

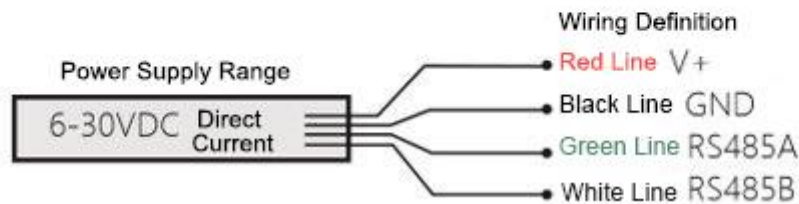
4 Electrode Electrical Conductivity (EC) Sensor

User Manual



Matters Need Attention

Before use, please carefully read the relevant operating procedures and precautions for this product.



Communication mode (default)

Protocol: Modbus-RTU

Address: 01

Format: 9600,N,8,1

Electrical Connections

- Please check the wiring definitions, power supply and communication interfaces before powering up the unit
- Do not power up the unit until all wiring has been completed. Avoid accidents and damage to the sensors.
- Waterproofing of the electrical connections is prohibited.
- No extension of the wiring.

Quality Assurance

The sensor consists of an electrode head (graphite or Hastelloy) and a digital plate.

- Electrode head: 12 months warranty
- Digital plate: 12 months warranty

Digital Sensor Communication Protocol

Communication Mode

- Communication Interface: RS485
- Device Address: 0x01 (default)
- Port Setting: 9600, N, 8, 1 (default)
- Protocol Specification: Modbus RTU

Command Support

- 0x03: Read Register
- 0x06: Write Register
- 0x10: Sequential Write Register

Information Frame Format

0x03 Read Data [HEX]				
01	03	xx xx	xxxx	xxxx
Address	Function code	Starting data address	Data length	Checksum

Parameter Setting Register

0x06 Read Data [HEX]				
01	06	xx xx	xxxx	xxxx
Address	Function code	Data address	Write data	Checksum

0x10 Write Data Continuously [HEX]						
01	10	xx xx	xxxx	xxxx	xxxx	xxxx
Address	Function code	Data address	Number of registers	Bytecount	Write data	Checksum

Note: The checksum is a 16-bit CRC with the low byte first.

Register Data Format

Address	Data Name	Conversion Factor	Range/Description	Status
0x00	Temperature	0.1°C	Range: 0-600	R
0x01	Conductivity (mS/cm)	0.01mS	Range: 0-10000	R
0x02	Conductivity (µs/cm)	1µs	Range: 0-60000	R
0x03	TDS	1ppm	Range: 0-60000	R
0x04	Salinity	0.01ppt	Range: 0-50000	R
0x05	Resistance (KΩ/cm)	-	Floating point: ABCD	R
0x07	User Command	-	See command list for details	R/W
0x09	Error Code 1	-	See notes	R

Note: Each address data is a 16-bit signed integer, 2 bytes in length

Actual result = register data * conversion factor

Technical Parameter

Measurement Parameters	Water temperature/salinity/conductivity/TDS
Electrode Material	Graphite
Measurement Range	Conductivity: 100~60000 μ S/cm Conductivity: 0.1~500mS/cm TDS: 0~60000ppm Salinity: 0~500ppt
Resolution	1 μ S/cm, 0.01ms/cm, 1ppm, 0.01ppt
Temperature Range	20~60°C/0.1°C
Electrode Constant	0.24 \pm 0.02
Measurement Accuracy	Conductivity: 1.5%F.S Temperature: \pm 0.5°C
Data Compensation	Default 25.0°C compensation temperature, 2%/°C (adjustable)
Communication Protocol	Standard MODBUS-RTU protocol
Communication Interface	RS485 interface
Communication Mode	Baud rate 966, 8, 1, N ID: 1-255, Default ID: 1 (0x01)
Setting Method	RS485 remote setting
Power Supply	6~30V DC (12 VDC recommended)
Power Consumption	30mA @12 VDC

	Wire length	Temperature compensation	Mounting method	Electrode material
Standard	5M	10K	B thread/sunk type Front and rear G3/4 threads	GR
Optional	Length can be customized	22K	D thread/flow-through Front G3/4 Threads	HA

Accessories: Special electrode protection cover- mandatory for flat conductivity electrodes, optional for bull's-eye type.

