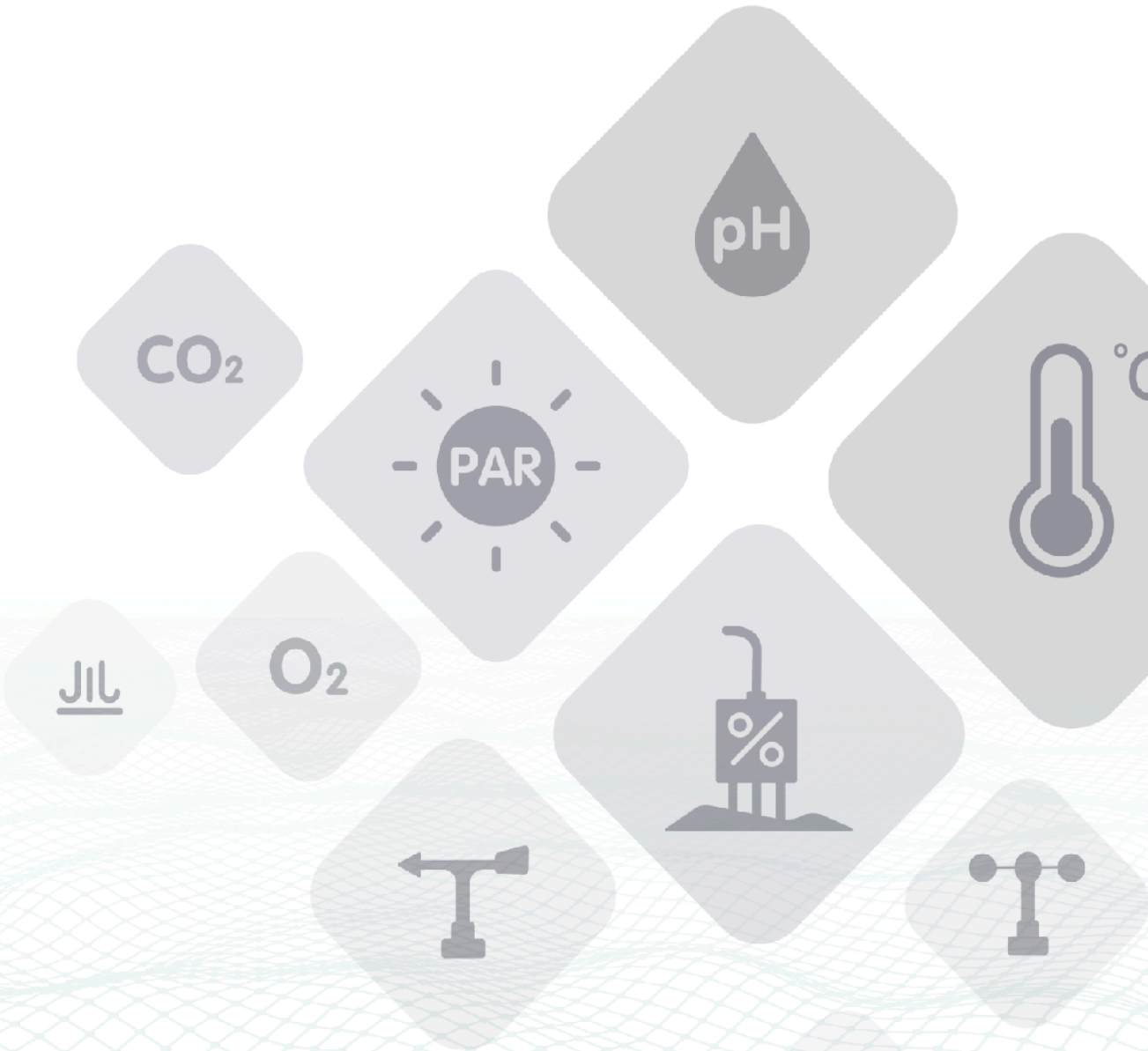
SENSECAP

RS485 pH, ORP and Temperature Sensor User Manual



Index

1 Introduction

RS485 pH, ORP and Temperature Sensor is a water quality monitoring instrument designed for continuous measurement in water and aqueous solutions. The sensor measures pH, oxidation-reduction potential (ORP), and temperature, and transmits the measurement data through the RS485 Modbus RTU interface. The RS485 physical interface is suitable for applications requiring long cable runs, reliable industrial communication, or multiple sensors connected to the same bus. Its IP68 enclosure and 3/4-inch NPT threads support submerged, pipeline, and tank installation.

RS485 pH, ORP, and Temperature Sensor is designed for industrial users, water and wastewater treatment, irrigation, smart agriculture, environmental monitoring, and system integrators, where real-time pH, ORP, and temperature information can be helpful for chemical dosing, process control, water quality assessment, and operational decision-making

Features

- Integrated pH and ORP electrodes, temperature sensing, and transmitter electronics
- Digital RS485 interface with Modbus RTU protocol
- IP68 enclosure for long-term field installation
- High measurement precision, fast response, and good interchangeability
- Compact, low-power design
- 3/4-inch NPT threads for submerged, pipeline, and tank installation
- RS485 surge protection, reverse-power protection, and built-in TVS/ESD protection

