Digital pH Sensor

Operation Manual

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Chapter 1 Specifications

Specifications	Details
Main Material	Shell: PPS; Cable: PVC; Electrode: glass core
Measurement Range	0-14 pH
Resolution	0.01 pH
Precision	±0.1 pH
Repeatability	±0.1 pH
Temperature Compensation	-10~110℃
Temperature Resolution	0.1 ℃
Temperature Accuracy	0.5℃
Pressure Range	0-0.1Mpa
Applicable Temperature	0.0~60.0℃ (not freeze)
Power Supply	12VDC
Level of Protection	IP68 (sheath protection)
Install The Screw	Top/bottom R3/4
Cable Length	Standard: 10 m, the maximum can be extended to 200m

Table 1 Technical Specifications of Digital pH Sensor

Note: The specifications of the product are subject to change without prior notice.

Chapter 2 Product Overview

2.1 Product Information

The digital pH sensor uses a composite electrode in which a glass indicating electrode and a reference electrode are combined to measure the pH of the water. The potential of the internal reference electrode in the glass electrode is constant regardless of the pH of the solution to be tested. When the glass bubble is immersed in the measured solution in which the H+ concentration changes, the difference between the stable potential of the reference electrode and the potential generated by the glass ball is read by the voltmeter and used as a measurement result. The product is widely used in water treatment, hydrological monitoring, wastewater treatment, swimming pool, fish pond and chemical fertilizer, chemical, biological and other fields of pH monitoring. The sensor size is shown in Figure 1.

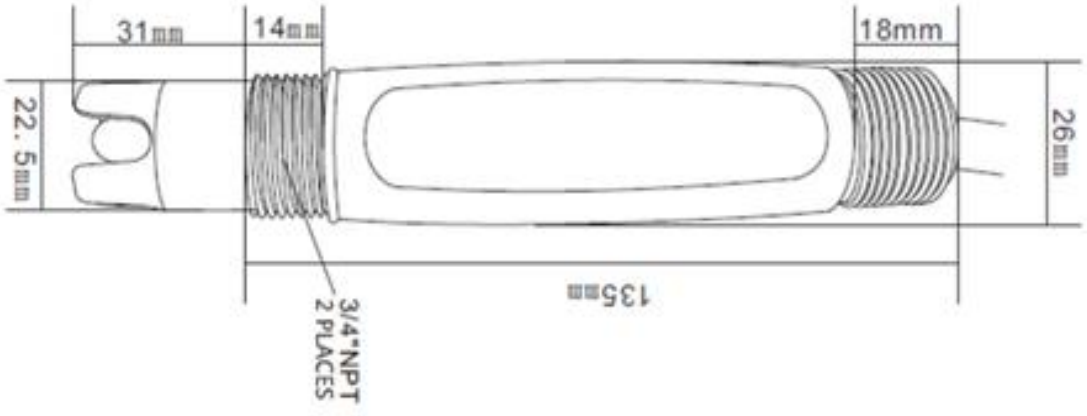


Figure1 Dimension Diagram of Digital pH Sensor

2.2 Safety Information

Please read this manual completely before opening the package, installing or using. Otherwise it may cause personal injury to the operator, or cause damage to equipment.

Warning labels

Please read all labels and signs on the instrument, and comply with the security label instructions, otherwise it may cause personal injury or equipment damage.

 When this symbol appears in the instrument, please refer to the operation or safety information in the reference manual.

