BQ301 Integrated Multi-parameter Sensor Operation manual

Introduction

First of all, thanks for your trust and support by using integrated multi-parameter analyzer.

Before installation, please do read this manual carefully. For properly installing sensor and setting parameters will maximize the performance and advantages of the product, to bring you a good experience.

This instrument is a precision analytical measurement and control instrument, which should be installed, operated and repaired by trained personnel or personnel who understand and have expertise in this technique.

Please contact the after-sales department of our company, if you encounter difficulties during installation or use.

After unpacking the box, please check the package list and the actual product you received. If there is any missing or damaged, please contact our company in time.

We solemnly guarantee that:

1. If there are any quality problem occurs within one year from the date of purchase, you will be served with product maintenance for free. Except the consumables

2. No matter where the product you buy from, the manufacturer hereby guarantees that you will be served with lifetime technical maintenance and service.

3. Damage to the product caused by the following reasons shall not be covered by the warranty:

A. Damage caused by mistaken connection to high voltage power supply or water immersion;

B. Damage caused by unauthorized modification and misuse;

C. Incidental losses caused by improper selection of model;

D. Damage caused by the working conditions which exceeds that specified by the product;

E. All physical damage caused by improper force;

F. Failure to store and transport in accordance with the specified storage or transportation conditions (reference to standard SJ/T10463-93); consumable materials should be purchased separately.

 When this symbol appears in the manual, it refers to that it is related to safety, installation, product function and use which should be paid special attention to.

Advancing with the times is the law of enterprise development, and the products will be

upgraded in stages. The general changes are subject to change without notice. Please refer to the actual product.

Table of Contents

Chapter 1 Product description

1.1 Products information

1.1.1 Integrated multi-parameter analyzer

The integrated multi-parameter analyzer is a monitoring instrument for long-term field use. It can select 2-7 parameters and realize simultaneous real-time online monitoring, data reading and storage functions of temperature, depth, pH, ORP, conductance, turbidity, dissolved oxygen, chlorophyll, blue-green algae, ammonia nitrogen, Nitrate ion, fluoride ion and chloride ion. Each sensor measures its own parameters through a variety of electrochemical, optical or physical means of detection.

The integrated multi-parameter analyzer can be equipped with self-cleaning system to obtain accurate data for a long time, and with different lengths of cable to meet customer needs, easy to operate, accurate data. It is widely used in online monitoring of water quality in different water bodies such as rivers, lakes, reservoirs, drinking water, groundwater and seawater （optional）. The external dimensions of the integrated multi-parameter analyzer are shown in Figure 1.

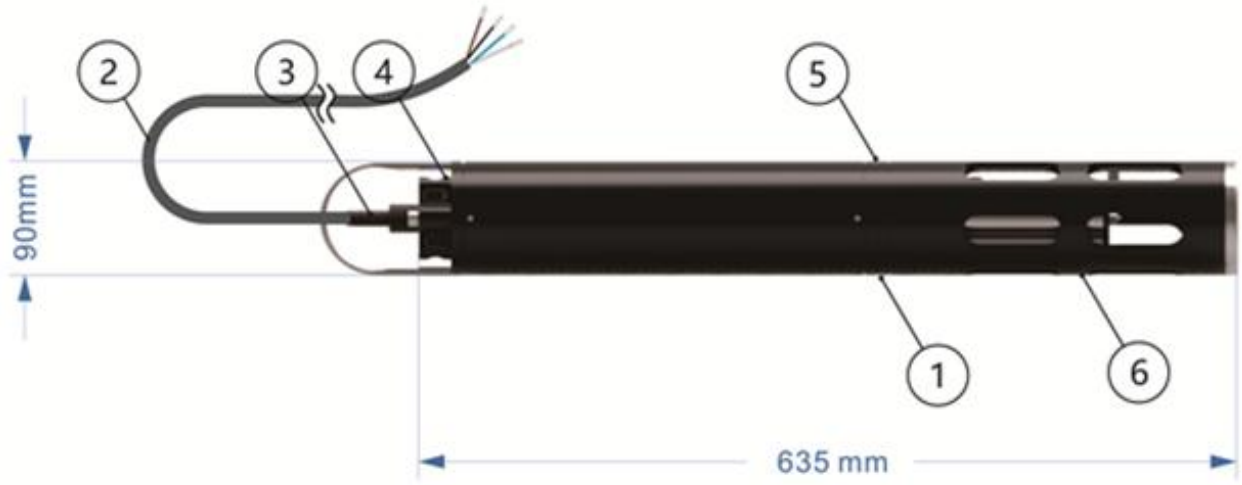


Figure 1 multi-parameter analyzer

1-Outer shell	2-Cable
3-Waterproof joint	4-Battery cover
5-Battery cover	6-Calibration cup

The technical parameters of the integrated multi-parameter analyzer host are shown in the following table.：

Host specification	
Voltage	12VDC
Power consumption	3 W
communication	MODBUS RS485
Maximum withstand pressure	Normal electrode：30 meter Ion electrode：10meter
Operating temperature	0~45 °C （not frozen）
storage temperature	0~50 °C（not frozen）
Protection level	IP68
Weight About	3 kg
Battery capacity	8 units, 8C, 3.6v lithium battery

1.1.2 Hand manipulator（Optional）

Specially designed for the customers, our company researches and develops a hand manipulator to make integrated multi-parameter analyzer complete the data reading, parameter setting, and calibration without the using of PC, and can be fit for being held in hand easily for any situation.

The hand manipulator can constantly read and display the data of integrated multi-parameter analyzer on line, and can read and export the history data (only can read and export history data stored by hand manipulator). Also, hand manipulator can complete the parameter setting and calibration for the sensor. The inside GPS acceptor can establish a one-to-one relationship between the data group measured each time and the geographic location information from GPS positioning system. Bluetooth function makes the hand manipulator communicate with multi-parameter sensor directly and conveniently without cables connection. The storage function makes history data stored by multi-parameter analyzer be exported and read with special setting. USB interface can realize the power supply for built-in battery and the exporting of data. Ergonomic curve design with rubber gasket makes hand-holding operation easy and be suitable for mastering in the humid environment. Appearance dimension diagram is showed in Diagram two as below.

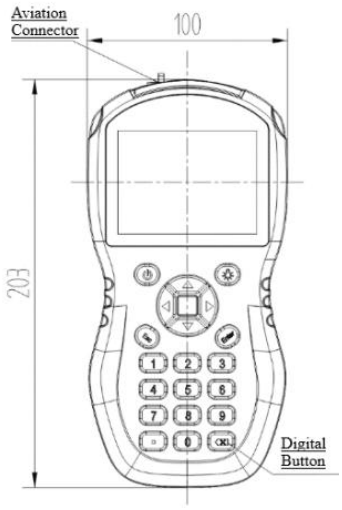


Figure 2 dimension diagram of hand manipulator

The technology parameters of hand manipulator have been showed as below：

Display	3.5-inch color display screen with adjustable backlight
Data Storage	8G
Power supply	Internal battery power supply, Battery Specification: 4 Section 3.7 V Lithium Battery
Protection Level	IP67
Operating Temp.	0~50℃（not frozen）
Storage Temp.	-15~60℃（not frozen）
Size	203*100*43mm
Weight	0.5KG

1.2 Safety Information

Please read this manual thoroughly before unpacking, setting up or operating the instrument.

Pay special attention to all hazard and warning statements. In the event of mishandling, it may cause serious injury to the operator or damage to the equipment.

This equipment must be used and installed only in accordance with the detailed instructions in this manual.

1.2.1 Use of dangerous information

For various hazards, this manual will use signal specific words (Danger, Caution, Note) that correspond to the degree of danger.

 ***Danger***

Indicates a potentially or imminently dangerous state that, if not prevented, could be life-threatening or cause serious injury.

 ***caveat***

Indicates a potentially dangerous state that may cause mild or moderate injury.

Important note: Information that requires special emphasis.

Tip: Information in the text that supplements the points

1.2.2 Reminder prevention label

Carefully read all the labels and identifiers attached to the instrument, otherwise it may cause personal injury or damage to the instrument.

	If the label is marked on the instrument, refer to the instrument manual for operation and/or safety information.
	If the label is marked on the product, it indicates that there is a fuse or current limiting device.
	If the label is marked on the product, it indicates that the device is susceptible to static electricity leakage and protective measures should be taken to prevent damage.
	If the label is marked on the product, it indicates the location of the ground wire.

1.3 Pressure limit

The maximum immersion pressure of the multi-parameter probe is 0.3Mpa or less. When the underwater probe pressure is greater than 0.3Mpa, the sensor will be mechanically damaged and deformed **（Note: If choose ion electrode, the max. immersion pressure should be less than 0.1Mpa.）**

1.4 Temperature limit

When storing a multi-parameter probe, the multi-parameter probe stores a temperature range of 0 to 50°C, non-freezing. The multi-parameter probe operates over a temperature range of 0 to 45°C and is not frozen. Exposing a multi-parameter probe outside of the above temperature range may result in mechanical damage and electrical failure.

To prevent freezing of the multi-parameter probe.

1.5 Minimum depth requirement

In order to prevent the sun exposure sensor, the sensor body must be completely submerged by water when in use.

Chapter 2 Introduction to Sensors

The integrated multi-parameter analyzer measures the following parameters: depth, temperature, pH, ORP, conductivity, turbidity, dissolved oxygen, chlorophyll, blue-green algae, ammonia nitrogen, nitrate, fluoride and chloride. The wide range of physical, biological and chemical properties of natural waters can be monitored.

Please note: That pH, Conductance, ORP, Ammonia nitrogen, Nitrate ion, fluoride ion, chloride ion, these seven parameters are analog electrodes, up to 4 can be selected but can't be repeated, the corresponding host interface is fixed, can't be universal .

And when the electrode parameter configuration is selected, are factory-set, even if the corresponding electrode is not connected in the field, the host can't prompt that the electrode is not connected, but will still have a value. In this case, the output value is an arbitrary value, and not accurate value of measurement. So when using, please make sure the corresponding electrode is connected!

2.1 Temperature Sensor

Principle:

Temperature is a measure of the amount of heat present in a body of water, and temperature is considered to be a very important single parameter. It affects other parameters of water quality and controls the metabolism of aquatic animals and plants.

The integrated multi-parameter analyzer uses a thermistor to measure the temperature of the water. The resistance value of the thermistor changes with temperature, and the measured resistance value can be converted into a temperature value using a corresponding calculation formula. This formula has been built into the host software, and the user can directly view the real-time Celsius. The appearance of the temperature sensor is shown in Figure 3.

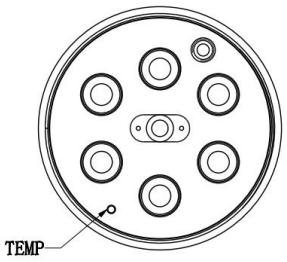


Figure 3 Temperature sensor

Temperature Sensor Specification	
Principle	Thermistor method
Range	0~50 °C
Resolution	0.01 °C
Accuracy	± 0.5 °C

2.2 pH Sensor

Principle:

pH describes the pH and basic properties of a water body. It is acidic when pH<7.0, neutral when pH=7.0, and alkaline when pH>7.0.

The pH sensor uses a glass electrode method to measure the pH of the water. The sensor consists of two parts, including a glass bubble containing a glass film that selectively responds to H+, a glass foam containing a 0.1 mol/L HCl internal reference solution, and an internal reference electrode Ag- AgCl

electrode. When the electrode is immersed in the solution to be tested, the difference between the stable potential of the reference electrode and the potential generated by the glass sphere is proportional to the H+ concentration in the solution.

The pH sensor measures data with stability, reliable performance and easy installation. The appearance of the pH sensor is shown in Figure 4.

Important Tip1: When using a new pH electrode, the electrode should be immersed in distilled water for a period of time, usually 24 hours or more, in order to form a good hydration layer. There should be no air bubbles between the bulbs of the inner electrodes of the glass electrodes, and if there are bubbles, the bubbles can escape easily.

Important Tip 2: Provided the pH is used in high sulfur ion environments, which is easy damaged and with short life time.

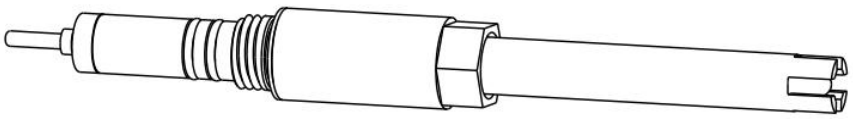


Figure 4 pH Sensor

pH Sensor Specification	
Principle	Glass electrode method
Range	0-14 pH
Resolution	0.01 pH
Accuracy	±0.1 pH

2.3 ORP Sensor

Principle:

ORP sensor is a composite electrode in which the indicator electrode and the reference electrode are combined. Also known as REDOX electrode. The data is stable and reliable.

The appearance of the ORP sensor is shown in Figure 5.

IMPORTANT: When using the new ORP electrode, the electrode should be immersed in distilled water for a period of time, usually more than 24 hours, in order to form a good hydration layer.

There should be no air bubbles between the bulbs of the inner electrodes of the glass electrodes, and if there are bubbles, the bubbles can escape easily.

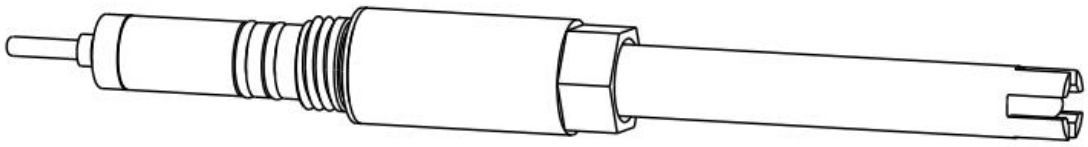


Figure 5 ORP Sensor

ORP Sensor Specification	
Principle	Glass electrode method
Range	-1000mV～1000 mV
Resolution	0.01mV
Accuracy	±0.1 mV

2.4 Conductivity Sensor

2.4.1 Conductivity Sensor

Principle:

Conductivity indicates the electrical conductivity of a substance. The greater the conductivity, the greater the conductivity and vice versa.

The conductivity sensor is a combination of two parallel plates. When it is placed in the solution to be tested and a certain potential (usually a sinusoidal voltage) is applied across the plates, the interpolate flow can be measured. The current passed. The conductivity of the water quality is calculated according to the corresponding calculation formula.

The company has designed two conductivity sensors with different ranges: 1 μS/cm-2000 μS/cm (k=1) and 100 μS/cm-100 mS/cm (k=10.0), users can follow their own The different requirements are selected. The specific parameters can be found in the technical specifications below, where K represents the electrode constant.

Conductivity probes not only test conductivity, but also convert to salinity and total dissolved solids.

Another salinity can be used for real-time compensation of dissolved oxygen. The appearance of the conductivity sensor is shown in Figure 6

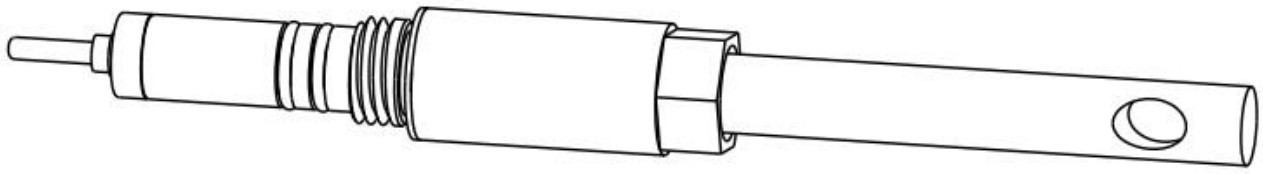


Figure 6 Conductivity probe

Conductivity probe **Specification**	
Principle	Platinum electrode
Range	1 μS/cm-2000 μS/cm (k=1) 100 μS/cm- 100 mS/cm (k=10.0)
Resolution	0.1 μS/cm- 0.01 mS/cm （Related to Range）
Accuracy	±3%

2.4.2 Salinity

Salinity is a measure of the total amount of salt dissolved in a body of water. It can be automatically calculated from the conductivity and temperature detected by the multi-parameter analyzer. The algorithm is based on the standard method for water and seawater detection (1989), and its unit output is ppt. Salinity can be used for real-time compensation of dissolved oxygen.

Salinity Specification	
Principle	Converted by conductivity
Range	0-1 ppt (k=1.0) ； 0-70 ppt (k=10.0)
Resolution	0.001ppt~0.01ppt（Related to Range）
Accuracy	±3%

2.4.3 Total dissolved solids

The total dissolved solids are also called the total amount of dissolved solids, which means the amount of

materials dissolved in water or small enough to be filtered, which can be used to reflect the degree of pollution of water bodies. The ionic species dissolved in the water causes the water to be electrically conductive, so the amount of the compound in which the ions are present can be roughly estimated by the conductivity, and the output unit is ppm.

Because the chemical composition of different water bodies causes different ionic properties, the conductivity cannot fully calculate the amount of TDS.

TDS Sensor Specification	
Principle	Converted by conductivity
Range	0-1000 mg/L（K=1） 50-500000 mg/L（K=10.0）
Resolution	0.1 mg/L ~1 mg/L（Related to Range）
Accuracy	±3%

2.5 Dissolved Oxygen Sensor

Principle:

Dissolved oxygen is a measure of the amount of oxygen present in a body of water and is usually referred to as DO. The dissolved oxygen sensor is measured by fluorescence method. The top of the sensor is covered with a layer of fluorescent substance. When the blue light emitted by the sensor is irradiated to the fluorescent substance, the fluorescent substance is excited to emit red light, and the oxygen molecule can carry away energy (quenching effect). Therefore, the time and intensity of the excited red light is inversely proportional to the concentration of oxygen molecules, and the concentration of dissolved oxygen in the water can be obtained by calculation. The appearance of the dissolved oxygen sensor is shown in 7.

Measurement / Interference:

1. When measuring, the air bubbles attached to the film must be avoided.

2. The presence of chlorine can distort the measurement results (overestimating the dissolved oxygen level).

3. After the sensor is inserted into the measurement environment, wait for the sensor temperature to stabilize before starting measurement.

Safety Cautions

Hazardous film factors are: chemicals (organic solvents, acids and peroxides); mechanical damage (impac t, friction or tear)

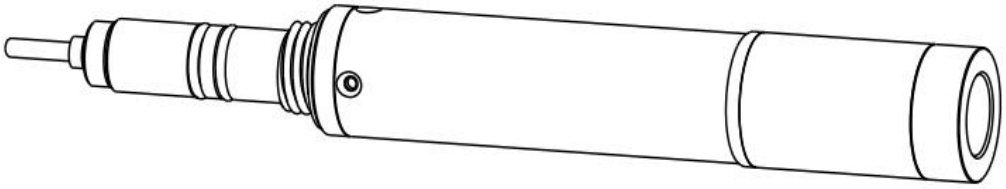


Figure 7 Dissolved Oxygen Sensor

DO Sensor Specification	
Principle	Fluorescence method
Range	0-20 mg/L；0-20 ppm；0-200%
Resolution	0.1%/0.01mg/L
Accuracy	±3% or ±0.3mg/l of Measured Value，take the greater value

2.6 Turbidity Sensor

Principle:

Turbidity is the measure of the amount of suspended solids in water. Suspended solids in water are generally clay, sand, colloidal matter, algae, plankton and microorganisms.

The turbidity sensor is designed based on a combined infrared absorption scatter ray method. The infrared light emitted by the light source is scattered by the particles in the water to be measured, converted into an electrical signal by a photo detector, and subjected to analog and digital signal processing to obtain a turbidity value of the water sample. A turbidity unit NTU having a basic turbidity standard using formalin (a white polymer produced by polymerization of a certain amount of barium sulfate and hexamethylamine) is usually used. The turbidity sensor is shown in Figure 8.

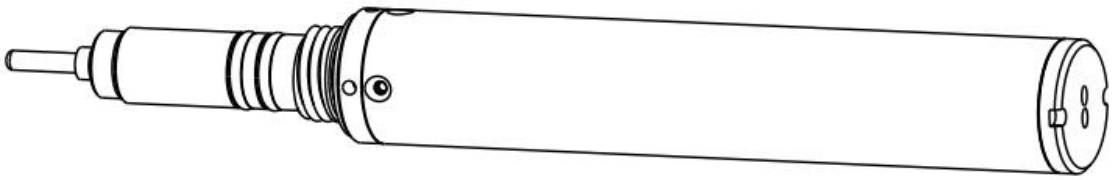


Figure 8 Turbidity Sensor

Turbidity Sensor Specification	
Principle	Light scattering
Range	0-1000 NTU
Resolution	0.1 NTU
Accuracy	±5% or ±0.3NTU，take the greater value

2.7 Depth Sensor

Principle:

The depth sensor uses a pressure sensitive method to measure the depth of the water. One side of the sensor faces the other side of the water facing the vacuum to measure the pressure. The depth is then calculated by subtracting the atmospheric pressure from the pressure applied by the water body. **The distance from the depth sensor to the liquid surface is the measurement distance.**

Reasons that affect depth measurements include atmospheric pressure, water density, and temperature. Due to differences in atmospheric pressure at different times and in different regions, the software uses atmospheric pressure at the time of calibration, which may result in small errors. Therefore, depth sensor calibration is required before use (see 6.1.7 Depth Sensor Calibration). Frequent calibration can reduce the error. The appearance of the depth sensor is shown in Figure 9.

