

SM181-01-A HART Smart Converter

Instructions for use



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Table of contents

1. Introduction to SM181-01-A Smart Converter	- 3 -
1.1 Product introduction	- 3 -
1.2 Product features	- 3 -
1.3 Main parameters	- 3 -
2. SM181-01-A intelligent converter physical drawing and indicator light function	- 4 -
2.1 Physical drawings	- 4 -
2.2 Wiring diagram	- 4 -
2.2.1 Wiring diagram of two-wire instrument	- 4 -
2.2.2 Four-wire instrument wiring diagram	- 4 -
2.3 Port introduction	- 5 -
2.4 Description of indicator light	- 5 -
2.5 MODBUS Data Register Address Table	- 5 -
3. Function introduction and operation steps of configuration software	- 6 -
3.1 Communication connection	- 6 -
3.2 System parameters	- 7 -
3.3 Transparent mode	- 9 -
3.4 MODBUS parameter configuration	- 10 -
3.5 Mod Scan32 Communication Test	- 12 -
4. Data register address	- 13 -
5. Service and warranty	- 14 -

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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 However, content may become outdated or invalid due to product/software upgrades.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.

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1. Introduction to SM181-01-A Smart Converter

1.1 Product Introduction

SM181-01-A HART smart converter is A product developed by using ARM microprocessor, HART protocol modem chip and combining with A lot of practical experience. It is designed according to the requirements of industrial products and has high reliability and stability. The intelligent converter is equipped with a standard RS485 interface, which can transparently transmit data with intelligent instruments with HART protocol or convert to MODBUS _ RTU protocol to read data, so as to ensure real-time data transmission.

The HART protocol uses the Bell202 Frequency Shift Keying (FSK) standard to superimpose a modulated digital signal on a 4 to 20 mA basis, allowing the HART protocol instrument to allow bidirectional data communication without interfering with the 4 to 20 mA analog signal. SM181-01-A HART intelligent converter is an intelligent converter that modulates and demodulates digital signals and analog signals in both directions.

1.2 Product Features

- Equipped with standard RS485 communication interface for parameter configuration, communication baud rate and parity check. It is independent of the 1200 communication speed on the HART bus, thus improving the operation speed of the whole system.
- Adopt industrial universal module shell, which is convenient for installation and commissioning.
- It is equipped with special configuration software, which can configure the parameters of SM181-01-A HART intelligent converter, and can communicate with HART protocol intelligent instrument through the intelligent converter.

Support for standard MODBUS _ RTU protocols.

- Support a variety of special HART protocol intelligent instruments, and can customize the instructions for reading special HART instruments.
- It has the functions of analog quantity acquisition and high-precision A/D simultaneous sampling.
- The range and zero point of collected data can be configured.
- With power-off memory function, parameters do not need to be reset after power off.

1.3 Main Parameters

- Power supply input voltage: DC 12 ~ 24 V, the ripple of the power supply shall not be greater than 200 mA, and the current shall be 100mA.
- Shell size: length 96 mm × width 80 mm × height 25 mm.
- Working temperature: -20 ℃ ~ + 80 ℃.
- Relative humidity: 10% ~ 80%.

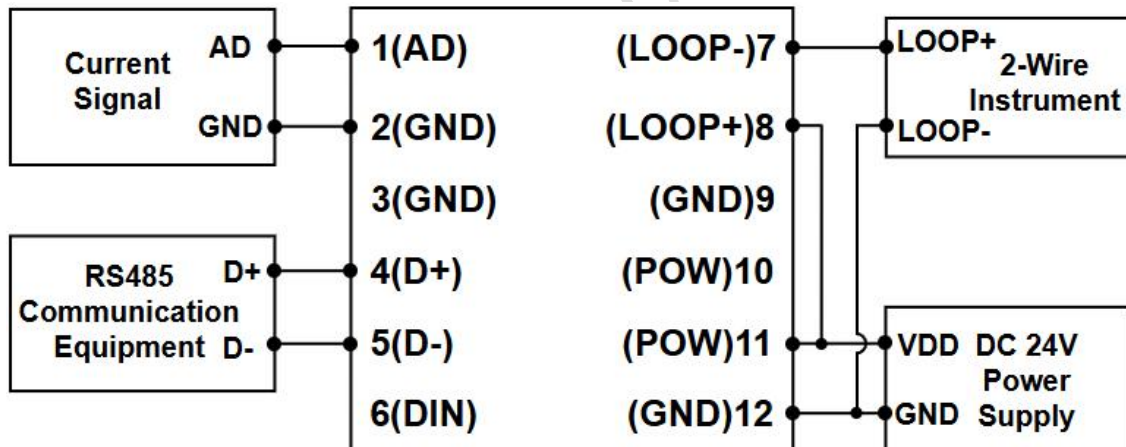
2. SM181-01-A Intelligent Converter Physical Drawing and Indicator Light Function