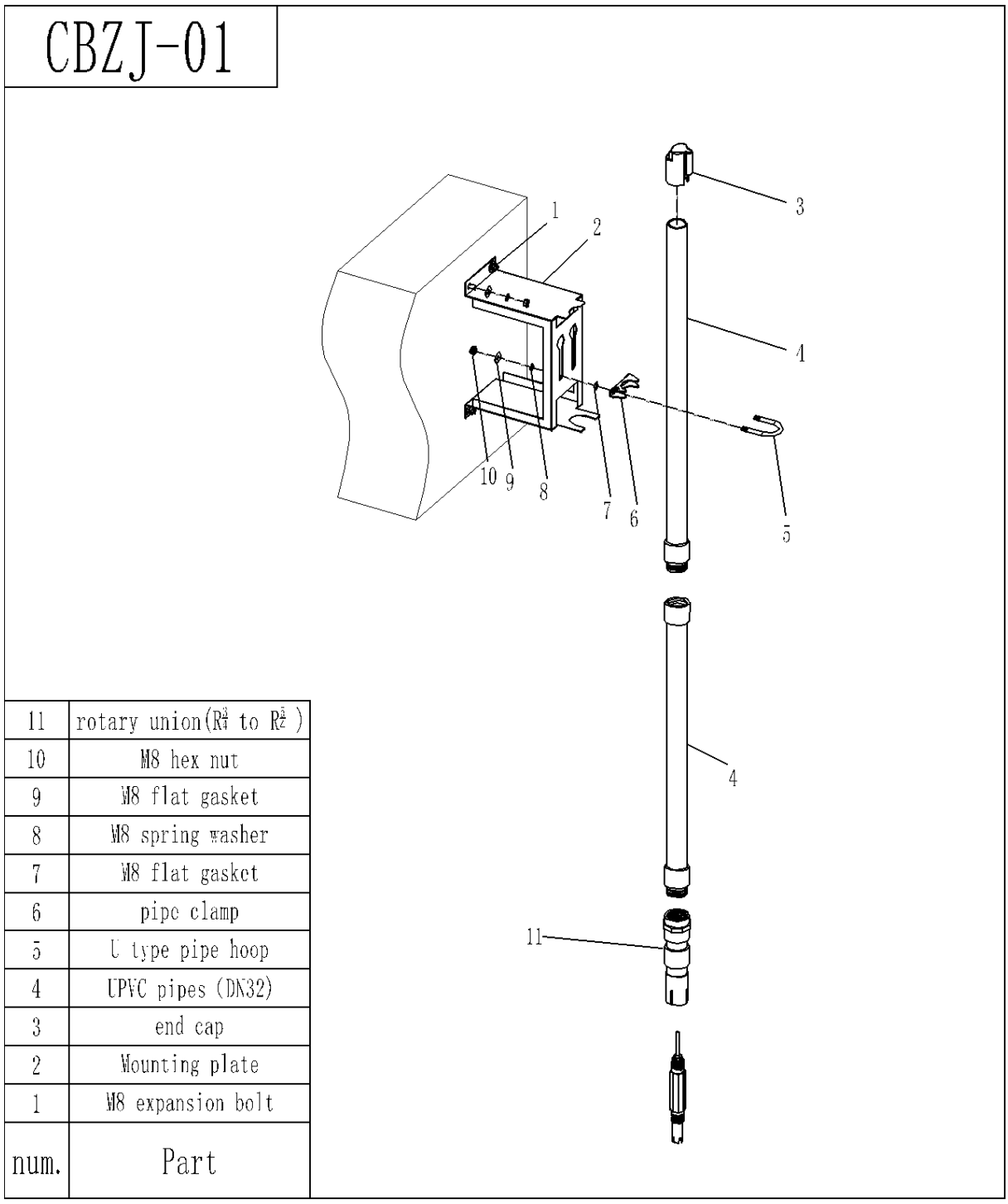
 While this symbol indicates an electric shock or risk of death from electric shock.

Please read this manual completely. Pay particular attention to some notes or warnings, etc. To ensure that the protective measures provided by the equipment are not destroyed.

Chapter 3 Installation

3.1 Installation of Sensors

3.1.1 Quick Dismantling pool side fixed installation

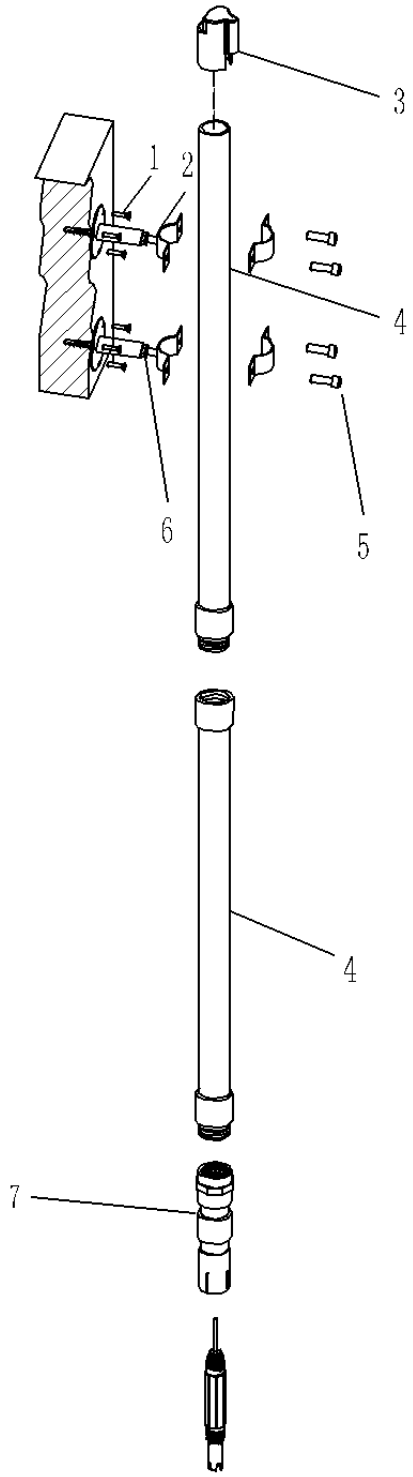


num.	Part
11	rotary union(R¾ to R¾)
10	M8 hex nut
9	M8 flat gasket
8	M8 spring washer
7	M8 flat gasket
6	pipe clamp
5	U type pipe hoop
4	UPVC pipes (DN32)
3	end cap
2	Mounting plate
1	M8 expansion bolt

