Turbidity Sensor

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Preface

Thank you for purchasing this turbidity sensor. To ensure proper operation and prevent potential losses due to improper use, please read this manual thoroughly before using the device.

Note

- The contents of this manual are subject to change without notice due to real-time factors such as function upgrading.
- We strive to ensure the accuracy of the manual. Nevertheless, if you identify any errors or inaccuracies, please contact us.
- Unauthorized reprinting or copying of this manual is strictly prohibited.

Version

U-SUP-ADU3500-EN2

Safety Precautions

For the safe operation of this product, please strictly follow the outlined safety precautions.

About this manual

- Please ensure the instrument operators have a careful reading of this manual.
  - Prior to operation, please study this manual in detail to ensure a thorough comprehension of the device's functionality.
- This manual only describes the product's functions. The responsibility as to the device 's suitability for any specific purpose lies solely in the operator.

Precautions for product protection, safety, and modification

- For your safety and the normal operation of the product and its controlling systems, the guidelines and precautions specified in this manual are supposed to be fully observed. Operating the instrument in ways not specified in this manual may compromise its protective features. Our company shall not be liable for any malfunctions or accidents resulting from non-compliance with the precautions described.
- When equipped the product and its controlling systems with lightning protection or separate safety protection circuits, it needs to be implemented by other devices.
- If you need to replace components or fittings of the product, please use the model specified by the company.
- This product is not designed for applications in systems directly related to personal safety, such as nuclear power facilities, radioactive equipment, railway systems, aviation equipment, marine equipment, and medical equipment. If applied, it is the user's responsibility to implement additional equipment or systems to ensure personal safety.
- Do not modify this product.
- The following safety symbols are used in this manual:

Hazard: Failure to take appropriate precautions may result in serious personal injury, product damage, or major property loss.

Warning: Pay special attention to critical information related to the product or specific sections of this user manual.

- Confirm whether the supply voltage is consistent with the rated voltage before operation.
- Do not use the instrument in a flammable and combustible or steam area.
- To prevent electric shock and operation errors, ensure proper grounding protection is in place.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at the correct electric level, shielded, with wires properly routed, and an SPD surge protector applied as needed.
- Some internal components may carry high voltage. To avoid the risk of electric shock, do not open the front square panel unless it is being handled by trained personnel or maintenance staff authorized by our company.
- To avoid electric shock, disconnect the power before performing any checks.
- Check the condition of the terminal screws regularly. If loose, please tighten them before use.
- Unauthorized disassembly, modification, or repair of the product is not allowed, as it may lead to malfunctions, electric shock, or fire hazards.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine, or other organic solvents, and avoid exposing the product to any liquids. If the product falls into the water, please cut off the power immediately to prevent leakage, electric shock, or fire hazards.
- Please check the grounding protection regularly. Do not operate the product if you think that the protection, such as grounding protection and fuses, is inadequate.
- 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; failure to do so may damage the product's protective devices.

- Do not use the instrument if it is found damaged or deformed upon opening the package.
- Prevent dust, wire end, iron fines, or other objects from entering the instrument during installation, as this may cause abnormal operation or failure.
- During operation, to modify the configuration, signal output, startup, stop, and operation safety shall be fully considered. Improper operation may lead to failure and even destruction of the instrument and control equipment.
- Each part of the instrument has a certain service life, which must be maintained and repaired on a regular basis for long-term use.
- If the product comes to the end of its service life, it should be disposed of as industrial waste as a way of environmental protection.
- Disconnect the instrument when it is not in use.
- 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.

Confirm the package contents

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

Please refer to the standard configuration list for product packaging contents.

No.	Item Name	Quantity	Remark
1	Turbidity Sensor	1	
2	User manual	1	
3	Certificate	1	

Note: Customized products may differ slightly from standard products. Please refer to the order.

Contents

1 Introduction

1.1 Overview

The Pressure-Compensated Turbidity Sensor is designed for online monitoring of drinking water quality. It features an ultra-low turbidity detection limit, high-precision measurement, fast response speed, and long-term maintenance-free equipment. It can be widely used in online turbidity monitoring of tap water, secondary water supply, pipe network terminal water, direct drinking water, membrane filtered water, swimming pools, surface water, etc.

1.2 Measuring Principle

The turbidity sensor operates based on the 90° laser light scattering method. A laser beam is emitted from the air into the water at a perpendicular angle to the water surface. Suspended particles in the water scatter the laser light, and a sensor positioned at a 90° angle to the incident beam detects the intensity of the scattered light. This intensity is then converted into a turbidity value using a pre-calibrated reference table.

1.3 Features

- Pressure-resistant flow channel design helps prevent bubble accumulation.
- Sealed structure supports efficient recovery of water samples.
- Compact size allows easy system integration.
- Self-cleaning optical window extends maintenance intervals.

