

MODBUS-HART Instruction Manual



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Disclaimer:

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Before using the product, please read the manual intensively. First, please confirm which type of Instruments is used with the HART protocol, and then find out the appropriate using method in the manual. Before switching on the power, please confirm all interfaces are correctly connected. The company will not be held liable for any damage caused by improper use that violates the methods specified herein unless following the instructions.

This document serves as the official product description. However, content may become outdated or invalid due to product/software upgrades. We do not guarantee consequences arising from such changes. Please monitor version updates and ensure prompt updates.

For the latest information, please refer to our website: www.smmeter.com. If you have any questions about this document or the performance description of this product, please contact your supplier or contact us directly. E-mail : sales@smdznet.com or contact tel: [86-573-82623038](tel:86-573-82623038) for advice and answers.

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1. Overview

1.1 Product Introduction

MODBUS-HART is composed of high precision operational amplifier, interface chip, input and output circuit, and embedded with HART modulation and demodulation chip, which has the characteristics of stable performance and high cost performance.

MODBUS-HART communicates with the equipment with MODBUS-RTU communication function through RS485 interface, which can convert the data in the equipment into HART equipment variable output and support 4 ~ 20 mA current output.

The MODBUS-HART hardware structure is designed in full compliance with industrial standards. Special design is adopted in terms of temperature range, vibration, electromagnetic compatibility and interface diversity, which ensures stable operation in harsh environment and provides high quality assurance for your equipment.

1.2 Product Performance

- One RS485 communication interface (optional).
- Two-way/four-way analog acquisition function (optional).
- Analog range and zero point can be set.
- All operating parameters can be queried and set locally.

1.3 Main Parameters

- Shell size: length 96 mm × width 80 mm × height 25 mm.
- Working temperature: -25 °C ~ + 85 °C.
- Relative humidity: 10% ~ 80%.
- Power input voltage: DC 24V.
- Input signal: DC 4 ~ 20mA.

2. MODBUS-HART Physical Drawing and Indicator Light Function

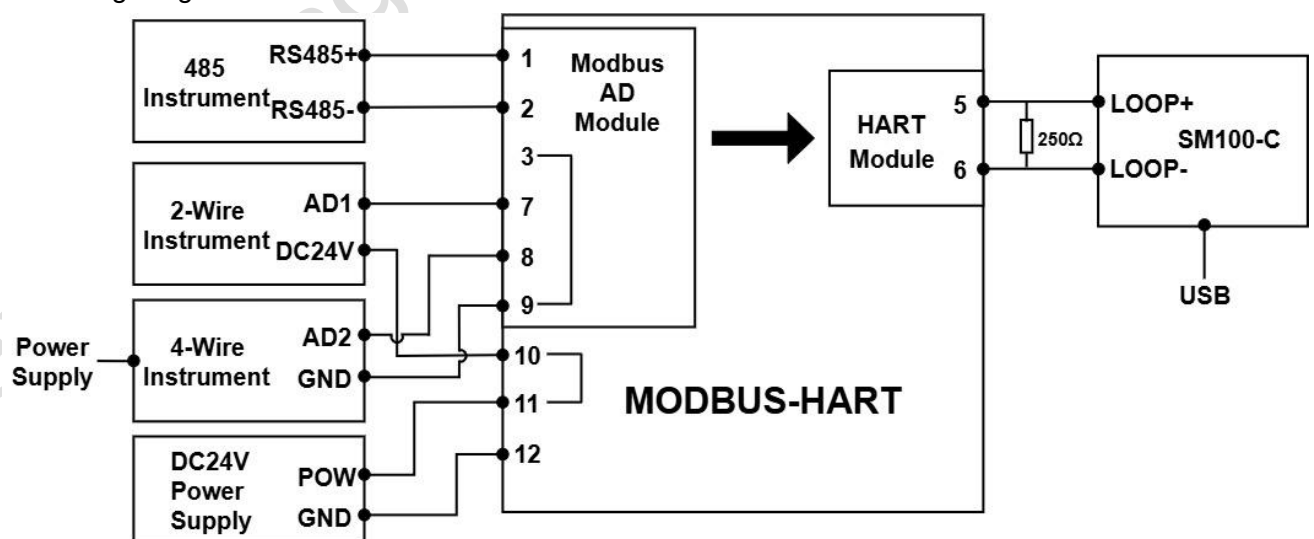
2.1 Physical Drawings



2.2 Product Selection

Serial number	Model	AD interface	RS485 interface	HART interface
1	MODBUS-HART-001	2	1	1
2	MODBUS-HART-002	None	1	1
3	MODBUS-HART-003	4	None	1

