Low-range Turbidity Sensor

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Preface

- Thank you for purchasing our company's products.
- This manual is an instruction manual about the various functions, wiring methods, setup methods, operation methods, fault handling methods, etc. of the product.
- Please read this manual carefully before operation, use this product correctly, and avoid unnecessary losses caused by incorrect operation.
- After you finish reading, please keep it in a convenient place for easy access at any time for reference during operation.

Note

- If there are any modifications to the content of this manual due to functional upgrades or other reasons, we will not notify you.
- We strive to ensure the accuracy of the content in this manual. If you find any errors, please contact us.
- The content of this manual is strictly prohibited from being reproduced or copied.
- This product is prohibited from use in explosion-proof environments.

Version

U-SUP-PTU-8012-EN1

Confirm Packaging Content

After opening the packaging box, please confirm the contents of the packaging before starting the operation. If you find any errors in the model and quantity or physical damage to the appearance, please contact our company.

Product List

Product Packaging Content

Number	Product Name	Quantity	Remarks
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Contents

1. Product Overview

The low-range turbidity sensor guides parallel light emitted by the light source downward into the water sample in the sensor. The light is scattered by suspended particles in the water sample, and the scattered light at a 90 degree angle to the incident angle is received by a silicon photovoltaic receiver immersed in the water sample. The turbidity value of the water sample is obtained by calculating the relationship between the 90 degree scattered light and the incident beam.

It can be widely used for online monitoring of turbidity in pre filtration, post filtration, factory water, and direct drinking water systems in water treatment plants; Online monitoring of turbidity in various industrial production processes such as circulating cooling water, filtered water, and reclaimed water reuse systems. The size of the low range turbidity sensor is shown in Figure 1.

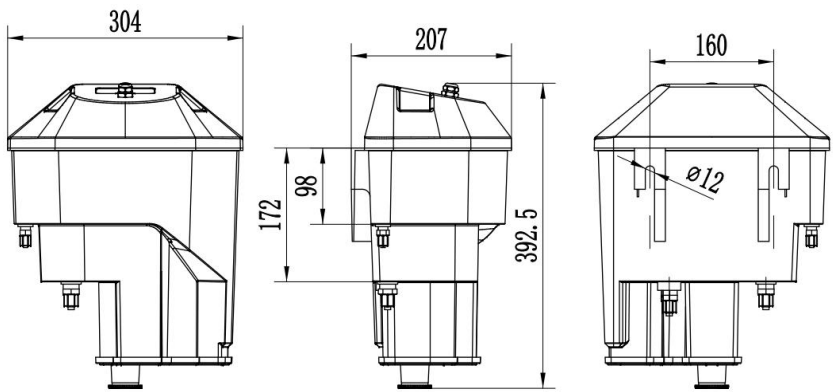


Fig. 1 Size Diagram of Low Range Turbidity Sensor

2. Technical Parameter

Table 1

Specifications	Description
Measurement Range	(0.001~100)NTU
Measurement Accuracy	(0.001-40) NTU is ± 2% of the reading or ± 0.015NTU, whichever is greater; (40~100) NTU is ± 5% of the reading
Repeatability	±2%
Resolution	(0.001~0.1)NTU，Depending on different ranges
Water Sample Flow Rate	300mL/min≤X≤700mL/min
Pipe Fitting	Injection Port：1/4NPT； Discharge Port：1/2NPT
Pressure Resistance	≤0.2Mpa
Main Materials of Sensors	Body：ABS + SUS316L； Sealing component: nitrile rubber; Cable: PUR
Power Supply	12VDC
Communication Output	RS485，MODBUS-RTU Communication Protocol
Storage Temperature	(-15~60)℃
Working Environment	(0~45)℃（No condensation）
Weight	2.1kg
Level of Protection	IP65（indoor）
Cable Length	Standard 3-meter cable, LED version can be extended up to 30 meters
Power Consumption	LED version sensor with low power consumption of 3.5W

3. Installation

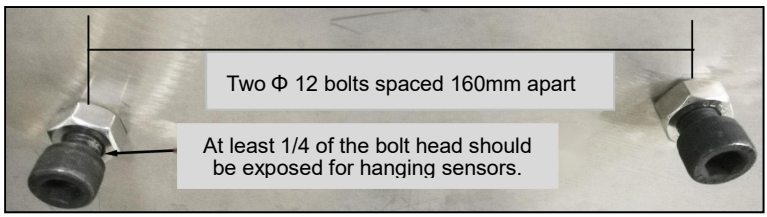
3.1. Installation of Sensors

Install the sensor as close as possible to the sampling point. The sample will produce a faster response time over a shorter distance. Clean the inside of the sensor before installation. Install according to the standard installation environment detailed below.

