

BT8033 3-Parameter Water Quality Analyzer

Product Manual



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I. Product overview

This product is equipped with a temperature, water level, conductivity integrated acquisition of the measuring instrument, is a stable and precise High degree, low power consumption, small size, full-featured pressure-type hydro-logical water quality measurement instrument, the product uses high precision, Highly stable pressure sensors are used as pressure sensing elements, and the output data is corrected by internal intelligent linear correction and temperature control.

The degree of compensation, good to meet the user's needs for high precision and high stability of the product.

This product adopts RS485 digital output mode, which can simultaneously detect water level, water temperature, conductivity and other kinds of Parameters, communication protocol for the standard MODBUS-RTU protocol, has a good compatibility, convenient for users of large scale Module network use.

This product has the following features.

- High accuracy: water level accuracy up to 0.05% F. S, resolution up to 1mm.
- Full-featured: real-time monitoring of water level, water temperature and conductivity at the same time
- Low power consumption: intelligent power management design
- Compact size: one-piece design structure
- Transmission distance: RS485 digital output, transmission distance up to 1.2Km
- Networkable: Standard MODBUS-RTU protocol, supports network multi point and addressable operation.
- Anti-jamming: integrated anti-reverse connection, anti-overvoltage circuit and anti-jamming processing circuits

II. Areas of application

This product comprehensively realises the real-time monitoring and recording of hydro-logical and water quality parameters such as water level, water temperature and conductivity.

The products can be widely used in groundwater monitoring, reservoirs and other areas with their unique features of high precision, multi-functionality and micro-power consumption.

Surface runoff water level monitoring, tank level monitoring and many other occasions.

The main applications of this product:

- Groundwater quality and level data monitoring
- Real-time monitoring of water quality and water levels dams in reservoirs and
- Lake, surface runoff water quality, water level monitoring
- Unmanned water quality and hydro-logical monitoring stations
- Real-time monitoring of water quality liquid level and in tanks
- Industrial control system on-site liquid level and water quality monitoring

III. Structure and working principle

1. Shape structure

Wooden products adopt - body design structure, each component indirectly connected to the head is convenient and reliable, easy to disassemble, easy to

Product installation and adjustment, use and maintenance.

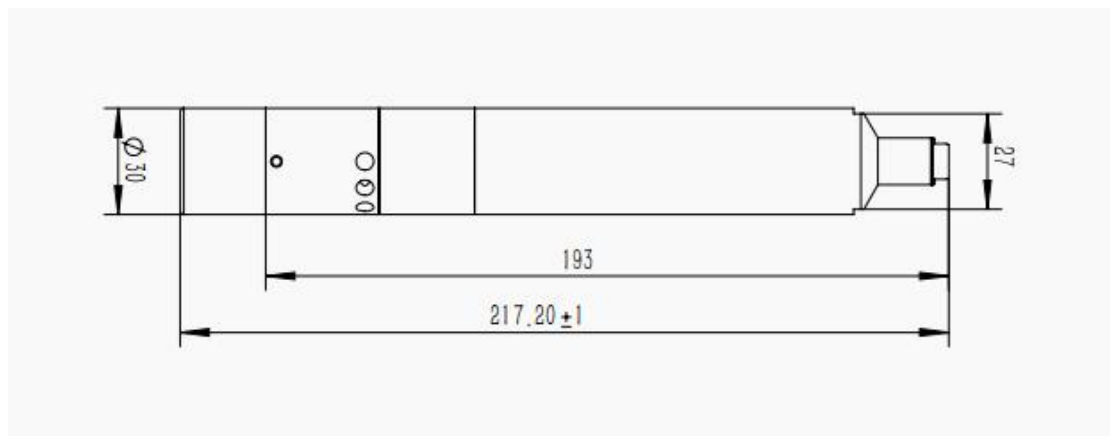


Fig. 1 Outline drawing of the product

2. Working Principle

The product adopts hydro-static level measurement principle, the central processing unit real-time acquisition or timed acquisition of pressure sensors, temperature sensors, and the use of complex algorithms within the pressure sensor data for linear correction and temperature compensation: the system adopts all the sensors for the high stability, high-precision sensors, to fundamentally ensure the stability and

accuracy of the product: the product for the RS485 digital output interface, the data protocol for the Standard MODBUS-RTU protocol, support for networking.

This product product internal integration of anti-reverse connection, anti-overload and anti-interference processing circuit, to ensure that the product works reliably in harsh environments.

