

# YEX-S1-TPS Online Transparency Sensor User Manual



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## User notes

- Please read this manual carefully before use and save it for reference.
- Please follow the operating procedures and precautions in this manual.
- When receiving the instrument, please carefully open the package and check whether the instrument and accessories are damaged due to shipping. If any damage is found, please inform the manufacturer and distributor immediately, and keep the package for return.
- When the instrument fails, do not repair it yourself. Please contact the maintenance department of the manufacturer directly.

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## I 、 Working principle

Many substances suspended in water can absorb or block visible light, which is manifested as the decrease of the transparency of water. Therefore, the transparency of water can be calculated by measuring the absorbance of a substance in water to light. The transparency sensor is designed according to this principle. When the transparency sensor is immersed in the liquid to be measured, it will read and measure the absorbance of the liquid to a specific wavelength beam, and then complete the measurement of the transparency data through specific curve fitting and calculation.



- Pollution-free, economic and environmental protection
- Small size, convenient installation, non-stop for online water quality monitoring
- Can measure the transparency and temperature parameters
- With cleaning brush, can prevent the impurity and microbial adhesion
- Drift is small, fast reaction, precise measurement
- Long-term monitoring data of drift small, stability is good
- Free maintenance, use cycle is long, using cost is low
- Digital signal output, the RS - 485 interface, Modbus/RTU protocol
- Low power design, anti-jamming design

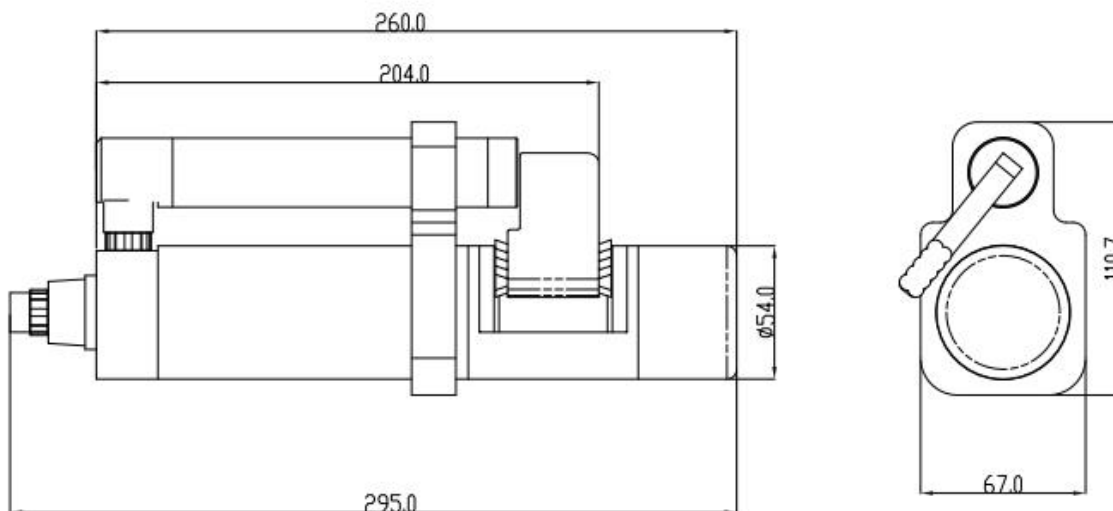
## II 、 Technical performance and specifications

### 1. Technical parameters

|                            |                           |
|----------------------------|---------------------------|
| <b>Model</b>               | YEX-S1-TPS                |
| <b>Measuring principle</b> | Visible absorption method |
| <b>Measuring range</b>     | 50~2000mm                 |

|                                |                                                 |
|--------------------------------|-------------------------------------------------|
| <b>Precision</b>               | $\pm 10\% \text{ F.S.}/\pm 0.5^{\circ}\text{C}$ |
| <b>Resolution</b>              | 1mm/ $0.1^{\circ}\text{C}$                      |
| <b>Calibration method</b>      | Two-point calibration                           |
| <b>Output method</b>           | RS-485( Modbus/RTU protocol)                    |
| <b>Power supply</b>            | 12~24VDC                                        |
| <b>Power consumption</b>       | 0.3W@12VDC                                      |
| <b>Working conditions</b>      | 0~45 $^{\circ}\text{C}$ 、<0.2MPa                |
| <b>Storage temperature</b>     | -5~65 $^{\circ}\text{C}$                        |
| <b>Protection level</b>        | IP68                                            |
| <b>Installation method</b>     | Immersion installation                          |
| <b>Cable length</b>            | 5 meters, other lengths can be customized       |
| <b>Sensor housing material</b> | POM and 316L stainless steel                    |

