Digital pH Sensor

User Manual

Contents

Guarantee

Our company seriously warrants each of the instrument for one year (12 months) from the specific date of delivery. Consumables and consumable parts in the equipment are not covered by the warranty. The terms of this warranty shall not apply if damage to the instrument occurs beyond the warranty period, or in the opinion of the company, the breakage or destruction of the instrument is due to improper use, lack of maintenance, improper installation, improper modification, abnormal environmental conditions, etc. The company's obligation under this warranty is limited to providing replacement or repair of this product, as the case may be. The product must be thoroughly cleaned to remove any contaminated chemicals before it is accepted for replacement or repair. Our obligations shall not exceed the price of the product itself. In no event shall the company be liable for damage caused by incidental or consequential damages, whether to persons or objects. The company shall not be liable for any other loss, damage or expense of any kind, including economic loss resulting from the installation, use or improper use of the product.

- For details, please refer to the product's quality promise with the product, and keep this manual and the quality promise properly.

Chapter 1 Specification

Product specifications are subject to change without notice.

Measuring Principle	Glass Electrode Method
Measuring Range	0.00~14.00 pH 0.0~50.0 °C
Resolution	0.01 pH 0.1 °C
Accuracy	±0.02pH
Temperature Compensation	0 to 50°C, NTC automatic or manual
Calibration Method	Zero calibration, slope calibration, deviation calibration
Working Temperature	0 to 50°C
Working Pressure	≤2Bar
Protection Grade	IP68
Power Supply	9~36VDC
Power Consumption	About 0.2W
Electrical Isolation	Power and communication are isolated inside the sensor
Communication Interface	RS485 MODBUS
Shell Material	ABS
Sensor Dimension	φ35mm Total Length 260mm (including the cleaning cover)
Installation Dimension	One 1" NPT thread at the beginning and end Insertion depth 100mm (including cleaning connector 115mm)
Weight	About 150g(not including the cable)
Cable	PUR (polyurethane) sheath, standard 5 meters length can be customized
Connect Method	Bare wire, M12 plug or waterproof aviation plug

Chapter 2 Basic Information

2.1 Security Information

Please read this manual completely before unpacking, installing and operating this equipment. Pay special attention to all precautions. Otherwise, it may cause serious personal injury to the operator or damage the equipment.

2.2 Overview

The digital pH sensor adopts the classic electrochemical principle, with reliable measurement and stable performance. It is widely used in environmental protection water treatment, surface water, purified water, circulating water and other systems, as well as electroplating, electronics, printing and dyeing, chemical, food, pharmaceutical and other process fields. Excellent performance in sewage treatment, drinking water treatment, surface water monitoring, pollution source monitoring, industrial process and other applications.
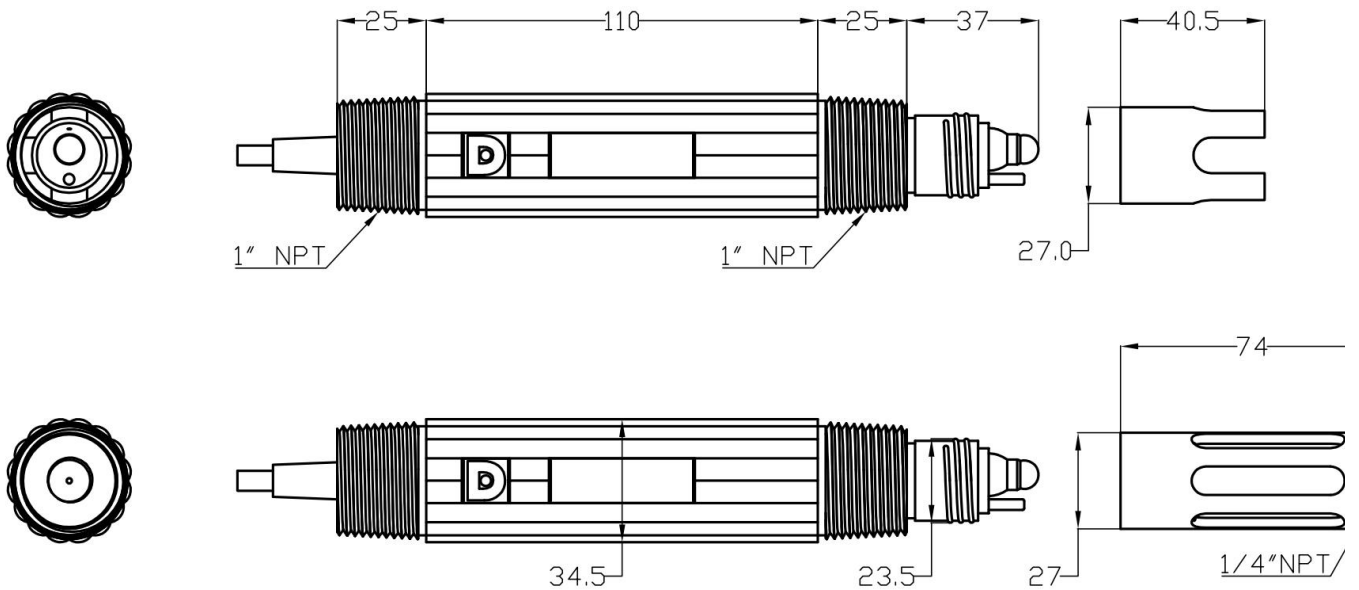
2.3 Dimensions

