Turbidity sensor

Supmea

Headquarters

5th floor,Building 4,Singapore Hangzhou Science Technology Park,No. 6 street,
Hangzhou Economic Development Area,Hangzhou 310018,China

Singapore

2 Venture Drive #11-30 Vision Exchange Singapore

info@supmea.com
www.supmea.com
Supmea Automation Co.,Ltd.

Preface

Thank you for purchasing turbidity sensor. Please read this manual carefully before operating and using it correctly to avoid unnecessary losses caused by false operation.

Note

- Modification of this manual's contents will not be notified as a result of some factors, such as function upgrading.
- We try our best to guarantee that the manual content is accurate, if you find something wrong or incorrect, please contact us.
- This product is forbidden to use in explosion-proof occasions.

Version

U-SUP-PTU-8010-EN1

Safety Precautions

In order to use this product safely, be sure to follow the safety precautions described.

About this manual

- Please submit this manual to the operator for reading.
- Please read the operation manual carefully before applying the instrument. On the precondition of full understanding.
- This manual only describes the functions of the product. The company does not guarantee that the product will be suitable for a particular use by the user.

Precautions for protection, safety and modification of this product

- To ensure safe use of this product and the systems it controls, Please read carefully the operation manual and understand the correct application methods before putting into operation, to avoid unnecessary losses due to operation mistakes. If the instrument is operated in other ways not described in the manual, the protections that the instrument give may be destroyed, and the failures and accidents incurred due to violation of precautions shall not be borne by our company.
- When installing lightning protection devices for this product and its control system, or designing and installing separate safety protection circuits for this product and its control system, it needs to be implemented by other devices.
- If you need to replace parts of the product, please use the model specifications specified by the company.
- This product is not intended for use in systems that are directly related to personal safety.Such as nuclear power equipment, equipment using radioactivity, railway systems, aviation equipment, marine equipment, aviation equipment and medical equipment.If applied, it is the responsibility of the user to use additional equipment or systems to ensure personal safety.

- Do not modify this product.
- The following safety signs are used in this manual:

Hazard, if not taken with appropriate precautions, will result in serious personal injury, product damage or major property damage.

Warning:Pay special attention to the important information linked to product or particular part in the operation manual.

- Confirm if the supply voltage is in consistent with the rated voltage before operation.
- Don't use the instrument in a flammable and combustible or steam area.
- To prevent from electric shock, operation mistake, a good grounding protection must be made.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at is-electric level, shielded, wires shall be located rationally, SPD surge protector shall be applied properly.
- Some inner parts may carry high voltage. Do not open the square panel in the front except our company personnel or maintenance personnel acknowledged by our company, to avoid electric shock.
- Cut off electric powers before making any checks, to avoid electric shock.
- Check the condition of the terminal screws regularly. If it is loose, please tighten it before use.
- It is not allowed to disassemble, process, modify or repair the product without authorization, otherwise it may cause abnormal operation, electric shock or fire accident.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine or other organic solvents. Prevent all kinds of liquid from splashing on the product. If the product falls into the water, please cut off the power immediately, otherwise there will be leakage, electric shock or even a fire

accident.

- Please check the grounding protection status regularly. Do not operate if you think that the protection measures such as grounding protection and fuses are not perfect.
- Ventilation holes on the product housing must be kept clear to avoid malfunctions due to high temperatures, abnormal operation, shortened life and fire.
- Please strictly follow the instructions in this manual, otherwise the product's protective device may be damaged.

- Don’t use the instrument if it is found damaged or deformed at opening of package.
- Prevent dust, wire end, iron fines or other objects from entering the instrument during installation, otherwise, it will cause abnormal movement or failure.
- During operation, to modify configuration, signal output, startup, stop, operation safety shall be fully considered. Operation mistakes may lead to failure and even destruction of the instrument and controlled equipment.
- Each part of the instrument has a certain lifetime, which must be maintained and repaired on a regular basis for long-time use.
- The product shall be scrapped as industrial wastes, to prevent environment pollution.
- When not using this product, be sure to turn off the power switch.
- If you find smoke from the product, smell odor, abnormal noise, etc., please turn off the power switch immediately and contact the company in time.

Disclaimer

- The company does not make any guarantees for the terms outside the scope of this product warranty.
- This company is not responsible for damage to the instrument or loss of parts or unpredictable damage caused directly or indirectly by improper operation of the user.

No.	Name	Quantity	Note
1	Turbidity Sensor	1	
2	Manual	1	
3	Certificate	1	

After opening the box, please confirm the package contents before starting the operation.If you find that the model and quantity are incorrect or there is physical damage in appearance, please contact us.

Contents

1. Product Specifications

Table 1 Technical Specifications of Turbidity Sensor

Specification	Details
Measurement Range	0.01-3000 NTU
Measurement Accuracy	Less than ±5% of the measured reading or ±0.5NTU, whichever is greater
Repeatability	±3%
Resolution	0.01NTU, 0.1NTU, Depend on the measuring range
Pressure Range	≤0.4Mpa
Main Material	Body: SUS316L; Cable: PUR
Power Supply	9~36VDC
Communication Protocol	MODBUS RS485
Storage Temperature	-15-50℃
Measuring Temperature	0-45℃（Non-freezing）
Weight	0.8KG
Protective Rate	IP68/NEMA6P;
Cable Length	Standard:10m, the maximum may be extended to 100m

Note: Product specifications are subject to change without notice.