Figure 2 Quick Dismantling pool side installation sketch map

3.1.2 Classic pool side fixed installation

CBJD-01



num.	Part
7	rotary union(R¾ to R⅝)
6	M8 hex nut
5	bolt M8*16
4	UPVC pipes (DN32)
3	end cap
2	pipe hoop (Φ40)
1	M4 expansion bolt

Figure 3 Classic pool side fixed installation sketch map

3.1.3 Railing fixed installation

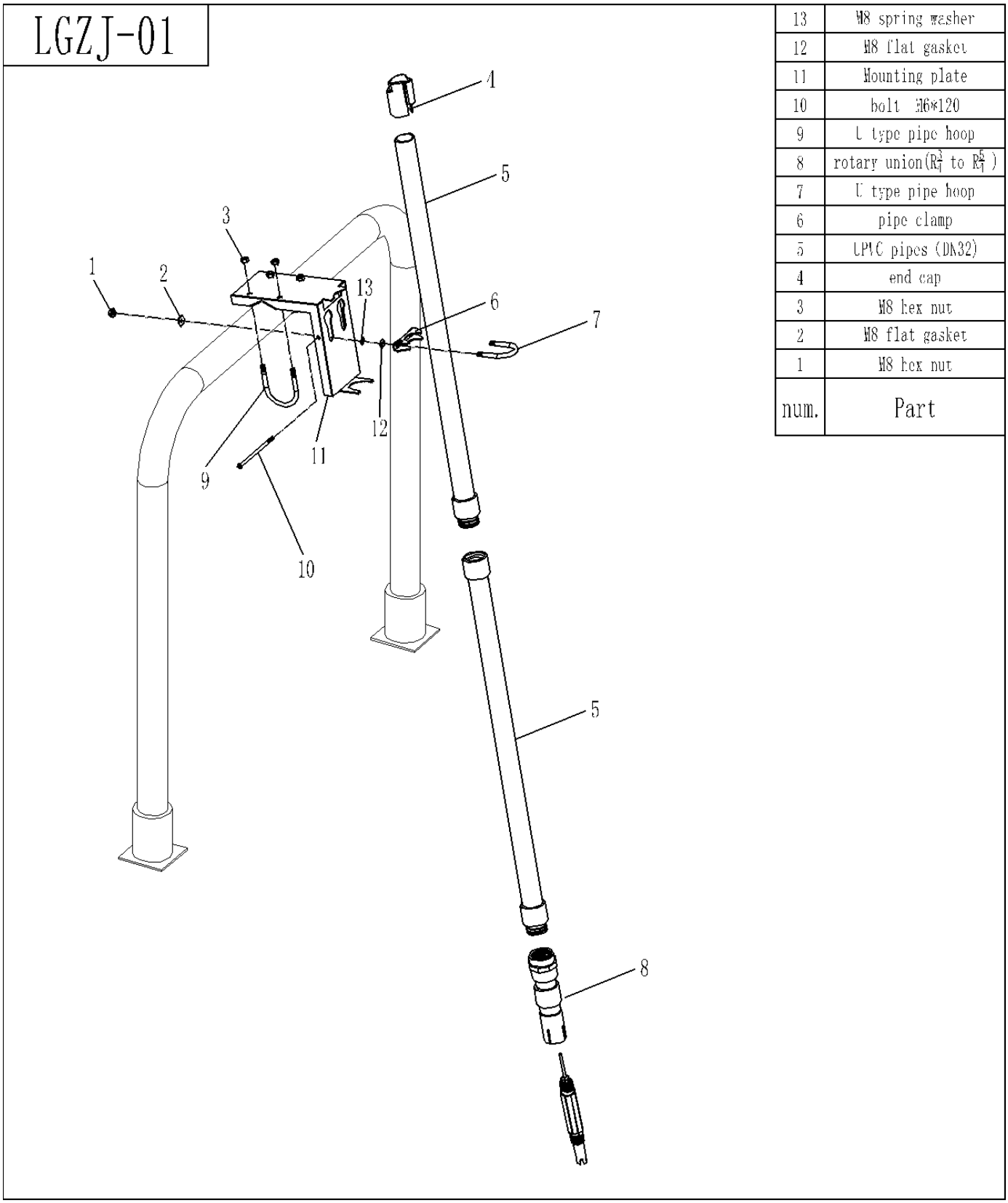


Figure 4 Railing fixed installation sketch map

3.2 Connection of sensor

Please connect the sensor correctly according to the following core definition

Serial No.	1	2	3	4
Sensor Cable	Red	Black	Yellow	White
Signal	+12VDC	AGND	RS485 A	RS485 B

Note：Where the sensor marked in Figure 5 is connected to the cable, IP68 protection cannot be realized. It is generally required to connect the mounting bracket or protective sleeve to the threaded connection of the sensor, wrap it around with raw tape. To avoid water flooding at the sensor connection cable marked in Figure 5.