（1）Installed in a location isolated from vibration.

（2）Fix two Ø 12 bolts horizontally on the installation surface, with a distance of 160mm between them. At least 1/4 of the bolt head should be exposed for hanging the rotary sensor (as shown in the figure below).

Fig. 2



（3）There should be at least 260mm of space above the instrument panel for removing the sensor cover. There should also be sufficient space below the sensor to remove the bottom plug cotton during calibration or cleaning, and a container should be placed under the drainage outlet.

（4）Hang the sensor properly, then place the sensor cover on top of the low turbidity sensor, and move the sensor cover forward and backward slightly to ensure that it is just in place on the instrument panel. If the sensor cover (head) is not properly positioned, it may cause light leakage and incorrect readings.

Note: Ensure that the turbidity meter sensor body is horizontal and vertical.

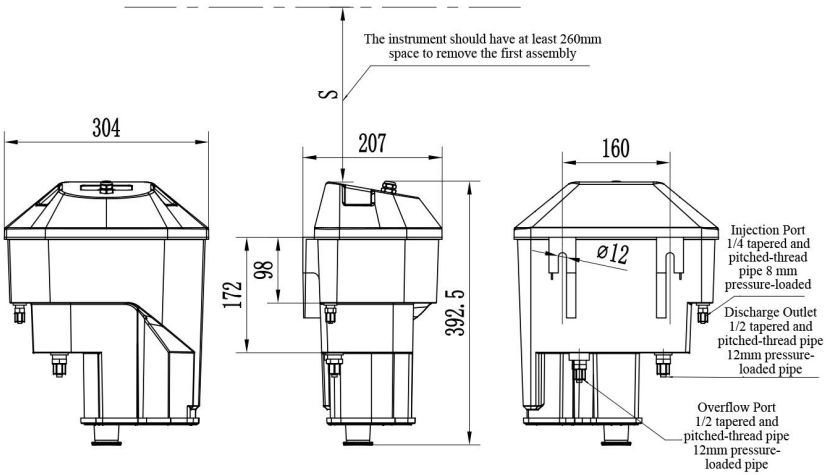


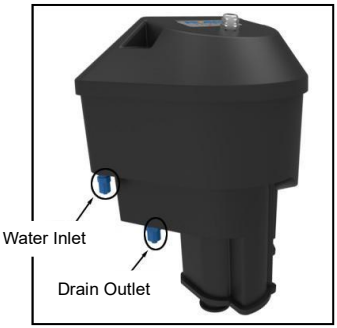
Fig. 3 Sensor Installation Diagram

（5）Install water sample pipeline (user provided)

It is recommended to use quarter cone pipe thread, rigid or semi-rigid pipe for the water sample tube. The pipe wiring should be directly connected to the low turbidity sensor and sampling point as much as possible to minimize the lag time of water sample circulation.

（6）Connection of sample inlet and outlet

There are water sample inlet and outlet on the turbidity sensor. The water inlet pipe fitting is a 1/4 cone pipe thread, 8mm pressure bearing pipe fitting. The water sample drainage outlet is equipped with a 1/2 cone pipe thread and a 12mm pressure bearing pipe fitting. The installation steps are as follows:



● Find the inlet and outlet as shown in the above picture.

● Unscrew the pressure bearing fittings of the inlet and outlet, then insert the matching hose into the fittings as shown in the above figure, and finally tighten the fittings.

● Cut the inlet pipe into two parts and insert them into both sides of the shut-off valve. Rotate the shut-off valve to control the flow rate, as shown in the above figure. Connect the empty end to the water sample pipeline.

Note：

The required flow rate is between 300 and 700 milliliters per minute. The flow rate entering the turbidity meter can be controlled by the shut-off valve on the inlet pipeline. Various flow rates below 300 milliliters per minute will reduce response time and result in incorrect readings. Various flow rates above 700 milliliters per minute will cause the turbidity meter to overflow, indicating that the flow rate is too high.

