

SM101-A (B) HART Smart Converter

Instructions for use



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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 However, content may become outdated or invalid due to product/software upgrades.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 for advice and answers.

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1. Introduction to SM101-A (B) HART Smart Converter

1.1 Product introduction

SM101-A (B) 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 provided with a standard RS232 interface and a standard RS485 interface, and can transparently transmit data with an intelligent instrument with a HART protocol or convert the data into a MODBUS _ RTU protocol to read the data, so that the real-time transmission of the data is ensured.

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. SM101-a (B) intelligent converter is an intelligent converter which can modulate and demodulate digital signals and analog signals in both directions.

1.2 Product features

- Equipped with standard RS232 and RS485 communication interfaces, which can be used to configure parameters, change communication baud rate and parity check bits. 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.
- Equipped with special configuration software, SM101-A (B) intelligent converter can be used for parameter configuration, and through the intelligent converter, it can communicate with HART protocol intelligent instrument.

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.

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. SM101-A (B) HART smart converter physical diagram and indicator light function

2.1 Physical drawings

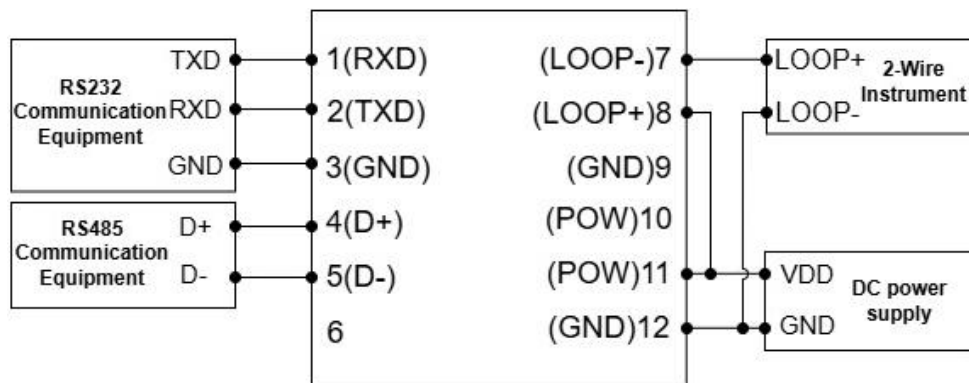


2.2 Product selection

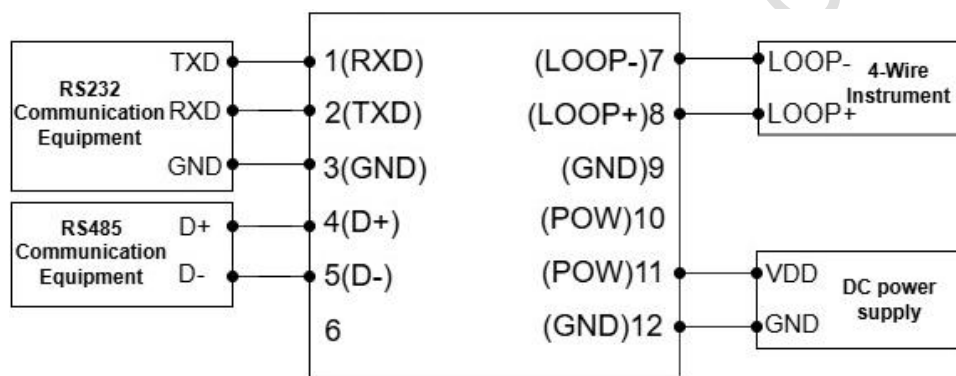
Model	Communication interface	Applicable occasions
SM101-A	RS232	The RS232 interface is applicable to the close communication between the collector and the SM101-A converter, and the bus mode is not required. The collector (or PLC) + SM101-A intelligent converter + HART protocol intelligent instrument
SM101-B	RS485	RS485 interface is applicable to long-distance communication between collector and SM101-B converter, and can be networked in bus mode, collector (or PLC) + multiple SM101-B intelligent converters + HART protocol intelligent instrument
SM100-A+B	RS232+RS485	RS232 interface and RS485 interface are independent communication channels. The same HART converter can communicate with different collectors. Two different system collectors (or PLC) + SM101-A + B intelligent converter + HART protocol intelligent instrument