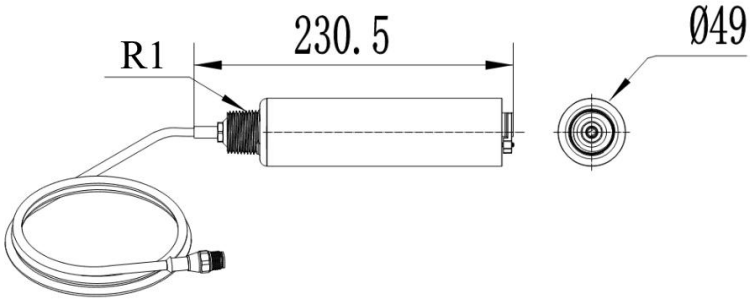
2. Product Overview

2.1. Product Information

The turbidity sensor is based on infrared scattered light technology, that is the infrared light emitted by the light source will scatter when passing through the sample under test, and the intensity of the scattered light is proportional to the turbidity value. The turbidity sensor is provided with a scattered light receiver in the direction of 90°, and the turbidity value is obtained by analyzing the intensity of the set of scattered light.

This product is widely used in online monitoring of turbidity of water inlet and sedimentation tank in waterworks and online monitoring in sewage plant, industrial production process and wastewater treatment process. The sensor dimensions are shown in Figure 1.

No automatic cleaning device:



With automatic cleaning device:

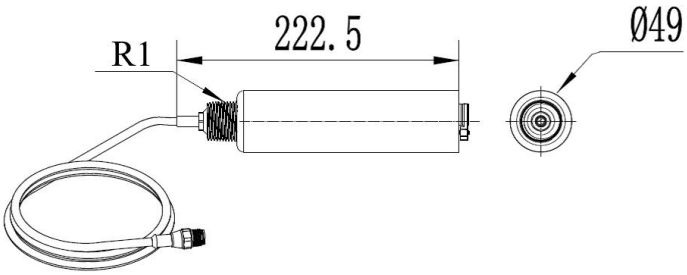


Fig. 1 Dimension Diagram of Turbidity Sensor

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.

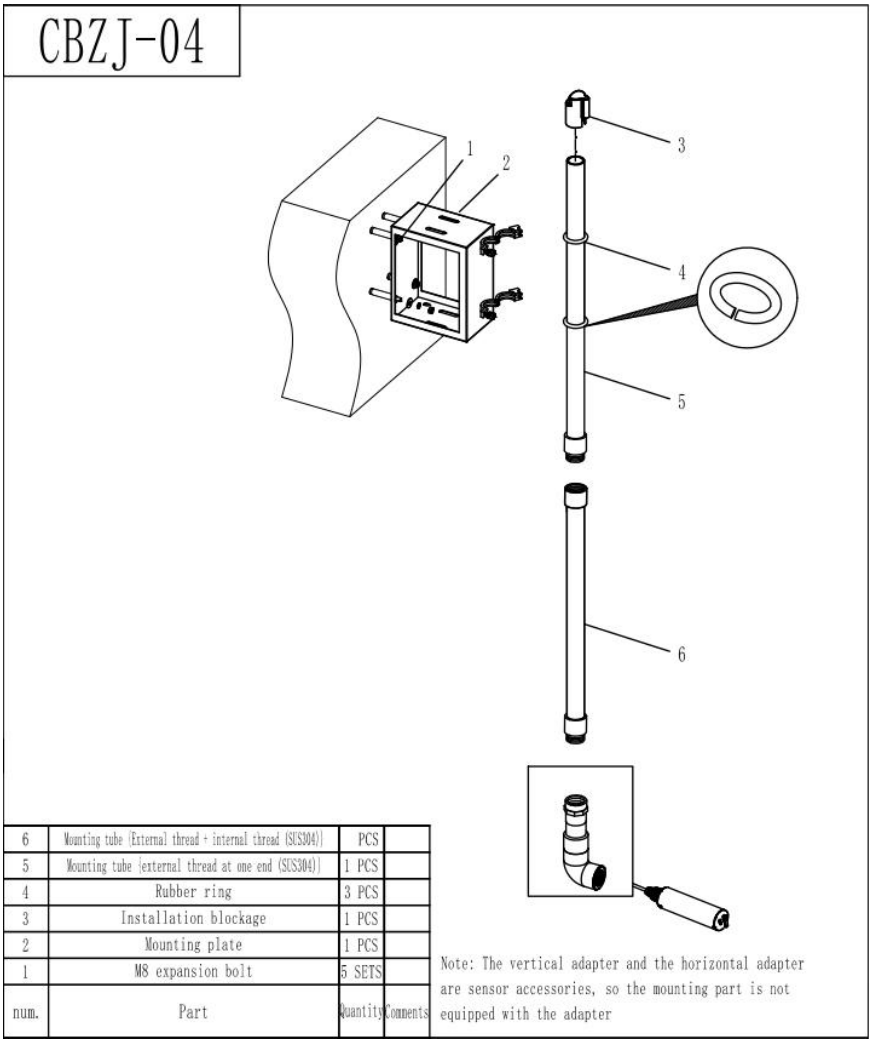
 While this symbol indicates an electric shock or risk of death from electric shock.