IV. Main technical parameters

- 1、 **Water level measurement accuracy:** 0.05%FS (0~50°C).
- 2、 **Range:** 10m, 20m, 40m, 80m or customized.
- 3、 **Power supply voltage:** 12~30VDC
- 4、 **Operating current:** 30mA
- 5、 **Temperature compensation range:** 0~50°C.
- 6、 **Operating temperature:** -10~70 °C.
- 7、 **Communication mode:** RS485 interface MODBUS RTU protocol.
- 8、 **Temperature measurement accuracy:** earth 0.1 °C.
- 9、 **Temperature measurement resolution:** 0. 01 °C.
- 10、 **Measuring range of conductivity:** 0~ 40mS/cm
- 11、 **Conductivity measurement accuracy:** 1.5%F. S
- 12、 **Protection level:** IP68

V. Installation and use

Before installation and use, please read the product description carefully and be sure to follow the requirements of the instruction manual for installation and commissioning.

1. On-site installation

1.1 Notes on use

- 1) The bottom of the product should be as far away from the bottom of the water body as possible and installed vertically as much as possible, in order to avoid the bottom of the sludge and debris clogging the product probe inlet, to ensure the accuracy of the measurement.
- 2) It is strictly prohibited to remove the water-guide plug for use, and it is strictly prohibited to touch the pressure diaphragm of the product with hard objects.
- 3) The product should be slowly put into the logging or other application site, and it is strictly prohibited to throw it randomly, so as to avoid water hammer damage to the pressure sensor;
- 4) The maximum variation of the measured water body is preferably within 70%~90% of the full scale range of the product to ensure sufficient resolving power, accuracy and necessary safety overload capacity;
- 5) The product waterproof cable shield must be connected with the metal junction box, metal protective sleeve and other reliable metal connections together, and with the nearest earth reliable connection to ensure that the ability to protect against lightning strikes;
- 6) The twin steel wires of the four-core waterproof gas-guide cable must be tightly mounted on the field fastening device (especially for a large number of ranges) to ensure the stability of the product's work and the accuracy and reliability of the measurement results;
- 7) During use, please strictly follow the following recommended wiring sequence, to avoid short circuit, wrong connection.
- 8) Product waterproof air-conducting cable users press the line end port air-conducting tube at the waterproof molecular plug, should be properly protected, do not lose, especially in the transport and installation process to avoid falling off and damage. Once damaged, replace it in time to avoid water and moisture entering the inside of the probe through the cable, resulting in damage.

9) All cables of the product are waterproof ventilated cables. They are relatively tough and reliable, but take care to avoid abrasion and cuts from hard objects.

Particularly severe bending can lead to cable breakage or clogging of the air conduit.

10) Be careful to hold the conductivity probe gently during installation to avoid damage. Be careful not to block the oval inlet hole of the conductivity probe.

1.2 Electrical connections

This product is the output interface for the RS485 digital output, the product through the four-core waterproof air-conducting cable and external communication, air-conducting cable connector part of the outer end of the user's end of the electrical interface, including two power cables (connected to the external power supply), the two RS485 signal lines, and in addition to shielding, air-conducting tubes, double steel wire fixing line is shown in Figure 2 below.

