Industrial Turbidity Sensor

User Manual

Product Model: S-DTS210-01

Version：V1.0

1. Product Introduction

The S-DTS210-01 turbidity sensor is designed based on the principle of scattering light turbidity measurement. When a light beam is transmitted into the water sample, turbidity particles in the sample cause the light to scatter. The sensor measures the intensity of the scattered light at a direction perpendicular to the incident light and compares it with internal calibration values to calculate the turbidity of the water sample. The final value is obtained after linearization processing.

Features:

- 90° scattering light principle, with an integrated temperature sensor
- Supports RS-485, Modbus/RTU protocols
- Optical fiber structure, offering strong resistance to external light interference
- Infrared LED light source, ensuring high stability
- IP68 protection level, allowing normal operation in deep water
- Convenient, fast, stable, and easy to maintain.

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2. Specification

Model	S-DTS210-01
Measurement Principle	Scattered light method
Range	0 ~ 1000.0NTU
Resolution	0.1NTU/0.1℃
Accuracy	±5% F.S, ±0.3°C
Calibration method	Two-point Calibration
Temperature Compensation	Auto Temperature Compensation (Pt1000)
Output	RS-485(Modbus/RTU)
Operating Condition	0 ~ 50℃ , <0.2MPa
Storage Temperature	-5 ~ 65℃
Installation Method	Immersion Mount, 3/4" NPT Pipe Threads
Cable Length	10 Meter
Power Consumption	0.3W@12V
Power Supply	12 ~ 24V DC (Typical values 12V DC)
Protection Level	IP68

3. Hardware Overview
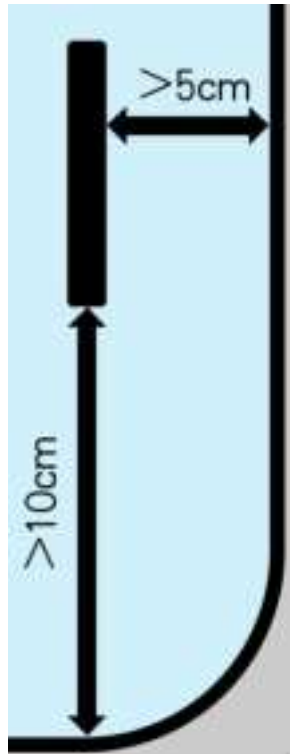
3.1Wiring
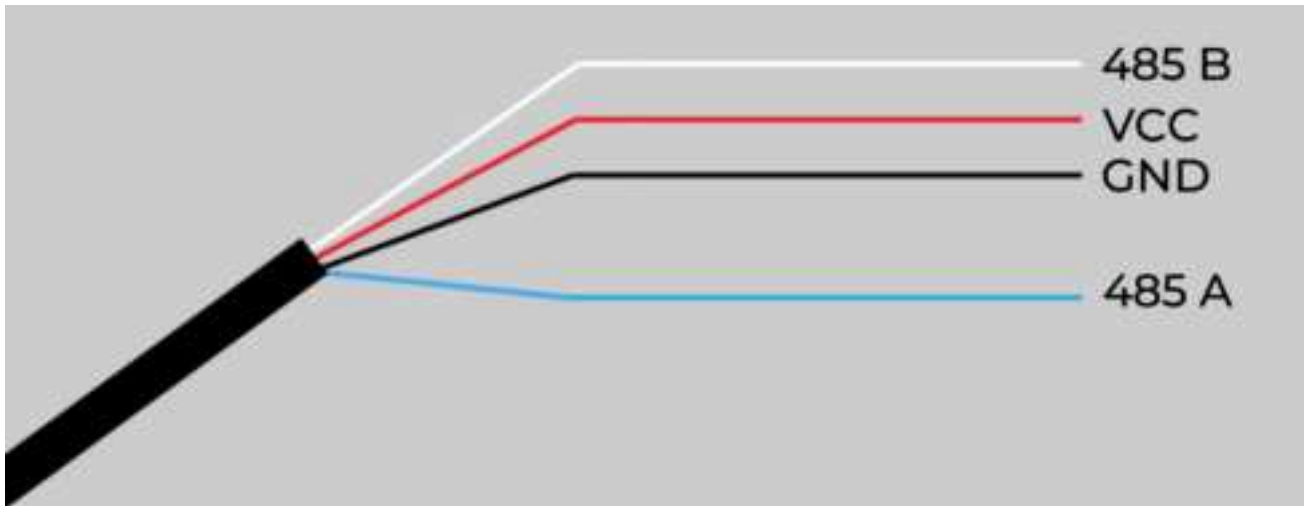
3.2 Dimensions
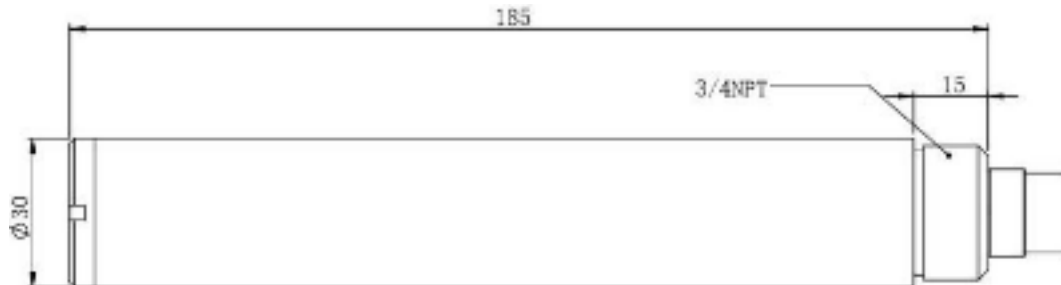
Unit: mm