Figure 5

Chapter 4 Interface and Operation

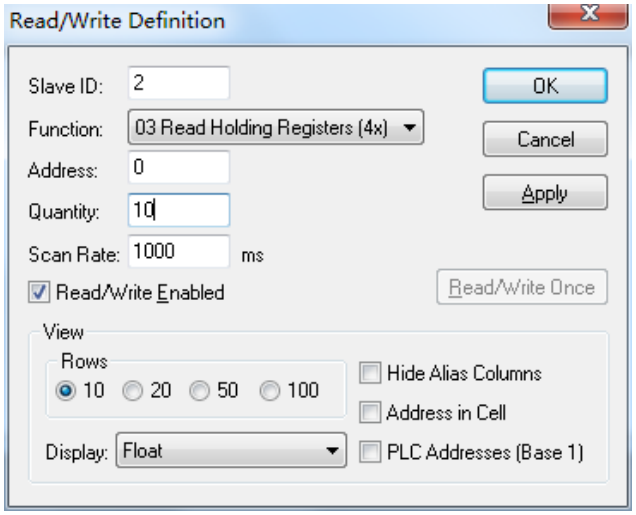
4.1 User Interface

The sensor is connected to the computer using RS485 to USB, and then use Modbus Poll to connect

Note: Modbus Poll software is a general software that can be downloaded online.

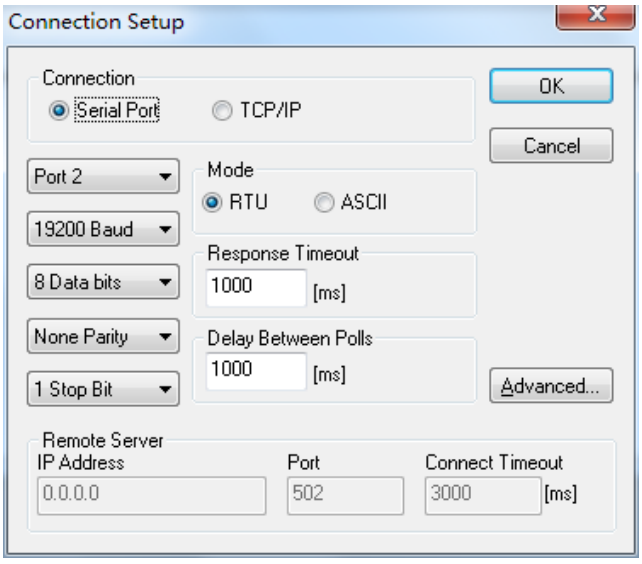
4.2 Parameter Setting

1、Click “Setup” on the menu bar, select “Read / Write Definition”, and then set the parameters (The slave address for the first time is the slave label), click “OK”



Note: After the slave address is changed, the new address will be used for communication and the slave address for the next time connection is also the most recently changed address.

2、Click “Connection” on the menu bar, select the first line in the drop-down menu “Connection setup” (The baud rate for the first time is the slave label) and click “OK”.



Note: Port is set according to the Port number of the connection

Note: If the sensor has been connected as described, and “Timeout Error” appears on the software “Display status”, it means that the connection is failed; remove and replace the USB port or check the USB to RS485 converter, repeat the above procedure until the sensor connection is successful.

Chapter 5 Calibration of Sensor

5.1 Preparation for Calibration

Before the test and calibration, some preparation need to be done for the sensor, which are as follows:

1、Before test, remove the test soak bottle or rubber cover which are used to protect the electrode from the soak solution, immerse the measuring terminal of the electrode into distilled water, stir and make it clean, then pull the electrode out of the solution, and clean the distilled water with filter paper.