2 Technical Parameters

Table 1 Technical Parameters

Measured variables	Turbidity
Measurement method	Laser 90° scattering method (laser light source)
light source	660nm laser
Measuring range	(0~ 1) NTU / (0~20)NTU/ (0~100)NTU/ (0~2000)NTU
Detection limit	0.005NTU
Accuracy	(0~ 1) NTU /(0~20)NTU/(0~100)NTU: 2% or ±0.02NTU (whichever is greater) (0~2000)NTU: 10% or ±0.5NTU (whichever is greater) (Based on formazine primary standard solution at 25°C)
Repeatability	1% (based on formazine primary standard solution at 25°C)
Indication stability	≤1.5%
Zero offset	≤1.5%
Response time	T_{90} ≤ 120 seconds
Transmitter output	(4 ~ 20) mA can be set to the corresponding parameter measurement range
Communication output	RS485 output, Modbus-RTU
Power supply	(9~28)VDC
Power consumption	≤ 5 W
Inlet flow	(100~1000) mL /min (500 mL/min recommended)
Withstand pressure	≤ 0.6 MPa
Operating temperature	(-5~45) ℃ (no freezing)

3 Structure and Dimensions

3.1 Dimensions

The low-range version of the pressure-compensated turbidity sensor (0~ 1 NTU /0~20 NTU/0~100 NTU) has a water inlet and outlet of 6mm; the high-range version (0~2000) NTU has a water inlet and outlet of 10mm.

（1）Low range

When both the inlet and outlet adopt 6 mm push-to-connect fittings, the product dimensions are as shown below:

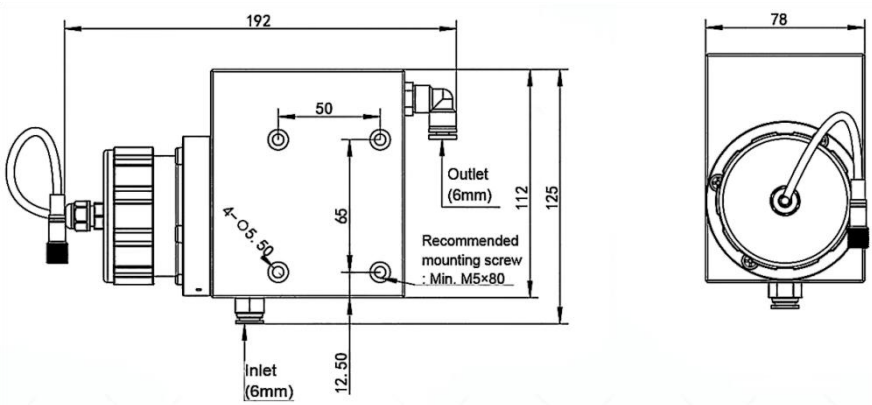

Fig. 1 Low range quick-connect fitting dimensions (unit: mm)

The product dimensions of the backplane installation are as shown below:

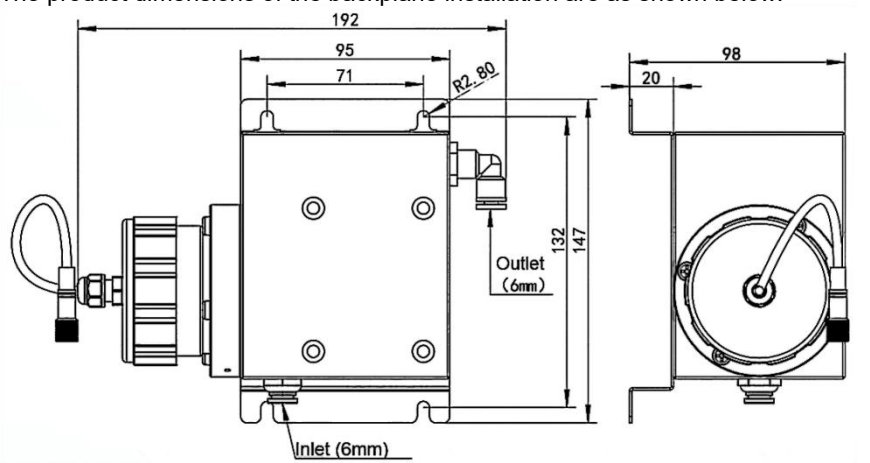

Fig. 2 Dimensions of low range sensor with back plate (unit: mm)

（2）High range version

When both the inlet and outlet adopt 10mm push-to-connect fittings, the product dimensions are as shown below:

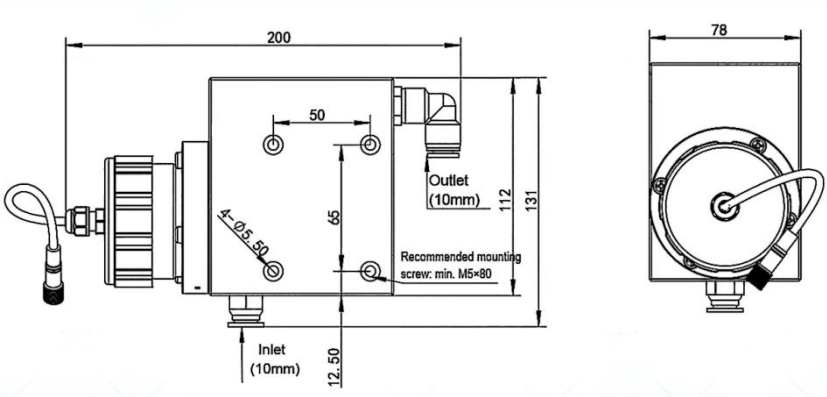

Fig. 3 High range quick-connect fitting dimensions (unit: mm)

The product dimensions of the backplane installation are as shown below:

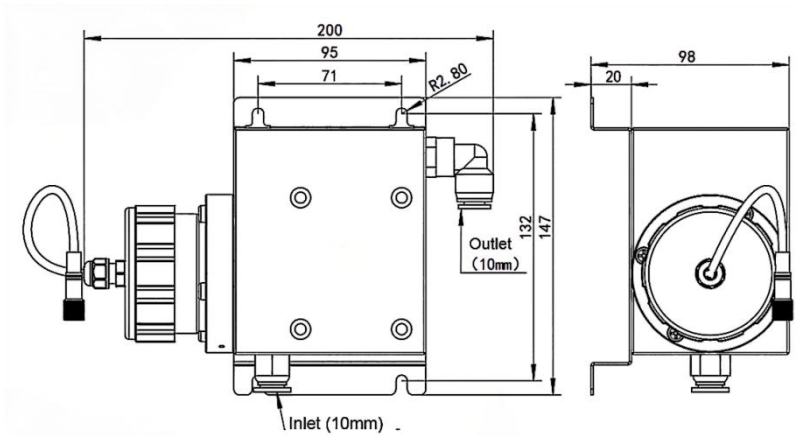

Fig. 4 Dimensions of high range sensor with back plate (unit: mm)

3.2 Material

Shell material: ABS and POM plastic

4 Installation

4.1 Installation Notes

- Do not install the device while water or power is being supplied.
- The equipment must be installed horizontally; tilting will affect the measurement and water flow.
- The inlet water pressure should be kept below 0.6 MPa.
- The flow rate should be maintained within the range of 100–1000 mL/min.
- Ensure a continuous water supply at the inlet; intermittent supply is not allowed.

4.2 Installation

Use 4 M5 *85mm screws to install the turbidity sensor. The installation diagram is shown in the following figure:

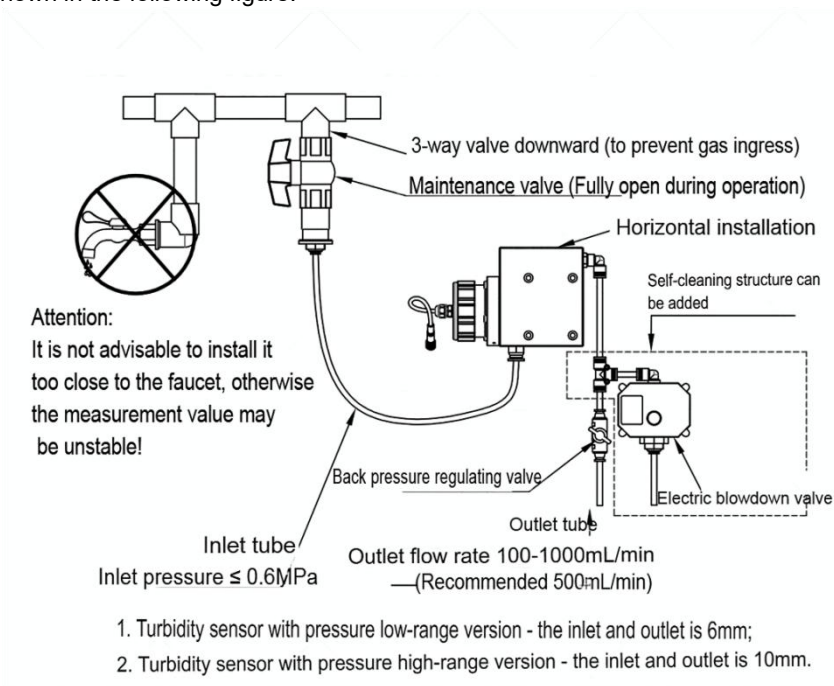

Fig. 5 Installation Diagram

Pressure-maintaining defoaming principle: When the water pressure is greater than 0.1MPa, bubbles in the water are not easy to precipitate. Therefore, when using it, a regulating valve must be set at the water outlet, and a regulating valve must not be set at the water inlet.