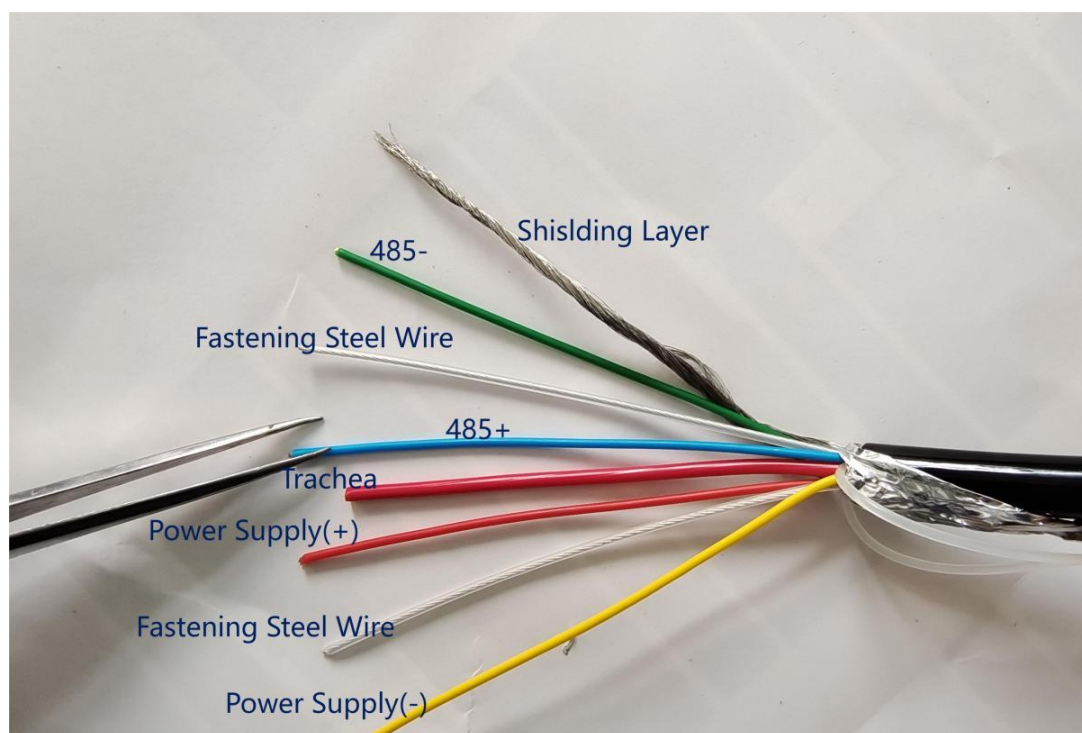


Figure 2: Cable description

The electrical interfaces of the air-conducting cables are defined in the table below:

Table 1 Definition of electrical interfaces for this product

Wire Colour	Electrical definitions
-------------	------------------------

pink	Power "+"
pornographic	Power "-"
blue (colour)	RS485 "A"
greener	RS485 "B"

Table 1

1.3 Wiring sequence

- a) All electrical equipment connected to the product must be de-energised.
- b) Reliable connection of the cable shield to earth ground
- c) Cable double wire line and fastening device reliable connection
- d) Connect the negative terminal of the product's power supply (yellow wire).
- e) Connect RS485 communication lines A (blue line) and B (green line).
- f) Connect the positive terminal (red wire) of the product's power supply,
- g) Check all connections to ensure correct and secure. May be stolen
- h) Confirm that there is no error and can be powered up to work.

2. MODBUS protocol

2.1 RTU transmission mode

This product uses the RTU (Remote Terminal Unit) mode to communicate on the MODBUS serial link, and reports to the user.

Each 8-bit byte in the text is represented as two 4-bit hexadecimal characters, and each message must be in a continuous stream of characters.

Send.

The format of each byte (11 bits) of the RTU mode is.

Coding system: 8-bit binary

Each 8-bit byte in the message contains two 4-bit hexadecimal characters (0 to 9, A to F).

Bit Definition: 1 Start Bit

8 data bits, lowest valid bit sent first

1 parity bit

1 stop bit

The transmission frame structure in MODBUS-RTU transmission mode is.

child node address	function code	data stream	CRC
1 byte	1 byte	0~252 bytes	2 bytes

Slave Address: Slave Device Address, 1~247 (0x01~0xF7)

Function Code: Indicates the requested operation command to be generated by the slave. It can be a standard or user-defined function code, with values from 1 to 127 (public function code, custom function code, reserved function code), and each value corresponds to one operation command.

Data stream: data information necessary to complete the operation of the request command, such as address, data, etc., maximum 252 bytes

CRC: CRC check bit. Low byte comes first, high byte comes second

The structure of the host request frame and the slave answer frame in MOOBUS-RTU transmission mode is the same, and the content of the child node address and function code is the same, only the data stream and the CRC check code are different.

The factory default serial communication configuration of this product is: 9600bps. no parity, 8 data bits, 1 stop bit.

2.2 Function Code Description

Function codes in the MODBUS-RTU protocol specify the type of protocol data inter-visit operations that can be performed with a single ratio of Special operation, 16-bit operation (register operation). Functions such as file record inter-visit. This product supports four functions

The responses to the energy codes are query slave address, read register operation, write register operation, read file record operations, as shown in Table 1.

Table 1 Product Function Code Definitions

Function Code	Functional Definition
03H	Read single or multiple consecutive

	registers
10H	Write single or multiple sequential registers

This product only supports the above four function codes, when sending unsupported function codes, the product will return an exception Response. Indicates that the function code does not exist. A detailed description of the four function code functions and how to use them is given in the following sections, the

The data in the request/response frames in all the following examples is hexadecimal by default, and the user can set the relative value according to the need.

should be XX (each XX represents 1BYTE).