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.

3. Installation

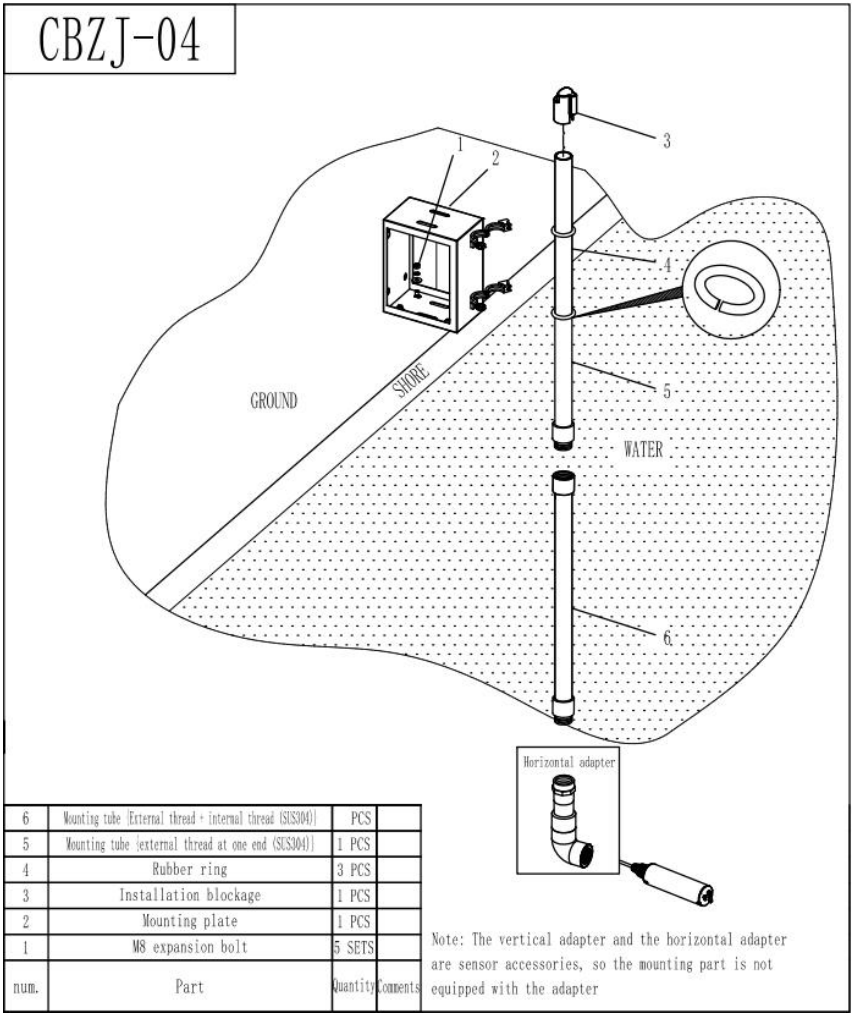
3.1. Installation of Sensors

3.1.1. Quick Dismantling Pool Side Fixed Installation



num.	Part	Quantity	Comments
6	Mounting tube (External thread + internal thread (SUS304))	PCS	
5	Mounting tube (external thread at one end (SUS304))	1 PCS	
4	Rubber ring	3 PCS	
3	Installation blockage	1 PCS	
2	Mounting plate	1 PCS	
1	M8 expansion bolt	5 SETS	

Fig. 2 Quick Dismantling Pool Side Installation Sketch Map (wall space)

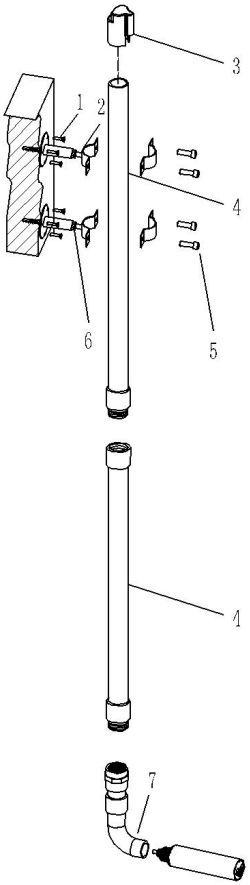


num.	Part	Quantity	Comments
6	Mounting tube (External thread + internal thread (SUS304))	PCS	
5	Mounting tube (external thread at one end (SUS304))	1 PCS	
4	Rubber ring	3 PCS	
3	Installation blockage	1 PCS	
2	Mounting plate	1 PCS	
1	M8 expansion bolt	5 SETS	

Fig. 3 Quick Dismantling Pool Side Installation Sketch Map (ground)

3.1.2. Classic Pool Side Fixed Installation

CBJD-04



num.	Part
7	rotary union(R1 to R$\frac{5}{4}$)
6	M8 hex nut
5	bolt M8*16
4	UPVC pipes (DN32)
3	end cap
2	pipe hoop (Φ40)
1	M4 expansion bolt

