

SM100-B-F 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 However, content may become outdated or invalid due to product/software upgrades.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](tel:86-573-82623038) for advice and answers.

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1. Introduction to SM100-B-F Converter

1.1 Product introduction

SM100-B-F HART smart converter is a product developed by using ARM microprocessor, HART protocol modem chip and a lot of practical experience. Designed according to the requirements of industrial products, it 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 read data with MODBUS _ RTU protocol 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 4-20 mA basis, allowing the HART protocol instrument to communicate data in both directions without interfering with the 4-20 mA analog signal. SM100-B-F intelligent converter is an intelligent converter for bidirectional modulation and demodulation of digital signals and analog signals.

1.2 Product features

- Equipped with standard RS485 communication interface, it can configure parameters, change communication baud rate and parity bit, and has nothing to do with 1200 communication speed on HART bus, so as to improve the operation speed of the whole system.
- Adopt industrial general explosion-proof aluminum shell, suitable for explosion-proof area.
- It is equipped with special configuration software, which can configure the parameters of SM100-B-F intelligent converter, and can communicate with HART protocol intelligent instrument through the intelligent converter.

Support for standard MODBUS _ RTU protocols.

- Support the connection of a single HART protocol intelligent instrument.
- Support a variety of special HART protocol intelligent instruments, and can read the special HART protocol commands of HART instruments.

1.3 Product technical parameters

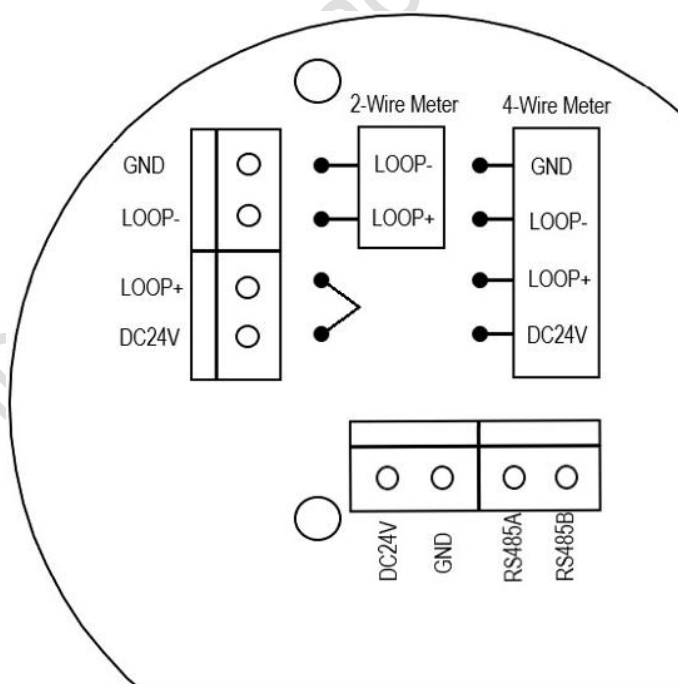
- Power supply: DC 12 ~ 24 V, the ripple of the power supply shall not be greater than 200 mV, and the current shall be 100mA.
- Working temperature: -20 °C ~ + 80 °C.
- Relative humidity: 10% ~ 80%.
- Housing dimensions: 153 mm L × 125 mm W × 58 mm H.

2. SM100-B-F converter physical drawing and indicator light function

2.1 Physical drawings



2.2 Wiring diagram



Communication parameters:	
9600 1 N 8	
Slave address:001	

Register address	Variable
40001 40002	current
40003 40004	Variable 1
40005 40006	Variable 2
40007 40008	Variable 3
40009 40010	Variable 4