2.2.1 03H Function Code

Function:Read single or multiple registers, you can use this function code to read the product's parameter registers, data registers.

Device and Status Registers

03H Request Frame Format.

Slave Address	Function Code	Starting Address	Number Of Registers	Crc Check Code
1 Byte	1 Byte	2 Byte	2 Byte	2 Byte
Xx	03	Xx Xx	Xx Xx	Check Digit

➤Slave Address: Valid address of the currently connected device (0x01~0xF7)

➤Starting address: The address of a single register to be read or the first address of a block of consecutive registers.

➤Number of registers: 0x0001 , actual number of registers in case of multiple registers for single registerN

03H Answer frame format.

Slave Address	Function Code	Byte Count	Register Contents	Crc Check Code
1 Byte	1 Byte	1 Byte	n*2 Byte	2 Byte
Xx	03	Xx Xx	Xx.....Xx	Check Digit

➤Slave address: same as slave address in request frame

➤Number of bytes: The return value is the number of registers in the request frame N multiplied by 2, .i.e. N*2

➤Register content: the content of the register to be read in the request frame, high byte first, low byte second

Example of 03H function code usage.

The water level, temperature and pressure values can be read from a product with address 95, which can be read using the 03H function code

4 consecutive registers with start address 0x0001 (2 for water level, 1 for temperature), number of device requests/answers

The frames are as follows.

Request data frame.

Slave Address	Function Code	Starting Address	Number Of Registers	Crc Check Code
02	03	00 01	00 03	54 38

Answer data frame.

Slave Address	Function Code	Byte Count	Register Contents	Crc Check Code
02	03	06	<u>Ff Ff Ff Ff Ff 01 2a</u>	b5 f5

2.2.2 10H Function Code

Function: Write single or multiple registers, you can use this function code to configure the product's parameter registers, complete the device

Address, serial port format, zero adjustment and other parameter settings.

10H request frame format.

Slave Address	Function Code	Starting Address	Number Of Registers	Byte Count	Configuration Word	Crc Check Code
1 Byte	1 Byte	2 Byte	2 Byte	1 Byte	n*2 Byte	2 Byte
Xx	10	Xx Xx	Xx Xx	Xx	Xx.....Xx	Check Digit

➤Slave Address: Valid address of the currently connected device (0x01~0xF7)

➤Start address: .the address of a single register or the first address of a block of consecutive registers to be set by the command

➤Number of registers: 0x0001 , actual number of registers in case of multiple registers for single register

➤Number of bytes: the amount of register data to be configured by the command N multiplied by 2

➤Configuration word: the content of the data to be written to the specified parameter register, **high byte first, low byte second**

10H Answer Frame Format.

Slave Address	Function Code	Starting Address	Number Of Registers	Crc Check Code
1 Byte	1 Byte	2 Byte	2 Byte	2 Byte
Xx	10	Xx Xx	Xx Xx	Check Digit

➤Starting address: This is the starting address in the request frame.

➤Number of registers: this is the number of registers in the request frame

10H Command Usage Examples.

Configure the baud rate of the slave device with address 95 to be 9600bps and the parity bit to be even parity, then you can use the 10H function code to configure the two consecutive registers with start address 0x0013. From the parameter register list, we can find the baud rate register address 0x0013, 9600bps corresponding to the configuration word 0x0001; parity bit register address 0x0014, even parity configuration word 0x0001, the device request/answer data frame is as follows.
Request data frame.

Slave Address	Function Code	Starting Address	Number Of Registers	Byte Count	Configuration Word	Crc Check Code
5f	10	00 13	00 02	04	<u>00</u> <u>01</u> 0001	17 5f

Answer data frame.

Slave Address	Function Code	Starting Address	Number Of Registers	Crc Check Code
5f	10	00 13	00 02	Bd 73

2.3 Exception response

The slave can create two types of responses based on the MODBUS request command from the host, one of the above 3

One is a normal MODBUS response, and the other is an abnormal MODBUS response, which is used to provide the slave with the information sent during processing.

The information related to the error that occurred. Exception Response Function Code = Request Function Code + 0x80, and provides an exception code to

Indicates the cause of the exception, such as execution of an illegal function code, incorrect register address, or out-of-range number of registers.

Exception Response Frame Format.