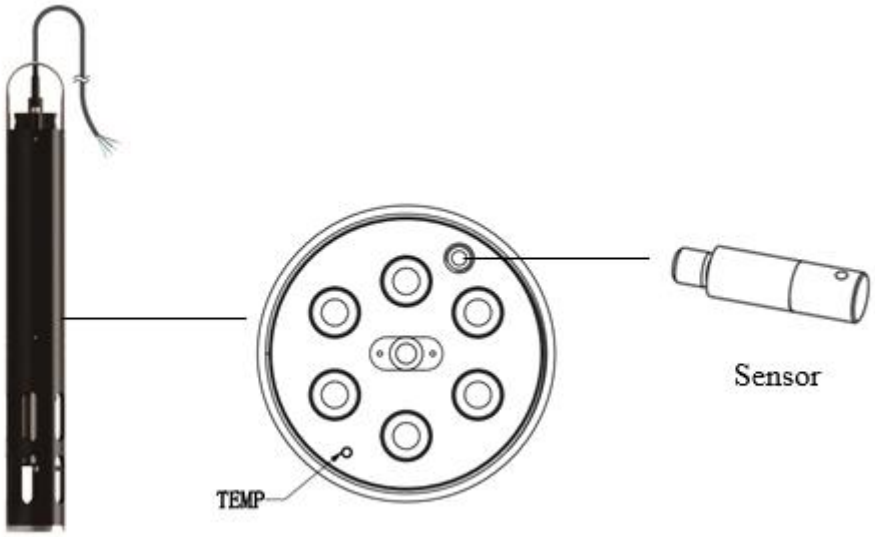


Figure 9 Depth sensor

Depth Sensor Specification	
Principle	Pressure Sensitive Method
Range	0-61 m
Resolution	2 cm
Accuracy	±0.3%

2.8 Chlorophyll sensor

Principle:

Chlorophyll is an important biochemical molecule that is the basis of photosynthesis and uses solar energy to produce oxygen. The concentration of suspended phytoplankton can usually be calculated by collecting the amount of chlorophyll in the water sample.

The chlorophyll sensor in utilizes the characteristic that chlorophyll A has absorption peak and emission peak in the spectrum. Monochromatic light emitting a specific wavelength is irradiated into water, and chlorophyll A in water absorbs the energy of the monochromatic light, releasing another wavelength. The monochromatic light, the light intensity emitted by chlorophyll A is proportional to the amount of chlorophyll A in the water. From this, the concentration of chlorophyll in the water body was calculated. The appearance of the chlorophyll sensor is shown in Figure 10.

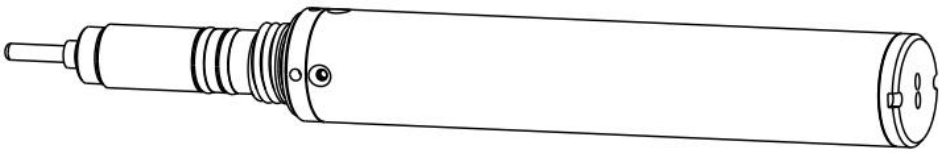


Figure 10 Chlorophyll sensor

Chlorophyll sensor Specification	
Principle	Fluorescence method
Range	0-500 μg/L
Resolution	0.1 μg/L
Accuracy	The signal level of 1ppb rhodamine WT dye corresponds to ±10% of the value（At the same temperature）

2.9 Blue-green Algae Sensor

Principle:

Blue-green algae, also known as cyanobacteria, is a widely distributed prokaryotic microorganism that is closely related to the environmental quality of water bodies. When the water body grows vigorously, it will cause discoloration and odor.

The blue-green algae sensor utilizes the characteristic that the cyanobacteria has an absorption peak and an emission peak in the spectrum, and a monochromatic light emitting a specific wavelength is irradiated into the water, and the cyanobacteria in the water absorbs the energy of the monochromatic light, releasing a single wavelength single. The color of light, the light intensity emitted by blue-green algae is proportional to the content of cyanobacteria in the water. The appearance of the blue-green algae sensor is shown in Figure 11.

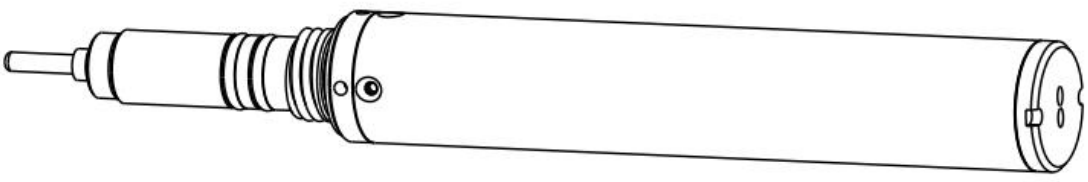


Figure 11 Blue-green algae Sensor

Blue-green algae Sensor Specification	
Principle	Fluorescence method
Range	200-300000 cells/mL
Resolution	20 cells/mL
Accuracy	The signal level of 1ppb rhodamine WT dye corresponds to ±10% of the value（At the same temperature）

2.10 Ammonia Nitrogen Sensor

The NH4 ion selective electrode is a grid film electrode， the material of which mainly uses a special organic ion exchange membrane that dissolves in the organic solution and penetrates with the PVC mesh. The fields it is widely used include: drinking water, fertilizer, and refrigerant. To use the electrode requires the reference electrode, it has good repeatability and faster response time, but its accuracy is no better than the colorimetric method. The outer appearance of the ammonia nitrogen sensor is shown in Figure 12.

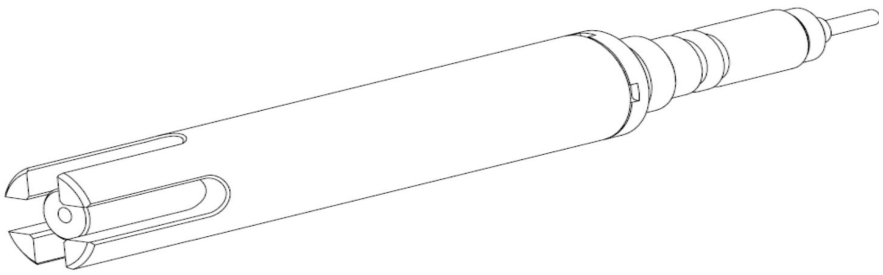


Figure 12 Ammonia Nitrogen Sensor

Technical Specification of Ammonia Nitrogen Sensor	
Principle	Ion Selective Electrode Method
Range	0.1~100mg/L
Resolution	0.01mg/L-N
Accuracy	±10 % of the measured value or ± 2 mg/L, (the electrode is greatly affected by temperature, field comparison is the best field calibration, otherwise it may be out of range)

Important Tip: Ammonia nitrogen must be set to no compensation if potassium ions are not

purchased and installed.

2.11 Nitrate ion sensor

It is a kind of mesh membrane electrode. A special organic ion exchange membrane is the main material of the membrane, which dissolves in organic solution and permeates with PVC mesh. Its accuracy is worse than colorimetric method, but it responds instantly. The appearance of Nitrate ion sensor is showed by Figure 13 as below.

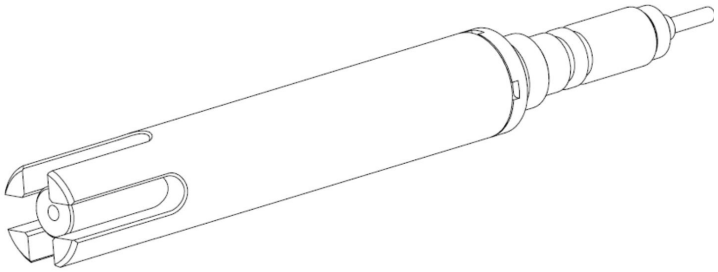


Figure 13 Nitrate ion sensor

Nitrate ion sensor Specification	
principle	ion-selective electrode method
Range	0.5~100mg/L
resolution	0.01~1 mg/L depending on the range
Accuracy	±10 % or ± 2 mg/L , (the electrode is greatly affected by temperature, field comparison is the best field calibration, otherwise it may be out of range)

2.12 Fluoride Ion Sensor

F-ion selective electrode is a kind of solid-state membrane electrode. LaF3 single crystal is the main material of the membrane, and the periphery of the membrane is a special polymer. The appearance of fluoride ion sensor is showed by Figure 14 as below.

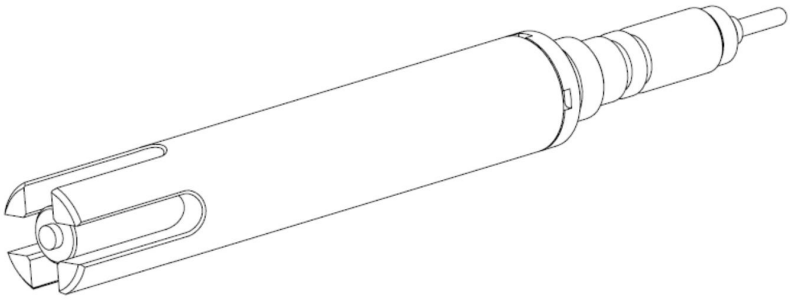


Figure 14 Fluoride ion sensor

Fluoride sensor Specification	
principle	ion-selective electrode method
Range	0.5~1000 mg/L
resolution	0.01~1 mg/L depending on the range
Accuracy	±10 % or ±2 mg/L, (the electrode is greatly affected by temperature, field comparison is the best field calibration, otherwise it may be out of range)

2.13 Chloride Ion Sensor

CL-ion selective electrode is a kind of solid membrane electrode. A high strength AgCl/Ag 2S compact solids is the main material of the membrane, which then is sealed in the plastic with resin. Sliver is adopted as the conductive electrode for the surface of solid. The appearance of chloride ion sensor is showed by the Figure 15

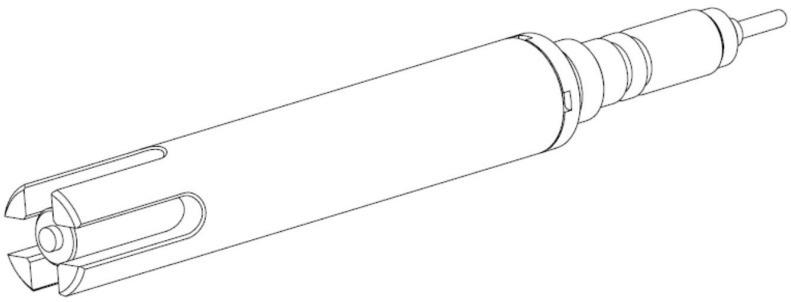


Figure 15 Chloride ion sensor

Chloride sensor Specification	
principle	ion-selective electrode method
Range	3~1000 mg/L
resolution	0.01~1 mg/L depending on the range
Accuracy	±10 % or±2 mg/L, whichever is greater(the electrode is greatly affected by temperature, field comparison is the best field calibration, otherwise it may be out of range)

Chapter 3 Instrument Installation

Danger

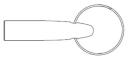
Only professionals can handle the tasks in this manual.

3.1 Instrument Unboxing

Take it out of the cartons that ship the instrument and check for obvious damage. If any item is lost or damaged, please call customer service.

Tip: *It is normal to leave a small amount of solution in the instrument cup.*

3.2 Starting the instrument

Please use the magnetic switch  equipped with the product, touch the power switch () on the integrated multi-parameter analyzer for 3 seconds, the green indicator light flashes, the instrument is turned on, use the magnetic switch, touch the blue switch on the integrated multi-parameter analyzer (), the blue display light flashes Lights up and Bluetooth is turned on.

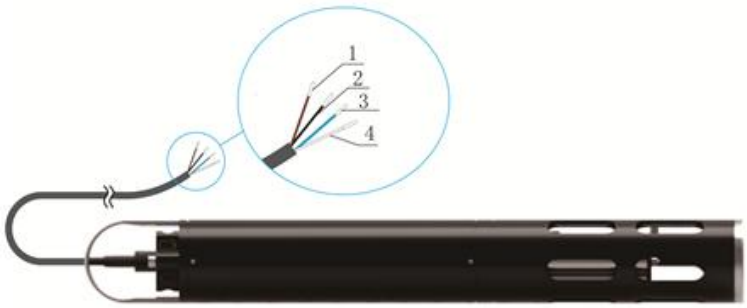
3.3 Instrument connection

3.3.1 Real-time online connection

The specific steps of the instrument connection:

Remove the protective cap of the PH before powering the instrument, and then connect the core at the end of the cable correctly according to the core definition table.

Important: *The power supply of this product is 9-36VDC. It is not allowed to connect directly to 220VAC power supply. Otherwise, the sensor will be over-pressed. If there is no suitable power supply at the site, you can use the 220VAC to 9-36VDC power*



Core definition table:

Wire Core No.	1	2	3	4
Sensor Wire	Red	Black	Blue	White
Signal	+12VDC	AGND	RS485 A	RS485 B

Connected with the host computer: multi-parameter sensor has standard MODBUS protocol, RS-485 interface, can be directly connected to the host computer (PC / data acquisition instrument, etc.), real-time online monitoring and data transmission of the instrument. The connection can be achieved in the following two ways:

(1) RS485 to USB converter

(2) RS485 to RS232 converter,

RS485 to RS232 can use any of the following:

Passive RS485 to RS232

Active RS485 to RS232.

When the instrument is used in a laboratory environment, or when instrument calibration is required, it can be implemented by connecting the PC and running the supporting software (Chapter 4 software and installation will focus on). The PC software will automatically scan the detection device, read the data stored by the probe, and complete the basic setup and calibration of the instrument.

Connection reference diagram: Figure 16 is a reference diagram

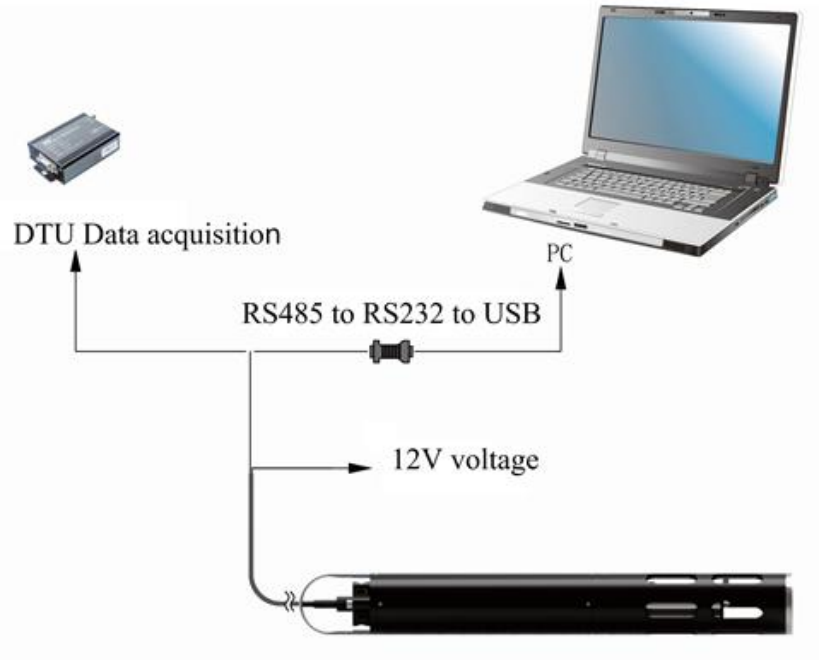


Figure 16 Connection reference diagram

3.3.2 Portable Connection

The bluetooth module is setted inside the integrated multi-parameter analyzer, which can make the analyzer be connected with hand manipulator through the bluetooth, or make the analyzer be connected with cable end by aviation joint mode. The operation process is showed by Figure 17 as below.

Figure 17 the diagram of operation process

3.4 Installation Environment

Avoid the following places during installation:

1. The place where the sunlight directly shines and the vicinity of the heat appliance.

2. The place where the ambient temperature exceeds 60 °C during work.

3. The vicinity of the electromagnetic source.

4. A place with strong mechanical vibration.

3.5 Installation Precautions

1. During handling or installation, please note: If there is an ion electrode, the counterweight should be placed face down, do not place it sideways (less than 60 degrees), do not invert. Or need to shake the probe vertically downwards to ensure that the ion probe is working properly.

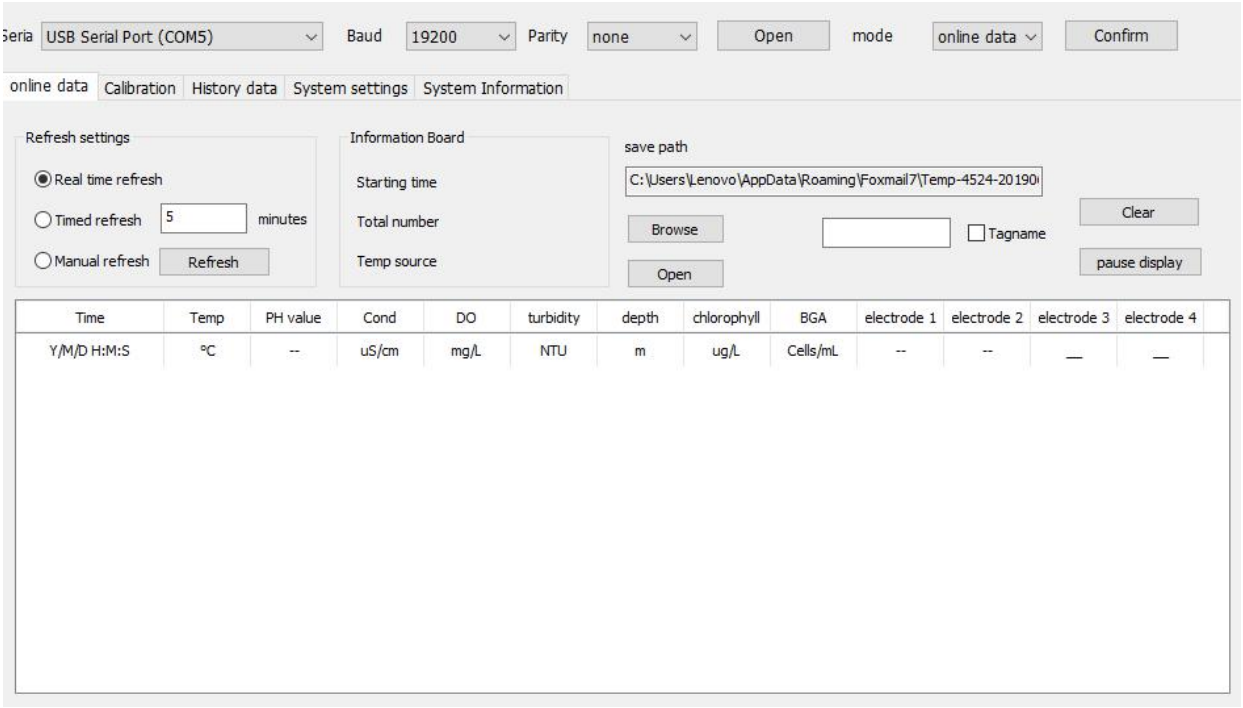
2. After power-on, observe that the running light is normally blinking. Then after 5 minutes, you need to read the working voltage through the platform to check whether the external power line connection is normal. For example, 12V power supply, the operating voltage is read to 28V, then the internal battery is powered, and the external power supply is abnormal.

3. When debugging, try to use the online running mode, Do not use the timing mode to ensure that the wir ing is ok and then set the timing mode as needed.

Chapter 4 Real-time online setup and operation

4.1 Software installation

Insert the U disk into the computer, open the U disk, double-click the file in the U disk, and install according to the steps. Start the software and the application displays as shown below. The electrode is an optional ion selective electrode (ammonia nitrogen, nitrate ion, chloride ion, fluoride ion) and an ORP electrode, which can be arbitrarily selected, and up to four are selected.



Tip: Installing software and shortcuts in advance can give you greater efficiency.

4.2 Software usage

Connect the meter well. Before measuring the data, run the software first. The serial port will automatically identify the connected serial port. If it is not recognized, please click the serial port to drop the small box and select the port number corresponding to USB. Select the baud rate (default is 19200)

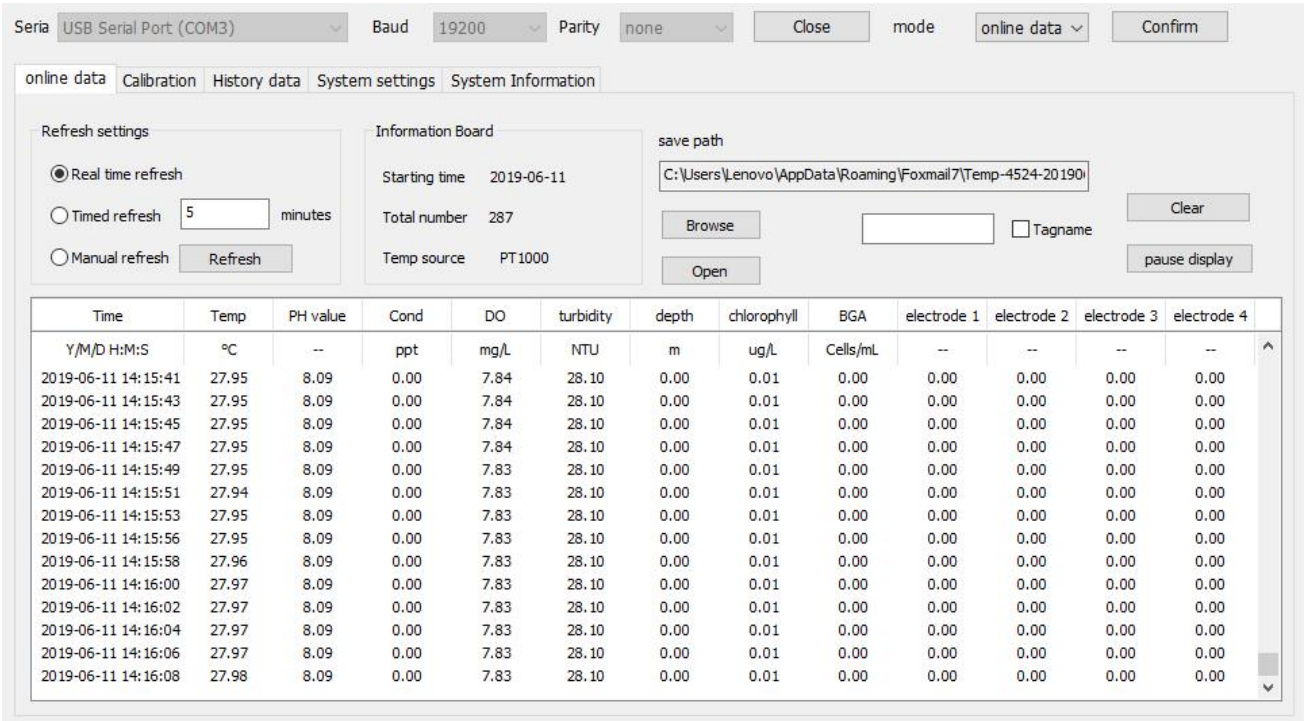
and finally click to open.

Tip: If the sensor has been connected as described, and the software prompt has not been connected, remove and replace the USB port or check the USB to RS485 converter, repeat the above operation until the sensor connection is successful.