2.3 Butt joint diagram with flowmeter

Physical wiring diagram of two-wire HART instrument



Four-wire HART instrument wiring diagram



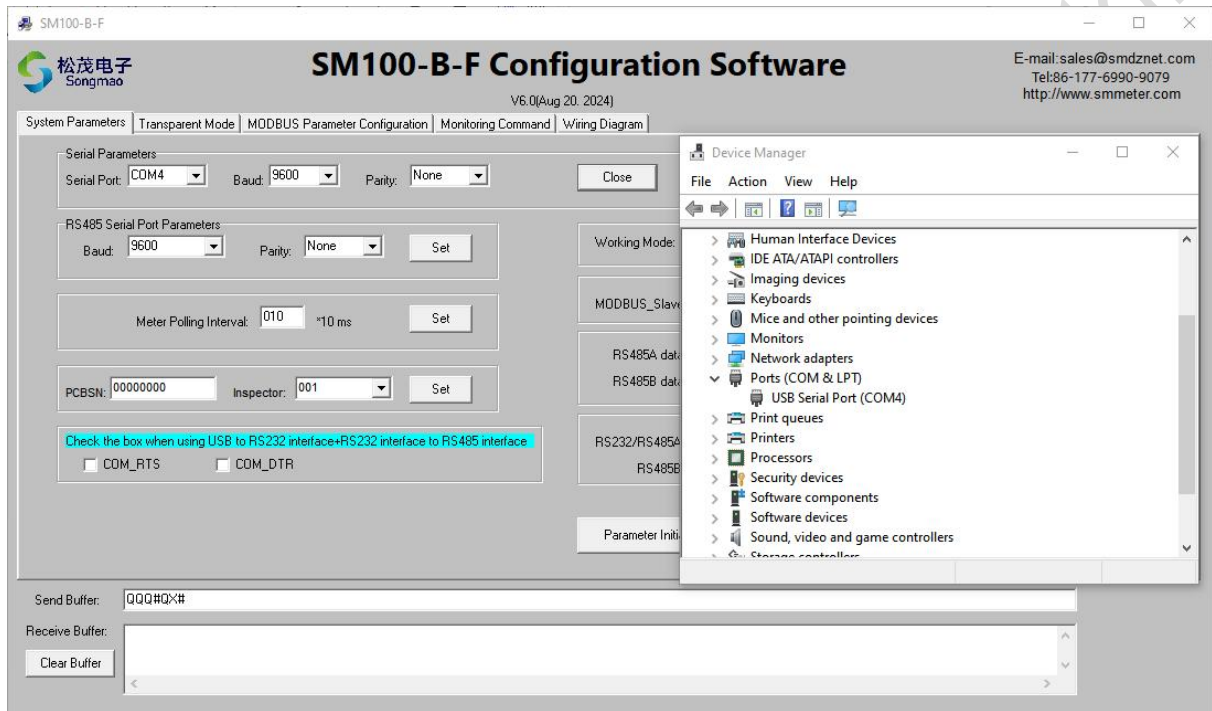
2.4 Description of indicator light

- M indicator: RS485 communication indicator.
- H indicator: display in communication with HART instrument.
- P indicator: power indication.

3. Function introduction and operation steps of configuration software

3.1 Communication connection

- 1) The converter is connected to the power supply and RS485 cable, and the parameter can be configured after the POW power indicator is normally 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 "Receiving 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: This product only supports RS485 communication. The user can select the baud rate and check bit (default baud rate: 9600, check bit: None) for RS485 communication interface 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.
- 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: Enter the 3-digit slave address and click "Set".
- 6) RS485A data return time: set the RS485 interface data delay return time according to the back-end access system.
- 7) RS232/RS485A data address base address: The register address range of MODBUS data output by the converter is 40001 to 4050. 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.

