

KWS-201 Online NH₄-N Ammonia Nitrogen Sensor

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1.Introduction

The online ammonia nitrogen sensor does not require reagents, is green and pollution-free, and can be monitored online in real time. It is equipped with ammonium ion electrode, pH electrode and reference electrode (potassium ion is optional) as standard. In the process of measuring ammonia nitrogen in water, automatic pH and temperature compensation are performed to make the measured value more accurate. The sensor can be directly installed, which is more economical, environmentally friendly, convenient and fast than traditional ammonia nitrogen analyzers. It adopts RS485 output and supports Modbus for easy integration.

2.Features

- Digital sensor, RS-485 output, supports MODBUS;
- No reagents required, no pollution, more economical and environmentally friendly;
- Automatically compensate for pH and temperature in water;
- Ion electrode method, no electrolyte required, electrodes can be replaced separately, easy to maintain.

Note: Ion electrodes are only suitable for freshwater applications, not seawater.

3. Technical Specifications

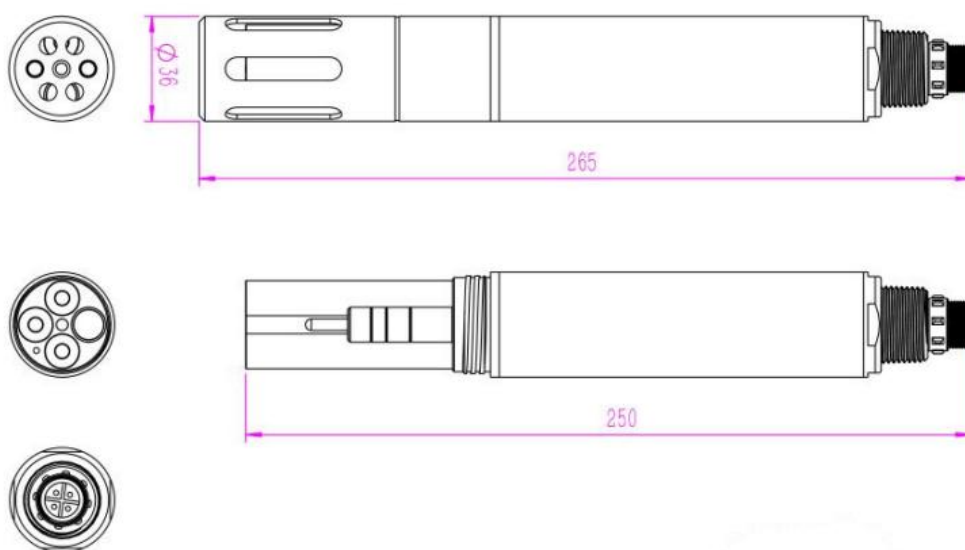
Name	Ammonia Nitrogen sensor
Measuring range	0-100mg/L (optional 0-1000mg/L)
Measurement accuracy	±10% or ±0.5mg/L (whichever is greater)
Resolution	0.01mg/L
pH range	4-10pH
pH accuracy	±0.1pH
pH resolution	0.01
Sensor size	φ36mm*265mm (with protective cover)
Protection level	IP68
Maximum depth	10 meters underwater
Temperature range	0-50℃
Sensor interface	Support RS-485, MODBUS protocol
Assembly	NPT3/4 thread, immersion installation
Power consumption	0.25W (recommended power supply: DC 9-24V, ≥1A)
Probe cable length	10 meters (default), customizable
Calibration	1-point or 2-point calibration
Casing	POM+316L (customizable titanium alloy)

Note: The above technical parameters are all data under laboratory standard solution environment; sensor life and maintenance and calibration frequency are related to actual on-site conditions.