Fig. 4 Classic Pool Side Fixed Installation Sketch Map

3.1.3. Railing Fixed Installation

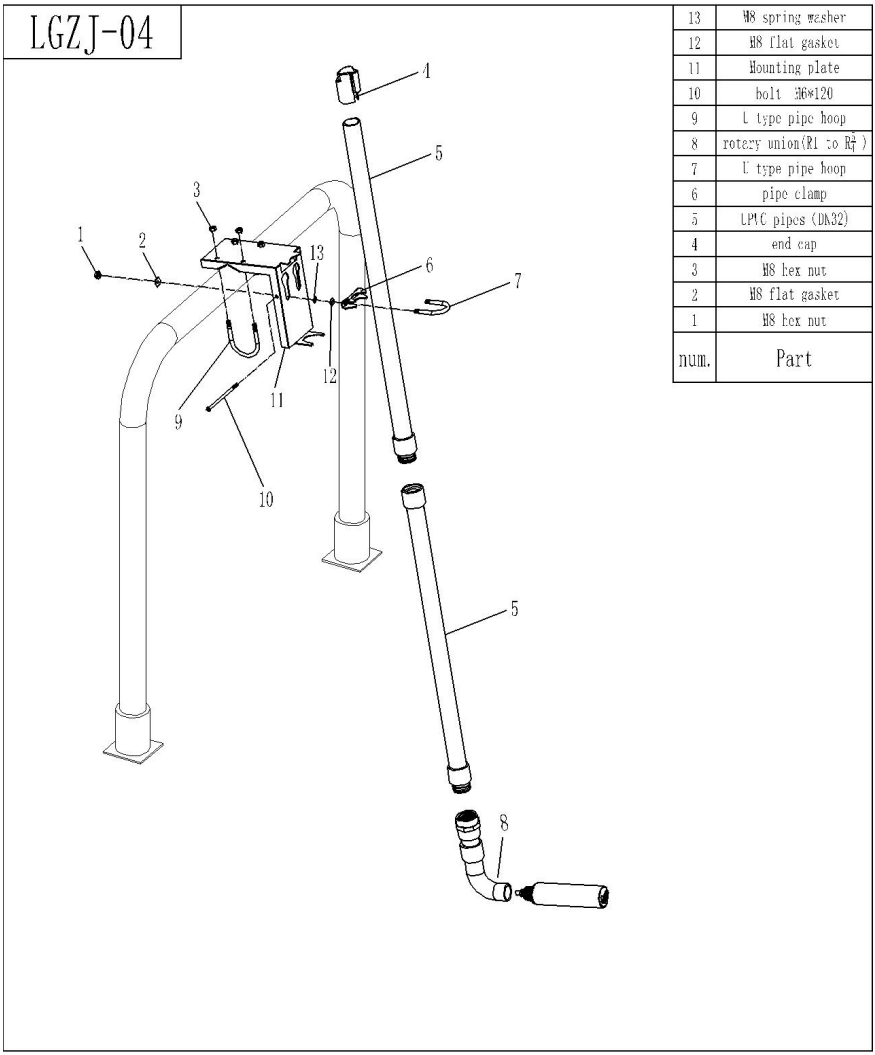


Fig. 5 Railing Fixed Installation Sketch Map

3.2. Connection of Sensor

The sensor should be correctly connected by the following definition of wire core:

Table 2

Serial No.	1	2	3	4	5
Sensor Cable	Red/Brown	Black	Blue	White	Yellow + Green
Signal	+12VDC	AGND	RS485 A	RS485 B	GND/PE

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”.

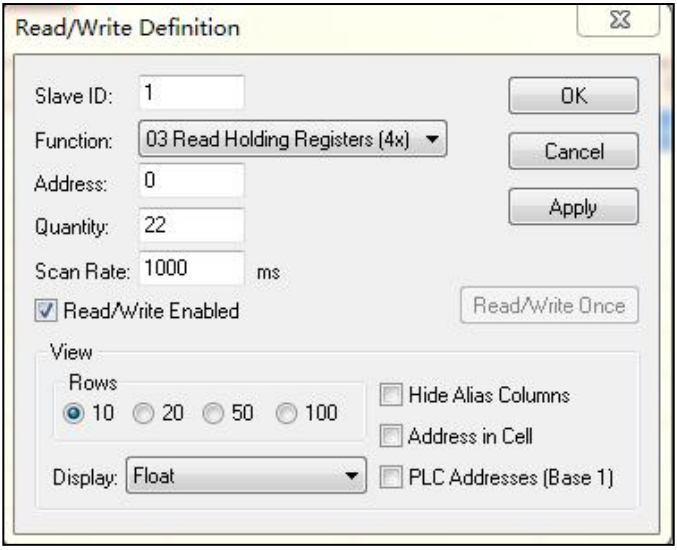


Fig. 6

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”.

