

SM701-D Multivariable Current Output

Operating instructions for the converter



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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 However, content may become outdated or invalid due to product/software upgrades.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. Introduction of SM701-D Converter

1.1 Product Introduction

SM701-D multivariable current output converter is a high-tech product integrating RS485 communication and multi-channel current output. It is composed of interface chip, hardware watchdog circuit and so on. It has the characteristics of stable performance and high cost performance.

The SM701-D multivariable current output converter is structurally designed to fully comply with industry standards. It is specially designed in terms of temperature range, vibration, electromagnetic compatibility and interface diversity to ensure stable operation in harsh environments and provide high quality assurance for your equipment.

1.2 Product Performance

- Equipped with RS485 communication interface for parameter configuration.
- Use the industrial universal housing, which is directly installed on the instrument.
- Special configuration software is adopted to realize data communication with RS485 intelligent instrument.
- With 3 current outputs, it can transmit and output current to RS485 instrument variables.
- Support standard MODBUS protocol.
- Support single RS485 instrument.
- Support a variety of special RS485 intelligent instruments.

1.3 Main Parameters

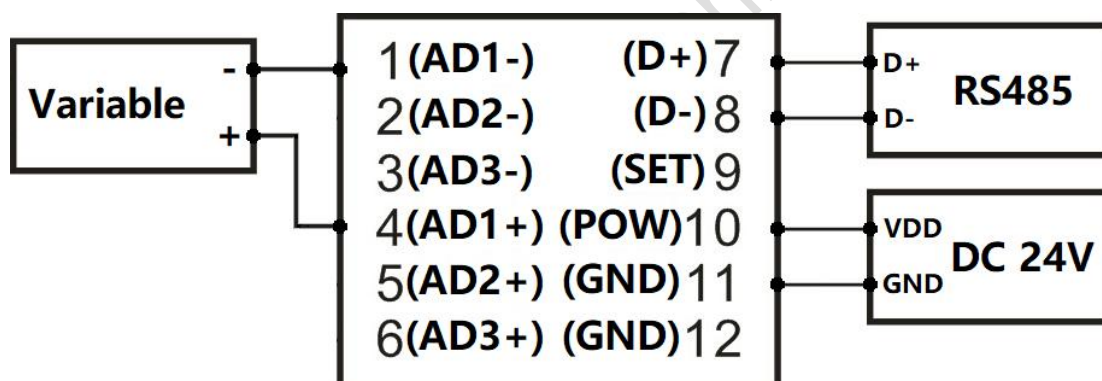
- Shell size: length 96 mm × width 80 mm × height 25 mm.
- Working temperature: -20 °C ~ + 80 °C.
- Storage temperature: -25 °C ~ + 80 °C.
- Power input voltage: DC 12 ~ 24V.

2. Physical Drawing and Wiring Diagram of SM701-D Converter

2.1 Physical Drawings



2.2 Wiring Diagram



2.3 Port Introduction

Port name	AD1-	AD2-	AD3-	AD1+	AD2+	ADD3+
Function/access device	Variable 1-	Variables 2-	Variables 3-	Variables 1 +	Variables 2 +	Variables 3 +
Port name	D+	D-	SET	POW	GND	GND
Function/access device	RS485 communication		Configuration & Initialization		Power source	

- AD1 +, AD1- ~ AD3 +, AD3-: 3-channel variable output, with sampling resistance of 250Ω.
- D +, D-: RS485 communication, refer to the connection diagram to connect the instrument and equipment to realize the data transmission between the converter and the equipment.
- SET, GND: Short circuit the SET and GND ports, and the converter enters the parameter setting mode. When the computer is connected to the D + and D- ports, the converter parameters can be set.
- POW, GND: DC power supply, the positive and negative poles (+, -) of the power line are connected to the corresponding (POW, GND) terminals respectively.