（7）To prevent overflow of water, an overflow port is installed on the back of the sensor. The matching overflow pipe can be directly inserted into the overflow port to prevent the sensor from overflowing.

3.2. Connection of Sensors

Sensors are correctly connected according to the following wire core definitions:

Core Number	1	2	3	4	5
Sensor Wires	Brown	Black	Blue	White	Yellow&Green
Signal	+12VDC	AGND	RS485 A	RS485 B	Ground Wire

4. Interface and Operation

4.1. User Interface

The sensor is connected to the computer via RS485 to USB and then connected using Modbus Poll.

Note: Modbus Poll software is a universal software that can be downloaded online by oneself.

4.2. Parameter settings

（1）Click on "Setup" on the menu bar, select "Read/Write Definition", and then set the parameters (the slave address used for the first time is based on the slave label). Click "OK".

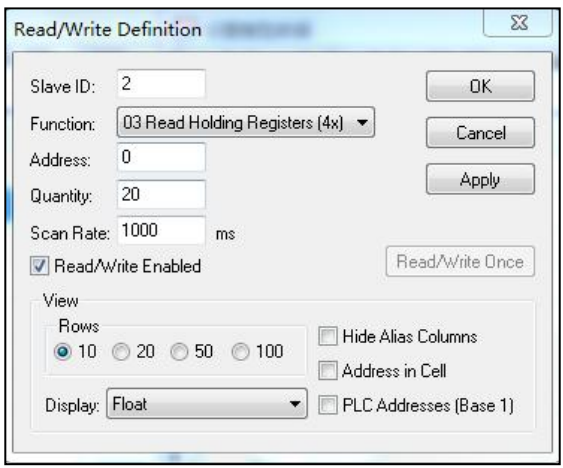


Fig. 4

Note: When the slave address is changed, communication will be carried out with the new address, and the next connected slave address will also be the most recently changed address.

（2）Click on "Connection" on the menu bar, select the first line "Connection setup" from the drop-down menu to set (the baud rate for the first time is based on the slave label), and click "OK".

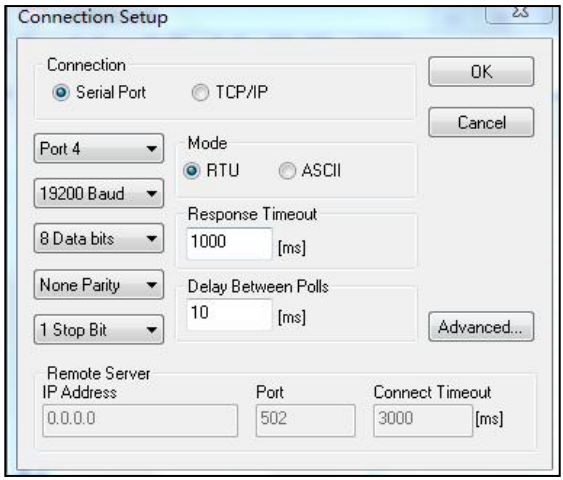


Fig. 5

Note: The port is set according to the connected port number.

Tip: If the sensor has been connected according to the instructions and a Timeout Error appears at the software Display status, it indicates that it has not been connected properly. Remove and replace the USB connection port or check the USB to RS485 converter, etc. Repeat the above steps until the sensor is successfully connected.

5. Sensor Calibration

5.1. Calibration of Standard Solution

The low-+range turbidity sensor has been calibrated before leaving the factory. If self calibration is required, the following steps can be followed. Turbidity calibration requires zero point correction first, followed by calibration of the standard solution. The specific steps are as follows:

Before calibration, clean the photoelectric cell window, sensor body, or calibration cylinder with deionized water and dry them with a soft, lint free cloth.

（1）Connect the sensor to Modbus software;

（2）After setting the parameters according to section 4.2, right-click on the second column and select "Format", then click on "Float CD AB", as shown in the following figure, and wipe the sensor clean;

Mbpoll1

Tx=426:Err=1:ID=10:F=03:SR=1000ms

	Alias	00000	Alias	00010
0	Principal Value	0.0082	Supply Voltage	-24515
1		---		16696
2	Internal Temperature	26.4	Lamp Current	3697
3		---		15975
4	Deviation Value	0	Standard Solution Calibration	0
5				16800
6	Factor	0.82	Water Sample Calibration	15148
7		---		19362
8	Lamp Voltage	4.20015	Restore Factory Fefault	-10487
9				15395

Fig. 6

（3）Slowly immerse the sensor into deionized water, click on the "06" mark on the menu bar, and the box below will pop up. Enter "33" at Address, then enter "11" at Value and click Send. Wait for 15 seconds to complete zero

calibration.