4.2.1 Online data

When online data measurement, first click on "Online Data" and then set the save path, refresh settings, tag name, etc. as shown. Then click the mode setting at the top right of the software to select "Online Data", click "Confirm" to monitor the online data in real time. If you select "Automatically switch" directly, you do not need to re-select the operating mode when changing the menu bar.

The "starting time", "total number" and "temperature source" of the meter can be viewed in the information board, as shown in the figure below.

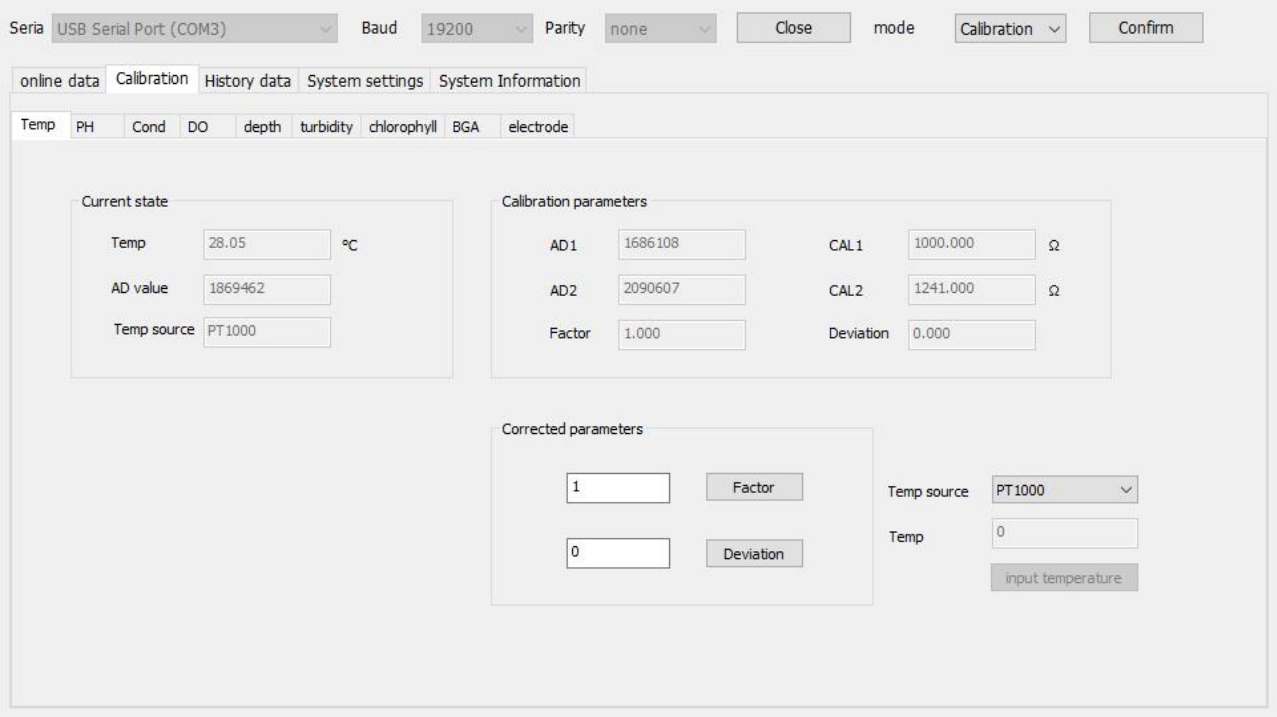


Time	Temp	PH value	Cond	DO	turbidity	depth	chlorophyll	BGA	electrode 1	electrode 2	electrode 3	electrode 4
Y/M/D H:M:S	℃	--	ppt	mg/L	NTU	m	ug/L	Cells/mL	--	--	--	--
2019-06-11 14:15:41	27.95	8.09	0.00	7.84	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:15:43	27.95	8.09	0.00	7.84	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:15:45	27.95	8.09	0.00	7.84	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:15:47	27.95	8.09	0.00	7.84	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:15:49	27.95	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:15:51	27.94	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:15:53	27.95	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:15:56	27.95	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:15:58	27.96	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:16:00	27.97	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:16:02	27.97	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:16:04	27.97	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:16:06	27.97	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2019-06-11 14:16:08	27.98	8.09	0.00	7.83	28.10	0.00	0.01	0.00	0.00	0.00	0.00	0.00

4.2.2 Calibration

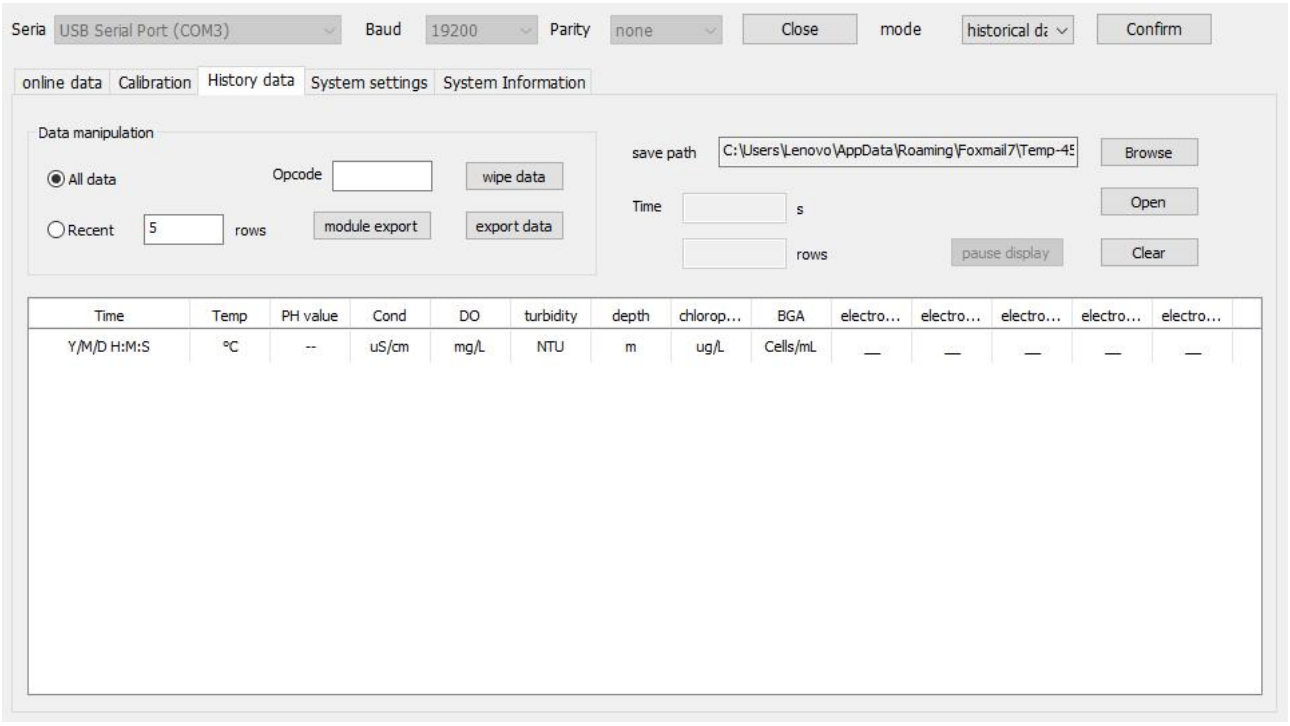
Calibration module will be specified in the following (Chapter 6 Sensor Calibration) and will not be described in detail here. First select the operation mode in the upper right corner as “Calibration”, then click “Confirm”, and select the parameter to be calibrated from the calibration menu to calibrate. If you select “Automatically switch” directly, you do not need to re-select the operation when changing the

menu bar. Mode, the interface is shown below.



4.2.3 History data

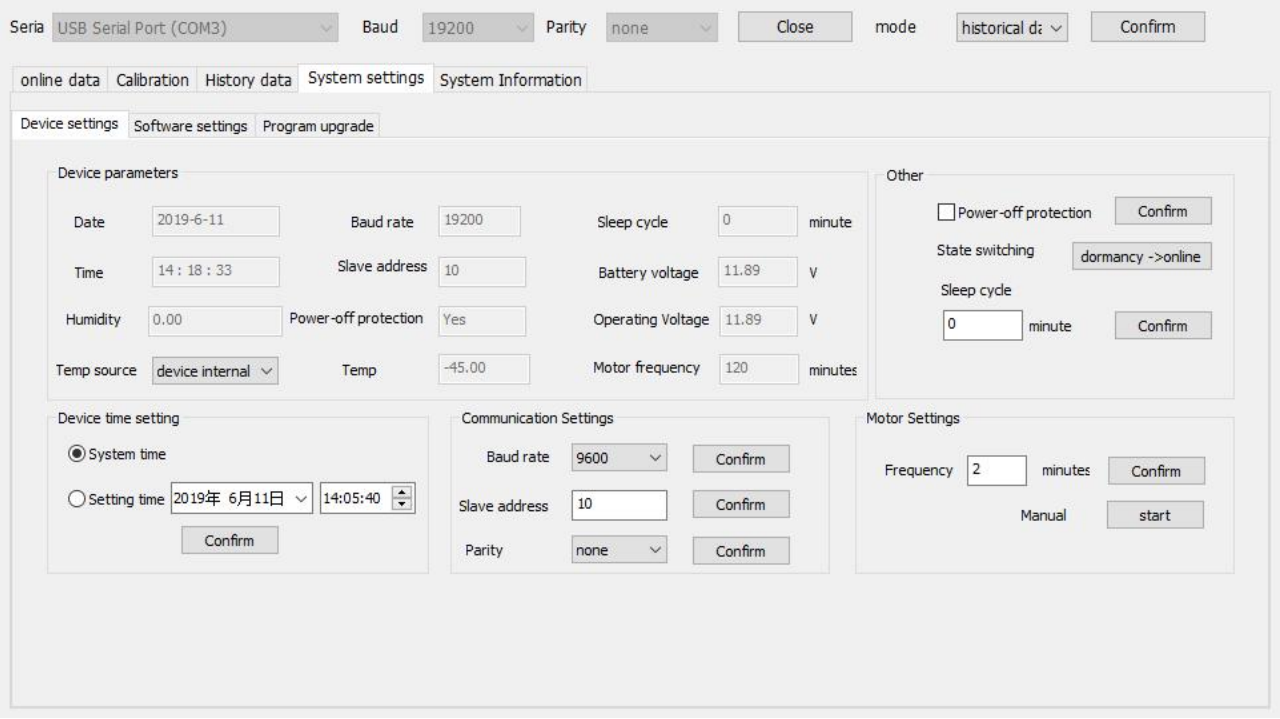
The software has the function of storing historical data. Before viewing historical data, need set the running mode to “historical data”, and then click “confirm” to view the required data in the menu of historical data. If you select “Automatically switch” directly, you do not need to re-select the operation mode when changing the menu bar. The interface is as shown below.



4.2.4 System Settings

4.2.4.1 Device settings

In settings of the system settings, you can view or set the current "Device Parameters", "Device Time Settings", "Communication Settings", "Motor Settings" etc. The interface is as shown below.



Device time setting

System time: When the system time is selected, clicking OK will automatically update the computer's system time to the sensor;

Setting time: When the computer time is not accurate, you can select the setting time. After manually setting the current time and clicking OK, the manually set time will be updated to the sensor.

Communication settings

Baud rate: 4800, 9600, 19200, 38400, 115200. When a baud rate is selected and clicked, the PC will disconnect and need to use the new baud rate to connect.

Slave address: The address is shaped data, the range can be set from 1~255. If the slave address is changed, the PC will not drop the line and reconnect wirelessly.

Motor setting

Frequency: The unit is minute. The setting is the period of hanging the brush automatically. The example is “Enter 60, which means scraping once in 60 minutes”.

Manual: Click once to scrape once, taking care not to click continuously, because the hanging brush does

not respond to repeated operations while rotating.

other

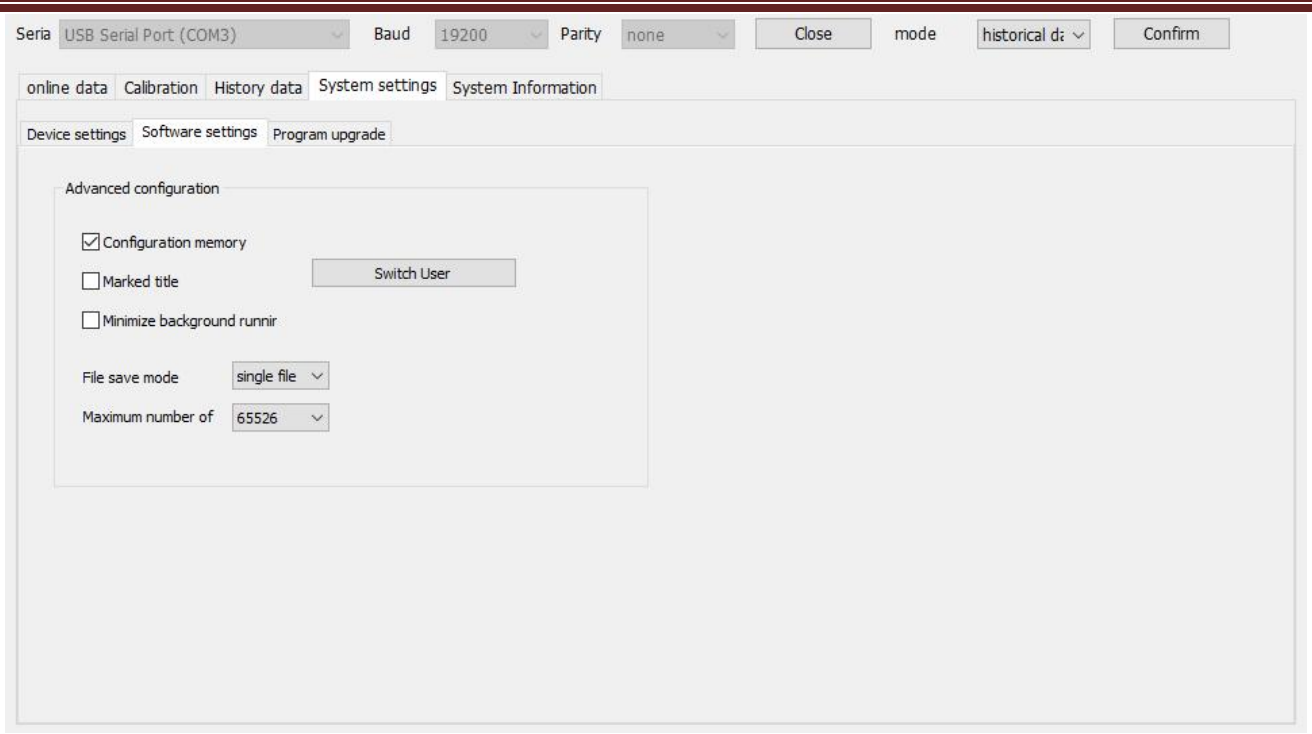
Power-off protection: Generally, the setting is set to Yes; after the power-off protection is selected, the sensor will remain in the previous operating state when it is powered off and then re-powered (for example: 1. Before the power is off, it is online, then power on again. It is still in the online running state; 2. It is the timing acquisition state before the power is cut off, then the power-on is still the timing acquisition state, but it will automatically wait after the acquisition, wait for the next acquisition start; 3. Manually shut down before power off State, then power-on is still off, unless the power-on switch is manually triggered ;).

Sleep cycle: It is the timing acquisition operation mode. It is necessary to set the timed acquisition mode to input an integer of more than 5 in the input box, the unit is minute; when set to 0, it means not to enter the timed acquisition mode, online real-time acquisition mode; when setting the integer of >5, the filled data represents Automatic start, acquisition complete shutdown, to the next automatic start, a full cycle time (for example: fill in 60, indicating a complete cycle is 60 minutes, including "start acquisition time 2~3 minutes, standby time = sleep cycle - When starting the acquisition = 57~58 minutes")

Status switching: This is a shortcut button. This button can quickly set the sleep period of the timing acquisition mode to 0, and quickly switch to online mode.

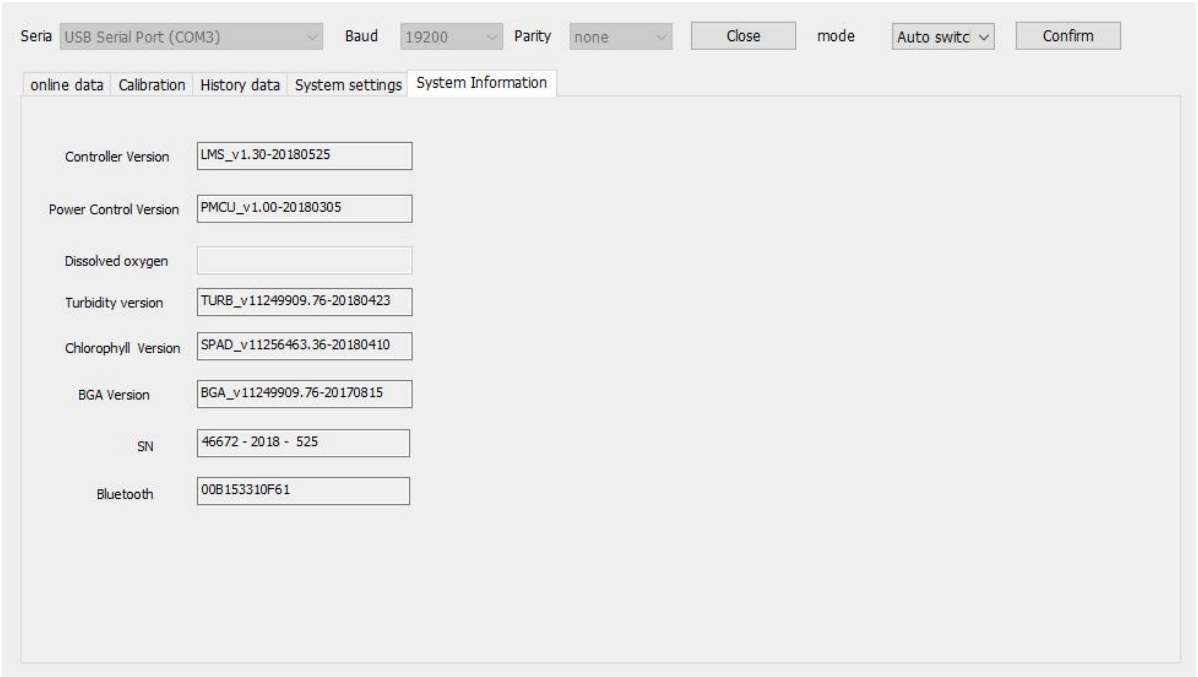
4.2.4.2 Software Settings

In software settings, can set "Advanced Settings" as shown in the figure below.



4.2.5 System Information

From the system information, you can view "Controller Version", "Power Control Version", "Dissolved Oxygen ", "Turbine Version", "chlorophyll Version" Software version, "chlorophyll version", "BGA Version", "SN" and "Bluetooth", the interface is shown below.



Chapter 5 Setting and operation of hand manipulator

5.1 Setting

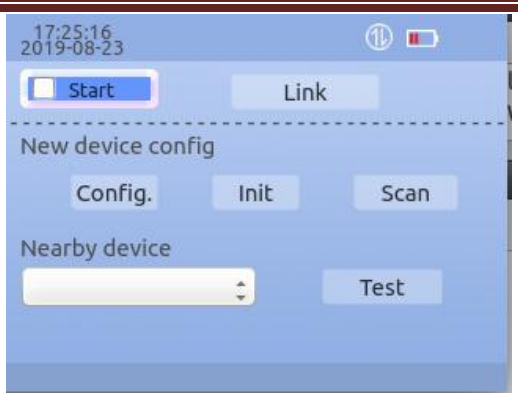
Press the blue switch key on the hand manipulator for some time, and then the starting up interface will be displayed just as showed below in the diagram.

5.1.1 Setting of Bluetooth

1）Press the key of direction, choose the key of “setting”, and press the key of “Enter” to get in. And then press the key of direction again to choose “controller set”, and press the key of “Enter” to get in. Then, choose “bluetooth” to get in, and choose “start”. At last, press the key of “Enter” to open the Bluetooth function of hand manipulator. **Note: to be sure that the integrated multi-parameter analyzer is starting up in the process of operation by hand manipulator. Please check the details in Chapter 3.2.**

2）Press the key of direction downward to choose “configuring”, and press “Enter”. Press the key of direction rightward to choose “scan” when the words of “configuration” occurs on the lower part of screen. Press the key of “Enter”, and the words of “waiting for 10s” will occur on the lower part of screen. And then, a string of Bluetooth numbers showed in the “nearby device” will occur on upper part of screen, Press the key of direction to choose the same Bluetooth numbers that occur on the label of the integrated multi-parameter analyzer of the integrated multi-parameter analyzer to match, and then click the key of “test” to connect. The process is showed by the diagram as below.

3）Withdraw from the Bluetooth setting by pressing the key of “Esc”



5.1.2 Sensor connection (choose one of two ways of connection between sensor connection and Bluetooth connection)

1）Press the key of direction to choose “setting”, and press the key of “Enter” to get in. And then, press the key of direction again to choose “controller set”. Press the key of “Enter” to get in, and choose “sensor”. After the process of getting in, depend on the situation to decide “power output” options.(That is to say, provide the power supply for the integrated multi-parameter analyzer by hand manipulator.) **Note: to be sure that the integrated multi-parameter analyzer is starting up in the process of operation by hand manipulator. Please check the details in Chapter 3.2.**

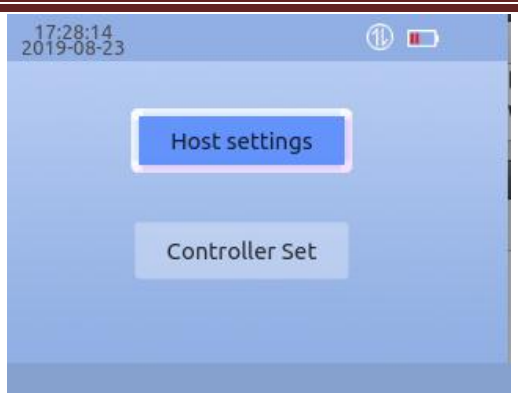
2）Press the key of direction to set the baud rate of probe. Press the keys of up and down to choose baud rate of “19200”, and then choose “scanning”. At last, press the key of “Enter” to confirm.