Slave Address	Function Code	Exception Code	Crc Check Code
1 Byte	1 Byte	1 Byte	2 Byte
Xx	Xx	Xx	Check Digit

➤Slave address: same as the address in the request frame

➤Function code: Function code in request frame+0x80

➤Exception code: indicate the cause of the exception, the code meaning is detailed as F

Table 2 Exception code definitions and descriptions

Exception Code	Causes Of Anomalies	Instructions
0x01	Function code error	Specifies a function code that does not exist
0x02	Register address error	Specifies the relative address of a register number that cannot be used.
0x03	Error in number of registers	The specified register number is out of its range of existence

3. Register List

The internal registers of this product can be divided into two types: parameter registers and data registers.

The length of the registers in the following table refers to the number of registers, the data type is divided into 2-byte UINT and 4-byte ULONG data, and the register attributes are read-only (R) and read-write (R).

Data type is divided into 2-byte UINT and 4-byte ULONG type data, and register attributes are read-only (R) and read/write (R/W).

3.1 Parameter registers

The product's general parameter registers hold the product's manufacturing information, communication settings, measurement settings, and storage.

Settings, most of the parameters are configurable (register attribute R/W), the user can modify the configuration as needed.

A few are default factory settings (register attribute R) and are not user configurable.

Table 3 Parameter register list

Register Name	Register Address	Register Length	Data Type	Causality	Instructions
Device Serial Number	0161	16	Char *	R	16 bytes, 12-bit serial number
Date Of Manufacture	0169	2	Char	R	R 4-byte integer
Version Number	0171	1	Short	R	2-byte integer, device version number
Mail Address	0130	1	Short	R/W	The address can be set from 1 to 247, Example. Modify the address to 247. The registers are configured with the following values: 00 F7
Baud	0132	1	Short	R/W	2-byte integer, baud rate setting. 1-9600 Default value 1. i.e. 9600bps
Check Digit	0134	1	Short	R/W	2-byte integer, parity bit set. 0-odd checksum, 1-even checksum. 2- No parity (2 stop bits), 3-No parity (1 stop bit); Default value 3: no parity, 1 stop bit
Density	0135	2	Float	R/W	4-byte floating point number, density of the measured liquid.

					In kg/m³, example. Configure the liquid to have a density of 1000 kg/m³. The register configuration value is: 3F 80 00 00
Hydraulic Zero Point Offset	0137	2	Float	R/W	4-byte long integer, negative numbers are binary-complemented. Code storage in millimeters (mm), example. When the measured zero point is 0lower than the actual zero point.1m , i.e. $Z_{\text{measured}} - Z_{\text{actual}} = -0.1\text{m}$ The register configuration values are: BD CC CC CD When the measured zero point is 0higher than the actual zero point.1m time, i.e. $Z_{\text{measured}} - Z_{\text{actual}} = 0.1\text{m}$ hosting The device is configured with the following values: 3D CC CC CD (The above example assumes that the original value of the register is 0, and the original value needs to be added if it is not zero.)

3.2 Data registers

This product will write the water level, temperature, and water pressure into the data register after each execution of the acquisition, and the user

You can use 03H function code to read the corresponding parameter according to the register address, and you can read a single parameter or multiple parameters at the same time.

A parameter readout.

Table 4 Data Register List

Register Name	Register Address	Register Length	Data Type	Causality	instructions
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Water Level	0001	2	Uint	R	Water level, 4-byte long integer in millimeters (mm), example. 00 00 03 E8 Indicates a water level of 1000mm
temperature of the body of water	0003	1	Short	R	Temperature (C), 2-byte integer, number of registers Values are signed data, the actual temperature is hosted The instrument value is divided by 100, Example. 00 6C indicates a temperature of 10.80C. FF 94 indicates a temperature of - 10.80C.
Water Pressure	0004	2	UINT	R	Water pressure (Pa), 4-byte long integer
Electrical Conductance	0006	2	UINT	R	32-bit binary in uS

4. Density adjustment method

Equipment factory products in accordance with the company's experimental environment for water level linear correction and uniform - calibration, in the user to make the actual use of the environment, if the measurement of the liquid temperature, purity and acceleration of gravity on-site changes in any one of the conditions will have an impact on the density of the liquid, and ultimately affect the product's measurement accuracy. For this reason, the user in the actual use of the density of the impact of the measurement accuracy, the product still can not meet the accuracy requirements, the user can adopt the following methods and steps to carry out their own on-site calibration.

Adjustment method: According to the standard measured values of Y1 and Y2 ($Y1 < 25\%FS$, $Y2 > 75\%FS$) and the corresponding measured values of y_1 and y_2 , calculate the correction slope $\Delta k = (y_2 - y_1) / (Y_2 - Y_1) - 1$, and correct the water density according to the calculated correction slope.