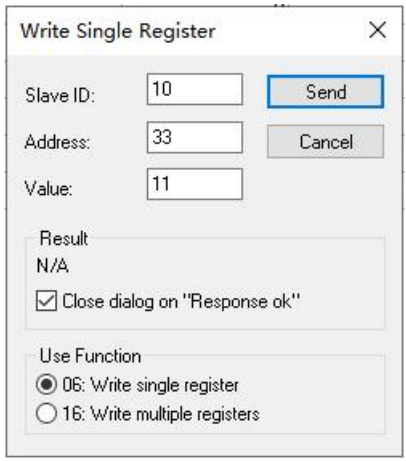


Fig. 7

（4）Wipe the zero point calibrated sensor dry, then pour the calibration standard solution (we recommend using 20NTU standard solution, users can also choose other concentrations of standard solution) into the sensor body, stir the standard solution evenly (be careful not to produce bubbles).

（5）After the main value stabilizes, select "16" in the menu bar to enter "14" for Address and "2" for Quantity in the dialog box that appears. Change the Type to "Float CD AB", double-click the value that pops up on the right to enter "20 (standard solution value)" for Value, click "OK", and then click "Send", as shown in the following figure;

（6）Calibration completed, remove the sensor for cleaning and wipe clean.

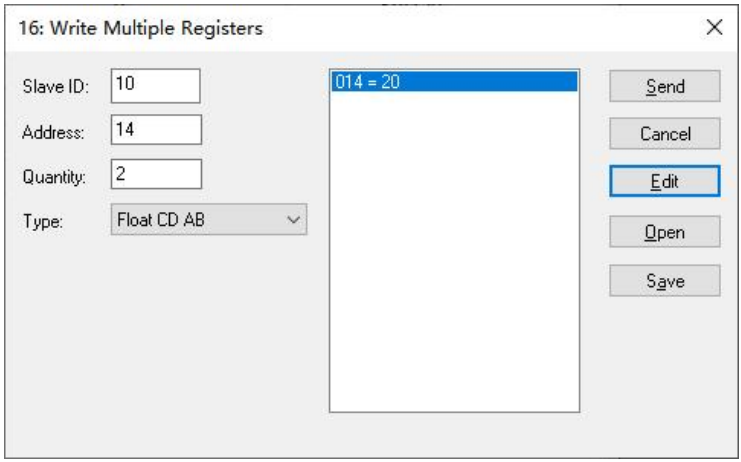


Fig. 8

5.2. Water Sample Calibration

The steps for water sample calibration are consistent with those for standard solution calibration.

（1）When calibrating the water sample, open the water sample regulating valve and start the water sample flow sensor. Let the sensor run for a sufficient amount of time to fully wet the pipeline and sensor, and adjust the regulating valve to stabilize the reading. After the reading stabilizes, calibrate.

（2）After the main value stabilizes, select "16" in the menu bar to enter "16" for Address and "2" for Quantity in the dialog box that appears. Change the Type to "Float CD AB", double-click the value that pops up on the right to enter "20 (water sample value)" for Value, click "OK", and then click "Send", as shown in the following figure;

（3）Calibration completed, remove the sensor for cleaning and wipe clean.

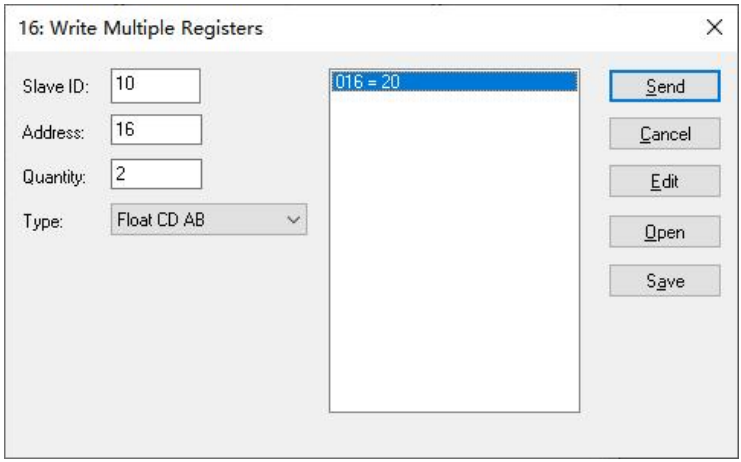


Fig. 9

5.3. Deviation Value

If there is a deviation between the measured value and the standard solution value, the deviation value can be set for the calibration value.