2.3 Wiring Diagram



2.4 Port Introduction

2.4.1 MODBUS-HART-001

Port number	1	2	3	4	5	6
Port name	RS485+	RS485-	GND		LOOP+	LOOP-
Function/access device	RS485 communication				Variable output	
Port number	7	8	9	10	11	12
Port name	AD1	AD2	GND	DC24V		GND
Function/access device	Analog input			Power source		

- RS485 _ A, RS485 _ B: RS485 communication, according to different requirements, refer to the connection diagram to connect MODBUS instrument equipment, to achieve data transmission between the converter and the equipment.
- LOOP +, LOOP-: connect HART protocol equipment and read output variable information.
- AD1, AD2, GND: analog channel input, used to collect analog signals. (Optional, the user can select the model according to the requirements)
- DC24V, GND: DC power supply, the positive and negative poles (+,-) of the power line are connected to the corresponding (DC24V, GND) terminals respectively.

2.4.2 MODBUS-HART-002

Port number	1	2	3	4	5	6
Port name	RS485+	RS485-	GND		LOOP+	LOOP-
Function/access device	RS485 communication				Variable output	
Port number	7	8	9	10	11	12
Port name				DC24V		GND
Function/access device				Power source		

- RS485 _ A, RS485 _ B: RS485 communication, according to different requirements, refer to the connection diagram to connect MODBUS instrument equipment, to achieve data transmission between the converter and the equipment.
- LOOP +, LOOP-: connect HART protocol equipment and read output variable information.
- DC24V, GND: DC power supply, the positive and negative poles (+,-) of the power line are connected to the corresponding (DC24V, GND) terminals respectively.

2.4.3 MODBUS-HART-003

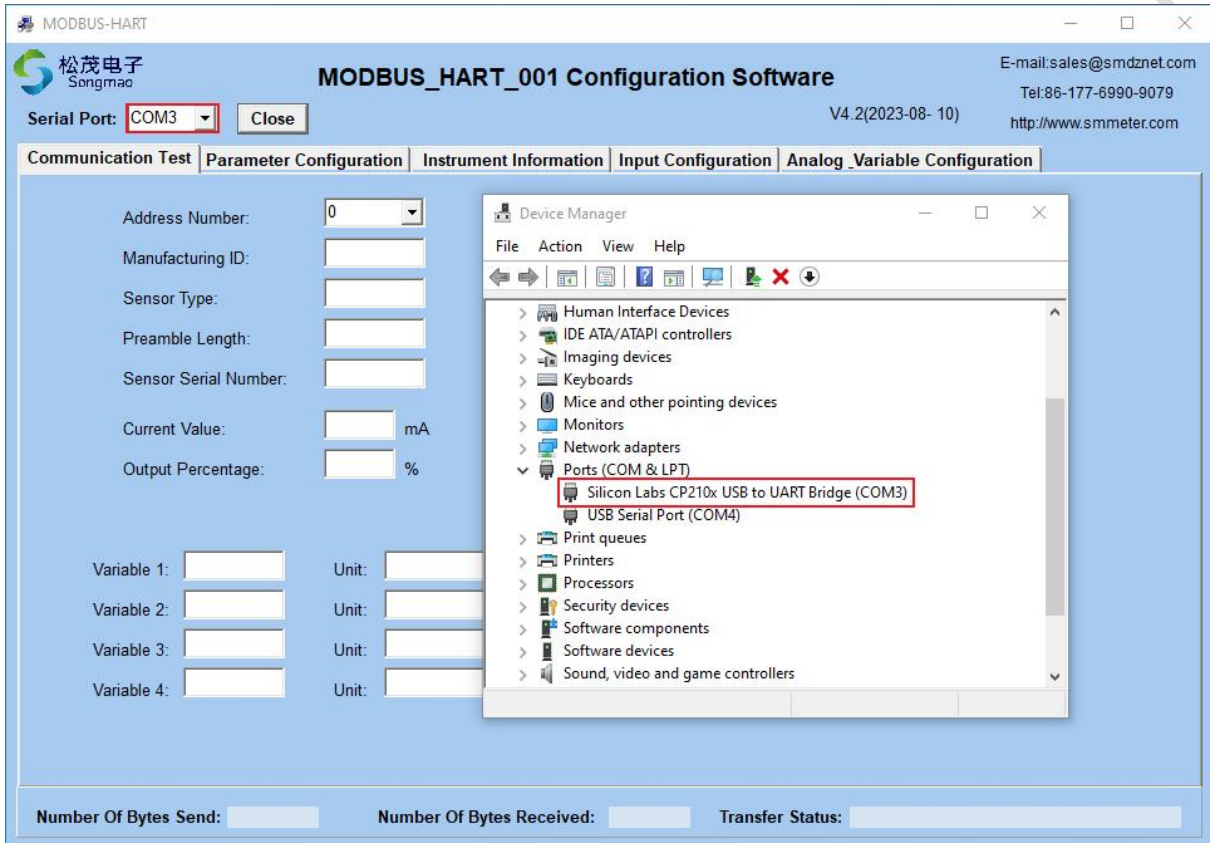
Port number	1	2	3	4	5	6
Port name	AD3	AD4	GND		LOOP+	LOOP-
Function/access device	Analog input				Variable output	
Port number	7	8	9	10	11	12
Port name	AD1	AD2	GND	DC24V		GND
Function/access device	Analog input			Power source		