5 Electrical Connections

(4 ~ 20) mA is 6-core wire, and the version without (4 ~ 20) mA is 4-core wire. The definition of sensor cable is shown in the figure below:

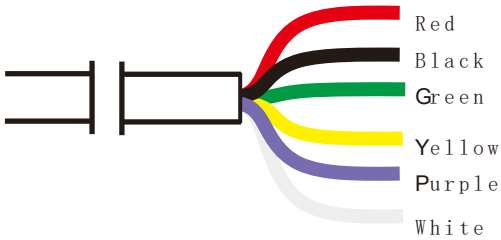

Fig. 6 Cable diagram

Table 2 Cable Definition

No.	Color	Definition
1	red	24VDC power supply
2	black	GND
3	green	RS485 Output A
4	yellow	RS485 Output B
5	Purple [only for optional (4~20) mA output function]	(4~20) mA output +
6	White [only for optional (4~20)mA output function]	(4~20) mA output -

6 Calibration

There are two ways to calibrate a turbidity sensor: **standard solution calibration** and **on-site calibration**.

It is recommended to perform maintenance before calibration, including cleaning the sensor and measuring cylinder, cleaning the sensor light source, etc. Generally, since turbidity standard solution is inaccessible on-site, single-point calibration is recommended during on-site calibration.

6.1 Low Range Turbidity Standard Calibration

There are two methods for standard solution calibration, 2-point calibration and 3-point calibration.

1) 2-point calibration: When the turbidity value and signal strength of the third calibration point are both 0 , the third calibration point is an invalid point, and this is the 2-point calibration mode.

2) 3-point calibration: When either the turbidity value or the signal strength of the third calibration point is not 0 , the third calibration point is a valid point, and this is the 3-point calibration mode.

3) In 3-point calibration, the third calibration point is included in the turbidity calculation; in 2-point calibration, the third point will not affect the calculation of turbidity value.

6.1.1 Two-Point Calibration Example :

2-point calibration requires the preparation of low-point water standard solution and high-point water standard solution. The turbidity value of the high-point water must be greater than the turbidity value of the low-point water. It is generally recommended to use tap water with a concentration of about 0.2NTU for low-point water and formazine standard solution with a concentration of about 20NTU for high-point water. The turbidity value of the standard solution can be verified using a handheld device or laboratory equipment. The calibration steps are as follows:

(1) Clean the sensor and measuring cylinder.

(2) Pass low-point water into the measuring cylinder until water overflows from the outlet, and wait for a few minutes for register 0x247 ; after the signal

strength is basically stable, write the turbidity value of the low-point water to register 0x263 .

(3) Drain the low point water and introduce enough pure water to clean the entire water path. Introduce enough high point water until water overflows from the outlet. Wait for a few minutes until the signal strength of register 0x247 is basically stable, and then write the turbidity value of the high point water to register 0x265 . After the operation of both the low point and the high point is completed, the two-point calibration is completed.

6.1.2 3-Point Calibration Example :

3-point calibration requires the preparation of low-point water standard solution, high-point water standard solution and third calibration point water standard solution. The turbidity value of the high-point water must be greater than the turbidity value of the low-point water, but the turbidity value of the third calibration point standard solution can be any value.

When used for low-range measurement, it is recommended to use tap water with a concentration of about 0.2NTU for the low-point water , and a formazin standard solution with a concentration of about 20NTU for the high-point water. It is recommended to use ultrapure water below 0.1NTU for the third calibration point .

When used for high-range measurement, it is recommended to use tap water with a concentration of about 0.2NTU for the low-point water , and a formazin standard solution with a concentration of about 20NTU for the high-point water. It is advisable to use a formazin standard solution with a concentration of 100NTU for the third calibration point. The turbidity value of the standard solution can be verified using a handheld device or laboratory equipment. The calibration steps are as follows:

(1) Clean the sensor and measuring cylinder.

(2) Pass low-point water into the measuring cylinder until water overflows from the outlet. Wait for a few minutes until the signal strength of register 0x247 is basically stable, and then write the turbidity value of the low-point water to register 0x263.

(3) Drain the low-point water and introduce enough pure water to clean the entire waterway. Introduce enough high-point water until water overflows from the outlet. Wait for a few minutes until the signal strength of register

0x247 is basically stable, and then write the turbidity value of the high-point water to register 0x265 .

