User Manual

Supmea

Turbidity Analyzer

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U-SUP-PTU300-EN5

Foreword

- Thank you for purchasing our products.
- This manual is an instruction manual for the product's various functions, wiring methods, setup methods, operation methods, troubleshooting methods, etc. For basic product information, please refer to the corresponding instruction manual.
- Please read this manual carefully before operation and use this product correctly to avoid personal injury and unnecessary losses due to incorrect operation.

Note

- If there are any software or hardware upgrades to this manual, please refer to the newly released document.
- We strive to ensure the accuracy of the information in this manual. If you find any errors, please contact us.
- The contents of this manual are strictly prohibited from being reproduced or copied.
- Please use this product in accordance with its explosion-proof characteristics and in compliance with national and regional laws and regulations.
- The final interpretation of this manual rests with our company.

Version

U - SUP- PTU300 -EN5

Confirm package contents

After opening the packaging box, please check the contents before starting any operations. If you find any errors in the model or quantity, or any physical damage to the exterior, please contact our company.

No.	Items	Qty	Note
1	Turbidity analyzer	1	
2	Expansion screw, M8 x 40 mm	4	
3	Adapter, G1/2 female thread to 6 mm OD push-in	1	
4	Inlet hose, 6 mm ID x 2000 mm L	1	
5	Water/sewage hose, 10 mm ID x 150 mm L	2	
6	Reducer, 50 mm to 25 mm	1	
7	User manual	1	
8	Certificate of Conformity	1	

Note: Customized products may differ slightly from standard products; please refer to your order for details.

Contents

1 Overview

1.1 Introduction

Flow-through turbidity analyzers are online turbidity analyzers for drinking water, featuring ultra-low turbidity detection limits, high-precision measurement, long-term maintenance-free operation, water-saving operation, and digital output . They support remote monitoring via cloud platforms and mobile devices, as well as RS485-Modbus communication, and can be widely used for online turbidity monitoring of tap water leaving treatment plants, secondary water supply systems, water at the end of pipe networks, direct drinking water, membrane-filtered water, swimming pools, and surface water.

1.2 Measuring principle

SUP-PTU300 turbidity meter adopts the 90° scattering detection principle and designs a unique photoelectric receiving structure, as well as an automatic temperature and light compensation method, which greatly improves the accuracy and accuracy of turbidity detection. The sensor ARM7 built-in data processor, and adopts an efficient digital filtering algorithm to avoid noise interference. At the same time, it adopts standard Modbus digital signal output and 4-20 mA analog output, which is convenient for users to access the computer monitoring system.

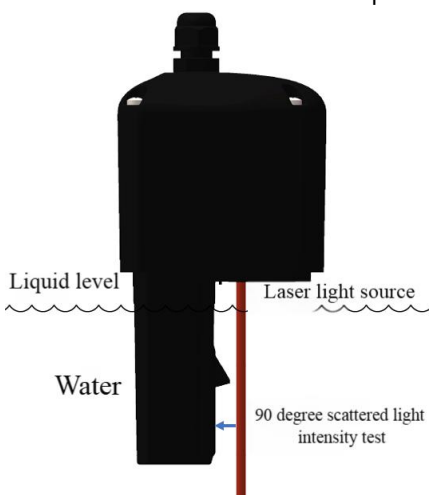

Fig.1 Measurement principle

2 Technical parameters

Table 1 Technical parameters

Measured variables	Turbidity
Measuring range	(0 ~ 1) NTU, (0 ~ 20) NTU , (0 ~ 100) NTU
Indication error	±2% or ±0.015 NTU, whichever is larger. (Based on Formazin primary standard solution at 25°C)
Resolution	0.001NTU
Zero offset	≤±0.015NTU
Output	(4~20) mA + RS485 output
Power supply	24VDC
Inlet flow rate	(50 ~ 300) ml /min
Operating temperature	(0 ~ 50) ℃
Storage temperature	(-20 ~ 60) ℃
humidity	Relative humidity 5 % ~ 95 % , non-condensing
Protection level	IP 54
Instrument Dimensions	183mm*349mm*113.5mm (width*height*thickness)
Instrument weight	4.5 kg
Sensor size	6.6 mm * 145 mm * 54 mm (width * height * thickness)
Sensor cable length	2 meters
Installation method	Wall-mounted

3 Structure and dimensions

3.1 External dimensions

Product Dimensions (W×H×D)：183 mm × 349 mm × 113.5 mm

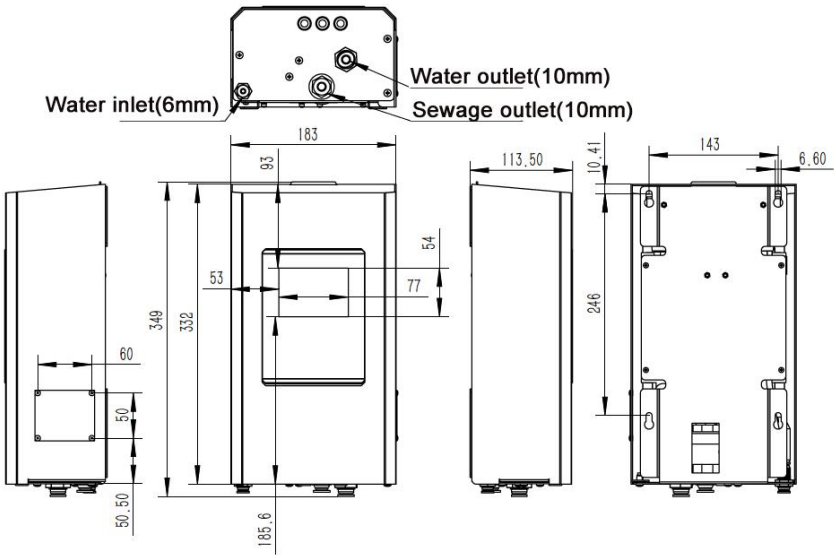

Fig.2 Product dimensions

3.2 Weight

Product weight : 4.5 kg

4 Installation

4.1 Mounting components

The standard mounting components for the turbidimeter are shown in the following diagram:

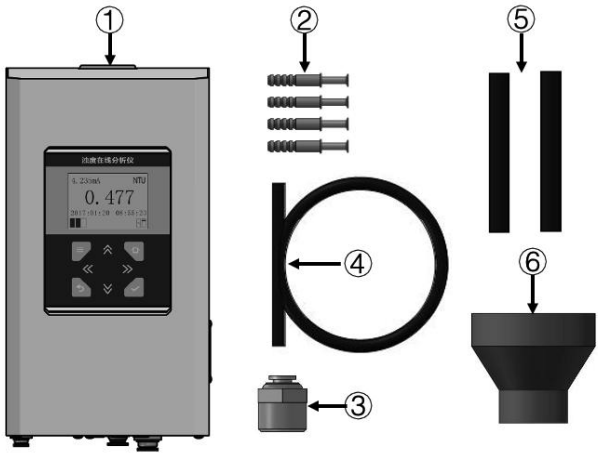

Fig.3 Installation components

Table 2 Installation component list table

No.	Items
1	1 Turbidity online analyzer
2	4 Expansion bolts, φ8mm × 40mm
3	1 Adapter, G1/2 thread to 6 mm push-in
4	1 Inlet hose, Φ6mm×2000mm
5	2 Outlet/drain hoses, Φ10mm×150mm
6	1 Reducer, Φ50mm－25mm

In addition to the standard factory-installed parts, customers need to provide the following parts themselves:

Table 3 User-supplied installation parts

Type	No.	Description
Components	1	DC24V power supply and two-core power cord
	2	Two-core shielded data cable (for connecting to a 485 interface or (4 ~ 20) mA interface)
	3	Conduit and clamps
	4	Φ 25mm drainage pipes, straight pipes, elbows, pipe clamps, etc., can be selected according to installation requirements.
	5	Water inlet pipes, straight pipes, elbows, tees, pipe clamps, etc., can be selected according to installation requirements.
	6	Inlet ball valve
	7	Inlet Y-type filter
	8	Water inlet pipe to water inlet pipe×G1/2 female thread
Tool	9	Plumbing installation tools, glue, Teflon tape, handsaw, etc.
	10	General hand tools, Phillips screwdrivers, etc.
	11	Electrical tools, electric or pneumatic impact drills, etc.
	12	Electrical tools, wire strippers, electrical tape, etc.

4.2 Mechanical installation

4.2.1. Fixed

Before mounting the turbidity analyzer onto a vertical wall, the front panel must be removed. Loosen the three screws at the bottom of the front panel to release the connection between the front panel and the back panel, then lift it off at an angle to remove it.

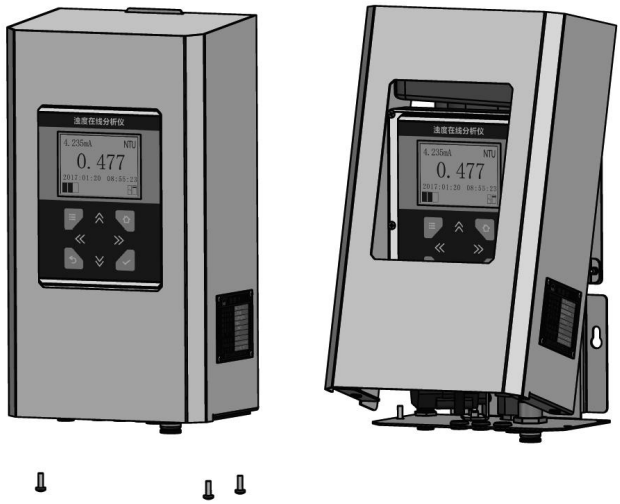

Fig.4 Remove the front panel

The online turbidity analyzer has four mounting holes on its back panel, as indicated by the arrows in the image below. Typically, please measure size on the mounting wall, insert expansion screws, and secure the instrument to the wall. Alternatively, the device can be installed inside a cabinet. Ensure that the instrument remains level when mounted.

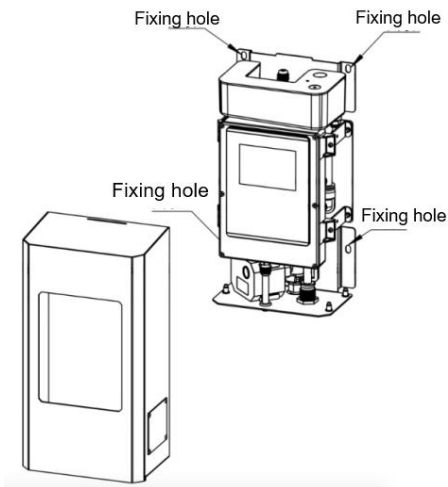

Fig.5 Fixing hole

4.2.2. Water supply

The water pipe connector for the online turbidity analyzer is located at the bottom of the device, as shown in the picture below.