2.1 Physical Drawings

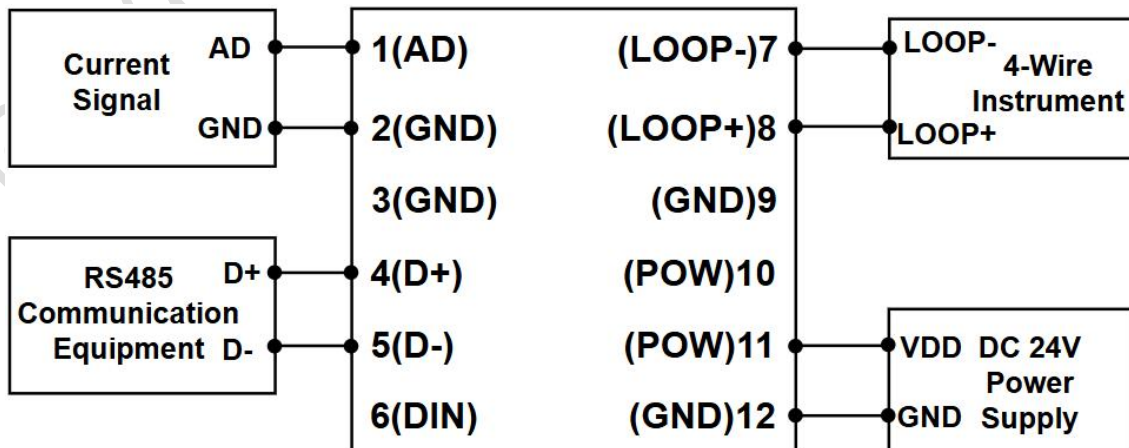


2.2 Wiring Diagram

2.2.1 Wiring diagram of two-wire instrument



2.2.2 Four-wire instrument wiring diagram



2.3 Port Introduction

Port number	1	2	3	4	5	6	7	8	9	10	11	12
Port name	AD	GND	GND	D+	D-	DIN	LOOP-	LOOP+	GND	POW	POW	GND
Function/access device	Analog quantity acquisition			RS485 communication			HART instrument			Power source		

- AD, GND: analog acquisition terminal.
- D +, D-: RS485 communication interface wiring terminal.
- LOOP +, LOOP-: HART instrument communication interface terminal.
- POW, GND: power interface terminal, POW is connected to the positive pole of the power supply, and GND is connected to the negative pole of the power supply.

2.4 Description of Indicator Light

- MOD communication indicator: it flashes when the RS485 serial port is used for data exchange.
- POW power indicator: always on after the power is turned on.
- HART communication indicator: Flashes when the HART converter exchanges data with the HART instrument.

