Daruifuno

Turbidity sensor

Basic User Manual

Model: OPTU790

Version 1.0

Contents

Chapter 1 Specification

Product specifications are subject to change without notice.

Measuring principle	The principle of color-independent infrared scattering
Measuring range	0.01~1000NTU
Accuracy	＜ 5% of the measured value
Calibration method	slope calibration, deviation calibration
Operating temperature	0-50°C
Work pressure	≤6bar
Waterproof level	IP68
Power requirements	5~12VDC
Power consumption	About 0.08W
Communication Interface	RS485 MODBUS-RTU
Shell material	PPS
Shell size	Diameter 35mm, total length about180mm (including cleaning protective cover)
About 150 grams (without cable)	About 220 grams (without cable)
Cable	rubber sheath, standard 10 meters, custom lengths available
Connection method	Bare wire, M12 plug or waterproof aviation plug

Chapter 2 Basic Information

2.1 Security Information

Please read this manual completely before unpacking, installing and operating this equipment. Pay special attention to all precautions. Otherwise, it may cause serious personal injury to the operator or damage the equipment.

2.2 Overview

The sensor is based on the 90-degree infrared scattering method of the ISO7027 standard, and measures the turbidity value of the sample according to the scattered light intensity of suspended particles in the water sample. The sensor uses a near-infrared LED as the light source, and even if there is color in the sample, it will not affect the measurement results. The unique protective structure design of the sensor detection surface can protect the sensor detection window to the greatest extent and avoid accidental collision damage to the sensor measurement surface during installation and use.

The sensor is suitable for sewage plants, water plants, water stations, surface water, environmental protection water treatment, metallurgical electronics, mining, paper, semiconductor and other fields, and can continuously monitor the turbidity value of aqueous solutions.

2.3 Dimensions

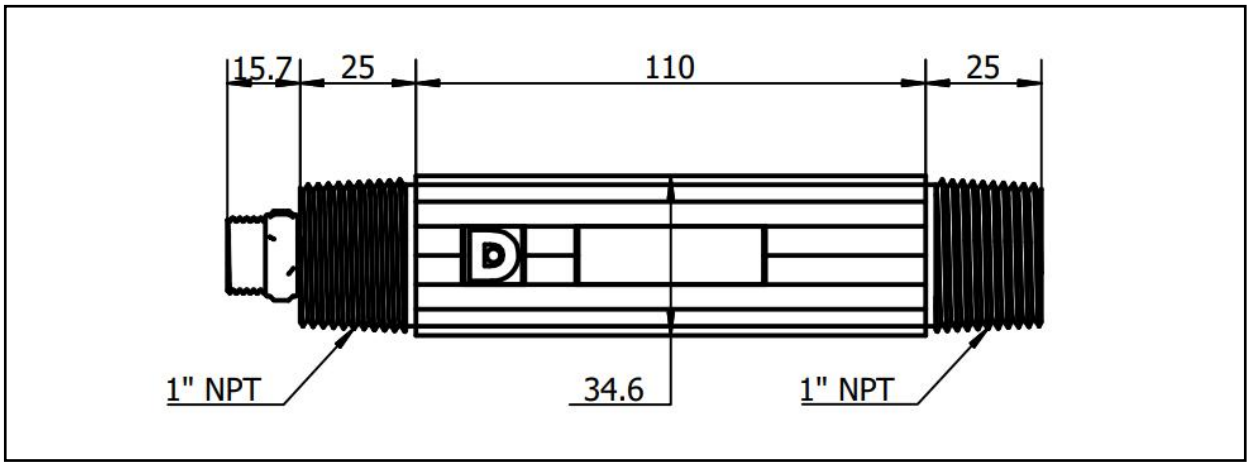

Figure 1 Dimensions of the sensor

Chapter 3 Installation

3.1 Sensor Installation

Refer to the pictures in this section to install and fix the sensor. To ensure that the sensor can measure safely and accurately, please meet the following conditions during installation:

- There should be no walls within at least 10cm around the detection surface of the sensor;
- The detection surface of the sensor should avoid directly facing the light or facing the highly reflective surface;
- When installed in an aerated pool, the sensor installation angle should be 90° to reduce the influence of air bubbles on the measurement;
- The installation direction of the sensor should be parallel to the direction of water flow.

