NBL-BOD-406 Online BOD Sensor
User Manual

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User Notes

- Please read the instructions carefully before using and save it for reference.
- Please follow the instructions and precautions.
- When receiving the instrument, please open the packaging carefully, inspect equipment's damage level in case of transportation, if you found spoiled equipment, please immediately notify the manufacturer and distributor, and retain the packaging, in order to send back to processing.
- When the instrument is in trouble, please don't repair it by yourself, please directly contact the maintenance department of the manufacturer.

Content

Ⅰ、Working principle

Many organic matter dissolved in water absorbs ultraviolet light and EXCITES fluorescence. Therefore, the content of dissolved organic pollutants in water can be accurately measured by measuring the intensity of excitation light of these organic compounds. NBL-BOD-406 on-line Bod sensor uses two light sources, one is ultraviolet light for measuring BOD content in water, the other is reference light for measuring water turbidity, in addition, the attenuation of optical path can be compensated by a special algorithm and the interference of particulate suspended matter can be eliminated to some extent, so that more stable and reliable measurement can be achieved.

Product features:

- No reagent, no pollution, economic and environmental protection
- Small size, more convenient installation, on-line continuous monitoring of water quality
- can measure BOD, turbidity and temperature parameters
- automatically to compensate for turbidity interference
- with a clean brush, can prevent biological adhesion
- drift small, fast response, more accurate measurements
- even long-term monitoring still offers excellent stability
- maintenance-free, Long Life Cycle, low-cost use

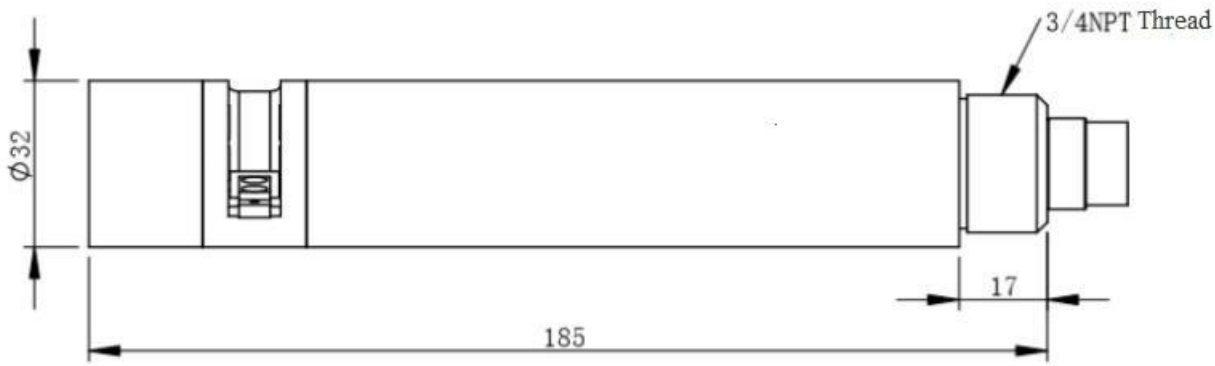
- digital sensors, RS-485 interface, Modbus/RTU Agreement
- Low-power electronics, and anti-jamming design

Ⅱ、Technical performance and specifications

1. Technical parameters

Model	NBL-BOD-406	
Measuring principle	Dual wavelength fluorescence method	
Range	BOD	TURBIDITY
	0～150mg/L	0～100NTU
BOD Accuracy	±5%F.S.	
BOD Resolution	0.1mg/L	
TURBIDITY accuracy	±5%F.S.	
TURBIDITY resolution	0.1NTU	
Calibration	Two-point calibration	
Signal output	RS-485（Modbus/RTU）	
Power supply	12～24VDC	
power consumption	0.2W@12V	
Working conditions	0～45℃、<0.1MPa	
Storage temperature	-5～65℃	
Protection grade	IP68	
Installation mode	Immersion Mount	
Cable length	5 meters, can be customized	
Shell material	POM and 316L stainless steel	

2. Dimension

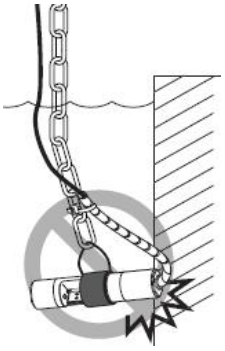


Note: the sensor joint is M16-5 waterproof joint

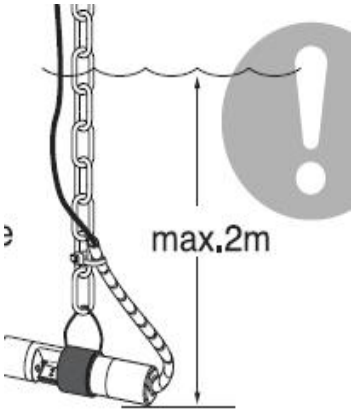
Ⅲ、Installation and electrical connection

1. Installation

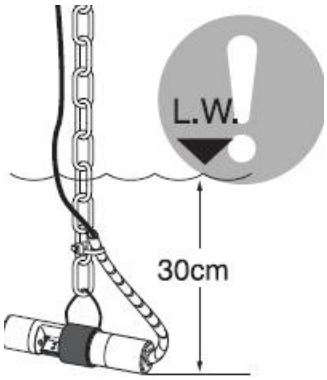
1.1 When the sensor is hung, the sensor caused by the water current should be avoided to hit the wall or other water conservancy facilities. If the current is strong, fix the sensor.