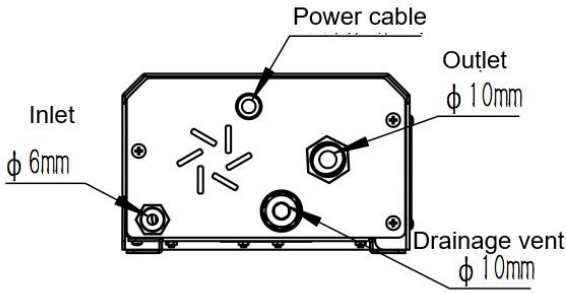

Fig.6 Water pipe joint

4.2.3. Installation diagram

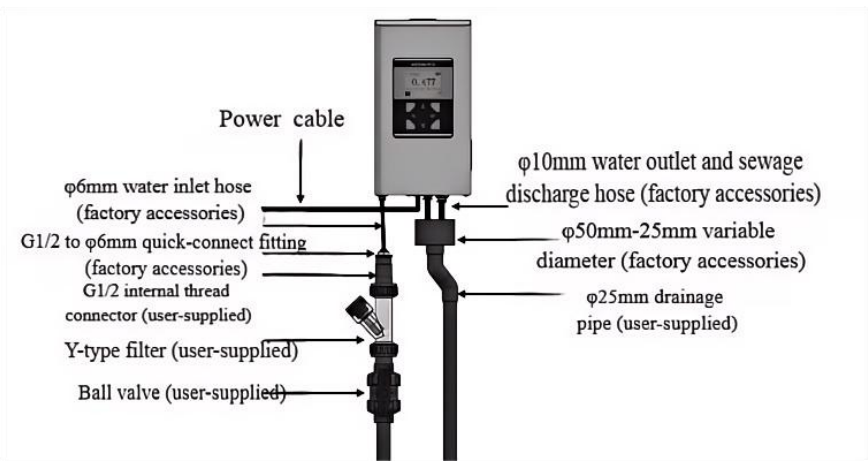

Fig.7 Overall installation effect diagram

4.3 Installation Precautions

Ensure the level of instrument installation

- Water can only be passed after installation
- Wait for a period of time for the value to stabilize for the first time after booting up
- The equipment automatically suspends the measurement order every time the sewage is discharged:
- The length of the water outlet hose and the sewage hose should not exceed 0.3 meters (it is recommended to use a DN25 water pipe to drain the water to the drainage pipe or drainage ditch)
- The power supply is not less than 20 watts
- The signal line cannot touch the 24V power line
- The length of the water inlet hose should not exceed 2 meters (if the sampling point of the tested water sample is far away, it is recommended to use a DN25 water pipe to lead the water sample to the vicinity of the equipment first)
- It is recommended to install a pre-filter or Y-type filter before the instrument enters the water to avoid the inflow of large foreign matter or sediment.
- It is recommended to install an inlet water regulating valve before the instrument enters water to control the inlet water flow and facilitate maintenance

5 Electrical connection

The wiring method for the online turbidity analyzer is shown in the table below. The operating voltage is DC24 V , and the daily operating current is between 0.05 A and 0.5 A.

Table 4 Color definition

Cable color	Wiring
red	+ 24V DC
black	GND
green	485 A
yellow	485 B
Purple	(4~20) mA+
White	(4~20) mA-

6 Operation

6.1 Operation panel

The control panel is located directly in front of the online turbidity analyzer.

Fig.8 Operation panel

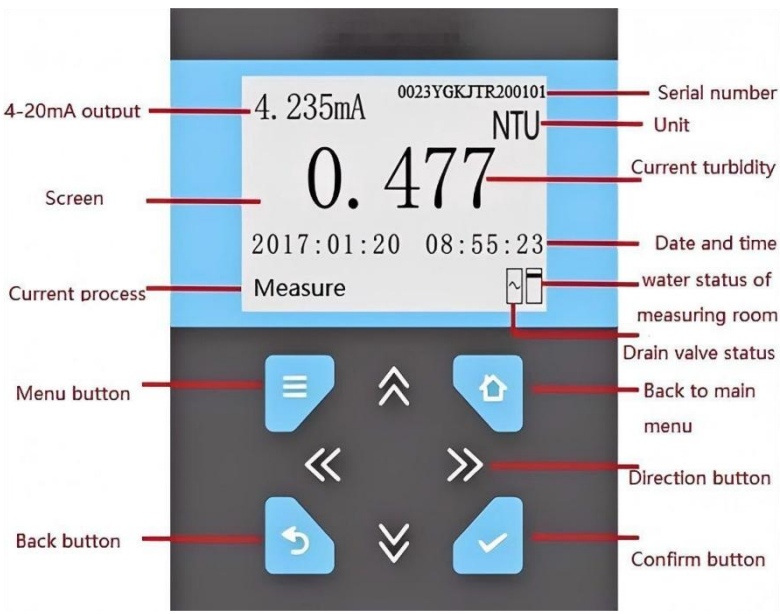

Fig.9 Display Screen

Fig.10 Operation button function table

Button	Description
	Menu
	Main interface
	Back
	Confirm
	Up, down, left, and right

6.2 Equipment Workflow

Table 5 Turbidity online analyzer workflow chart

Step	Description
1	Automatic cleaning: There will be an automatic cleaning process for a few minutes after the equipment is powered on. After completion, go to step 2。
2	Initialization: the device performs the initialization operation, and then enters step 3 after completion; If there is an error, go to step 6。
3	Waiting for water: the device waits for water to fill the measuring cylinder, and then enters step 4 after completion; If there is an error, go to step 6.
4	Measurement: The equipment enters the normal measurement phase, and then enters step 5 after completion; If there is an error, go to step 6。
5	Drainage: The equipment enters the drainage stage, and then enters step 3 after completion; If there is an error, go to step 6.
6	Error: The device enters the error phase, after the countdown is completed, go to step 5.

6.3 Main settings

6.3.1. Execution time settings

Table 6 Set waiting time

Step	Choose	Description	Confirm
1		Main menu	——
2		Parameter settings	
3			
4		Select characters	——
5		Choose the right number.	
6		Main interface	——

Setting the measurement time, drainage time, and error restart interval time is similar to the setting of the waiting time, just select the measurement pool waiting time as the corresponding option in the parameter setting.