3）Settings of manual and automatic refresh of data. Choose the key of “0” in the options of “refresh rate”, and press the key of “OK” to confirm. Then the manual operation mode is set when the constant data is displayed. Choose the keys of other numbers, and press the key of “OK” to confirm. Then the automatic operation mode is set when the constant data is displayed. For instance, when you choose the key of “5”, then the constant data will be refreshed once every 5 seconds. (the key of “1” and “2” cannot be chose as their rates of refreshing are too fast.)

4）Withdraw from setting of the sensor connection by pressing the key of “Esc”.

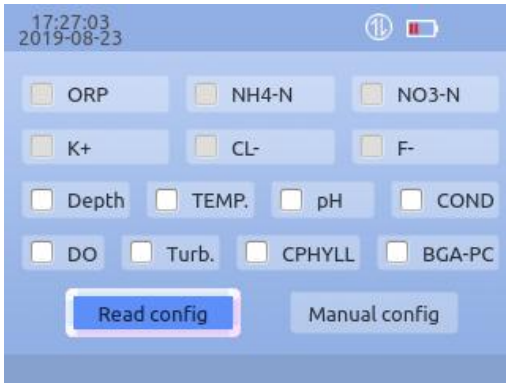
5.1.3 Sensor connection

1）Press the key of direction to choose the key of “setting”, and press the key of “Enter” to get in. The process is showed by the diagram as below. (It can be displayed only when the probe and hand manipulator are connected.)



2）Press the key of direction to choose “controller set”, and press the key of “Enter” to get in. The process is showed by diagram as below.

3）Press the key of direction to choose “probe configuring”, and press the key of “Enter” to get in. Choose “read”, and then the option of initial access probe will occur. So, choose “read” first. If the existing probe does not occur, please revise the related options by manual operation, and then choose the option of “manual configuring”. At last, press the key of “Enter”, and the result will be showed by diagram as below. (If the change of electrode is needed, the operation of power-off is needed!)



5.1.4 Time setting

The time setting for new product is according to Beijing time. If it is necessary, the customers can reset the local time by the keys of direction and numbers in the menu of time setting.

5.1.5 GPS

Choose the key of “GPS”, and press the key of “Enter” to get in. Choose the key of “enable” if it is necessary, which can be operated only in the open air. And then, the status of GPS will change when the operation is done, and also, the information of longitude and latitude on the interface will change when the location changes. If it is necessary to save current information of longitude and latitude, please choose the key of “save” and press the key of “Enter”, and then, the saved information of longitude and latitude can be seen in the column of “history information”. (The information of longitude and latitude can be seen in the column of “history information” will not change with the change of the locations. The information of longitude and latitude in the column of “history information” refers to the last information saved by pressing the key of “save”.) If it is not necessary to save current information of longitude and latitude, please choose the key of “delete” and press the key of “Enter”. The process of operation is showed by diagram as below.

5.2 Constant data

After the right connection of hand manipulator and integrated multi-parameter analyzer, the constant data can be checked and measured in the interface of “real-time data” of the main page. For instance, when you press the key of “Enter”, you get the information of unconnected with probe, you should check the situation of probe. Please check the details in Chapter 5.1.1 and 5.1.2 to reset the connection.

5.3 Historical data

After getting into the menu of “historical data”, you can search the data through the selection of time quantum that customers need. If it is necessary to output the data, the hand manipulator will output all the history data stored at any time.

Choose the key of “data output” and press the key of “Enter”. After about one minute, connect the computer when you get the information of “OK”, and make the hand manipulator connect with computer by USB data wire. Then, a file of 500M will come out in the computer, and save the documents in the file to the specific location of the computer.

Chapter 6 Calibration of Sensors

The probe is calibrated at the factory and is selectively calibrated depending on the situation on the site. There is a need to calibrate the sensor when the following situation occurs:

1. When the measured value of the parameter is inconsistent with the known calibration standard value.

2. When dirt appears or could be seen obviously.

3. When the components are replaced.

Some system components are susceptible to time, use, and environment. To ensure the accuracy of the instrument, it is recommended to perform routine testing under the standard conditions for the system.

Note: If there is only one parameter to be measured, you need not take down other sensors.

6.1 Calibrate the sensor with software

6.1.1 Basic calibration process

1. Rinse the used probe with clean tap water.

2. Rinse the calibration container thoroughly with water first and then rinse with a small amount of standard solution for calibration.

3. Pour off the rinsed standard solution and refill the calibration container with the unused standard solution to ensure the sensor is submerged.

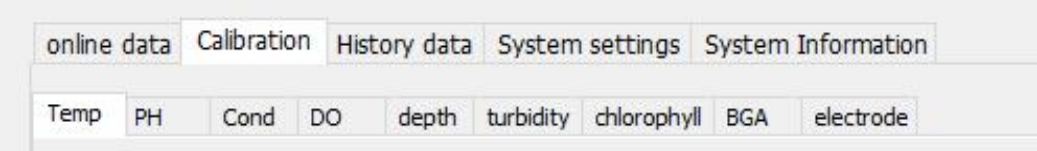
Important Tip: When changing the calibration solution, rinse the calibration container with distilled water. Please avoid cross-contamination between different standard solutions.

4. Place the clean and dry probe in the calibration container. It is recommended to use one calibration container for calibration only and the other hollow calibration container for on-site measurement. By this

way, it will greatly guarantee the accuracy of the calibration and cleanliness during the process.

5. Connect the instrument to the computer correctly (the connection method is the same as the instrument connection of 3.3), start the software program, change the mode setting to calibration, and then click OK.

6. Then find the sensor to be calibrated from the calibration menu and calibrate according to different calibration methods. The specific sensor calibration method will be introduced later in this chapter. The calibrated menu bar is shown below.

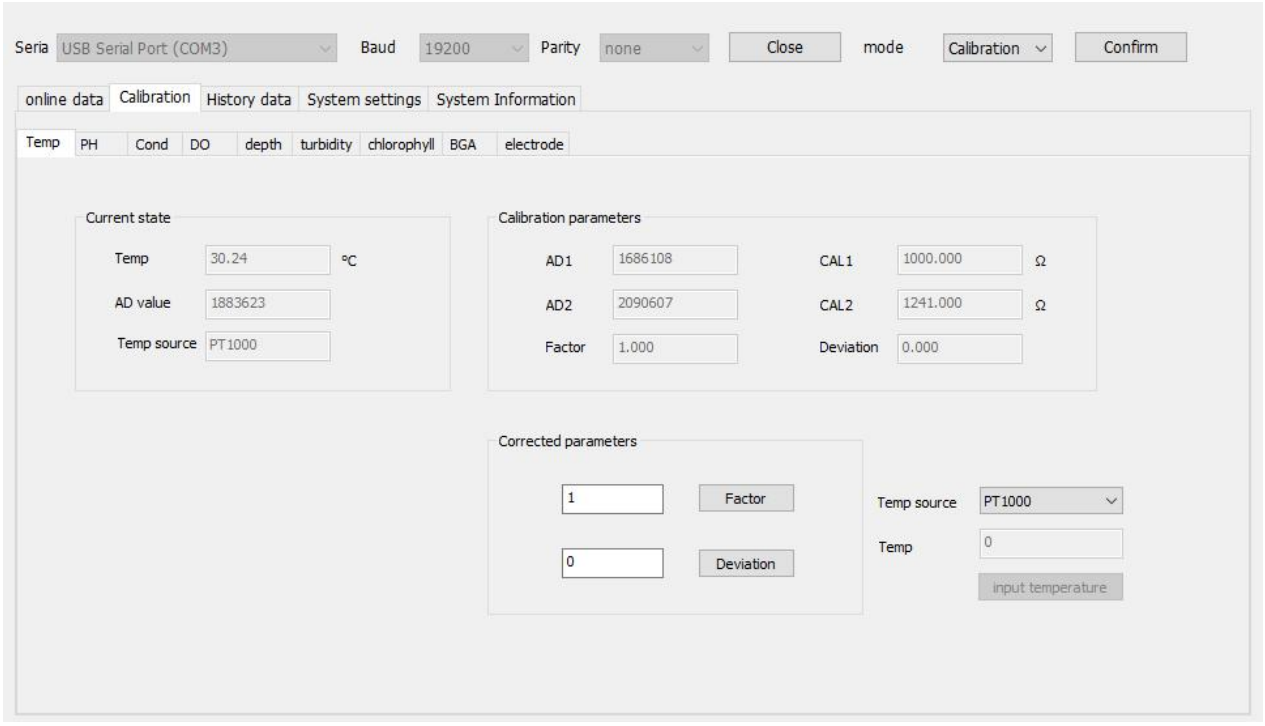


Tip: The calibration of each sensor follows the basic steps above. Always keep the sensor clean and dry before calibrating.

Note: The values of all the following interfaces are not available for reference. The customer only takes the values measured by the customer.

6.1.2 Temperature Sensor Calibration

From the Calibration menu, select the "Temperature" option to enter the temperature calibration procedure as shown below.

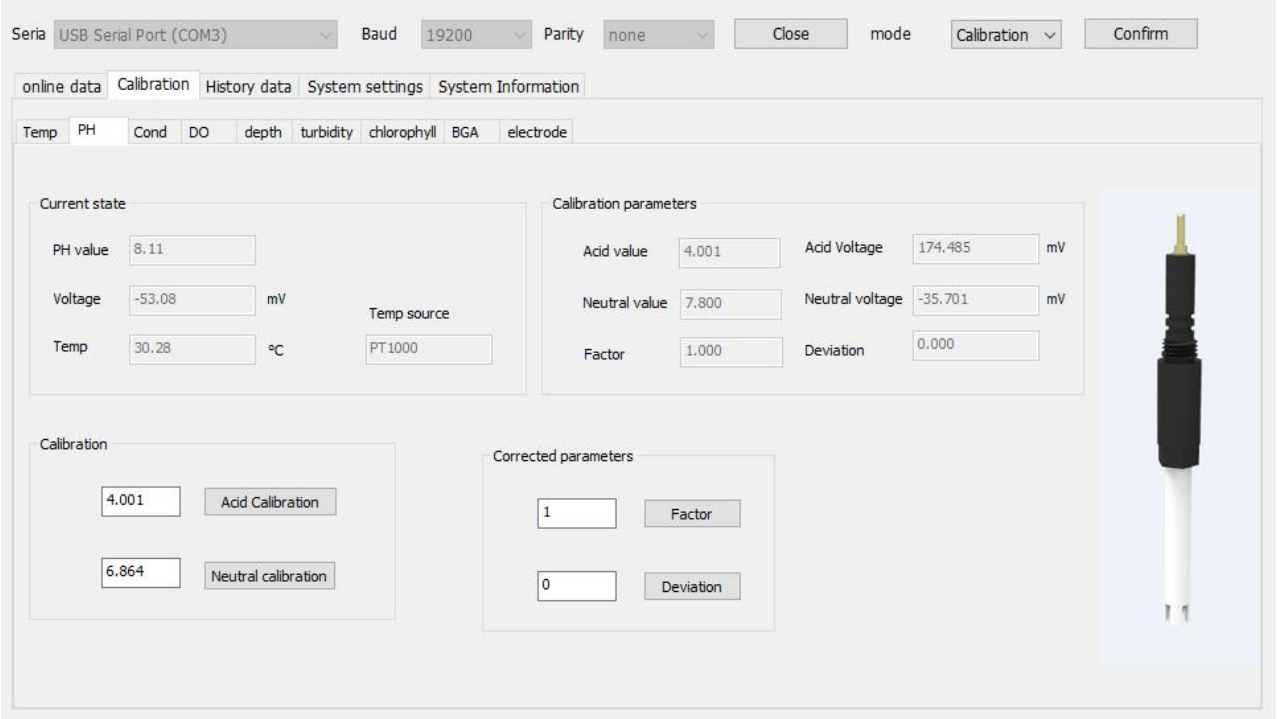


The temperature sensor is calibrated at the factory and does not need to be calibrated again. However, you

can directly enter the values in the “Correction Parameters” box and click “Factor” and “Deviation” to calibrate the factors and deviation values.

6.1.3 pH Sensor Calibration

From the Calibration menu, select the “pH” option to enter the pH calibration procedure, as shown in the figure below, and then you are ready to start calibration.



Before the test, remove the protective soaking bottle or rubber sleeve with the soaking liquid on the sensor, immerse the sensor in distilled water, then remove it and gently absorb the water. Be careful not to break the glass bulb and keep the sensor clean and dry. The pH sensor uses a 2-point calibration method.

The specific calibration steps are:

1. First point (neutral point): Pour the correct amount of pH=6.864 buffer/standard solution into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Make sure the glass bulb is immersed in the solution at least 1 cm. When the pH electrode voltage data in the software interface is stable, enter the “6.864” buffer/standard solution value in the “Calibration” box and click “Neutral Calibration”.

2. Second point (acidic point): Rinse the probe with water and wipe it clean. Pour the correct amount of pH=4.001 buffer/standard solution into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Make sure the glass bulb is immersed in the solution

at least 1 cm. When the pH electrode voltage data in the software interface is stable, enter "4.001" buffer/standard solution value in the "Calibration" box and click "Acid Calibration".

After the calibration is complete, rinse the sensor and calibration container with water and dry to ensure the following use.

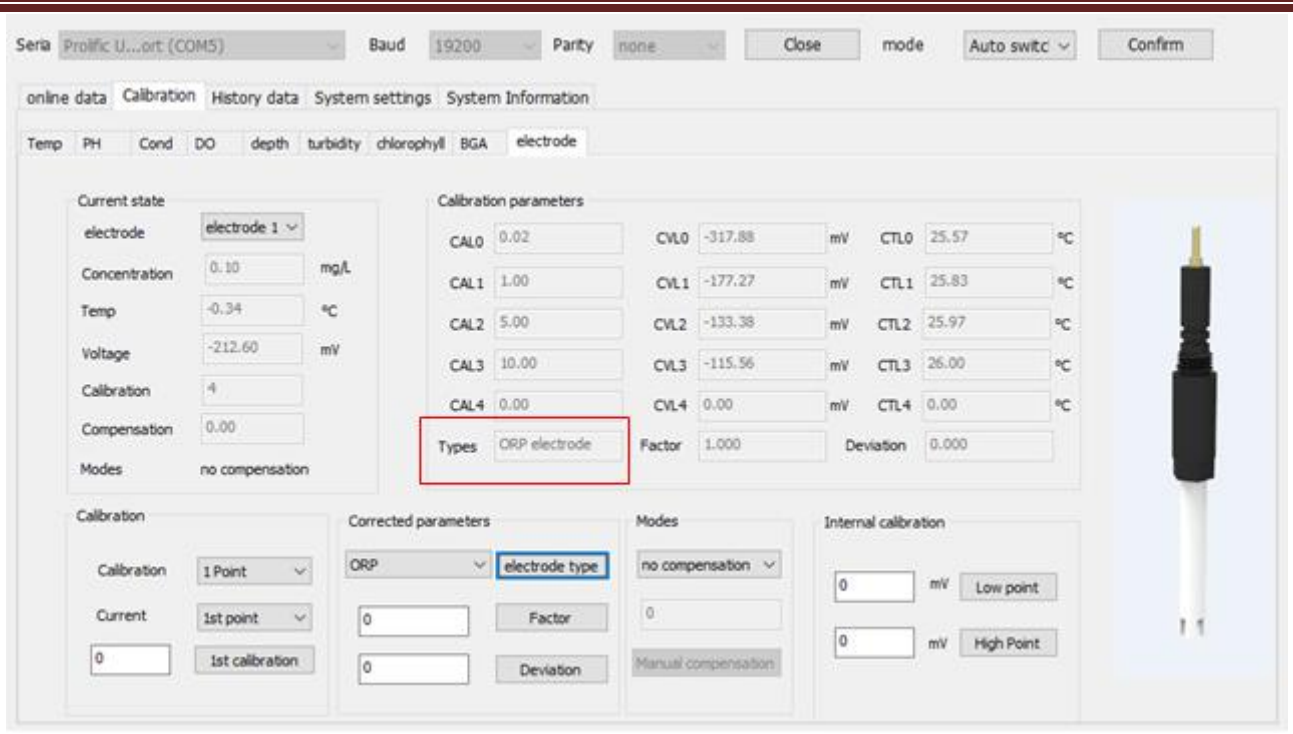
Tip: *Be sure to calibrate the neutral point and then calibrate the acid point. The order cannot be reversed.*

In order to ensure the accuracy of the calibration, we will provide a buffer/standard solution with pH=9.18. After the above calibration is completed, the calibration accuracy can be verified by detecting the pH of the buffer. The specific steps are: change the mode setting. For "on-line date", place the probe in a calibration container containing the correct amount of buffer/standard solution at pH=9.18, place the glass bubble into the solution at least 1 cm, leave it for at least one minute, and then click on the confirmation on the side of the mode setting. , watch online data. If the data is found to be significantly different from 9.18, it needs to be recalibrated until there is no deviation.

You can also directly enter the value in the "Correction Parameters" box and click "factor" and "deviation" to calibrate the factor and deviation value.

6.1.4 ORP Sensor Calibration

From the calibration menu, select the "Electrode" option to enter the electrode calibration procedure. The interface is as shown below, and the electrode type is pre-configured, such as the box. You can then prepare to start the calibration.



Before use, remove the protective soaking bottle or rubber sleeve with the soaking liquid on the sensor, immerse the sensor in distilled water, then remove it and gently absorb the water. At this point the electrode can be used (be careful not to rub the sensitive component part). The ORP sensor uses a 2-point calibration method to select two points in the “Calibration” box.

The specific calibration steps are:

1. First point calibration: first adjust the current calibration point of the “Calibration” box to “1 Point”, and pour the correct amount of pH 7.00 standard solution into a clean, dry or pre-rinsed calibration container. Add a little quinhydrone（quinhydrone is extremely toxic, so wear mask gloves and protective clothing when preparing the solution）, stir to dissolve to saturation, and place the sensor in the standard solution and stir at an appropriate rate. Carefully immerse the probe at the end of the main unit in the solution. Make sure the glass bulb is immersed in the solution at least 1 cm. When the ORP electrode voltage in the software interface is stable, enter the “86” standard solution value in the “Calibration” box and click “1st Calibration”.

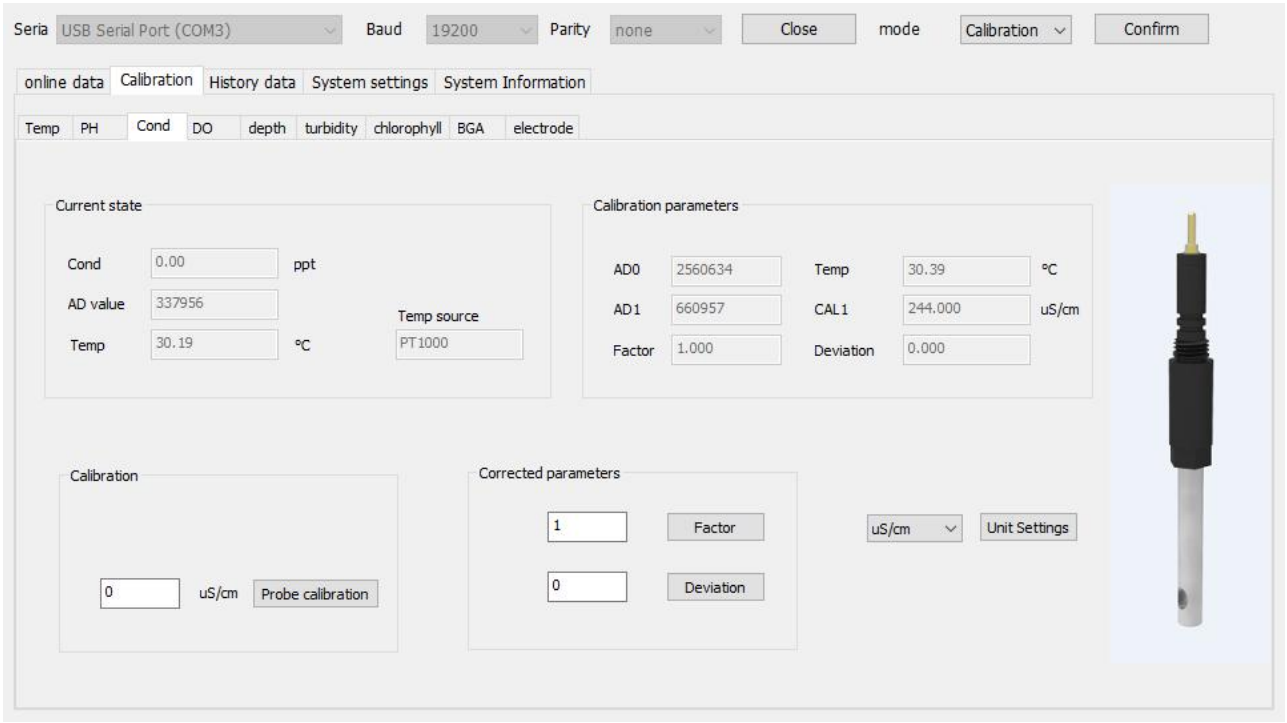
2. The second point calibration: adjust the current calibration point of the “Calibration” box to “2 Point”, rinse the probe with water and wipe it clean, pour the correct amount of pH 4.00 standard solution into a clean and dry or pre-washed In the calibration vessel, add a little quinhydrone, stir well to dissolve, and place the sensor in the standard solution and stir at an appropriate rate. Carefully immerse the probe at the end of the main unit in the solution. Make sure the glass bulb is immersed in the solution at least 1 cm.

When the ORP electrode voltage data in the software interface is stable, enter the “256” standard solution value in the “Calibration” box and click “2st Calibration”.

You can also directly enter the value in the correction parameter box and click “factor” and “deviation” to calibrate the factor and deviation value.

6.1.5 Conductivity Sensor Calibration

From the Calibration menu, select the “Conductivity” option to enter the conductivity calibration procedure as shown below, and then you are ready to begin calibration.



Before the test and calibration, some preparation work for the conductivity sensor is required. Before the test, remove the protective soaking bottle or rubber sleeve with the soaking liquid on the sensor, immerse the sensor in distilled water, and then remove and gently absorb the moisture. The electrode is ready for use. (Be careful not to rub the sensitive component part.) Conductivity calibration requires： When K=1, use 1000±50 μS/cm standard buffer solution; when K=10, use 10000±100μS/cm standard buffer solution. The actual value of the standard liquid is used for calibration.

