



Shandong Renke Control Technology Co.,Ltd.

# **Smart Aquaculture Solutions**

## **(Solar float installation)**

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## Chapter 1 Project Background

The overall goal of the intelligent aquaculture solution is to build an aquaculture online monitoring system based on intelligent sensing, wireless communication and other Internet of Things technologies, which integrates online collection of water quality and environmental parameters, wireless transmission, intelligent control, over-limit alarm and remote management.

**Specific construction goals are as follows:**

**1. Real-time monitoring of water quality:** Real-time online monitoring of water quality environment (PH, dissolved oxygen, ammonia nitrogen, turbidity, nitrite, etc.) to grasp the water quality conditions of the breeding area at any time and anywhere. The operation of equipment such as baiting machine, automatic feeding, water change, oxygenation, etc., to achieve remote automatic control of farming equipment, improve the efficiency of farming.

**2. Monitoring and Warning:** Through the system platform, the user can set the safety value of the monitored parameters domain, when the front-end sensors monitor a water quality parameters exceed the safety value, the system will send alarm information to notify the user, so as to timely processing, to ensure that the reservoir, reservoir water quality is good.

**3. Intelligent management of aquaculture:** Based on data mining and statistical analysis of IOT information, it provides decision support and statistical reporting capabilities to summarize experience and guide management of aquaculture for users.

## Chapter 2 Project Overview

### 2.1 Introduction of Aquaculture Monitoring System

The intelligent aquaculture monitoring system is mainly composed of **water quality online monitoring system - solar floating water quality monitoring station, intelligent control system, and integrated environmental monitoring cloud platform.**

The system is based on the core of water quality online monitoring system, through the configuration of a variety of water quality sensors real-time monitoring of the type of pollutants in the water body, the concentration of various pollutants and the trend of change. Through the water environment **PH, ammonia nitrogen, dissolved oxygen,**



**turbidity, nitrite, conductivity (salinity), ORP, COD, suspended solids, chlorophyll, blue-green algae, each ion (sodium ions, potassium ions, nitrate ions, chloride ions, calcium ions, ammonium ions, magnesium ions)** and other parameters for real-time monitoring, and the collected data through 4G signal wireless transmission to the environmental monitoring cloud platform for analysis, and send The data collected will be transmitted wirelessly via 4G signal to the environmental monitoring cloud platform for analysis, and control commands will be sent to the multi-functional control cabinet for remote automatic control of baiting machines, oxygenation pumps, water changers, ventilation and shading equipment to realize the refinement of aquaculture production, intelligent equipment, visualization of management and digital management for decision making to improve the efficiency of aquaculture.

The system adopts 4G wireless communication technology, which is simple to deploy, considerate in details and easy to expand. The monitoring software platform is also very user-friendly, with friendly interface, simple operation and comprehensive functions, which is convenient for users to invest in the project according to their own needs and investment budget, and will not cause wasteful duplication of investment.

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## 2.2 Aquaculture Monitoring System Topology Diagram



## 2.3 Advantages of Aquaculture Monitoring System

### ■ Concentration so professional

We have been focusing on the environmental monitoring industry for many years and strive to provide customers with the best and most cost-effective environmental monitoring products and solutions, and are a well-known manufacturer in the environmental monitoring industry. With a complete range of products and solutions, we supply 300+ regions and serve 110k+ customers worldwide.

### ■ Professional sensors , accurate monitoring

Water quality monitoring equipment in the program are high-precision sensors, measuring a wide range, high accuracy, to ensure excellent reliability, high precision and interchangeability of products. And water quality monitoring station with waterproof box, using expansion screws installed, greatly improving the overall protection capacity, can better protect the equipment, reduce the impact of other external factors, to ensure accurate monitoring results.

### ■ Multifunctional, on-demand configuration

Water quality online monitoring system through the configuration of different types of sensors to achieve the water environment **PH, ammonia nitrogen, dissolved oxygen, turbidity, nitrite, conductivity (salinity), ORP, COD, suspended solids, chlorophyll, blue-green algae, each ion (sodium ions, potassium ions, nitrate ions, chloride ions, calcium ions, ammonium ions, magnesium ions)** and other elements of monitoring, the user can be freely used as required to meet the needs of various occasions.

