



User Manual

BSQ-Mini (EC/ER/PH/ORP)



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I. Precautions Before Use:

Please read the relevant sections of this manual carefully before installation and use to prevent incorrect operations that may cause measurement errors or damage to the instrument.

Improper installation and unsuitable flow rates can lead to significant measurement deviations.

Please understand the installation section in detail.

This transmitter is a precision electrochemical instrument and should be installed and operated by personnel familiar with and knowledgeable about the relevant professional expertise.

II. Warranty Terms:

The product quality warranty period is one year from the date of purchase. (Excluding pH meters and ORP electrodes) During the warranty period, if the product has quality issues, the company will provide free repair or replacement.

The company provides lifetime maintenance services for battery products.

Damage caused by the following reasons is not covered by the warranty:

Improper use or maintenance;

Damage caused by water;

Unauthorized modifications and misuse;

Damage caused by exceeding the specified usage environment of the product;

Consequential losses caused by improper use;

Insulation breakage or damage caused by improper installation or use;

Inaccurate sensor measurements due to unauthorized disassembly or wiring;

Returned products that affect the company's secondary sales.

III. BSQ-mini Upgrade and Modification Instructions

The BSQ-MINI water quality transmitter module is an optimized version of the previous BSQ-2019 model, with the following main features:

1. Removal of the previous LCD display, replaced by dual-color LED lights to indicate functional status;
2. Volume reduced by 60% compared to BSQ-2019;
3. Higher cost-performance ratio;
4. Automatic recognition of conductivity calibration waves for calibration.



IV. Overview:

The EC/ER/pH series transmitters are mainly used for transmitting signals from water quality monitoring sensors. They amplify the weak signals output by the sensors and transmit them via 4-20mA, RS485, or TTL levels, facilitating communication with PLCs, configuration software, microcontrollers, etc. The communication protocol uses the standard MODBUS RTU protocol: This product is widely used in industrial sectors such as metallurgical manufacturing, power, light industry, textiles, water treatment equipment, water supply networks, and scientific research.

Note: The EC/ER transmitter module is a universal module, and the PH module is another universal module. Both modules have the same appearance but different hardware, distinguished by panel markings. Use with caution. One transmitter module can only be set to one electrode input.

1. Transmitter Series Description:

Note: One transmitter module can only be paired with one electrode. EC is a separate module, and PH is another module.

- ①: EC conductivity transmitter; range: 0~2000 μ S/cm²; optional 0-4000 μ S, 0-10.00mS, 0-20.00mS, 0-200.0mS;
- ②: ER resistivity transmitter; range: 0~18.2M Ω
- ③: pH acidity transmitter; range: 0~14.00 pH

2. EC Conductivity Technical Specifications

➤ Range selection

No.	Measurement Range	Matching Electrode	Accuracy	Interface
1	0.1 ~ 18.25M Ω (0.05 ~ 10.00 μ S)	1: 316L stainless steel insert type 0.01 electrode; 2: Quick-connect type 0.02 electrode;	2 % FS	1/2"NPT (4 points) 2 points quick connector
2	0.1 ~ 2000 μ S	316L stainless steel insert type 0.1 electrode;		1/2"NPT (4 points)
3	0.5 ~ 2000 μ S (standard)	ABS1D platinum black electrode (standard); 316L stainless steel insert type 1.0 electrode;	1.5% FS	1/2"NPT (4 points)
4	2 ~ 4000 μ S	ABS1D platinum black electrode (standard); 316L stainless steel	1.5% FS	1/2"NPT (4 points)



No.	Measurement Range	Matching Electrode	Accuracy	Interface
		insert type 1.0 electrode;		
5	0.5 ~ 10mS	ABS1D platinum black electrode (standard); 316L stainless steel insert type 1.0 electrode;	3 % FS	1/2"NPT (4 points)
6	0.5 ~ 20mS	1: 316L stainless steel insert type 10.0 electrode; 2: Optional PTFE + titanium alloy 10.0 electrode;	1.5% FS	1/2"NPT (4 points) 3/4"NPT (6 points)
7	0.5 ~ 100mS	1: 316L stainless steel insert type 10.0 electrode; 2: PTFE + titanium alloy 10.0 electrode;	2 % FS	1/2"NPT (4 points) 3/4"NPT (6 points)
8	0.5 ~ 200mS	Optional PTFE + titanium alloy 10.0 electrode;	2 % FS	3/4"NPT (6 points)