The specific calibration steps are:

1. Try to ensure that the sensor is dry before calibrating. Pour the correct amount of 300-500μS/cm standard into a clean, dry or pre-rinsed calibration container.

2. Carefully immerse the probe at the end of the main unit in the solution. Make sure the top vent of the

conductance probe is immersed in the solution at least 1cm and make sure the temperature probe is also immersed at least 1cm below the solution. Slightly rotate or move the unit up and down to ensure there are no air bubbles on the probe.

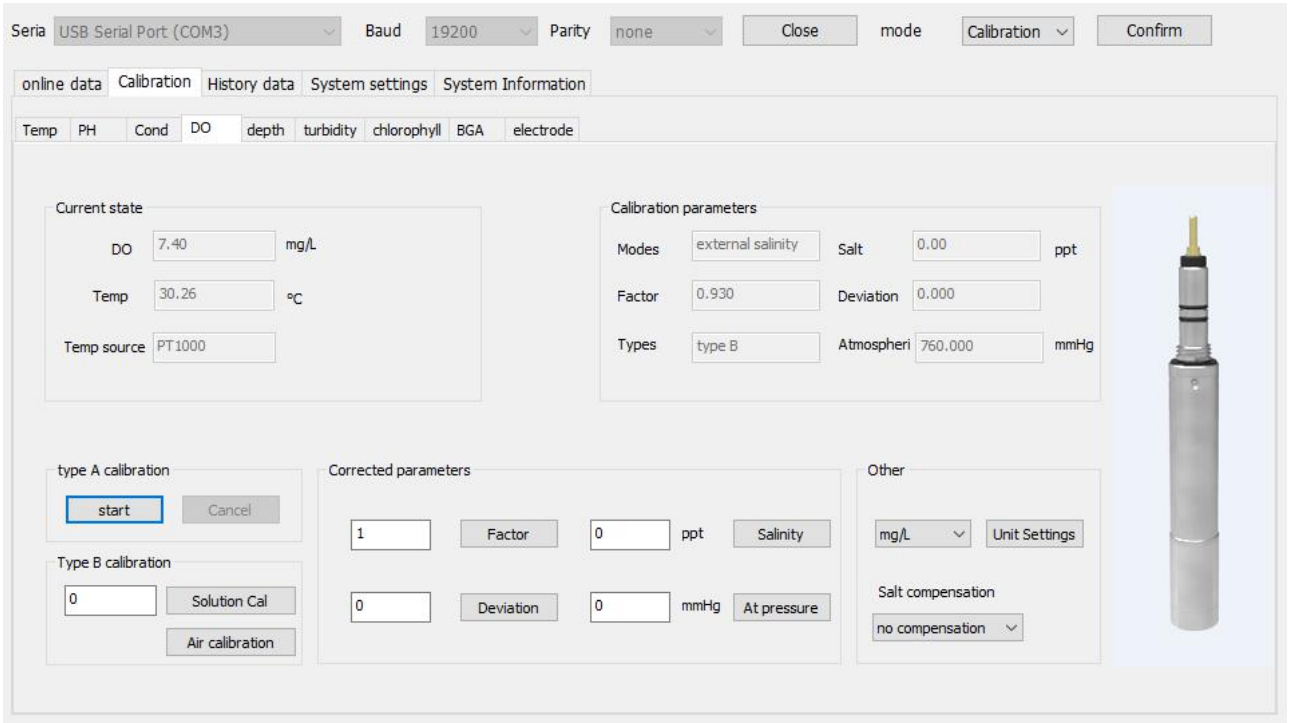
3. When the AD value in the software interface is stable, enter the value of the selected standard buffer in the "Calibration" box and click the probe calibration.

4. After the calibration is complete, rinse the sensor and calibration container with water and allow to dry.

You can also directly enter the value in the "Correction Parameters" box and click "factor" and "deviation" to calibrate the factor and deviation value.

6.1.6 DO Dissolved Oxygen Calibration

From the Calibration menu, select the Dissolved Oxygen option to enter the Dissolved Oxygen Calibration procedure as shown below, and then ready to begin calibration.



The dissolved oxygen sensor is calibrated at the factory and can be air calibration if it needs to be calibrated.

Specific calibration steps:

1. Remove the dissolved oxygen sensor, clean the sensor with a clean rag (soft texture and smooth surface), then blot the moisture on the sensor to ensure the sensor is dry.

2. After the current state data of the instrument is stabilized (or about 10 minutes later), start calibration

again, and avoid direct sunlight.

3. Click “Air calibration” in the Type B calibration

4. After the calibration is complete, rinse the sensor and calibration container with water and allow to dry.

Note: During the calibration process, the sensor must be protected from direct sunlight, otherwise the performance of the dissolved oxygen sensor will be lost.

You can also directly enter the value in the “Correction Parameters” box, click “factor”, “deviation” to calibrate the factor and deviation value, or directly input the value by clicking “salinity” and “atmospheric pressure setting” for salinity and atmospheric pressure compensation and settings.

6.1.6.1 Salinity compensation and temperature compensation

1）Salinity compensation

The water contains a large amount of salt substances, which will have a certain influence on the dissolved oxygen content, so that the output signal of the dissolved oxygen sensor drifts with the change of salinity. In order to reduce this phenomenon, certain compensation measures can be taken. Correcting the output result, to achieve a certain range, to eliminate the influence of salinity change on the output signal of the sensor is called "salt compensation". The other conditions are the same, the greater the salinity, the lower the dissolved oxygen.

Under normal circumstances, the sensor is calibrated under the standard 0. When the working environment deviates, it can compensate for the effect of salinity on dissolved oxygen, ensuring measurement accuracy, convenient use and comparison.

The probe has a salinity compensation function, and the dissolved oxygen has compensated for the salinity in the solution in real time. If manual salinity compensation is required, the on-site salinity value can be entered into the dialog box after salinity compensation.

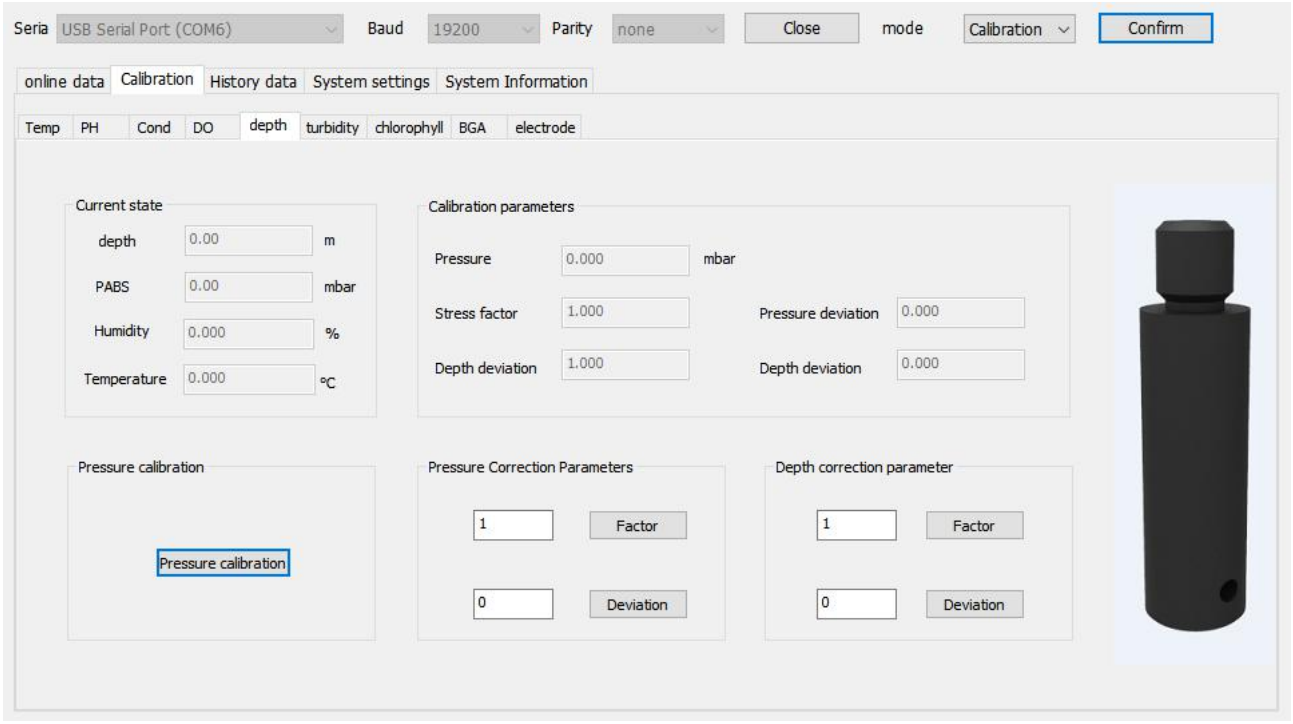
2）Temperature compensation

It is necessary to take certain compensation measures to correct the output result, and to eliminate the influence of temperature change on the output signal of the sensor within a certain range is called “temperature compensation”. In general, the temperature of the sensor is calibrated to 25 ° C, which compensates when the working environment deviates, which can eliminate the effect of temperature on

dissolved oxygen. The oxygen-dissolving probe features automatic temperature compensation and requires no additional compensation.

6.1.7 Depth Sensor

From the Calibration menu, select the “Depth” option to enter the depth calibration procedure as shown below, and then you are ready to begin calibration.



Make sure the depth sensor is clean and dry before calibration. For depth sensor calibration, it is mainly for atmospheric pressure calibration, so make sure the depth sensor is in the air instead of being immersed in any container.

The specific calibration steps are as follows:

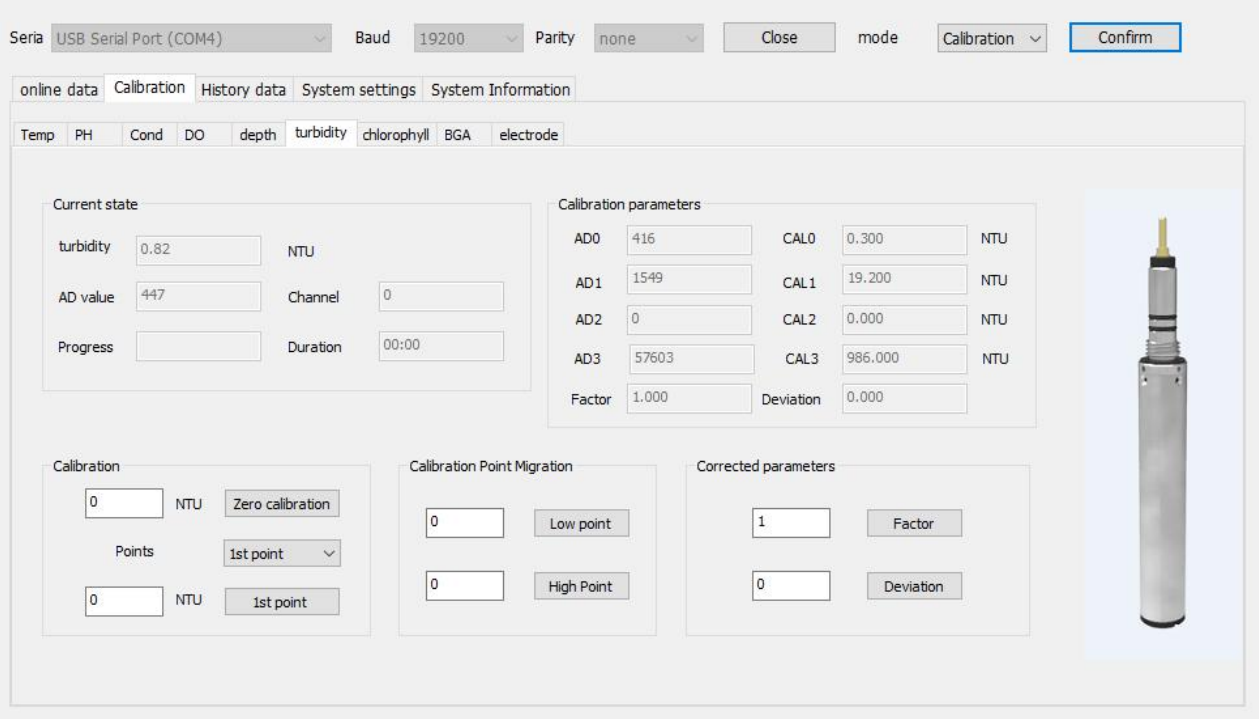
Try to ensure that the sensor is dry before calibration. When the atmospheric pressure value in the calibration interface is stable, click “Pressure Calibration” in the “Pressure Calibration” box. The system will automatically save the data to complete the calibration. Due to the special nature of the depth sensor, it is recommended that customers need to calibrate frequently to maintain data accuracy.

You can also directly enter the value in the pressure correction parameter box, click “factor”, “deviation” to calibrate the factor and deviation value, or directly input the value in the depth correction parameter box, click “factor” and “deviation”. Factor and deviated values are calibrated.

6.1.8 Optical Sensor Calibration

6.1.8.1Turbidity Sensor Calibration

From the Calibration menu, select the Turbidity option to enter the turbidity calibration procedure as shown below, and you are ready to begin calibration.



Before calibrating, make sure the probe is clean and dry and free of solid particles, debris, algae, etc.. These substances will contaminate the standard solution during calibration and cause calibration errors or incorrect measurement data. Turbidity probes are typically subjected to 4-point calibration or high-low-point calibration using a Forma turbidity standard.

The specific calibration steps are as follows:

A、4-point calibration:

1. Pour distilled water into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Make sure that the front end of the turbidity probe is immersed in the solution for at least 2cm. When the AD value in the software interface is stable, enter the standard value “0” in the “Calibration” box and click the zero calibration (At this time, the calibration progress display box will prompt the calibration status).

2. Select the “1st point” in “Points” and pour the standard solution of the first point (20NTU is recommended, the customer can choose according to the actual situation) into the clean and dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution.

Make sure that the front end of the turbidity probe is immersed in the solution for at least 2cm. When the AD value in the software interface is stable, enter the turbidity value in the "Calibration" box and click "1st point" (At this time, the calibration progress display box will prompt the calibration status). Rinse and dry the sensor and calibration container with water after completion.

3. Select the 2nd point in the "Points" and pour the standard solution of the second point (recommended 200 NTU, the customer can choose according to the actual situation) into the cleaned or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Make sure that the front end of the turbidity probe is immersed in the solution for at least 2 cm. When the AD value in the software interface is stable, enter the turbidity value in the "Calibration" box and click "2nd point" (At this time, the calibration progress display box will prompt the calibration status). Rinse and dry the sensor and calibration container with water after completion.

4. Select the 3rd point in the "Points" and pour the standard solution of the third point (recommended 2000 NTU, the customer can choose according to the actual situation) into the cleaned or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Make sure that the front end of the turbidity probe is immersed in the solution for at least 2 cm. When the AD value in the software interface is stable, enter the turbidity value in the "Calibration" box and click "3rd Point" (At this time, the calibration progress display box will prompt the calibration status). Rinse and dry the sensor and calibration container with water after completion.

B、high and low point calibration:

1. Select the low point in the calibration point migration, and pour the low standard solution (0.4NTU-1NTU, customers can choose according to the actual situation) into the clean dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Make sure that the front end of the turbidity probe is immersed in the solution for at least 2cm. When the AD value in the software interface is stable, enter the turbidity value in the "Calibration Point Migration" box and click "Low Point" (At this time, the calibration progress display box will prompt the calibration status). Rinse and dry the sensor and calibration container with water after completion.

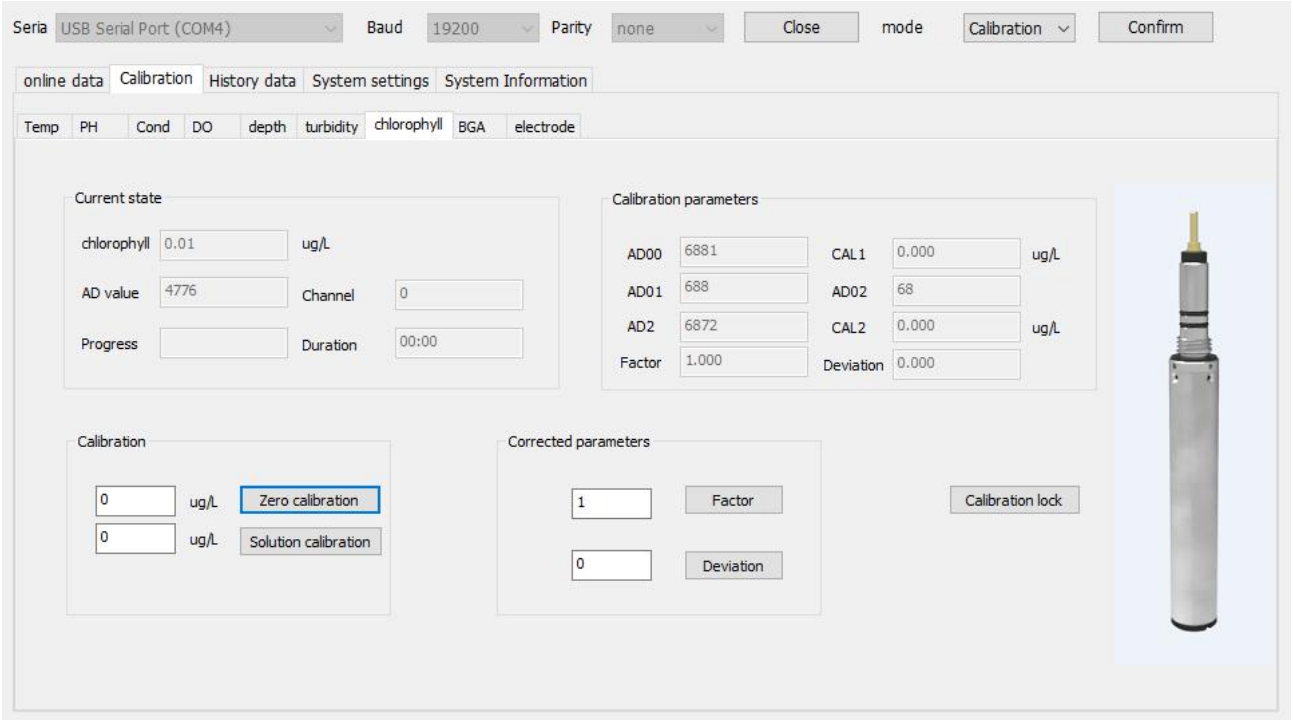
2. Select the high point in the calibration point migration, and pour the low standard solution (20NTU-500NTU, customers can choose according to the actual situation) into the clean dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Make sure

that the front end of the turbidity probe is immersed in the solution for at least 2 cm. When the AD value in the software interface is stable, enter the turbidity value in the “Calibration Point Migration” box and click “High Point” (At this time, the calibration progress display box will prompt the calibration status). Rinse and dry the sensor and calibration container with water after completion.

You can also directly enter the value in the “Correction Parameters” box and click “factor” and “deviation” to calibrate the factor and deviation value.

6.1.8.2 Chlorophyll Sensor Calibration

From the calibration menu, select the “chlorophyll” option to enter the chlorophyll calibration procedure, as shown in the figure below, and then ready to start calibration.



Chlorophyll calibration typically uses a two-point calibration.

The specific calibration steps are as follows:

1. Place the clean and dry chlorophyll sensor probe in a clean calibration container filled with distilled water. The probe should be at least 2 cm below the solution and the probe mirror should be free of air bubbles. When the AD value in the software interface is stable, click “Zero Calibration” in the “Calibration” box. Rinse the wiper sensor and calibration container after calibration is complete.

2. For "Solution calibration" we need a standard water sample with known chlorophyll concentration. There are usually two standards that can be used: A. Water samples with known chlorophyll content

obtained by ***water and seawater standard test methods***; B, 0.3 mg/L Rhodamine B stain solution.

Remove the probe from the distilled water and wipe it into a calibration container containing 0.3 mg/L of Rhodamine B stain solution or water sample. The probe should be at least 2 cm below the solution, and the probe mirror should not have air bubbles.

When the AD value in the software interface is stable, enter the chlorophyll value of 0.3 mg/L Rhodamine B stain solution at the corresponding temperature in the "Calibration" box (0.3 mg/L rhodamine B as a function of temperature) Table, as shown in Table 1) or experimentally measured chlorophyll values, then click on "Solution Calibration".

3. After calibration is complete, rinse the sensor and calibration container with water and dry.

You can also directly enter the value in the "Correction Parameters" box and click "factor" and "deviation" to calibrate the factor and deviation value.

Important note: Shading should be used during the calibration process; the temperature of the standard solution should be determined each time the counter standard is measured to determine the chlorophyll value of the standard solution.