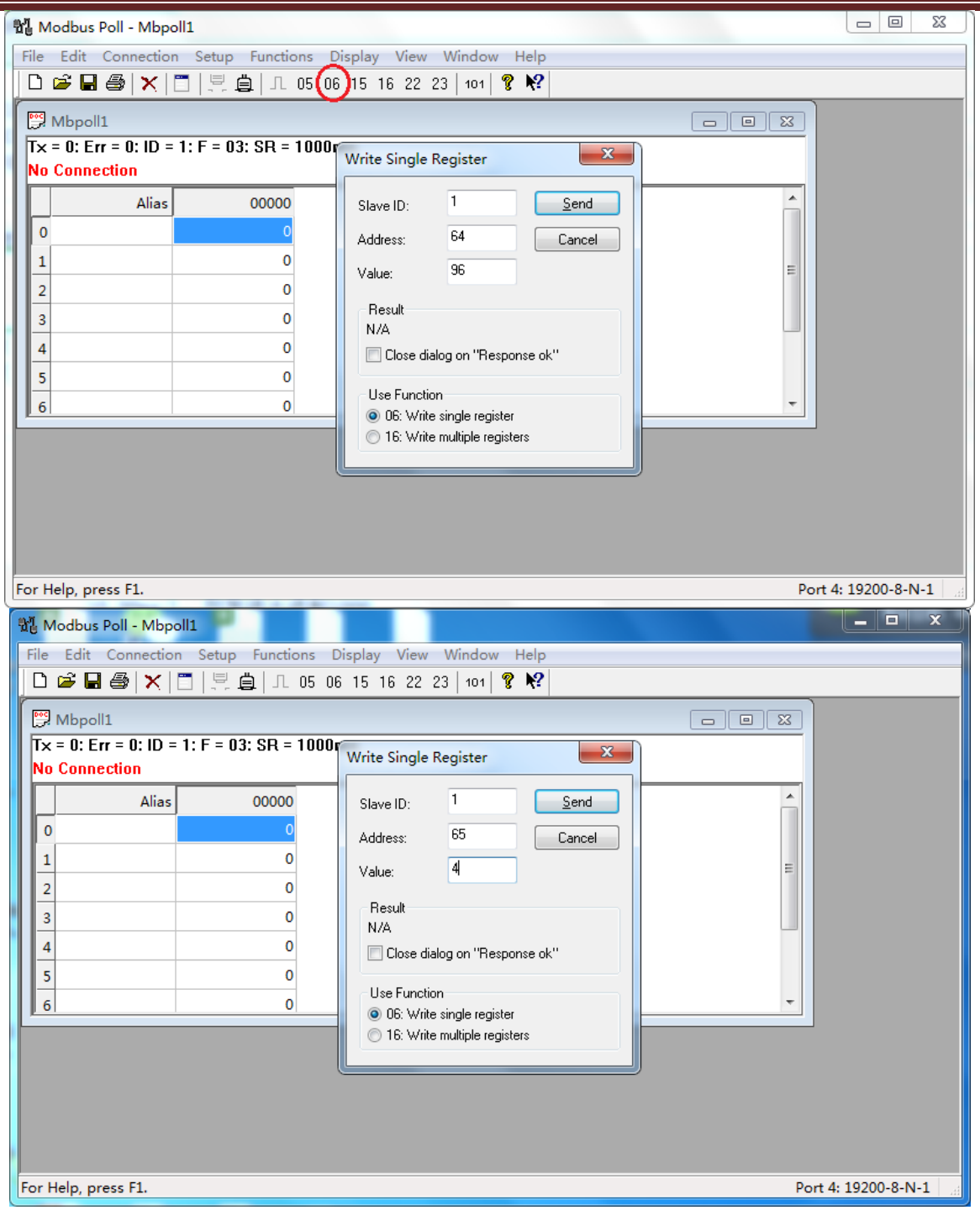
2、Observe the inside of the sensitive bulb to see if it is full of liquid, if bubbles have been found, the measuring terminal of the electrode should be shaken gently downwards (like shaking body thermometer) to remove the bubbles inside the sensitive bulb, otherwise it will affect the accuracy of the test.

5.2 pH Calibration

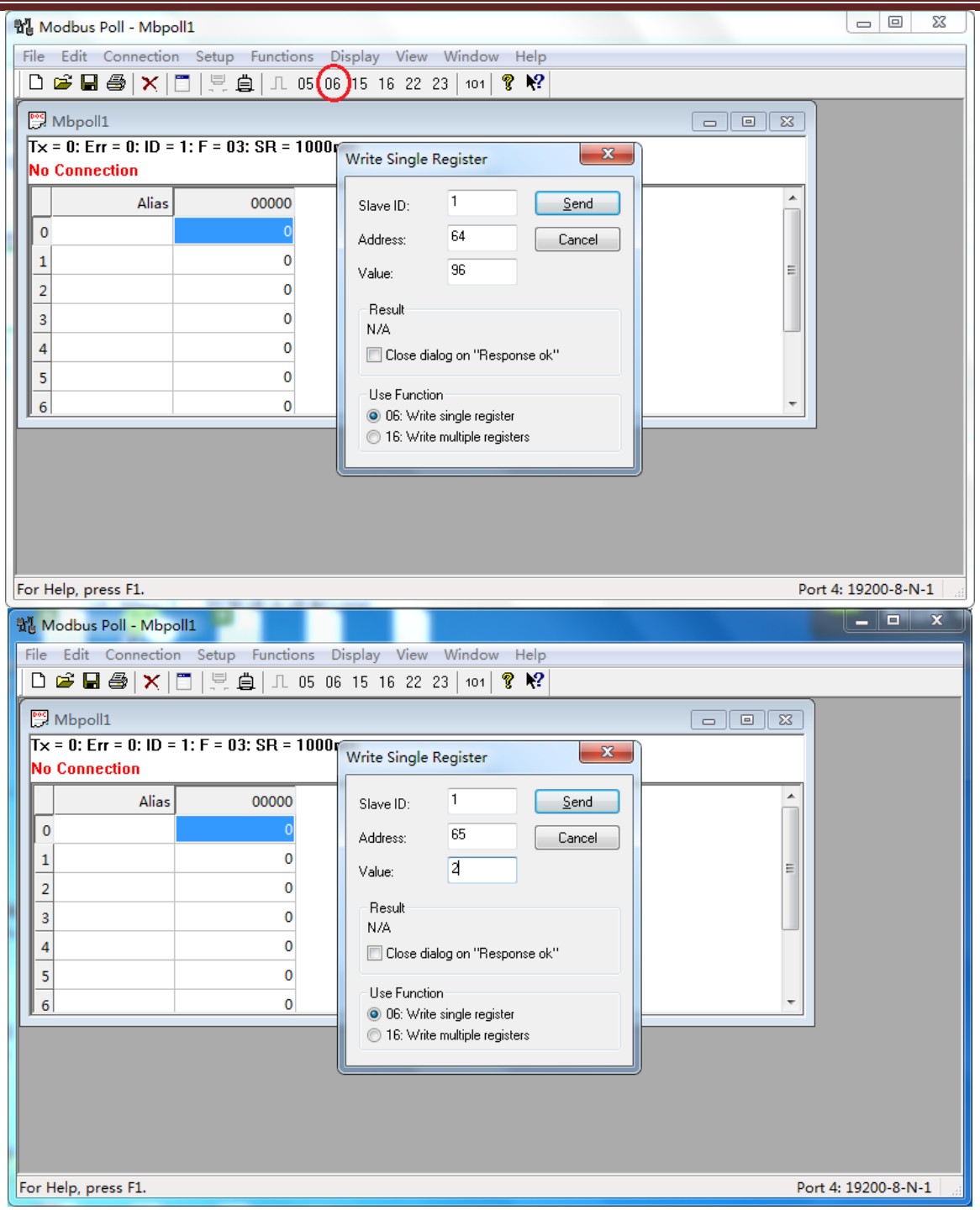
The pH sensor has been calibrated before leaving the factory. If calibration is required, follow the following steps. PH calibration requires standard buffer solutions of 6.864 pH and 4.001 pH，specific steps are as follows：