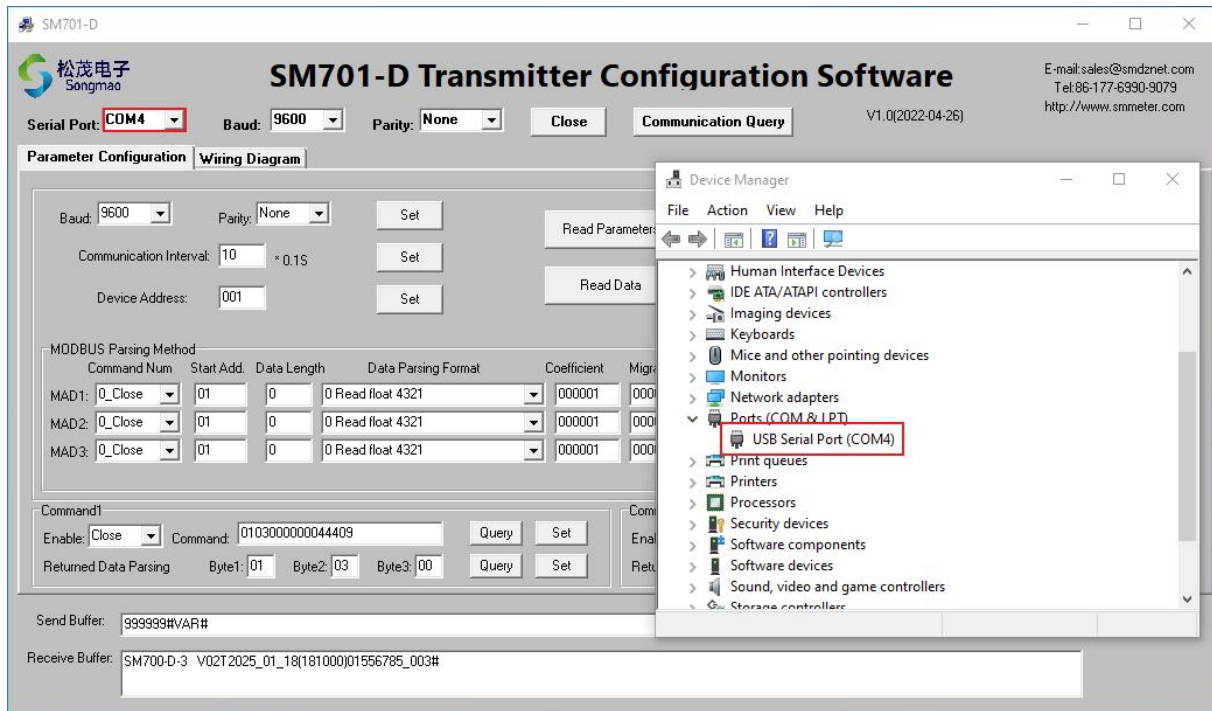
2.4 Description of Indicator Light

- MOD: RS485 communication interface indicator, which flashes when RS485 interface receives and sends data.
- POW: Power indicator. The power indicator is always on when the converter works normally.

3. Function Introduction and Operation Steps of Configuration Software

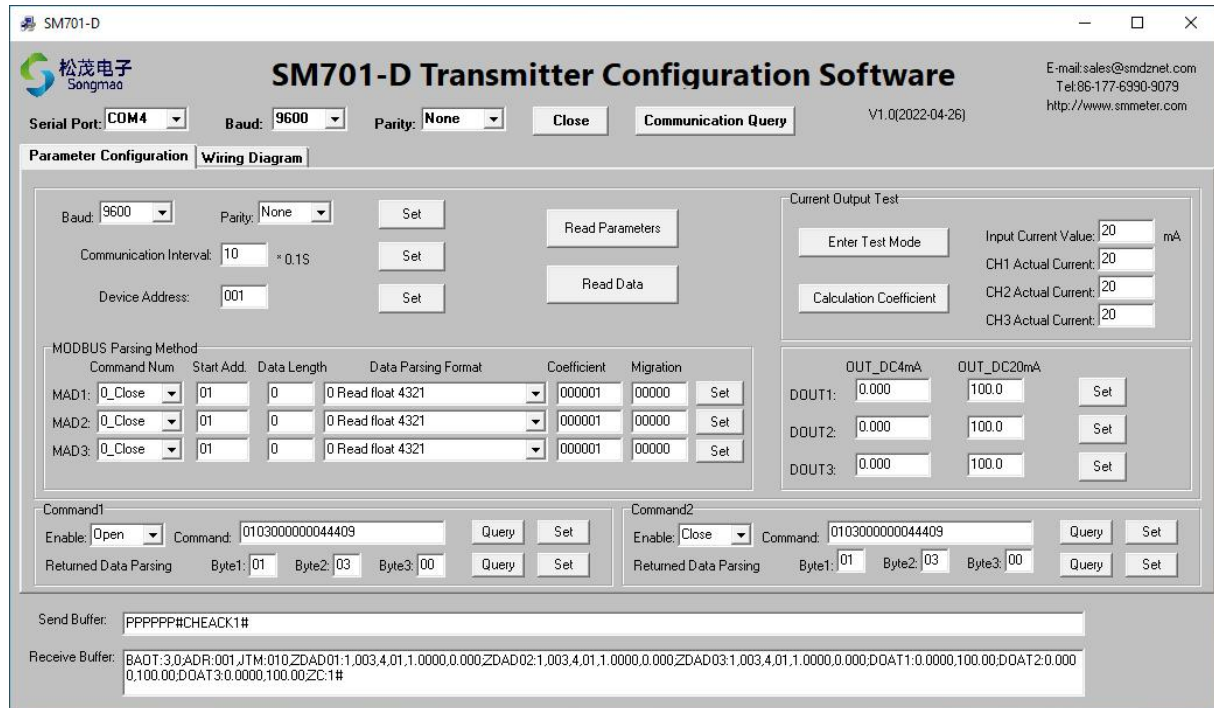
3.1 Communication Connection

- 1) According to the introduction of the port in the above part, connect the power supply and RS485 interface, and short the SET and GND ports at the same time to enter the parameter setting mode.
- 2) Open the configuration debugging software, select the correct serial port number and open the serial port. (Serial numbers can be viewed through Device Manager-Ports (COM and LPT))
- 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 Parameter Query

- 1) Read parameters: Click "Read parameters" to read the converter's baud rate, check bit, device address, MODBUS resolution format, OUT _ DC4 ~ 20 mA range and other basic information.