- LOOP +, LOOP-: connect HART protocol equipment and read output variable information.
- AD1 ~ AD4, GND: analog channel input, used to collect analog signals. (Optional, the user can select the model according to the requirements)
- DC24V, GND: DC power supply, the positive and negative poles (+,-) of the power line are connected to the corresponding (DC24V, GND) terminals respectively.

3. Function Introduction and Operation Steps of Configuration Software

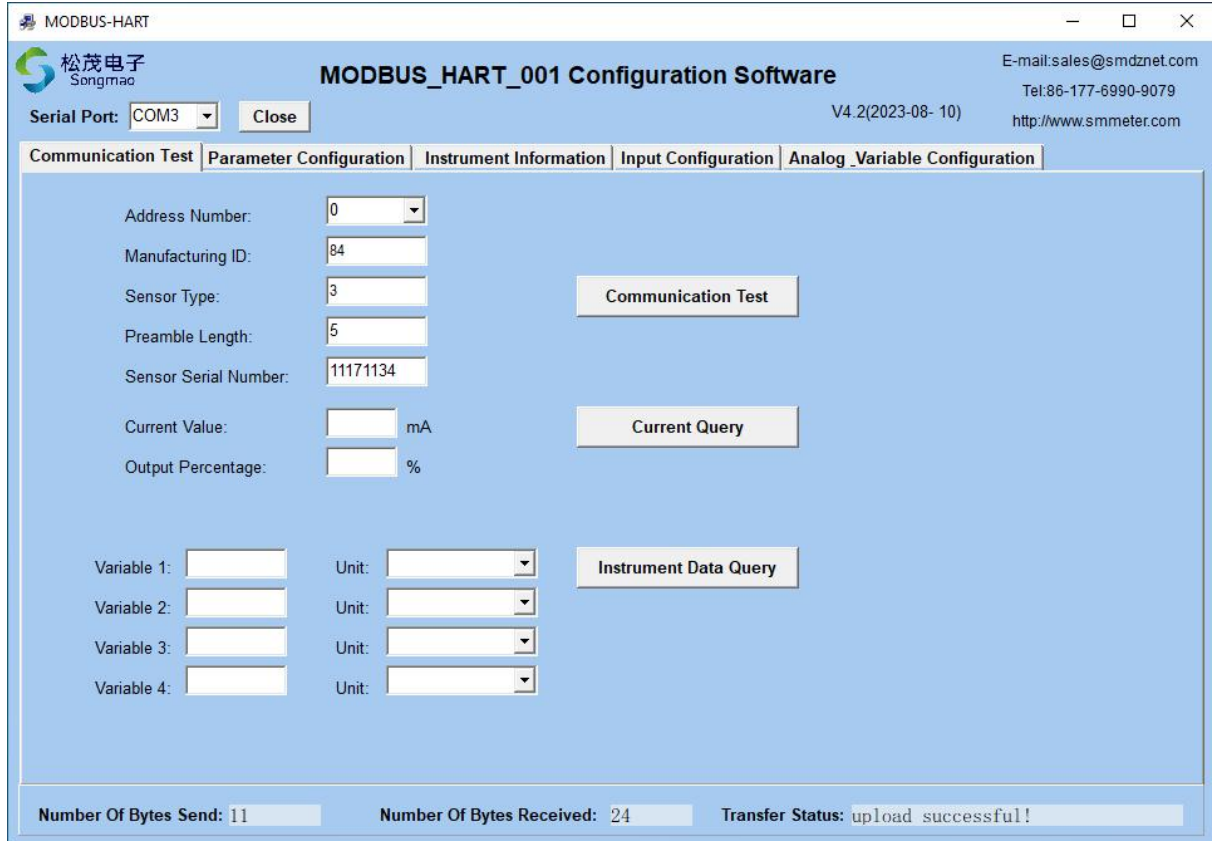
3.1 Communication Connection

- 1) According to the introduction of the port in the previous part, select the signal to be collected, and connect the corresponding RS485 communication port, analog input port and power supply.
- 2) Open the configuration debugging software, select the correct serial port number and open the serial port.
- 3) Click "Communication Test" in the online test interface, and the transmission status below prompts "Upload successful", which means the online is successful.