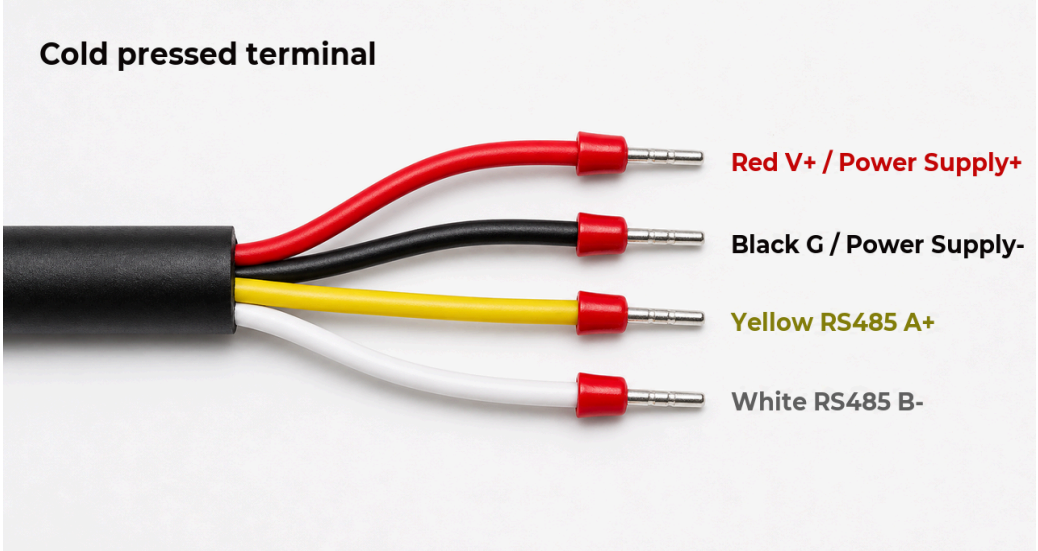
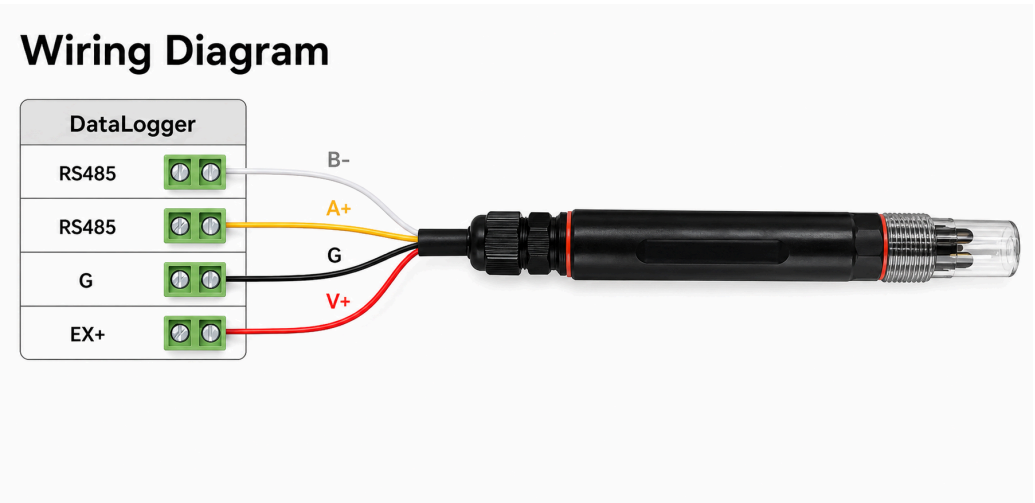
Applications

- Industrial water treatment and process monitoring
- Wastewater and sewerage systems
- Irrigation water monitoring
- Smart agriculture and greenhouse systems
- Tanks, pipelines, and environmental monitoring installations