1. Connect the sensor to the PC first to ensure the connection is correct， then place it in a buffer solution with a pH of 6.864 (The neutral point must be calibrated first) and stir in the solution at an appropriate rate；

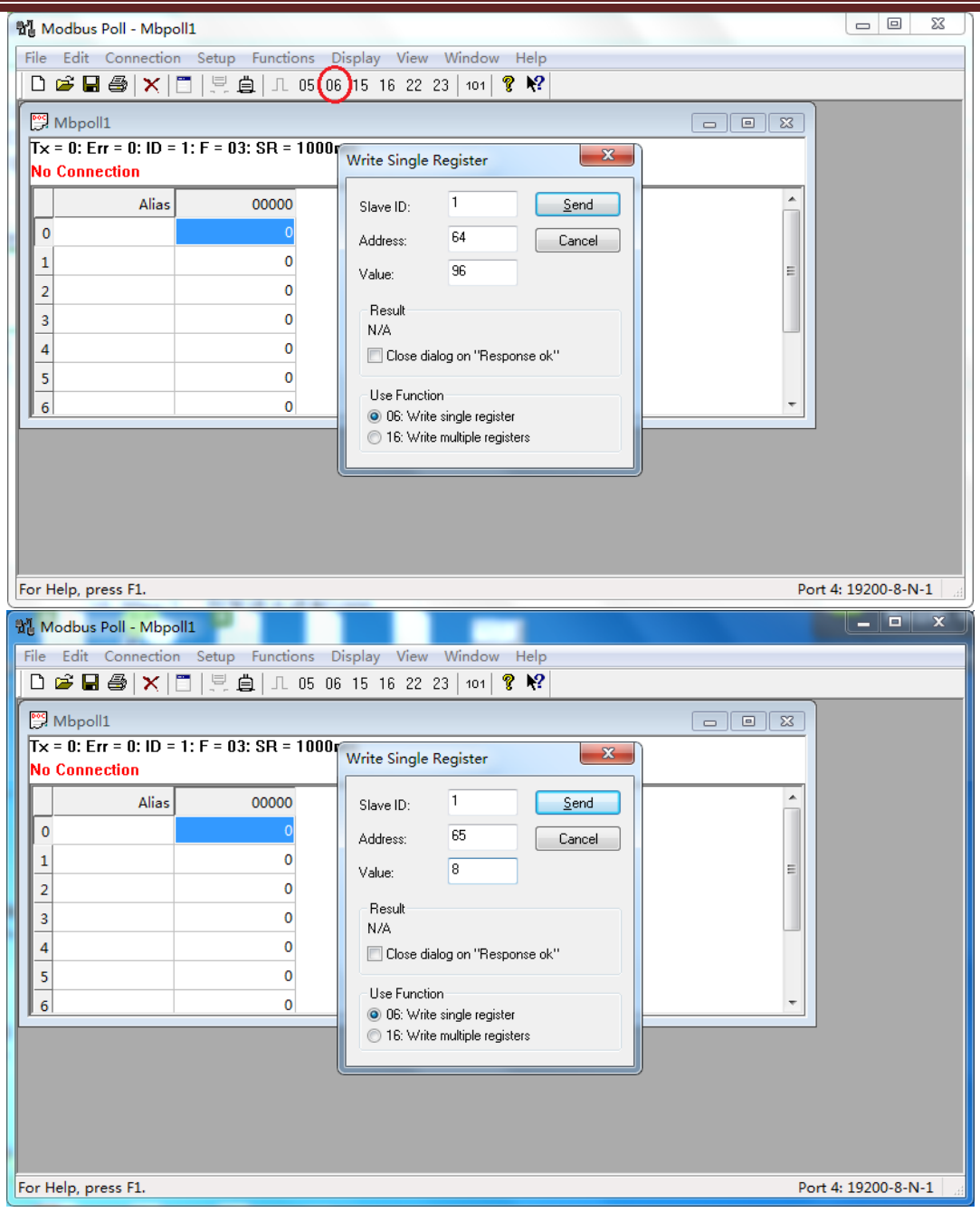
2. After the data is stable, enter the calibration mode instruction first, select “06” in the menu bar (circle), enter “64” for address and “96” for value in the data frame. Then send the calibration point (pH 6.864) command, select “06” in the menu bar (circle), enter “65” for address and “4” for value in the data frame. As shown below, then click Send.