6.3.2. ID setting

Table 7 ID setting

Step	Choose	Description	confirm
1		Main menu	——
2		Parameter settings	
3		ID setting	
4		Select characters to edit	——
		Choose the right number.	
5		Main interface	

6.3.3. Date and time settings

Table 8 Date and time settings

Step	Choose	Description	confirm
1		Main menu	——
2		Date and time settings	
3		Date settings	
4		Select characters to edit	——
5		Choose the right number	
6		Date settings	
7		Select characters to edit	——
8		Choose the right number	
9		Main interface	

6.3.4. (4~20) mA calibration

Table 9 （4~20）mA calibration

Step	Choose	Description	confirm
1		Main menu	——
2		Calibration	
3		（4~20）mA calibration	
4		4mA calibration	
5		Select characters to edit	——
		Choose the right number until output 4mA	

6		20mA calibration	
		Select characters to edit	——
7		Choose the right number until output 20mA	
8		Main interface	

6.3.5. Turbidity calibration

Table 10 Turbidity calibration

Step	Choose	Description	confirm
1		Main menu	——
2		Calibration	
3		Turbidity calibration	
4		Single point calibration	
5		Select characters to edit	——
6		Choose a suitable number, unit mNTU	
7		Main interface	

7 Calibration

7.1 Calculation equation

The online turbidity analyzer has good linearity, and the calibration formula is a linear equation.

Two points determine a straight line. Assume the coordinates of the two points are (lower x , lower y) and (higher x , higher y), where (X) = , as shown in the figure .

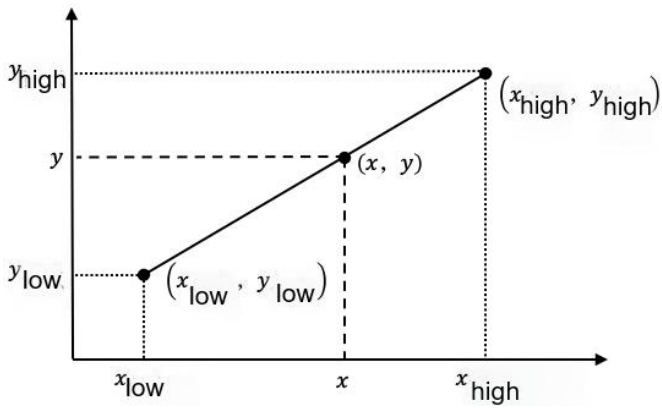

Fig.11

of a straight line can be obtained using the two- point form of the equation formula.

$$\frac{(x-x_{low})}{(x_{high}-x_{low})}=\frac{(y-y_{low})}{(y_{high}-x_{low})} \quad (1)$$

If we transform formula (1) into an equivalent intercept $y=kx+b$ form, we can obtain

$$y=\frac{y_{high}-y_{low}}{x_{high}-x_{low}}x+\frac{y_{low}x_{high}-y_{high}x_{low}}{x_{high}-x_{low}} \quad (2)$$

in :

$$k=\frac{y_{high}-y_{low}}{x_{high}-x_{low}} \quad (3)$$

$$b = \frac{y_{low}x_{high} - y_{high}x_{low}}{x_{high} - x_{low}} \quad (4)$$

According to formula (1) or (2) , y can be calculated if x is known; x can be calculated if y is known .

7.2 Turbidity sensor calibration line

The turbidity sensor outputs a turbidity value, with the ordinate (y) representing turbidity in NTU and the abscissa representing the sensor's internal signal strength, known as the gain. Two points determine the turbidity sensor calibration line: the " low point" and the " high point," with coordinates of (low gain, low turbidity) and (high gain, high turbidity), respectively. Therefore, the four parameters—low-point gain, low-point turbidity, high-point gain, and high-point turbidity—determine the turbidity sensor calibration line.

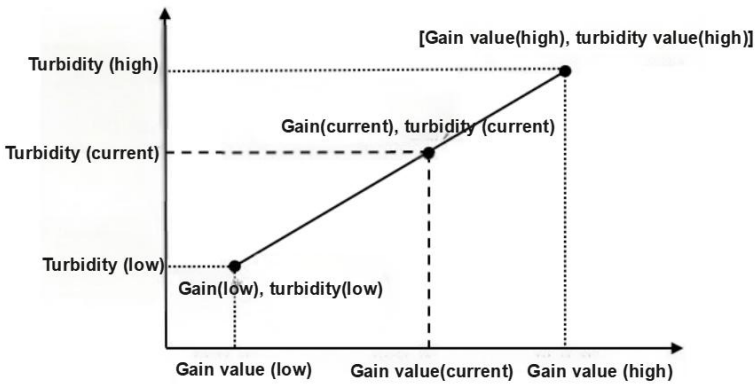

Fig.12

According to formula (1) , the calibration line is obtained.

$$\frac{(Gain_{current} - Gain_{low})}{(Gain_{high} - Gain_{low})} = \frac{(Turbidity_{current} - Turbidity_{low})}{(Turbidity_{high} - Turbidity_{low})} \quad (5)$$

If we transform the formula into an equivalent intercept form, that is...

$$Turbidity\ value_{current} = k\ gain\ value_{current} + b \quad (6)$$

in:

$$k = \frac{Turbidity_{high} - Turbidity_{low}}{Gain_{high} - Gain_{low}} \quad (7)$$

$$b = \frac{Turbidity_{low} \times Gain_{high} - Turbidity_{high} \times Gain_{low}}{Gain_{high} - Gain_{low}} \quad (8)$$

current gain value obtained by the sensor and the stored " sensor calibration point low" and " sensor calibration point high", the current turbidity value can be calculated using formula (7) or formula (8) .

from formulas (7) and (8), modifying any 1 to 4 of the four values of low gain value , low turbidity value, high gain value , and high turbidity value can change the calibration line and affect the current output result of turbidity value .

These four numbers are stored in registers using UINT 32 format. The starting address for the lowest turbidity value is 0x14 , the starting address for the lowest gain value is 0x16 , the starting address for the highest turbidity value is 0x18 , and the starting address for the highest gain value is 0x1A . Registers with starting addresses of 0x1C, 0x1E, 0x20, and 0x22 store the corresponding factory default values.