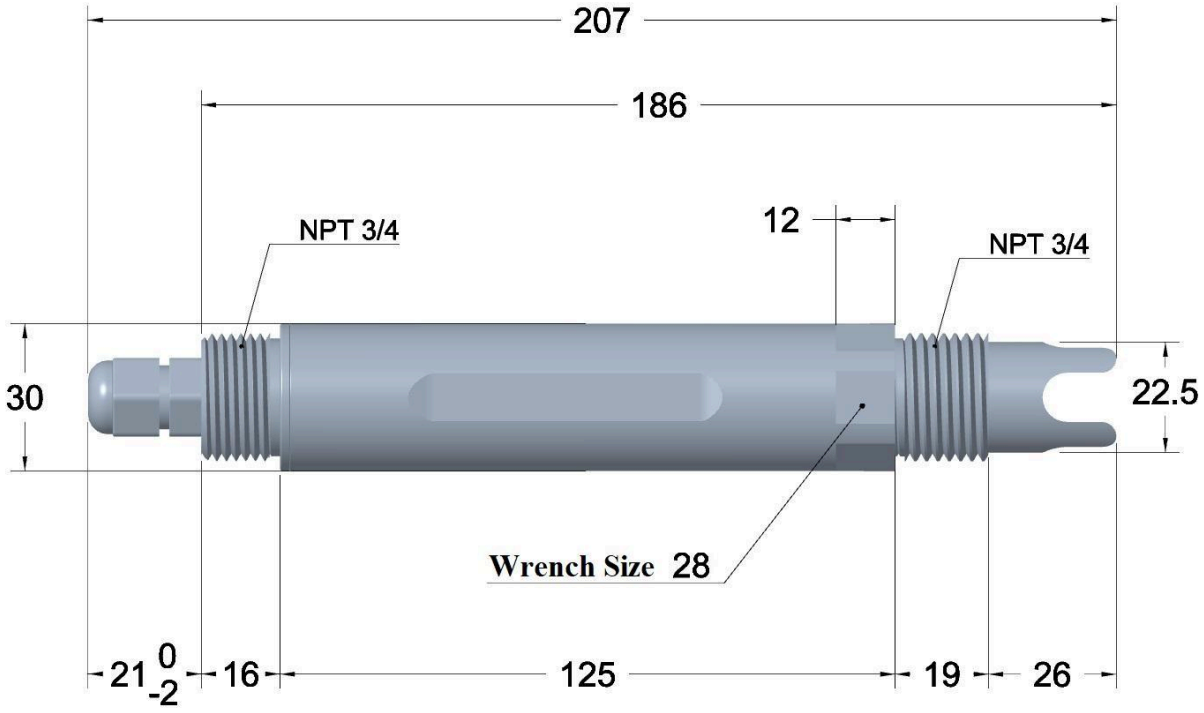
2 Specifications

pH Measurement	
Range	0.00–14.00 pH
Resolution	0.01 pH
Accuracy	±0.1 pH
Response time	<10 s
ORP Measurement	
Range	−2000.0 to 2000.0 mV
Resolution	0.1 mV
Accuracy	±20 mV
Response time	<30 s
Temperature Measurement	
Range	−40 to 80 °C
Resolution	0.1 °C
Accuracy	±0.5 °C
General Parameters	
Product model	S-pH&ORP-01A
Output interface	RS485
Protocol	Modbus RTU
Default serial communication	Slave address: 1; baud rate: 9600 bps; data bits: 8; stop bits: 1 stop bit;
Power supply	4.5–28 V DC
Power consumption	Quiescent <8 mA at 12 V DC; measuring <10 mA at 12 V DC;
IP rating	IP68
Operating conditions	0–80 °C; 0–100% RH; pressure ≤0.2 MPa
Storage conditions	−5 to 65 °C; 0–90% RH
Cable length	2 m;
Dimensions	207 × 30 mm (length × diameter)
Mechanical connection	3/4-inch NPT threads

3 Wiring

Type	Wiring diagram
RS485 interface	
Connections	

4 Dimensions



Mechanical dimensions. Unit: mm; general tolerance: ±0.5 mm.

5 RS485 Communication

5.1 Modbus Protocol

The sensor operates as a Modbus RTU slave on an RS485 bus. A request frame contains the slave address, function code, data, and CRC-16 checksum. The default serial settings are shown below.

Parameter	Default
Slave address	1
Protocol	Modbus RTU
Baud rate	9600 bps
Data format	8 data bits, no parity, 1 stop bit (8N1)

Function code	Purpose
0x03	Read holding registers
0x04	Read input registers
0x06	Write a single holding register
0x10	Write multiple holding registers

5.2 Modbus Register

Measurement registers

Register	Address HEX / DEC	Type	Function (hex)	Range/behavior	Default
TEMPERATURE_CALIBED	0x0000 / 0	INT16 / RO	03/04	−4000~8000 → −40.00~80.00 °C; −4000~17600 → −40.00~176.00 °F	N/A
PH (Temperature Compensation)	0x0001 / 1	INT16 / RO	03/04	0~1400 → 0.00~14.00 pH; compensated to 25 °C when enabled	N/A
ORP (Temperature Compensation)	0x0002 / 2	INT16 / RO	03/04	−20000~20000 → −2000.0~2000.0 mV;	N/A
PH_VOLT (Temperature Compensation)	0x0003 / 3	INT16 / RO	03/04	−20000~20000 → −2000.0~2000.0 mV;	N/A

Register	Address HEX / DEC	Type	Function (hex)	Range/behavior	Default
PH_TX (No Temperature Compensation)	0x0004 / 4	INT16 / RO	03/04	0~1400 → 0.00~14.00 pH;	N/A
PH_VOLT_TX (No Temperature Compensation)	0x0005 / 5	INT16 / RO	03/04	−20000~20000 → −2000.0~2000.0 mV;	N/A
ORP_VOLT (Temperature Compensation)	0x0006 / 6	INT16 / RO	03/04	−20000~20000 → −2000.0~2000.0 mV;	N/A
ORP_TX (No Temperature Compensation)	0x0007 / 7	INT16 / RO	03/04	−20000~20000 → −2000.0~2000.0 mV;	N/A
ORP_VOLT_TX (No Temperature Compensation)	0x0008 / 8	INT16 / RO	03/04	−20000~20000 → −2000.0~2000.0 mV;	N/A
TEMPERATURE Original	0x0009 / 9	INT16 / RO	03/04	−4000~8000 → −40.00~80.00 °C; −4000~17600 → −40.00~176.00 °F;	N/A
RESERVED	0x000A–0x000F / 10–15	INT16 / RO	03/04	Reserved	0

Configuration and calibration registers

Register	Address HEX / DEC	Type	Function (hex)	Range/behavior	Default
TEMPUNIT	0x0020 / 32	UINT16 / R/W	03/06/10	0: °C; 1: °F	0
TOFFSET	0x0021 / 33	INT16 / R/W	03/06/10	−1000~1000 → −10.00~10.00	0
TEMPCOMPENSATEEN	0x0022 / 34	UINT16 / R/W	03/06/10	0: enable pH compensation to 25 °C; 1: disable	0
FLOATBYTEORDER	0x0023 / 35	UINT16 / R/W	03/06/10	0: Big-endian [ABCD] 1: Little-endian[DCBA] 2: Big-endian byte swap [BADC] 3: Little-endian byte swap[CDAB]	3
FILTERSTRENGTH	0x0024 / 36	UINT16 / R/W	03/06/10	0~15; 0 disables filtering; higher values increase stability	2