Figure 1 Dimensions of the sensor

Chapter 3 Installation

3.1 Sensor Installation

Refer to the pictures in this section to install and fix the sensor. To ensure that the sensor can measure safely and accurately, the following conditions must be met during installation:

● Choose a location that is convenient for operation and maintenance to install the sensor. The pH sensor needs regular maintenance;

● The electrode installation angle is within ±30°, and the electrode cannot be installed horizontally or upside down;

● Do not remove the protective cap when installing the electrode on site, and then remove the protective cap after the installation is over.
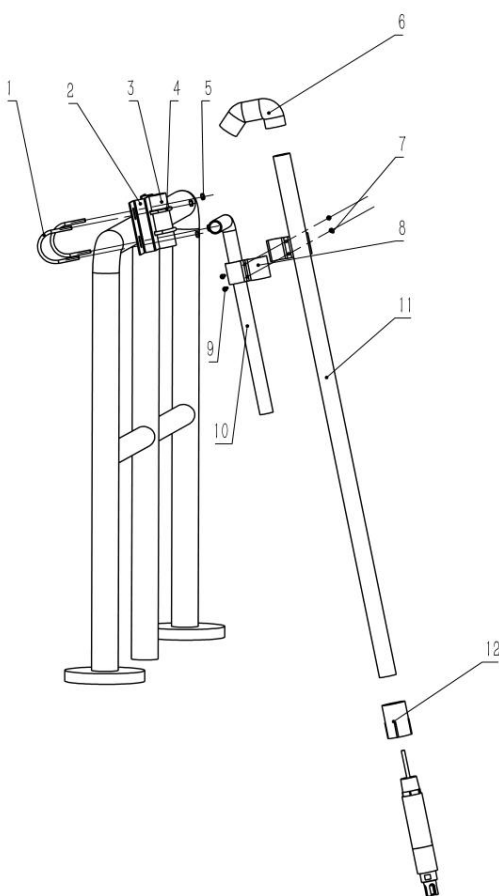
Figure 2 Schematic diagram of railing installation