- Stability: $\pm 2 \times 10^{-3}$ FS/24h
- Matching electrode: Standard 1.0cm-1 ABS plastic platinum black electrode; other specifications optional;
- Electrode thread: 1/2"NPT
- Contact length: Insert type standard 5 meters; quick-connect type standard 1.5 meters;
- Medium temperature: 0 ~ 50°C
- Electrode withstand pressure: 0.5Mpa
- Temperature compensation element: NTC10K
- Temperature compensation: Automatic compensation based on 25°C

3. Resistivity - Technical Specifications:

Measurement range: 0~18.25MΩ;

Accuracy: 2.0%/FSD;

Stability: $\pm 2 \times 10^{-3}$ FS/24h;

Matching electrode: Standard 0.05cm-1 316L stainless steel electrode, optional insert type or quick-connect type;

Electrode thread: 1/2"NPT;

Cable length: Insert type standard 5 meters; quick-connect type standard 1.5 meters;

Medium temperature: 0~50°C;

Electrode withstand pressure: 0.5Mpa;

Temperature compensation element: NTC10K;

Temperature compensation: Automatic compensation based on 25°C.



4. pH (Acidity) - Technical Specifications:

Measurement range: 0~14.00;

Accuracy: 2.0%/FSD;

Stability: $\pm 2 \times 10^{-3}$ FS/24h;

Matching electrode: Online pH electrode ABS two-composite electrode (2-wire system);

Cable length: Standard 5 meters;

Electrode thread: 3/4NPT pipe thread;

Temperature compensation element: NTC10K;

Medium temperature: 0~50°C;

Temperature compensation: Manual or automatic compensation based on 25°C;

Calibration method: Three-point calibration, pH4.00, pH6.86, pH9.18.

5. Other Related Technical Specifications

Output current: 4~20mA/optional; 1-5V/2-10V; 4-20mA corresponding range can be set, default is 0~full scale;

Relay output: High/low frequency relay alarm output can be set, contact current 24V/3A, 220V/2A; (passive dry contact);

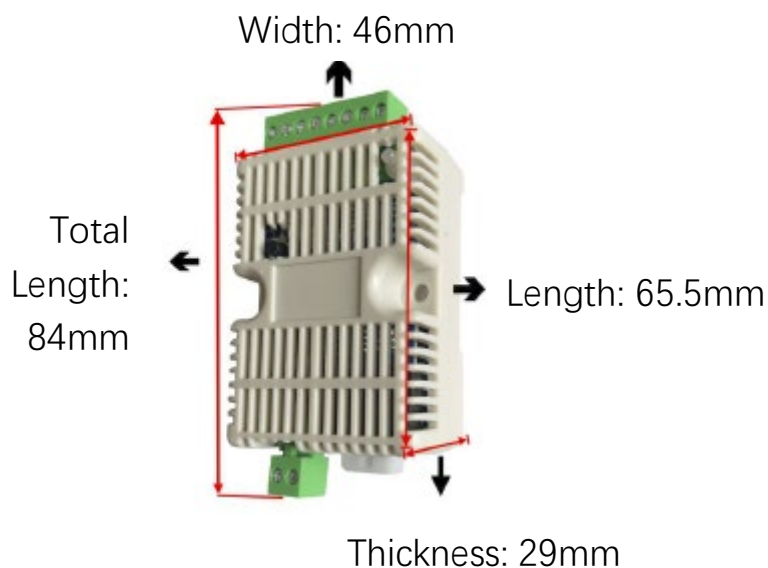
Power supply: DC12V-28V, 24V current <0.1A;

Environmental conditions: (1) Temperature 0~50°C (2) Humidity $\leq 85\%$ RH

Dimensions: 122×72×45mm (L×W×H);

Installation method: Rail installation;