2.3 Wiring diagram

2.3.1 Wiring diagram of two-wire instrument



2.3.2 Four-wire instrument wiring diagram



2.4 Port Introduction

Port number	1	2	3	4	5	6
Port name	RXD	TXD	GND	D+	D-	
Function/access device	RS232 communication			RS485 communication		

Port number	7	8	9	10	11	12
Port name	LOOP-	LOOP+	GND	POW	POW	GND
Function/access device	HART instrument			Power source		

- RXD, TXD, GND: RS232 communication interface wiring 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.

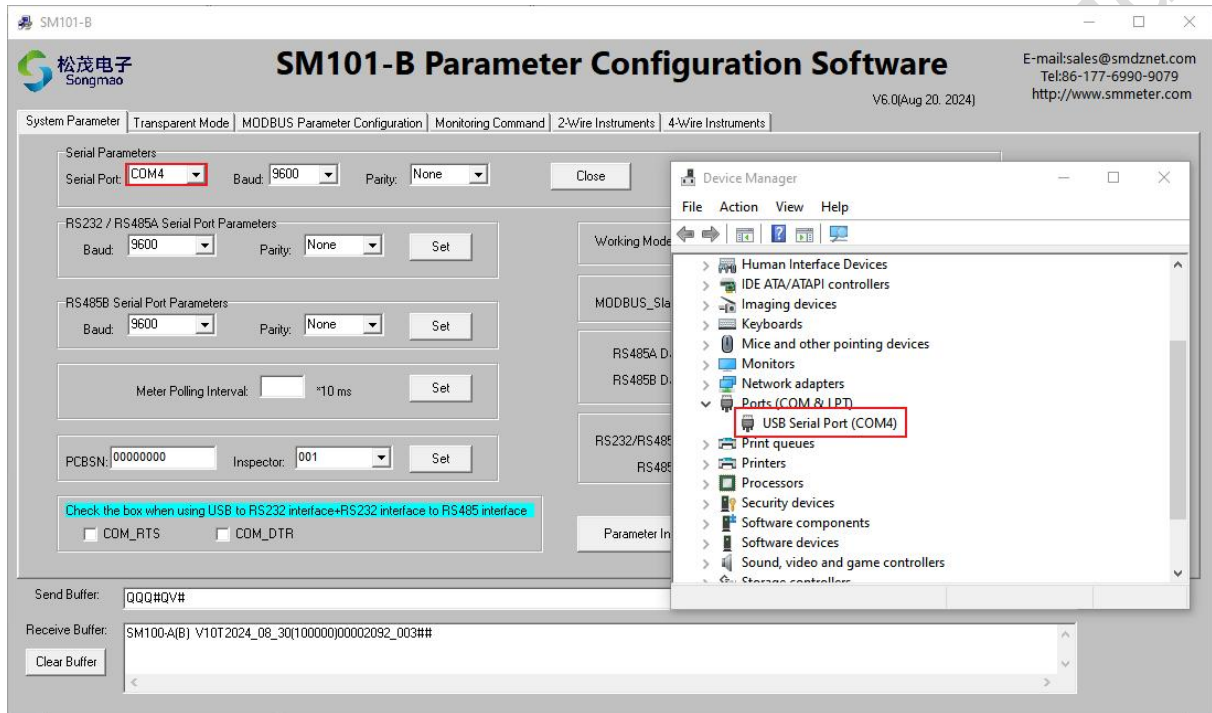
2.5 Indicator light description

- MOD communication indicator: flickers when RS485/RS232 serial port is used for data exchange.
- PWR power indicator: always on after the power is turned on.
- HART communication indicator: Flashes when the HART converter exchanges data with the HART instrument.