(4) Drain the high-point solution and introduce enough pure water to clean the entire water path. Fill with the third calibration point until water overflows from the outlet. Wait for a few minutes until the average signal strength of register 0x247 is basically stable, and then write the turbidity value of the third calibration point water to register 0x267. After the low point, high point and third calibration point are all completed, the three-point calibration is completed.

6.2 Low Range Turbidity on-site Single Point Calibration

To meet the on-site comparative calibration requirements of some users, this product can be temporarily calibrated on-site. The operation process is as follows: wait for the turbidity sensor to stabilize, as shown by the signal strength of register 0x247 being basically stable, write the turbidity value to be calibrated to register 0x261 , and wait for a few seconds for the turbidity sensor to complete the single-point automatic calibration.

Note:

(1) Since the calibration point is the slope determination point, it is recommended that the turbidity of the on-site comparison water should not be less than 0.5NTU or not less than 80% of the average turbidity value during normal operation. For example: when the average turbidity value is 0.4NTU during the on-site level , it cannot be lower than 0.4*80%=0.32NTU during comparison calibration .

(2) During the calibration process, the turbidity of water should not change too much. It is recommended that the change be kept within 2% .

(3) The accuracy of the calibration depends on the change in water turbidity during the calibration process, the accuracy of the calibration equipment used, and the degree of standardization of the operator's operation of the calibration equipment;

(4) When calling the single-point calibration register in two-point mode (when the turbidity value and signal strength of the third calibration point are both 0) , if the calibration turbidity value is less than 2NTU , the turbidity value and signal strength of the lower point will be modified; if the calibration turbidity

value is greater than 2NTU , the turbidity value and signal strength of the higher point will be modified.

(5) When calling the single-point calibration register in the three-point mode (when any of the turbidity value and signal strength of the third calibration point is not 0) , a comparison will be made among the low-point turbidity value, the high-point turbidity value and the third calibration point turbidity value, and the calibration point whose turbidity value is closest to the turbidity value to be calibrated among the three calibration points will be found to modify its turbidity value and signal strength.

6.3 High Range Turbidity Standard Solution Calibration Example

Standard solution calibration requires the preparation of two calibration standard solutions in advance. The calibration standard solutions are generally recommended to cover the turbidity values encountered during normal use. For example, during normal use, the sensor needs to measure a water source of 2NTU-50NTU . The selected calibration standard solution can be tap water of about 0.2NTU and a standard solution of 100NTU. In theory, the closer the coverage range, the more accurate the measurement value. In the following calibration process, A represents the actual value of standard solution one, B represents the sensor measurement value of standard solution one, C represents the actual value of standard solution two, and D represents the sensor measurement value of standard solution two. The following are the calibration steps:

(1) Clean the measuring cylinder and sensor;

(2) Write 1 to register 0x13 to restore the factory calibration table;

(3) After recording the actual value A of standard solution 1, pass standard solution 1 into the measuring cylinder until water overflows from the outlet. After waiting for a few minutes, when the turbidity value of register 0x243 is basically stable, record the turbidity value displayed by register 0x243 as the sensor measurement value B of standard solution 1;

(4) After draining the standard solution, clean the measuring cylinder and sensor;

(5) After recording the actual value C of the standard solution 2, pass the standard solution 2 into the measuring cylinder until water overflows from the outlet.

After waiting for a few minutes, when the turbidity value of register 0x243 is basically stable, record the turbidity value displayed by register 0x243 as the sensor measurement value D of the standard solution 2;

(6) According to the formula: turbidity factor = (CA)/(DB), turbidity bias = A-turbidity factor * B; calculate the turbidity factor and turbidity bias;

(7) Write the turbidity factor into register 0x27C and the turbidity offset into register 0x27E .

6.4 High Range Turbidity on-site Single Point Calibration

Turbidity sensors are generally recommended to be accurately calibrated with standard solutions. In order to meet the requirements of some users for on-site comparative calibration, temporary calibration can also be performed on-site. After the turbidity value of register 0x243 is basically stable, the turbidity value of the current water source is written to register 0x261 to complete the calibration.

6.5 (4 ~ 20) mA Calibration (optional)

Only some optional (4 ~ 20) mA sensors require calibration.

(1) 4mA calibration

① Write 0x02 to register 0x2A to enter 4mA calibration mode.

② Adjust the multimeter (or other device that can detect current) to the current range, connect the positive probe to (4~20)mA +, and the negative probe to (4~20)mA - . The current value should be 4mA .

③ If the current is not 4mA, read register 0x28. If the current read by the multimeter is less than 4mA, increase the value appropriately and write it to register 0x28; if the current read by the multimeter is greater than 4mA, decrease the value appropriately and write it to register 0x28;

④ Use a multimeter to check the current value again. If it is still different from 4mA , repeat step 3 until the current value reaches 4mA .