2.5 MODBUS Data Register Address Table

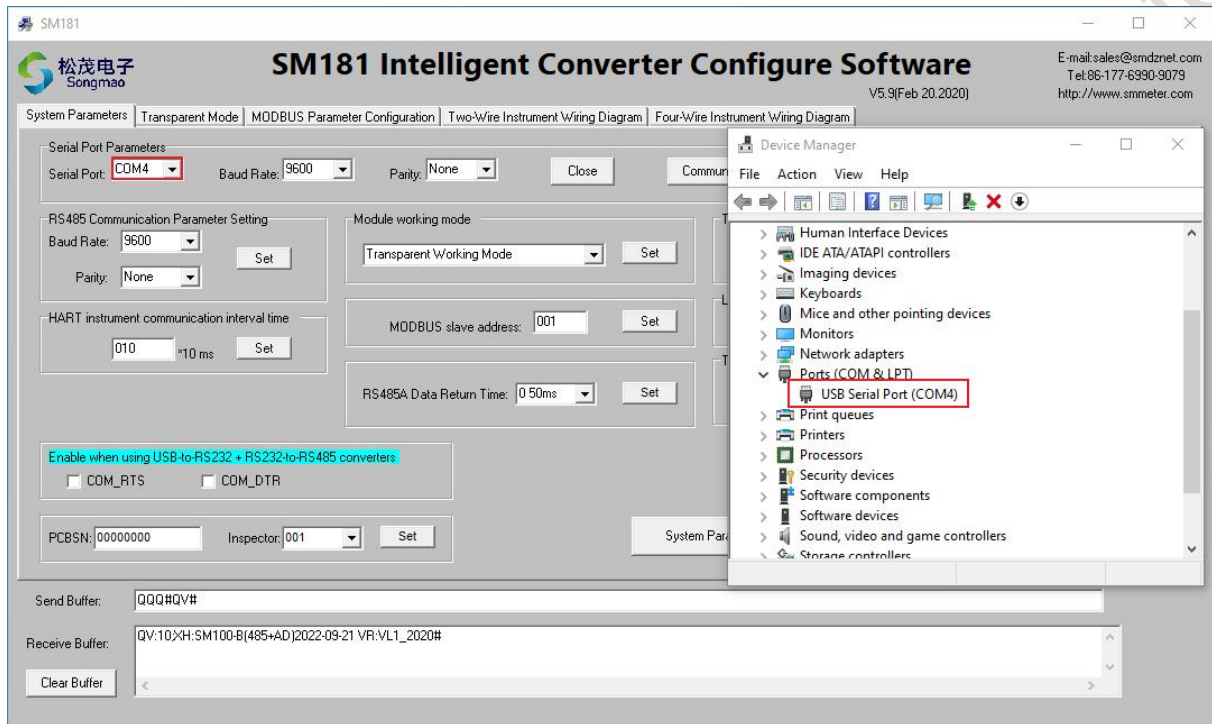
Default parameters: Slave address 001, baud rate 9600, data bit 8, stop bit 1, check bit None.

Serial number	Message content	Meaning	Function Code	Data address	Data type	Data format
1	HA00	Electric current	03	40001 40002	IEE754	F2 F1 F4 F3
2	HA02	Dynamic variable 1	03	40003 40004	IEE754	F2 F1 F4 F3
3	HA04	Dynamic Variables 2	03	40005 40006	IEE754	F2 F1 F4 F3
4	HA06	Dynamic variables 3	03	40007 40008	IEE754	F2 F1 F4 F3
5	HA08	Dynamic variables 4	03	40009 40010	IEE754	F2 F1 F4 F3
6	FLOW-SPEE	Flow rate	03	40021 40022	IEE754	F2 F1 F4 F3
7	FLOW	Flow rate	03	40023 40024	IEE754	F2 F1 F4 F3
8	TOTAL	Cumulative flow (integer part)	03	40025 40026	UINT32	F2 F1 F4 F3
9	TOTXS	Cumulative Flow (Fractional)	03	40027 40028	IEE754	F2 F1 F4 F3

3. Function Introduction and Operation Steps of Configuration Software

3.1 Communication Connection

- 1) According to the introduction of the port in the above part, connect the power supply and RS485 cable, and then configure the parameters after the POW power indicator is always on.
- 2) Open the configuration debugging software, select the correct serial port number, baud rate and check bit (default baud rate 9600, check bit None), and then open the serial port.
- 3) Click "Communication Query" to query the version number of this converter in the "Receive Buffer" below. At this time, the connection is successful.



3.2 System Parameters

This interface is used to set and query basic parameters such as communication parameters, module working mode, MODBUS slave address and HART communication interval.

