NBL-NHN-302 Multi-parameter online Ammonia Nitrogen 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- Introducttion

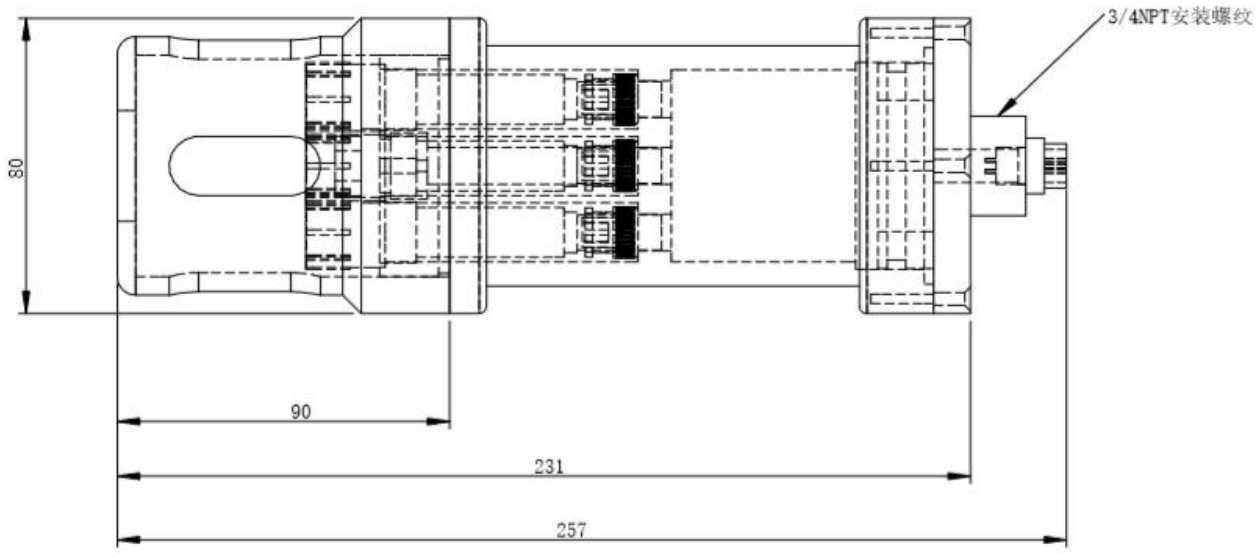
NBL-NHN-302 multi-parameter online ammonia nitrogen sensor is an ammonium ion-selective electrode based on PVC membrane for monitoring ammonium content in water, with potassium ion, temperature and pH compensation to ensure fast, simple, accurate and economical measurement. This booklet introduces the technical parameters, communication protocol, use and maintenance of the ammonia nitrogen sensor in detail.

II、 Technical performance and specifications

1. Technical parameters

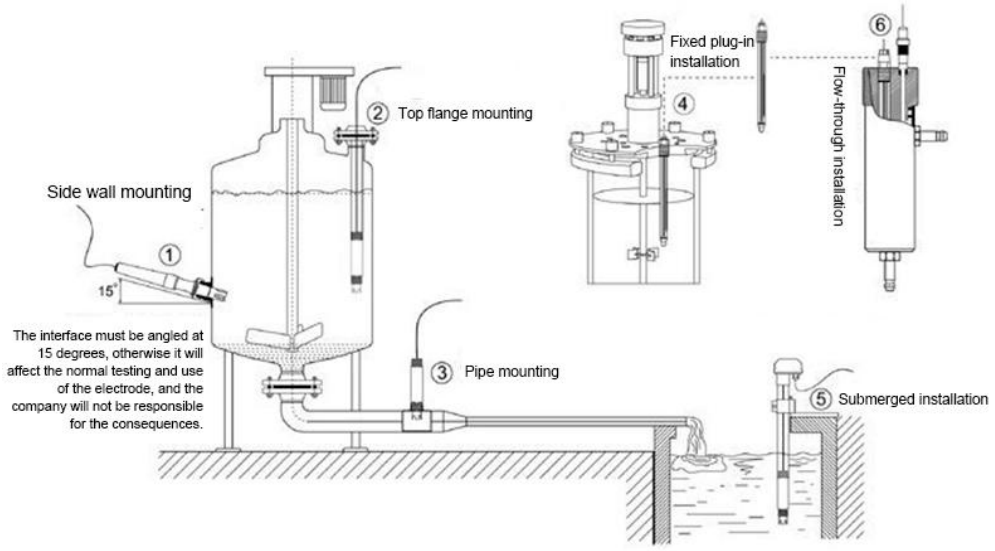
NBL-NHN-302 technical parameters	
range	NH_4^+：0～1000mg/L or 0～100mg/L NH_3：0～150mg/L or 0～15mg/L K^+：0～1000mg/L pH: 0～14pH temperature:0～35℃
Resolution	NH_4^+：0.1mg/L
precision	NH_4^+：±5% NH3 or total ammonia nitrogen: ±5% K^+：±5% pH：0.1pH temperature：0.5℃
storage temperature	-5～65℃
working conditions	0～35℃，＜0.1MPa
Power supply	12～24VDC
Signal output	RS-485(Modbus/RTU protocol)
shell material	PVC/POM
Installation method	3/4NPT pipe thread
Measurement compensation method	Automatic temperature compensation (Pt1000) pH compensation range: 4～10pH K+ compensation range: 0～1000mg/L
Calibration method	Two point calibration
Protection class	IP68
Measurement principle	Ion selection method (ISE)
Electrode life	6 to 12 months