Set Parameter Register

Address	Name	Range/Description	Status
0x0B	RS485.ID	1-255	R/W
0x0C	Baud Rate	4800, 9600(default), 14400, 19200	R/W
0x0D	Communication Format	0=N81, 1=N82, 2=E81, 3=081	R/W
0x0E	Temperature Drift	±50~+50 [0.1°C]	R/W
0x0F	Temperature Manual	0-600 [0.1°C]	R/W
0x10	Compensation	0=Manual, 1=NTC22K, 2=NTC10K (default)	R/W
0x11	Temperature Type	0=°C (default), 1=°F	R/W
0x12	Temperature Unit	2200±500 [0.0001]	R/W
0x13	Sensor Coefficient	1-13000 [0.0001]	R/W
0x14	Conductivity Custom.mS	1-60000 [1us]	R/W
0x15	Conductivity Custom. µS	100-50000 [0.01ppt]	R/W
0x16	Salinity Custom	150-250 [0.01%/°C]	R/W
0x17	Temperature Consation Coefficient	0-600 [0.1°C]	R/W
0x18	Salinity Conversion Coefficient	100-1000 [0.001]	R/W
0x19	TDS Conversion Coefficient	100-1000 [0.001]	R/W

Helpful Instructions

To calibrate custom conductivity (mS): Set register address 0x13, default value: 12.88 mS

To calibrate custom conductivity (µS): Set register address 0x14, default value: 1413 µS

To calibrate custom salinity (ppt): Set register address 0x15, default value: 25.00 ppt

Operation Command Set [HEX]

Reading Temperature, Conductivity (mS), Conductivity (μS), TDS, Salinity:

[Send (Tx)]: 01 03 00 00 00 05 85 C9

[Receive (Rx)]: 01 03 0A 00 FA C4 07 AF 03 D7 00 7F 30 2F

Register Values * Conversion Factor = Actual Values

Temperature = 00FA = $250 * 0.1^{\circ}\text{C} = 25.0^{\circ}\text{C}$

Conductivity (mS) = 00C4 = $196 * 0.01 \text{ mS/cm} = 1.96 \text{ mS/cm}$

Conductivity (μS) = 07AF = $1967 * 1 \text{ μS/cm} = 1967 \text{ μS/cm}$

TDS = 03D7 = $983 * 1 \text{ ppm} = 983 \text{ ppm}$

Salinity = 007F = $127 * 0.01 \text{ ppt} = 1.27 \text{ ppt}$

Setting RS485 Address

Register Address: 1 / 0x0B

Original Address: 0x01, change to: 0x02

[Send (Tx)]: 01 06 00 0B 00 02 79 C9

Query RS485 Address (Standalone Mode)

If the device address is unknown, use address 0x00 and send the 0x03 command.

[Send (Tx)]: 00 03 00 00 00 03 04 1A

[Receive (Rx)]: 01 03 06 00 FA 02 BC 00 06 B9 3F

Setting RS485 Baud Rate (Effective After Power Reset)

Register Address: 12 / 0x0C

Baud Rate Options: 4800, 9600 (default), 14400, 19200

Set to 4800: [Send (Tx)]: 01 06 00 0C 12 C0 45 39

Set to 9600: [Send (Tx)]: 01 06 00 0C 25 80 52 F9

Setting RS485 Communication Format (Effective After Power Reset)

Register Address: 13 / 0x0D

Communication Format Options:

00 = N81 (8 Data Bits, 1 Stop Bit, No Parity)

01 = N82 (8 Data Bits, 2 Stop Bits, No Parity)

02 = E81 (8 Data Bits, 1 Stop Bit, Even Parity)

03 = O81 (8 Data Bits, 1 Stop Bit, Odd Parity)

Set to N81: [Send (Tx)]: 01 06 00 0D 00 00 18 09

Setting Restore Factory Defaults

Restore Factory Default Settings [Send (Tx)]: 01 06 00 07 00 D2 B8 56

User Command Table

Calibration Type	Command	HEX	Notes
µs Standard	30	0x1E	Use 84 µS standard solution
µS Standard	31	0x1F	Use 1413 µS standard solution
mS Standard	32	0x20	Use 12.88 mS standard solution
Salinity Standard (ppt)	33	0x21	Use 25 ppt standard solution
Custom µS Standard	34	0x22	Use custom µS standard solution
Custom mS Standard	35	0x23	Use custom mS standard solution
Custom Salinity (ppt)	36	0x24	Use custom ppt salinity solution

Error Code	Description
0x01	Invalid command or current command not available.
0x02	This address content cannot be written, or sensor status prevents execution of the command.
0x03	Invalid input data, exceeds allowable range.