3.2 Communication Test

- 1) Instrument communication test: Click "Communication Test" to query instrument address number, sensor type, sensor serial number and other instrument information.
- 2) Check current: Click "Check Query" to query current value and output percentage.
- 3) Instrument data query: click "Instrument Data Query" to query the dynamic variable information of HART instrument.



MODBUS-HART

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MODBUS_HART_001 Configuration Software

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Serial Port: COM3 Close V4.2(2023-08-10)

Communication Test | Parameter Configuration | Instrument Information | Input Configuration | Analog Variable Configuration

Address Number: 0
Manufacturing ID: 84
Sensor Type: 3
Preamble Length: 5
Sensor Serial Number: 11171134

Current Value: mA
Output Percentage: %

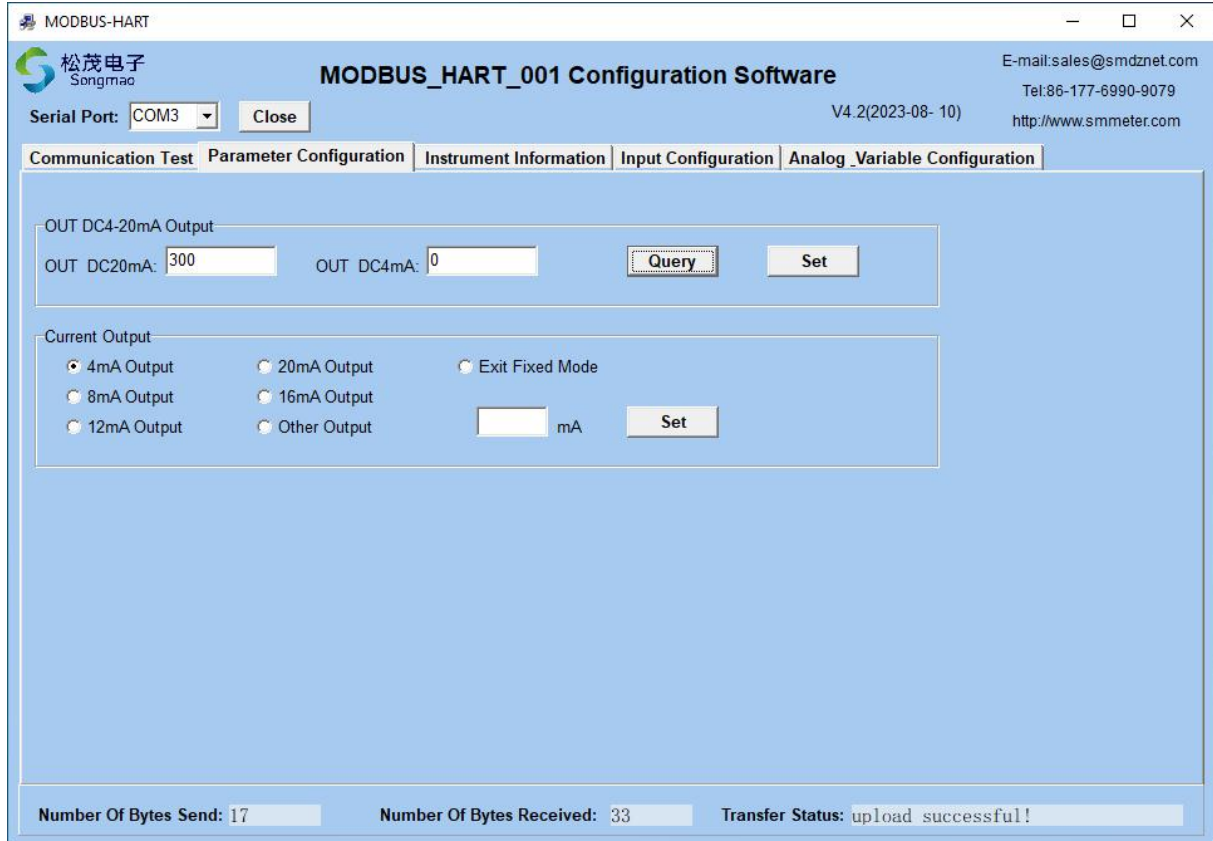
Variable 1: Unit:
Variable 2: Unit:
Variable 3: Unit:
Variable 4: Unit:

Communication Test
Current Query
Instrument Data Query

Number Of Bytes Send: 11 Number Of Bytes Received: 24 Transfer Status: upload successful!

3.3 Parameter Configuration

- 1) OUT DC4-20mA: it can read and set the upper and lower limits of the range corresponding to the 4-20 mA current output by the HART instrument.
- 2) Current output: when HART instrument simulates current output, you can select the corresponding current output value, and then click Set, HART instrument will fix the output current according to the set current value.



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Serial Port: COM3 Close

V4.2(2023-08-10)

Communication Test Parameter Configuration Instrument Information Input Configuration Analog Variable Configuration

OUT DC4-20mA Output

OUT DC20mA: 300 OUT DC4mA: 0 Query Set

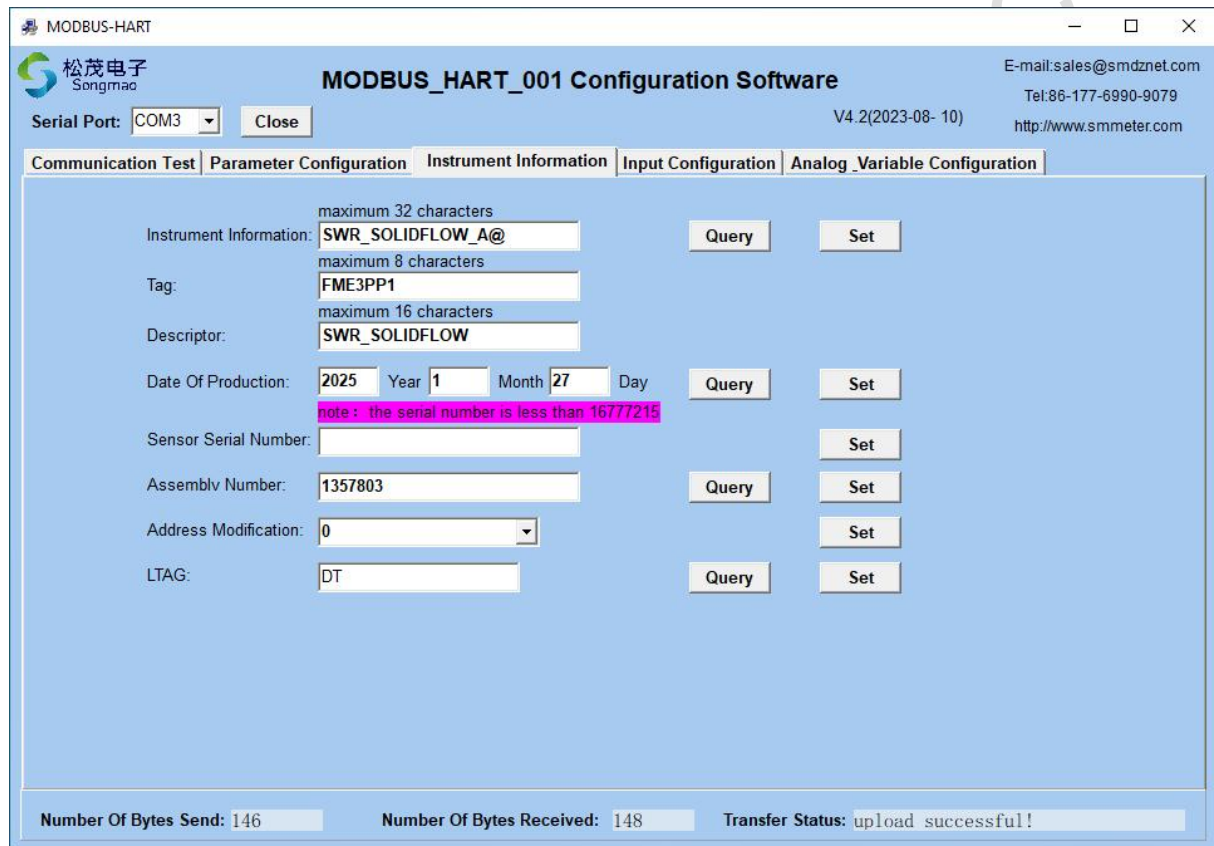
Current Output

☒ 4mA Output
 ☐ 20mA Output
 ☐ Exit Fixed Mode
 ☐ 8mA Output
 ☐ 16mA Output
 ☐ 12mA Output
 ☐ Other Output
 mA
 Set

Number Of Bytes Send: 17 Number Of Bytes Received: 33 Transfer Status: upload successful!

3.4 Instrument Information

- 1) Instrument information: the equipment information of HART instrument can be read and set, and the equipment information is 32 characters at most.
- 2) Tag: The marking information of HART instrument can be read and set, and the marking information is 8 characters at most.
- 3) Descriptor: The descriptor information of HART instrument can be read and set, and the descriptor information is 16 characters at most.
- 4) Date of production: read and set the ex-factory date of HART instrument.
- 5) Sensor serial number: The sensor serial number of the HART instrument can be set.
- 6) Assembly number: read and set the assembly number of HART instrument.
- 7) Address modification: The short frame address of the HART instrument can be modified.
- 8) LTAG: long tag information of HART instrument can be read and set.