2. Dimensions



Ⅲ、 Installation and electrical connection

1. Installation



Note: The sensor cannot be installed upside down or horizontally, at least at an angle of more than 15 degrees.

a) Check whether there are air bubbles inside the sensor membrane head, if there are any,

hold the sensor vertically with your hand, and shake it firmly in the direction of the sensor membrane head protective cover (downward), or flick it several times on the outside of the sensor membrane head protective cover , so that the air bubbles attached to the electrode membrane head escape.

b) The protective shell of the sensor is connected with the shell by M66×3 thread, and the user can also install it with M66×3 thread according to the installation method.

2. Electrical connection

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

a) Red line - power cord (12 ~ 24V)

b) Black line - ground (GND)

c) Blue line - 485A

d) white line - 485B

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

Wiring instructions: Considering that the cables are immersed in water (including seawater) or exposed to air for a long time, all wiring points are required to be waterproofed, and the user cables should have certain anti-corrosion capabilities.

IV、 Maintenance

1. Use and maintenance

Before the test, the electrode can be soaked in the mixed solution of 10 mg/L ammonium ion standard solution and 10 mg/L potassium ion standard solution for 24 hours to fully activate the sensitive membrane of the electrode. Clean. If the electrode is not used for a long time (more than two weeks), it should be stored dry, and the sensing element of the electrode should be put into a protective cap.
Check whether the terminal is dry. If it is stained, please wipe it with anhydrous alcohol and use it after drying. Prolonged immersion should be avoided
in distilled water or protein solution and prevent contact with silicone grease. For electrodes that have been used for a long time, its PVC film may become translucent or have deposits attached. In this case, it can be rinsed with distilled water (or deionized water). The electrode has been used for a long time, and when a measurement error occurs, it needs to be re-calibrated.
When the electrode can not be calibrated and measured by the above methods, it means that the electrode has failed, please
Replace electrode.

The main interfering ions are shown in the following table：

Interfering ion concentration with 10% error at different ammonium ion concentrations

Interferences (moles/liter)	10^{-4} M Ammonium	10^{-3} M Ammonium	10^{-2} M Ammonium
H^+	< 2	< 1	< 1
Li^+	0.2	0.5	0.5
Na^+	0.005	0.08	0.8
K^+	$7*10^{-5}$	$6*10^{-4}$	$6*10^{-3}$
Cs^+	0.003	0.05	0.5
Mg^{3+}	> 0.5	> 1	> 1
Ca^{2+}	> 0.2	> 1	> 1
Sr^{2+}	> 0.2	> 1	> 1
Ba^{2+}	> 0.1	> 0.5	> 0.5
Zn^{2+}	0.001	0.01	0.1
$N_2H_5^+$	> 0.1	> 0.1	> 0.1
Bu_4N^+	$1*10^{-5}$	$1*10^{-4}$	$1*10^{-3}$

2. Calibration

Note: The sensor has been calibrated before leaving the factory, and it is not suitable for random calibration unless the measurement error is exceeded. K+ and pH are calibrated first, and NH4+ is calibrated last.