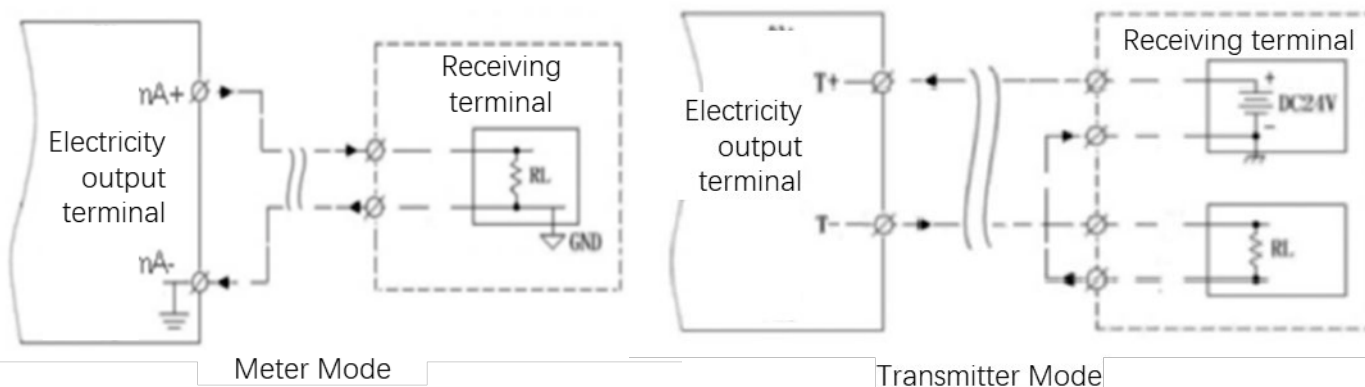
6. Transmitter Outline Diagram



7. Wiring notes:

No.	2 terminals from left to right	Description	8 terminals from left to right	Conductivity transmitter wiring	pH transmitter wiring
1	24V+	Power input positive (- reverse protection)	1	EC electrode (conductivity measurement white wire)	pH+ electrode measurement signal input (transparent wire)
2	24V-	Power input negative (- reverse protection)	2	EC electrode (conductivity measurement yellow wire)	pH- electrode reference signal input (black wire)
			3	Temperature measurement red wire NTC10K	Temperature measurement red wire NTC10K
			4	Temperature measurement black wire (internal ground)	Temperature measurement black wire (internal ground)
			5	RS-485 A- signal terminal	RS-485 B- signal terminal
			6	RS-485 B- signal terminal	RS-485 B- signal terminal
			7	4-20mA output positive	4-20mA output positive
			8	4-20mA output negative	4-20mA output negative

Note: 4-20mA output wiring diagram



8. Operation Instructions

LED Light Status Description:

Operation Description	Event Description	LED Light	Remarks
Power on	No RS485 communication	Green light on, blinking at 1-second intervals	4-20mA version, always in this state
Power on	RS485 communication normal	Green light blinks once per communication	Blinking speed same as communication speed
Initialize communication address	Press and hold the button, then power on, wait: green light -> red light, then release	Red light blinks for 5 seconds, then turns green, indicating successful initialization	After initialization: RS485 communication address: conductivity: 01; pH: 02 Baud rate: 9600 Electrode constant: 1.000
Conductivity calibration	In measurement state, press and hold the button for 3 seconds, LED changes from green -> yellow, release	Yellow light indicates entering calibration preparation program	
Conductivity	In measurement state, press and hold the button for 6 seconds, LED changes from green -> yellow -> red, release	Indicates entering conductivity	Electrode constant factory default: 1.000
Electrode constant adjustment (increase)	In measurement state, press and hold the button for 9 seconds, LED changes from green -> yellow -> red -> green, release	Indicates entering conductivity	Electrode constant factory default: 1.000

Calibration Instructions:

- Conductivity Calibration: (Note: This calibration does not support resistivity mode, resistivity error needs to correct electrode constant)
 - a. In measurement state, press and hold the button for 3 seconds, LED changes from green -> yellow, release;
 - b. Clean the electrode and place it in the prepared conductivity standard solution. The BSQ-MINI-EC transmitter supports three standard solutions: 84uS, 1413uS, 12.88mS;



- c. Stir the electrode in the standard solution, then press the button. The yellow light will blink at 0.5-second intervals for about 10 seconds. The transmitter module will automatically recognize the current standard solution (84uS, 1413uS, 12.88mS) and perform calibration;
- d. After calibration is completed, the green light will stay on for 5 seconds, indicating successful calibration; if the red light stays on for 5 seconds, it indicates calibration failure;
- e. Automatically exit the calibration program and return to measurement state; if calibration fails or the reading is not ideal, repeat the above calibration steps for recalibration.