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SM100-B-F Configuration Software

V6.0(Aug 20, 2024)

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System Parameters
Transparent Mode
MODBUS Parameter Configuration
Monitoring Command
Wiring Diagram

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

RS485 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: 1_Single Meter Operation Mode Set

MODBUS_Slave_Adr: 001 Set

RS485A data return time: 4 400ms Set
RS485B data return time: 4 400ms Set

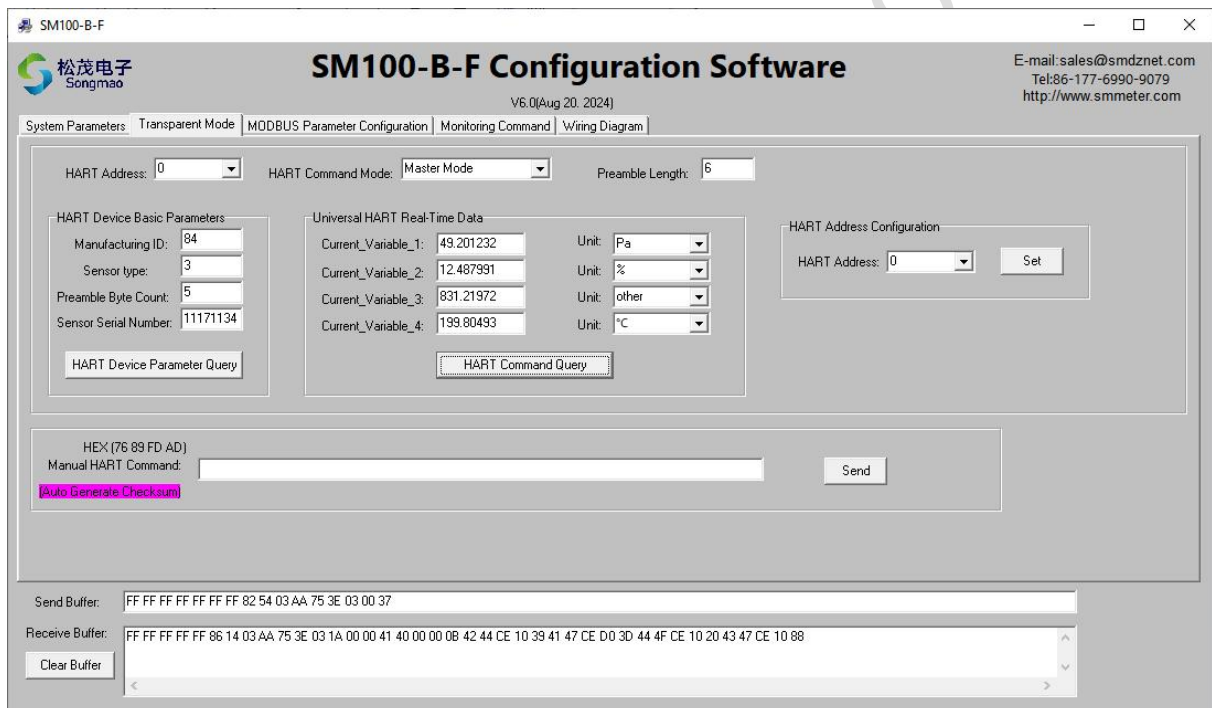
RS232/RS485A data base address: 00000 Set
RS485B data base address: 00000 Set

Parameter Initialization System Parameters

Send Buffer: QQQ#QX#
Receive Buffer: QX:1BA1:30,BA2:30,ADR:001,X,Y1:4,X,Y2:4,MD:1,JTM:010,ADR: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 SM100-B-F Configuration Software interface. The title bar indicates the window is titled "SM100-B-F". The main window has a menu bar with "System Parameters", "Transparent Mode", "MODBUS Parameter Configuration", "Monitoring Command", and "Wiring Diagram". The "Transparent Mode" tab is selected. The interface 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
 - A button labeled "HART Device Parameter 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
 - A button labeled "HART Command Query".
- HART Address Configuration:**
 - HART Address: 0
 - A "Set" button.
- Manual HART Command:**
 - HEX (76 89 FD AD)
 - Manual HART Command: A text input field.
 - A "Send" button.
 - A link labeled "Auto Generate Checksum".
- Send Buffer:** A text area showing the hex string: FF FF FF FF FF FF 82 54 03 AA 75 3E 03 00 37.
- Receive Buffer:** A text area showing the hex string: FF FF FF FF FF 86 14 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 88.
- A "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.