Register	Address HEX / DEC	Type	Function (hex)	Range/behavior	Default
PHUSERCALIB0	0x0030 / 48	INT16 / R/W	03/06/10	Write 0x7FFF: calibrate pH 4.00 point	N/A
PHUSERCALIB1	0x0031 / 49	INT16 / R/W	03/06/10	Write 0x7FFF: calibrate pH 7.00 or 6.86 point	N/A
PHUSERCALIB2	0x0032 / 50	INT16 / R/W	03/06/10	Write 0x7FFF: calibrate pH 10.01 or 9.18 point	N/A
PHCALIBGROUP	0x0033 / 51	UINT16 / R/W	03/06/10	0: 4.00/7.00/10.01; 1: 4.00/6.86/9.18	0
ORPTCOMPCOEF	0x0040 / 64	INT16 / R/W	03/06/10	Raw 0~100; scaling is firmware-dependent—see note	20
ORPSTANDARDMV	0x0041 / 65	INT16 / R/W	03/06/10	−2000~2000 mV; Write the nominal standard value to calibrate	256
ORPMEASUREDMV	0x0042 / 66	INT16 / RO	03/04	Measured electrode mV recorded during the last ORP calibration	256
RESETCALIB	0x0050 / 80	UINT16 / R/W	03/06/10	Write 0: reset pH; 1: reset ORP; 0xFFFF: reset both	N/A
SYSTEMRESET	0x0051 / 81	UINT16 / R/W	03/06/10	Write 0xFFFF to restart the sensor	N/A

Communication and identification registers

Register	Address HEX / DEC	Type	Function (hex)	Range/behavior	Default
ADDRESS	0x0200 / 512	UINT16 / R/W	03/06/10	Use 1~247; 0 is broadcast; 248~255 reserved	1
BAUDRATE	0x0201 / 513	UINT16 / R/W	03/06/10	0-5 0:1200; 1:2400; 2:4800; 3:9600; 4:19200; 5:38400 bps	3
PROTOCOL	0x0202 / 514	UINT16 / R/W	03/06/10	0: Modbus RTU	0
PARITY	0x0203 / 515	UINT16 / R/W	03/06/10	0-2 0:none; 1:even; 2:odd	0

Register	Address HEX / DEC	Type	Function (hex)	Range/behavior	Default
DATABITS	0x0204 / 516	UINT16 / R/W	03/06/10	1: 8 data bits	1
STOPBITS	0x0205 / 517	UINT16 / R/W	03/06/10	0-1 0: 1 stop bit; 1: 2 stop bits	0
RESERVED	0x0206–0x0207 / 518–519	Reserved	—	Reserved—do not write	0
USERSN	0x0220–0x0223 / 544–547	4 × UINT16 / R/W	03/10	64-bit user serial number; read/write all four registers together	N/A

Floating-point measurement registers

Register FLOAT / RO	Start address HEX / DEC	Description 0x03/0x04, qty 2	Range/unit
TEMPERATURE_CALIBED_FLOAT	0x1000 / 4096	Calibrated temperature	Temperature unit setting
PH_FLOAT	0x1002 / 4098	pH, temperature compensated	0~1400 → 0.00~14.00 pH;
ORP_FLOAT	0x1004 / 4100	ORP, temperature compensated	−20000~20000 → −2000.0~2000.0 mV;
PH_VOLT_FLOAT	0x1006 / 4102	pH electrode mV, compensated	−20000~20000 → −2000.0~2000.0 mV;
PH_TX_FLOAT	0x1008 / 4104	pH, uncompensated	0.00–14.00
PH_VOLT_TX_FLOAT	0x100A / 4106	pH electrode mV, uncompensated	−20000~20000 → −2000.0~2000.0 mV;
ORP_VOLT_FLOAT	0x100C / 4108	ORP electrode mV, compensated	−20000~20000 → −2000.0~2000.0 mV;
ORP_TX_FLOAT	0x100E / 4110	ORP, uncompensated	−20000~20000 → −2000.0~2000.0 mV;
ORP_VOLT_TX_FLOAT	0x1010 / 4112	ORP electrode mV, uncompensated	−20000~20000 → −2000.0~2000.0 mV;
TEMPERATURE_FLOAT	0x1012 / 4114	Original temperature	Temperature unit setting
RESERVED_FLOAT	0x1014, 1016, ..., 101E / 4116...4126	Six reserved FLOAT slots; occupy 0x1014–0x101F	0

UINT16: 16-bit unsigned integer
INT16: 16-bit signed integer
RO: Register is Read Only
R/W: Register is Read/Write

HEX: Hexadecimal (data with 0x/0X prefix)
DEC: Decimal
FLOAT: Floating point register, the byte order is configured by "Floating Point Register Byte Order, FLOATBYTEORDER" register. Please refer to "Modbus Register Detail Description" for more details.