The turbidity value is stored in mNTU, ranging from 1 to 99999 , or 0.001 NTU to 99.999 NTU; the gain value has no unit and ranges from 0 to 16777215 .

7.3 Common methods for calibrating straight lines

Taking a turbidity analyzer with a range of 0 ~ 20 NTU as an example, the low point of turbidity value is usually 2 5 mNTU, or 0.025 NTU , and the high point of turbidity value is 20000 mNTU, or 20 NTU . Generally, the calibration meter can be adjusted by modifying the two parameters of low gain value and high gain value.

Increasing the gain value will decrease the turbidity value of the current output.

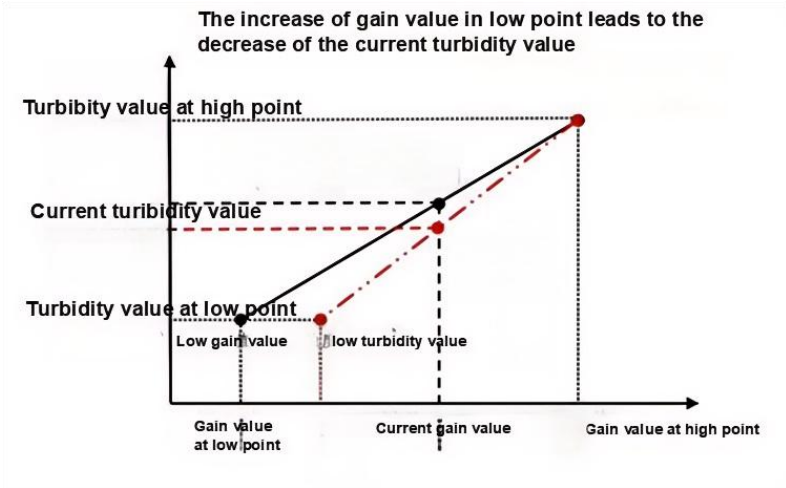

Fig.13

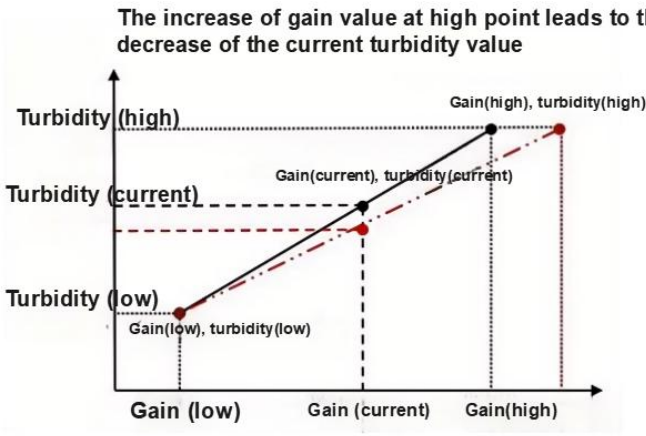

Fig.14

Conversely, decreasing a gain value will increase the turbidity value of the current output.

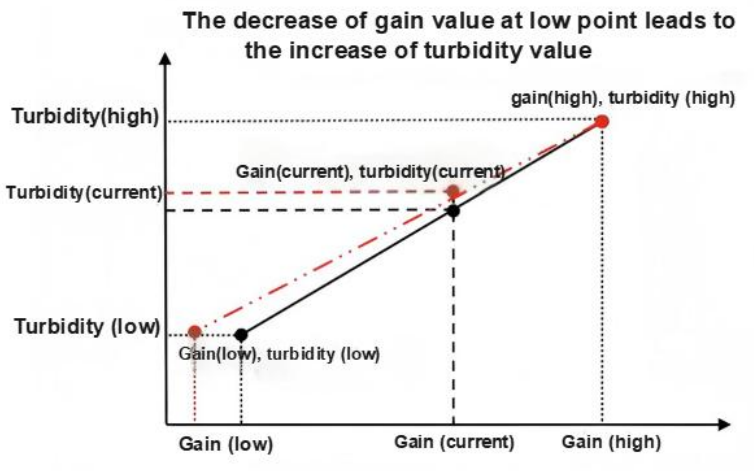

Fig.15

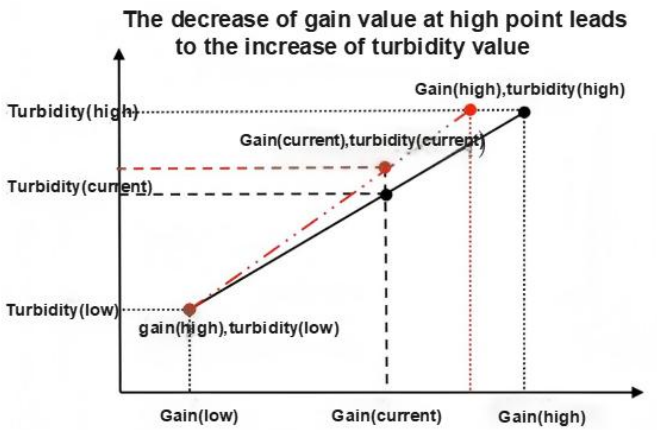

Fig.16

7.4 Single-point calibration example

If you wish to correct the turbidity value within 10% of the range (0 NTU) , it is recommended to correct the low point. If you wish to correct the turbidity value between 90% and full scale, it is recommended to correct the high point. If you wish to correct the turbidity value between 10% and 90 % of the range , it is

recommended to use two-point calibration, where the difference in turbidity between the two points should be greater than 50% of the range .