SM701-D Transmitter Configuration Software

Serial Port: **COM4** Baud: **9600** Parity: **None** Close Communication Query V1.0(2022-04-26)

Parameter Configuration Wiring Diagram

Baud: **9600** Parity: **None** Set Read Parameters

Communication Interval: **10** * 0.1s Set

Device Address: **001** Set Read Data

MODBUS Parsing Method

Command Num	Start Add	Data Length	Data Parsing Format	Coefficient	Migration
MAD1: 0_Close	01	0	0 Read float 4321	000001	00000
MAD2: 0_Close	01	0	0 Read float 4321	000001	00000
MAD3: 0_Close	01	0	0 Read float 4321	000001	00000

Current Output Test

Enter Test Mode Input Current Value: **20** mA

CH1 Actual Current: **20**

CH2 Actual Current: **20**

CH3 Actual Current: **20**

Calculation Coefficient

OUT_DC4mA OUT_DC20mA

DOUT1: **0.000** **100.0** Set

DOUT2: **0.000** **100.0** Set

DOUT3: **0.000** **100.0** Set

Command1 Enable: **Open** Command: **0103000000044409** Query Set

Returned Data Parsing Byte1: **01** Byte2: **03** Byte3: **00** Query Set

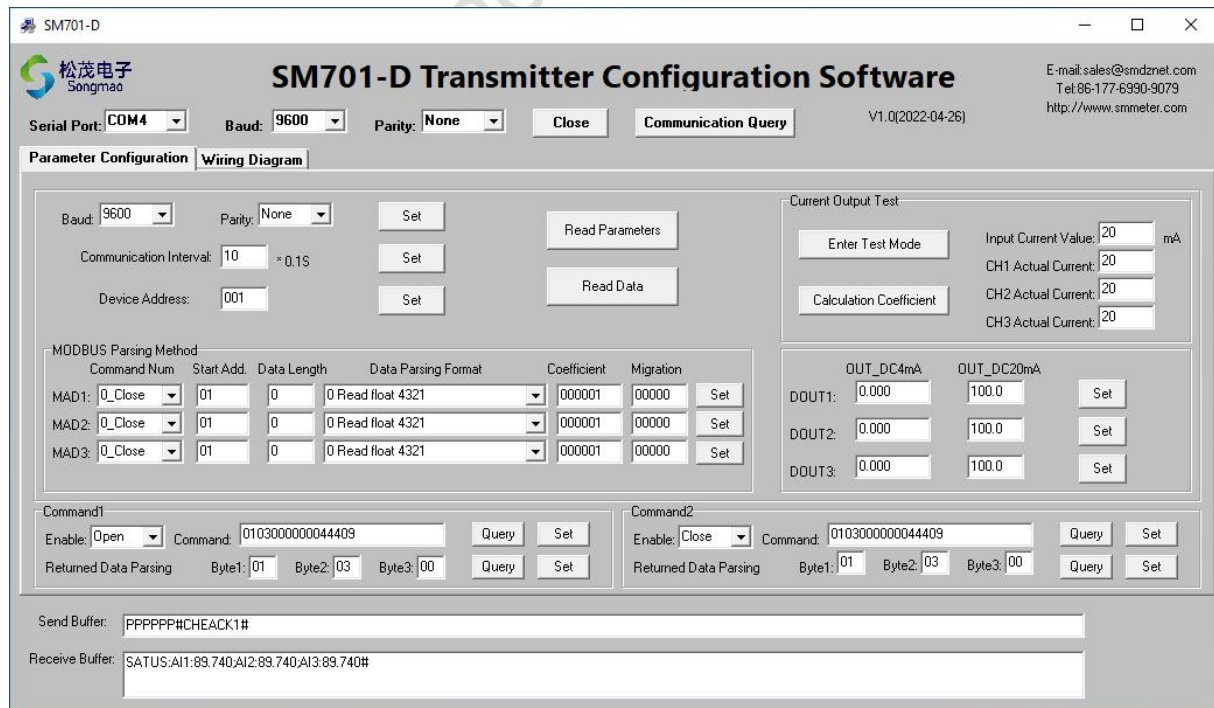
Command2 Enable: **Close** Command: **0103000000044409** Query Set

Returned Data Parsing Byte1: **01** Byte2: **03** Byte3: **00** Query Set

Send Buffer: **PPPPPP#CHECK1#**

Receive Buffer: **BAOT:3;0;ADR:001;JTM:010;ZDAD01:1.003,4,01,1.0000,0.000;ZDAD02:1.003,4,01,1.0000,0.000;ZDAD03:1.003,4,01,1.0000,0.000;DOAT1:0.0000,100.00;DOAT2:0.0000,100.00;DOAT3:0.0000,100.00;ZC:1#**

- 2) Read data: After reading the parameters in the operation mode, short-circuit the SET and GND ports to exit the operation mode and enter the parameter setting mode. Click "Read Data" to read the values of three RS485 variables MAD1 ~ MAD3 in the parameter setting mode. The values can be viewed in the message returned from the "Receive Buffer".