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, the converter is connected to the power supply, RS485 line/RS232 line, and the parameter configuration can be carried out 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 command interval.

- 1) Communication query: You can query the version number of the converter.
- 2) RS232/RS485A communication parameter setting: the user can select the baud rate and check bit (default baud rate: 9600, check bit: None) of RS232 or RS485 communication interface 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.
- 3) 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.
- 4) Working mode of module
 - ① Transparent working mode: when reading the data in the "Transparent working mode" interface, the module working mode is set to "Transparent working mode".
 - ② MODBUS single instrument working mode: when a single HART instrument is connected and the HART address of the instrument is 0, the working mode of the module is set as "MODBUS single instrument working mode".
 - ③ MODBUS multi-instrument working mode: when multiple HART instruments are connected and the HART address of the instrument is not 0, the working mode of the module is set as "MODBUS multi-instrument working mode".
 - ④ Monitor to MODBUS RTU (user-defined): When other devices collect HART instrument data at the same time, the working mode of the module is set to "Monitor to MODBUS RTU (user-defined)" to meet the condition that two devices collect HART instrument data at the same time.
 - ⑤ Monitoring data output: When other equipment collects HART instrument data at the same time, the working mode of the module is set as "monitoring data output", which can monitor the command sending and receiving of other equipment and HART instrument communication, and the customer can set the converter monitoring command parameters according to the monitored commands.
- 5) MODBUS slave address: input 3-digit slave address and click "Set".
- 6) RS485A data return time: set the delay return time of RS232 or RS485 interface data according to the system accessed by the back-end.
- 7) RS232/RS485A data address base address: The register address range of MODBUS data output by the converter is 4001 ~ 40050. If there is a requirement for the register address of output data, the register address range of data can be modified by setting the address base address.
- 8) 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.
- 9) Parameter initialization: The parameters of the converter can be restored to the initialized state.
- 10) System parameters: can read the communication interface type, communication parameters, module working mode, MODBUS slave address, HART instrument communication interval and other parameter information.

SM101-B
— □ ×



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SM101-B Parameter Configuration Software

V6.0(Aug 20, 2024)

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System Parameter
Transparent Mode
MODBUS Parameter Configuration
Monitoring Command
2-Wire Instruments
4-Wire Instruments

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

RS232 / RS485A Serial Port Parameters
 Baud: 9600 Parity: None Set

RS485B Serial Port Parameters
 Baud: 9600 Parity: None Set

Meter Polling Interval: 010 *10 ms Set

PCBSN: 00000000 Inspector: 001 Set

Check the box when using USB to RS232 interface+RS232 interface to RS485 interface