- 1) Communication query: You can query the version number of the converter.
- 2) Communication interface type: Click "Communication query" to read the communication interface type parameter information of the converter. RS485/RS232 indicates the communication interface of the converter, and 1/4/8 indicates the maximum number of HART instruments that can be connected to the converter.
- 3) RS485 communication parameter setting: The user can select the baud rate and check bit (default baud rate 9600, check bit None) for RS485 communication according to the actual situation, and then click "Set". After the setting is successful, the configuration software automatically closes the serial port. At this time, it is necessary to re-select the set baud rate and check bit, and open the serial port for normal communication.
- 4) HART instrument communication interval time: It is the time period for the converter to communicate with the HART instrument. Enter the interval time and click "Set". Interval time = input time * 0.1S.
- 5) Module working mode: select the transparent working mode when reading the data in the "Transparent Working Mode" interface, select the MODBUS single instrument working mode when reading the data in the "MODBUS Parameter Configuration" interface, and then click "Set". (Note: the function of the module working mode setting box in the "MODBUS parameter configuration" interface is the same as that of the module working mode setting box here)
- 6) MODBUS slave address: input 3-digit slave address and click "Set".
- 7) COM _ RTS/COM _ DTR: When using the connection mode of "USB-RS232 communication cable + RS232 to RS485", check this option, and then open the serial port for communication.
- 8) Totalizer: the user configures the corresponding parameters according to the accessed analog signal.
 - ① Upper range 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.
- 9) Low flow cutoff: the converter can calculate the flow of the signal acquired by the AD analog acquisition channel. Set the small flow cut-off value of the instantaneous flow in m3/H. When the instantaneous flow is less than small flow cutoff value, the flow at this time is considered to be 0.
- 10) Totalization channel parameters: AD1 channel can be used as instantaneous flow to realize totalization.
 - ① Integer digit base: the user sets the count base of the cumulative flow according to the current cumulative value of the instrument. Enter the floor value of the integer digit, and finally click "Set".
 - ② Decimal base: The user sets the count base of the cumulative flow according to the current cumulative value of the instrument. Enter the value of the decimal place, and finally click "Set".
- 11) Parameter initialization: The parameters of the converter can be restored to the initialized state.
- 12) System parameter: can read the communication interface type, communication parameters, module working mode, MODBUS slave address, HART instrument communication interval and other parameter information.
- 13) AD channel query: read HART instrument data and AD channel totalized instantaneous flow, instantaneous flow rate, cumulative flow and other data information.

SM181

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SM181 Intelligent Converter Configure Software
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System Parameters | Transparent Mode | MODBUS Parameter Configuration | Two-Wire Instrument Wiring Diagram | Four-Wire Instrument Wiring Diagram

Serial Port Parameters
Serial Port: COM4 Baud Rate: 9600 Parity: None Close Communication Query Parameter Initialization