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Serial Port: COM3 Close

V4.2(2023-08-10)

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Communication Test Parameter Configuration **Instrument Information** Input Configuration Analog Variable Configuration

Instrument Information: SWR_SOLIDFLOW_A@ Query Set

Tag: FME3PP1 Query Set

Descriptor: SWR_SOLIDFLOW Query Set

Date Of Production: 2025 Year 1 Month 27 Day Query Set

note: the serial number is less than 16777215

Sensor Serial Number: Set

Assembly Number: 1357803 Query Set

Address Modification: 0 Set

LTag: DT Query Set

Number Of Bytes Send: 146 Number Of Bytes Received: 148 Transfer Status: upload successful!

3.5 Input Configuration

1) RS485 parameter configuration: select the correct baud rate and check bit according to the connected RS485 instrument, input the communication interval between the converter and the RS485 instrument, and then click Set.

2) Read the settings of instrument commands 1 ~ 4

① Enabled

Close-The converter does not send this command;

Open-the converter sends the instruction, but does not check and judge the instruction code sent and returned;

Turn on CRC-the converter sends the instruction and checks and judges the instruction code sent and returned.

② Command code: View the instrument protocol, and input the command code sent when reading the instrument data according to the instrument data to be read.

③ Return byte 1/2: This byte is a judgment byte. Only when the first two bytes of the instruction code returned by the RS485 instrument are consistent with the return byte 1 and 2 respectively, the data information is considered to be valid, and the converter will further analyze the data. (Note: When the return bytes 1 and 2 are 00, it means that the returned instruction code is not judged, and all the instruction codes are correct by default.)