SM701-D Transmitter Configuration Software

Serial Port: **COM4** Baud: **9600** Parity: **None** Close Communication Query V1.0(2022-04-26)

Parameter Configuration Wiring Diagram

Baud: **9600** Parity: **None** Set Read Parameters

Communication Interval: **10** * 0.1s Set

Device Address: **001** Set Read Data

MODBUS Parsing Method

Command Num	Start Add	Data Length	Data Parsing Format	Coefficient	Migration
MAD1: 0_Close	01	0	0 Read float 4321	000001	00000
MAD2: 0_Close	01	0	0 Read float 4321	000001	00000
MAD3: 0_Close	01	0	0 Read float 4321	000001	00000

Current Output Test

Enter Test Mode Input Current Value: **20** mA

CH1 Actual Current: **20**

CH2 Actual Current: **20**

CH3 Actual Current: **20**

Calculation Coefficient

OUT_DC4mA OUT_DC20mA

DOUT1: **0.000** **100.0** Set

DOUT2: **0.000** **100.0** Set

DOUT3: **0.000** **100.0** Set

Command1 Enable: **Open** Command: **0103000000044409** Query Set

Returned Data Parsing Byte1: **01** Byte2: **03** Byte3: **00** Query Set

Command2 Enable: **Close** Command: **0103000000044409** Query Set

Returned Data Parsing Byte1: **01** Byte2: **03** Byte3: **00** Query Set

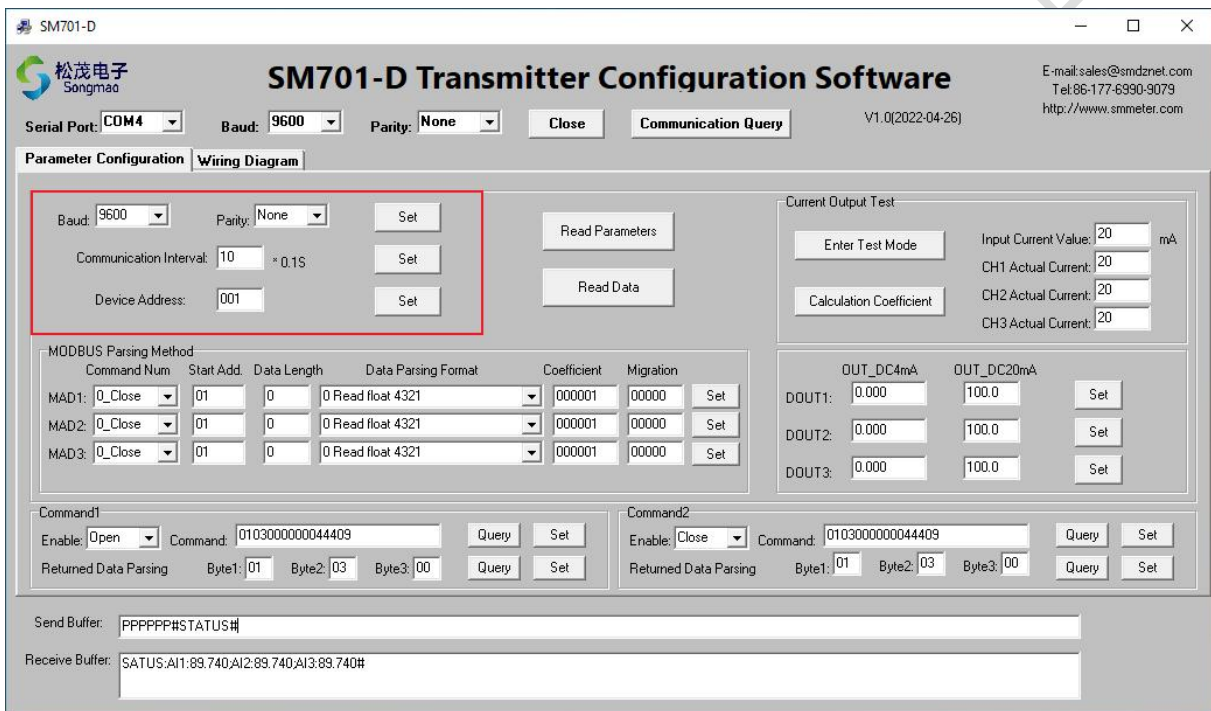
Send Buffer: **PPPPPP#CHECK1#**

Receive Buffer: **SATUS:A11:89.740;A12:89.740;A13:89.740#**

3.3 RS485 Parameter Configuration

Configure basic communication parameters such as baud rate, check bit and communication interval according to the connected RS485 instrument.

- 1) Baud and parity: they are the communication baud rate and check bit of RS485 instrument. Only when the set baud rate and check bit are consistent with the baud rate and check bit of RS485 instrument, can communication be carried out. The factory default baud rate is 9600 and the check digit is None.
- 2) Communication interval: communication interval time between converter and RS485 instrument, communication time = set time $\times 0.1$ s. For example, if the set time is 010, the communication interval between the converter and the RS485 instrument is 10×0.1 s = 1 s.
- 3) Device address: MODBUS communication address of RS485 instrument.