☐ COM_RTS ☐ COM_DTR

Working Mode: 0_Transparent Mode Set

MODBUS_Slave_Ad: 001 Set

RS485A Data Return Time: 4 400ms Set

RS485B Data Return Time: 4 400ms Set

RS232/RS485A Data Base Address: 00000 Set

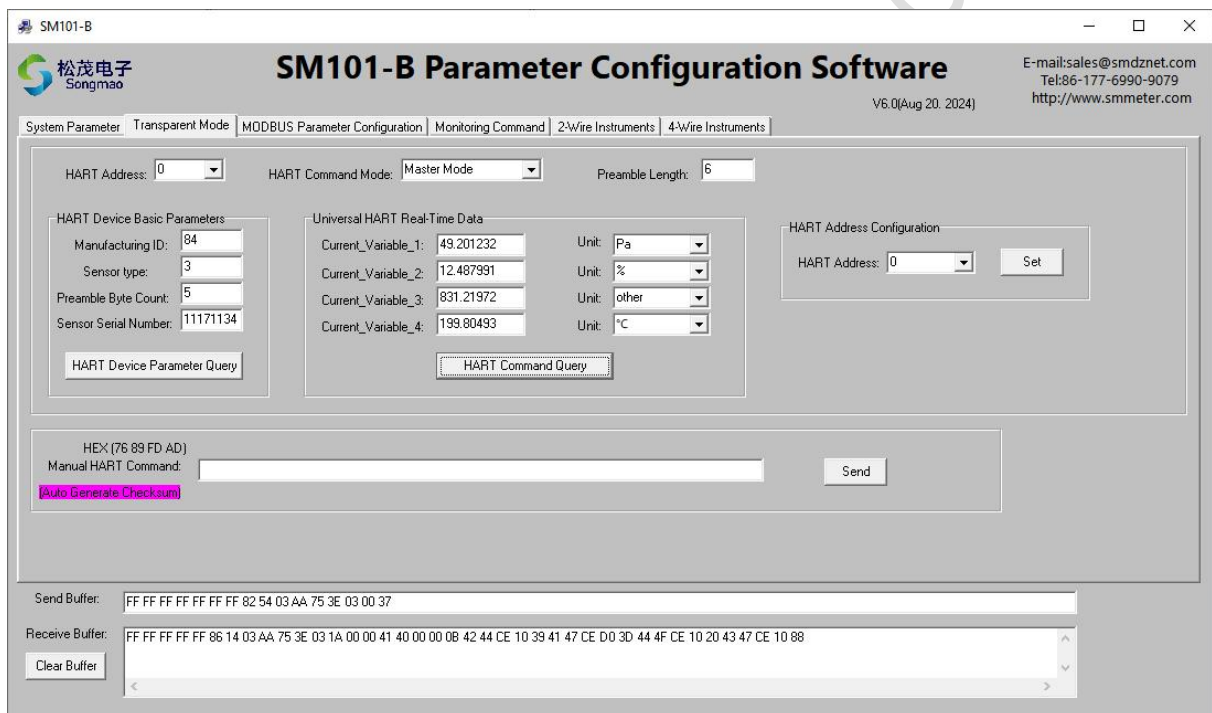
RS485B data base Address: 00000 Set

Parameter Initialization
System Parameters

Send Buffer: QQQ#QX#
 Receive Buffer: QX:1BA1:30:BA2:30:ADR:001XY1:4XY2:4MD:0JTM:010AADR:00000,00000,RG:1#
Clear Buffer

3.3 Transmission Mode

- 1) Before entering the "Transparent working 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 working mode: main mode and auxiliary main mode are available for selection, which can be selected according to the requirements of the instrument.
 - ③ Leader length: the 'FF' quantity of the leader of the HART instruction, which is generally 6 bytes.
- 3) Parameter query of HART instrument: basic parameter information of HART instrument can be queried.
- 4) General HART command data query: real-time data of general HART instruments can be read, but real-time data of other customized instruments cannot be displayed.
- 5) HART address setting: 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 'SM101-B Parameter Configuration Software' interface. The title bar indicates 'SM101-B'. The interface includes a menu bar with options: System Parameter, Transparent Mode, MODBUS Parameter Configuration, Monitoring Command, 2-Wire Instruments, and 4-Wire Instruments. The main area is divided into several 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:**
 - Manufacturing ID: 84
 - Sensor type: 3
 - Preamble Byte Count: 5
 - Sensor Serial Number: 11171134
 - Buttons: 'HART Device Parameter Query' and 'HART Command Query'.
- Universal HART Real-Time Data:**
 - Current_Variable_1: 49.201232, Unit: Pa
 - Current_Variable_2: 12.487991, Unit: %
 - Current_Variable_3: 831.21972, Unit: other
 - Current_Variable_4: 199.80493, Unit: °C
- HART Address Configuration:**
 - HART Address: 0
 - Set button
- Manual HART Command:**
 - HEX (76 89 FD AD)
 - Manual HART Command: [Text Input Field]
 - Send button
 - Auto Generate Checksum button
- Send Buffer:** FF FF FF FF FF FF FF 82 54 03 AA 75 3E 03 00 37
- Receive Buffer:** FF FF FF FF FF 86 14 03 AA 75 3E 03 1A 00 00 41 40 00 00 0B 42 44 CE 10 39 41 47 CE D0 3D 44 4F CE 10 20 43 47 CE 10 88
- Clear Buffer** button