### ■ Intelligent Control

It supports **remote/local manual control, automatic control, timed control** and other control modes to remotely realize the baiting machine, oxygenation pump, water changer and other aquaculture machinery and equipment on/off control. It can meet the situation of unattended, also can timely control equipment, saving manpower.

### ■ 4G communication technology, easy networking

Unlike the traditional wired signal transmission, the system adopts 4G wireless output method to realize wireless connection between measurement points and gateways without wiring, avoiding problems such as massive cable laying, cable exposure and long communication lines, which provides the most effective monitoring means for centralized intelligent monitoring of multiple sites with wide distribution and large number of monitoring nodes.

### ■ Free cloud platform with powerful features

The platform adopts B/S architecture, which is simple to maintain and upgrade, and supports monitoring and management of at least 1000 collection devices. It adopts professional database, which is stable, reliable and easy to expand, supports software and hardware hierarchy, and supports multi-level user management authority. With multi-level alarm mode, support voice, SMS, e-mail and on-site sound and light alarm mode. Cloud platform automatically collects monitoring data uploaded by water quality monitoring stations, through GPS maps, lists, icons, curves in the way of the platform page end display, to meet the user's real-time monitoring information multi-dimensional, multi-level view data.

### ■ Simple to deploy, easy to maintain

The whole system integrates hardware and software design, low power consumption, highly integrated, long service life. The weather monitoring host and the transmitter are connected by waterproof pair of plugs, and the factory will weld the plugs and the corresponding connecting wires, so there is no complicated wiring process. The system uses solar power supply method to easily solve the problem of field power supply.

### ■ Unified management across regions



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Through the establishment of a unified monitoring and management station, a number of equipment and information distributed in different areas of centralized monitoring and management of all digital, to meet the needs of modern aquaculture unified supervision.

#### ■ Multiple management methods

The system can view data in real time through various ways such as web terminal, local terminal, WeChat public number, mobile APP, etc.

#### ■ With a wealth of automatic alarm mode

The system supports mobile, SMS, e-mail and other alarm methods, and has a variety of alarm methods can be selected to meet the needs of the majority of users.

#### ■ High integration of software and hardware products

Aquaculture online monitoring system software and hardware products according to the needs of industry development, keep pace with the times, constantly update the corresponding products, eliminate obsolete and redundant functions, and constantly integrate effective new functions, so that the product has a higher and higher degree of integration, to provide customers with more cost-effective products.

#### ■ Unique features to meet customer needs

The aquaculture online monitoring system integrates many practical functions with customer requirements, and can be customized according to customer needs. From the customer's point of view, it makes the application and maintenance as convenient and hassle-free as possible.

## Chapter 3 Solar Floating Water Quality Monitoring Station

Renke solar floating water quality monitoring station is used to monitor real-time changes in water quality and make corresponding early warning alerts monitoring instruments. It is mainly composed of three major parts: **monitoring system, power supply system and basic support.**



### 3.1 Monitoring System

The system is composed of waterproof data collector and water quality sensor, which is connected with waterproof plug-in cable to save the complicated wiring process for customers. Combined with the actual application of customers, in the design and development process to optimize each parameter, detection of a full range: **PH, dissolved oxygen, ammonia, nitrite, turbidity, ORP, COD, suspended solids, chlorophyll, blue-green algae, ions** and other elements, customers according to the needs of free to use with.

#### 3.1.1 Water quality PH monitoring

**Monitoring Meaning:** PH is one of the important indicators of water quality,

freshwater aquaculture PH is generally controlled between 6.5 ~ 9.0, the optimal PH range is 7 ~ 8. PH <6.5 can weaken the oxygen-carrying capacity of the blood of farmed fish and shrimp. Although the dissolved oxygen in the water is high, it can also lead to anoxic symptoms in fish and shrimp, often floating head, and stunted growth or disease. PH > 8 will make the water alkaline, resulting in ammonia poisoning of fish and shrimp. In addition, the PH in water changes in real time with the temperature of the water, and the temperature of the water changes with the atmosphere, so the measurement of PH in the water must use the electrode transmitter with automatic temperature compensation.