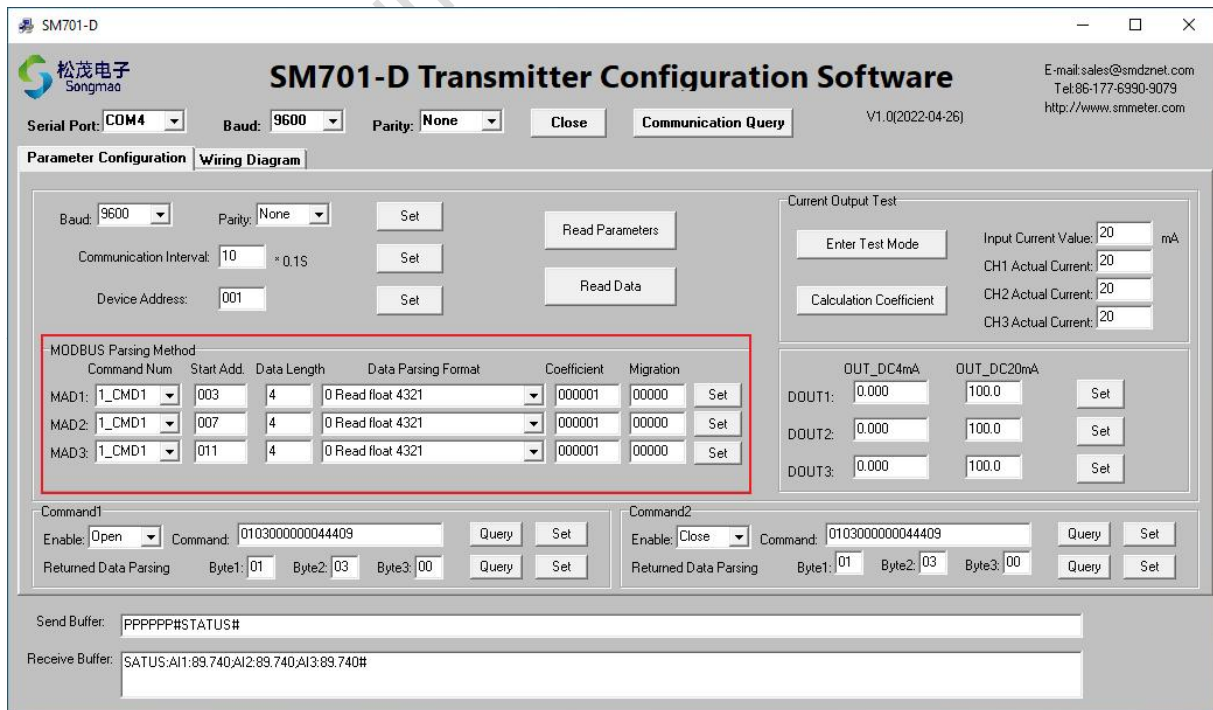
The screenshot shows the 'SM701-D Transmitter Configuration Software' interface. The 'Parameter Configuration' tab is active. A red box highlights the 'Baud: 9600', 'Parity: None', 'Communication Interval: 10 * 0.1s', and 'Device Address: 001' settings. Other sections include 'MODBUS Parsing Method' with a table of commands, 'Current Output Test' with input/output values, and 'Command1'/'Command2' sections for enabling/disabling commands and setting return data parsing.

Command Num	Start Add	Data Length	Data Parsing Format	Coefficient	Migration	
MAD1:	0_Close	01	0	0 Read float 4321	000001	00000 Set
MAD2:	0_Close	01	0	0 Read float 4321	000001	00000 Set
MAD3:	0_Close	01	0	0 Read float 4321	000001	00000 Set

3.4 MODBUS Parsing Method

The setting box can set the instruction number, start address, data length, data analysis format and other parameters of each variable.

- 1) Command num: click the corresponding pull-down button  Multiple options appear: Close, CMD1, CMD2, select the command number, and the variable will read the RS485 instrument data according to the command code corresponding to the command number.
- 2) Start add.: Get the start address of the 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) Data length: get 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) Data parsing format: the parsing 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 there is a deviation between the actual output current signal and the calculated theoretical current signal, the output current signal can be calibrated by setting the coefficient. Coefficient values can be calculated for each channel using the Current Output Test box.
- 6) Migration: When the read data needs to be offset, the read value can be offset by setting the offset value.
- 7) Set: Click the corresponding save button to display the Set success! In the receiving buffer area! This means that the setting is successful.



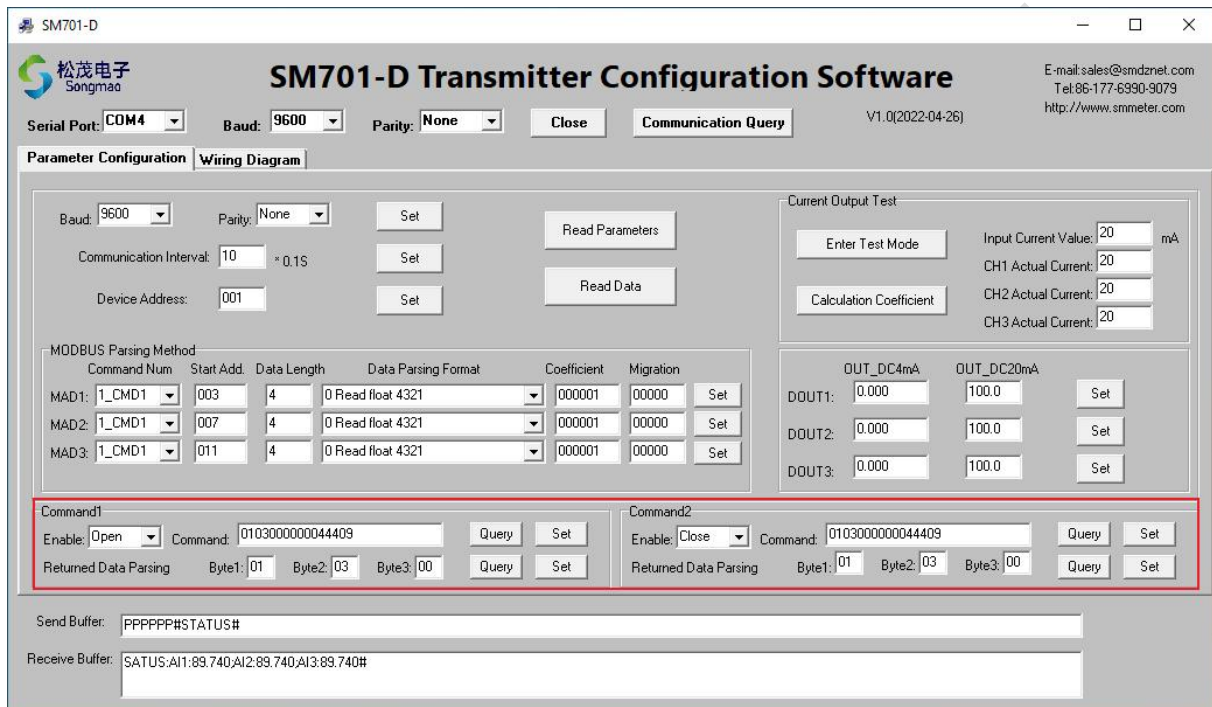
The screenshot shows the SM701-D Transmitter Configuration Software interface. The main window is titled "SM701-D Transmitter Configuration Software" and includes a logo for Songmao Electronics. The interface is divided into several sections:

- Serial Port Settings:** Serial Port: COM4, Baud: 9600, Parity: None. Buttons: Close, Communication Query.
- Parameter Configuration:**
 - Baud: 9600, Parity: None, Set button.
 - Communication Interval: 10, * 0.1S, Set button.
 - Device Address: 001, Set button.
 - Read Parameters button.
 - Read Data button.
- MODBUS Parsing Method:** A table with columns: Command Num, Start Add., Data Length, Data Parsing Format, Coefficient, Migration. It lists three channels (MAD1, MAD2, MAD3) with their respective settings. A red box highlights this section.
- Current Output Test:**
 - Enter Test Mode button.
 - Input Current Value: 20 mA.
 - CH1 Actual Current: 20.
 - CH2 Actual Current: 20.
 - CH3 Actual Current: 20.
 - Calculation Coefficient button.
- OUT_DC4mA and OUT_DC20mA:**
 - OUT_DC4mA: DOUT1: 0.000, DOUT2: 0.000, DOUT3: 0.000.
 - OUT_DC20mA: 100.0, 100.0, 100.0.
 - Set buttons for each output.
- Command1 and Command2:**
 - Enable: Open/Close, Command: 0103000000044409, Query/Set buttons.
 - Returned Data Parsing: Byte1: 01, Byte2: 03, Byte3: 00, Query/Set buttons.
- Send Buffer:** P P P P P # S T A T U S #
- Receive Buffer:** S A T U S : A I 1 : 8 9 . 7 4 0 ; A I 2 : 8 9 . 7 4 0 ; A I 3 : 8 9 . 7 4 0 #

3.5 Command Settings

The setting box can query and set parameters such as instruction enable and instruction code.

- 1) Click "Query" to read instruction parameter information such as instruction enable and instruction code.
- 2) Enable: when the converter is required to send the command in the command box to the RS485 instrument, the command enable shall be set to "open".
- 3) Command: read the instruction code of RS485 instrument data information.
- 4) Byte1, 2, 3 of the returned data parsing packet header: When the first 3 bytes of the returned data information code are consistent with the set packet header byte1, 2, 3, the data information code is considered to be a valid data code. If the byte of the packet header is set to 00, it indicates that the returned data information code is not judged, that is, the judgment is correct no matter what data information code is returned.
- 5) Click the corresponding setting button to display the Set success! In the receiving buffer area! This means that the setting is successful.



SM701-D Transmitter Configuration Software

Serial Port: COM4 Baud: 9600 Parity: None Close Communication Query V1.0(2022-04-26)

Parameter Configuration Wiring Diagram

Baud: 9600 Parity: None Set Read Parameters

Communication Interval: 10 * 0.1S Set Read Data

Device Address: 001 Set

Command Num	Start Add	Data Length	Data Parsing Format	Coefficient	Migration	
MAD1	1_CMD1	003	4	0 Read float 4321	000001	00000 Set
MAD2	1_CMD1	007	4	0 Read float 4321	000001	00000 Set
MAD3	1_CMD1	011	4	0 Read float 4321	000001	00000 Set