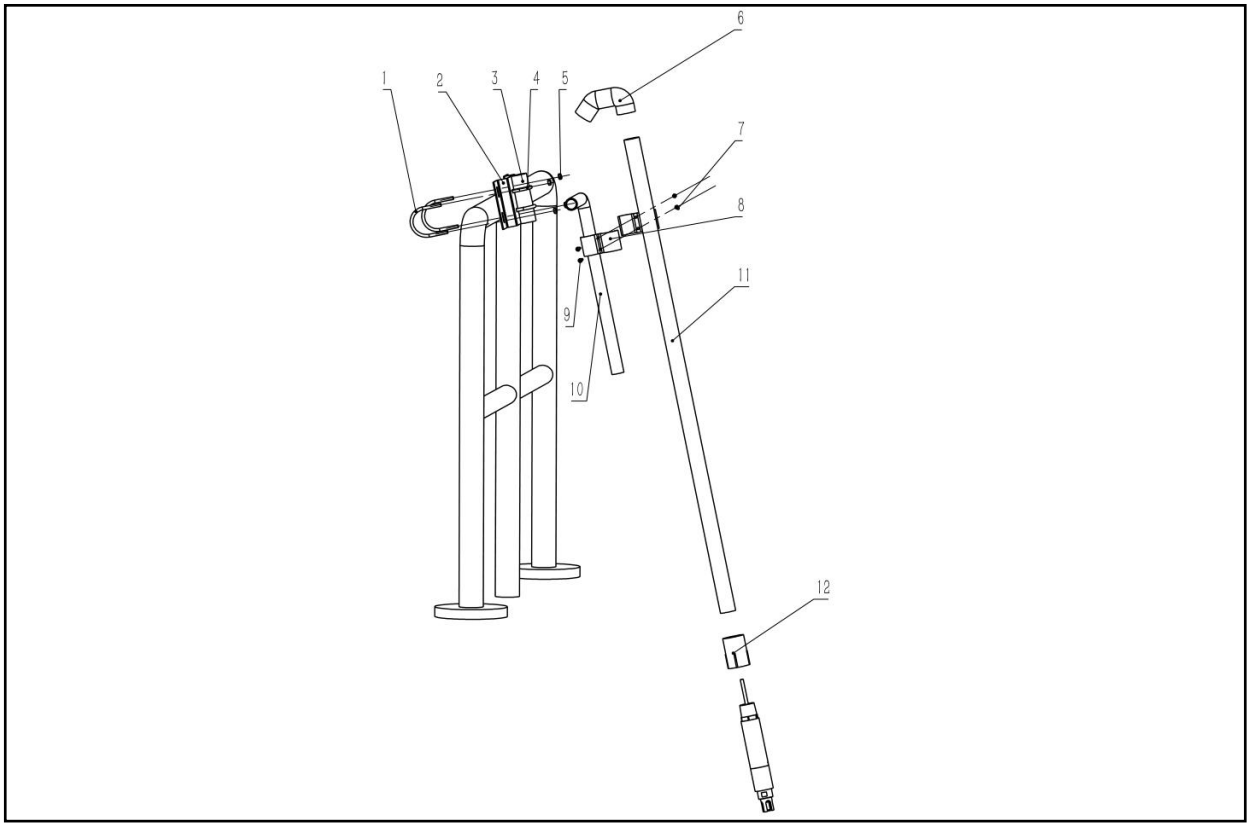

Figure 2 Schematic diagram of railing installation

1- DN60 U-shaped card	7- M4 screw nut*2
2- “⊓”shaped board	8- “8”shaped clip 25&32
3- Handle sleeve	9- M4*25 screw*2
4- DN40 U-shaped card	10- Handle
5- M6 screw nut*8	11- DN32PVC Bracket
6- Rainproof elbow	12-1 inch inner wire straight pipe joint