**Monitoring Content:** Real-time alarm for continuous monitoring of water quality PH and temperature in different areas of the aquaculture farm.

**Monitoring Effect:** By installing **water PH and temperature 2 in 1 sensor** in the important water area, we can monitor the PH of the water area. For different use environments, we have conventional composite electrode, flat desulfurization electrode, tetrafluorine electrode, electroplating electrode, glass electrode and antimony electrode for users to choose. The transmitter is connected to the weather monitoring host through RS485 intelligent interface and communication protocol, and the data is uploaded to the environmental monitoring cloud platform by 4G wireless transmission for real-time monitoring. When the PH and temperature values in any water exceed the set upper and lower thresholds, the system automatically triggers SMS, voice and email alarms to notify the management staff for emergency treatment.

**Monitoring Function:** Water PH, temperature 2 in 1 sensor is a device to measure solution PH value (hydrogen ion concentration index, acidity and alkalinity), with automatic temperature compensation function, and manual temperature compensation can be switched at will.



Equipment	Technical Parameter	
<b>Water quality PH, temperature 2 in 1 sensor Model: RS-PH-N01-3</b>	DC power supply (default): DC 7 ~ 30V	
	Max. power consumption:0.3W	
	Signal Output: Support RS-485, MODBUS/RTU Protocols.Communication baud rate default 4800 (1200、2400、4800、9600、19200、38400、57600、115200 Available)	
	Detection principle: The reference solution in the electrode glass bubble is influenced by the pH of the measured solution so that the electrode produces an electric potential (voltage), the magnitude of the electric potential responds to the pH of the measured solution.	
	PH	Measurement Range: 0 ~ 14PH



**Electrode calibration instructions:** Our PH transmitter electrode is equipped with two different PH standard buffer solution, if measuring acidic solution, use the standard buffer solution of 4.01 and 6.86; if measuring alkaline solution, use the standard buffer solution of 6.86 and 9.18. If measuring acidic solution, use the standard buffer solution of 4.01 and 6.86; if measuring alkaline solution, use the standard buffer solution of 6.86 and 9.18. For general purpose situations, standard buffers of 4.01 and 9.18 are used.

**Maintenance and cleaning:** The equipment itself generally does not require routine maintenance.

**Caution:** (1) When the PH electrode is not in use, it should be placed in a protective cover with potassium chloride solution, which is used to keep the electrode activated and prevent the glass bulb from being damaged.

(2) The air bubbles in the glass bulb of the electrode should be shaken off before measurement, otherwise it will affect the measurement. The glass

bulb at the front of the PH electrode should not be in contact with hard objects, and any breakage or wiping of the hair will make the electrode fail.

(3) The electrode should be cleaned with deionized water (clean water) before and after measurement, and the sensor should be cleaned with a wet soft cloth to ensure accuracy.

### 3.1.2 Dissolved oxygen monitoring

**Monitoring Objects:** Oxygen is not only necessary for our survival, but also the basis for the survival of fish, shrimp and shellfish in the water.


Dissolved oxygen (DO) is the amount of oxygen dissolved in water. Generally speaking, the dissolved oxygen in the culture water should be maintained at 5~8mg/L, and at least 4 mg/L should be maintained. When the dissolved oxygen level is lower than 4 mg/L, the growth will be slowed down, easy to develop diseases, and the heavy head floating death. Of course, the higher the dissolved oxygen level is, the better, when the dissolved oxygen level reaches 14.4 mg/L, it will cause the fish to produce bubble disease. Therefore, the appropriate amount of dissolved oxygen is essential for the growth and survival of aquaculture fish.

**Monitoring content:** Monitoring and alarming of dissolved oxygen saturation, concentration and temperature of water in different areas of the aquaculture farm.