3.4 MODBUS Parameter Set

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 Instrument number: select the corresponding instrument number, which is consistent with the HART address of the instrument connected. The default gauge number is "Gauge 0".
- ② Instrument enable: connect the HART instrument and turn on the enable, i.e. select "Enable".
- ③ HART mode: main equipment and auxiliary main equipment are available for selection, which can be selected according to the requirements of the instrument.
- ④ Instrument 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 Leader length: the 'FF' quantity of the leader of the HART instruction.
- ⑥ Clear cache 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 and resolution mode: 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) Customize the read HART data analysis format: set the read instrument command number, data start address, data length and address bit. The address bit (data length) is used to calculate the data check bit to determine the correctness of the data. The default value is 8, and the common values are 4, 6 and 8. The user can choose according to the actual situation.

6) 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 "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 ~ variable 4 coefficient: when the read variable unit 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.

SM101-B

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System Parameter | Transparent Mode | **MODBUS Parameter Configuration** | Monitoring Command | 2-Wire Instruments | 4-Wire Instruments

Meter ID: Device 0 | Enabled: ☐ | Device Mode: Secondary Master Device | Meter Type: 0 Custom Meter | Preamble Length: 4 | Buffer Clear Time: s | Set

current(RTU_ADR) 40001 | Variable_1(RTU_ADR) 40003 | Variable_2(RTU_ADR) 40005 | Variable_3(RTU_ADR) 40007 | Variable_4(RTU_ADR) 40009

00000 | 49.201232 | 12.487991 | 831.21972 | 199.80493 | Set

Custom HART Command Parsing
Read Meter Command 1: | Set
Read Meter Command 2: | Set

Custom HART Data Parsing Format

Variable	Command Number	Start Addr	Data Length	Address Bits
Variable_1	0 Not analytic		4 byte	8
Variable_2	0 Not analytic		4 byte	
Variable_3	0 Not analytic		4 byte	
Variable_4	0 Not analytic		4 byte	

Set

Module Operation Mode
0 Transparent Mode | Set

IEE754 calculation
Data Format HEX(FF FF FF FF): value: | Calculation

Variable 1 Coefficient
0 close | Coefficient: 0.001 | Set

variable 2 coefficient | variable 3 coefficient | variable 4 coefficient
1.000 | 1.000 | 1.000 | Set