1-DN60 U-shaped card	7-M4 screw nut 8*4
2-U-shaped board	8-"8"shaped clip 25&32
3-Handle sleeve	9-M4 screw*25*2
4-DN40 U-shaped card	10-handle
5-M6 screw nut*8	11-DN32PVC Bracket
6-Rainproof elbow	12-1 inch inner wire straight pipe joint
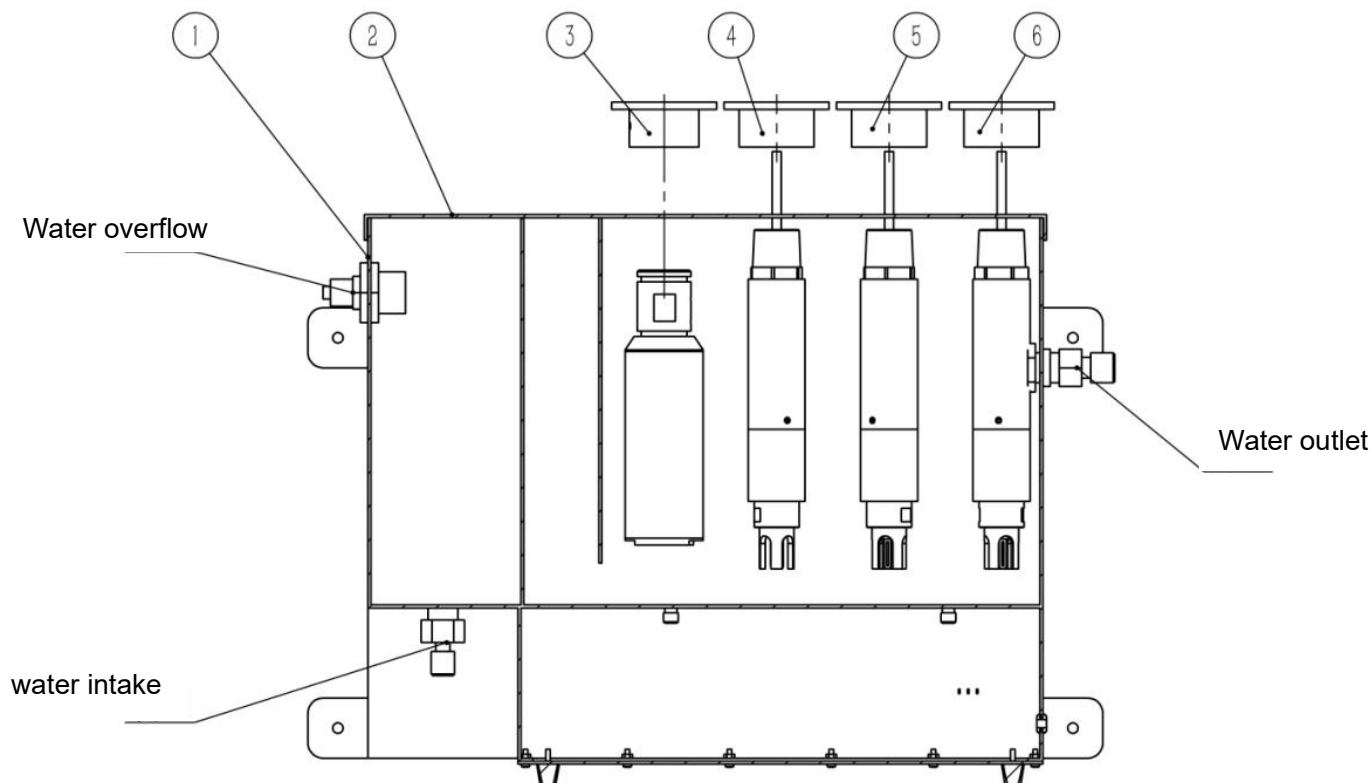
Figure 3 Schematic diagram of five-parameter flow cell installation

1-Flow cell	4-pH sensor fixed connection cover
2-Flow cell cover	5-dissolved oxygen sensor fixed connection cover
3-Turbidity sensor fixed connection cover	6-conductivity sensor fixed connection cover

3.2 Sensor Wiring

The sensor is correctly connected as defined in the table below.

Wire Color	red	black	white	green
Terminal Definition	Power positive	Power negative	RS485 data A (+)	RS485 data B (-)
Instrument Terminal Symbols	V+	V-	AS	BS

Chapter 4 Communication

4.1 Communication Protocol

The instrument acts as a slave on the network and supports the Modbus RTU communication protocol. The data communication is initiated by the host and the first byte of the transmitted message is the target slave address. When the first byte is received by all slaves on the network, each slave will decode it to determine whether the message is sent to itself.

The transmission of the RTU message frame starts with a pause interval of at least 3.5 characters. After the last character is transmitted, a pause of at least 3.5 characters marks the end of the message frame. A new message can start after this pause. In the transmission process, the entire message frame must be transmitted in a continuous stream.

If there is a pause of more than 1.5 characters before the completion of the message frame transmission, the receiving device will refresh the incomplete message and assume that the next byte is the start of the new message. Similarly, if a new message starts after the previous message frame in less than 3.5 character, the receiving device will assume that it is a continuation of the previous frame, and this will cause an error because the last CRC value cannot be correct.