**Monitoring effect:** Through the installation of water quality dissolved oxygen saturation, concentration, temperature 3 in 1 transmitter in important waters to achieve monitoring of water dissolved oxygen saturation, concentration, temperature, membrane head using the fluorescence method of measurement principle, no oxygen consumption, no electrolyte, no calibration, fast response time, stable measurement results, no requirements for the flow, no interference, reduce the frequency of cleaning, low maintenance, divided into seawater models and freshwater models, two types, the user can choose. Users can choose according to their needs. Transmitter through RS485 intelligent interface and communication protocol to access the weather monitoring host, by 4G wireless transmission will upload data to the environmental monitoring cloud platform for real-time monitoring. When the dissolved oxygen saturation, concentration, temperature in any water exceeds the set upper and lower thresholds, the system automatically triggers SMS, voice, e-mail alarms to notify the management of emergency treatment.

**Monitoring function:** Water dissolved oxygen saturation, concentration, temperature

3 in 1 sensor has the advantages of no pollution, long life, good stability, low maintenance difficulties. Water dissolved oxygen measurement probe unique optical detection method, can effectively measure the molecular state of dissolved oxygen in water, and can eliminate the PH value fluctuations in the water, ammonia and other chemicals or heavy metals interference, so as to provide more stable and accurate measurement results in a longer period of time.

Equipment	Technical Parameter	
<b>Water quality dissolved oxygen saturation, concentration Degree and temperature three-in-one transmitter Model: RS-LDO-N01</b>	DC power supply (default): DC10 ~ 30V	
	Power Consumption: 0.2W	
	Signal output: support RS 485, MODBUS/RTU protocol	
	Dissolved oxygen membrane head detection principle: It adopts the measurement principle of fluorescence method, does not consume oxygen, and does not need electrolyte.	
	Dissolved oxygen	Range: 0~20 mg/L; 0~200% Measurement error: $\pm 3\%$ FS Resolution: 0.01mg/L; 0.1%
	Temperature	Measuring range: 0°C ~ 60°C Measurement error: $\pm 0.5^\circ\text{C}$ (25°C) Resolution: 0.1°C
	Equipment working temperature: 0~ 40°C	
	Response time: $\leq 60\text{sec}$	
	Electrode wire length: default 5m (10m, 15m, 20m can be customized)	
	Protection class: IP68	
	Use cycle: about one year, after aging, replace the new electrode in time.	

**Maintenance and cleaning:**(1) For the external surface of the device, you can clean it with tap water, wipe it with a moist soft cloth, for some stubborn dirt, you can add some household detergent to the tap water to clean it.

(2) For the outer surface of the fluorescent cap, use water to rinse the dirt on the sensor window; if you need to wipe, use a soft cloth to gently wipe, do not

scrape hard to prevent damage to the fluorescent film, resulting in inaccurate measurement settings can not be measured.

(3) If there is dust or water vapor inside the fluorescent cap, turn off the fluorescent cap and rinse the inner surface of the fluorescent cap and the optical glass window of the device with tap water; if there is dirt containing oil and grease, use tap water mixed with household detergent to clean it, then rinse the detergent and dry all the cleaned surfaces with a lint-free soft cloth, then put it in a dry place to make the water evaporate completely.

- Caution:** (1) The front of the device should avoid collision or scratching of the fluorescent film, any damage will lead to a decrease in measurement accuracy or even unusable.
- (2) Avoid using in organic solvents, avoid using organic solvents to clean the fluorescent cap.
- (3) When installing the equipment, try to avoid too tight or stress on the cable.

### 3.1.3 Ammonia nitrogen monitoring

**Monitoring Meaning:** Ammonia nitrogen is the nitrogen present in water in the form of free ammonia ( $\text{NH}_3$ ) and ammonium ions ( $\text{NH}_4^+$ ). China's fishery The total ammonia nitrogen content should not exceed 0.2 mg/L, when the water body ammonia nitrogen is greater than 0.2 mg/L, will lead to eutrophication of the water body. Molecular ammonia concentration reaches 0.2-0.5mg/L, it is mildly toxic to fish, making its body surface mucus increased, bleeding, loss of appetite, the concentration of molecular ammonia for a long time more than 0.5mg / L, will affect the growth and reproduction of fish and shrimp, the seriousness of the poisoning to death.

