Command 19 : Write Final Assembly Number

Request Data Bytes		3	
Byte Index	Format		Desciption
0~2	Uint24		Final assembly number (MSB first)
Response Data Bytes 2 + 3		2+3	3 = 5
Byte Index	Format		Desciption
0	Uint8		Response Code 1
1	Uint8		Response Code 2
2~4	Uint24		Final assembly number (MSB first)

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Appendix B Command Format

The HART data format of Modbus address is divided into the Normal and Simple format.

1. Normal format

When read / write HART data by Modbus, the Modbus data format is HART standard command format.

2. Simple format

When read / write HART data by Modbus, the Modbus data format is simple format (omit the Response Code and Unit data). In this mode, the HMI or SCADA software can read or write HART data easily. Now, it only supports HART command number 1, 2 and 3.

The simple format of HART command

Command 1 : (Read Primary Variable)

Response Data Bytes		4	
Byte Index	Format		Desciption
0~3	Float		Primary Variable

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

Response Data Bytes		8	
Byte Index	Format		Desciption
0~3	Float		Primary Variable Current
4~7	Float		Primary Variable Percentage of Range

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

Response Data Bytes		20	
Byte Index	Format		Desciption
0~3	Float		Primary Variable Current
4~7	Float		Primary Variable
8~11	Float		Secondary Variable
12~15	Float		Tertiary Variable
16~19	Float		Quaternary Variable

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Appendix C. Revision History

This chapter provides revision history information to this document.

The table below shows the revision history.

Revision	Date	Description
		Add Fig 2.3.2-4
1.10	2020/08/19	Add FAQ Q26
		Add the "In Offset" field in the UserCMD setting
1.09	2020/07/02	Add FAQ Q24 / Q25
		Add FAQ Q21
1.08	2018/10/29	Add FAQ Q22
		Add FAQ Q23
		Modify FAQ Q15, 18, 19 with Modbus command
1.07	2018/05/22	FC06
		FAQ Q04 add TCP firmware update section
1.06	2018/04/10	Add FAQ Q20
1.05	2017/12/20	Add FAQ Q18, Q19
1.04	2017/05/10	Add MB starting address explanation to FAQ Q03
		Add FAQ17
1.03	2016/10/20	Modify Firmware Update Process
		(Q04 of FAQ)
1.02	2016/01/28	Modbus/UDP server is also supported.
1.01	2015/08/04	Add FAQ chapter to this users' manual
1.00	2014/01/21	First revision

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