For example, the sensor 's factory-built -in calibration points are " low turbidity value 25 (0.025 NTU) ", " low gain value 50000 " , " high turbidity value 10000 (10 NTU) ", and " high gain value 2000000" . Using formulas (7) and (8) , the current calibration line mode is calculated.

$$Gian_{current} = \frac{13}{26000} Gian_{current} - \frac{3000}{13}$$

current turbidity value output by the sensor is 300 (0.3 NTU), the current gain value is calculated to be 103759 based on the calibration line .

However, the turbidity value measured by the handheld / laboratory turbidimeter is 350 (0.35 NTU) at this moment, so the low-point gain value needs to be modified.

At this point, using the current turbidity value of 350 and the current gain value of 103759, and the high point turbidity value of 10000 and the high point gain value of 2000000, a new calibration line is calculated .

$$Turbidity_{current} = \frac{9650}{1896241} Gian_{current} - \frac{337590000}{1896241}$$

According to the new formula, the gain value is calculated to be 39895 when the low turbidity value is 25 (0.025 NTU).

At this point, rewrite the low-point gain value register to 39895 to complete the adjustment.

8 Maintenance

8.1 Maintenance preparation

（1）Remove the instrument surface cover;
（2）Confirm that the instrument is powered normally;
（3）Confirm that the sewer / drainage pipe / drainage ditch is unobstructed;
（4）Confirm that there is water coming into the inlet pipe.

8.2 Maintenance work

8.2.1. Water supply checked and found to be normal

（1）There is water flowing though the pipes ;
（2）Incoming water can flow into the defoaming tank ;
（3）No water overflows from the inlet of the defoaming tank .

8.2.2. Check that the drainage is unobstructed.

Assuming the incoming water is normal, the liquid level in the defoaming tank is normal, and there is no water overflow:

(1) Check if there is water inside the equipment (bottom plate, back plate, measuring cylinder). If there is water, it means that there was an overflow situation before. There are two reasons for this phenomenon: one is that the incoming water pressure is too high and the water overflows directly from the defoaming cylinder; the other is that the drainage is not smooth, causing the water to overflow from the measuring cylinder. If the situation of excessive incoming water pressure can be ruled out, it means that the drainage is not smooth.

(2) Recommended installation method: Use two short (within 20 cm) plastic hoses to connect the water outlet and the drain outlet respectively, and then insert these two hoses into a PVC drain pipe with a diameter of 25 cm . Use the PVC drain pipe to introduce the water into the sewer.

(3) Installations that can lead to poor drainage:

Because flexible hoses inevitably bend and coil, using them for drainage can easily lead to poor drainage. If the hose is too long and contains a section enclosed by air, it will increase drainage resistance and make drainage even

more difficult. The following are installation methods that can easily cause drainage problems; however, due to varying site conditions, the specific method used should be considered.

a. Use two long (over 1 meter) plastic hoses to direct the water from the outlet and the drain into the sewer respectively;
b. Use two short plastic pipes and a T-joint to connect the water outlet and the drain outlet, and then use a long (more than 1 meter) plastic hose to guide the water into the sewer.
c. The hose extending from the water outlet or sewage outlet has an upward-facing section;
d. The hose extending from the water outlet or sewage outlet has a rotating part;
e. Power supply checked and found to be normal

The instrument is powered by DC, with a voltage value within DC2.4V ±4V, and the voltage is stable.

8.2.3. Check the automatic sewage discharge electric valve

An electric valve for automatic sewage discharge is installed at the bottom of the instrument. After power-on, the instrument will start a self-cleaning process. During this process, please pay attention to the following two aspects :

(1) Listen to the sound: At this time, you will hear the sound of the electric valve rotating at regular intervals. The sound should be continuous and stable without any abnormal noise. If the electric valve of the newly installed equipment makes abnormal noise, it needs to be returned to the factory for repair. If the equipment makes abnormal noise after running for a period of time, you need to pay special attention to whether the electric valve is working properly.

(2) Observe the water flow: When the electric valve is powered on, it will be in the closed state. When the power is cut off, it will automatically return to the open state. During the automatic cleaning process, the electric valve will switch between being powered on and off. When the water supply is normal, you can observe the drain outlet. When the electric valve is open, water will be discharged. When the electric valve is closed, no water will flow out. If

water keeps flowing out of the drain outlet or there is no water flowing out, it indicates that the electric valve is faulty and needs to be returned to the factory for repair.

8.2.4. Check the sensor

(1) Clean the sensor

Disconnect the power to the instrument, remove the sensor from the measuring cylinder, and clean the sensor.

When cleaning the aperture, use cotton swabs, preferably dipped in alcohol. If alcohol is unavailable, use dry cotton swabs; if cotton swabs are also unavailable, use dry paper towels. Do not use wet cotton swabs or wet paper towels.

(2) Check the light source

Power on the instrument. After entering the measurement state, point the removed sensor at a white wall. You can observe that the sensor emits a red bright spot similar to a laser pointer every 5 to 10 seconds, lasting for 1 to 3 seconds. The brightness perceived by the naked eye should be no less than that of a laser pointer.

Common fault conditions of light sources include:

a. No change after power-on, no timed laser emission;
b. The red spot is very dim, far less bright than a laser pointer;
c. Confirm that when there is no water stains in the sensor aperture, the emitted light is red patches, not concentrated red bright spots.

If the light source fails, the sensor can be removed from the instrument and sent back to the manufacturer for repair and calibration.

Before inserting the sensor back into the measuring cylinder, the instrument needs to be powered off. After placing it into the measuring cylinder, press down gently with your hand to ensure it is fully inserted and not tilted. You can observe from the side of the instrument whether the sensor is properly positioned.

8.2.5. Clean the cylinder

Use a test tube brush to clean the defoaming tank and measuring tank, ensuring that there are no visible sediments such as mud or sand on the bottom and side walls of the tanks.

8.2.6. Check running status

After the instrument is powered on and completes its self-cleaning process, it will display information such as the system date and instrument working status. To ensure that the measuring cylinder is full of water, the instrument will wait for a preset time (3 to 5 minutes) before starting the measurement and displaying the measured turbidity result.