4. Dimension

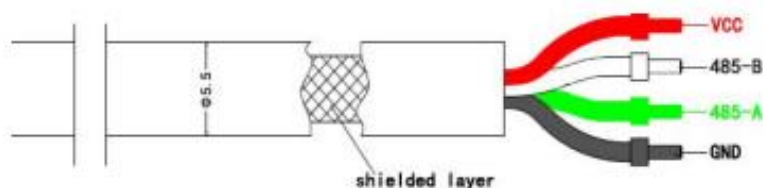


▲ Ammonium ISE Sensor



5. Wiring

wire AWG-24 or AWG-26 shielding wire.OD=5.5mm



- 1, Red—Power (VCC)
- 2, White—485 Date_B (485_B)
- 3, Green—485 Date_A (485_A)
- 4, Black—Ground (GND)

6. Installation and Preparation

6.1 Preparation

(1) Remove the protective cover

- Before installation, please carefully remove the rubber protective cover at the front end of the reference electrode and pH electrode, and store the protective cover properly;

Note: The ammonium ion electrode has no protective cover and can be stored dry.

(2) Probe cleaning and activation

- Please rinse the electrode with deionized water (**special attention, just rinse, do not wipe or scrub**);
- Electrode activation is required before use. Method: Soak the sensor electrode in 10ppm ammonium chloride standard solution for 24 hours.

6.2 Installation

(1) Wiring and power supply

① Do not use the sensor cable to hoist the sensor! It is recommended to install a cable protective cover to ensure that the cable is well powered and watertight.

② Make sure the line sequence and power supply voltage are accurate before powering on !

(2) Sensor installation

① 6-point threaded fixed installation at the tail and housing clamp installation (**Note: the sensor must be installed vertically with the electrode facing downward, not horizontally or even with the electrode facing upward**);

② Considering the influence of water level, the sensor must be installed 30cm below the lowest water level to prevent the low water level electrode from being exposed to the air;

③ The sensor is recommended to be installed in a position without bubbles in the water, as far away from the aeration port as possible.

7. Calibration

7.1 Calibration standard solution and calibration formula

(1) pH standard solution

It is recommended to directly purchase standard solutions with pH standard values of 4.00, 6.86, and 9.18.

pH user calibration formula:

$\text{pH}(\text{standard value}) = K * \text{pH}(\text{measured value}) + B$. Normal factory default $K=1; B=0$

(2) NH_4^+ standard solution

NH_4^+ standard solution mother solution (NH_4^+ concentration: 1000mg/L), users can use this mother solution to dilute the corresponding concentration standard solution;

Note: Before testing, the prepared NH_4^+ standard solution needs to be added with ISA ion activator and fully stirred to ensure ionic strength. The addition ratio is 2% of the standard solution volume. The specific amount of solution required is recommended to be enough to contact the metal sleeve of the sensor.

(3) Potassium ion standard solution (when using potassium ion electrode)

① Take 1.9067g KCl and dissolve it in deionized water, dilute to 1L, and obtain 1000mg/L K^+ standard solution;

- ② Take 1ml 1000mg/L K⁺ standard solution and add it to a 1000mL volumetric flask, dilute to 1000mL with deionized water, and shake well to obtain 1mg/L K⁺ standard solution;
- ③ Take 10ml of 1000mg/L K⁺ standard solution and add it to a 1000mL volumetric flask, dilute to 1000mL with deionized water, and shake well to get 10mg/L K⁺ standard solution;
- ④ Take 100ml of 1000mg/L K⁺ standard solution and add it to a 1000mL volumetric flask, dilute to 1000mL with deionized water, and shake well to get 100mg/L K⁺ standard solution.

Note: All the above standard solutions must be diluted with deionized water. When the deionized water preparation conditions are insufficient, pure water can be used instead.

K⁺ user calibration formula:

$K + (\text{standard value}) = K * K + (\text{measured value}) + B$. Normal factory default $K=1; B=0$

8. Maintenance and Methods

8.1 Maintenance schedule

Regular maintenance of the ion electrode ammonia nitrogen sensor can keep the sensor in good working condition.