**Monitoring content:** As the content of toxic molecules in the water body is directly related to the PH value and water temperature, the higher the water temperature, the higher the PH value, the more toxic the water body. So for the long-term monitoring of ammonia, PH, temperature in different areas of the farm water real-time alarm.

**Monitoring effect:** By installing ammonia nitrogen, PH and temperature 3 in 1 sensors in the important water area, we can monitor ammonia nitrogen, PH and temperature in the water. The sensor is connected to the weather monitoring host through RS485 intelligent interface and communication protocol, and the data will be uploaded to the environment monitoring cloud platform by 4G wireless transmission for real-time monitoring. When the

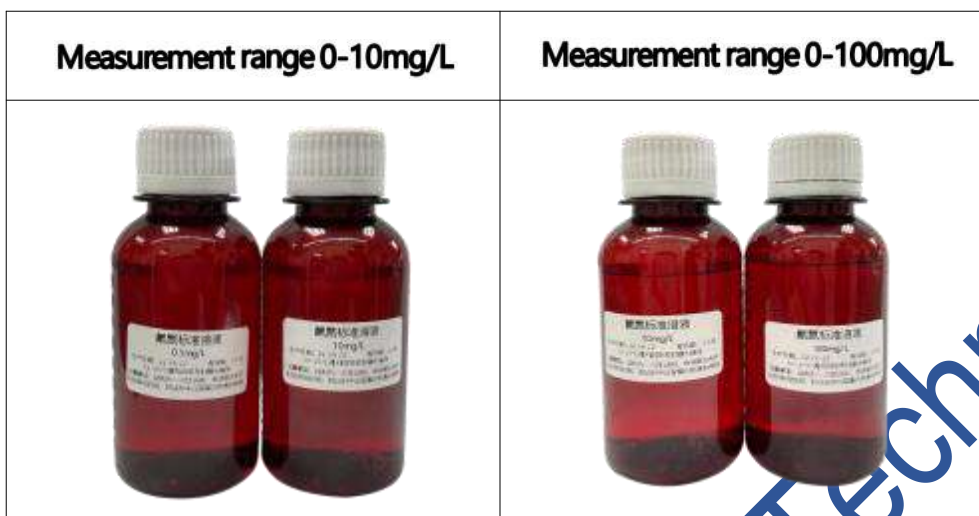
value of ammonia, PH and temperature in any water exceeds the set upper and lower thresholds, the system automatically triggers SMS, voice and email alarms to notify the management personnel for emergency treatment.

**Monitoring function:** The Ammonia, PH, and Temperature 3 in 1 sensor is a device that measures the concentration of ammonia in the water body [as free ammonia (NH<sub>3</sub>) and ammonium ions (NH<sub>4</sub><sup>+</sup>)]. It can automatically compensate for temperature and PH and is suitable for high accuracy measurement in various environments. It can be installed directly into the device, compared with the traditional ammonia nitrogen analyzer It is more economical and convenient than traditional ammonia analyzer.

Equipment	Technical Parameter	
<b>Ammonia nitrogen, PH, temperature 3 in 1 sensor</b>  <b>Model: RS-NHN-N01-3-*</b>	DC power supply (default) : DC 10 ~ 30V	
	Max. power consumption: 0.3W	
	Signal Output: Support RS-485,MODBUS/RTU Protocols	
	Ammonia nitrogen	Range: 0-10mg/L, Resolution: 0.01mg/L Error: ±3%FS
	PH	Measurement Range: 0 ~ 14PH, Resolution: 0.01PH Error: ±0.15PH
	Temp	Measurement Range: -20 ~ 80℃, Resolution: 0.1℃ Error: ±0.2℃
	Working conditions: 0~50℃; <0.2MPa	
	Response time: <30S	
	Protection level: IP68	
	Service life: Use the electrode for 1 year or longer, and replace the electrode with a new one after aging.	
	Electrode wire length : Default 5m (10m、15m、20m Customization )	

**Electrode calibration instructions:** Our ammonia nitrogen transmitter electrode is equipped with different standard solutions according to two different ranges. If the equipment range is 0-10mg/L, two standard solutions of 0.1mg/L and 10mg/L will be configured; if the range is 0-100mg/L, two standard solutions of 10mg/L and 100mg/L

will be configured.