RS485 Communication Parameter Setting
Baud Rate: 9600 Parity: None Set

Module working mode
Transparent Working Mode Set

HART instrument communication interval time
010 *10 ms Set

MODBUS slave address: 001 Set

RS485A Data Return Time: 0.50ms Set

Totalizer
URV LRV Starting Point
AD1: 100.0 0.000 1.000 Set

Low Flow Cutoff
AD1 Channel: 0.000 Set

Totalization channel parameters
Integer LSD: 0000000 Set
Decimal LSD: 000 Set

Enable when using USB-to-RS232 + RS232-to-RS485 converters
☐ COM_RTS ☐ COM_DTR

PCBSN: 00000000 Inspector: 001 Set System Parameter AD Channel Query

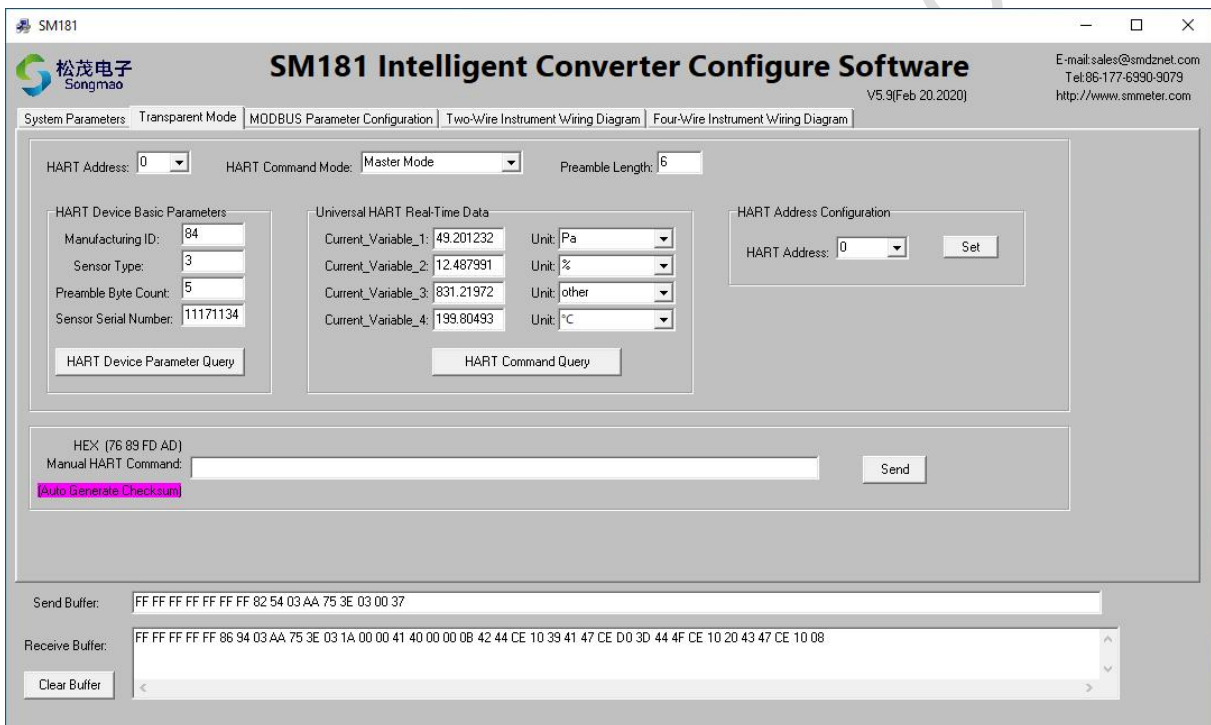
Send Buffer: QQQ#QX#

Receive Buffer: QX-BA2:30ADR:001XY:0MD:1JTM:010RG:1AIN:100.00.000.1.000ZOM:0.000.#

Clear Buffer

3.3 Transparent Mode

- 1) Before entering the "Transparent mode" interface, first set the module working mode to "Transparent working mode".
- 2) Configure HART instrument parameters:
 - ① HART address: refers to the address of HART instrument.
 - ② HART command mode: main mode and auxiliary main mode are available for selection, which can be selected according to the requirements of the instrument.
 - ③ Preamble length: the 'FF' quantity of the leader of the HART instruction, which is generally 6 bytes.
- 3) HART device basic parameters: basic parameter information of HART instrument can be queried.
- 4) Universal HART real-time data: real-time data of general HART instruments can be read, but real-time data of other customized instruments cannot be displayed.
- 5) HART address configuration: when the connected HART instrument address is not address 0, the HART address shall be set as address 0.
- 6) Manual HART command: read the real-time data of HART instrument by manually inputting HART command.



The screenshot shows the 'SM181 Intelligent Converter Configure Software' interface. The title bar indicates 'SM181'. The interface includes a menu bar with 'System Parameters', 'Transparent Mode', 'MODBUS Parameter Configuration', 'Two-Wire Instrument Wiring Diagram', and 'Four-Wire Instrument Wiring Diagram'. The 'Transparent Mode' tab is active. The main area contains several configuration sections:

- HART Address:** A dropdown menu set to '0'.
- HART Command Mode:** A dropdown menu set to 'Master Mode'.
- Preamble Length:** A text input field set to '6'.
- HART Device Basic Parameters:** A section with fields for 'Manufacturing ID' (84), 'Sensor Type' (3), 'Preamble Byte Count' (5), and 'Sensor Serial Number' (11171134). Below these is a 'HART Device Parameter Query' button.
- Universal HART Real-Time Data:** A section with four rows of 'Current_Variable' (1-4) and their corresponding 'Unit' (Pa, %, other, °C). Below these is a 'HART Command Query' button.
- HART Address Configuration:** A section with a 'HART Address' dropdown set to '0' and a 'Set' button.
- Manual HART Command:** A section with a 'Manual HART Command' text input field, a 'Send' button, and a link '[Auto Generate Checksum]'.
- Send Buffer:** A text area showing the hex value 'FF FF FF FF FF FF 82 54 03 AA 75 3E 03 00 37'.
- Receive Buffer:** A text area showing the hex value 'FF FF FF FF 86 94 03 AA 75 3E 03 1A 00 00 41 40 00 00 08 42 44 CE 10 39 41 47 CE D0 3D 44 4F CE 10 20 43 47 CE 10 08'.
- Clear Buffer:** A button located below the Receive Buffer.

 The bottom of the interface features a large, faint watermark reading 'Jiaxing Songmao Electronics Co., Ltd.'

3.4 MODBUS Parameter Configuration

1) Before entering the "MODBUS parameter configuration" interface, set the working mode of the module to "MODBUS single instrument working mode", and then click "MODBUS parameter query" to read the parameter information on this interface.

2) Configure HART instrument parameters

- ① Meter ID: select "Device 0".
- ② Enable: connect the HART instrument and turn on the enable, i.e. select "Open".
- ③ Device mode: main equipment and auxiliary main equipment are available for selection, which can be selected according to the requirements of the instrument.
- ④ Meter type: select according to the actually connected instrument.

Customized instrument-the instrument connected is not commonly used HART protocol instrument, which may be old HART protocol instrument or special HART command protocol instrument. The user can define the resolution mode according to the HART command, and can directly convert the MODBUS _ RTU protocol without upgrading the program.

General Purpose Instruments-Suitable for most HART protocol instruments.

Special instrument-the instrument connected is not the instrument that the general HART command reads the data. If the model corresponds to the special instrument model, just select the model.

- ⑤ Preamble length: the 'FF' quantity of the leader of the HART instruction.
- ⑥ Buffer clear time: input 3-digit clear cache time (unit: S).

3) Data analysis format: there are four types, and the user needs to configure the corresponding analysis format according to the format of instrument data output.

- 0 IEE754 (FF4 FF3 FF2 FF1)-Floating-point, high-order inverted (default format)
- 1 IEE754 (FF2 FF1 FF4 FF3)-Floating-point, high-order
- 2 Uint32 (FF4 FF3 FF2 FF1)-unsigned long, high-order inverted
- 3 Uint32 (FF2 FF1 FF4 FF3)-Unsigned long, high order

4) Custom HART command parsing: When the instrument type is "Custom Instrument", the user can enable the command and read the HART instrument data by inputting the command code.

5) Custom HART data parsing format: set the start address, data length and address bit of the data read by instruction 1 and instruction 2.

- ① Read the instrument command number: check the instrument protocol, and select the command number corresponding to the command code according to the instrument data to be analyzed.
- ② Data start address: After sending the command corresponding to the command number, the HART instrument will return the corresponding data command code. For the returned instruction code, start parsing from the instruction code of the non-leader FF and count from 0. If the data to be parsed starts from the Nth byte, the data start address is set to N.
- ③ Data length: byte length of the data to be parsed.
- ④ Address bit: The address bit is used to calculate the data check bit to judge the correctness of the data. The default value is 8, and the common values are 4, 6 and 8, which can be set by the user according to the actual situation.