SM100-B-F Configuration Software

V6.0(Aug 20, 2024)

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System Parameters | Transparent Mode | MODBUS Parameter Configuration | Monitoring Command | Wiring Diagram

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

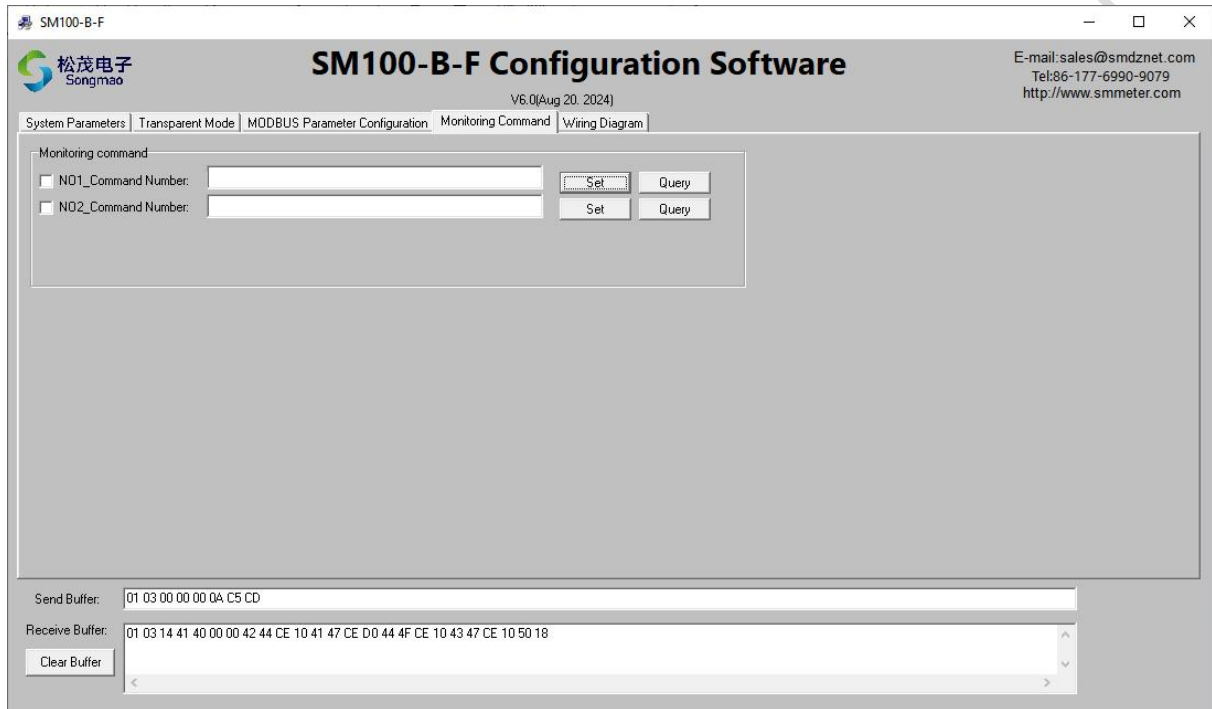
Receive Buffer: 01 03 14 41 40 00 00 42 44 CE 10 41 47 CE D0 44 4F CE 10 43 47 CE 10 50 18

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.



The screenshot shows the 'SM100-B-F Configuration Software' window. The title bar indicates 'SM100-B-F'. The interface includes a logo for '松茂电子 Songmao' and the version 'V6.0(Aug 20, 2024)'. Contact information is provided: 'E-mail:sales@smdznet.com', 'Tel:86-177-6990-9079', and 'http://www.smmeter.com'. The 'Monitoring Command' tab is selected, showing two input fields for 'NO1_Command Number' and 'NO2_Command Number', each with 'Set' and 'Query' buttons. At the bottom, there are 'Send Buffer' and 'Receive Buffer' text areas with a 'Clear Buffer' button. The 'Send Buffer' contains '01 03 00 00 00 0A C5 CD' and the 'Receive Buffer' contains '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'.