Maintenance tasks	Maintenance cycle (cleaning, calibration)
Cleaning sensors	Clean once every 30 days, shorter if the water is dirty
Calibrating sensors	Recommended every 3~4 weeks (depending on the working conditions)

8.2 Methods

(1) Cleaning the sensor surface

The outer surface of the shell can be rinsed with tap water and scrubbed with a soft brush. If it is severely dirty, it can be scrubbed with soapy water;

(2) Cable inspection

Check whether the cables and connectors are damaged, and check whether the power supply of the cables is normal;

(3) Cleaning and precautions of the electrodes (important)

- ① The surface of the electrode column can be scrubbed with a soft brush, but do not touch the ammonium ion sensitive membrane;
- ② After rinsing the pH and reference electrode membrane heads with tap water, they can be gently scrubbed with a dust-free cloth or a soft brush;
- ③ The ammonium ion electrode sensitive membrane cannot be scratched or scrubbed! Only tap water (preferably deionized water) can be used for rinsing;
- ④ After the sensor is cleaned, if no calibration is required, it can be directly reinstalled and continued to be used; if calibration is required, the probe needs to be rinsed and dried with deionized water. The sensor housing and electrode cylinder can be wiped dry with a dust-free cloth. Do not wipe the electrode membrane head. It is recommended to blow dry or gently wipe dry with absorbent paper!
- ⑤ During calibration, each step of standard solution calibration requires the deionization and cleaning of the electrode to be repeated to avoid contamination of the standard solution.

(4) Sensor storage

When the sensor is not in use, the sensor should be cleaned and properly stored, especially the electrode. The pH and reference electrodes need to use the corresponding protective solutions provided by our company; ammonium ions need to be covered with protective covers and stored dry.

Note: If the membrane head is dirty and dried and the electrode is dried for a long time, it will cause the electrode to fail and is not covered by the warranty.

(5) Replacement of consumables and wearing parts

Ammonium ion, reference and pH electrodes are all consumables with a 3-month warranty. Please replace them in time according to actual conditions.

9. FAQ

The following table lists the possible problems and solutions of the ammonia nitrogen sensor. If your problem is not listed or the solution cannot solve your problem, please contact us.

ERROR	POSSIBLE CAUSE	SOLUTION
Communication abnormality	Power supply, wiring abnormalities	Check whether the power supply and wiring are normal according to the instructions
	Interface, protocol problems	1. Use the host computer software provided by our company to check whether the communication is normal; 2. Check according to the product supporting communication protocol.
No change in value	Software and hardware abnormalities	Please contact us
Measurement value is too high, too low or the value is continuously unstable	Sensor is seriously contaminated	Clean the sensor body, chemical electrode, etc.
	Electrode wear and tear	Replace new electrode
	Need to calibrate	Perform user calibration
Other problems	Please contact us	

10. Warranty instructions

(1) The hardware warranty period is 1 year, and the chemical electrode warranty period is 3 months.

(2) This warranty does not include the following situations:

- ① Damage caused by force majeure, natural disasters, social unrest, war (announced or unannounced), terrorism, war or any government coercion;
- ② Damage caused by improper use, negligence, accident or improper application and installation;
- ③ Freight for returning the goods to our company;
- ④ Freight for expedited or express delivery of parts or products within the warranty scope;
- ⑤ Travel expenses for local warranty repairs.

(3) This warranty includes all the contents of the warranty provided by our company for its products.

① This warranty constitutes the final, complete and exclusive statement of the terms of the warranty, and no person or agent is authorized to formulate other warranties on behalf of our company.

② The remedies such as repair, replacement or refund of the goods as mentioned above are special cases that do not violate this warranty. The remedies such as replacement or refund of the goods are for the company's products themselves. We are not liable for any damages resulting from product defects or negligence, including consequential damages arising out of a causal relationship between these circumstances, based on strict liability or any other legal theory.

11. Modbus Protocol

RS485 communication protocol adopts MODBUS communication protocol, and sensors are used as slaves.