3) MODBUS parsing format

① Command number: check the instrument protocol, and select the command number corresponding to the command code according to the instrument data to be analyzed. In particular, when commands 1 to 4 are selected, the converter will keep the data information read last time no matter whether the RS485 instrument replies or not. When commands 1 ~ 4-3 are selected to be cleared, the converter will clear the data information read at the last time when the RS485 instrument does not reply to the commands sent by the converter for three times.

② Data address: fetch the start address of data. When the converter communicates with the RS485 instrument, the converter sends a command corresponding to the command number to the instrument, and the instrument returns the data information code after receiving the command request. The client intercepts a valid data code for the returned data information code. The data information code starts counting from 0 byte, and the valid data to be intercepted is the Nth byte, so the start address is set to N. For example:

Send Command: 01 03 00 00 00 02 C4 0B

Return command: 01 03 04 7A E1 42 B3 C2 08

7A E1 42 B3 is the valid data code to be intercepted, counting from 0. The code starts from the third byte, so the starting address should be set to 003.

③ Length: take the data length of the data. For example, 7A E1 42 B3 is the valid data code to be intercepted. This code is 4 bytes in total, so the data length should be set to 4.

④ Parsing format: the analysis format of the read data. The data format includes floating point, integer, BCD code, character string, double floating point number and other data formats. The user selects the corresponding analytical format according to the data format in the MODBUS protocol of RS485 instrument.

⑤ Coefficient: When the coefficient processing is to be performed on the analyzed data, it can be completed by setting the coefficient.

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Serial Port: COM3
Close
V4.2(2023-08-10)

Communication Test
Parameter Configuration
Instrument Information
Input Configuration
Analog Variable Configuration

RS485 Parameter Configuration
Baud Rate: 9600
Parity Bit: None
Communication Interval Time: 10 * 0.1S

when the interval time is 00,the converter writes variable according to the MODBUS instruction

Query
Set

Instrument Command 1
Enable: 1-Open
Command Code: 01 03 00 00 00 08 44 0C
Return Byte 1: 01
Byte 2: 03
Query
Set

Instrument Command 2
Enable: 0-Close
Command Code:
Return Byte 1: 00
Byte 2: 00
Query
Set

Instrument Command 3
Enable: 0-Close
Command Code:
Return Byte 1: 00
Byte 2: 00
Query
Set

Instrument Command 4
Enable: 0-Close
Command Code:
Return Byte 1: 00
Byte 2: 00
Query
Set

MODBUS Paring Format

	Command Number	Data Addr	Length	Parsing Format	Coefficient	
RS485 AD3 Value:	1-Instruction 1	3	4	0-Float (4321)	1.000	
RS485 AD4 Value:	1-Instruction 1	7	4	0-Float (4321)	1.000	Query
RS485 AD5 Value:	1-Instruction 1	11	4	0-Float (4321)	1.000	Set
RS485 AD6 Value:	1-Instruction 1	15	4	0-Float (4321)	1.000	
Serial Number:	0-Close		4	0-Float (4321)	1.000	

Number Of Bytes Send: 165
Number Of Bytes Received: 148
Transfer Status: Upload data timeout!

3.6 Analog and Variable Configuration

1) Analog channel configuration: the user configures corresponding parameters on the corresponding analog channel according to the accessed analog signal.