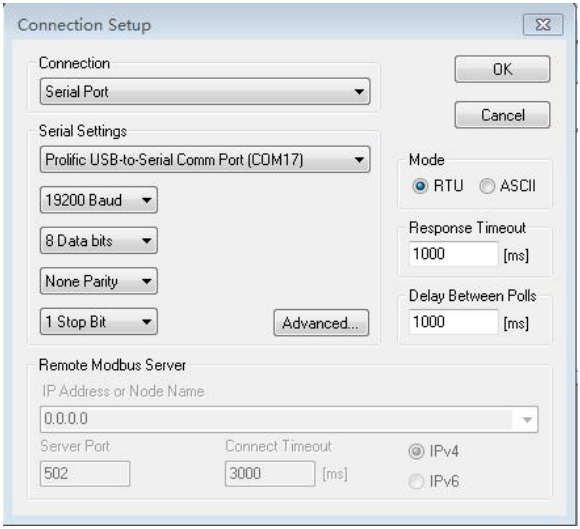


Fig. 7

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.

5. Calibration of Sensor

The turbidity sensor has been calibrated at the factory, and can be calibrated according to the following procedures. Turbidity calibration requires using a turbidity standard. During the process of calibration, make sure the lens of sensor is 15cm far from the bottom of calibration cup and no bubbles in front of the lens, meanwhile, it is recommended to keep the calibration cup away from the light.

5.1. Factor Calibration

If there is a large deviation between the measured value and the standard solution value, the slope of calibration curve needs factor calibration.

1. Connect the sensor to the Modbus software;
2. Set the relevant parameters and wipe the sensor;
3. Select “16”，then enter “04” for Address in the dialog box, “2” for Quantity and change type into “Float CD AB”. Double-click the up on the right to enter “1” for the value, click “OK”, then click “Send” , as shown below;

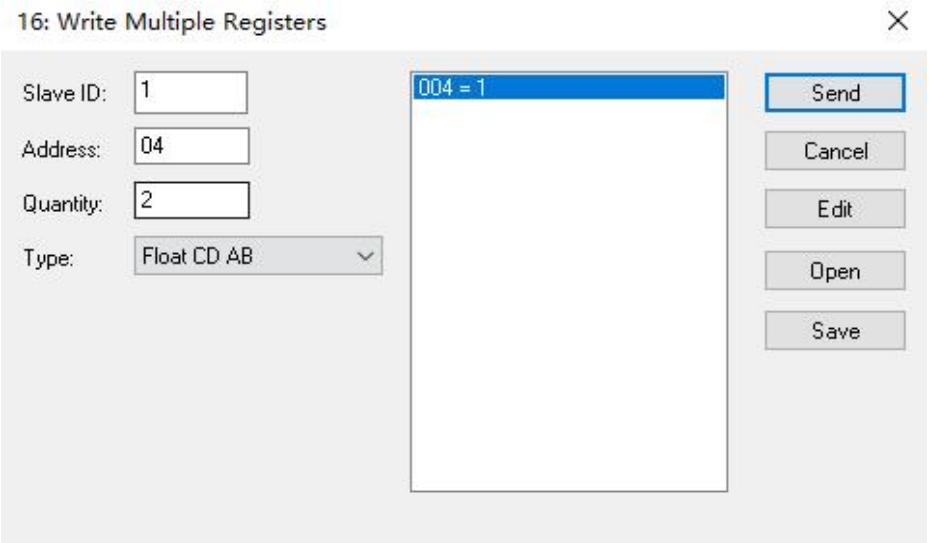


Fig. 8

4. Slowly immerse the sensor into the turbidity standard solution;
5. Wait for the value to be stable and record the stable value;
6. Calculate the correction factor. The correction factor equals to the standard solution value divided by the value measured in the 5 step. (Factor = standard solution value / stable value);
7. Select “16”，then enter “04” for Address in the dialog box, “2” for Quantity, and change type into “Float CD AB”. Double-click the up on the right to enter “Factor Value” for the value（The factor value is the calculated value in step 6）. Click “OK”, then click “Send”.

Assume that the factor value calculated in step 6 is 1.02, as shown in the figure below:

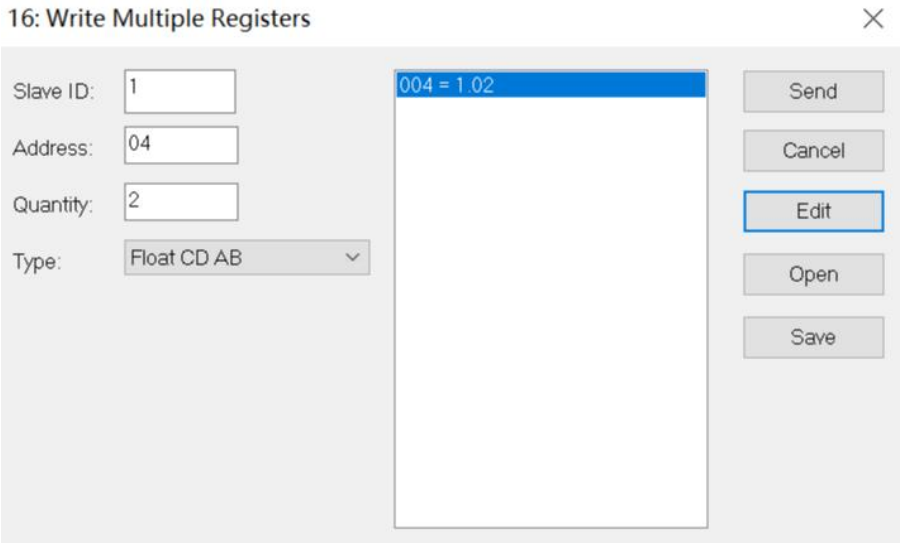


Fig. 9

Tx = 253: Err = 11: ID = 1: F = 03: SR = 1000ms

	Alias	00000	Alias	00010	Alias	00020
0	Turbidity	803.158		0	Manual Brushing Order	0
1		--	Brushing Time	1	Automatic Brushing Order	0
2		338	Response Time	3		0
3		--	Turbidity	1		--
4	Turbidity Factor	1.02	Sensor Humidity	4		0
5		--		0		--
6		0	Sensor Baud Rate	2		0
7		--	Sensor Slave Address	1		--
8	Turbidity Deviation	0	Serial No. 1	2699		0
9		--	Serial No. 2	400		--