Notes: Response code: Function code + 0x80

System Error Code

Register Address	ERR-04	ERR-03	ERR-02	ERR-01
0x09	None	None	EC-ERR	Temp-ERR

System Fault Code Explanation

Fault Code [HEX]

0x00	0x01	0x02	0x03	0x04
None	Below Measurement Range	Above Measurement Range	Calibration Failed	No Temperature Sensor

Conductivity Calibration Instructions

Electrode Calibration

[Receive Rx] returns the same command as [Send Tx], indicating successful calibration.

Calibrating with a custom standard solution of 1413 μ S/cm:

Step 1: Write the standard solution value of 1413 to register 0x14.

[Send Tx]: 01 06 00 14 05 85 0B 3D

Step 2: Write user command 34/0x22 to register 0x07.

[Send Tx]: 01 06 00 07 00 22 B8 12

Calibrating with a custom standard solution of 84 μ S/cm:

Step 1: Write the standard solution value of 84 to register 0x14.

[Send Tx]: 01 06 00 14 00 54 C8 31

Step 2: Write user command 34/0x22 to register 0x07.

[Send Tx]: 01 06 00 07 00 22 B8 12

Calibrate with a custom standard solution to 12.88mS/cm:

Step 1: Write the standard solution value 1288 to register 0x13.

[Send Tx]: 01 06 00 13 05 08 7A 99

Step 2: Write the user command 35/0x23 to register 0x07.

[Send Tx]: 01 06 00 07 00 23 79 D2

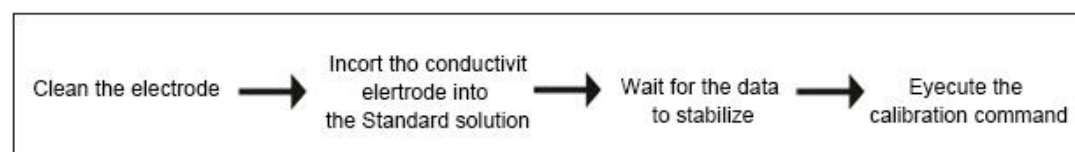
Conductivity only supports single-point calibration. Please select the appropriate standard solution for the conductivity range of the medium.

Maintenance Interval:

Please clean the electrode and calibrate the standard solution regularly, depending on the measurement environment. It is generally recommended to maintain the electrode every 1-2 months. If the environment is harsh, the maintenance interval may need to be shortened, or even replaced regularly.

For example: calibrating to a salinity of 0.25ppt.

	Address	Function Code	Data Address	Write Address	Check Code
Remote send	01	06	00 07	00 21	F8 13
Successful return	01	06	00 07	00 21	F8 13



Frequently Asked Questions

Electrode Storage:

If the electrode is not used for an extended period, keep it dry and store it away from highly polluted environments to prevent contaminants from accumulating on the electrode surface and causing measurement errors.

Electrode Usage:

Always ensure that the measuring portion of the electrode is completely submerged in the liquid being measured, especially when installed in a pipe. Improper measurement may result in abnormal data fluctuations or even no data acquisition.

Sensor Calibration Failure:

Sending a calibration command results in sensor data not updating or an error code being returned.

Main Causes:

1. Sensor contamination. Contaminants on the graphite sheet cause abnormal measurement data. Wipe the graphite sheet with a cotton swab. If the contaminants have formed scale, polish the sheet surface.
2. Standard solution contamination. Incorrect standard solution values may not be recognized by the sensor, leading to calibration errors.

Sensor Communication Failure:

- *Check the device electrical connections for leaks and corrosion.
- *Check the power supply.
- *Check the sensor power consumption (<40mA @12VDC).
- *Check the 485 address.