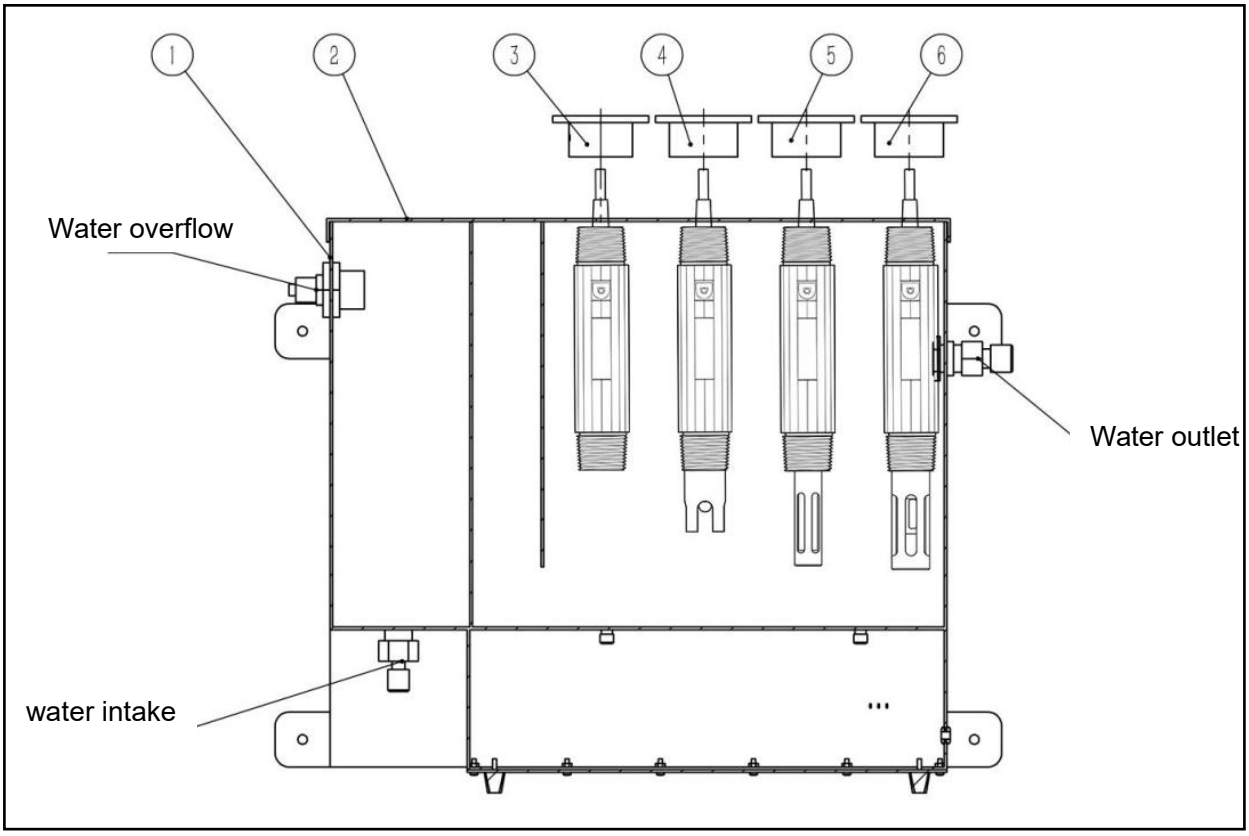

Figure 3 Schematic diagram of flow cell installation

1- Flow cell	4- pH sensor fixed connection cover
2- Flow cell cover	5- DO sensor fixed connection cover
3- Turbidity sensor fixed connection cover	6- Conductivity sensor fixed connection cover

3.2 Sensor Wiring

The sensor is correctly connected as defined in the table below.