**Maintenance and cleaning:** Just scrub with a damp soft cloth when cleaning the equipment.

- Caution:**
- (1) Long period of time without the use of ammonia nitrogen transmitter in the measurement before, need to be soaked to activate the process.
  - (2) Be sure to fully clean the sensor before testing after activation, soak the front of the sensor in deionized water for 5 minutes and stir the water solution.
  - (3) Before measuring ammonia nitrogen transmitters that have not been used for a short period of time, soak them in deionized water to prevent measurement errors.
  - (4) After using the sensor, please rinse the sensor head with clean water and cover it with a protective cap.
  - (5) Before using the equipment need to test the front of the ammonia nitrogen transmitter whether there are bubbles, if there is no bubble normal use, if there are bubbles need to shake down the sensor to remove the bubbles.
  - (6) Ammonia nitrogen transmitter should not be used in a more corrosive liquid environment, to avoid irreversible damage to the sensor. irreversible damage to the sensor.

### 3.1.4 Nitrite monitoring

**Monitoring meaning:** Aquaculture nitrite standard requires less than 0.1ppm. When the content of nitrite > 0.1ppm will The fish, shrimp and crab in the water body will show symptoms of hypoxia. Such as reduced feeding, breathing difficulties, slow swimming, physical decline, gill damage and blackening, and even "swimming pond", "floating head", "stealing death", "bottom up" and other phenomena.

**Monitoring content:** For online monitoring of nitrite ions in water in aquaculture sites with real-time alarms.

**Monitoring effect:** By installing **nitrite ion sensors** in important area of water to monitor the nitrite ion in water environment, the data will be uploaded to the environment monitoring cloud platform by 4G wireless transmission through RS485 intelligent interface and communication protocol to the weather monitoring host for real-time monitoring. When any value in a certain water exceeds The system automatically triggers SMS, voice and email alarms when any value in a certain water exceeds the standard, and notifies the management personnel to deal with it urgently.

Equipment	Technical Parameter
<p><b>Nitrite ion sensor</b></p> <p><b>Mode: IRS-LNO2-N01-*</b></p>	Slope: 56 ± 3mv
	Repeatability: ± 2%
	Interference: Acetate, fluoride ion, chloride ion, nitrate, sulfate, etc.
	Temperature range: 0-50°C
	Pressure range: 0-2 atm
	Response speed: 90% response in 30 seconds
	Measurement range: 0.2ppm –2200ppm
	PH range: 1.1-1.7
	Output resistance: 20-50MΩ
	Temperature compensation: 10k/22k/PT1000/PT100 optional
	Material: PMMA+PVC

**Maintenance and cleaning:** with diluted nitrogen oxide standard solution, optimal PH range: PH 4.5 - PH 8.

**Storage:** Long-term: keep in dry; short-term: keep in nitrogen oxide solution.

### 3.1.5 ORP Monitoring

**Monitoring meaning:** ORP indicates the redox potential of the solution, which cannot


independently judge the quality of water, but can be integrated with other water quality indicators to reflect the ecological environment in the aquarium system. In the process of aquaculture, the increase of reducing substances such as bait, feces and organic sludge in the bottom of the pool will lead to the potential being pulled down, making the water body show reduction. When the redox potential environment is  $-200\sim-250\text{mV}$ , there will be a large amount of  $\text{NH}_3$ ,  $\text{H}_2\text{S}$ ,  $\text{NO}_2$  and other reducing substances. When the redox potential environment is  $-300\sim-400\text{mV}$ , the substrate is in extreme anoxic condition, and the specialized anaerobic methane-producing bacteria start to decompose the organic matter in the substrate to produce methane. These toxic and harmful substances accumulate in the fish body, leading to the death of aquaculture products in large quantities. Therefore, in aquaculture, it is necessary to avoid the reduction of water quality is too low.