➤ pH Transmitter Three-Point Calibration Method:

- a. Before calibration, prepare standard solutions with pH values of 4.00, 6.86, 9.18, and pure water (or distilled water). Before calibration, the electrode detection part must be immersed in clean water or the measured solution for activation for more than 1 hour, then power on the transmitter and preheat for 5 minutes;
- b. In measurement state, press and hold the button for 3 seconds, LED changes from green -> yellow, release; this enters the 4.00 calibration program;
- c. Insert the cleaned electrode into the prepared 4.00 standard solution, press the "button", the yellow light starts blinking, and ends after about 10 seconds;
- d. After successful 4.00 calibration, the yellow light turns orange, entering the 6.86 calibration program. If calibration fails, the yellow light stays on, return to the previous step, and restart the 4.00 calibration;
- e. Insert the cleaned electrode into the prepared 6.86 standard solution, press the "button", the red light starts blinking, and ends after about 10 seconds;
- f. After successful 6.86 calibration, the red light turns green, entering the 9.18 calibration program. If calibration fails, the red light stays on, return to the previous step, and restart the 6.86 calibration;
- g. The instrument displays the current standard solution corresponding mV value. When the mV value stabilizes, wait for about 1-3 minutes, press the "Enter" key to save. The instrument will display the next calibration item E, BG; if ERR is displayed, it indicates calibration failure, repeat the above steps. If calibration fails multiple times, it indicates the electrode may be invalid, please replace the electrode or contact the supplier;
- h. Insert the cleaned electrode into the prepared 9.18 standard solution, press the "button", the green light starts blinking, and ends after about 10 seconds;
- i. After successful 9.18 calibration, the green light blinks at 1-second intervals, exiting the calibration program. If calibration fails, the green light stays on, return to the previous step, and restart the 9.18 calibration;



- j. After calibration is completed, return to the main parameter measurement interface, and repeat the measurement verification for the three standard solutions to check if the display is accurate and consistent. (Note: When changing standard solutions, clean the electrode in pure water once to avoid contamination of another standard solution by oxides on the electrode, causing inaccurate standard values); if the deviation is large, repeat the calibration; if calibration fails multiple times, replace the electrode or contact the supplier;

Note: For all operations, after modifying internal settings, the system delays for 20 seconds before saving. Do not power off immediately during this time.

9. Communication Protocol Description

MODBUS RTU protocol format description, default communication format: 9600-N-8-1, Addr: 1;
Instrument conversion method: 9600, communication interval >0.5 seconds/time

Instrument voltage range: 1°25s;

Device: 0.05, write command;

Power input register: 4000! symbol, "4" represents holding memory, but not allowing memory address.

① In general port sending data software, "000!" is the memory address, then the address in the data frame should be "0000".

10. RS-485 Communication Address Description

EC Transmitter Module - Register Function Table: (The following data type is unsigned integer, PLC register address 40XX)

pH/ORP Transmitter Module - Register Function Table: (The following data type is signed integer, PLC register address 40XX)



Address	Function	Status	Description	Remarks
00	Local address number	Read/Write	Setting range 1 ~ 255	Default value: 01
01	Baud rate	Read only	Fixed 9600	Fixed value: 9600
02	Resistivity value	Read only	Default two decimal places; unit: MΩ	03
EC: Conductivity value (high 16 bits)	Read only	EC: Conductivity value =	(Conductivity high 16-bit value * 65536 + Conductivity high 16-bit value)/100	(Default 2 decimal places)
(Default 2 decimal places)	04	EC: Conductivity value (low 16 bits)	Read only	
05	Temperature value	Read only	Value divided by 10, default 1 decimal place	Range: 0-120°C
06	Electrode type	Read/Write	1: K=0.01; 2: K=0.02; 10: K=0.1; 100: K=1.0; 1000: K=10.0	
07	Electrode constant	Read/Write	Final value = Measured value * electrode constant, default divided by 1000, e.g.: write 1000, internally recognized as 1.000;	Range 0-9999
08	Conductivity error manual correction	Read/Write	Final value = Measured value + manual correction value, default divided by 100, e.g.: write 1000, internally recognized as 10.00;	Range:-9999 ~ 9999
09	Temperature manual correction	Read/Write	write 10, internally recognized as 1;	
35	Communication status	Read only	Increments once per communication	Counting range: 0-65535



pH/ORP Transmitter Module - Register Function Table: (The following data type is signed integer, PLC register address 40XX)