(2) 20mA calibration

① Write 0x03 to register 0x2A to enter 20mA calibration mode.

② Adjust the multimeter (or other device that can detect current) to the current range, connect the positive probe to (4~20)mA + , and the negative probe to

(4~20)mA - . The current value should be 20mA .

③ If the current current is not 20mA , read register 0x29 . If the current current read by the multimeter is less than 20mA , increase the value appropriately and write it to register 0x29 ; if the current current read by the multimeter is greater than 20mA , decrease the value appropriately and write it to register 0x29 ;

④ Use a multimeter to check the current value again. If it is still different from 20mA , repeat step 3 until the current value reaches 20mA .

⑤ After 4mA or 20mA calibration is completed, if no further calibration is required and (4~20)mA normal output is desired, it is necessary to write 0x01 to register 0x2A or power off and restart to enter normal output mode.

7 Maintenance

Notice	
	Regarding the problem of measuring values that are too large when measuring below 0.1 NTU or low turbidity: **Reason 1**: The flow cell has not been cleaned for an extended period. Solution: Clean the flow cell thoroughly. **Reason 2**: Inconsistency in calibration standards for the low point or the third point (during ultrapure water calibration). Solution: Use a standardized reference instrument to verify and recalibrate the low point or third point (ultrapure water calibration).

(1) Check regularly whether the water inlet and outlet are normal.

(2) Clean the sensor's optical window and the interior of the flow cell regularly.

(3) Regularly verify the measurement accuracy. If the measurement error exceeds the requirement, the sensor needs to be recalibrated.

8 Fault Analysis and Troubleshooting

For common equipment failures, please refer to the table below to troubleshoot. If the problem still cannot be eliminated, please contact our company .

Table 3 Common troubleshooting

Fault phenomenon	Possible cause analysis	Troubleshooting
RS485 cannot communicate	The signal line is not connected properly	Reconnect the signal cable after power failure
	Controller damage	Contact us
Abnormally high turbidity values (Ruling out the reason of water source issues)	Internal contamination of equipment	Clean the internal water circuits and sensors of the equipment
	The water pressure regulating valve is installed in the wrong position	Install the water pressure regulating valve as recommended
Low turbidity value	Light source damage	Contact us
Equipment leakage	Excessive water pressure	Control the water pressure within 0.6MPa

9 Warranty & After-Sale Service

We promise to the customer that the hardware accessories provided during the supply of the instrument have no defects in the material and manufacturing process.

From the date of the purchase, if the user's notice of such defects is received during the warranty period, the company will unconditionally maintain or replace the defective products without charge, and all non-customized products are guaranteed to be returned and replaced within 7 days.

Disclaimers:

- During the warranty period, product faults caused by the following reasons are not in the scope of the Three Guarantees service.
- Product faults caused by improper use by customers.
- Product faults caused by disassembling, repairing and refitting the product.

After-sales service commitment:

- We promise to deal with the customer's technical questions within 2 hours.
- For the instruments returned to the factory for maintenance, we promise to issue the test results within 3 working days and the maintenance results within 7 working days after receiving them.

Appendix A Communication Protocol

A.1 Physical Interface

The product adopts RS485 Modbus-RTU protocol, supports 0x03 read instruction and 0x10 write instruction, and the default Modbus slave address is 1 .

The default interface is baud rate 9600 , data bit 8 , no parity, stop bit: 1. After modifying the configuration through the register, you need to restart the device to take effect.

A.2 Format

(1) Host call format

The host sends a read command to the Turbidity sensor, 8 bytes, in the following format (MSB first) :

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

Explanation:

① Byte 1: Turbidity sensor ID number, its value range is 0x01-0xFF, the default value is 0x01;

② Byte 2: Function code in Modbus protocol, should be filled in 0x03 (read);

③ Byte 3, Byte 4: Register start address, the high byte is in byte 3, the low byte is in byte 4;

④ Byte 5, Byte 6: Number of registers, high byte in byte 5, low byte in byte 6

⑤ Byte 7, Byte 8: 16-bit CRC check, the low byte is in byte 7, and the high byte is in byte 8 .

(2) Sensor response format

The turbidity sensor parses the command correctly and responds to the host normally. If the host calls the register number as 1, the data length of the reply is 2 bytes and the response length is 7 bytes; if the host calls the register number as 2, the data length of the reply is 4 and the response length is 9, and so on; the reply format for the register number as 2 is as follows (MSB first):

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9

Explanation:

① Byte 1: Turbidity sensor ID number, its value range is 0x01-0xFF, the default value is 0x01;

② Byte 2: Function code in Modbus protocol, should be filled in 0x03 (read);

③ Byte 3: reply data length;

④ Byte 4, Byte 5, Byte 6, Byte 7: data;

⑤ Byte 8, Byte 9: 16-bit CRC check, the low byte is in byte 8, and the high byte is in byte 9 .