## 2. Dimensional drawing

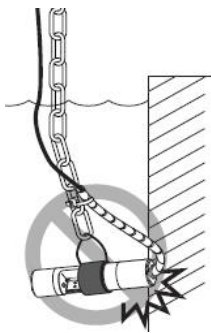


**Note:** The sensor connector is the male end of m16-5 core waterproof connector.

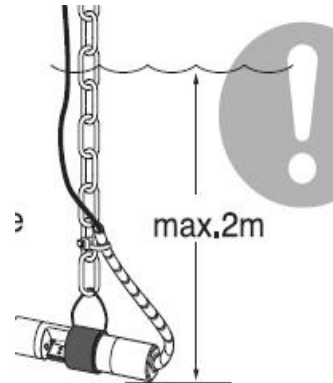
### III、 Installation and electrical connection

#### 1. Installation

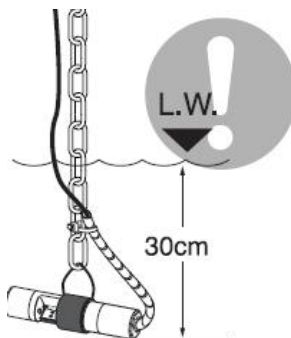
When the sensor is attached, the sensor caused by water flow should be prevented from hitting the wall or other water conservancy facilities. If the water flow is very strong then fix the sensor.



Install the sensor to a depth of no more than 2 meters from the water surface.



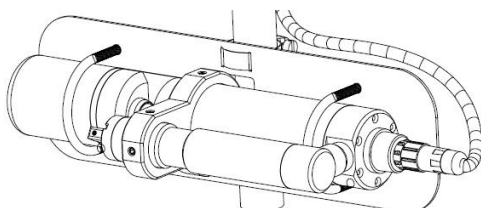
Taking into account the fluctuation of the water level, the sensor is immersed in the lowest possible water level below 30 cm.



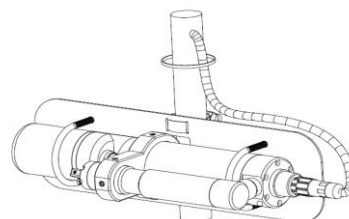
The sensor is placed in a position where there are no bubbles in the water.



Install a cable protector outside the sensor cable.  
Fix the sensor as shown below:



Fastened and the sensor needs to be placed horizontally as shown below:



## 2. Electrical connection

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

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

Check wiring sequence carefully before power-on to avoid unnecessary losses caused by wiring errors.

**Wiring instructions:** considering that the cables have been immersed in water (including sea water) or exposed to air for a long time, all wiring points are required to be waterproofed, and the user's cables should have certain corrosion resistance.

## IV、Maintenance and maintenance

### 1. Maintenance schedule and method

#### 1.1 Maintenance schedule

To ensure accurate measurements, cleaning is important, and regular sensor cleaning helps data stability.

| Maintenance task                                              | Recommended maintenance frequency                                                           |
|---------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Calibrate the sensor (if required by the competent authority) | Determine maintenance frequency according to specific water quality conditions              |
| Maintain and check the self-cleaning brush                    | Return to the factory every 18 months for inspection and maintenance of self-cleaning brush |

Note: The maintenance frequency in the above table is only a recommendation. Please maintain the sensor according to the actual usage of the sensor.

#### 1.2 Maintenance method

- 1) Sensor outer surface: Clean the outer surface of the sensor with tap water. If there is still debris left, wipe it with a soft, damp cloth. For some stubborn dirt, add some household washing liquid to the tap water to clean it.
- 2) Check the cable of the sensor: the cable should not be tightened during normal operation.

Otherwise, the cable inside the cable may be broken, causing the sensor to malfunction.