Address	Function	Status	Description	Remarks
00	Local address number	Read/Write	Setting range 1 ~ 255 (Addresses 1-5 are for the company's dedicated communication software)	Default value: 02
01	Baud rate	Write only	Fixed: 9600	Fixed: 9600
02	Empty			
03	Electrode constant setting	Read/Write	Final value = Measured value * electrode constant, default divided by 1000, e.g.: write 1000, internally recognized as 1.000;	Default value: 1000, Instrument display: 1.000
04	Current mV value	Read only	Original mV value; (Not *CON electrode constant)	
05	Current 4-20mA output value	Read only	Read value divided by 100, default 2 decimal places	Range: 0-100°C
06	Temperature value	Read only	Read value divided by 10, default 1 decimal place	
07	Current pH value	Read only	Read value/100, default two decimal places;	Range:0-14.00pH
08	Same as 04		Same as 04	
09	Factory internal debugging address			
10	Factory internal debugging address			
11	Factory internal debugging address			
12	Factory internal debugging address			
13	pH temperature mode	Read/Write	Setting range: 0 or 1, 0: Manual,1: Automatic	
14	pH manual temperature setting value	Read/Write	Setting range:1-1000;(System default divided by 10,e.g. set to 250,actual temperature is 25	
15	PH Manual Error Correction	Read/Write	Final Value = Measured Value * Manual Correction Value, default divided by 100, e.g., write 100, internally recognized as 1.00	Range: -1400~-1400
16	Empty			



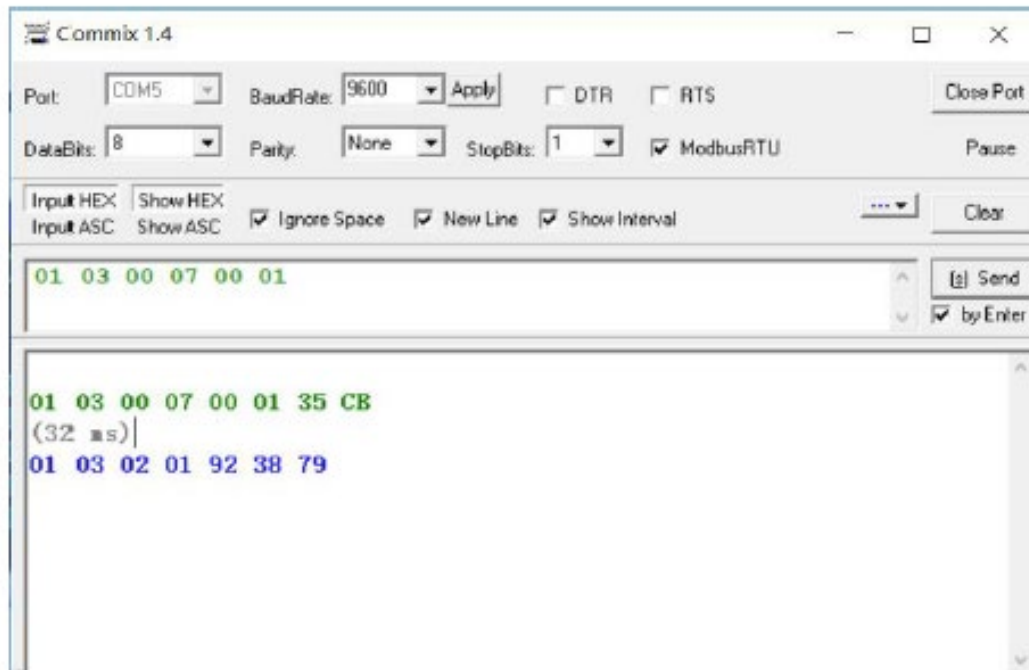
Address	Function	Status	Description	Remarks
17	PH Three-Point Calibration Mode Setting	Read/Write	0 = (4.00/6.86/9.18), 1 = (4.01/7.00/10.00)	
18	PH 4.00 Calibration (+127~+227)	Read/Write	mV value output by PH electrode in 4.00 standard solution, write current mV value to this address as PH 4.00 calibration value	
19	PH 6.86 Calibration (-42~+58)	Read/Write	mV value output by PH electrode in 6.86 standard solution, write current mV value to this address as PH 6.86 calibration value	
20	PH 9.18 Calibration (-79~+179)	Read/Write	mV value output by PH electrode in 9.18 standard solution, write current mV value to this address as PH 9.18 calibration value	
21	PH 4.01 Calibration (+127~+227)	Read/Write	mV value output by PH electrode in 4.01 standard solution, write current mV value to this address as PH 4.01 calibration value	
22	PH 7.00 Calibration (-50~+50)	Read/Write	mV value output by PH electrode in 7.00 standard solution, write current mV value to this address as PH 7.00 calibration value	
23	PH 10.00 Calibration (-127~+227)	Read/Write	mV value output by PH electrode in 10.00 standard solution, write current mV value to this address as PH 10.00 calibration value	
35	Communication Status	Read Only	Increments once per communication	Count Range: 0~65535