Current Output Test

Enter Test Mode Input Current Value: 20 mA

CH1 Actual Current: 20

CH2 Actual Current: 20

CH3 Actual Current: 20

Calculation Coefficient

OUT_DC4mA OUT_DC20mA

DOUT1: 0.000 100.0 Set

DOUT2: 0.000 100.0 Set

DOUT3: 0.000 100.0 Set

Command1

Enable: Open Command: 0103000000044409 Query Set

Returned Data Parsing Byte1: 01 Byte2: 03 Byte3: 00 Query Set

Command2

Enable: Close Command: 0103000000044409 Query Set

Returned Data Parsing Byte1: 01 Byte2: 03 Byte3: 00 Query Set

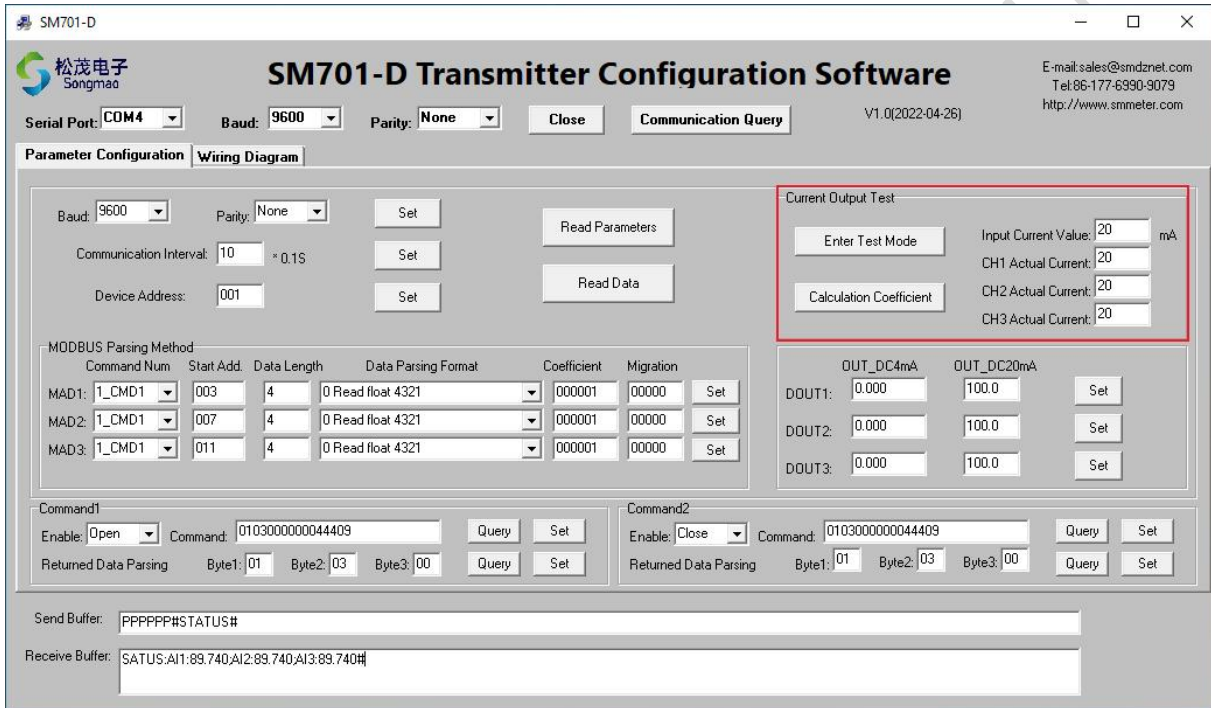
Send Buffer: P P P P P # S T A T U S #

Receive Buffer: S A T U S ; A I 1 : 8 9 . 7 4 0 ; A I 2 : 8 9 . 7 4 0 ; A I 3 : 8 9 . 7 4 0 #

3.6 Current Output Test

The setting box can fix the current output value and detect and calibrate three current output channels.

- 1) Input current value: Set the current value in the range of 4 ~ 20 mA. When the converter enters the test mode, the output current of the 3 current output channels is fixed according to the set current value.
- 2) Enter test mode: click this button, the converter enters the test mode, and the output current of the 3 current output channels is fixed according to the set input current value.
- 3) Calculate coefficient: after entering the test mode, measure the actual output current of the three current output channels respectively with the current gear of the multimeter, and then fill the measured current values into the "CH1 ~ CH3 Actual Current" box respectively, and finally click "Calculate Coefficient", the converter will automatically calculate the coefficient value according to the input value. It is displayed in the "MODBUS resolution mode"- "coefficient" input box.



The screenshot shows the SM701-D Transmitter Configuration Software interface. The window title is "SM701-D". The interface includes a top bar with the Songmao logo, version "V1.0(2022-04-26)", and contact information. Below the top bar, there are fields for "Serial Port" (COM4), "Baud" (9600), and "Parity" (None), along with "Close" and "Communication Query" buttons. The main area is divided into two tabs: "Parameter Configuration" and "Wiring Diagram". The "Parameter Configuration" tab is active and contains several sections:

- Communication Settings:** Includes fields for "Baud" (9600), "Parity" (None), "Communication Interval" (10 * 0.1s), and "Device Address" (001), each with a "Set" button. There are also "Read Parameters" and "Read Data" buttons.
- MODBUS Parsing Method:** A table with columns for "Command Num", "Start Add", "Data Length", "Data Parsing Format", "Coefficient", and "Migration". It lists three commands: MAD1, MAD2, and MAD3, each with a "Set" button.
- Current Output Test:** A section highlighted with a red box. It contains an "Enter Test Mode" button, an "Input Current Value" field (20 mA), and three "Actual Current" fields for CH1, CH2, and CH3, each with a "Set" button. Below these are "OUT_DC4mA" and "OUT_DC20mA" sections, each with three "DOUT" fields (DOUT1, DOUT2, DOUT3) and "Set" buttons.
- Command1 and Command2:** Two sections for configuring commands. Each has an "Enable" dropdown, a "Command" field, and "Query" and "Set" buttons. Below each is a "Returned Data Parsing" section with "Byte1", "Byte2", and "Byte3" fields and "Query" and "Set" buttons.
- Send Buffer and Receive Buffer:** Two text input fields at the bottom. The "Send Buffer" contains "PPPPP#STATUS#". The "Receive Buffer" contains "STATUS;A11:89.740;A12:89.740;A13:89.740#".