Connector: M16-5-Pole waterproof M connector.

4. Installation

The sensors are kept more than 5cm from the side walls and more than 10cm from the bottom.

5. RS485 Modbus Protocol

5.1 Modbus Protocol

Modbus Protocol is widely used to establish master-slave communication between intelligent devices or sensors.

A MODBUS message sent from a master to a slave contains the address of the slave, the function code (e.g. 'read register' or 'write register'), the data, and a check sum(LRC or CRC).

Industrial Turbidity Sensor (S-DTS210-01) with RS485 interface, support Modbus protocol. The communication parameters to factory default values for:

Baud rate 9600 bps, one start bit, 8 data bits, no parity, one stop bit.

5.2 Modbus Registers

Parameter Name	Register Address	Parameter Type	Number of Register (bytes)	Parameter Range and Description
Measured Value & Temperature	0x0000	Read, unsigned short	4 (8 bytes)	4 double-byte integers: measured value, decimal places of the measured value, temperature value, and decimal places of the temperature value.
Temperature Value	0x0100	Read, unsigned short	1 (2 bytes)	℃x10 (25.6℃ temperature is displayed as 256, default 1 decimal place)
Turbidity Value	0X0101	Read, unsigned short	1 (2 bytes)	NTU x 10 (10 NTU of turbidity is displayed as 100, defaulting to 1 decimal place)
Temperature Calibration	0x1000	Read/Write, unsigned short	1 (2 bytes)	Write data is actual temperature value x 10; read data is temperature calibration offset x 10.
Turbidity Zero Point Calibration	0x1001	Read/Write, unsigned short	1 (2 bytes)	Calibrated in zero turbidity water or distilled water, calibrated with a write data of 0. (Can also be calibrated in 0-10 NTU turbidity standards)
Turbidity Slope Calibration	0x1003	Read/Write, unsigned short	1 (2 bytes)	Calibrate in 1000 NTU standard solution. The data written for calibration is the actual value of the standard solution x 10.
Sensor Address	0x2000	Read/Write, unsigned short	1 (2 bytes)	The default is 50 and the data range is 1-255.
Baud Rate Settings	0x2003	Read/Write, unsigned short	1 (2 bytes)	The default is 9600. write 0 can be set to 4800; write 1 can be set to 9600; write 2 can be set to 19200.
Restore Factory Setting	0x2020	Write, unsigned short	1 (2 bytes)	The calibration value restores the default value after writing 0. Note that the sensor needs to be calibrated again after resetting before it can be used.

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5.3 Command Examples

(1) Change the slave address:

Register address	Number of registers	Function code	Default address
0x2000(42001)	1	0x06	01

To change the Modbus device address of the sensor, change the device address 01 to 06, the example is as follows:

Send: 01 06 20 00 00 06 02 08

Response: 01 06 20 00 00 06 02 08;

Note: The address is changed to 06 and saved by power down.

(2) Baud rate:

Address	Number of registers	Function code	Default Value	Supported values
0x2003 (42004)	1	0x06	1 (9600bps)	0-2 (4800-19200bps)

Baud rate can be changed by upper computer setting, it can work without reboot after change, baud rate save upper computer setting after power down.

Baud rate support 4800,9600,19200. integer value assigned baud rate is as follows:

Input	Baud rate
0	4800 bps
1	9600 bps
2	19200 bps

Send command: 01 06 20 03 00 02 F3 CB

Response: 01 06 20 03 00 02 F3 CB

Note: The baud rate was changed to 19200 bps and saved by power down.

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(3)Function registers:

a. Measurement temperature:

Address	Number of registers	Function code
0x0100 (40101)	1	0x03

Read example value: 19.2°C

Send: 01 03 01 00 00 01 85 F6

Response: 01 03 02 00 C0 B8 14

Return hexadecimal unsigned integer data, temperature value = Integer/10, keep 1 decimal place.