(3) Data type

Table 4 Data Type Description Table

Data Types	Number of bytes	Byte Order
UINT16	2	Big Endian: AB
UINT32	4	Big Endian: ABCD
FLOAT	4	Big Endian: ABCD

A.3 Register Address

The register address of the low-range pressure-maintained turbidity is shown in Table 5 , and the register address of the high-range pressure -maintained turbidity is shown in Table 6 .

Table 5 Low range pressure-compensated turbidity register address table

No.	Addr.	Length	Meaning	Access	Data Types	Remark
1	0x01	1	Slave Address	R/W	UINT16	1-247
2	0x0D	2	Turbidity value	RO	UINT32	Unit: mNTU
3	0x0F	1	Sensor working status	R/W	UINT16	1 Work 0 Stop
4	0x13	1	Restore factory calibration table	WO	UINT16	Write 1 to restore the factory calibration

No.	Addr.	Length	Meaning	Access	Data Types	Remark
5	0x24	2	Single point automatic calibration, write the current measured water Turbidity value	WO	UINT32	Unit: mNTU
6	0x28	1	4mA output calibration value	R/W	UINT16	0~4095
7	0x29	1	20mA output calibration value	R/W	UINT16	0~4095
8	0x2A	1	(4~20)mA output mode	R/W	UINT16	1: (4~20) mA normal output 2: 4mA calibration mode 3: 20mA calibration mode
9	0x2B	1	Average number of times	R/W	UINT16	Default: 20; Write range: 1-20;
10	0x2C	1	Baud rate	R/W	UINT16	1=4800 2=9600 (default) 3=19200 4=38400 5=57600

No.	Addr.	Length	Meaning	Access	Data Types	Remark
11	0x2D	1	Serial port settings	R/W	UINT16	1=N81 (default), 2=N82, 3=E81, 4=O81 N: No parity E: Even parity O: Odd parity 8: 8 data bits 1: 1 stop bit 2: 2 stop bits
12	0x2E	2	(4~20)mA output range	R/W	UINT32	Unit: mNTU
13	0x42	2	Signal Strength	RO	UINT32	Turbidity value measurement signal strength
14	0x21C	2	Current calibration table low point turbidity value	R/W	UINT32	It is not recommended to write 0. The unit is mNTU
15	0x21E	2	Current calibration table low point signal strength	R/W	UINT32	It is not recommended to write 0
16	0x220	2	Current calibration table high point turbidity value	R/W	UINT32	Unit: mNTU

No.	Addr.	Length	Meaning	Access	Data Types	Remark
17	0x222	2	Current calibration table high point signal strength	R/W	UINT32	
18	0x224	2	Turbidity value of the third calibration point in the current calibration table	R/W	UINT32	Unit: mNTU. When the turbidity value and signal intensity of the third calibration point are both 0, it is a two-point calibration mode. When either the turbidity value or the signal intensity at the third calibration point is not 0, it is a three-point calibration mode.
19	0x226	2	Signal strength of the third calibration point in the current calibration table	R/W	UINT32	When the turbidity value and signal intensity of the third calibration point are both 0, it is a two-point calibration mode. When either the turbidity value or the signal intensity at the third

No.	Addr.	Length	Meaning	Access	Data Types	Remark
						calibration point is not 0, it is a three-point calibration mode.
20	0x228	2	Factory calibration table low point turbidity value	RO	UINT32	Unit: mNTU
twenty one	0x22A	2	Factory calibration table low point signal strength	RO	UINT32	
twenty two	0x22C	2	Factory calibration table high point turbidity value	RO	UINT32	Unit: mNTU
twenty three	0x22E	2	Factory calibration table high point signal strength	RO	UINT32	
twenty four	0x230	2	Turbidity value of the third calibration point in the factory	RO	UINT32	Unit: mNTU

No.	Addr.	Length	Meaning	Access	Data Types	Remark
			calibration table			
25	0x232	2	Signal strength of the third calibration point in the factory calibration table	RO	UINT32	
26	0x243	2	Turbidity value	RO	FLOAT	UnitNTU
27	0x247	2	Signal Strength	RO	FLOAT	Turbidity value measurement signal strength
28	0x249	2	Current calibration table low point turbidity value	R/W	FLOAT	It is not recommended to write 0, the unit is NTU
29	0x24B	2	Current calibration table low point signal strength	R/W	FLOAT	It is not recommended to write 0
30	0x24D	2	Current calibration table high point turbidity value	R/W	FLOAT	UnitNTU
31	0x24F	2	Current calibration table high point signal	R/W	FLOAT	