（1） Connect the sensor to Modbus software；

（2） After setting the parameters according to section 4.2, right-click on the second column and select "Format", then click on "Float CD AB" as shown in the figure below, and wipe the sensor clean；

Mbpoll1

Tx=426:Err=1:ID=10:F=03:SR=1000ms

	Alias	00000	Alias	00010
0	Principle Value	0.0082	Supply Voltage	-24515
1		—		16696
2	Internal Temperature	26.4	Lamp Current	3697
3		—		15975
4	Deviation Value	0	Standard Solution Calibration	0
5				16800
6	Factor	0.82	Water Sample Calibration	15148
7		—		19362
8	Lamp Voltage	4.20015	Restore Factory Default	-10487
9				15395

Fig. 10

（3） Slowly immerse the sensor into the turbidity standard solution；

（4） Wait for the numerical stability and record the measured value；

（5） Calculate the deviation value; The deviation value is equal to the standard solution value minus the value measured in step 4. (Deviation value=standard solution value - measured value)；

（6） Select "16" from the menu bar and enter "04" for Address and "2" for Quantity in the dialog box that appears. Change the Type to "Float CD AB", double-click the value that pops up on the right, enter "Deviation Value" (the deviation value is calculated in step 5), click "OK", and then click "Send".

（7） Calibration completed, remove the sensor for cleaning and wipe clean.

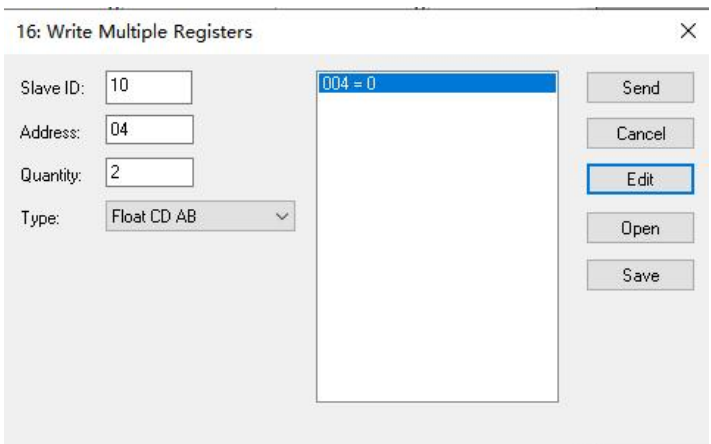


Fig. 11

5.4. Factor

If there is a deviation between the measured value and the standard solution value, the calibration value can also be factor adjusted (with a correction range of 0.1-10).

（1） Connect the sensor to Modbus software；

（2） After setting the parameters according to section 4.2, right-click on the second column and select "Format", then click on "Float CD AB" as shown in

the figure below, and wipe the sensor clean；

Mbpoll1

Tx=426:Err=1:ID=10:F=03:SR=1000ms

	Alias	00000	Alias	00010
0	Principle Value	0.0082	Supply Voltage	-24515
1		---		16696
2	Internal Temperature	26.4	Lamp Current	3697
3		---		15975
4	Deviation Value	0	Standard Solution Calibration	0
5				16800
6	Factor	0.82	Water Sample Calibration	15148
7		---		19362
8	Lamp Voltage	4.20015	Restore Factory Default	-10487
9				15395

Fig. 12

（3） Slowly immerse the sensor into the turbidity standard solution；

（4） Wait for the numerical stability and record the measured value；

（5） Calculate the correction factor; The correction factor is equal to the standard solution value divided by the value measured in step 4. (Factor=standard solution value/measured value)；

（6） Select "16" from the menu bar and enter "06" for Address and "2" for Quantity in the dialog box that appears. Change the Type to "Float CD AB", double-click the value that pops up on the right, enter "Factor" for Value (the factor value is calculated in step 5), click "OK", and then click "Send".

（7） Calibration completed, remove sensor for cleaning and wipe clean.

