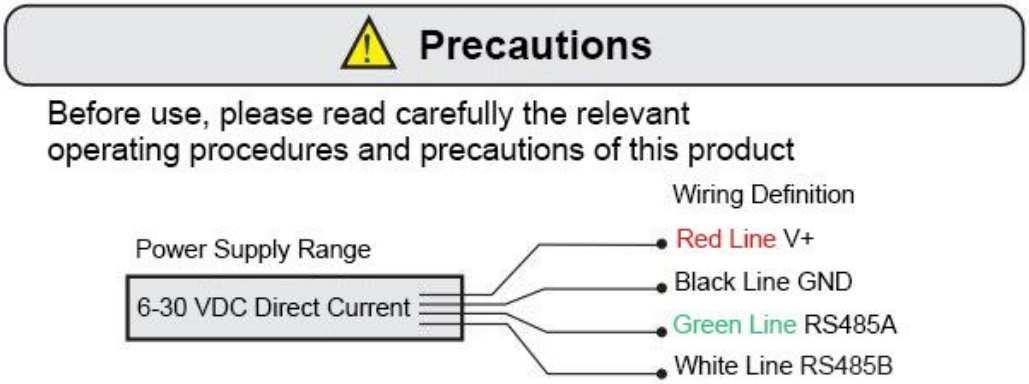
2 Electrode Electrical Conductivity (EC) Sensor

User Manual



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.
- Please ensure that electrical interfaces are waterproofed.
- Do not extend the wiring

Quality Assurance

The sensor consists of two parts: an electrode head and a digital board.

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

Digital Sensor Communication Protocol

Communication Methods

Communication Interface: RS485

Device Address: 0x01 (Default)

Port Settings: 9600,N,8,1 (Default)

Protocol Specification: Modbus RTU

Instruction Support 0x03 Read Register | 0x06 Write Register | 0x10 Continuous 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℃	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: 0-9999	R
0x04	Salinity	0.01ppt	Range: 0-4000	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

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Technical Parameter

Measurement Parameters	Water temperature/salinity/conductivity/TDS
Measurement Range	Conductivity: 0-60000μs/cm or 0.1-70ms/cm TDS: 0-60000ppm
Resolution	1us/cm, 0.01ms/cm, 1ppm
Temperature Range	0~60.0℃, resolution 0.1℃
Sensor Type	2 electrical graphite sensor
Electrode Constant	0.8±0.1
Measurement Accuracy	<2.5%F.S, 0.5℃
Data Compensation	Default 25.0℃ compensation temperature, 2%/℃ (adjustable)
Communication Method	RS485 interface*1
Communication Protocol	Compatible with standard MODBUS-RTU protocol
Communication Method	Baud rate 9600, 8, 1, N ID: 1-255, Default ID: 1 (0x01)
Calibration and Parameters 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	Sunken type Front and rear G3/4 threads	Electrodes: PPS + Graphite Shell: PC + ABS
Optional	Length can be customized	None 22K	Flow type Front G3/4 Threads	Electrode: PPS + Graphite Housing: 304 Stainless Steel

Special electrode protective cover - used to protect graphite electrodes during transportation.

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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℃]	R/W
0x0F	Temperature. Manual compensation	0-600 [0.1℃]	R/W
0x10	Temperature Type	0=Manual, 1=NTC22K, 2=NTC10K (default)	R/W
0x11	Temperature Unit	0=℃ (default), 1=℉	R/W
0x12	Sensor Coefficient	2200±500 [0.0001]	R/W
0x13	Conductivity Custom.mS	1-13000 [0.0001]	R/W
0x14	Conductivity Custom. μS	1-60000 [1us]	R/W
0x15	Salinity Custom	100-50000 [0.01ppt]	R/W
0x16	Temperature Compensation Coefficient	150-250 [0.01%/℃]	R/W
0x17	Compensation Reference Temperature	0-600 [0.1℃]	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

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Operation Command Set [HEX]

Reading Temperature, Conductivity.MS, Conductivity.US, 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°C = 25.0°C

Conductivity.MS = 00C4 = 196 * 0.01 mS/cm = 1.96 mS/cm

Conductivity.US = 07AF = 1967 * 1 μS/cm = 1967 μS/cm

TDS = 03D7 = 983 * 1 ppm = 983 ppm

Salinity = 007F = 127 * 0.01 ppt = 1.27 ppt

Setting RS485 Address

Register Address: 11 / 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

[Rceive (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 Support: 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 Support:

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

User Calibration	Command	HEX	Notes
uS Standard Solution	30	0x1E	Use 84 uS
uS Standard Solution	31	0x1F	Use 1413 uS
mS Standard Solution	32	0x20	Use 12.88 mS standard solution
Salinity.25ppt	33	0x21	Use 25 ppt standard solution
Custom Standard Solution	34	0x22	Use custom µS standard solution
Custom Standard Solution	35	0x23	Use custom mS standard solution

Error Code	Descriptipn
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.

Other notes: Return code: Function code + 0x80

System Error Code

Content format: 4*4bit, 0xFFFF

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 1413uS/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 84uS/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:

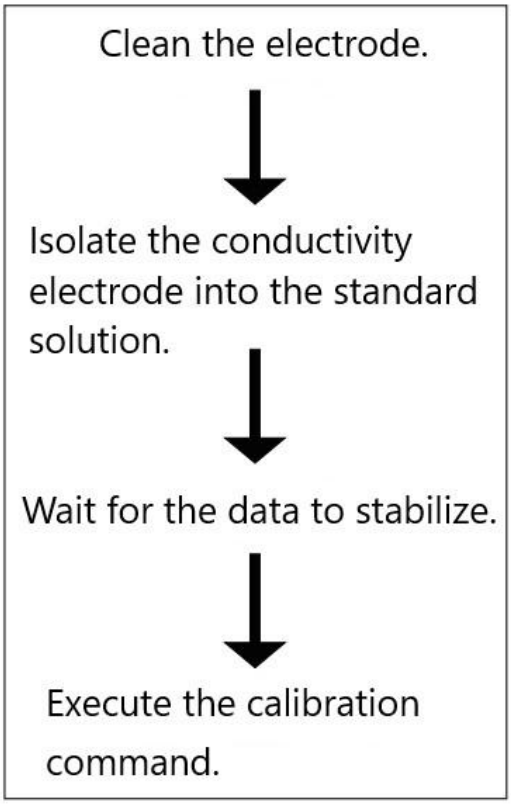
Step 1: Write the standard solution value 1288 to register 0x13.

[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	0021	F8 13
	Address	Return Code	Error Code	Check Code	
Error Returned	01	86	02	C3 A1	

User command error code returned

Example	Address	Return Code	Error Code	Check Code
Error Returned	01	86	02	C3 A1

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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:

Before use, remove the protective cover of the electrode and compare it with the standard solution to ensure that the sensor reading is correct.

Sensor Calibration Failure:

The calibration command was sent, but the sensor data was not updated or an error code was 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.