If you encounter the following problems, please follow the recommended troubleshooting steps:

(1) Fault: The display screen is not lit;

Recommended solution: Check if the instrument's power supply is normal. If the power supply is normal, the entire unit needs to be returned to the factory for repair.

(2) Fault: The backlight of the display screen is on, but there is no content, including the date;

Recommended solution: The entire machine needs to be returned to the factory for repair.

(3) Fault: The system displays the date and working status normally, but after waiting for a sufficient period of time (more than 10 minutes), no measurement results are displayed;

Recommended solution: Check if the sensor is properly connected to the instrument, or disconnect the power and reconnect the four-pin waterproof connector between the sensor and the instrument. If there is still no measurement result, the entire unit needs to be returned to the factory for repair.

(4) Fault: The sensor is not responding;

Recommended procedure: Check if the sensor is properly connected to the instrument, or disconnect the power and reconnect the four-pin waterproof connector between the sensor and the instrument. If the sensor still does not respond, the sensor needs to be sent back for testing.

(5) Fault: The turbidity value is displayed as 0 for a long time (more than 20 minutes) ;

Recommended procedure: Remove the sensor and check if the light source is working properly (see 6.2) ; if the light source is working properly, turn off the water inlet and power off, put the sensor back into the measuring cylinder and

install it in place , then power on again, wait, and observe whether the sensor measures an air value of 0. If it is still 0 , the sensor needs to be sent back for testing.

8.2.7. Check the turbidity measurement effect

Before determining that the instrument measurement results are inaccurate, the following preparatory work should be done:

(1) Confirm that the handheld / laboratory turbidimeter is working properly.

Recommended procedure: Use two or more water samples to validate the handheld / laboratory turbidimeter. For example, the turbidity value of bottled water, mineral water, and barrelled water should be within 0.1 NTU; tap water should generally be above 0.1 NTU and within 1 NTU; surface water should generally be above 1 NTU. The same water sample can be measured more than twice to confirm the reliability of the handheld / laboratory turbidimeter in the field.

(2) Confirm that the sampling points are consistent

Recommended procedure: When comparing with handheld / laboratory equipment, water samples should be taken from the outlet of the measuring instrument.

If any problems are found, we recommend handling them in the following ways:

Problem: The measured values have a serious deviation.

Recommended procedure: First, confirm that the handheld / laboratory turbidimeter is working properly.

(3) Problem: The instrument measurement result is much larger than the actual value (more than 0.5 NTU);

Recommended procedure: Confirm that the sensor aperture is free of water stains (see 6.1) , the light source is functioning normally (see 6.2) , and clean the cylinder (see 6). Restore the factory calibration chart; if the values are still too high, it is recommended to return it to the factory for calibration.

(4) Problem: The instrument measurement result is much smaller than the actual value (more than 0.5 NTU), or remains at a very small value (less than 0.01 NTU) without changing;

Recommended procedure: Confirm that the sensor light source is normal (see 6.2), restore the factory calibration table. If the value is still too low, it is recommended to return it to the factory for calibration.

(5) Problem: There is a small deviation between the instrument measurement

results and the measurement results of handheld / laboratory instruments whose reliability has been verified.

Recommended approach: Every instrument has its own inherent error, especially when the handheld / laboratory instrument and the online instrument are not aligned, resulting in a noticeable difference. This is normal. In daily practice, people often place greater emphasis on the measurement results of handheld / laboratory instruments. Therefore, there is a tendency to calibrate online equipment using the results of handheld / laboratory instruments (the standard practice is to calibrate using national standard solutions, but the preparation, storage, and use of turbidity standard solutions require a high degree of cleanliness in the glassware and strict operational procedures, and the conditions for using standard solutions for calibration are often not available on-site).

If, after confirming that the sensor aperture is free of water stains (see 8.1), the light source is functioning normally (see 8.2) , the cylinder is cleaned (see 6), and the factory calibration table has been restored, and if a deviation still exists, and you wish to fine-tune the instrument's measurement results, you can choose to manually correct the calibration table. For example, if the on-site turbidity value is 0.03 NTU , but the instrument displays 0.06 NTU, increasing the low-point gain value of the turbidity analyzer will cause the instrument to calculate a lower measurement result based on the adjusted calibration curve. After adjustment, the instrument will automatically save the adjustment results.

9 Fault Analysis and Troubleshooting

The table below lists potential problems with the instrument and their solutions. If your problem is not listed or the solution does not address your issue, please contact us.

Table 11 Troubleshooting

Fault phenomenon	Possible Cause Analysis	Elimination methods
RS485 communication failed.	The signal cable is not connected properly.	Reconnect the signal cable after power failure
	Sensor damage	Contact our company
The turbidity level is abnormally high (water source issues have been ruled out).	Improper installation caused water to enter and contaminate the sensor aperture.	Clean the sensor aperture glass plate
	Sensor internal contamination	Cleaning sensors (Operators must undergo relevant operational training)
Turbidity value too low	Light source damaged	Contact our company

10 Warranty and After-Sales Service

Our company guarantees that any product quality issues arising during the warranty period will be covered under our unconditional "Three Guarantees" policy, which includes free repair, replacement, or return. All non-customized products are eligible for return or exchange within 7 days (excluding products damaged due to misuse). For customized products, the warranty terms specified in the contract shall apply.

Disclaimer

The following situations are not covered under the "Three Guarantees" policy, even during the warranty period:

(1) Product malfunctions caused by improper use by the customer.

(2) Product malfunctions resulting from unauthorized disassembly, repair, or modification by the customer.

Appendix A Communication Protocol

A.1 Overview

The online turbidity analyzer supports two standard data interfaces: a 485 Modbus interface and a (4 ~ 20) mA interface. Users can choose either one according to their needs .