1.2 Installation of sensors, not more than 2 meters from the water surface depth.



1.3 Taking into account the fluctuation of the water level, drop the sensor below the possible minimum water level of 30 cm.



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

It is recommended to install a cable sheath outside the sensor cable. The sensor is positioned horizontally and firmly, and the measuring area is oriented toward the current.

2. Electrical connection

Cable for the 4-core twisted pair shielded wire, wire sequence definition:

- Red cord—power cord（12V～24VDC）
- Black cord —ground cord（GND）
- Blue cord—485A
- white cord—485B

The wiring sequence should be carefully checked before power-on to avoid unnecessary losses caused by faulty wiring.

Wiring instructions: considering the cable long-term Immersion in water (including sea water)

or exposure to air, all wiring are required to do waterproof treatment, the user cable should have a certain degree of corrosion resistance.

Ⅳ、Maintenance

1. Maintenance procedures and methods

1.1 Maintenance schedule

The cleanliness of the measurement window is very important to maintain accurate readings.

Maintenance task	Recommended maintenance frequency
Calibration of sensors (as required by the competent authority)	According to the maintenance schedule required by the competent department
Maintain and check self-cleaning brushes	Check and maintain self-cleaning brush every 18 months

Note: The maintenance frequency in the table above is only a suggestion. Please ask the maintenance staff to clean the sensor according to the actual use of the sensor.

1.2 Maintenance methods

1) Sensor Outer Surface: Clean The sensor outer surface with tap water, if there are still debris residue, wipe with a damp soft cloth, for some stubborn dirt, can add some household detergent in tap water to clean.

2) check the cable of the Sensor: The cable should not be Taut when working normally, otherwise it is easy to make the cable internal wires broken, causing the sensor can not work normally.

3) check the sensors measurement window is dirty, clean brush is normal.

4) check the cleaning brush of the sensor for any damage.

5) use continuously for 18 months, need to return to the factory to replace the dynamic sealing device.

1.3 Cautions

The sensor contains sensitive optical and electronic components. Ensure that the sensor is not subjected to severe mechanical impact. There are no components inside the sensor that need to be maintained by the user.

2. Sensor calibration

2.1 TURBIDITY calibration

1) zero calibration: use a large beaker to measure the amount of zero turbidity liquid, put the sensor vertically in the solution, 3 -5 minutes to be numerical stability after zero calibration. Instructions refer to the appendix.
2) slope calibration: The sensor is placed in a solution in 100 NTU standard solution, 3-5 minutes after the numerical stability of the slope calibration. Instructions refer to the appendix.

2.2 BOD calibration

Calibration (2-point calibration)

① place the sensor in a 5 mg/L BOD solution and confirm that all light paths are immersed under Water >2 cm and free of bubbles. Zero calibration as per appendix command.

② put the sensor into 100mg/L BOD solution and calibrate the slope according to the appendix. Note: 1. When calibrating, first calibrate the temperature, then calibrate the turbidity, then calibrate the BOD.

If the calibration slope, sensor values in 3 minutes, no change after power failure can be re-energized.

3. noting points

- Avoid exposure of sensors to sunlight
- Please do not touch the sensor with your hands
- Measuring and calibrating the sensor surface to avoid the adhesion of bubbles
- The use of the sensor to avoid the direct application of any mechanical stress (pressure, scratches, etc.)

4. Frequently asked questions and countermeasures

Error	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 controller and cable
	Cable failure	Please contact us
The measured value is too high, too low or the value is continuously unstable	The sensor window is attached by a foreign object	Cleaning the sensor window surface
	Sensor self-cleaning damaged	Change 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, to do a 72-hour aging test and stability test on the product, and not to allow one unqualified product to leave the factory.
- The receiving party directly returns the product batch with a failure 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 spare and parts

This product includes:

- 1 sensor
- 1 copy of the 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. If damaged on the way, the company will repair the damage of the instrument for free.