11. Serial Port Assistant Communication Instructions:

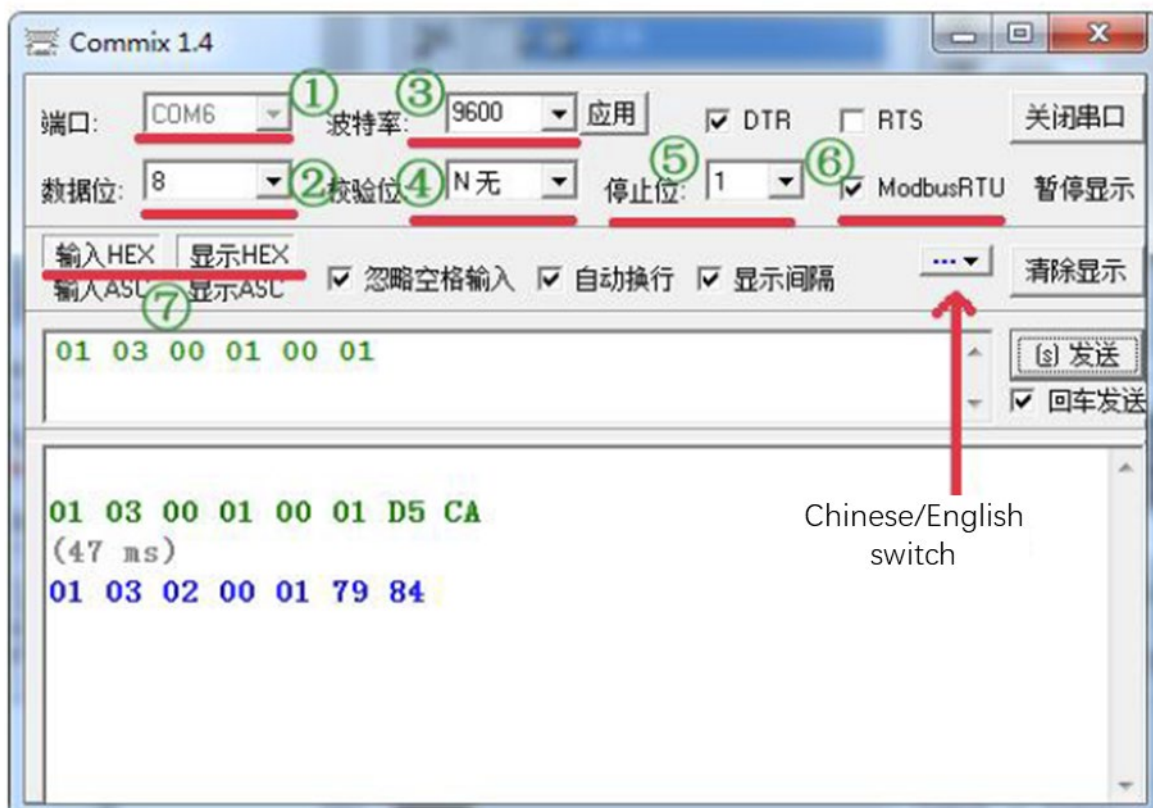
Commix 1.4 is a popular network tool specifically designed for debugging MODBUS RTU protocol serial communication. Using this software, you can easily debug the RS485 communication function of the instrument. (Users can also use other serial port debugging software, as the usage is similar.) The software parameters are set as follows: (This software can be obtained for free from our company.)