3.6 ModScan32 Communication Test

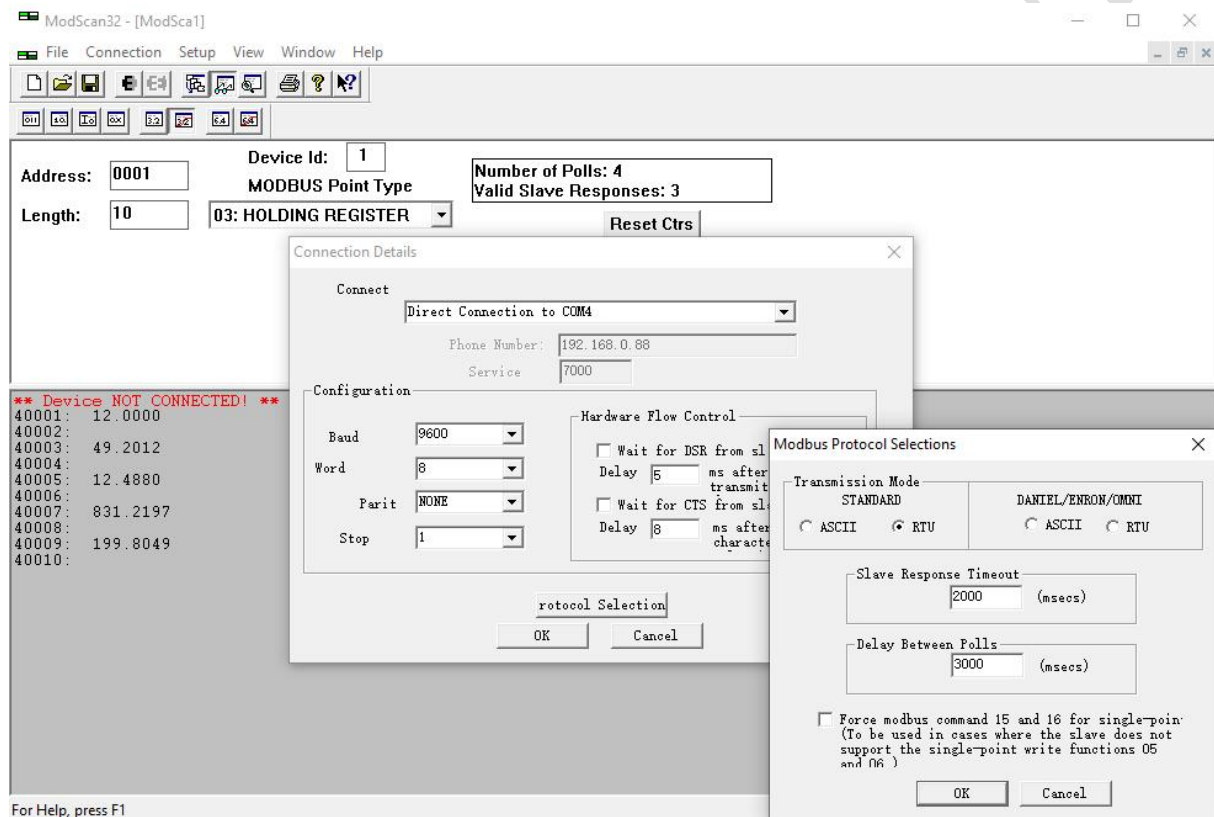
- 1) Close the serial port of the configuration software, open the Modscan32 software, click "connection", configure the appropriate parameters in the pop-up dialog box according to the arrow in the figure below, and then click OK.
- 2) Select the appropriate data format in the main window of modscan32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

SM100-B-F 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.

SM100-B-F 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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