A.2 485 Modbus interface

A.2.1 Wiring Method

485 Modbus interface is shown in the table below.

Table 12 485 Modbus Interface Wiring Diagram

color	Function
green	485 A
yellow	485 B

A. 2.2 485 baud rate

485 Modbus interface has a baud rate of 9600, 8 data bits, no parity, and 1 stop bit.

A.2.3 Modbus Protocol

(1) Host sending format

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

MSB LSB

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

meaning:

Byte 1: Turbidity sensor ID number, with a value range of 0x01-0xFF and a default value of 0x03;

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

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

Bytes 5 and 6: Number of registers; the high byte is in byte 5, and the low byte is in byte 6.

Bytes 7 and 8: 16-bit CRC checksum, with the low byte in byte 7 and the high byte

in byte 8;

(2) Sensor response format

The turbidity sensor parsed the command correctly and responded normally to the host. If the host called for 1 register, the reply data length is 2 bytes, and the response length is 7 bytes; if the host called for 2 registers, the reply data length is 4 bytes, and the response length is 9 bytes, and so on. The meaning of the reply format with 2 registers is as follows (MSB sent first) :

MSB LSB

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

meaning :

Byte 1: Turbidity sensor ID number, with a value range of 0x01-0xFF and a default value of 0x03;

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

Byte 3: Length of the response data ;

Bytes 4, 5, 6, and 7: Data ;

Bytes 8 and 9: 16-bit CRC checksum, with the low byte in byte 8 and the high byte in byte 9;

【example】

(1) Read the turbidity value (register address 0x0013, length 2)

Hexadecimal transmission: 03 03 00 13 00 02 34 2C

Hexadecimal reception ; 03 03 04 00 00 00 76 58 15

Note: 00 00 00 76 is the turbidity value (integer , unit mNTU , value is 118 mNTU or 0.118 NTU), and 58 15 is the check value.

(2) Modify the device ID (register address 0x0001, length 1) .

For example, if the device's current ID is 03, and it changes to 04:

Hexadecimal transmission: 03 10 00 01 00 01 02 00 04 BF 22

Hexadecimal reception ; 03 10 00 01 00 01 51 EB

If only this device is connected on the 485 bus, the sensor ID can be modified using the Modbus broadcast address.

Hexadecimal transmission: 00 10 00 01 00 01 02 00 04 AB 02

Hexadecimal reception ; 03 10 00 01 00 01 51 EB

(3) Read the current calibration table and the factory calibration table

The current calibration table has four relevant parameters: "Low Turbidity Value at Sensor Calibration Point," "Low Gain Value at Sensor Calibration Point," "High Turbidity Value at Sensor Calibration Point," and "High Gain Value at Sensor Calibration Point." The factory calibration table has four relevant parameters: "Factory Low Turbidity Value at Sensor Calibration Point," "Factory Low Gain Value at Sensor Calibration Point," "Factory High Turbidity Value at Sensor Calibration Point," and "Factory High Gain Value at Sensor Calibration Point." The "Factory Low Turbidity Value at Sensor Calibration Point" in the factory calibration table corresponds to the factory default value of the "Low Turbidity Value at Sensor Calibration Point" in the current calibration table, and so on. The current calibration table is readable and writable, used to modify the calibration line . The factory calibration table is read-only; it can be read and its values written to the corresponding current calibration parameters to restore factory settings.

The eight parameters related to the calibration table can be read back together with a single command, including both the current calibration table and the factory calibration table. Alternatively, each parameter or several parameters can be read separately. The following example shows how to read all eight parameters at once. Commands to read parameters 1 to 7 can be sent and parsed according to the Modbus protocol.

Hexadecimal transmission: 03 03 00 14 00 10 05 E0

Hexadecimal reception : 03 03 20 00 00 00 50 00 00 C3 50 00 00 4E 20 00 4C 4B 40 00 00 00 51 00 00 C3 51 00 00 4E 21 00 4C 4B 41 21 79

Note: 00 00 00 50 is the low turbidity value of 80 mNTU (0.08 NTU), 00 00 C3 50 is the low gain value of 50000, 00 00 4E 20 is the high turbidity value of 20000 mNTU (20 NTU), 00 4C 4B 40 is the high gain value of 5000000, 00 00 00 51 is the factory low turbidity value of 81 mNTU (0.081 NTU), 00 00 C3 51 is the factory low gain value of 50001, 00 00 4E 21 is the factory high turbidity value of 20001 mNTU (20 NTU), 00 4C 4B 41 is the factory high gain value of 5000001, and 21 79 is the calibration value.

(4) Write the current calibration table

The current calibration table can be written at once, or one or more parameters can be written separately. The following example shows how to read four parameters at once. The command to read one to three parameters can be sent

and parsed according to the Modbus protocol.

Hexadecimal transmission: 03 10 00 14 00 08 10 00 00 00 50 00 00 C3 50 00 00 4E 20 00 4C 4B 40 02 3D

the hexadecimal value is 03 10 00 14 00 08 80 29, it means the register write was successful.

A.3 (4 ~ 20) mA interface (optional)

(4 ~ 20) mA interfaces are shown in the table below.

Table 13 (4~20) mA Interface Wiring Table

color	Function
brown	(4 ~ 20) mA positive
White	(4 ~ 20) mA negative

If the equipment wiring label differs from the (4 ~ 20) mA wiring table, the equipment wiring label shall prevail.

The relationship between output current value and turbidity value is shown in the table below .

Table 14 Table of correspondence between current value and turbidity value (Type 31)

Current value	Turbidity value
4 mA	0 NTU
x mA	[(x - 4) ×20 / 16] NTU
20 mA	20 NTU

Table 15 Table of correspondence between current value and turbidity value (Type 30)

Current value	Turbidity value
4 mA	0 NTU
x mA	[(x - 4) / 16] NTU
20 mA	1 NTU