5.3 Modbus Register Detail Description

TEMPERATURE_CALIBED: Temperature Calibrated, INT16		
Range	-4000-8000 mapping to -40.00-80.00 (Temperature Unit set to ℃); -4000-17600 mapping to -40.00-176.00 (Temperature Unit set to ℉)	Default: N/A
Parameter Save	N/A	

Note: Temperature measurement value calibrated by TOFFSET register.

TEMPERATURE_CALIBED_FLOAT: Temperature Calibrated, FLOAT		
Range	-40.00-80.00 (Temperature Unit set to ℃); -40.00-176.00 (Temperature Unit set to ℉)	Default: N/A
Parameter Save	N/A	

Note: Temperature measurement value calibrated by TOFFSET register. The byte order is configured by the "Floating Point Register Byte Order, FLOATBYTEORDER" register.

TEMPERATURE: Temperature Original Value, INT16		
Range	-4000-8000 mapping to -40.00-80.00 (Temperature Unit set to ℃); -4000-17600 mapping to -40.00-176.00 (Temperature Unit set to ℉)	Default: N/A
Parameter Save	N/A	

Note: Temperature original value.

TEMPERATURE_FLOAT: Temperature Original Value, FLOAT		
Range	-40.00-80.00 (Temperature Unit set to ℃); -40.00-176.00 (Temperature Unit set to ℉)	Default: N/A
Parameter Save	N/A	

Note: Temperature original value. The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

PH: PH (Temperature Compensation), INT16		
Range	0-1400 mapping to 0.00-14.00	Default: N/A
Parameter Save	N/A	

Note: PH (Temperature Compensation to 25℃).

PH_FLOAT: PH (Temperature Compensation), FLOAT		
Range	0.00-14.00	Default: N/A
Parameter Save	N/A	

Note: PH (Temperature Compensation to 25℃). The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

PH_VOLT: The millivolt value corresponding to the pH value (Temperature Compensation), INT16		
Range	-20000~20000 mapping to- 2000.0~2000.0 mV	Default: N/A
Parameter Save	N/A	

Note: The millivolt value corresponding to the pH value (Temperature Compensation to 25℃).

PH_ VOLT_FLOAT: The millivolt value corresponding to the pH value (Temperature Compensation), FLOAT		
Range	-2000.0~2000.0mV	Default: N/A
Parameter Save	N/A	

Note: The millivolt value corresponding to the pH value (Temperature Compensation to 25℃). The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

PH_TX: PH (No Temperature Compensation), INT16		
Range	0-1400 mapping to 0.00-14.00	Default: N/A
Parameter Save	N/A	

Note: PH (No Temperature Compensation).

PH_TX_FLOAT: PH (No Temperature Compensation), FLOAT		
Range	0.00-14.00	Default: N/A
Parameter Save	N/A	

Note: PH (No Temperature Compensation). The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

PH_VOLT_TX: The millivolt value corresponding to PH value (No Temperature Compensation), INT16		
Range	-20000~20000 mapping to- 2000.0~2000.0 mV	Default: N/A
Parameter Save	N/A	

Note: The millivolt value corresponding to the pH value (No Temperature Compensation).

PH_ VOLT_TX_FLOAT: The millivolt value corresponding to the pH value (No Temperature Compensation), FLOAT		
Range	-2000.0~2000.0mV	Default: N/A
Parameter Save	N/A	

Note: The millivolt value corresponding to the pH value (No Temperature Compensation). The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

ORP: ORP (Temperature Compensation), INT16		
Range	-20000~20000 mapping to- 2000.0~2000.0 mV	Default: N/A
Parameter Save	N/A	

Note: ORP (Temperature Compensation to 25℃).

ORP_FLOAT: ORP (Temperature Compensation), FLOAT		
Range	-2000.0~2000.0mV	Default: N/A
Parameter Save	N/A	

Note: ORP (Temperature Compensation to 25℃). The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

ORP_VOLT: The millivolt value corresponding to ORP value (Temperature Compensation), INT16

Range	-20000~20000 mapping to- 2000.0~2000.0 mV	Default: N/A
Parameter Save	N/A	

Note: The millivolt value corresponding to ORP value (Temperature Compensation to 25℃).

ORP_ VOLT_FLOAT: The millivolt value corresponding to ORP value (Temperature Compensation), FLOAT		
Range	-2000.0~2000.0mV	Default: N/A
Parameter Save	N/A	

Note: The millivolt value corresponding to the ORP value (Temperature Compensation to 25℃). The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

ORP_TX: ORP (No Temperature Compensation), INT16		
Range	-20000~20000 mapping to- 2000.0~2000.0 mV	Default: N/A
Parameter Save	N/A	

Note: ORP (No Temperature Compensation).

ORP_TX_FLOAT: ORP (No Temperature Compensation), FLOAT		
Range	-2000.0~2000.0mV	Default: N/A
Parameter Save	N/A	

Note: ORP (No Temperature Compensation). The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

ORP_VOLT_TX: The millivolt value corresponding to ORP value (No Temperature Compensation), INT16		
Range	-20000~20000 mapping to- 2000.0~2000.0 mV	Default: N/A
Parameter Save	N/A	

Note: The millivolt value corresponding to ORP value (No Temperature Compensation).

ORP_ VOLT_TX_FLOAT: The millivolt value corresponding to ORP value (No Temperature Compensation), FLOAT		
Range	-2000.0~2000.0mV	Default: N/A
Parameter Save	N/A	

Note: The millivolt value corresponding to the ORP value (No Temperature Compensation). The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

TEMPUNIT: Temperature Unit, UINT16		
Range	0: ℃ 1: ℉	Default: 0
Parameter Save	YES	

Note: Temperature Unit.