Address	Number of registers	Function code
0x0002	2	0x03

Read example value: Temperature 18.5°C

Request frame: 01 03 00 02 00 02 65 CB

Answer frame: 01 03 04 00 B9 00 01 EA 16

Example:

Temperature
00 B9 00 01

Temperature value 00 B9 indicates a hexadecimal reading temperature value, 00 01 indicates a temperature value with 1 decimal place, which is converted to a decimal value of 18.5℃.

b. Measurement turbidity:

Address	Number of registers	Function code
0x0101 (0x40102)	1	0x03

Read example value: 98.5NTU
Send: 01 03 01 01 00 01 D4 36
Response: 01 03 02 03 D9 79 2E
Return hexadecimal unsigned integer data, turbidity value = Integer/10, retain 1 decimal place.

Address	Number of registers	Function code
0x0000	2	0x03

Read example value: turbidity value 86.6 NTU

Request frame: 01 03 00 00 00 02 C4 0B

Answer frame: 01 03 04 03 62 00 01 9A 69

Example:

Turbidity
03 62 00 01

Turbidity value 03 62 indicates a hexadecimal reading turbidity value, and 00 01 indicates a turbidity value with 1 decimal place, which converts to a decimal value of 86.6.

c. Continuous reading temperature and turbidity:

Address	Number of registers	Function code
0x0100(40101)	2	0x03

Read sample values: temperature 19.2°C and turbidity value 98.5 NTU

Send instruction: 01 03 01 00 00 02 C5 F7

Response: 01 03 04 00 C0 03 D9 3B 65

The register returns hexadecimal unsigned integer data, temperature value = Integer/10, with 1 decimal place.

Register returns hexadecimal unsigned integer data, turbidity value = Integer/10,keep 1 decimal place.

Address	Number of registers	Function code
0x0000	4	0x03

Read sample value: temperature 18.5℃ and turbidity value 86.6NTU

Request frame: 01 03 00 00 00 04 44 09

Answer frame: 01 03 08 03 62 00 01 00 B9 00 01 BB E1

Example:

Turbidity	Temperature
03 62 00 01	00 B9 00 01

Turbidity value 03 62 indicates a hexadecimal reading turbidity value, and 00 01 indicates a turbidity value with 1 decimal place, which converts to a decimal value of 86.6.

Temperature value 00 B9 denotes the hexadecimal reading temperature value, 00 01 denotes the temperature value with 1 decimal point, converted to decimal value of 18.5℃.

d. Calibration

1) Temperature calibration:

Address	Number of registers	Function code
0x1000(41001)	1	0x06

Calibration example: Calibration at temperature 25.8°C

Send command: 01 06 10 00 01 02 0D 5B

Response: 01 06 10 00 01 02 0D 5B

The sensor needs to be calibrated in a constant temperature environment after the temperature indication no longer fluctuates.

2) Turbidity zero calibration

Address	Number of registers	Function code
0x1001(41002)	1	0x06

Calibration example: Calibration in distilled water or deionized water with zero turbidity

Send command: 01 06 10 01 00 00 DC CA

Response: 01 06 10 01 00 00 DC CA

3) Turbidity slope calibration

Address	Number of registers	Function code
0x1003(41004)	1	0x06

Calibration example: Calibration in 1000 NTU turbidity solution

Send command: 01 06 10 03 27 10 67 36

Response: 01 06 60 03 27 10 67 36

5.4 Error response

If the sensor fails to execute the host computer command correctly, a message of the following format is returned:

Define	Address	Function code	CODE	CRC
Data	ADDR	COM+80H	xx	CRC 16
Byte	1	1	1	2

(1) CODE: 01 - Function Code Error
      03 - Data error
(2) COM: received function code

6. Maintenance

6.1 Use and Maintenance

1. Cleanse:
Use tap water to clean the external surface of the sensor, if there is still debris residue, wipe with a moist soft cloth, for some stubborn dirt, you can add some household detergent solution in tap water to clean.

2. Check the cable of the sensor:
The cable should not be taut during normal operation, otherwise it will be easy to make the internal wires of the cable break, so that the sensor can not work properly.

3. Check for dirt:
Check whether the measuring window of the sensor is dirty and whether the cleaning brush is normal.

4. Avoid impact:
The sensor contains sensitive optical and electronic parts. Make sure that the sensor is not subjected to severe mechanical impact. There are no parts inside the sensor that require maintenance by the user.

7. Calibration

1. Zero Calibration
Use a larger beaker to measure the appropriate amount of zero turbidity solution, the sensor is placed vertically in the solution, the sensor measurement end from the bottom of the beaker at least 10cm, 3 ~ 5 minutes to be stable values for zero calibration.

2. Slope Calibration
Place the measuring end of the sensor in the standard solution, the measuring end of the sensor from the bottom of the beaker at least 10cm, 3 ~ 5 minutes to be stabilized for slope calibration.

8. Document Version

Version	Date	Description	Editor
V1.0.0	1/21/2025	First edition	Zeke CAI