3. Remove the probe, rinse the probe with deionized water, and clean the residual water with filter paper, then place it in a buffer solution with a pH of 4.001 and stir in the solution at an appropriate rate. After the data is stable, enter the calibration mode instruction first, select “06” in the menu bar (circle), enter “64” for address and “96” for value in the data frame. Then send the calibration point (pH 4) command, select “06” in the menu bar (circle), enter “65” for address and “2” for value in the data frame. As shown below, then click Send.



4. Remove the probe, rinse the probe with deionized water, and clean the residual water with filter paper; then place it in a buffer solution with a pH of 9.18 and stir in the solution at an appropriate rate. After the data is stable, enter the calibration mode instruction first， select “06” in the menu bar (circle)， enter “64” for address and “96” for value in the data frame. Then send the calibration point (pH 9.18) command, select “06” in the menu bar (circle)，enter “65” for address and “8” for value in the data frame. As shown below, then click Send.



5. After the calibration, the sensor is cleaned with distilled water and the remaining distilled water is sucked up. Then the tested solution will be tested with the sensor, and the pH value will be recorded when the readings are stable.

Chapter 6 Communication Protocol

A、Sensor with MODBUS RS485 communication function, specific MODBUS-RTU table is as follows.

MODBUS-RTU	
Baud Rate	19200
Data Bits	8 bit
Parity Check	No
Stop Bit	1 bit

B、It adopts MODBUS standard protocol, and the details of which are shown in the table below.

Address	**Data Type**	**Description**	**Register number**	**Read/ Write**	**Remarks**
pH Data Reading					
0	Float	pH Value	2	R	0.01~14
2	Float	Temperature Value	2	R	0.1~99.9
4	Float	Electrode signal	2	R	-1000mV~1000mV
6	Float	Factor	2	R/W	0.1~10.0
10	Float	Deviation	2	R/W	(-14.00 ~ 14.00)
35	Singed	High serial number	1	R	
36	Singed	Middle serial number	1	R	
37	Singed	Low serial number	1	R	
pH Calibration (see calibration for details)					
1st Step					

64	Singed	Send 96	1	R/W	Enter calibration mode
2nd Step					
65	Singed	Send 4	1	W	Calibration neutral solution 6.864
65	Singed	Send 2	1	W	Calibration acid solution 4.001
65	Singed	Send 8	1	W	Calibration alkaline solution 9.18
67	Singed	Status indication	1	R	0x0000: Successfully calibrated 0x0001: Calibration on processing 0x0002: Standard fluid information is not received or standard fluid error 0x0003: The signal cannot be stabilized or the signal is out of range 0x0004: The slope or offset exceeds the allowable range
pH Communication Settings					
61961	Singed	Communication rate	1	W/R	0:4800 **(Defaults 2)** 1:9600 2:19200 3:38400
61962	Singed	Parity check	1	W/R	0: No verification **(Defaults 0)** 1: Even parity 2: Odd parity
61964	Singed	Stop bit	1	W/R	0:1bit **(Defaults 0)** 1:2bit

61965	Singed	Local address	1	W/R	1~200 **(Defaults 2)**
Function code		W: Write integer data to 06 floating point type 16 R: 03			

485 analysis：

1、Read the pH Value

pH Data Reading					
Address	**Data Type**	**Description**	**Register number**	**Read/Write**	**Remarks**
0	Float	pH Value	2	R	0.01-14

Send the command：01 03 00 00 00 02 C4 0B

The equipment return：01 03 04 00 00 40 E0 CA 7B

Send command parsing：

01：device address 01

03：Function code 03 for reading register content

00 00：The starting register address read is 0000

00 02：Read 2 registers

C4 0B：CRC16 check code

The device returns the analysis:

01：device address 01

03：Function code 03 for reading register content

04：The length of the returned data is 4 bytes

00 00 40 E0：The pH value read is 7.00 (analyze 40 E0 00 00 using IEEE 754)

CA 7B：CRC16 check code

2、Read the serial number

pH Data Reading					
Address	**Data Type**	**Description**	**Register number**	**Read/ Write**	**Remarks**
35	Singed	High serial number	1	R	

Send the command：01 03 00 23 00 01 75 C0

The equipment return：01 03 02 00 00 B8 44

Send command parsing：

01：device address 01

03：Function code 03 for reading register content

00 23：The starting register address read is 0035

00 01：Read 1 registers

75 C0：CRC16 check code

The device returns the analysis：

01：device address 01

03：Function code 03 for reading register content

02：The length of the returned data is 2 bytes

00 00：The serial number read is 0

B8 44：CRC16 check code

3、pH calibration

pH Calibration (see calibration for details)					
Address	**Data Type**	**Description**	**Register number**	**Read/ Write**	**Remarks**
65	Singed	Send 4	1	W	Calibration neutral solution 6.864

Send the command：01 06 00 41 00 04 D8 1D

The equipment return：01 06 00 41 00 04 D8 1D

Send command parsing：

01：device address 01

06：Function code 06 for writing register content

00 41：The register address of write data is 0065

00 04：Write data content of 0004

D8 1D：CRC16 check code

The device returns the analysis：

01：device address 01

06：Function code 06 for reading register content

00 41：The register address of the return write data is 0065

00 04：Returns modified data content of 0004

D8 1D：CRC16 check code

4、Set the factor

pH Data Reading					
Address	**Data Type**	**Description**	**Register number**	**Read/ Write**	**Remarks**
6	Float	Factor	2	R/W	0.1~10.0

Send the command：01 10 00 06 00 02 04 00 00 3F 80 63 D5

The equipment return：01 10 00 06 00 02 A1 C9

Send command parsing：

01：device address 01

10：Function code 16 for writing register content

00 06：The starting register address write is 0006

00 02：Write 2 registers

04：The length data is 4 bytes

00 00 3F 80：The factor value write is 1.00 (analyze 3F 80 00 00 using IEEE 754)

The device returns the analysis：

01：device address 01

10：Function code 16 for writing register content

00 06：The starting register address of the return write data is 00 06

00 02：Returns 2 registers

A1 C9：CRC16 check code

Chapter 7 Maintenance

In order to obtain the best measurement results, it is very necessary to maintain the sensor regularly. Maintenance mainly includes cleaning, inspecting damage of the sensor. You can also view the sensor's status during maintenance and inspection.

7.1 Sensor Cleaning

After long-term use, the slope and response speed of the electrode maybe slow down. The measuring terminal of the electrode can be immersed in 4% HF for 3~5 seconds or diluted HCl solution for 1~2 minutes. And then be washed with distilled water in potassium chloride (4M) solution and soaked for 24 hours. **Note：The protective cap at the front end of the PH electrode is filled with potassium chloride solution. During transportation, the protective fluid may flow out and form white crystals. We promise that this phenomenon will not affect the performance and service life of the electrodes. If the user finds that this phenomenon occurs at the new electrode, the electrode can be wiped clean directly, then immersed in water for one hour, and the activity of the electrode can be restored to normal use. If the electrode is not installed for the time being, the user can add a small amount of 3mol/L or lower concentration of potassium chloride solution by himself. If there is no potassium chloride solution, it can be replaced by tap water in a short time.**

7.2 Preservation of Sensor

During the interstitial period of the use of electrode, please try to clean the measuring terminal of the electrode with distilled water. If the electrode shall not be used for a long period of time; it should be rinsed and dried, and should be stored in the attached soak bottle or rubber cover containing the soaking solution.

7.3 Inspection on the Damage of Sensor

Check the appearance of the sensor and glass bulbs to see if they are damaged or not, if damages are found, it is necessary to replace the sensor in time. In the tested solution, if it contains sensitive bulb or junction-blocking substances leaving the electrode passivation, the phenomenon is significantly slower response time, slope reduction or unstable readings. As a result, it should be based on the nature of these contaminants, use the appropriate solvent for cleaning. Contaminants and appropriate Detergents are listed below for reference.

Contaminants	**Detergents**
Inorganic Metallic Oxide	0.1N HCl
Organic Grease Substance	Weak Alkalinity or Detergent
Resin, High Molecular Hydrocarbons	Alcohol, Acetone and Ethanol
Protein Blood Deposit	Acidity Enzyme Solution
Dyestuff Substance	Diluted Hypochlorous Acid Liquid

Note: If the customer cuts short cables without permission, they will not participate in the warranty.

7.4 Sensor maintenance

If the pH sensor is used in occasions with high oil, solvent, and sulfide content, the pH may change color and reduce the service life. Therefore, the pH sensor needs to be maintained regularly during use. (E.g. Cleaning, calibration or replacement of electrodes)