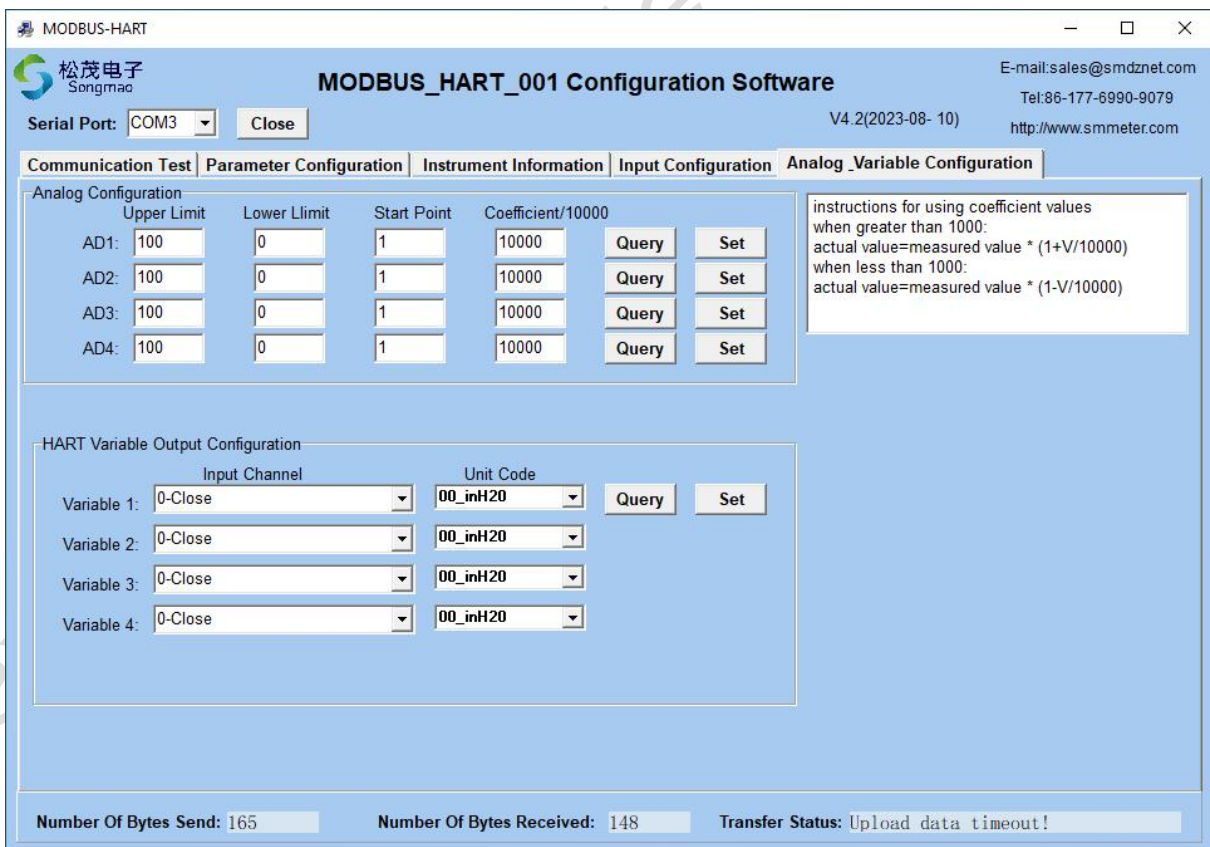
- ① Upper limit: corresponding value of 20 mA.
- ② Lower limit of range: 0 mA or 4mA.
- ③ Starting point: when the input analog signal is 0 ~ 20 mA, the starting point is 0; When the input analog signal is 4 to 20 ma, the starting point is 1.
- ④ Coefficient: When there is a deviation between the collected actual data and the calculated theoretical data, the data can be calibrated by setting the coefficient.

X_{AV} Represents the actual value, X_{TV} Represents the theoretical value, K Represents a coefficient

$$\text{When } X_{AV} \geq X_{TV} \text{ When, } X_{TV} = X_{AV} \times \left(1 - \frac{K}{10000}\right), \text{ then } K = 10000 \times \left(1 - \frac{X_{TV}}{X_{AV}}\right)$$

$$\text{When } X_{AV} < X_{TV} \text{ When, } X_{TV} = X_{AV} \times \left(1 + \frac{K - 1000}{10000}\right), \text{ then } K = 10000 \times \left(\frac{X_{TV}}{X_{AV}} - 1\right) + 1000$$

2) HART variable output configuration: select the input channels of variables 1 ~ 4 respectively. The configurable channels include AD1 ~ AD4 four analog channels and MODBUS instrument AD3 ~ AD6 four variables. Select the corresponding unit code after configuration, and then click Set.



4. Service and Warranty

1. This product is guaranteed for three years under normal use conditions.
2. During the warranty period, our company will provide you with warranty service for any failure caused by product technology.
3. The following circumstances are not within the scope of free warranty:
 - ① Products that are disassembled and repaired without the consent of the Company;
 - ② Damage caused by external force and other natural disasters.
4. If the user thinks that the product of our company needs to be repaired, please call our company to contact us in time, and we will repair and send it back as soon as possible.
5. The warranty liability is limited to the fault maintenance of the product during the warranty period, and does not assume other responsibilities.

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