3.7 OUT _ DC Range Setting

Respectively configure the upper and lower limits of the range according to the variables read, wherein the lower limit of the range corresponds to OUT _ DC4mA, and the upper limit of the range corresponds to OUT _ DC20mA.

Define the RS485 instrument DA data as X_{AV} , the current output has an upper range of X_U . The lower limit is X_D , the converter

① The output current value is

$$A_{TV} = \frac{X_{AV} - X_D}{X_U - X_D} \times (20 - 4)mA + 4mA$$

② Output voltage value is (load 250Ω)

$$V_{TV} = \left[\frac{X_{AV} - X_D}{X_U - X_D} \times (20 - 4)mA + 4mA \right] \times 250\Omega$$

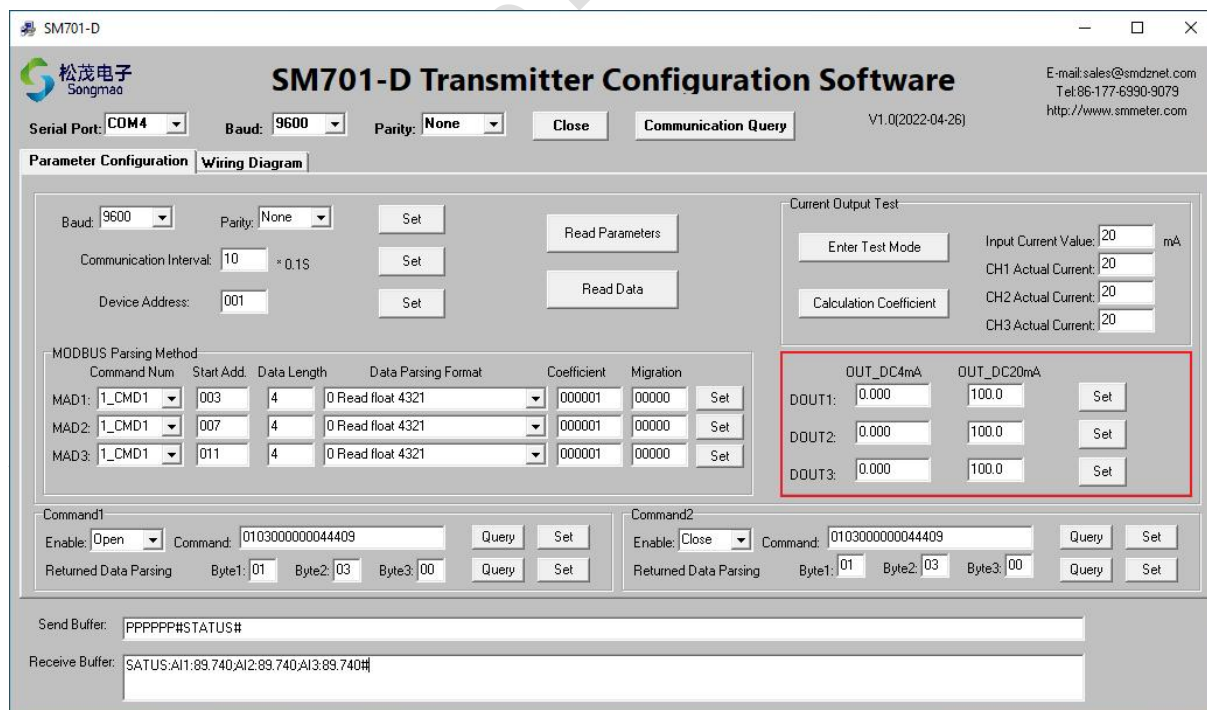
Example: Read the temperature value of an RS485 instrument, the temperature value is 45.7912, the resolution mode is configured on the MDA1 variable, and the range DOUT1 is set as 0 ~ 100.

Calculation: ① Actual current value output by converter AD1 + and AD1- port

$$A_{OI1} \approx A_{TV} = \frac{45.7912 - 0}{100 - 0} \times (20 - 4)mA + 4mA = 11.32mA$$

② Actual voltage value output by converter AD1 + and AD1- port

$$V_{OI1} \approx V_{TV} = \left[\frac{45.7912 - 0}{100 - 0} (20 - 4)mA + 4mA \right] \times 250\Omega = 2.83V$$



The screenshot shows the SM701-D Transmitter Configuration Software interface. The main window is titled "SM701-D Transmitter Configuration Software" and includes a logo for Songmao Electronics. The interface is divided into several sections:

- Serial Port Configuration:** Includes fields for Serial Port (COM4), Baud (9600), Parity (None), and buttons for Close and Communication Query.
- Parameter Configuration:** Contains a table for MODBUS Parsing Method with columns for Command Num, Start Add, Data Length, Data Parsing Format, Coefficient, and Migration. It also includes fields for Baud, Parity, Communication Interval, and Device Address.
- Current Output Test:** Features a table for OUT_DC4mA and OUT_DC20mA with input fields for DOUT1, DOUT2, and DOUT3, and buttons for Set and Calculation Coefficient.
- Command Configuration:** Includes fields for Command1 and Command2, with buttons for Enable, Query, and Set.
- Send Buffer:** A text field containing "PPPPPP#STATUS#".
- Receive Buffer:** A text field containing "SATUS:A11:89.740/A12:89.740/A13:89.740#".

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.

After-sales service hotline: 86-573-82623038

Email: service@smdznet.com