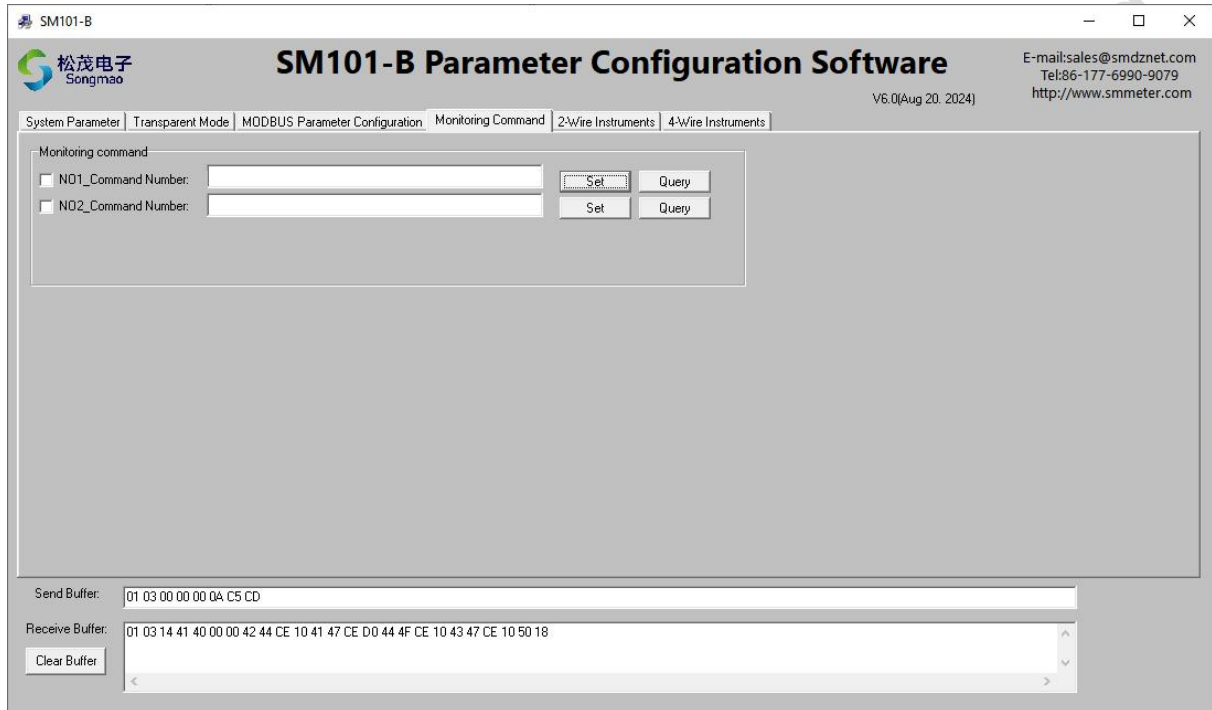
Modbus Communication Test
MODBUS Slave Address: 001 | MODBUS Start Address: 00 | Read Data Length: 10 | MODBUS Comm Test | MODBUS Parameter Query

Send Buffer: 01 03 00 00 00 0A C5 CD
Receive Buffer: 01 03 14 41 40 00 00 42 44 CE 10 41 47 CE D0 44 4F CE 10 43 47 CE 10 50 18
Clear Buffer

3.5 Monitoring Command

When other devices collect HART instrument data at the same time, the working mode of the module shall be set as "monitoring to MODBUSRTU (user-defined)" to meet the condition that two devices collect HART instrument data at the same time.

The converter can set two monitoring commands. When the set monitoring command appears during the communication between other equipment and HART instrument, the converter will convert the intercepted data into standard MODBUS protocol output.