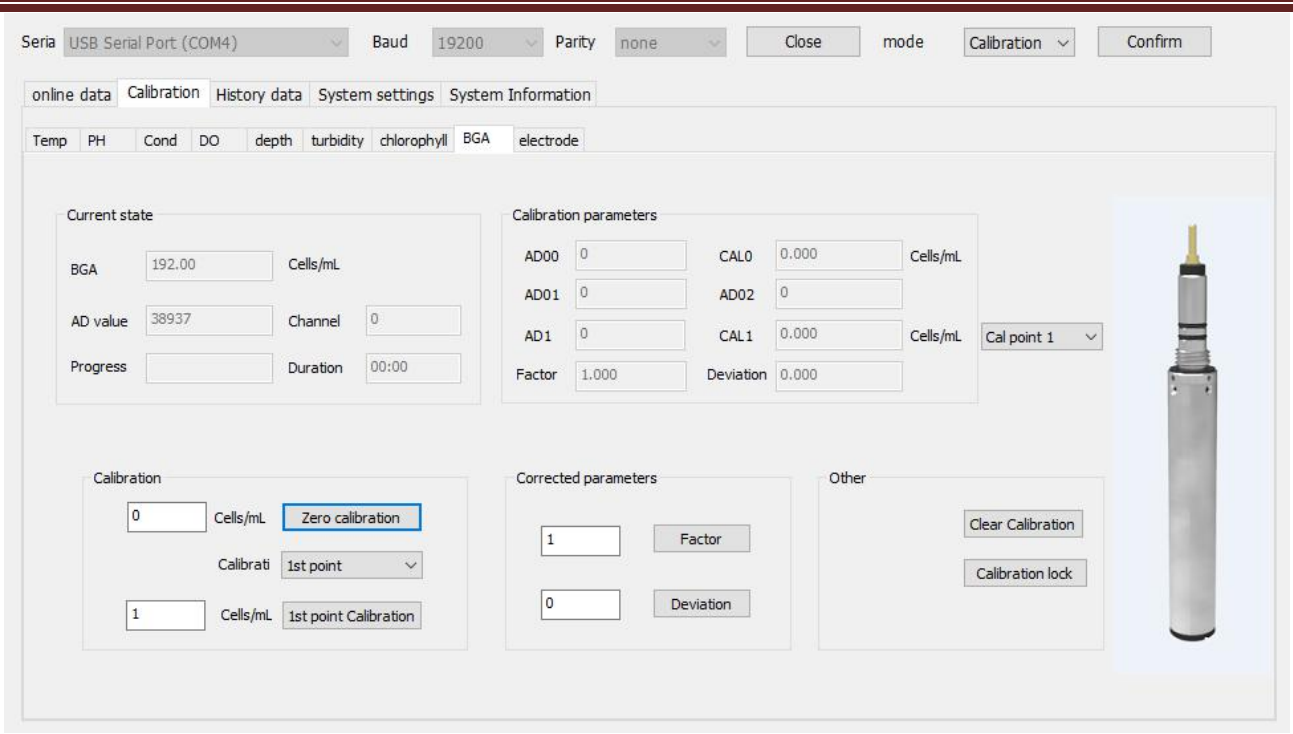
Table 1 Algae chlorophyll as a function of temperature for 0.3 mg/L rhodamine B

Temperature （℃）	Chlorophyll（μg/L）	Temperature （℃）	Chlorophyll（μg/L）
30	43.51	18	65.06
28	47.23	16	67.82
26	51.23	14	70.5
24	56.11	12	73.1
22	59.74	10	75.8
20	63.46	8	77.3

Note: As shown in the table, 0.3mg/L Rhodamine B corresponds to 56.11μg/L chlorophyll at 24°C.

6.1.8.3 Blue Green Algae Sensor

From the Calibration menu, select the Blue Green Algae option to enter the Blue Green Algae Calibration Program, as shown in the image below, and then ready to begin calibration.



The calibration of blue-green algae generally uses a two-point calibration.

The specific calibration steps are as follows:

1. For “zero calibration” we generally use distilled water for calibration. Place the clean and dry blue-green algae sensor probe in a clean calibration container filled with distilled water. The probe should be at least 2 cm below the solution and there should be no air bubbles on the mirror surface. When the AD value in the software interface is stable, click Zero Calibration. Rinse the wiper sensor and calibration container after calibration is complete.

2. For “Solution calibration” we need a standard water sample of blue-green algae. There are usually two standards that can be used: A, phytoplankton water samples of known blue-green algae content, B, Rhodamine B stain solution.

Remove the probe from the distilled water and wipe it into a calibration container containing a standard water sample or dye solution. The probe should be at least 2 cm below the solution and there should be no bubbles on the mirror surface.

When the AD value in the software interface is stable, select “1st point” in “Calibration Point”, then enter the content of blue green algae in the box on the left, and then click “1st point calibration”.

3. After calibration is complete, rinse the sensor and calibration container with water and dry.

You can also directly enter the value in the “Correction Parameters” box and click “factor calibration” and “deviation value calibration” to calibrate the factor and deviation value.

Important note: The rhodamine B stain solution of 0.03mg/L corresponds to 2000/ml. The rhodamine B stain solution of 0.3mg/L corresponds to 20,000 blue/green.

6.1.9 Ion Sensors Calibration

Calibration instructions：

1) For the sensors of ammonia nitrogen, nitrate ion, fluoride ion, and chloride ion, when the standard solution difference is 10 times(such as 1mg/L and 10 mg/L， and 10 mg/L and 100 mg/L, etc..), the voltage difference measured by the new electrode should be in the range of 57 + 3 mV. The voltage difference will reduce as the utility time increases, and the electrolyte or membrane head should be replaced according to the maintenance cycle.

2) Because the concentration below 1 mg/L of chloride ion electrode cannot measured, 1 mg/L and 10mg/L of the chloride ion sensor is special for their pressure difference will be between 35mV and 45mV. Therefore, the calibration point should select proper range.

3) Since the concentration pressure difference of potassium ion below 5mg/L is small, it should be larger than 3mg/L and then judge whether the standard pressure difference is in line with the 10-fold relation.

6.1.9.1 Ammonia Nitrogen Sensor Calibration

See section 6.1.9 for instructions before calibration. Take an option from the calibration menu to enter the "electrode" calibration program, and the interface is showed by diagram as below. Then, the operation of calibration can be prepared to start. Types of ion electrodes should be pre-configured, such as that showed in the square frame.

The Ammonia Nitrogen sensor is calibrated with Ammonia Nitrogen standard solution for three to five point calibration. The factory requires 4-point calibration. The customer can base on the situation on the site to calibrate with three to five point calibration method. The calibration points and current calibration points can be selected in the calibration box.

1. Generally, three-point calibration can be selected when measuring water below 50mg/L: 0.02mg/L、1mg/L and 10mg/L

2. Generally, the following calibration methods can be selected when measuring water over 50mg/L:

1）Three-point Calibration: 0.02mg/L、1mg/L or 10mg/L (or 25mg/L or 100mg/L)

2）Four -point Calibration: 0.02mg/L、1mg/L、5mg/L (or 10mg/L or 25mg/L)、100mg/L (or 200mg/L)

3）Five -point Calibration: 0.02mg/L、1mg/L、25mg/L、200mg/L、500mg/L or 1000mg/L

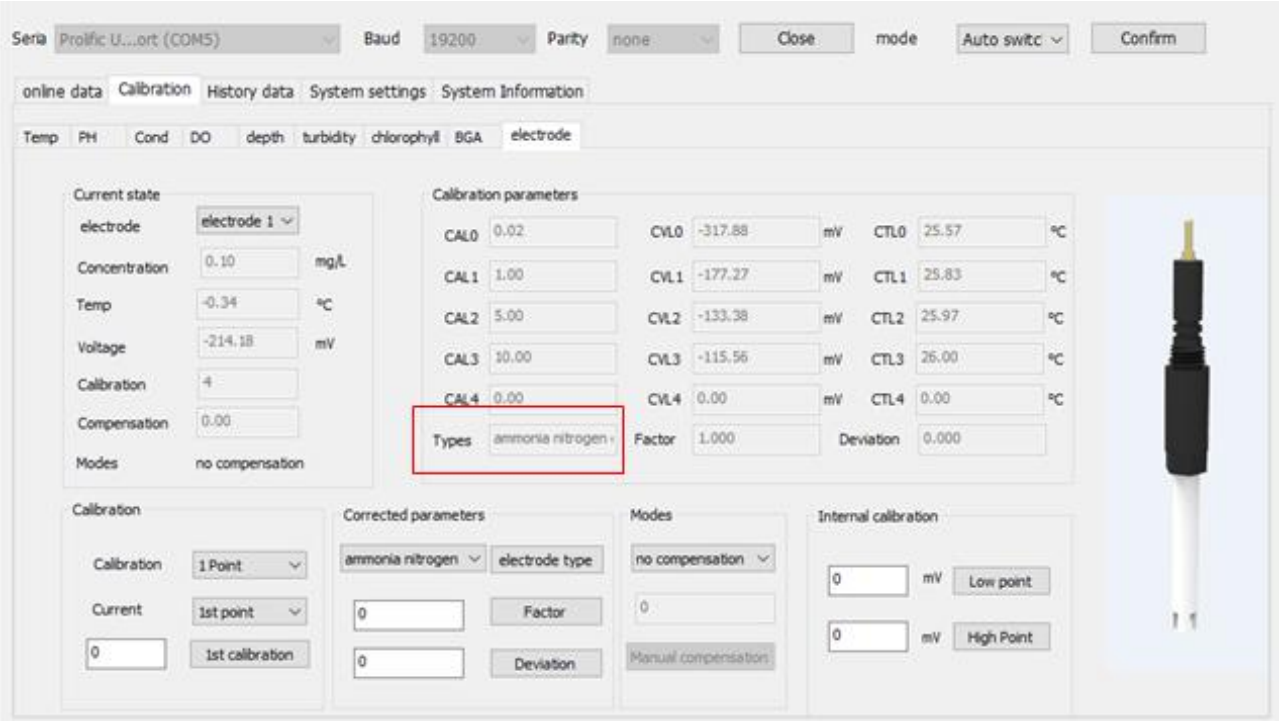
3. But when the water condition is stable, the three-point calibration can be performed according to the concentration range of the water body, and it can achieve a result with better accuracy.

For example, when the concentration range of the measured water is generally between 0.5 and 2, then 0.02mg/L、1 mg / L and 5 mg / L can be selected;

When the concentration range of the measured water is generally between 5 and 10, then 0.02mg/L、5 mg / L and 10 mg / L can be selected;

When the concentration range of the measured water is generally between 20 and 30, then 0.02mg/L、10 mg / L and 50 mg / L can be selected;

When selecting the calibration point, please note that when the measured value is high, select a higher value of the calibration point which is close to the measured value, and the lower point should generally be no more than 10mg/L.



The specific calibration steps are as follows:

The following is an example of three-point calibration when measuring water below 50mg/L:

Pour the standard solution from point 1 (generally recommended 0.02 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Ammonia Nitrogen Sensor is immersed in the solution at least 2 cm

and enter the standard value. After the value in the software interface is stable, click “1 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

Pour the standard solution at point 2 (generally recommended 1 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Ammonia Nitrogen Sensor is immersed in the solution at least 2 cm and enter the standard value. When the value in the software interface is stable, click “2 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

Pour the standard solution at point 3 (generally recommended 10 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Ammonia Nitrogen Sensor is immersed in the solution at least 2 cm and enter the standard value. When the value in the software interface is stable, click “3 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

You can directly select the input value in the correction parameter box and click “factor” and “deviation” to calibrate the factor and deviation value.

In the "mode" box, you can also select "no compensation" and "manual compensation". According to the water source selected by the customer, select "manual compensation" when the potassium ion concentration in the water is stable, and directly enter the potassium ion concentration.

6.1.9.2 Nitrate ion Sensor Calibration

See section 6.1.9 for instructions before calibration. Take an option from the calibration menu to enter the "electrode" calibration program, and the interface is showed by diagram as below. Then, the operation of calibration can be prepared to start. Types of ion electrodes should be pre-configured, such as that showed in the square frame.

The Nitrate ion sensor is calibrated with Nitrate ion standard solution for three to five point calibration. The factory requires 4-point calibration. The customer can base on the situation on the site to calibrate with three to five point calibration method. The calibration points and current calibration points can be selected in the calibration box.

1. Generally, three-point calibration can be selected when measuring water below 50mg/L: 0.02mg/L、1mg/L and 10mg/L

2. Generally, the following calibration methods can be selected when measuring water over 50mg/L:

1）Three-point Calibration: 0.02mg/L、1mg/L or 10mg/L (or 25mg/L or 100mg/L)

2）Four -point Calibration: 0.02mg/L、1mg/L、5mg/L (or 10mg/L or 25mg/L)、100mg/L (or 200mg/L)

3）Five -point Calibration: 0.02mg/L、1mg/L、25mg/L、200mg/L、500mg/L or 1000mg/L

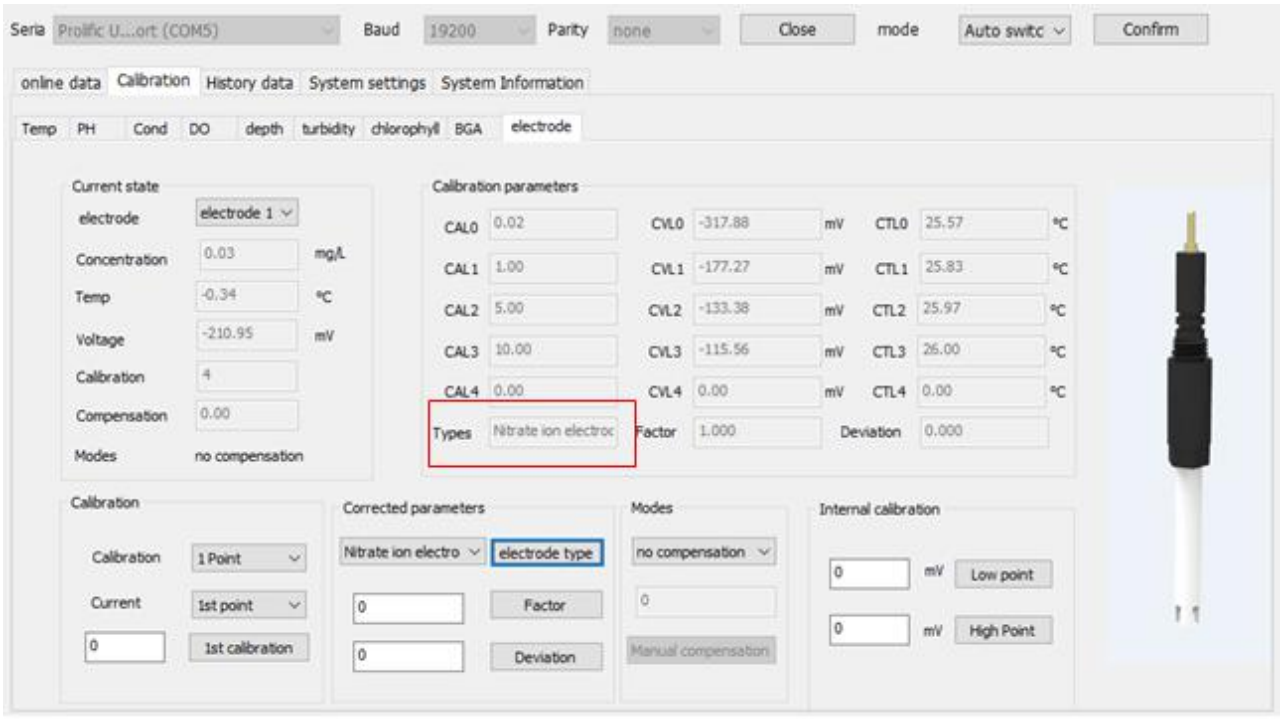
3. But when the water condition is stable, the three-point calibration can be performed according to the concentration range of the water body, and it can achieve a result with better accuracy.

For example, when the concentration range of the measured water is generally between 0.5 and 2, then 0.02mg/L、1 mg / L and 5 mg / L can be selected;

When the concentration range of the measured water is generally between 5 and 10, then 0.02mg/L、5 mg / L and 10 mg / L can be selected;

When the concentration range of the measured water is generally between 20 and 30, then 0.02mg/L、10 mg / L and 50 mg / L can be selected;

When selecting the calibration point, please note that when the measured value is high, select a higher value of the calibration point which is close to the measured value, and the lower point should generally be no more than 10mg/L.



The specific calibration steps are as follows:

The following is an example of three-point calibration when measuring water below 50mg/L:

Pour the standard solution from point 1 (generally recommended 0.02 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution.

Please ensure that the front end of the Nitrate ion Sensor is immersed in the solution at least 2 cm and enter the standard value. After the value in the software interface is stable, click “1 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

Pour the standard solution at point 2 (generally recommended 1 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Nitrate ion Sensor is immersed in the solution at least 2 cm and enter the standard value. When the value in the software interface is stable, click “2 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

Pour the standard solution at point 3 (generally recommended 10 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Nitrate ion Sensor is immersed in the solution at least 2 cm and enter the standard value. When the value in the software interface is stable, click “3 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

You can directly select the input value in the correction parameter box and click “factor” and “deviation” to calibrate the factor and deviation value.

6.1.9.3 Fluorine Ion Sensor Calibration

See section 6.1.9 for instructions before calibration. Take an option from the calibration menu to enter the "electrode" calibration program, and the interface is showed by diagram as below. Then, the operation of calibration can be prepared to start. Types of ion electrodes should be pre-configured, such as that showed in the square frame.

The Fluorine ion sensor is calibrated with Fluorine ion standard solution for three to five point calibration. The factory requires 4-point calibration. The customer can base on the situation on the site to calibrate with three to five point calibration method. The calibration points and current calibration points can be selected in the calibration box.

1. Generally, three-point calibration can be selected when measuring water below 50mg/L: 0.02mg/L、1mg/L and 10mg/L

2. Generally, the following calibration methods can be selected when measuring water over 50mg/L:

1）Three-point Calibration: 0.02mg/L、1mg/L or 10mg/L (or 25mg/L or 100mg/L)

2）Four -point Calibration: 0.02mg/L、1mg/L、5mg/L (or 10mg/L or 25mg/L)、100mg/L (or 200mg/L)

3）Five -point Calibration: 0.02mg/L、1mg/L、25mg/L、200mg/L、500mg/L or 1000mg/L

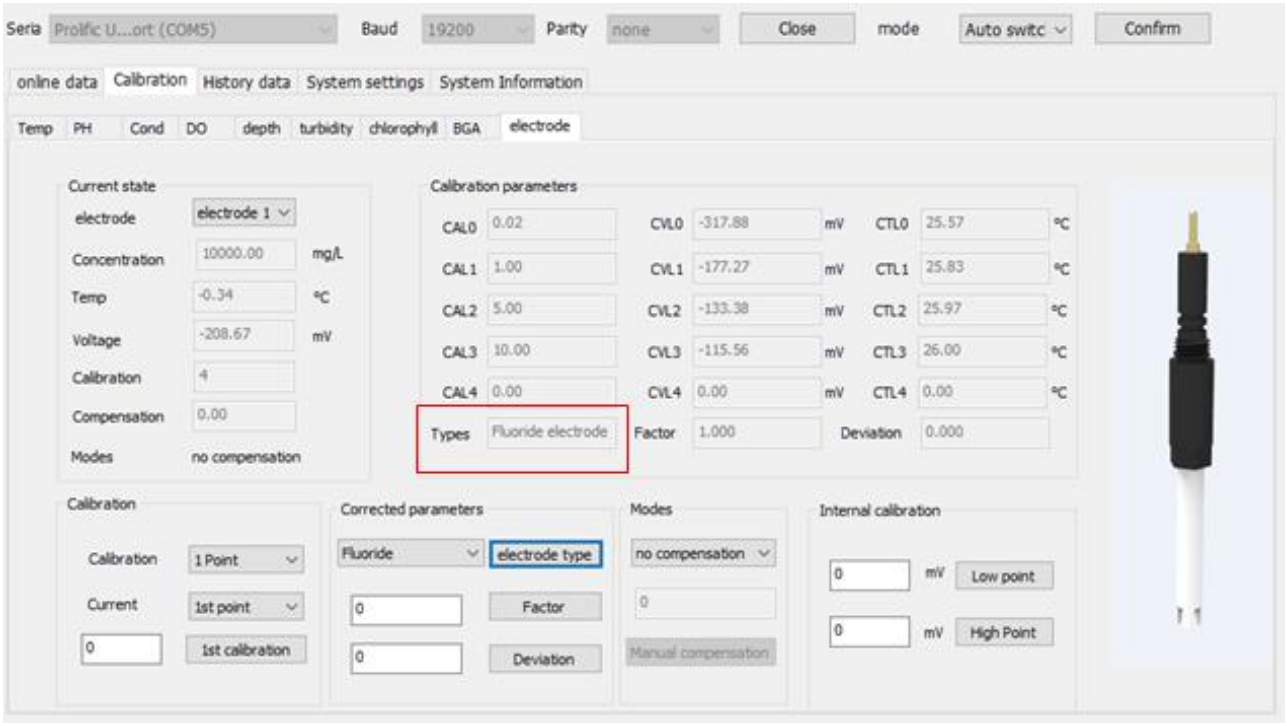
3. But when the water condition is stable, the three-point calibration can be performed according to the concentration range of the water body, and it can achieve a result with better accuracy.

For example, when the concentration range of the measured water is generally between 0.5 and 2, then 0.02mg/L、1 mg / L and 5 mg / L can be selected;

When the concentration range of the measured water is generally between 5 and 10, then 0.02mg/L、5 mg / L and 10 mg / L can be selected;

When the concentration range of the measured water is generally between 20 and 30, then 0.02mg/L、10 mg / L and 50 mg / L can be selected;

When selecting the calibration point, please note that when the measured value is high, select a higher value of the calibration point which is close to the measured value, and the lower point should generally be no more than 10mg/L.



The specific calibration steps are as follows:

The following is an example of three-point calibration when measuring water below 50mg/L:

Pour the standard solution from point 1 (generally recommended 0.02 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Fluorine Ion Sensor is immersed in the solution at least 2 cm and enter the standard value. After the value in the software interface is stable, click “1 point Calibration”.

Rinse and dry the sensor and calibration container with water after completion.

Pour the standard solution at point 2 (generally recommended 1 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Fluorine Ion Sensor is immersed in the solution at least 2 cm and enter the standard value. When the value in the software interface is stable, click “2 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

Pour the standard solution at point 3 (generally recommended 10 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Fluorine Ion Sensor is immersed in the solution at least 2 cm and enter the standard value. When the value in the software interface is stable, click “3 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

You can directly select the input value in the correction parameter box and click “factor” and “deviation” to calibrate the factor and deviation value.

6.1.9.4 Chloride Ion Sensor Calibration

See section 6.1.9 for instructions before calibration. Take an option from the calibration menu to enter the "electrode" calibration program, and the interface is showed by diagram as below. Then, the operation of calibration can be prepared to start. Types of ion electrodes should be pre-configured, such as that showed in the square frame.

The Chloride Ion sensor is calibrated with Chloride Ion standard solution for three to five point calibration. The factory requires 4-point calibration. The customer can base on the situation on the site to calibrate with three to five point calibration method. The calibration points and current calibration points can be selected in the calibration box.

1、Usually, 3 points calibration can be chose when the water below 1000mg/L is measured, including 0.02mg/L、10mg/L and 200mg/L.

2、In addition to the first point, the fixed use of pure water as zero, when the water condition is tested to be stable, it can be adjusted according to the concentration range of the water to obtain better accuracy in the normal concentration range of the water.