3) Check if the sensor's measurement window is dirty and the cleaning brush is normal.

4) Check the sensor's cleaning brush for damage.

5) For 18 months of continuous use, it is necessary to return to the factory to replace the dynamic sealing device.

### 1.3 Precautions

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

## 2. Sensor calibration

**2.1** The first calibration point: measure an appropriate amount of deionized water with a large beager, place the sensor vertically in the water to ensure that the liquid level does not pass the measured area, wait for 3-5 minutes and perform the first calibration when the value is stable. Instructions refer to appendix.

**2.2** Second calibration point: The sensor is placed in a standard solution with specific transparency (50 ~ 500mm) and waited for 3-5 minutes for the value to stabilize before the second calibration point. Instructions refer to appendix.

Note: When the sensor is calibrated, the liquid should not pass through the measuring area at all. When calibrating, first calibrate the temperature, then calibrate the transparency.

## 3. Precautions

- Avoid the sun exposure of the sensor
- Please do not touch the sensor by hand
- Avoid contact with the sensor surface during measurement and calibration
- Avoid using any mechanical stress (pressure, scratches, etc.) directly on the sensor during

use.

## 4. Common problems and countermeasures

| Problem                                                                                      | Possible reason                                   | Solution                           |
|----------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------|
| <b>The operation interface cannot be connected<br/>Or do not display measurement results</b> | Controller and cable connection error             | Reconnect controller and cable     |
|                                                                                              | Cable failure                                     | Please contact us                  |
| <b>The measured value is too high, too low or the value</b>                                  | The sensor window is attached by a foreign object | Cleaning the sensor window surface |



|  |                             |                            |
|--|-----------------------------|----------------------------|
|  | Sensor self-cleaning damage | Replace the cleaning brush |
|--|-----------------------------|----------------------------|

## V、Quality and service

### 1. Quality assurance

- The quality inspection department has standardized inspection procedures, advanced and perfect testing equipment and means, and strictly in accordance with the regulations, 72 hours of aging experiments and stability tests on the products, and does not allow a substandard product to leave the factory.
- The receiving party directly returns the batch of products with a non-conformity rate of 2%, and all the costs incurred are borne by the supplier. The reference standard refers to the product description provided by the supplier.
- Guarantee the quantity of goods and the speed of shipment.

### 2. Accessories and spare parts

This product includes:

- 1 sensor
- 1 instruction manual
- 1 certificate

### 3. After-sales service commitment

The company provides local after-sales service within one year from the date of sale, but does not include damage caused by improper use. If repair or adjustment is required, please return it, but the shipping cost must be conceited. Damaged on the way, the company will repair the damage of the instrument for free.

## Appendix data communication

### 1. Data format

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

The baud rate can be customized.

## 2. Information frame format

a)Data read instruction

|           |               |                  |                |                           |
|-----------|---------------|------------------|----------------|---------------------------|
| <b>0D</b> | 03            | xx xx            | xx xx          | xx xx                     |
| Device    | Function code | Register address | Register count | CRC code (low byte first) |

b)Data read response

|           |               |                  |            |                           |
|-----------|---------------|------------------|------------|---------------------------|
| <b>0D</b> | 03            | xx               | xx.....xx  | xx xx                     |
| Device    | Function code | Data bytes count | Data bytes | CRC code (low byte first) |

c)Data write instruction

|           |               |                  |               |                           |
|-----------|---------------|------------------|---------------|---------------------------|
| <b>0D</b> | 06            | xx xx            | xx xx         | xx xx                     |
| Device    | Function code | Register address | Data to write | CRC code (low byte first) |

d)Data write response(same with data write instruction)

|           |               |                  |               |                           |
|-----------|---------------|------------------|---------------|---------------------------|
| <b>0D</b> | 06            | xx xx            | xx xx         | xx xx                     |
| Device    | Function code | Register address | Data to write | CRC code (low byte first) |