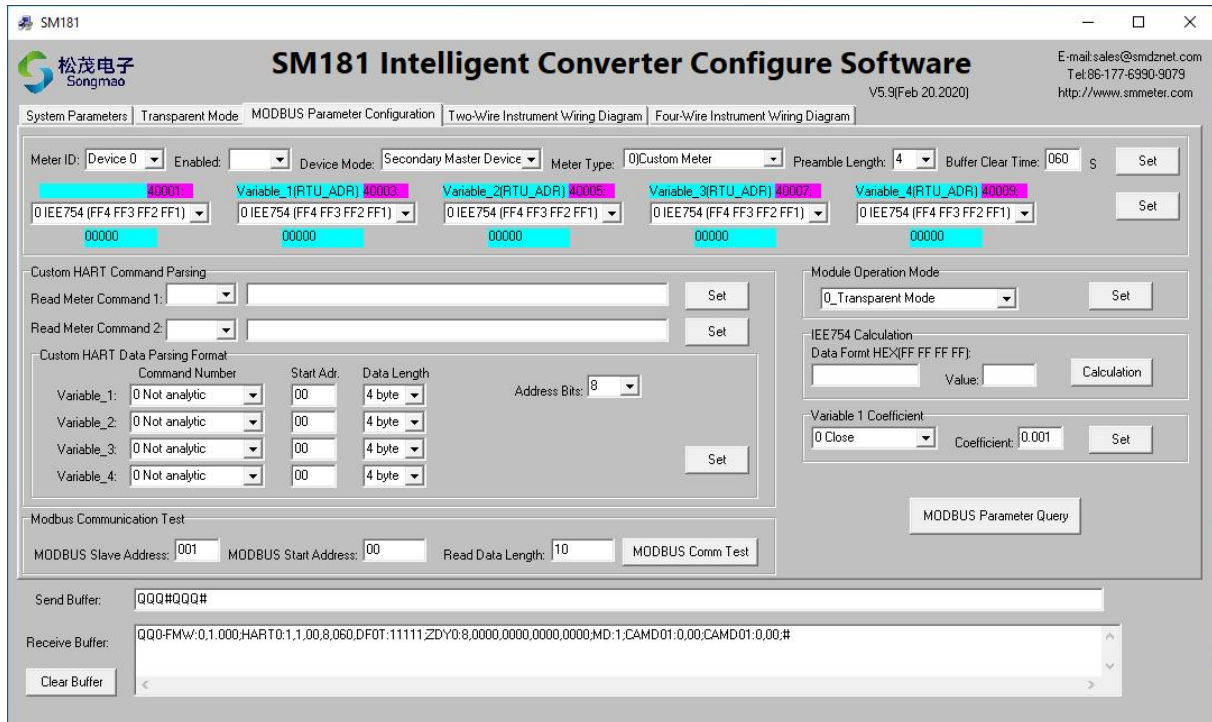
6) Module operation mode: select the transparent working mode when reading the data in the "Transparent Mode" interface, select the MODBUS single instrument working mode when reading the data in the "MODBUS Parameter Configuration" interface, and then click "Set". (Note: the function of the module working mode setting box in the "System Parameters" interface is the same as that of the module working mode setting box here)

7) IEE754 calculation: Input the received data instruction code and click "Calculation" to convert the hexadecimal data format into the decimal data format, which is convenient for the approval of the received data.

8) Variable 1 coefficient: when the read unit of main variable 1 is inconsistent with the unit displayed on the HART instrument

header, the corresponding coefficient can be set for conversion between units.

- 9) MODBUS communication test: input the correct MODBUS slave address, initial register address of read data and data length, and then click "MODBUS communication test" to read MODBUS data information.