Data byte format:

Baud rate	9600
Start Bit	1
Data bits	8
Stop bits	1
Parity Bit	N

Read and write data (standard MODBUS protocol)

The default address is 0x01, the address can be modified by register

11.1 Reading Data

Host call (hexadecimal)

01 03 00 00 00 01 84 0A

Code	Function Definition	Remarks
01	Device Address	
03	Function code	
00 00	Start Address	See register table for details
00 01	Number of registers	Length of registers (2 bytes for 1 register)
84 0A	CRC checksum, front low and back high	

Slave answer (hexadecimal)

01 03 02 00 xx xx xx xx

Code	Function Definition	Remarks
01	Device Address	
03	Function Code	
02	Number of bytes read	
xx xx	Data (front low and back high DCBA)	See register table for details
xx xx	CRC checksum, front low and back high	

11.2 Writing Data

Host call (hexadecimal)

01 10 1B 00 00 01 **02 01** 00 0C C1

Code	Function Definition	Remarks
01	Device Address	
10	Function Code	
1B 00	Register Address	See register table for details
00 01	Number of registers	Number of read registers
02	Number of bytes	Number of read registers x2
01 00	Data (front low and back high DCBA)	
0C C1	CRC checksum, front low and back high	

Slave answer (hexadecimal)

01 10 1B 00 00 01 07 2D

Code	Function Definition	Remarks
01	Device Address	
10	Function Code	
1B 00	Register Address	See register table for details
00 01	Returns the number of registers written	
7D 2D	CRC checksum (front low and back high)	

11.3 Calculate CRC Checksum

- (1) Preset a 16-bit register to hexadecimal FFFF (i.e. all 1s), and call this register the CRC register;
- (2) XOR the first 8-bit binary data (i.e. the first byte of the communication information frame) with the lower 8 bits of the 16-bit CRC register, and put the result in the CRC register. The upper 8 bits of data remain unchanged;
- (3) Shift the content of the CRC register right by one bit (towards the lower bit), fill the highest bit with 0, and check the shifted bit after right shift;
- (4) If the shifted bit is 0: repeat step 3 (shift right by one bit again); if the shifted bit is 1, the CRC register is equal to the polynomial A001 (1010 0000 0000) 0001) for XOR;
- (5) Repeat steps 3 and 4 until the right shift is 8 times, so that the entire 8-bit data is processed;
- (6) Repeat steps 2 to 5 to process the next byte of the communication information frame;
- (7) After all bytes of the communication information frame are calculated according to the above steps, the high and low bytes of the 16-bit CRC register are exchanged;
- (8) The final content of the CRC register is: CRC code.

11.4 Register Table

Register starting address	Function definition	Number of registers	Data format (hexadecimal)
0x3000H	Device address (read and write) Factory default: 01	1	2 bytes in total 00~01: device address The settable range is 1~254 For example, if the acquired data is 02 00 (low bit first, it means the address is 2) Take address 15 as an example, then write 0F 00 (low bit first) to the corresponding address. When the current device address is unknown, FF can be used as the general device address to query the current device address.
0x3600H	LGNH4+ user calibration coefficient K/B (read and write)	4	8 bytes in total 00~03: K 04~07: B Take reading K as an example, the readout is 4 bytes of data (lower bit first, DCBA format, this data needs to be converted to floating point numbers, the conversion method is as follows). Take writing K as an example, k needs to be converted to a 32-bit floating point number first, and written in (DCBA format).
0x1100	pH User calibration K/B(read/write)	4	Total 8 bytes 00~03:K 04~07:B
0x2900	Original internal factory parameters of pH electrode (read and write) Note: If the customer only performs a 2-point pH calibration, this item can be ignored, but it should not be changed at will.	12	Total 24 bytes 00~03: K1 04~07:K2 08~11: K3 12~15: K4 16~19: K5 20~23: K6 The default parameter is K1=6.86,K2=6.72,K3=0.04, K4=6.86,K5=6.56,K6=-1.04
0x3400	LGNH4+ Value acquisition	2	Total 4 bytes 00~03:LGNH4+ This value is used for the user calibration
0x2600H	Potential/pH Value acquisition	4	Total 8 bytes 00~03: Potential Value

			04~07:pH The reading Potential value/pH value is 4 bytes of data. (The low position is in the front, DCBA format, and this data needs to be converted to a change floating point number. The conversion method is shown below)
0x2800	NH4 N、K+ and NH4+ Value acquisition	6	Total 12 bytes 00~03: NH4 N value 04~07: K+ value 08~11: NH4+ value
0x2400	Temperature value acquisition	2	Total 4 bytes 00~03: Temperature value