(1) Zero calibration

Put the sensor into the vial containing the zero-point standard solution, wait for 5 minutes, and check whether the displayed value is within the error range after the value is stable. If not, zero-point calibration is required. Refer to the appendix for calibration instructions.

(2) Slope calibration

Put the sensor into the vial containing the slope standard solution, wait for 5 minutes, and check whether the displayed value is within the error range after the value is stable. If not, the slope calibration needs to be performed. Refer to the appendix for calibration instructions.

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 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 and spare parts

This product includes:：

- 1 NBL-NHN-302 sensor
- 1 copy of the manual
- 1 certificate
- 1 cable (5 meters)
- pH Buffer 3 Pack
- 1000mg/L ammonium ion standard solution 100mL
- 1000mg/L potassium ion standard solution 100mL

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

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).

Parameters such as baud rate can be customized.

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
40001 (0x0000)	NH4 + concentration measurement + temperature	4 double-byte integers, which are the measured value, the number of decimal places of the measured value, the temperature value, and the number of decimal places of the temperature value.	4 (8 bytes)	read(0x03)
40005 (0x0004)	K+ concentration measurement	2 double-byte integers, which are the measured value and the number of decimal places of the measured value (default 1 decimal).	2（4bytes）	read(0x03)
40007 (0x0006)	pH measurement	2 double-byte integers, which are the measurement value and the number of decimal places for the measurement value (default 2 decimal places).	2（4bytes）	read(0x03)
40009 (0x0008)	NH3 concentration measurement	2 double-byte integers, which are the measured value and the number of decimal places of the measured value (default 1 decimal).	2（4bytes）	read(0x03)
40011 (0x000A)	NH3 + NH4+ concentration	2 double-byte integers, which are the measured	2（4bytes）	read(0x03)

	measurements	value and the number of decimal places of the measured value (default 1 decimal).		
44097 (0x1000)	NH4+ zero calibration	When the range is 0 ～ 100mg/L, the zero point needs to be calibrated in 1mg/L standard solution, and when the range is 0～ 1000mg/L, the zero point needs to be calibrated in 10mg/L standard solution. The data written during zero calibration is the concentration of the zero standard solution used x10. The read data is the mV value corresponding to the zero point calibration value x100	1 (2 bytes)	Write (0x06)/Read (0x03)
44101 (0x1004)	NH4+ slope calibration	When the range is 0 ～ 100mg/L, the slope should be calibrated in 10mg/L standard solution, and when the range is 0 ～ 1000mg/L, the slope should be calibrated in 100mg/L standard solution. The written data is the concentration of the standard solution used for the slope x10.	1 (2 bytes)	Write (0x06)/Read (0x03)

		The read data is the mV value x100 corresponding to the slope calibration value.		
44098 (0x1001)	K+ zero calibration	When the range is 0 ～ 100mg/L, the zero point needs to be calibrated in 1mg/L standard solution, and when the range is 0～ 1000mg/L, the zero point needs to be calibrated in 10mg/L standard solution. The data written during zero calibration is the concentration of the zero standard solution used x10. The read data is the mV value corresponding to the zero point calibration value x100	1 (2 bytes)	Write (0x06)/Read (0x03)
44102 (0x1005)	K+ slope calibration	When the range is 0 ～ 100mg/L, the slope should be calibrated in 10mg/L standard solution, and when the range is 0 ～ 1000mg/L, the slope should be calibrated in 100mg/L standard solution. The written data is the concentration of the standard solution used for the slope x10.	1 (2 bytes)	Write (0x06)/Read (0x03)

		The read data is the mV value x100 corresponding to the slope calibration value.		
44099 (0x1002)	pH zero calibration	Calibrated in a standard solution of pH 6.86, the written data is 0; the read data is the pH zero offset value x100.	1 (2 bytes)	Write (0x06)/Read (0x03)
44103 (0x1006)	pH Slope Calibration	When calibrating in a standard solution of pH 4.00, the written data is 0; when calibrating in a standard solution of pH 9.18, the written data is 1; the read data is the slope value x1000.	1 (2 bytes)	Write (0x06)/Read (0x03)
44113 (0x1010)	temperature calibration	Temperature calibration: The written data is the actual temperature value x10; the read data is the temperature calibration offset x10.	1 (2 bytes)	Write (0x06)/Read (0x03)
48195 (0x2002)	Sensor address	The default is 6, and the data range is 1 to 255.	1 (2 bytes)	Write (0x06)/Read (0x03)
48225 (0x2020)	reset sensor	The calibration value is restored to the default value, and the write data is 0. Note that after the sensor is reset, it needs to be calibrated again before it can be used.	1 (2 bytes)	write(0x06)

1. Command example

(1) read data command：

Function: Obtain the ammonia nitrogen value and temperature measured by the sensor; the unit of ammonia nitrogen is mg/L; the unit of temperature is ° C.