No.	Addr.	Length	Meaning	Access	Data Types	Remark
			strength			
32	0x251	2	Turbidity value of the third calibration point in the current calibration table	R/W	FLOAT	Unit: NTU. When the turbidity value and signal intensity of the third calibration point are both 0, it is a two-point calibration mode. When either the turbidity value or the signal intensity at the third calibration point is not 0, it is a three-point calibration mode.
33	0x253	2	Signal strength of the third calibration point in the current calibration table	R/W	FLOAT	When the turbidity value and signal intensity of the third calibration point are both 0, it is a two-point calibration mode. When either the turbidity value or the signal intensity at the third calibration point is not 0, it is a three-point

No.	Addr.	Length	Meaning	Access	Data Types	Remark
						calibration mode.
34	0x255	2	Factory calibration table low point turbidity value	RO	FLOAT	UnitNTU
35	0x257	2	Factory calibration table low point signal strength	RO	FLOAT	
36	0x259	2	Factory calibration table high point turbidity value	RO	FLOAT	UnitNTU
37	0x25B	2	Factory calibration table high point signal strength	RO	FLOAT	
38	0x25D	2	Turbidity value of the third calibration point in the factory	RO	FLOAT	UnitNTU

No.	Addr.	Length	Meaning	Access	Data Types	Remark
			calibration table			
39	0x25F	2	Signal strength of the third calibration point in the factory calibration table	RO	FLOAT	
40	0x261	2	Single-point automatic calibration, write the turbidity value of the current measured water	WO	FLOAT	UnitNTU
41	0x263	2	Turbidity Low Point Calibration	WO	FLOAT	UnitNTU
42	0x265	2	Turbidity high point calibration	WO	FLOAT	UnitNTU
43	0x267	2	Turbidity third calibration point calibration	WO	FLOAT	UnitNTU
44	0x1388	7	Serial Number	RO	STRING	

Table 6 High range pressure maintaining turbidity register

No.	Addr.	Length	Meaning	Access	Data	Remark
1	0x01	1	Modbus slave address	R/W	UINT16	1-247
2	0x0D	2	Turbidity value	RO	UINT32	Unit: mNTU; turbidity value = measured turbidity value * turbidity factor + turbidity bias;
3	0x0F	1	Sensor working status	R/W	UINT16	1 Work 0 Stop
4	0x13	1	Restore factory calibration table	WO	UINT16	Write 1 to restore the factory calibration table
5	0x24	2	Single point automatic calibration	WO	UINT32	Unit: mNTU; write the turbidity value of the currently measured water
6	0x28	1	4mA output calibration value	R/W	UINT16	0~4095
7	0x29	1	20mA output calibration value	R/W	UINT16	0~4095
8	0x2A	1	(4~20)mA output mode	R/W	UINT16	1: (4~20)mA normal output mode 2: 4mA calibration mode 3: 20mA calibration mode
9	0x2B	1	Average number of times	R/W	UINT16	Default: 20; Write range: 1-20;

No.	Addr.	Length	Meaning	Access	Data	Remark
10	0x2C	1	Baud rate	R/W	UINT16	1=4800 2=9600 (default) 3 = 19200 4=38400 5=57600
11	0x2D	1	Serial port settings	R/W	UINT16	1=N81 (default), 2=N82 3=E81 4=O81 N: No verification E: Even parity O: Odd parity 8: Data bits 8 bits 1: stop bit 1 bit 2: Stop bit 2 bits
12	0x2E	2	(4~20)mA output range	R/W	UINT32	Unit: mNTU
13	0x243	2	Turbidity value	RO	FLOAT	Unit: NTU; turbidity value = measured turbidity value * turbidity factor + turbidity bias;
14	0x261	2	Single point automatic calibration	WO	FLOAT	Unit: NTU; write the turbidity value of the currently measured water
15	0x27C	2	Turbidity Factor	R/W	FLOAT	The default value is 1.0. Modification range 0.01 -99.99

No.	Addr.	Length	Meaning	Access	Data	Remark
16	0x27E	2	Turbidity bias	R/W	FLOAT	Unit: NTU; The default value is 0. Modification range: ±2000;
17	0x1388	7	Serial Number	RO	STRING	

Note: If the meaning of registers is the same, then they will point to the same target. When one is modified, the other will also change at the same time. The two registers are just different in position or unit, but the content and meaning are the same. For example, register 0x21C and register 0x249.

A.4 Communication Example

Example: Read turbidity value (register address 0x0243 , length 2 , floating point type)

Send message: 01 03 02 43 00 02 35 85

Receive message: 01 03 04 3E B3 26 1F 7E 54

Message analysis: 01 device address

03 Function code

04 data length, 4 registers

3E B3 26 1F Turbidity value, according to FLOAT data type, ABCD byte order parsing, the value is 0.3499 , unit NTU

7E 54 CRC check code