Host send：

1	2	3	4	5	6	7	8
Slave Address	Function code	Register starting address High 8 bit	Register starting address Low 8 bit	Register number High 8 bit	Register number Low 8 bit	CRC Low 8 bit	CRC High 8 bit

Slave response:

1	2	3	4	5	5+n	5+n+1	5+n+2	5+n+3
Slave Address	Function code	Number of data bytes	Data 1 high 8 bit	Data 1 Low 8 bit	Data n high 8 bit	Data n Low 8 bit	CRC Low 8 bit	CRC High 8 bit

Examples:
Send frame: [01 04 00 02 00 02 D0 0B], the meaning is as follows:
[01]: Slave address
[04]: Function code
[00 02]: The starting register address is 0x02
[00 02]: Read 2 registers starting from the starting address (that is, read 1single-precision floating-point data result)
[D0 0B]: CRC check data
Return frame: [01 04 04 CC CD 41 48 65 4D], the meaning is as follows:
[01]：salve address
[04]：function code
[04]：The number of bytes returned (here 4)
[00 00 41 C8] ： 41 C8 00 00 (that is, the floating-point value is 25, the specific meaning of the value is to find the corresponding address)
(Note: Combine two 16-bit integer registers to form a single-precision floating-point number, pay attention to the order of the data)

4.2 Use

4.2.1 Read Measuring Values

Read the pH value and temperature value measured by the sensor
(assuming the sensor address is 1)

Host sensds [01 04 00 02 00 04 50 09]
[01] Indicates the electrode address, where the electrode address is 1
[04] Indicates function code, here use function code 04 to read the measured value
[00 02] Indicates the starting register address, where the starting register address is 2
[00 04] Indicates the number of read registers, here 4 registers are read
[50 09] Represents CRC check code

Electrode return data [01 04 08 00 00 40 E0 00 00 41 C8 9A DD]
[01] Indicates the electrode address, where the electrode address is 1
[04] Indicates function code, here use function code 04 to read the measured value
[08] Indicates the number of data bytes, there are 8 bytes here
[00 00 40 E0] These 4 bytes represent the pH value, and the value is represented by a floating point number, [00 00] is the low 16 bits, [40 E0] is the high 16 bits, that is, the 32-bit floating point number is [40 E0 00 00], converted to a decimal number, it is 7, and the pH value is 7
[00 00 41 C8] These 4 bytes represent the temperature value, the value is represented by a floating point number, [00 00] is the low 16 bits, [41 C8] is the high 16 bits, that is, the 32-bit floating point number is [41 C8 00 00], converted to a decimal number, it is 25, and the temperature value is 25 degrees Celsius
[9A DD] means CRC check code

4.2.2 Modify Sensor Address

Modify the electrode address, change the electrode address from 1 to 2
Host sends [01 06 00 00 00 02 08 0B]

4.2.3 Sensor Calibration

Electrode calibration (assuming electrode address is 1)
Zero calibration:
The calibration value is the value set at calibration point two, the default is 6.86
Use function code 16 to write value 7 to register address 206 to perform calibration
Host sends [01 10 00 CE 00 02 04 00 00 40 E0 4E 3B]
Slope one calibration:
The calibration value is the value set at calibration point one, the default is 4.01
Use function code 16 to write value 4 to register address 200 to perform calibration
Host sends [01 10 00 C8 00 02 04 00 00 40 80 CE 39]
Slope two calibration:
The calibration value is the value set at calibration point three, the default is 9.18
Use function code 16 to write value 9 to register address 214 to perform calibration
Host sends [01 10 00 D6 00 02 04 00 00 41 10 4F 45]

4.2.4 Reset Factory

Reset the factory (communication parameters are not reset) (assuming sensor address is 1)
Use the function code 06 to write the value 99 to the register address 400 to execute the recovery.
Host sends [01 06 01 90 00 63 C8 32]

Chapter 5 Maintenance

In order to obtain the best measurement results, regular maintenance is required. Maintenance includes cleaning of electrodes and checking for damage.