Note: When using RS485 Modbus RTU communication, our company provides relevant testing software. You can request it from our company. (MCGS touch screens are optional.)



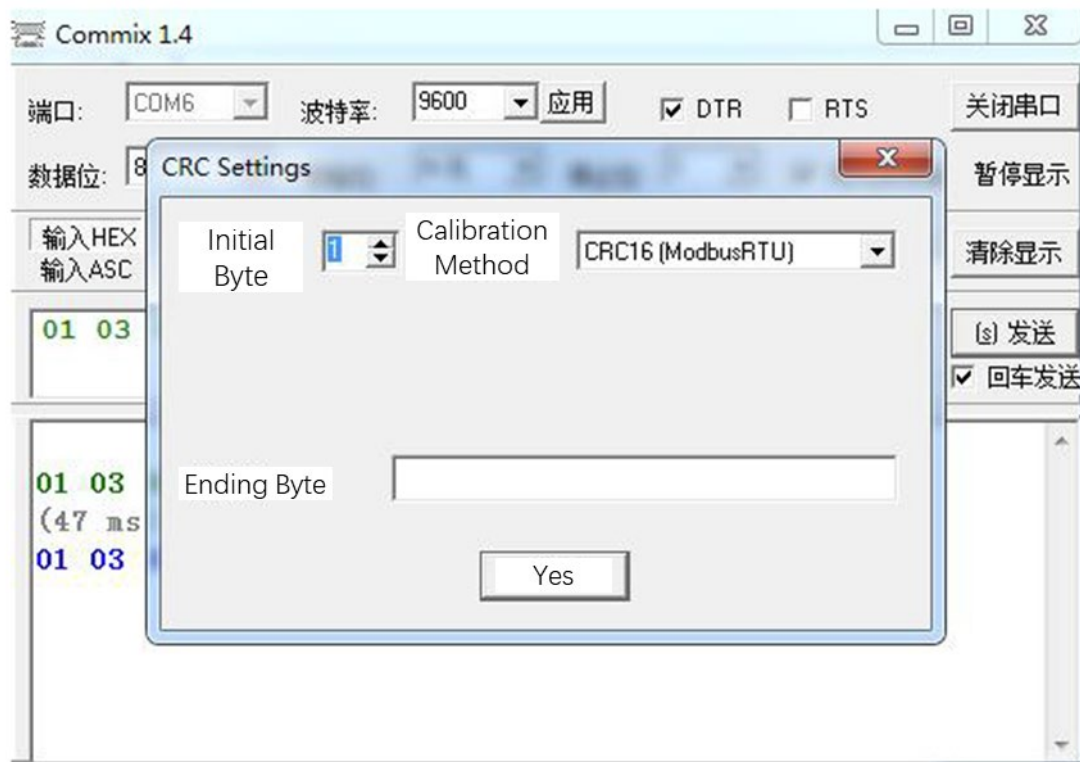


Commix Serial Port Debugging Assistant



Parameter Settings





Modbus RTU Check Settings

Commix 1.4 MODBUS RTU Communication Parameter Configuration:

Serial Port Number Setting: Determined by the computer or device. Note: Each USB to 485 data cable simulates a different port number.

Data Bit Length: 8 bits.

Communication Baud Rate (Communication Speed): Default 9600 bps, consistent with the baud rate setting in the instrument menu.

Check Method: None (N).

Stop Bit: 1 bit.

Check Method: CRC16.

The above parameters are the most commonly used configuration for MODBUS RTU communication (industry term: 96, N, 8, 1). The time interval between reading or querying data should not be less than 500 milliseconds.

Input Data Format: HEX (Hexadecimal).

Note: When using the serial port debugging assistant, the address in the register table above needs to be reduced by one. For example, 02: Local Communication Address, in the serial port debugging assistant, it should be 01.



Example 1: Reading Local Communication Address (Register Table Address Minus One)

Serial Port Assistant Sends: 01 03 00 01 00 01 D5 CA (The last two bytes do not need to be filled in, Commix 1.4 will automatically calculate the CRC16 check code and add it to the end of the sent data string.)

Send Data Format Description:

01: Local Communication Address.

03: Read Command.

00 01: Start reading data from register 01.