TOFFSET: Temperature Offset, INT16		
Range	-1000～1000 mapping to -10.00～10.00℃	Default: 0
Parameter Save	YES	

Note: Temperature Offset.
TEMPRATURE_CALIBED = TEMPRATURE + TOFFSET;
TEMPRATURE_CALIBED_FLOAT = TEMPRATURE_FLOAT + TOFFSET / 100.00;

TEMPCOMPENSATEEN: PH Temperature Compensation Enable/Disable, UINT16		
Range	0: Enable PH temperature compensation (to 25℃); 1: Disable PH temperature compensation;	Default: 0
Parameter Save	YES	

Note: PH Temperature Compensation Enable/Disable. After disabling temperature compensation, the following PH-related register values will not be temperature-compensated:
Register PH, PH_FLOAT, PH_VOLT, PH_VOLT_FLOAT

FLOATBYTEORDER: Floating Point Register Byte Order, UINT16		
Range	0: Big-endian [ABCD] 1: Little-endian[DCBA] 2: Big-endian byte swap [BADC] 3: Little-endian byte swap[CDAB]	Default: 3
Parameter Save	YES	

Note: Configure floating point register byte order.
Example: The 123456.00 in IEC754 is 0x47F12000 (A=47, B=F1, C=20, D=00), then
0: Big-endian [ABCD]

1: Little-endian[DCBA]
2: Big-endian byte swap [BADC]
3: Little-endian byte swap[CDAB]

FILTERSTRENGTH: PH&ORP Value Filter Strength, UINT16		
Range	PH&ORP Value Filter Strength. The larger the value, the more stable the data. 0-15, 0 is disabled.	Default: 2
Parameter Save	YES	

Note: Configure PH&ORP Value Filter Strength.

PHCALIBGROUP: PH Calibration Group, UINT16		
Range	Set calibration group for user calibration: 0: Use PH standard solutions 4.00, 7.00, and 10.01 for user calibration; 1: Use PH standard solutions 4.00, 6.86, and 9.18 for user calibration	Default: 0
Parameter Save	YES	

Note: PH Calibration Group. After setting the calibration group, please use the PHUSERCALIB0, PHUSERCALIB1, and PHUSERCALIB2 registers to perform the PH value calibration operation.

PHUSERCALIB0:PH User Calib Point 0, INT16		
Range	Write 0x7FFF for automatic calibration. During automatic calibration: ● When the PHCALIBGROUP register is 0, calibrate using a standard solution with PH=4.00; ● When the PHCALIBGROUP register is 1, calibrate using a standard solution with PH=4.00;	Default: N/A
Parameter Save	YES	

Note: PH User Calib Point 0.

PHUSERCALIB1:PH User Calib Point 1, INT16		
Range	Write 0x7FFF for automatic calibration. During automatic calibration: ● When the PHCALIBGROUP register is 0, calibrate using a standard solution with PH=7.00;	Default: N/A

	● When the PHCALIBGROUP register is 1, calibrate using a standard solution with PH=6.86;	
Parameter Save	YES	

Note: PH User Calib Point 1.

PHUSERCALIB2:PH User Calib Point 2, INT16		
Range	Write 0x7FFF for automatic calibration. During automatic calibration: ● When the PHCALIBGROUP register is 0, calibrate using a standard solution with PH=10.01; ● When the PHCALIBGROUP register is 1, calibrate using a standard solution with PH=9.18;	Default: N/A
Parameter Save	YES	

Note: PH User Calib Point 2.

ORPTCOMPCOEF: ORP Temperature Compensation Coefficient, INT16		
Range	0~100 mapping to 0.00～10.00	Default: 20
Parameter Save	YES	

Note: ORP Temperature Compensation Coefficient.

ORPSTANDARDMV: The nominal millivolt value of the ORP standard solution, INT16		
Range	Range: -2000 to 2000 When calibrating the ORP electrode, the written data is the nominal millivolt value of the standard solution used. The read data is the nominal millivolt value of the standard solution used in the last calibration of the ORP electrode	Default: 256
Parameter Save	YES	

Note: The nominal millivolt value of the ORP standard solution.

ORPMEASUREDMV: The millivolt value output by the ORP electrode in the standard solution, INT16		
Range	The read data represents the millivolt value output by the ORP electrode in the standard solution during the last calibration	Default: 256

Parameter Save	YES	

Note: The millivolt value output by the ORP electrode in the standard solution.