For example, when the concentration range of the measured water is generally between 0 and 20, then 0.02mg/L、1 mg / L and 10 mg / L can be selected;

When the concentration range of the measured water is generally between 0 and 200, then 0.02mg/L、10 mg / L and 100 mg / L can be selected;

When the concentration range of the measured water is generally between 200 and 1000, then 0.02mg/L、10 mg / L and 200 mg / L can be selected;

3、If higher accuracy is required, 4 or 5 points calibration is recommended in the measuring for the water.

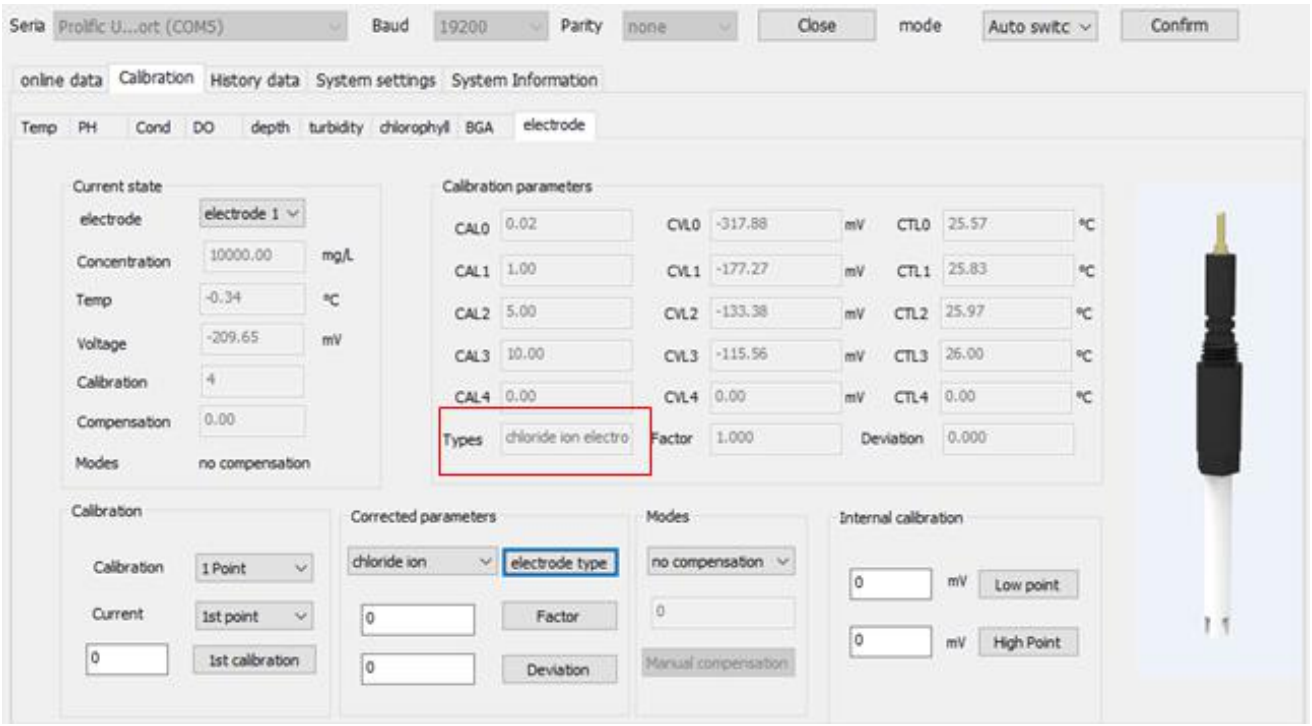
For instance, the points of 0.02mg/L、1 mg/L, 10mg/L, and 100mg/L can be used;

For instance, the points of 0.02mg/L、1 mg/L, 10mg/L, and 200mg/L can be used ;

For instance, the points of 0.02mg/L、1 mg/L, 10mg/L , 100mg/L, and 1000mg/L can be used;

For instance, the points of 0.02mg/L、1 mg/L, 10mg/L, 200mg/L, and 1000mg/L can be used;

Usually, choose the points of 1 mg/L and 10mg/L of chloride ion, and add some other points can obtain better accuracy.



The specific calibration steps are as follows:

The following is an example of three-point calibration when measuring water below 1000mg/L:

Pour the standard solution from point 1 (generally recommended 0.02 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Chloride Ion Sensor is immersed in the solution at least 2 cm and enter the standard value. After the value in the software interface is stable, click “1 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

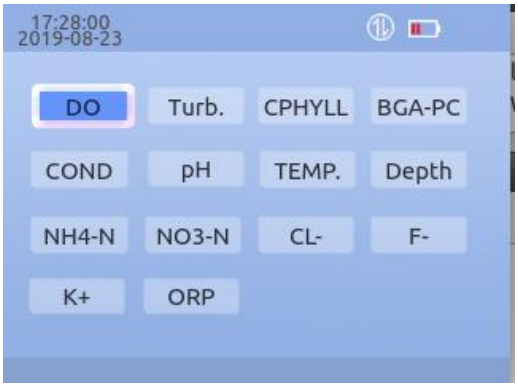
Pour the standard solution at point 2 (generally recommended 1 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Chloride Ion Sensor is immersed in the solution at least 2 cm and enter the standard value. When the value in the software interface is stable, click “2 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

Pour the standard solution at point 3 (generally recommended 200 mg/L) into a clean, dry or pre-rinsed calibration container. Carefully immerse the probe at the end of the main unit in the solution. Please ensure that the front end of the Chloride Ion Sensor is immersed in the solution at least 2 cm and enter the standard value. When the value in the software interface is stable, click “3 point Calibration”. Rinse and dry the sensor and calibration container with water after completion.

You can directly select the input value in the correction parameter box and click “factor” and “deviation” to calibrate the factor and deviation value.

6.2 Calibrate the sensor by hand manipulator

Choose “calibration” in the main menu page, and press the key of “Enter” to confirm. Then, you can get into the calibration interface of selective parameters. The parameters you choose must be the probes that have been connected as showed in the diagram below.



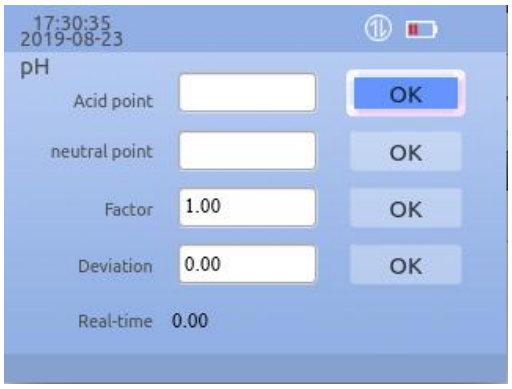
Please check the details of all the specific calibration steps of sensors below in the Chapter 6.1

6.2.1 Temperature calibration

The new product of temperature sensor has been calibrated, and the default of the temperature source is Pt 1000.It is not necessary to calibrate again.

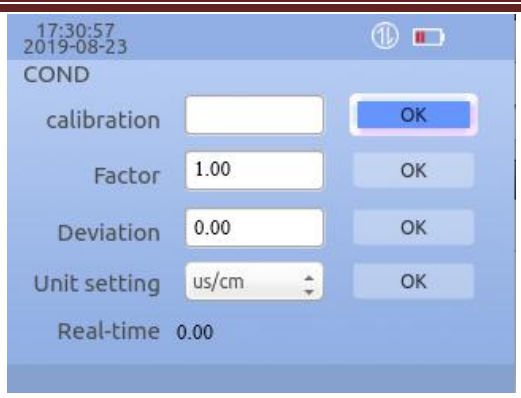
6.2.2 pH calibration

Get into the pH calibration interface, and the pH standard solution value (acidity) can be manually input at the acid point, such as 4.01. Choose the key of “OK”, and press the key of “Enter”. And then, the pH standard solution value (neutral) can be input at the neutral point, such as 6.86. Choose the key of “OK”, and press the key of “Enter”.



6.2.3 Conductivity calibration

Get into the interface of conductivity calibration, and manually input the concentration value of conductivity standard solution at the site of “calibration”. And then, choose the key of “OK”, and press the key of “Enter”. At the same time, the unit of TDS and salinity (ppt) can be switched in this interface. If it is switched into the unit of TDS, the “real time” will display the value of TDS.

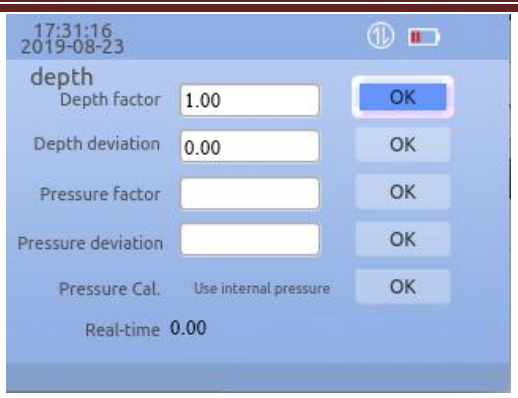


6.2.4 Dissolved oxygen calibration

The new product of dissolved oxygen sensor has already been calibrated. If it is necessary to be calibrated, the way of air calibration can be adopted.

6.2.5 Depth calibration

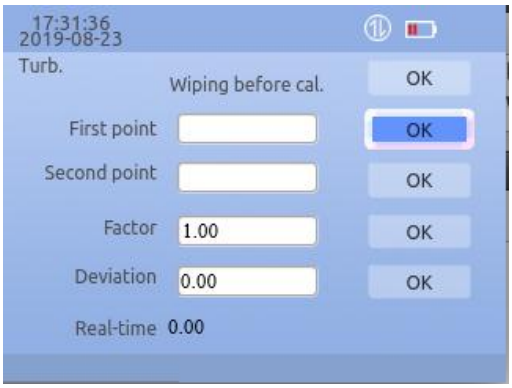
Make sure it is clear and dry for the depth sensor before calibration. The calibration for depth sensor is mainly the calibration for the pressure of atmosphere, so please make sure that the depth sensor is in the air, and not immerged in any container. Click the key of “calibration of atmosphere pressure” when the value of atmosphere pressure is stable in the calibration interface. Then, the system will automatically save the data to complete the calibration. Because of the particularity of depth sensor, frequent calibration is recommended to make sure the accuracy of data.



6.2.6 Turbidity calibration

Get into the interface of turbidity calibration, and press the key of “OK” at the site of “wiping before calibration”. Press the key of “Enter” to perform cleaning procedure for one time by scratching, and eliminate the influence of bubbles on turbidity calibration process.

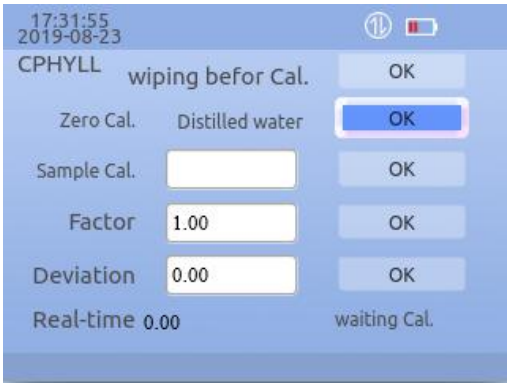
Choose first point/second point turbidity calibration according to actual requirement to make integrated multi-parameter analyzer immerge into standard solution, and at the same time, input corresponding standard solution value in the square frame of the hand manipulator. Then, choose the key of “OK” and press "Enter" for calibration and confirm the calibration status according to the prompt of calibration status. When the calibration is indicated to be successful, the calibration at this point is complete.



6.2.7 Chlorophyll calibration

Get into the interface of chlorophyll calibration, and make integrated multi-parameter analyzer immerge into distilled water or rinsing. Press the key of “OK” at the site of “wiping before calibration”. Press the key of “Enter” to perform cleaning procedure for one time by scratching, and eliminate the influence of bubbles on chlorophyll calibration process. Press the key of “OK” at the site of “zero calibration” in the interface, and press the key of “Enter”.

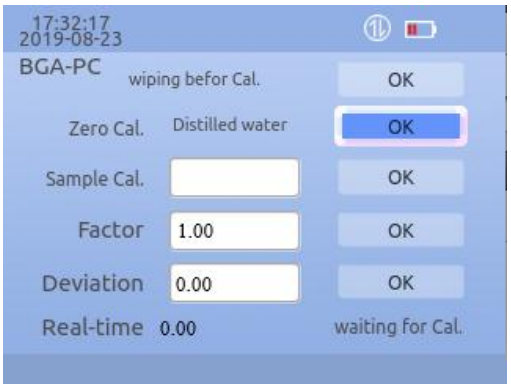
Make integrated multi-parameter analyzer immerge into Rhodamine B standard solution, and input corresponding sample value of water at the site of “sample calibration”. Press the key of “OK”, and press the key of “Enter”.



6.2.8 Blue-green algae calibration

Get into the interface of blue-green algae calibration, and make integrated multi-parameter analyzer immerge into distilled water or rinsing. Press the key of “OK” at the site of “wiping before calibration”. Press the key of “Enter” to perform cleaning procedure for one time by scratching, and eliminate the influence of bubbles on blue-green algae calibration process. Press the key of “OK” at the site of “zero calibration” in the interface, and press the key of “Enter”.

Make integrated multi-parameter analyzer immerge into Rhodamine B standard solution, and input corresponding sample value of water at the site of “sample calibration”. Press the key of “OK”, and press the key of “Enter”.



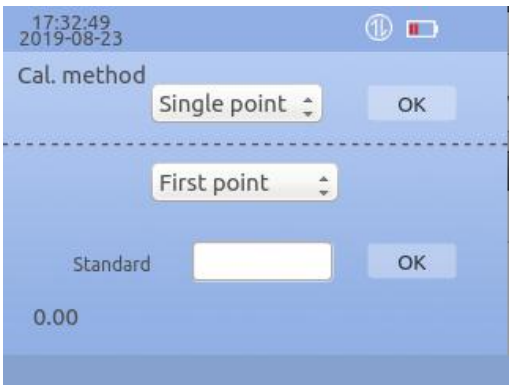
6.2.9 Fluoride ion calibration

Get into the interface fluoride ion calibration, and press the key of “calibration”. Press the key of “Enter” to calibrate the fluoride ion. Choose first point/second point/third point/fourth point/fifth point fluoride

ion calibration according to actual requirement to make integrated multi-parameter analyzer immerge into standard solution, and at the same time, input corresponding standard solution value in the square frame of the hand manipulator. Then, choose the key of “calibration”, and press the key of “OK”. At last, press the key of “Enter”.

6.2.10 Chloride Ion Calibration

Get into the interface chloride ion calibration, and press the key of “calibration”. Press the key of “Enter” to calibrate the chloride ion. Choose first point/second point/third point/fourth point/fifth point chloride ion calibration according to actual requirement to make integrated multi-parameter analyzer immerge into standard solution, and at the same time, input corresponding standard solution value in the square frame of the hand manipulator. Then, choose the key of “calibration”, and press the key of “OK”. At last, press the key of “Enter”.



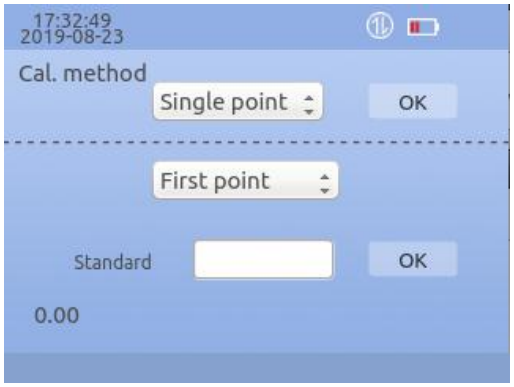
6.2.11 Nitrate ion Calibration

Get into the interface Nitrate ion calibration, and press the key of “calibration”. Press the key of “Enter” to calibrate the Nitrate ion. Choose first point/second point/third point/fourth point/fifth point Nitrate ion calibration according to actual requirement to make integrated multi-parameter analyzer immerge into

standard solution, and at the same time, input corresponding standard solution value in the square frame of the hand manipulator. Then, choose the key of “calibration”, and press the key of “OK”. At last, press the key of “Enter”.

6.2.12 Ammonia Nitrogen Calibration

Get into the interface ammonia nitrogen calibration, and press the key of “calibration”. Press the key of “Enter” to calibrate the ammonia nitrogen. Choose first point/second point/third point/fourth point/fifth point ammonia nitrogen calibration according to actual requirement to make integrated multi-parameter analyzer immerge into standard solution, and at the same time, input corresponding standard solution value in the square frame of the hand manipulator. Then, choose the key of “calibration”, and press the key of “OK”. At last, press the key of “Enter”.



Chapter 7 Maintenance

Danger

Only professionals can undertake the maintenance tasks described in this chapter of this manual.

To ensure continuous and reliable operation of the water quality monitoring system, we recommend a thorough and standardized maintenance process over time. In order to determine the appropriate maintenance intervals required at a site of use, the equipment and sensors should be periodically observed to compare the results before and after calibration and the corresponding time of the sensors.

A contaminated, worn or damaged sensor will not produce a reliable reading. It is recommended to maintain the sensor before calibration.

In order to get the best measurement results, regular maintenance and maintenance is required.

Maintenance and maintenance mainly include cleaning of sensors.

7.1 Sensor maintenance

7.1.1 Temperature sensor maintenance

Use soap or scrub alcohol to remove grease, oil or microbes and rinse the sensor probe with water. Do not use any object to poke the sensor, otherwise the sensor film will rupture.

7.1.2 pH sensor maintenance

The pH sensor requires frequent maintenance to remove contaminants from the sensing element, which can reduce the sensor's reaction time. Remove the sensor from the main unit before cleaning the sensor.

If the pH sensor is covered by deposits or micro-organisms, clean the glass with a very clean, soft, wet, non-scratched cloth or cotton ball with a mild soap and then use 0.01 mol/L HCL or NaOH solution.

Brush, (dissolve the hardly soluble scale such as calcium and magnesium with EDTA disodium solution), rinse with clean water, dry it and calibrate with the meter.

If there is oil on the electrode, it can be rubbed with cotton soaked with CCl4 or acetone. Then, it was immersed in a 0.1 mol/L HCI solution for 12 hours, and then repeatedly rinsed with distilled water and dried, and then calibrated with a meter.

Avoid long-term dry storage, usually in a protective cover with 3.0 mol / L potassium chloride solution.

Important note: Avoid using anhydrous ethanol or dehydrating detergent to treat the electrode.

7.1.3 Conductivity sensor maintenance

Clean the elliptical measurement compartment (channel to the internal electrode) on the conductivity sensor with a small non-abrasive brush or cotton swab. Use soap to remove oils, oils or micro-organisms. Rinse with water and calibrate with the meter.

Note:

1. High-purity water and ultra-pure water can not choose the open sampling and measurement method. When the high-purity water is exposed to the air, a large amount of carbon dioxide is quickly dissolved into the water, and the inner wall of the vessel is dirty and the dust in the air. It will also be redissolved in water, resulting in multiple errors. High-purity water can only be verified by closed, flowing, bypass flow cells. Measuring open high-purity water with laboratory instruments is a cognitive error. It's not comparable at all.

2. Adhesion of resin regenerated dirt easily leads to contamination of the conductivity cell, which can be recovered after cleaning with an alcohol cotton ball.

7.1.4 Dissolved oxygen sensor maintenance

It is recommended to clean the dissolved oxygen sensor at intervals (usually 3 months, depending on the site environment) to ensure the accuracy of the measurement.

Clean the outer surface of the sensor with water (do not use organic solvents). If debris remains, wipe it with a soft, damp cloth. Do not place the sensor in direct sunlight or where it can be illuminated by radiation. If the total exposure time of the sensor reaches one hour throughout the life of the sensor, it will cause the fluorescent cap to age, causing the fluorescent cap to malfunction and causing an erroneous reading. Carefully rinse the sensor and membrane with water after each use.

Generally, the dissolved oxygen sensor has an inherent limitation, and the life of the sensor membrane cover is 12 months. When the membrane cover is over 12 months or the membrane cover is severely damaged, the membrane cover needs to be replaced.

Note: Do not pull out the membrane cover when replacing the membrane cover. Slowly screw it on to allow the air to slowly drain.

7.1.5 Depth sensor maintenance

Clean the surface of sensor by water. If it is still dirty after cleaning, please wipe by wet soft cloth. It is noteworthy that the sensor cannot touch the corrosive solution in the process of maintenance, otherwise the function of the sensor will be damaged.

7.1.6 Standard optical sensor maintenance

Standard optical sensors include turbidity, chlorophyll and blue-green algae sensors.

The optical probe requires periodic maintenance and should be performed after each measurement cycle (long-term online measurement). The measurement cycle should be adjusted according to the pollution level of the measurement area. The probe should also be maintained before and after calibration.

Rinse the entire probe with clean water and wipe off the attachment on the surface of the instrument with soap and water. Soak the entire instrument in clean water for at least 5 minutes. Observe the optical window of the probe, clean the optical window of the probe with a tissue paper or cotton swab dipped in soapy water, then rinse with water and allow it to dry.

IMPORTANT: Do not scrub the probe with an organic solvent such as acetone or methanol to avoid damaging the plastic surface of the probe.

7.1.7 Ion Sensor Maintenance

Ion sensor includes sensors of ammonia nitrogen, nitrate ion, fluoride ion, and chloride ion.

If the electrode is away from the water by about 15 minutes, then, it is recommended to place the electrode into the water again to regenerate for 1 hour. If the electrode membrane cap is contaminated, the user needs to clean the cap according to the maintenance cycle. Do not touch the cap by hand. Please clean the cap by clean cloth or clean water. Usually, for the ion electrodes adopting PVC ion exchange membranes, it is necessary to replace the membrane head by half a year (the time depends on the situation of using of electrode).