00 01: Number of registers to read (Note: Register 0-65536 is double-byte, represented in hexadecimal as FF FF).

D5 CA: CRC16 check code, automatically calculated by the serial port software.

Received Transmitter Data: 01 03 02 00 01 79 84

Receive Data Format Description:

01: Local Communication Address.

03: Read Command.

02: Number of bytes returned (one register data = 2 bytes).

00 01: Returned data 01 (hexadecimal number).

79 84: CRC16 check code, automatically calculated by the transmitter.

Example 2: Reading Local Communication Device (Register Address Minus One)

Serial Port Assistant Sends: 01 03 00 02 00 01 25 CA (The last two bytes do not need to be filled in, Commix 1.4 will automatically calculate the CRC16 check code and add it to the end of the sent data string.)

Send Data Format Description:

01: Local Communication Address.

03: Read Command.

00 02: Start reading data from register 02.

00 01: Number of registers to read (Note: Register 0-65536 is double-byte, represented in hexadecimal as FF FF).

25 CA: CRC16 check code, automatically calculated by the serial port software.

Received Transmitter Data: 01 03 02 25 80 A3 74

Receive Data Format Description:

01: Local Communication Address.

03: Read Command.

02: Number of bytes returned (one register data = 2 bytes).

25 80: Returned data 9600 (hexadecimal number); (Hexadecimal 2580 = Decimal 9600).

A3 74: CRC16 check code, automatically calculated by the transmitter.



Example 3: Temperature Value (Register Address Minus One)

Serial Port Assistant Sends: 01 03 00 05 00 01 94 0B (The last two bytes do not need to be filled in, Commix 1.4 will automatically calculate the CRC16 check code and add it to the end of the sent data string.)

Received Transmitter Data: 01 03 02 00 FA 38 07

Returned Data: 00 FA (hexadecimal number); (Hexadecimal 00FA = Decimal 250), divided by 10 to retain one decimal place; 25.0°C.

Example 4: Reading Conductivity Value 1 (Register Address Minus One)

Serial Port Assistant Sends: 01 03 00 03 00 02 34 0B (The last two bytes do not need to be filled in, Commix 1.4 will automatically calculate the CRC16 check code.)

Send Data Format Description:

01: Local Communication Address.

03: Read Command.

00 02: Start reading data from register 03, continuously read 2 registers 03, 04; (0028 is hexadecimal, decimal is 40).

00 02: Number of registers to read, starting from register 03 = 04.

34 0B: CRC16 check code, automatically calculated by the serial port software.

Received Transmitter Data: 01 03 04 00 63 00 50 04 11

Receive Data Format Description: (Conductivity Calculation: High Byte * 65536 + Low Byte, default divided by 100, retain 2 decimal places.)

01: Local Communication Address.

03: Read Command.

04: Number of bytes returned (4) (one register data = 2 bytes).

00 03: Integer part of conductivity value 00 00 converted to decimal = 99.

00 50: Decimal part of conductivity value 00 50 converted to decimal = 80, default retain 2 decimal places (divided by 100), Conductivity = 99 + 0.8 = 99.8 us/cm.

04 11: CRC16 check code, automatically calculated by the transmitter.

Example 5: Reading PH Value (Register Address Minus One)

Serial Port Assistant Sends: 01 03 00 07 00 01 35 CB (The last two bytes do not need to be filled in, Commix 1.4 will automatically calculate the CRC16 check code.)

Send Data Format Description:

01: Local Communication Address.

03: Read Command.

00 27: Start reading data from register 28; (0028 is hexadecimal, decimal is 40).

00 01: Number of registers to read, starting from register 40 = 41.

44 03: CRC16 check code, automatically calculated by the serial port software.



Received Transmitter Data: 01 03 02 01 92 38 79

Receive Data Format Description: (Conductivity Calculation: High Byte * 65536 + Low Byte, default divided by 100, retain 2 decimal places.)

01: Local Communication Address.

03: Read Command.

04: Number of bytes returned (4) (one register data = 2 bytes).

01 92: PH value, default divided by 100, retain 2 decimal places, 01 92 converted to decimal = 402, default retain 2 decimal places (divided by 100), = 4.02 pH.

38 79: CRC16 check code, automatically calculated by the transmitter.



For other question, feel free to contact us.

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