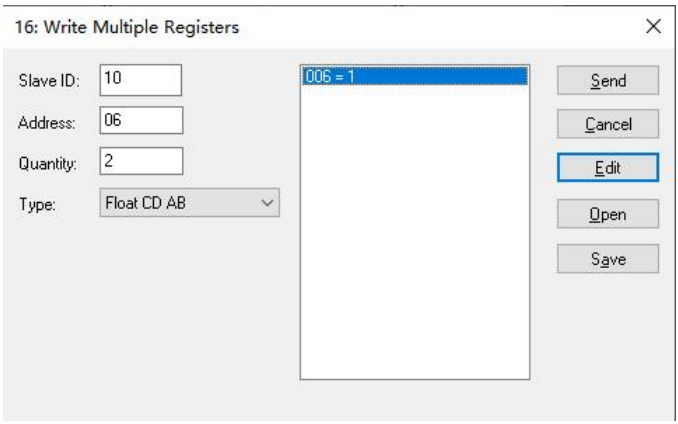


Fig. 13

Note: Do not disturb or mix dilution water during testing, as it can cause various noises (fluctuations) in readings.

6. Maintenance

In order to achieve the best measurement results, regular maintenance and upkeep are necessary. Maintenance and upkeep mainly include cleaning the sensors and checking if they are damaged. During maintenance and testing, the relevant status of sensors can also be viewed.

6.1. Cleaning of Sensors

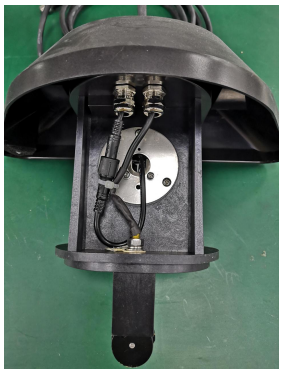
The two lenses on the sensor need to be cleaned. Please regularly clean and maintain them according to actual usage to ensure measurement accuracy. When cleaning, rinse with clean water first, and then use a cleaning agent and cloth to wipe away stubborn stains.

6.2. Sensor Damage Inspection

Check the appearance of the sensor for any damage. If there is any damage, contact the after-sales maintenance center for replacement in a timely manner to prevent water ingress and malfunction of the sensor due to damage.

6.3. Sensor Bulb Replacement - LED Version

The light bulb in the low turbidity sensor is a consumable, and it is recommended to replace it once a year to ensure the accuracy of the instrument.
The specific replacement steps are as follows:



（1）Remove the upper cover of the low turbidity sensor, and the back view of the bulb is shown in the above figure.

（2）Find the power cord for the light bulb and disconnect it.

(3) Unscrew the screws marked in the box on Figure C, and then remove the bulb.

（4）Install the new light bulb according to the reverse process of the appeal.

7. Warranty and After-Sales Service

Our company promises to customers that the hardware accessories provided during the supply of this instrument have no defects in material and manufacturing process.

Starting from the date of purchase of the instrument, if we receive notification from the user regarding such defects during the warranty period, our company will provide unconditional free maintenance or replacement for products that are indeed defective. We guarantee that all non customized products can be returned or exchanged within 7 days.

Disclaimer

During the warranty period, product malfunctions caused by the following reasons are not within the scope of the three guarantee service：

(1) Improper use by the customer resulted in product malfunction.

(2) The customer's self disassembly, repair, and modification of the product resulted in product malfunction.

After sales service commitment:

(1) We promise to respond and handle customer technical questions within 2 hours after receiving them.

(2) We promise to provide test results within 3 working days and repair results within 7 working days after receiving the instruments for factory repair.

8. Communication Protocol

The sensor is equipped with MODBUS RS485 communication function. Please refer to section 3.2 of this manual for communication wiring. The specific MODBUS-RTU table is shown in the following table.