3.5 Mod Scan32 Communication Test

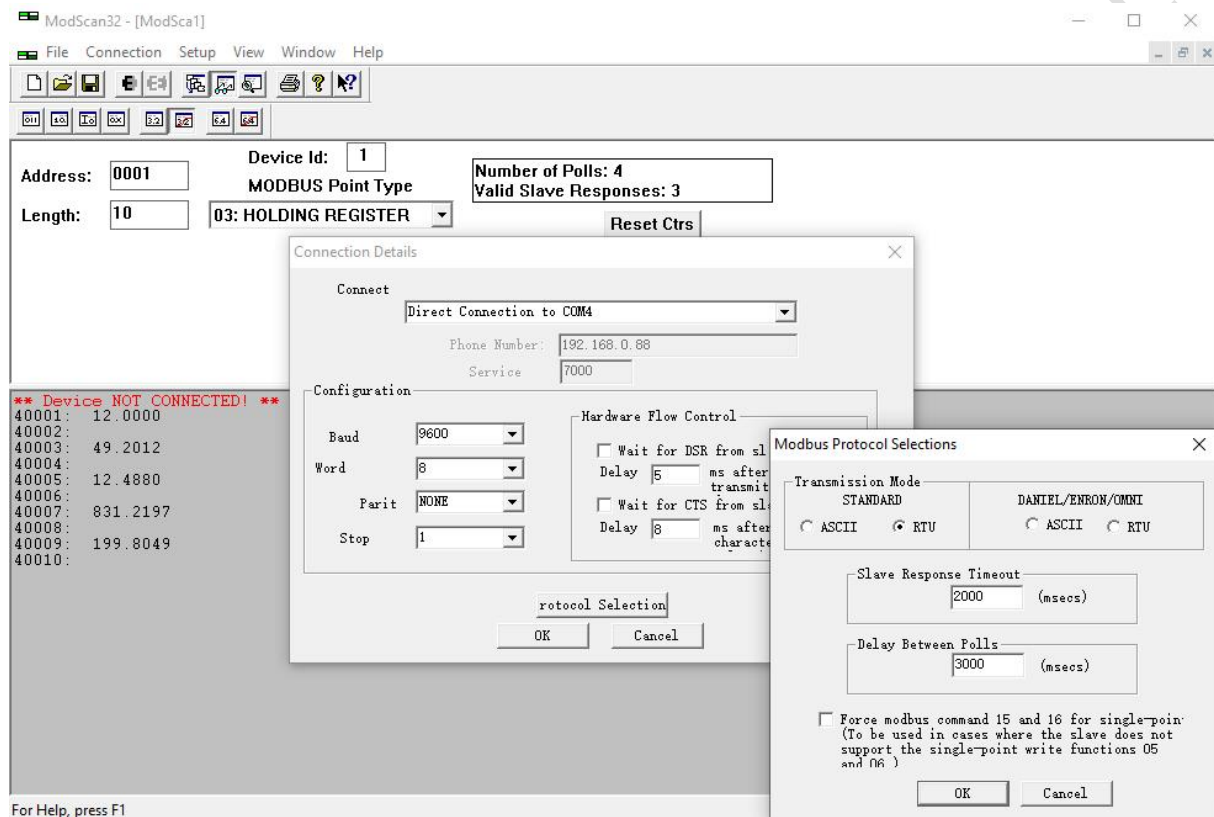
- 1) Close the serial port of the configuration software, open the Modscan32 software, click "connection", configure the appropriate parameters in the pop-up dialog box according to the arrow in the figure below, and then click OK.
- 2) Select the appropriate data format in the main window of modscan32 software, input the correct parameter information, and then click the "Connect" button to read the instrument data information.

Address-Address of MODBUS data start register

Device Id-MODBUS slave address

Length-read data length

MODBUS Point Type-Function Code



4. Data Register Address

Factory default parameters: station address 001, baud rate 9600, check bit None, data bit 8, stop bit 1. 03 function code is used when reading data.

Serial number	Data name	Data address	Data type	Data format (default)
1	Current value	40001 40002	IEE754	4321
2	Primary variable 1	40003 40004	IEE754	4321
3	Variable 2	40005 40006	IEE754	4321
4	Variable 3	40007 40008	IEE754	4321
5	Variable 4	40009 40010	IEE754	4321

5. Service and Warranty

SM181-01-A Smart Converter Quality Assurance

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.

SM181-01-A Smart Converter Precautions

1. Please read the instructions carefully before use.
2. Confirm whether the power supply meets the working requirements of equipment.
3. Check whether the distance from the HART instrument equipment is more than 200 m. If it is beyond this range, please use a thicker wire and add a shielded cable. When using a shielded wire, connect one end to ground.
4. Whether there is a large inductive load nearby, which seriously interferes with the signal, and appropriate shielding measures should be taken.

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