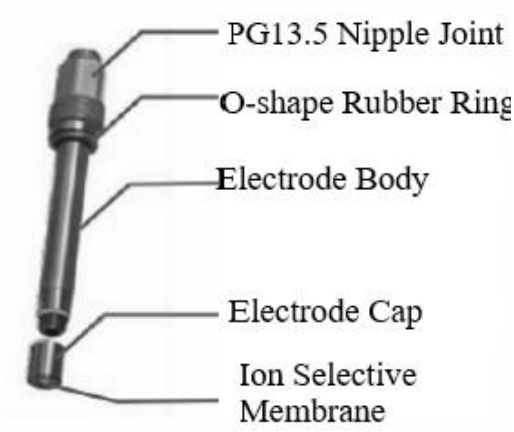


Figure18 Diagram of Ammonia Nitrogen Electrode

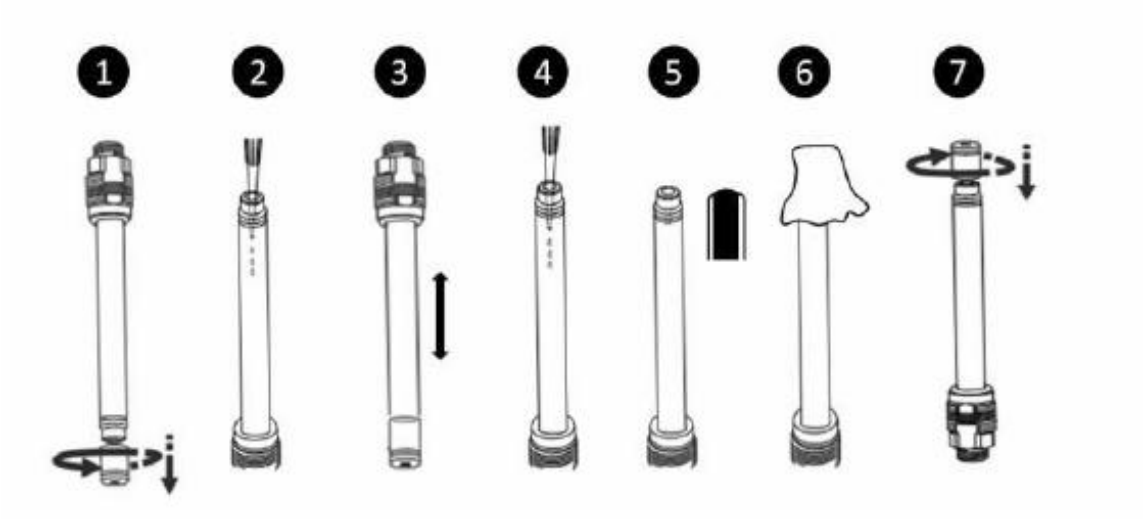


Figure 19 Diagram of Replacing Electrolyte

The steps of electrolyte replacement:

1. Unscrew the cap of the ion electrode，and pour out the remaining electrolyte in the electrode.

2. Put a little electrolyte into the electrode by a straw. (If the electrode should be used for a long time, a little deionized water can be put into the electrode first, and the electrode should be cleaned according to process 3. And then, a little electrolyte should be added.)

3. Clean the electrode by shaking slightly up an down. And pour out the electrolyte after cleaning.

4. Put the electrolyte into the electrode by straw again till the electrolyte forms a bulge.(capillarity)

5. The electrolyte that forms a bulge. It is not allowed to add electrolyte into the cap of membrane. The water in the cap of membrane should be cleaned out for the cap of membrane that has been used.

6. Wipe dry the electrolyte overflow.

7. Tighten the diaphragm. Then slowly rotate the electrode and make the head of electrode down toward. This process can eliminate the bubbles in the head. Swing the electrodes vertical downward slightly. Make sure the head of electrode down toward in the process of swing, and do not swing too hard. Otherwise, the cap of electrode will be damaged.

7.2 Sensor Storage

7.2.1 Short Storage

Short term refers to the intermittent period (days, weeks, two weeks, etc.) in which the host is in normal use.

For short-term storage users should keep the sensor moist, but do not immerse in water (immersion in water can cause the sensor to drift). The user should place it in a humid saturated air environment (100% humidity). Inject approximately 1 cm of water into the bottom of the calibration container (note: never immerse the sensor), then insert the sensor-equipped main unit into the calibration container and tighten to prevent evaporation of the water.

7.2.2 Long-term storage

Long-term refers to the state of being unused for a long time.

1) For long-term storage of the pH sensor, remove it from the main unit, clean it, and then immerse it in a protective cover with 3.0 mol/L potassium chloride solution, pay attention to tightening.

2) For dissolved oxygen sensors, due to their intrinsic properties, there are two methods for long-term storage:

A. Keep it on the main machine and immerse it in water. Tighten the calibration container to prevent evaporation. When the storage is finished, you should re-exchange the film to use it. This article recommends using the method.

B. Remove the sensor from the main unit, immerse the probe in the water, do not damage the membrane or the probe tip when putting it into the bottom, and check the water level regularly. When the storage is finished, it must be replaced again before it can be used. The interface end should be protected with a plastic bag.

3) The other sensors are removed from the main unit, the sensor is cleaned, and it is recommended that

the device be stored in a shipping container or in a plastic container with electric shock protection in a non-freezing and dry environment. The empty end left by the sensor on the main unit should be sealed with a port protection plug.

7.3 Cable maintenance

When operating in the field, care should be taken not to place any non-waterproof cables (ie any cables other than waterproof underwater cables) near any source of water. Keep the joints dry at all times.

Use a silicone grease to properly lubricate the sealing surfaces of all subsea joints.

Keep all cables clean, dry, and stored (tidy and coiled) in a large plastic container.

Do not allow the cable to be less than 6 inches in diameter, as this will damage the cable.

Do not knot the cable or use a clip to mark a certain depth.

Any cable should be protected from wear, unnecessary tension, repeated bending or severe bending (such as railings) during use.

7.4 Sensor damage check

Check the appearance of the sensor for damage. If there is any damage, contact the after-sales service center for replacement to prevent the sensor from entering the water due to damage.

7.5 Host battery replacement

1. Place the multi-function probe horizontally on the work surface to prevent water from leaking into the multi-function probe battery compartment;

2. Unscrew the battery cover screw counterclockwise, as shown in Figure 9.

3. Unplug the cover from the housing and slide the old battery out;

4. Throw away the old battery and insert a new one, as shown in Figure 10. Observe the polarity identification on the inside label. If the battery is installed in the wrong direction, it may cause serious injury and damage to the instrument;

5. Slip on the battery cover O-ring with a small amount of silicon, reinsert the cover into the multi-probe housing, and tighten the screw clockwise.

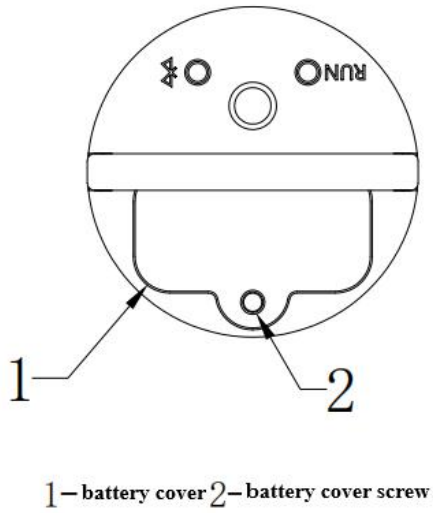


Figure 9

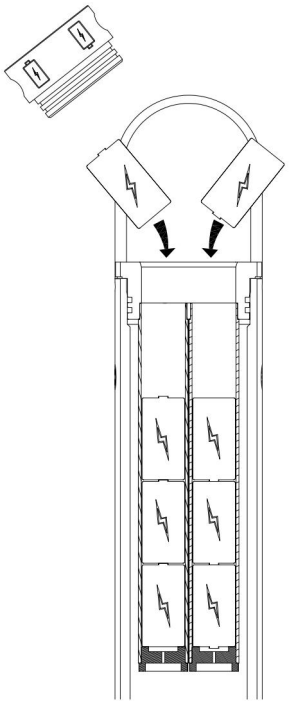


Figure 10

Chapter 8 Communication Protocol

A、The sensor probe comes with Modbus RS485 function, communicates in RTU mode, and the default baud rate is 9600. It can communicate with the host computer (PC/digital instrument, etc.) with RS485 communication function. The specific MODBUS-RTU table is shown in the table below.

MODBUS-RTU	
Baud rate	9600/4800/19200/38400/115200
Data bit	8 Bits
Parity	No
Stop bit	1 Bit
Slave address	1-254（Default 10）

B、Adopt standard communication protocol of MODBUS. The details of the protocol content have been showed as below.

address	name	type of data	type of operation	remarks
0	temperature value	float	read	0~50℃
1040	temperature AD value	float	read	
1610	temperature factor	float	read/write	Default：1
1510	temperature deviation	float	read/write	Default：1
420	temperature source	float	read/write	the source of temperature: 1 represents PT1000 2 represents dissolved oxygen temperature 3 represents pressure temperature 4 represents manual input temperature
422	manual temperature compensation value	float	read/write	range:10-100
2	pH value	float	read	0~14
1000	pH AD value	float	read	
1600	pH factor	float	read/write	Default：1
1500	pH deviation	float	read/write	Default：0
900	pH acidic calibration point	float	write	
902	pH neutral calibration point	float	write	
4	conductivity value	float	read	1 μS/cm-2000 μS/cm (k=1) 100 μS/cm- 100 mS/cm (k=10.0)
1050	conductivity AD value	float	read	
1602	conductivity factor	float	read/write	Default：1

1502	conductivity deviation value	float	read/write	Default：0
334	conductivity probe calibration	float	read /write	Input the standard liquid value
6	dissolved oxygen value	float	read	0-20 mg/L
1606	dissolved oxygen factor	float	read/write	Default：1
1506	dissolved oxygen deviation	float	read/write	Default：0
904	dissolved oxygen calibration	float	write	Send 2, and wait for at least 20 seconds. And then, send 3 to complete the air calibration.
430	salinity compensation model	float	read/write	0: no compensation 1: manual compensation 2:salinity sensor compensation
432	salinity compensation value	float	read/write	Register 430 salinity compensation mode is manual compensation mode, this value is used to compensate
8	turbidity value	float	read	0.01~1000NTU
1010	turbidity AD value	float	read	
1608	turbidity factor	float	read/write	Default：1
1508	turbidity deviation value	float	read/write	Default：0
1100	turbidity calibration progress value	float	read	0 represents successful calibration 1 represents wrong calibration 2 represents entering the calibration model 20 represents it is in the process of calibration

				255 represents the lock of calibration has been unfolded, and it is well ready for the operation of calibration
906	turbidity calibration model	float	write	enter 1 to access the calibration model
1014	turbidity low point calibration	float	write	Enter 1 into the turbidity calibration mode of register address 906 first, so that the turbidity sensor enters into the calibration mode, and then enter the actual value of the standard liquid
1016	turbidity high point calibration	float	write	Enter 1 into the turbidity calibration mode of register address 906 first, so that the turbidity sensor enters into the calibration mode, and then enter the actual value of the standard liquid
10	depth value	float	read	0~61m
40	pressure value	float	read	common electrode: ≤0.3Mpa ion electrode: ≤0.1 Mpa
1604	depth factor	float	read/write	Default：1
1504	depth deviation value	float	read/write	Default：0
130	atmosphere pressure calibration	float	read/write	enter any value can realize the calibration
12	chlorophyll value	float	read	0.01~500ug/L
1020	chlorophyll AD value	float	read	

1022	chlorophyll channel value	float	read	
1612	chlorophyll factor	float	read/write	Default：1
1512	chlorophyll deviation value	float	read/write	Default：0
1104	progress value of chlorophyll calibration	float	read	
310	zero point calibration of chlorophyll	float	write	Enter any value
312	calibration of chlorophyll standard solution	float	write	Input the standard liquid value
14	blue-green algae value	float	read	100-300000 cells/mL
1030	blue-green algae AD value	float	read	
1032	blue-green algae channel value	float	read	
1614	blue-green algae factor	float	read/write	Default：1
1514	blue-green algae deviation value	float	read/write	Default：0
1102	calibration progress value of blue-green algae	float	read	
320	zero point calibration of blue-green algae	float	write	
322	Standard solution calibration of blue-green algae	float	write	Set calibration point of Register 324 blue-green algae first to confirm the corresponding calibration point.(181 represents the first point, 182 represents the second point, 183 represents

				the third point, and 184 represents the fourth point). And then, send the actual value of corresponding calibration point to 322 calibration register of standard solution of blue-green algae.
324	calibration point setting of blue-green algae	float	write	Set the calibration point of blue-green algae. (180 represents distinct calibration data, 181 represents the first point, 182 represents the second point, 183 represents the third point, and 184 represents the fourth point).
530	interval of scratching	float	read/write	unit: min
532	manual scratching	float	Write	1 represents scratching
70	year	float	read/write	
72	month	float	read/write	
74	day	float	read/write	
76	hour	float	read/write	
78	minute	float	read/write	
80	second	float	read/write	
9995	slave baud rate	float	read/write	The range of setting for baud rate includes 4800, 9600, 19200, 38400, and 115200. And the floating point number of 1, 2, 3, 4, and 5 will represent corresponding baud

				rate.
9997	slave address	unsigned	read/write	Write using command 06, range:1-255
16	value of ion electrode 1	float	read	command 03
2200	electrode voltage of electrode 1	float	read	
2202	factor of electrode 1	float	read/write	Default：1
2204	deviation of electrode 1	float	read/write	Default：0
2206	type of electrode 1	float	read/write	The types of electrode are represented by floating point number of 1, 2, 3, 4, 5, and 6. 1 represents ORP; 2 represents ammonia nitrogen; 3 represents Nitrate ion; 4 represents chloride ion; And 5 represents fluoride ion.
2208	calibration points of electrode 1	unsigned	read/write	Support the command of 03 and 16. The written values of 1, 2, 3, 4, and 5 respectively represent single point calibration to 5 point calibration.
2215	stability	float	read	Represents the stability of the electrode voltage (used during calibration, the value on 0.9 represents the stability)
2234	first point calibration of electrode 1	float	write	input the standard solution value

2236	the first point standard solution value of electrode 1	float	read	
2238	electric voltage of the first point standard solution calibration of electrode 1	float	read	
2240	temperature of the first point standard solution calibration of electrode 1	float	read	
2242	second point calibration of electrode 1	float	write	input the standard solution value
2244	the second point standard solution value of electrode 1	float	read	
2246	electric voltage of the second point standard solution calibration of electrode 1	float	read	
2248	temperature of the second point standard solution calibration of electrode 1	float	float	
2250	third point calibration of electrode 1	float	write	input the standard solution value
2252	the third point standard solution value of electrode 1	float	float	
2254	electric voltage of the third point standard solution calibration of	float	read	

	electrode 1			
2256	temperature of the third point standard solution calibration of electrode 1	float	read	
2258	fourth point calibration of electrode 1	float	write	input the standard solution value
2260	the fourth point standard solution value of electrode 1	float	read	
2262	electric voltage of the fourth point standard solution calibration of electrode 1	float	read	
2264	temperature of the fourth point standard solution calibration of electrode 1	float	read	
2266	fifth point calibration of electrode 1	float	write	input the standard solution value
2268	the fifth point standard solution value of electrode 1	float	read	
2270	electric voltage of the fifth point standard solution calibration of electrode 1	float	read	
2272	temperature of the fifth point standard solution calibration of electrode 1	float	read	
18	value of electrode 2	float	read	command 03

2300	electrode voltage of electrode 2	float	read	
2302	factor of electrode 2	float	read/write	Default：1
2304	deviation of electrode 2	float	read/write	Default：0
2306	type of electrode 2	float	read/write	The types of electrode are represented by floating point number of 1, 2, 3, 4, 5, and 6. 1 represents ORP; 2 represents ammonia nitrogen; 3 represents Nitrate ion; 4 represents chloride ion; And 5 represents fluoride ion.
2308	calibration points of electrode 2	UINT16	read/write	Support the command of 06. The written values of 1, 2, 3, 4, and 5 respectively represent single point calibration to 5 point calibration.
2315	stability	float	read	Represents the stability of the electrode voltage (used during calibration, the value on 0.9 represents the stability)
2334	first point calibration of electrode 2	float	write	input the standard solution value
2336	the first point standard solution value of electrode 2	float	read	
2338	electric voltage of the first point standard solution	float	read	

	calibration of electrode 2			
2340	temperature of the first point standard solution calibration of electrode 2	float	read	
2342	second point calibration of electrode 2	float	write	input the standard solution value
2344	the second point standard solution value of electrode 2	float	read	
2346	electric voltage of the second point standard solution calibration of electrode 2	float	read	
2348	temperature of the second point standard solution calibration of electrode 2	float	float	
2350	third point calibration of electrode 2	float	write	input the standard solution value
2352	the third point standard solution value of electrode 2	float	float	
2354	electric voltage of the third point standard solution calibration of electrode 2	float	read	
2356	temperature of the third point standard solution calibration of electrode 2	float	read	
2358	fourth point calibration of	float	write	input the standard solution

	electrode 2			value
2360	the fourth point standard solution value of electrode 2	float	read	
2362	electric voltage of the fourth point standard solution calibration of electrode 2	float	read	
2364	temperature of the fourth point standard solution calibration of electrode 2	float	read	
2366	fifth point calibration of electrode 2	float	write	input the standard solution value
2368	the fifth point standard solution value of electrode 2	float	read	
2370	electric voltage of the fifth point standard solution calibration of electrode 2	float	read	
2372	temperature of the fifth point standard solution calibration of electrode 2	float	read	
20	value of electrode 3	float	read	command 03
2400	electrode voltage of electrode 3	float	read	
2402	factor of electrode 3	float	read/write	Default：1
2404	deviation of electrode 3	float	read/write	Default：0
2406	type of electrode 3	float	read/write	The types of electrode are

				represented by floating point number of 1, 2, 3, 4, 5, and 6. 1 represents ORP; 2 represents ammonia nitrogen; 3 represents Nitrate ion; 4 represents chloride ion; And 5 represents fluoride ion.
2408	calibration points of electrode 3	UINT16	read/write	Support the command of 06.The written values of 1, 2, 3, 4, and 5 respectively represent single point calibration to 5 point calibration.
2415	stability	float	read	Represents the stability of the electrode voltage (used during calibration, the value on 0.9 represents the stability)
2434	first point calibration of electrode 3	float	write	input the standard solution value
2436	the first point standard solution value of electrode 3	float	read	
2438	electric voltage of the first point standard solution calibration of electrode 3	float	read	
2440	temperature of the first point standard solution	float	read	

	calibration of electrode 3			
2442	second point calibration of electrode 3	float	write	input the standard solution value
2444	the second point standard solution value of electrode 3	float	read	
2446	electric voltage of the second point standard solution calibration of electrode 3	float	read	
2448	temperature of the second point standard solution calibration of electrode 3	float	float	
2450	third point calibration of electrode 3	float	write	input the standard solution value
2452	the third point standard solution value of electrode 3	float	float	
2454	electric voltage of the third point standard solution calibration of electrode 3	float	read	
2456	temperature of the third point standard solution calibration of electrode 3	float	read	
2458	fourth point calibration of electrode 3	float	write	input the standard solution value
2460	the fourth point standard solution value of	float	read	

	electrode 3			
2462	electric voltage of the fourth point standard solution calibration of electrode 3	float	read	
2464	temperature of the fourth point standard solution calibration of electrode 3	float	read	
2466	fifth point calibration of electrode 3	float	write	input the standard solution value
2468	the fifth point standard solution value of electrode 3	float	read	
2470	electric voltage of the fifth point standard solution calibration of electrode 3	float	read	
2472	temperature of the fifth point standard solution calibration of electrode 3	float	read	
22	value of electrode 4	float	read	command 03
2500	electrode voltage of electrode 4	float	read	
2502	factor of electrode 4	float	read/write	Default：1
2504	deviation of electrode 4	float	read/write	Default：0
2506	type of electrode 4	float	read/write	The types of electrode are represented by floating point number of 1, 2, 3, 4, 5, and 6. 1 represents ORP;

				2 represents ammonia nitrogen; 3 represents Nitrate ion; 4 represents chloride ion; And 5 represents fluoride ion.
2508	calibration points of electrode 4	UINT16	read/write	Support the command o06.The written values of 1, 2, 3, 4, and 5 respectively represent single point calibration to 5 point calibration.
2515	stability	float	read	Represents the stability of the electrode voltage (used during calibration, the value on 0.9 represents the stability)
2534	first point calibration of electrode 4	float	write	input the standard solution value
2536	the first point standard solution value of electrode 4	float	read	
2538	electric voltage of the first point standard solution calibration of electrode 4	float	read	
2540	temperature of the first point standard solution calibration of electrode 4	float	read	
2542	second point calibration of electrode 4	float	write	input the standard solution value
2544	the second point standard solution value of	float	read	

	electrode 4			
2546	electric voltage of the second point standard solution calibration of electrode 4	float	read	
2548	temperature of the second point standard solution calibration of electrode 4	float	float	
2550	third point calibration of electrode 4	float	write	input the standard solution value
2552	the third point standard solution value of electrode 4	float	float	
2554	electric voltage of the third point standard solution calibration of electrode 4	float	read	
2556	temperature of the third point standard solution calibration of electrode 4	float	read	
2558	fourth point calibration of electrode 4	float	write	input the standard solution value
2560	the fourth point standard solution value of electrode 4	float	read	
2562	electric voltage of the fourth point standard solution calibration of electrode 4	float	read	

2564	temperature of the fourth point standard solution calibration of electrode 4	float	read	
2566	fifth point calibration of electrode 4	float	write	input the standard solution value
2568	the fifth point standard solution value of electrode 4	float	read	
2570	electric voltage of the fifth point standard solution calibration of electrode 4	float	read	
2572	temperature of the fifth point standard solution calibration of electrode 4	float	read	

Note: electrode 1-4 channels, customers can choose to access, according to the access channel corresponding to the corresponding address.

Chapter 9 Problems and Solutions

	phenomenon	Possible factors	Method of exclusion
Conductivity	Display instability	A, there are bubbles in the pipeline	A, rectification of the pipeline or alternative measurement points
	Large reading	B, unstable water quality	B. Reasons for using a stable water source to remove the meter
Dissolved	Low test	Inappropriate flow rate	Install the conductivity cell at a

oxygen			suitable flow rate
pH	pH meter cannot be calibrated	Viscous substance attached to the fluorescent cap	Wipe with a soft, damp cloth
	Not allowed after calibration	Standard solution is not properly formulated or the electrode is damaged	
	Slow data response	Is the standard liquid contaminated?	According to the type of pollutants, it is cleaned according to the corresponding method. Slow winter is normal.
Turbidity	The data is very high	A, the front end of the probe lens has contaminants B, scraping the lens to block the front end of the probe	Cleaning the probe front lens