## 3. Register address

| Register address | Name                           | Instruction                                                                                                                                                            | Number of registers | Access method          |
|------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------|
| 0x0000           | Transparency measurement value | 2 double-byte integers, one for the measured value and one for the measured decimal number (0 if there is no decimal number)                                           | 2 (4byte)           | Read (0x03)            |
| 0x0002           | Temperature measurement value  | 2 double-byte integers, the temperature value and the decimal place of the temperature value (the default is 1 decimal place).                                         | 2 (4 byte)          | Read (0x03)            |
| 0x1000           | First calibration point        | Calibration was performed in deionized water.The calibration data written during calibration is 0;The data read out is the signal strength at the time of calibration. | 1 (2 byte)          | Write(0x06)/Read(0x03) |

|        |                                     |                                                                                                                                                                                                                                    |            |                        |
|--------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------|
| 0x1004 | Second calibration point            | It can be calibrated in a standard liquid of 50-500mm. The calibration data written during calibration is the transparency value of the standard liquid used; The data read out is the signal strength at the time of calibration. | 1 (2 byte) | Write(0x06)/Read(0x03) |
| 0x1010 | Temperature calibration             | Temperature calibration: write the data as the actual temperature value x10; The readout data is the temperature calibration offset x10.                                                                                           | 1 (2 byte) | Write(0x06)/Read(0x03) |
| 0x1100 | Sensor switch                       | Turn on or off the sensor measurement function. Turn off the measurement when the write data is 0. Turn on the measurement when the write data is 1. The sensor is on by default.                                                  | 1 (2 byte) | Write(0x06)            |
| 0x2002 | Sensor address                      | The default is 13 and the data range is 1-255.                                                                                                                                                                                     | 1 (2 byte) | Write(0x06)/Read(0x03) |
| 0x1300 | Automatic cleaning interval setting | The default is 30 minutes and the data range is 6-6000 minutes.                                                                                                                                                                    | 1 (2 byte) | Write(0x06)/Read(0x03) |
| 0x1301 | Automatic cleaning number setting   | The default is 3 laps and the data range is 1 ~ 6 laps.                                                                                                                                                                            | 1 (2 byte) | Write(0x06)/Read(0x03) |
| 0x2020 | Reset sensor                        | The calibration value restores the default value and the write data is 0. Note that the sensor must be recalibrated before use after reset.                                                                                        | 1 (2 byte) | Write(0x06)            |

#### 4. Command example

a) Measurement instructions:

Function: Read the transparency and temperature values of the sensor; the unit of transparency value is mm, and the unit of temperature is °C.

Request frame: 0D 03 00 00 00 04 44 C5

Response frame: 0D 03 08 01 02 00 00 00 B0 00 01 88 AC

Reading example:

| Transparency value | Temperature value |
|--------------------|-------------------|
| 01 02 00 00        | 00 B0 00 01       |

In the table: the transparency value 01 02 is the transparency value expressed in hexadecimal, and the following 00 00 indicates that the decimal place of the transparency value is 0, so the transparency value is finally converted into a decimal value of 258, that is, the current transparency is 258mm; temperature The value 00 B0 is the temperature value expressed in hexadecimal, and the following 00 01 indicates that the temperature value has 1 decimal point, so the temperature value is finally converted into a decimal value of 17.6 degrees Celsius.

b) Calibration instructions:

temperature calibration

Function: Calibrate the sensor temperature to 25.8 ° C; temperature calibration should be performed after the temperature has stabilized for a period of time.

Request frame: 0D 06 10 10 01 02 0C 52

Response frame: 0D 06 10 10 01 02 0C 52

Transparency first point calibration

Function: Set the first point calibration value of the sensor; instructions when calibrating the zero point in deionized water:

Request frame: 0D 06 10 00 00 00 8D C6

Response frame: 0D 06 10 00 00 00 8D C6

Transparency second point calibration

Function: Set the second point calibration value of the sensor; for example, instructions when calibrating in a solution with a transparency of 160mm:

Request frame: 0D 06 10 04 00 A0 CC 7F

Response frame: 0D 06 10 04 00 A0 CC 7F

c) Change device ID address:

Function: Change the Modbus device address of the sensor. For example, the command to change the device address 13 to 01:

Request frame: 0D 06 20 02 00 01 E2 C6

Response frame: 0D 06 20 02 00 01 E2 C6

## 5. Error response

If the sensor does not execute the host computer 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 - functional code error  
03 - Data error
- b) COM: received function code