Fig. 10

5.2. Standard Solution Calibration

If there is a large deviation between the measured value and the standard value,, the turbidity calibration shall be performed again，Specific steps are as follows:

1. Connect the sensor to the Modbus software;
2. Set the relevant parameters, the turbidity factor is set to 1 and wipe the sensor;
1. Start the calibration, slowly immerse the sensor into the distilled water. Select “06”, then enter “120” for Address in the dialog box, enter “0” for Value, click “Send”, the channel automatically switches to 4, wait for the average AD to stabilize，as shown below;

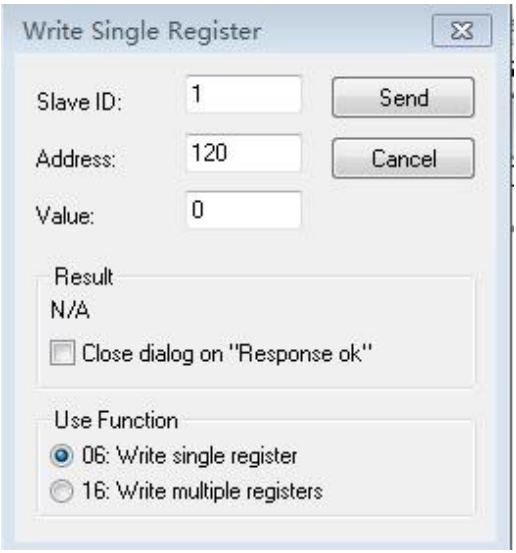

Write Single Register
Slave ID:
1
Send
Address:
120
Cancel
Value:
0
Result
N/A
Close dialog on "Response ok"
Use Function
06: Write single register
16: Write multiple registers

Fig. 11

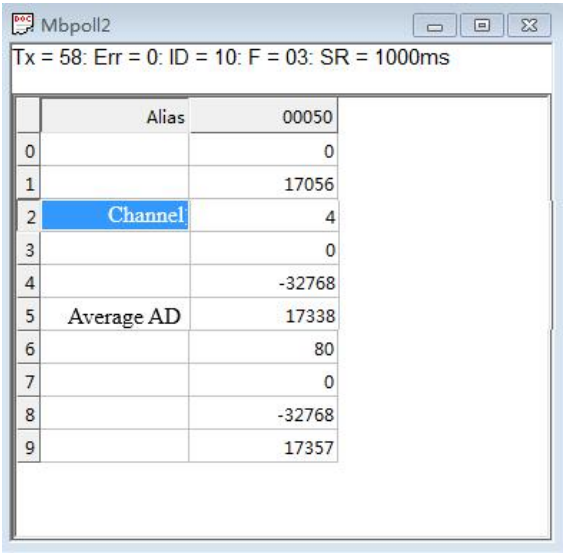

Mbpoll2
Tx = 58: Err = 0: ID = 10: F = 03: SR = 1000ms
Alias
00050
0
17056
Channel
4
0
-32768
Average AD
17338
80
0
-32768
17357

Fig. 12

3. Select “06”，then enter “120” for Address in the dialog box, enter “1” for Value, click “Send”, dark value calibration completed;

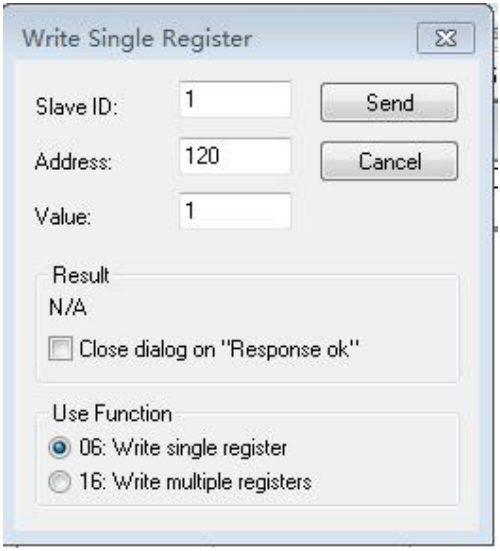


Fig. 13

5. Slowly immerse the sensor into the turbidity standard solution 1(distilled water) , it is recommended that turbidity standard solution 1 should be in the range of 0.1-5NTU. Select “16”， then enter “66” for Address in the dialog box, “2” for Quantity and change type into “Float CD AB”. Wait until the value stabilizes, double-click the up on the right to enter “turbidity standard solution 1” for the value. Click “OK”, then click “Send”. If the turbidity principal value changes to be consistent with the input turbidity standard solution 1, indicates that the first point has been successfully calibrated, as shown below:

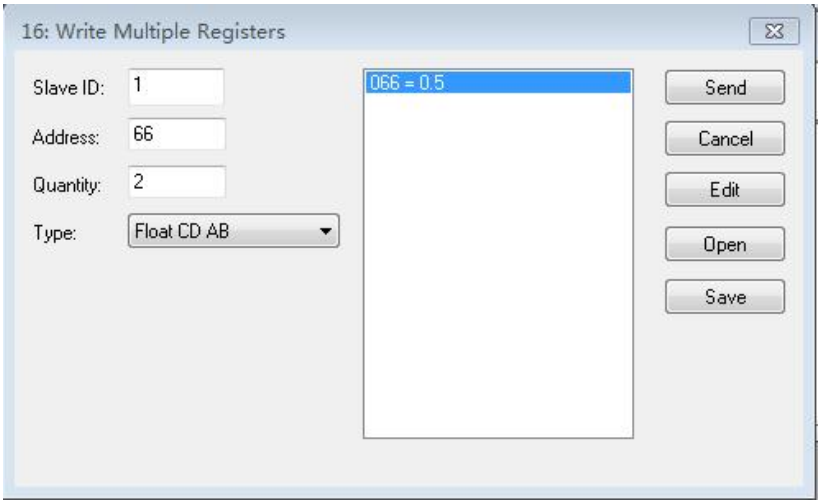


Fig. 14

Tx = 7558: Err = 3019: ID = 1: F = 03: SR = 1000ms

	Alias	00000	Alias	00010	Alias	00020
0	Turbidity	0.5		0	Manual Brushing Order	0
1		--	Brushing Time	1	Automatic Brushing Order	0
2		340	Response Time	3		0
3		--	Turbidity	1		--
4	Turbidity Factor	1	Sensor Humidity	4		0
5		--		0		--
6		0	Sensor Baud Rate	2		0
7		--	Sensor Slave Address	1		--
8	Turbidity Deviation	0	Serial No. 1	2699		0
9		--	Serial No. 2	400		--

Fig. 15

6. Clean the sensor. Slowly immerse the sensor into the turbidity standard solution 2, it is recommended that turbidity standard solution 2 should be in the range of 500-800NTU NTU. Select “16”，then enter “66” for Address in the dialog box, “2” for Quantity and change type into “Float CD AB”. Wait until the value stabilizes, double-click the up on the right to enter “turbidity standard solution 2” for the

value. Click “OK”, then click “Send”. If the turbidity principal value changes to be consistent with the input turbidity standard solution 2, indicates that the second point has been successfully calibrated, as shown below:

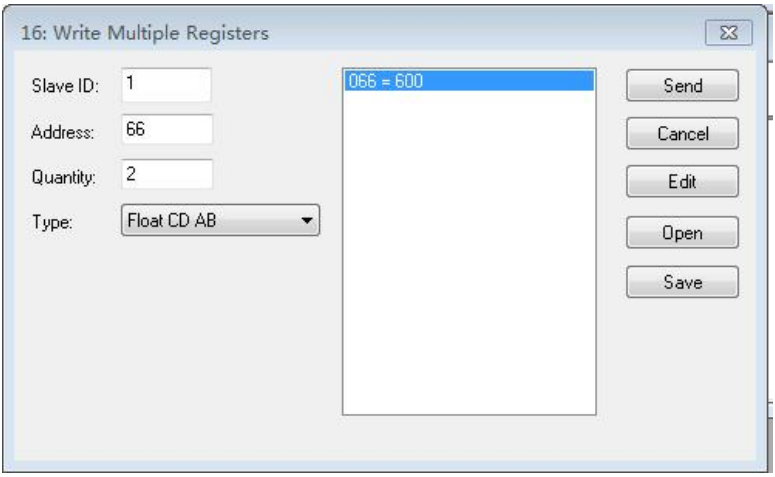


Fig. 16

Tx = 7739: Err = 3019: ID = 1: F = 03: SR = 1000ms

	Alias	00000	Alias	00010	Alias	00020
0	Turbidity	600		0	Manual Brushing Order	0
1		--	Brushing Time	1	Automatic Brushing Order	0
2		780	Response Time	3		0
3		--	Turbidity	1		--
4	Turbidity Factor	1	Sensor Humidity	3		0
5		--		0		--
6		0	Sensor Baud Rate	2		0
7		--	Sensor Slave Address	1		--
8	Turbidity Deviation	0	Serial No. 1	2699		0
9		--	Serial No. 2	400		--

Fig. 17

6. Communication Protocol

The sensor is equipped with MODBUS RS485 communication function, please refer to this manual section 3.2 to check the communication wiring. the specific MODBUS RTU table is shown in the following table.