**Monitoring content:** Real-time alarm for online monitoring of redox potential of water in different areas of the farm, timely response Pond water quality substrate and disease bacteria.

**Monitoring effect:** Through the installation of water quality ORP transmitter head in important waters to achieve monitoring of the water body redox potential, the transmitter through the RS485 intelligent interface and communication protocol to access the weather monitoring host, by 4G wireless transmission to upload data to the environmental monitoring cloud platform for real-time monitoring. When the ORP value exceeds the standard in a certain water body, the system automatically triggers SMS, voice and email alarms to notify the management staff for emergency treatment.

**Monitoring function:** The ORP sensor is a device that measures the redox potential of a solution using a high-purity platinum ORP electrode. ORP composite electrode made of high-purity platinum, with strong resistance to acid and alkali and oxidation resistance, high measurement accuracy, fast response, good stability, the electrode can be automatically compensated according to the temperature.



Equipment	Technical Parameter	
<p><b>ORP Sensor</b></p> <p><b>Model: RS-ORP -N01-*</b></p> 	DC power supply (default): DC 10 ~ 30V	
	Max. power consumption: 0.6W	
	Signal Output: Support RS-485,MODBUS/RTU Protocols	
	ORP	Measuring range: -1999 ~ 1999mV
		Measurement error: ±1mV
		Resolution: 1mV
	ORP electrode working temperature: 0 ~ 80℃	
	ORP electrode withstand voltage: 0.6MPA	
	Equipment working conditions: Environment temperature: 0 ~ 60℃; Relative humidity: <85%	
	Protection level: IP68	
Electrode service life: About 1 year, after aging, should be replaced by new electrodes		
Electrode wire length: Default 5m(10m, 15m,20m Customizable)		

**Maintenance and cleaning:** The equipment itself generally does not require routine maintenance.

- Caution:**
- (1) The protection bottle at the front of the electrode has an appropriate amount of soaking solution, in which the electrode head is immersed, in order to ensure the activation of the platinum sheet and the liquid junction.
  - (2) Before measurement, the air bubbles in the glass bubble of the electrode should be shaken off, otherwise it will affect the measurement, the glass bulb at the front of the electrode should not be in contact with hard objects, any breakage and wiping hair will make the electrode fail.
  - (3) Deionized water (clean water) should be used to clean the electrode before and after measurement, and a wet soft cloth can be used to clean the sensor to ensure accuracy.
  - (4) In general, the ORP electrode does not need to be calibrated and can

be used directly.

(5) Electrode contamination or liquid junction blockage, will also make the electrode passivation, then, according to the nature of the contaminants, with the appropriate solution to clean.


### 3.1.6 Water conductivity (salinity) monitoring

**Monitoring meaning:** Water conductivity is a numerical representation of the ability of a solution to conduct an electric current, and is often used to indicate the purity of water. The conductivity value is generally used to understand the salinity of the water, and in general, the higher the conductivity, the higher the salinity and the higher the TDS. For most freshwater fish, a salinity of 2-3 g/L is the optimal salinity to maintain the osmotic pressure in the body and maintain the metabolism of the organism. However, excessive salinity can lead to disruption of fish body functions and significant changes in osmotic pressure, resulting in direct fish mortality.

**Monitoring content:** Real-time alarms for continuous monitoring of electrical conductivity (EC), temperature, salinity and TDS of water in different areas of the aquaculture farm.

**Monitoring effect:** By installing the water conductivity, temperature, salinity, TDS 4 in 1 sensor in the important water area, the water conductivity, temperature, salinity, TDS can be monitored. Conductivity, temperature, salinity, TDS monitoring, for different environments, we have stainless steel electrodes, plastic electrodes for the user to choose. The transmitter is connected to the weather monitoring host through RS485 intelligent interface and communication protocol, and the data is uploaded to the environmental monitoring cloud platform by 4G wireless transmission for real-time monitoring. When the conductivity, temperature, salinity, TDS value in any water exceeds the set upper and lower thresholds, the system automatically triggers SMS, voice, email alarms to notify the management of emergency treatment.