3.6 Mod Scan32 Communication Test

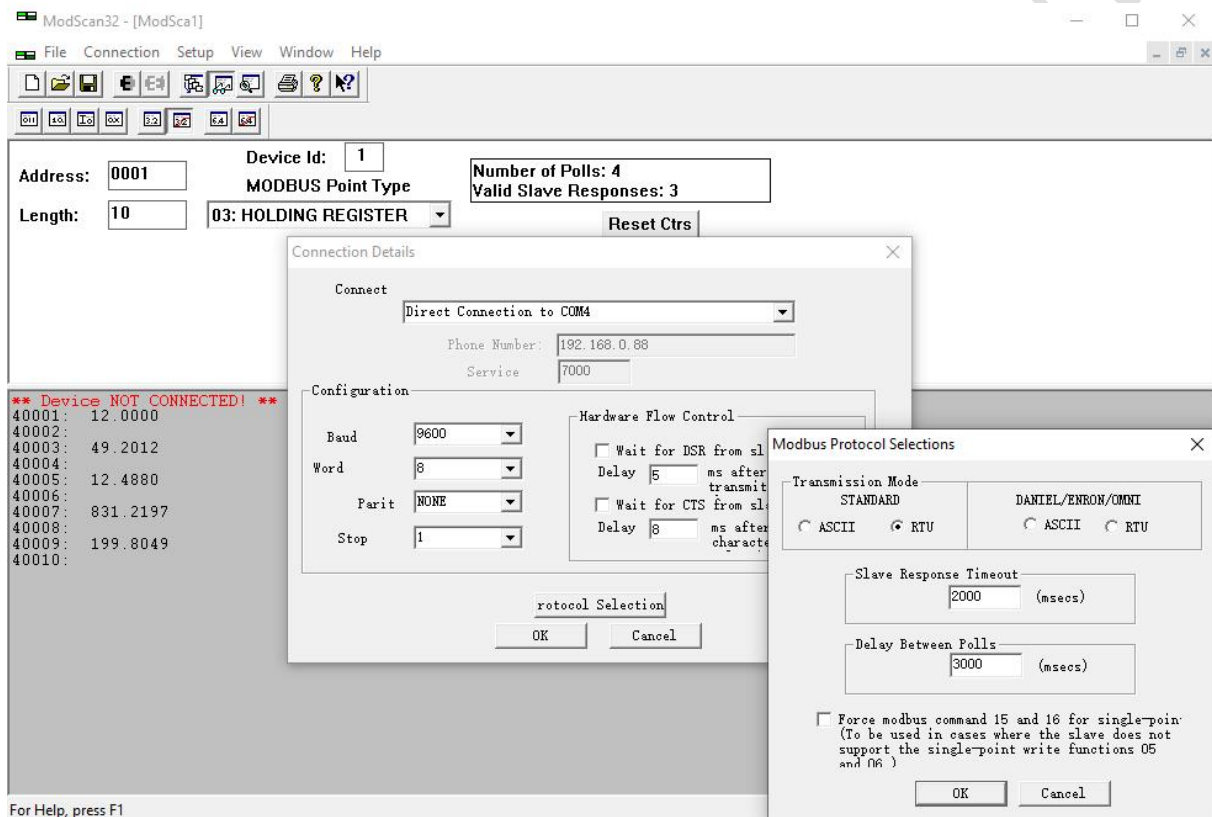
- 1) Close the serial port of the configuration software, open the Modscan32 software, click "connection", configure the appropriate parameters in the pop-up dialog box according to the arrow in the figure below, and then click OK.
- 2) Select the appropriate data format in the main window of modscan32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

How the module works	HART instrument number	Data name	Data address	Data type	Data format (Default)
MODBUS single instrument working mode	0	Current value	40001 40002	IEE754	4321
		Primary variable 1	40003 40004	IEE754	4321
		Variable 2	40005 40006	IEE754	4321
		Variable 3	40007 40008	IEE754	4321
		Variable 4	40009 40010	IEE754	4321
MODBUS multi-instrument working mode	1	Current value	40011 40012	IEE754	4321
		Primary variable 1	40013 40014	IEE754	4321
		Variable 2	40015 40016	IEE754	4321
		Variable 3	40017 40018	IEE754	4321
		Variable 4	40019 40020	IEE754	4321
	2	Current value	40021 40022	IEE754	4321
		Primary variable 1	40023 40024	IEE754	4321
		Variable 2	40025 40026	IEE754	4321
		Variable 3	40027 40028	IEE754	4321
		Variable 4	40029 40030	IEE754	4321
	3	Current value	40031 40032	IEE754	4321
		Primary variable 1	40033 40034	IEE754	4321
		Variable 2	40035 40036	IEE754	4321
		Variable 3	40037 40038	IEE754	4321
		Variable 4	40039 40040	IEE754	4321
	4	Current value	40041 40042	IEE754	4321
		Primary variable 1	40043 40044	IEE754	4321
		Variable 2	40045 40046	IEE754	4321
		Variable 3	40047 40048	IEE754	4321
		Variable 4	40049 40050	IEE754	4321

5. Service and warranty

SM101-A (B) HART 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.

SM101-A (B) HART 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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