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

a) read data instruction frame

06	03	xx xx	xx xx	xx xx
Address	Function code	Register 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	Bytes	Answer 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	Write data	CRC check code(low byte first)

d) Write data response frame (same data command frame)

06	06	xx xx	xx xx	xx xx
Address	Function code	Register address	Write data	CRC check code (low byte first)

3. Register address

Register address	Name	Instruction	Number of registers	Access method
0x0000	BOD Measured value	2 double-byte integers, scale of measurement and scale of measurement (Default 1 decimal) .	2（4Byte）	Read(0x03)
0x0002	Temperature measurements	2 double-byte integers, in decimal places for the temperature value and the temperature value (default 1 decimal) .	2（4Byte）	Read(0x03)
0x0004	Turbidity	2 double-byte integers, scale of	2（4Byte）	Read(0x03)

	measurements	measurement and scale of measurement (Default 1 decimal) .		
0x1000	BOD Zero calibration	Calibrate in deionized water. The calibration value data written in is 0; the read-out data is the BOD zero original signal. (Calibration can also be performed in 0-20 mg/L BOD standard solution, with the calibration values written as the values of the standard solution concentration x10 used)	1（2Byte）	Write(0x06)/Read(0x03)
0x1004	BOD Slope calibration	Calibration was carried out in 20-150 mg/L standard solution. The calibration values are written as the values of the standard liquid concentration x10 used; the readings are the BOD slope raw signals.	1（2Byte）	Write(0x06)/Read(0x03)
0x1010	Temperaturecalibration	Temperature calibration: write data for the actual temperature value X10; read data for temperature calibration offset X10.	1（2Byte）	Write(0x06)/Read(0x03)
0x1020	Turbidity Zero calibration	Calibration in zero turbidity water. The calibration value data written at calibration time is 0; the read data is zero offset.	1（2Byte）	Write(0x06)/Read(0x03)
0x1024	Turbidity Slope calibration	Calibration can be performed in 20-100 NTU standard solution. The calibration values	1（2Byte）	Write(0x06)/Read(0x03)

		are written as values of the standard liquid concentration used x10 and the read-out values are slope values x1000.		
0x1100	Sensor switch	Turn sensor measurement function on or off. The measure is closed when the write data is 0; the measure is opened when the write data is 1. The sensor is powered on by default.	1（2Byte）	Write(0x06)
0x2002	Sensor address	The default is 6, and the data range is 1-127.	1（2Byte）	Write(0x06)/Read(0x03)
0x1300	Automatic cleaning interval time setting	Default is 30 minutes, data range 6 ~ 6000 minutes.	1（2Byte）	Write(0x06)/Read(0x03)
0x1301	Auto-wash cycle setting	The default is 3 laps, with a data range of 0-6 laps.	1（2Byte）	Write(0x06)/Read(0x03)
0x2020	Reset the sensor	The calibration value reverts to the default value, and the write data is 0. Note that the sensor must be recalibrated before it can be used.	1（2Byte）	Write(0x06)

4. Command example

a) measurement instructions:

Function: read the BOD value and temperature value of the sensor; BOD value in mg/L and temperature in ° C.

Request Frame：06 03 00 00 00 04 45 BE
Response Frame：06 03 08 03 62 00 01 00 B9 00 01 E5 95

Example of reading:

BOD value	Temperature value
03 62 00 01	00 B9 00 01

For example: BOD Value 03 62 represents the hexadecimal reading COD value, 00 01 represents BOD with 1 decimal point, converted to decimal values of 86.6.

The temperature value 00 B9 represents the hexadecimal reading temperature value, and 00 01 represents the temperature value with 1 decimal place, which translates to a decimal value of 18.5 ° C.

a) Calibration instructions：

Temperature calibration

Function:Calibrate the temperature of sensor 25.8 ° C. The temperature calibration should be carried out after the temperature is stable for a period of time.

Request Frame：06 06 10 10 01 02 0D 29

Response Frame：06 06 10 10 01 02 0D 29

TURBIDITY zero calibration

Function: Setting the zero-point calibration value of the turbidity sensor; zero-point calibration is carried out in zero-turbidity water.

Request Frame：06 06 10 20 00 00 8D 77

Response Frame：06 06 10 20 00 00 8D 77

TURBIDITY slope calibration

Function:Setting the turbidity slope calibration value for the sensor; commands for calibration of the slope in 100 NTU SOLUTION:

Request Frame：06 06 10 24 03 E8 CC 08

Response Frame：06 06 10 24 03 E8 CC 08

BOD Zero calibration

Function:Setting the BOD zero calibration value for the sensor; commands for Zero calibration in 5 mg/l solution:

Request Frame：06 06 10 00 00 32 0D 68

Response Frame：06 06 10 00 00 32 0D 68

BOD Slope calibration

Function:Setting the BOD slope calibration value for the sensor; commands for calibration of Slope in 100 mg/L solution:

Request Frame：06 06 10 04 05 DC CF B5

Response Frame：06 06 10 04 05 DC CF B5

b) Boot instructions：

Function:Turn sensor measurement function on or off. Note that power-on is on by default.

Request Frame：06 06 11 00 00 01 4C 81

Response Frame：06 06 11 00 00 01 4C 81

c) change the device ID address:

Function:Change the sensors Modbus device address.

Change Sensor address 06 to 01 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 does not correctly execute the host command, 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 error
   03 – Data is wrong
b) COM: The received function code