5.1 Maintenance Cycle

Maintenance Work	Maintenance frequency
Visual inspection	Every month
Check calibration	Every month (According to the environmental conditions of use)
Replace the pH sensor	Every year (According to the environmental conditions of use)
Seal maintenance	Every two years

5.1 Common problems and solutions

Problems	Solutions
Sensors cannot communicate	1. Check whether the electrode wiring is correct
	2. Check the communication setting parameters (address, baud rate, parity bit, stop bit)
The measured value is abnormal	1. Check whether the electrode bulb is cleaned and whether the sensor is damaged
	2. Restore the electrode to the factory calibration value, clean it and recalibrate it with a standard buffer
	3. Check the service life of the electrode

Appendix A Modbus Register Information

Main measurement(use function code 04 to read)					
Parameter	Address	Data format	Value range	Initial value	Instruction
Main measurement	2	32 Bit Float	0~14	-	Unit: pH
Temperature measurement	4	32 Bit Float	0~50	-	Unit: ℃

Communication parameter(use function code 03 to read, function code 06 to write)					
Parameter	Address	Data format	Value range	Initial value	Instruction
Address	0	Unsigned	1~254	9	-
Baud rate	1	Unsigned	0~3	1	0：4800 1：9600 2：19200 3：38400
Check digit	2	Unsigned	0~2	0	0：None 1：Even parity 2：Odd parity
Stop bit	3	Unsigned	1~2	1	1：1 bit 2：2 bit

System setting parameters(use function code 03 to read, function code 06 to write)					
Parameter	Address	Data format	Value range	Initial value	Instruction
Sampling rate	4	Unsigned	0~4	2	0：Level 2 buffer 1：Level 4 buffer 2：Level 8 buffer 3：Level 16 buffer 4：Level 32 buffer
Temperature mode	5	Unsigned	0~1	0	0：automatic 1：manual
Solution compensation type	6	Unsigned	0~3	0	0：no compensation 1：natural water 2：pure water 3：other

System setting parameters(use function code 03 to read, function code 06 to write)

Parameter	Address	Data format	Value range	Initial value	Instruction
Cal point 1	100	32 Bit Float	3.5<value≤4.51	4.01	The cal point value can be changed, setting range: 3.5~4.51
Cal point 2	102	32 Bit Float	6.36<value≤7.5	6.86	The cal point value can be changed, setting range: 6.36 ~7.5
Cal point 3	104	32 Bit Float	8.68<value≤10.5	9.18	The cal point value can be changed, setting range: 8.68 ~10.5
Zero point	106	32 Bit Float	-50~50	8.28	The zero value can be changed, setting range: -50 ~ 50
Slope 1	108	32 Bit Float	45~60	59.16	The slope one value can be changed, setting range: 45~60
Slope 2	110	32 Bit Float	45~60	59.16	The slope two value can be changed, setting range: 45~60
Main measure offset	112	32 Bit Float	-14~14	0	The main measurement offset value can be changed, setting range: -14~14
Temp offset	114	32 Bit Float	-100~100	0	The temperature offset value can be changed, setting range: -100~100
Manual temp value	116	32 Bit Float	0~100	25	Manual temperature value can be changed, setting range: 0 ~100
Natural water compensation coefficient	120	32 Bit Float	0~1	0.008	The compensation coefficient value can be changed, setting range: 0~1
Pure water compensation coefficient	122	32 Bit Float	0~1	0.015	The compensation coefficient value can be changed, setting range: 0~1
Other solution compensatio coefficient	124	32 Bit Float	0~1	0.1	The compensation coefficient value can be changed, setting range: 0~1

User calibration parameters (use function code 03 to read, function code 16 to write)

Parameter	Address	Data format	Value range	Initial value	Instruction
Cal point1 Cal	200	32 Bit Float	-	-	Write value 4 for pH 4.01 calibration
Cal point2 Cal	206	32 Bit Float	-	-	Write value 7 for pH 6.86 calibration
Cal point3 Cal	214	32 Bit Float	-	-	Write value 9 for pH 9.18 calibration

Recovery (use function code 06 to write)

Parameter	Address	Data format	Value range	Initial value	Instruction
Reset setting parameters	400	Unsigned	-	-	Write the value 99 to reset the setting parameters, the communication setting will not be reset