ZD01
Online turbidity sensor
User Manual

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1. System Overview

- The ZD01 integrated online turbidity sensor is designed and manufactured using the principle of scattered light turbidity measurement. When a beam of light enters the water sample, the light is scattered due to the turbidity material in the water sample. The turbidity in the water sample is calculated by measuring the intensity of the scattered light perpendicular to the incident light and comparing it with the internal calibration value. Degree, the final value is output after linearization processing.

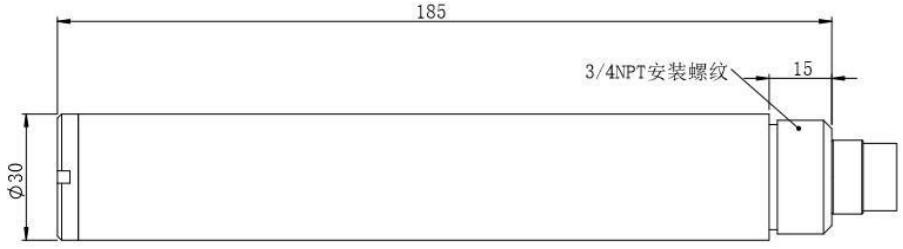
1.1Features

- 90° angle scattered light principle, built-in temperature sensor
- Support RS-485, Modbus/RTU protocol
- Optical fiber structure, strong resistance to external light interference
- Infrared LED light source, high stability
- IP68 protection, within 20 meters of water depth
- Convenient, fast, stable and easy to maintain

1.2Technical Parameters

model	ZD01	
Measuring principle	Scattered light method	
Range/resolution	0～20.00NTU	0.01NTU/0.1℃
	0～100.0NTU	0.1NTU/0.1℃
	0～1000.0NTU	0.1NTU/0.1℃
Precision	±5%或±3NTU(0～1000.0NTU) ±3%或±2NTU(0～100.0NTU) ±3%或±1.5NTU(0～20.00NTU) ±0.3℃	
Calibration method	Two-point calibration	
Temperature compensation	Automatic temperature compensation (Pt1000)	
output method	RS-485(Modbus/RTU)	
Working conditions	0～50℃，<0.2MPa	
storage temperature	-5～65℃	
shell material	POM、ABS	
Installation method	Immersion installation, 3/4"NPT pipe thread	
Cable length	5 meters, other lengths can be customized	
Power consumption	0.2W@12V	
power supply	12～24VDC	
Protection level	IP68	

1.2.1Dimensions



Note: The sensor connector is M16-5 core waterproof connector male

1.3product model

ZD01-				Turbidity sensor
	N01-			RS485.MODBUS protocol
		1-		First generation shell
			1000	0-1000NTU range

2.Device installation

2.1installation

Installation distance requirements: keep more than 5cm from the side wall and more than 10cm from the bottom.

2.2Electrical connections

The cable is a 4-core twisted-pair shielded cable, and the wire sequence definition:

- Red wire—power wire (12～24VDC)
- Black wire—ground wire (GND)
- Blue line—485A
- White line—485B

Check the wiring sequence carefully before turning on the power to avoid unnecessary losses due to incorrect wiring.

Wiring instructions: Considering that the cables are immersed in water (including sea water) or exposed to the air for a long time, all wiring locations are required to be waterproofed, and the user cables should have a certain degree of corrosion resistance.

3.Maintenance and maintenance

3.1Maintenance procedures and methods

3.1.1Maintenance schedule

The cleanliness of the measurement window is very important for maintaining accurate readings.

Maintenance task	**Recommended maintenance frequency**
Calibrate the sensor (if required by the competent authority)	According to the maintenance schedule required by the competent authority

3.1.2Maintenance method

- External surface of the sensor: Use tap water to clean the external surface of the sensor. If there are still debris remaining, wipe it with a moistened soft cloth. For some stubborn dirt, you can add some household detergent to the tap water to clean it.
- Check the cable of the sensor: The cable should not be taut during normal operation, otherwise the wires inside the cable may break and the sensor cannot work normally.
- Check whether the measuring window of the sensor is dirty and the cleaning brush is normal.

3.1.3Precautions

The sensor contains sensitive optical and electronic components. Make sure that the sensor is not subject to severe mechanical shocks. There are no parts inside the sensor that need user maintenance.

3.2Sensor calibration

- Zero point calibration: Use a larger beaker to measure an appropriate amount of zero turbidity liquid, and place the sensor vertically in the solution. The measuring end of the sensor is at least 10 cm away from the bottom of the beaker. After the value is stable, perform zero point calibration for 3 to 5 minutes. Refer to the appendix for instructions.
- Slope calibration: Place the measuring end surface of the sensor in the standard solution. The measuring end surface of the sensor is at least 10cm away from the bottom of the beaker. After the value is stable, perform the slope calibration for 3 to 5 minutes. Refer to the appendix for instructions.