RESETCALIB: Reset PH calibration to the factory Settings, UINT16		
Range	The read value is 0. Write 0: Reset the calibration data of PH calibration group 0 and PH calibration group 1 to factory Settings. Including the following registers: PHUSERCALIB0, PHUSERCALIB1, PHUSERCALIB2; Write 1: Reset the ORP calibration data to the factory Settings. Including the following registers: ORPTCOMPCOEF, ORPSTANDARDMV, ORPMEASUREDMV; Write 0xFFFF: Reset PH and ORP calibration data	Default: N/A
Parameter Save	N/A	

Note: Reset PH and ORP calibration to the factory Settings

SYSTEMRESET: Restart the sensor, UINT16		
Range	The read value is 0; Writing 0xFFFF restarts the sensor (equivalent to repowering on).	Default: N/A
Parameter Save	N/A	

Note: Restart the sensor

SLAVEADDRESS: Modbus Slave Address, UINT16		
Data Range	0-255	Default: 1
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

BAUDRATE: Serial Comm Baudrate, UINT16		
Data Range	0-5 0:1200bps 1:2400bps	Default: 3

	2:4800bps 3:9600bps 4:19200bps 5:38400bps	
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

PROTOCOL: Serial Comm Protocol, UINT16		
Data Range	0:Modbus RTU	Default: 0
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

PARITY: Serial Comm Parity, UINT16		
Data Range	0:NONE 1:EVEN 2:ODD	Default: 0
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

DATABITS: Serial Comm Databits, UINT16		
Data Range	1:8 databits	Default: 1
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

STOPBITS: Serial Comm Stopbits, UINT16		
Data Range	0:1 stopbit 1:2 stop bits	Default: 0
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

USER_SN--- User Serial Number		
Data Range	0x0000000000000000-0xFFFFFFFFFFFFFFFF	Default: N/A

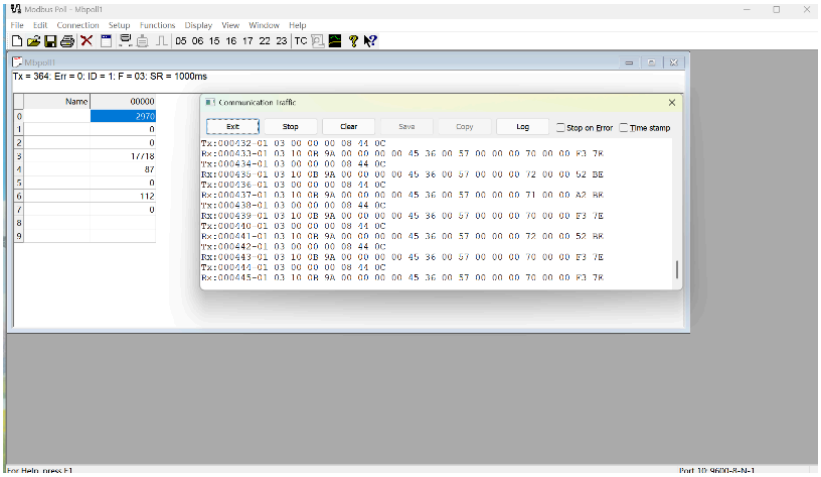
	User Serial Number. These four registers should be read and written together from the start address 0x0220 with a quantity 4.	
Parameter Storage	YES	

5.4 Software Configuration Utility

Software: Modbus Poll

You can use the software listed below to try reading/ writing the register of the sensor.

Download



5.5 Command example

5.5.1 Modify the slave address

Default Registers	1
Change Slave Address	05
Address	0x0200 (512)
Number of Registers	1
Function Code	0x06
Default Sensor Address	01

To change the Modbus device address of the sensor from 01 to 05, use the following command:

Example:

Send Command	01 06 02 00 00 05 48 71
Response	01 06 02 00 00 05 48 71

Note: The address is changed to 05 and saved after power-off

5.5.2 Modify the baud rate

Address	0x0201 (513)
Number of Registers	1
Function Code	0x06
Default Value	3 (9600bps)
Supported Values	0-5 (1200-38400bps)

The baud rate can be set via the upper computer and takes effect after re-powering the sensor. The baud rate is saved after power-off.

The integer values map to baud rates as follows:

Integer value	Baud Rate
0	1200bps
1	2400bps
2	4800bps
3	9600bps
4	19200bps
5	38400bps

Example:

Send Command	05 06 02 01 00 02 59 F7
Response	05 06 02 01 00 02 59 F7

Note: The baud rate is changed to 4800bps and saved after power-off

5.5.3 Read measurement data

This reading includes ten values.

Address	0x0000 (0)
Number of Registers	10
Function Code	0x03

Example:

Send Command	01 03 00 00 00 0A C5 CD
Response	01 03 14 09 F1 03 0F 09 5B FE 14 03 0F FE 13 09 5B 09 5B 09 5B 09 F1 95 90

6 Safety, Care and Installation

6.1 Care and Safety

- Disconnect the power supply before installing or changing wiring.
- Do not exceed 28 V DC, reverse the supply polarity, or operate above 0.2 MPa.
- Handle the sensing end gently. Do not strike, scrape, or touch the pH membrane or ORP metal surface.
- Install the sensor vertically to support stable reference-electrolyte diffusion.
- Rinse the sensing end with deionized water between samples and before calibration.
- Do not use abrasive tools or solvents that are incompatible with the electrode materials.

6.2 Installation

1. Choose a location with representative flow and enough clearance for the 207 mm sensor body.
2. Use the 3/4-inch NPT thread for submerged, tank, or pipeline mounting. Seal the thread with a chemically compatible method.
3. Keep the sensor vertical and ensure the sensing end is fully exposed to the sample.
4. Route the cable away from high-voltage conductors, motors, and variable-frequency drives.
5. Complete the RS485 wiring, check supply polarity, and then apply power.
6. Allow the readings to stabilize before using them for control or recording.

6.3 pH Electrode Maintenance

Typical service life is 1–2 years; harsh media may require more frequent replacement.