Request frame: 06 03 00 00 00 04 45 BE;

Response frame: 06 03 08 00 62 00 01 01 01 00 01 60 59;

Example of reading:：

Ammonia nitrogen value	temperature value
00 62 00 01	01 01 00 01

For example: Ammonia nitrogen value: 00 62 means hexadecimal reading ammonia nitrogen value, 00 01 means ammonia nitrogen value with 1 decimal, converted to decimal value as 9.8.

Temperature value: 01 01 means hexadecimal reading temperature value, 00 01 means temperature value with 1 decimal, converted to decimal value is 25.7.

(2) Potassium ion read command：06 03 00 04 00 02 84 7D

(3) pH read command：06 03 00 06 00 02 25 BD

(4) pH calibration

Prepare three standard solutions of pH=4.0, pH=6.86, pH=9.18 within the validity period of the test, a cup of deionized water and a clean towel.

a) Zero calibration: Rinse the sensor with deionized water, dry it with a towel, put it in the pH=6.86 standard solution, stir the standard solution first, then adjust the sensor position to ensure that the sensor is in the center of the standard solution, and let it stand for 3 minutes Send zero calibration command, the command is as follows：

request frame：06 06 10 02 00 00 2D 7D;

acknowledgment frame：06 06 10 02 00 00 2D 7D;

b) Slope calibration: Take out the sensor, rinse it with deionized water and then dry it. According to customer requirements, if the customer's test medium is an alkaline solution, put it in the pH=9.18 standard solution (if the medium is an acidic solution, put it in pH=9.18). 4.0 standard solution) for slope calibration, first stir the standard solution, then adjust the sensor position to ensure that the sensor is in the center of the standard solution, and send the slope calibration command after standing for 3 minutes, the command is as follows：

High point standard solution 9.18pH calibration：

request frame：06 06 10 06 00 01 AD 7C;

acknowledgment frame：06 06 10 06 00 01 AD 7C;

Low point standard solution 4.00pH calibration：

request frame：06 06 10 06 00 00 6C BC;

acknowledgment frame: 06 06 10 06 00 00 6C BC;

(5) Potassium Electrode Calibration

a) Zero calibration. Function: Set the zero point calibration value of the potassium ion electrode. The zero point calibration is carried out in 10mg/L or 100mg/L potassium ion standard solution. For

example, please refer to the following; (1mg/L)

request frame：06 06 10 01 00 0A 5D 7A;

acknowledgment frame：06 06 10 01 00 0A 5D 7A;

b) Slope calibration. Function: Set the slope calibration value of potassium ion electrode; slope calibration is carried out in 100mg/L or 1000mg/L standard solution, the example is as follows：（10mg/L）

request frame：06 06 10 05 00 64 9D 57;

acknowledgment frame：06 06 10 05 00 64 9D 57;

(6) Ammonium ion electrode calibration

a) Zero calibration. Function: Set the ammonia nitrogen zero point calibration value of the electrode, and the zero point calibration is at 1mg/L or 10mg/L ammonium

Ion standard solution, see below for example (1mg/L)；

request frame：06 06 10 00 00 0A 0C BA;

acknowledgment frame：06 06 10 00 00 0A 0C BA;

c) Slope calibration. Function: Set the ammonia nitrogen slope calibration value of the electrode; the slope is calibrated at 100mg/L or 1000mg/L ammonium

Ion standard solution, the example is as follows (10mg/L)：

request frame：06 06 10 04 00 64 CC 97;

acknowledgment frame：06 06 10 04 00 64 CC 97;

(7) Set the sensor ID address

Function: Set the Modbus device address of the sensor.。

Change the device address 06 to 01, the example is as follows

request frame：06 06 20 02 00 01 E3 BD;

acknowledgment frame：06 06 20 02 00 01 E3 BD;

2. Error response

If the sensor cannot execute the command of 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 – function code error

03 – data error

b) COM：Received function code