3.3Frequently Asked Questions

problem	possible reason	Solution
The operation interface cannot be connected or the measurement result is not displayed	The measured value is too high, too low or the value is continuously unstable	Reconnect the controller and cables
	Cable failure	Please contact us
The measured value is too high, too low or the value is continuously unstable	Sensor window is attached to foreign objects	Clean the surface of the sensor window

Appendix Data Communication

1.Data Format

The default data format for Modbus communication is: 9600, n, 8, 1 (baud rate 9600bps, 1 start bit, 8 data bits, no parity, 1 stop bit).

2. Information frame format (xx represents one byte)

a)Read data command frame				
06	03	xx	xx xx	xx xx
Address	Function code	Register start address	Number of registers	CRC check code (low byte first)

b)Read data response frame				
06	03	xx	xx……xx	xx xx
address	function code	Number of bytes	Response data	CRC check code (low byte first)
c)Write data instruction frame				
06	06	xx xx	xx xx	xx xx
address	function code	Register address	data input	CRC check code (low byte first)
d)Write data response frame (same as write data command frame)				
06	06	xx xx	xx xx	xx xx
address	function code	Register address	data input	CRC check code (low byte first)

3.Register address

Register address	name	Description	Number of registers	interview method
40001 (0x0000)	Measured value + temperature	4 double-byte integers, which are measured value, measured value decimal places, temperature value, temperature value decimal places.	4 (8 bytes)	read
44097 (0x1000)	Zero point calibration	0～20NTU, the range is 0～10NTU Calibrate in turbidity liquid, write data as standard Actual value of quasi-solution×100; 0 ～ 100NTU range is 0～20NTU turbidity Calibration in solution, write data as standard Actual value of solution×10; 0～ 1000NTU Range is in 0～200NTU turbidity liquid Calibration, write data for standard solution Intermediate value×10; read data is zero offset Shift.	1 (2 bytes)	Write/read
44101 (0x1004)	Slope calibration	0 ～ 20NTU range in 10 ～ Calibration in 100NTU turbidity solution, the written data is the actual value of the standard solution×100;	1 (2 bytes)	Write/read
		0 ～ 100NTU range in 20 ～ Calibrate in 200NTU turbidity solution, the written data is the actual value of standard solution×10; 0～1000NTU range is 200～		

		Calibration in 1000NTU turbidity solution, the written data is the actual value of the standard solution ×10; the read data is the slope value ×1000.		
44113 (0x1010)	Temperature calibration	Calibrate in solution, write data as real The value of the international temperature×10; the read data is the temperature calibration offset×10.	1 (2 bytes)	Write/read
48195 (0x2002)	Sensor address	The default is 6, and the range of writing data is 1～127.	1 (2 bytes)	Write/read
48225 (0x2020)	Reset sensor	The calibration value is restored to the default value, and the written data is 0. Note that after the sensor is reset It can be used after re-calibration.	1 (2 bytes)	write

4.Command example

a）Start measurement command

Function: Obtain the turbidity and temperature measured by the sensor; the unit of temperature is °C, and the unit of turbidity is NTU.

Request frame: 06 03 00 00 00 04 45 BE

Response frame: 06 03 08 01 02 00 01 00 B0 00 01 90 48

Examples of readings:

Turbidity value	Temperatur e value
01 02 00 01	00 B0 00 01

For example, the turbidity value 01 02 represents the hexadecimal reading turbidity value, and 00 01 represents the turbidity value with a decimal point, which is converted into a decimal value of 25.8.

The temperature value 00 B0 represents the hexadecimal reading temperature value, and 00 01 represents the temperature value with 1 decimal point converted to a decimal value of 17.6.

b）Calibration instructions

Zero point calibration

Function: Set the zero point calibration value of the sensor; zero point calibration is performed in zero turbidity water, the example is as follows: Request frame: 06 06 10 00 00 00 8C BD

Response frame: 06 06 10 00 00 00 8C BD

Slope calibration

Function: Set the slope calibration value of the sensor;

For 0～1000NTU and 0～100NTU range products, the slope calibration example is as follows (calibrate in 1000NTU standard solution, write the value as 1000x10, that is, 0x2710):

Request frame: 06 06 10 04 27 10 D7 40

Response frame: 06 06 10 04 27 10 D7 40

For 0～20NTU range products, the slope calibration example is as follows (calibrate in 20NTU standard solution, write the value as 20x100, that is, 0x07D0):

Request frame: 06 06 10 04 07 D0 CE D0

Response frame: 06 06 10 04 07 D0 CE D0

Set the device ID address:

Function: Set the MODBUS device address of the sensor; Change the sensor address 06 to 01, the example is as follows

Request frame: 06 06 20 02 00 01 E3 BD

Response frame: 06 06 20 02 00 01 E3 BD

5.Error response

If the sensor cannot execute the host computer command correctly, it will return the following format information:

definition	address	function code	CODE	CRC check
data	ADDR	COM+80H	xx	CRC 16
Number of bytes	1	1	1	2

a) **CODE: 01-Function code is wrong**

b) **03-Data errorCOM: Function code received**