Cable Colour	Red	Black	Green	White
Terminal definition	+6~12VDC	Power ground	RS485 A（+）	RS485 B（-）
Terminal symbols	V+	V-	AS	BS

Chapter 4 Use

4.1 Communication Protocol

The sensor communication is RS485 Modbus-RTU. For the specific communication protocol, please refer to the Modbus related protocol description. The default sensor communication address is 16, the baud rate is fixed at 9600, 8 data bits, 1 stop bit, no parity.

4.2 Read Measured Value

The measured value of the sensor can be read by connecting the meter or using other Modbus master devices. Please refer to Appendix A for the Modbus register address. The sensor measurement value data is 4-byte floating point data, and the data sequence is little endian. Pay attention to the conversion sequence.
Example, to read sensor measurements, the host sends
[01 03 26 00 00 04 4F 41]
sensor return
[01 03 08 00 00 C8 41 F6 28 04 41 C8 E0]
return value
[00 00 C8 41] means the temperature is 25℃
[F6 28 04 41] means the turbidity is 8.26NTU

4.3 Calibration Turbidity Measurements

The sensor provides two measurement calibration methods, one-point calibration and two-point calibration. One-point calibration corrects for sensor slope. Two-point calibration, which calibrates sensor zero and slope, provides the highest possible accuracy.

4.3.1 One Point Calibration

One-point calibration is to calibrate the sensor in a formazin standard solution of known turbidity value.
Restore the sensor to factory calibration, set K=1, B=0;
Put the sensor into the standard solution with a turbidity of Y, wait for the sensor reading to stabilize, and record the reading X;
Calculate the factor value K=Y/X, and write the calculated K and B=0 into the sensor.

4.3.2 Two Point Calibration

Two-point calibration uses two turbidity standard solutions to calibrate the sensor linearity to obtain the best measurement accuracy. The calibration method is as follows

Restore calibration first, set K=1, B=0;

Perform one-point calibration first, and record the reading of the sensor in the standard solution of turbidity Y1 as X1;

Put the sensor into the standard solution with turbidity of Y2, wait for the reading to stabilize, and record the reading as X2;

Calculate the factor K and deviation B according to the formula, and write K and B into the sensor

K(Y1-Y2)/(X1-X2), B=Y1-K*X1

4.3.3 Reset Calibration

Set the sensor factor K to 1 and the bias to 0 to restore calibration.

Chapter 5 Maintenance

The sensor contains precision optoelectronic components. Please ensure that the sensor will not be subjected to any strong mechanical impact during use. There are no user maintenance parts inside the sensor.

5.1 Maintenance Cycle

Maintenance work	**Maintenance Frequency**
Visual inspection	Every month
Check calibration	Every month (According to the environmental of use)

5.2 Cleaning

Keeping the sensor measurement window clean is critical for accurate measurements, and the measurement window should be inspected monthly for smudges. The measuring window can be cleaned with detergent and cloth when maintenance is required.

Appendix A Modbus Register Information

Baud Rate:9600
Data Bits: 8
Parity Bit: NONE
Stop Bit: 1
Slave Address: 1~254, default 16

Item	Register	Data Type	Length	Access Type	Function Code	Description
Slave address	0x3000	uint16	1	R/W	03/16	Default 16
Serial number	0x0900	char	7	RO	03	ASCII format string
Hardware version	0x0700	uint16	1	RO	03	Hardware version number
Software version	0x0701	uint16	1	RO	03	Software version number
Temperature	0x2600	float 注	2	RO	03	Temperature measurement value，unit ℃
Turbidity	0x2602	float	2	RO	03	Turbidity measurement value，unit NTU
K	0x1100	float	2	R/W	03/16	Turbidity calibration factor
B	0x1102	float	2	R/W	03/16	Turbidity calibration deviation

Note: The floating-point format is ANSI/IEEE-754 single-precision floating-point numbers, byte order DCBA.

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