The procedure for on-site density adjustment is as follows.

1) Put the water level meter products into the field level, respectively collect the standard measured value Y_1 , Y_2 and product measurement.

Values y_1 , y_2 ($Y_1 < 20\%FS$, $Y_2 > 80\%FS$ recommended).

2) Calculate the slope deviation based on the data measured in step 1: $Ok = (y_2 - y_1) / (Y_2 - Y_1) - 1$;

3) Read the original water density of the product as ρ_1 , according to the original density and the slope deviation calculation need to set real

The value of the interstitial density is $\rho_2 = \rho_1 - \Delta k$.

4) Write the density value calculated in step 3 into the product density register to complete the product density adjustment.

Zero point adjustment is required to achieve the desired accuracy after the product density adjustment on site, zero point adjustment

The steps are as follows: .

1) Put the water level meter product into the liquid level in the field, collect the standard measured value Z_1 and the product measurement value z_1 , and calculate the error as $\Delta z = z_1 - Z_1$;

2) Read the original value Z in the product zeroing singularity store, and calculate the value $z = Z - \Delta x$.

3) Write the zero adjustment value calculated in step 2 into the product zero register to complete the product zero point.

Adjustments.

If the product still cannot meet the accuracy requirement after one-time density adjustment and zero point adjustment, it can be repeated to carry out the density adjustment.

Degree adjustment and zero point adjustment.

Product user parameters can be modified using the water level meter test software, we provide a detailed parameter modification within the

It is easy and convenient to operate.

VI. Failure analysis and troubleshooting

Fault Phenomenon	Screening Methods
Equipment does not communicate	Check that the external power supply is switched on
	Check for correct electrical interface connections
	Check that the baud rate setting is correct
	Check that the device address is set correctly
	The above methods still can not solve the problem please contact the manufacturer
Large data discrepancies	Short time in liquid (>1h recommended) affects accuracy
	Check that the airway is properly ventilated
	Check that the water inlet holes of the equipment are not blocked
	Re-calibration of product density and zero point
	The above methods still can not solve the problem please contact the manufacturer

VII. Care and maintenance

- 1, the most range of the water level meter can be selected, respectively, with different lengths of cable.
- 2、 After the debugging is completed, it can be used by putting it into water slowly, and there is no need for maintenance in the process of using.

VIII. Transport and storage

1. Avoid serious bumping during transport, and waterproof and moisture-proof measures should be taken.
2. The product storage place should avoid corrosive gases erosion:.
3. The product should be stored at a temperature of 0-50°C and a humidity of 50-95 per cent.
4. Strong vibration and shock are strictly prohibited.

IX. Unpacking and inspection

1. After unpacking, check that the documents and accessories are complete according to the contents of the dispatch list (shown in the table below).
2. Observe whether the water level gauge is damaged due to transport, etc., so as to deal with it properly.

Serial Number	Items	Quantity
1	Shipment list	1
2	Product Manuals	1
3	Certificate of Conformity	1
4	Pressure-type level gauge (with cable)	1

X. Precautions

1. Precautions for use

- ◆ It is strictly prohibited to remove the water-conducting plug for use, and it is strictly prohibited to disassemble and reassemble it.
- ◆ Do not touch the pressure sensor diaphragm with hard objects.
- ◆ It is strictly prohibited to throw the product into the liquid to be measured during use.
- ◆ Do not block the air duct during installation.
- ◆ When wiring, please follow the recommended wiring sequence.
- ◆ Do not use this product in an over-range environment.

2. Safety Precautions

- ◆ Handle with care and do not dismantle with violence.
- ◆ Do not expose to strong acids, alkalis and other corrosive substances.
- ◆ Strictly prohibit the use of ultra-high temperature

XI. After-sales service and technical support

1. After-sales service

Within one year from the date of shipment, the Company shall not be liable for any defective products caused by material and workmanship.

The product is free to replace or repair; the use of the process of non-quality reasons for product failure, our company can carry out a

Reimbursement for maintenance, only the cost of materials, packaging and shipping costs are borne by the user.

2. Technical support

For difficult problems during installation or use, contact the company or contact the regional

of salespeople, with telephone or on-site guidance from a technician.

XII. Ordering instructions

1, the name of the product, model specifications.

2, the main technical parameters of the product and the use of the environment;

3、 If the user has special requirements, it should be specially indicated when ordering.