Table 3

MODBUS-RTU					
Baud Rate		4800/9600/19200/38400			
Data Bits		8 bit			
Parity Check		no			
Stop Bit		1bit			
Register Name	Address Location	Read/ Write	Data Type	Register Number	Descriptions
Turbidity	0	OR	Float	2	0- Range
Turbidity Factor	4	RW	Float	2	0.1-9.99
Turbidity Deviation	8	RW	Float	2	±80% FS NTU
Brushing Time	11	OR	Int	1	Time between sending intervals (1-10080 units: min)
Response Time	12	RW	Int	1	3-60s
Parameter	13	RW	Int	1	1- Turbidity 2-Suspended Solids

Sensor Humidity	14	OR	Int	1	It is recommended to be less than 10
Sensor Baud Rate	16	RW	Int	1	0 stands for 4800 1 stands for 9600 2 stands for 19200 3 stands for 38400
Sensor Slave Address	17	RW	Int	1	1-200
Serial No. 1	61400	OR	Int	1	First 4 numbers of Serial No.
Serial No. 2	61401	OR	Int	1	Median 4 numbers of Serial No.
Serial No. 3	61402	OR	Int	1	Last 4 numbers of Serial No.
Manual Brushing Order	20	W	Int	1	Send 66
Automatic Brushing Order	21	W	Int	1	Time between sending intervals (1-10080 units: min)
Current AD Channel	52	OR	Int	1	
The Average AD	56	OR	Int	1	
Power on the brush switch	429	RW	Signed	1	0 stands for the close 1 stands for the open
Calibration of Sensor					
First Factor	60	RW	Float	2	
Second Factor	62	RW	Float	2	

The Standard Value (First Point And Second Point)	66	RW	Float	2	The first point of standard solution is recommended to select the range of 0.1-5NTU；The second point of standard solution is recommended to select the range of 500-800NTU
Dark Value Calibration	120	W	Int	1	0: Start 1: Confirm

485 analysis:

1.Read the turbidity factor

Table 4

Register Name	Address Location	Read/Write	Data Type	Length	Descriptions
Turbidity Factor	4	RW	Float	2	0.1-9.99

Send the command: 01 03 00 04 00 02 85 CA

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 04: The starting register address read is 0004

00 02: Read 2 registers

85 CA: 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 turbidity factor read is 7.00（analyze 40 E0 00 00 using IEEE 754）

CA 7B: CRC16 check code

2.Read the Brushing Time

Table 5

Register Name	Address Location	Read/Write	Data Type	Length	Descriptions
Brushing Time	11	OR	Int	1	Time between sending intervals (1-10080 units: min)

Send the command: 01 03 00 0B 00 01 F5 C8

The equipment return: 01 03 02 00 0A B8 44

Send command parsing:

01: device address 01

03: Function code 03 for reading register content

00 0B: The starting register address read is 0011

00 01: Read 1 registers

F5 C8: 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 0A: The brushing time read is 10

B8 44: CRC16 check code

1.Set the Manual Brush

Table 6

Register Name	Address Location	Read/ Write	Data Type	Length	Descriptions
Manual Brushing Order	20	W	Int	1	Send 66

Send the command: 01 06 00 14 00 42 49 FF
The equipment return: 01 06 00 14 00 42 49 FF
Send command parsing:
01: device address 01
06: Function code 06 for writing register content
00 14: The register address of write data is 00 20
00 42: Write data content of 66
49 FF: CRC16 check code
The device returns the analysis:
01: device address 01
06: Function code 06 for reading register content
00 14: The register address of the return write data is 66
00 42: Returns modified data content of 66
49 FF: CRC16 check code

1.Set the Turbidity Factor

Table 7

Register Name	Address Location	Read/Write	Data Type	Length	Descriptions
Turbidity Factor	4	RW	Float	2	0.1-9.99

Send the command: 01 10 00 04 00 02 04 00 00 3F 80 E2 0C

The equipment return: 01 10 00 04 00 02 00 09

Send command parsing:

01: device address 01

10: Function code 16 for writing register content

00 04: The starting register address write is 00 04

00 02: Write 2 registers

04: The length data is 4 bytes

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

E2 0C: CRC16 check code

The device returns the analysis:

01: device address 01

10: Function code 16 for writing register content

00 04: The starting register address of the return write data is 00 04

00 02: Returns 2 registers

00 09: CRC16 check code

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, and periodic calibration. You can also view the sensor's status during maintenance and inspection.

7.1. Sensor Cleaning

Both the two lenses on the sensor need to be cleaned and maintained regularly to ensure the accuracy of the measurement on the basis of actual use. Wash with clean water, then wipe with a cleanser and rag to remove stubborn stains.

7.2. Inspection on the Damage of Sensor

Check the appearance of the sensor to see whether there is damage, if it's damaged, please contact to the after-sales service center in time for replacement to prevent malfunction of sensor caused by water due to the damage.
Note: it is recommended to replace the sealing ring once a year.

7.3. Sensor Blade Replacement

It is recommended that the blade of the sensor should be replaced quarterly with a new rubber one, the specific steps are as follows:

1. The position of the blade is shown in the figure;
2. Remove the rubber sheet from the scraper;
3. Then apply lubricant to the bracket
4. Load new rubber sheet.

8. Special Description

The optional self-cleaning brush is motor-driven. In order to avoid the internal motor gear, please don't move the brush with hand. The warranty doesn't include the misfunction/damage caused by manually moving of the brush.

The default brush cycle is once every 1 hours. If the brush cycle becomes shorter, the maintenance cycle should be shortened:

Shorter brush intervals will result in shorter brush life. Please carefully set the brush cycle.