Table 2

MODBUS-RTU	
Baud Rate	4800/9600/19200/38400
Data Bits	8 Bits
Parity Check	Null
Stop Bit	1 Bit

Table 3

Address	Function Description	Data Type	Range
0	Principal Value	Floating Point（OR）	0.001-100
2	Internal Temperature	Floating Point（OR）	0-100℃
4	Deviation Value	Floating Point（RW）	±80NTU（Default 0）
6	Factor	Floating Point（RW）	0.1-10（Default 1）
8	Lamp Voltage	Floating Point（OR）	
10	Supply Voltage	Floating Point（OR）	
12	Lamp Current	Floating Point	

Address	Function Description	Data Type	Range
		（OR）	
Standard solution calibration (first step zero point calibration, second step standard solution calibration)			
33	Zero Point Calibration	Integer	Send value 11
14	Standard Solution Calibration	Floating Point （RW）	Send value 0-60NTU
16	Water Sample Calibration	Floating Point （OW）	Send value 0-60NTU
18	Restore Factory Default	Integer（OW）	Restore to default curve, zero point, factor, deviation value Send value 11
20	Signal Averaging	Integer（RW）	0:Null 1:5s 2:15s 3:30s（Default） 4:60s
21	Alarm Message	Integer（OR）	（1）Leakage of light alarm （2）The light bulb is not working. （3）Leakage of light& Bulb is not working. （4）Over range alarm （5）Leakage&Over Range

Address	Function Description	Data Type	Range
27	Probe Address	Integer（RW）	1-200（Default 10）
28	Probe Baud Rate	Integer（RW）	0:4800 1:9600 2:19200 (Default) 3:38400
9999	Restore Modbus Default (with correct baud rate)	Integer（OW）	Send value 99 （Restore to 19200,10）

485 Analysis

- Read the Main Value

Table 4

Address	Function Description	Data Type	Range
0	Principal Value	Floating Point（OR）	0.001-100

Dispatch Orders：01 03 00 00 00 02 C4 0B

Equipment Return：01 03 04 00 00 40 E0 CA 7B

Send Command Parsing：

01：Device Address 01

03：Function code for reading register contents 03

00 00：The starting register address for reading 0000.

00 02：Read 2 registers.

C4 0B：CRC16 Check Code

Device Return Analysis：

01：Device Address 01

03：Function code for reading register contents 03.

04：The length of the returned data 4 bytes.

00 00 40 E0：The main value read is 7.00 (using IEEE 754 method to parse 40 E0 00 00).

CA 7B：CRC16 Check Code

- Read alarm information

Table 5

Address	Function Description	Data Type	Range
21	Alarm Message	Integer（OR）	（1）Leakage of light alarm （2）The light bulb is not working. （3）Leakage of light&Bulb is not working. （4）Over range alarm （5）Leakage of light&Over range

Dispatch Orders：01 03 00 15 00 01 95 CE

Equipment Return：01 03 02 00 01 79 84

Send command parsing：

01：Device Address 01

03：Function code for reading register contents 03

00 15：Read the starting register address 0021

00 01：Read 1 register

95 CE：CRC16 Check Code

Device Return Analysis：

01：Device Address 01

03：Function code for reading register contents 03

02：The length of the returned data 2 bytes

00 01：The alarm information read 1

79 84：CRC16 Check Code

- Restore factory default

Table 6

Address	Function Description	Data Type	Range
18	Restore factory default	Integer（OW）	Restore to default curve, zero point, factor, deviation value Send value 11

Dispatch Orders：01 06 00 12 00 0B 68 08

Equipment Return：01 06 00 12 00 0B 68 08

Send command parsing：

01：Device Address 01

06：Function code for writing register contents 06

00 12：Register address for writing data 0018

00 0B：Write data content 0011

68 08：CRC16 Check Code

Device Return Analysis：

01：Device Address 01

06：Function code for writing register contents 06

00 12：Return the register address for writing data 0018

00 0B：The modified data content returned 0011

68 08：CRC16 Check Code

- Water Sample Calibration

Table 7

Address	Function Description	Data Type	Range
16	Water Sample Calibration	Floating Point（OW）	Send Value 0-60NTU

Dispatch Orders：01 10 00 10 00 02 04 00 00 3F 80 E2 F3

Equipment Return：01 10 00 10 00 02 40 0D

Send Command Parsing：

01：Device Address 01

10：Function code for writing register contents 16

00 10：The starting register address for writing data 0016

00 02：Write data for two registers

04：Data length 4 bytes

00 00 3F 80：The calibration value of the water sample written is 1.00 (analyzed using IEEE 754 method for 3F 80 00 00)

E2 F3：CRC16 Check Code

Device Return Analysis：

01：Device Address 01

10：Function code for writing register contents 16

00 10：Return the starting register address for writing data0016

00 02：Return 2 registers

40 0D：CRC16 Check Code