Item	Guidance
Hydration	Soak a new or dried electrode in 3 M KCl for 24 hours before use.
Operating limits	Avoid prolonged exposure below pH 2 or above pH 12. Temperatures above 80 °C may damage the membrane.
Cleaning—protein	Soak in 0.1 M HCl with pepsin for 30 minutes, then rinse.
Cleaning—inorganic deposits	Clean with 0.1 M EDTA solution, then rinse.
Calibration interval	Calibrate monthly; calibrate daily where high precision is required.
Short-term storage	Store in 3 M KCl solution.
Long-term storage	Fit the dry storage cap as specified for this sensor to limit electrolyte crystallization.

Issue	Corrective action
Slow response	Check for fouling or electrode aging.
Drifting readings	Inspect the electrode and replace it if necessary.

Issue	Corrective action
Calibration failure	Clean the membrane and confirm that the buffer is valid and not expired.

6.4 ORP Electrode Maintenance

Typical service life is 1–3 years; annual replacement may be required in harsh industrial wastewater.

Item	Guidance
Initial activation	Soak a new electrode in an ORP standard solution, such as ZoBell solution, for 30 minutes.
Contaminating media	Rinse immediately after measuring sulfides, cyanides, or strong oxidizers.
Monthly verification	Check with +258 mV standard at 25 °C. Clean or replace if deviation exceeds ±30 mV.
Cleaning—organic fouling	Soak in 0.1 M HCl for 5 minutes, then rinse.
Cleaning—sulfide contamination	Clean with 10% thiourea solution, then rinse.
Short-term storage	Store in 3 M KCl solution.
Long-term storage	Fit the dry storage cap as specified for this sensor to limit electrolyte crystallization.

Issue	Corrective action
Slow response	Clean the sensing surface with a suitable electrode-cleaning solution.
Drifting readings	Check temperature compensation and replace the electrode if required.
Calibration failure	Replace the ORP standard solution and verify the electrode response.

7 Calibration

7.1 pH Calibration

Use the command to set the required calibration group (**the calibration group Settings are stored after power failure and can be set only once**), then immerse the sensor in the corresponding standard buffer solution and send the instructions for calibration:

Calibration Group <PHCalibGroup>	PH standard buffer	Calibration Command
0	(1) Set the calibration group expected to be used (2) Immerse the sensor in PH=4.00 buffer solution (3) Immerse the sensor in PH=7.00 buffer solution (4)Immerse the sensor in PH=10.01 buffer solution	Write 0 to register PHCALIBGROUP Write 0x7FFF to register PHUSERCALIB0 Write 0x7FFF to register PHUSERCALIB1 Write 0x7FFF to register PHUSERCALIB2
1	(1) Set the calibration group expected to be used (2) Immerse the sensor in PH=4.00 buffer solution (3) Immerse the sensor in PH=6.86 buffer solution (4) Immerse the sensor in PH=9.18 buffer solution	Write 0 to register: PHCALIBGROUP. Write 0x7FFF to register PHUSERCALIB0 Write 0x7FFF to register PHUSERCALIB1 Write 0x7FFF to register PHUSERCALIB2

The following example uses the buffer of calibration group 0 (PHCALIBGROUP=0), that is, PH=4.00, PH=7.00, PH=10.01 to calibrate the transmitter; the calibration process is as follows:

Steps	**Description**	**Command**

1	Set the calibration group to 0, that is, use PH=4.00, PH=7.00, PH=10.01 buffer for electrode calibration.	Write 0 to register PHCALIBGROUP
2	Rinse the electrodes with deionized water. Immerse the electrode in the PH=4.00 standard buffer, stir the electrode moderately, wait for the PH reading to stabilize, and wait for the electrode temperature (if any) to balance with the standard buffer, then send the calibration command.	Write 0x7FFF to register PHUSERCALIB0
3	Rinse the electrodes with deionized water. Immerse the electrode in the PH=7.00 standard buffer, stir the electrode moderately, wait for the PH reading to stabilize, and wait for the electrode temperature (if any) to balance with the standard buffer, then send the calibration command.	Write 0x7FFF to register PHUSERCALIB1
4	Rinse the electrodes with deionized water. Immerse the electrode in the PH=10.01 standard buffer, stir the electrode moderately, wait for the PH reading to stabilize, and wait for the electrode temperature (if any) to balance with the standard buffer, then send the calibration command.	Write 0x7FFF to register PHUSERCALIB2
5	Rinse the electrodes with deionized water. Verify the measured values.	Data measurement command
6	If calibration fails, use the command to reset the PH calibration value to the factory setting. The calibration data of calibration group 0 and calibration group 1 are restored to factory Settings.	Write 0xFFFF to register RESETCALIB

7.2 ORP Calibration

Use an ORP standard whose nominal value is known at the calibration temperature (for example, 256 mV or 420 mV). Writing the nominal value to ORPSTANDARDMV initiates the calibration.

Step	Action	Register operation
1	Rinse, immerse in the ORP standard, gently stir, and wait for a stable reading.	Write the nominal mV value to ORPSTANDARDMV (0x0041).
2	Rinse and verify the measured ORP value.	Read ORP or ORP_FLOAT.
3	If necessary, restore only the ORP calibration data.	Write 1 to RESETCALIB (0x0050).

Writing 0xFFFF to RESETCALIB restores both pH and ORP calibration data. Use the selective values above when only one measurement channel must be reset.

8 Document Version

Version	Date	Description	Editor
V1.0		First Version	Zhai Chenyang