**Monitoring function:** Water conductivity, temperature, salinity, TDS 4 in 1 transmitter is a device that measures the conductivity value of a solution.

Equipment	Technical Parameter		
<p><b>Water conductivity, temperature, Salinity, TDS 4-in-1 Sensor</b></p> <p><b>Model: RS-EC-N01-3</b></p> 	DC power supply (default): DC 7 ~ 30V		
	Max. power consumption: 0.4W		
	Signal Output: Support RS-485, MODBUS/RTU Protocols		
	Measurement principle: The measured value of the EC of the solution is calculated from the magnitude of the resistance		
	EC	Range	Electrode constants K=1: 1 ~ 2000 $\mu$ s/cm Resolution: 0.1 $\mu$ s/cm Electrode constant K=10: 10 ~ 20000 $\mu$ s/cm Resolution: 1 $\mu$ s/cm
	Error: $\pm$ 1%FS		
	Temp	Measurement Range: -20~60 $^{\circ}$ C	
	Resolution: 0.1 $^{\circ}$ C		
	Compensation range: -20~60 $^{\circ}$ C (Default25 $^{\circ}$ C)		
	Compensation range: Default 0.02		
	Salinity	Measurement Range: 0~11476ppm	
	TDS	Measurement Range: 0~13400ppm	
	Equipment working conditions: Environmental temperature: -20 ~ +60 $^{\circ}$ C , Relative humidity: <85%		
Electrode wire length: Default 5m (10m,15m,20m Customizable)			
Conductivity electrode protection leve: IP68			
Electrode service life: 1 year			

**Description of electrode calibration:** Conductivity is equipped with different standard solutions according to two different ranges. The range 2000 is equipped with a standard solution of 1413; the range 20000 is equipped with a standard solution of 12880.

Range: 1-2000

Range: 10-20000



**Maintenance and cleaning:** The equipment generally does not require routine maintenance.

**Caution:** (1) In principle, the electrode should be calibrated before each measurement, and the electrode should be calibrated periodically for long-term use.  
(2) If the electrode is not used for a long time, it can be stored in a dry place, but it must be put (stored) in distilled water for several hours to activate the electrode before use, and the electrode can be put (stored) in distilled water for frequent use.  
(3) The electrode can be cleaned with warm water containing detergent to clean the organic components on the electrode stain, but also can be cleaned with alcohol.  
(4) Calcium and magnesium precipitates are best cleaned with 10 % citric acid.  
(5) Cleaning of electrode plates or poles should only be done chemically or by shaking in water. Be careful not to wipe the electrode tabs or poles, otherwise the plating (platinum black) on the electrode surface will be damaged.

### 3.1.7 Other water quality elements monitoring

**Monitoring content:** On-line monitoring of turbidity, COD, suspended solids, chlorophyll, blue-green algae, ions (sodium, potassium, nitrate, chloride, calcium, ammonium, magnesium) in water with real-time alarms

**Monitoring effect:** By installing water quality sensors in important water areas to monitor the water environment, the sensors are connected to the weather monitoring host by RS485 intelligent interface and communication protocol,

and the data is uploaded to the environmental monitoring cloud platform via 4G wireless transmission for real-time monitoring. When any value in one of the waters exceeds the standard, the system automatically triggers SMS, voice, e-mail alarms, notify the management of emergency treatment.

### 3.1.8 Weather monitoring host

Weather monitoring host (Model: RS-QXZ-M-Y) with 1-channel ModBus-RTU master interface, which can connect each water quality sensor (water temperature, water level, turbidity, conductivity, PH, ammonia, dissolved oxygen, COD, ORP, ion) to the host through 485 bus, and it can also upload each water quality data to the cloud platform or customer's own in real time through 4G signal.



#### 3.1.8.1 Technical Parameter

Parameter Name	Range or Interface	Description
Data upload communication interface	RJ45 Network port	Upload data via network port
	GPRS Wireless	Upload data via GPRS
Data acquisition communication interface	GSM SMS	Support SMS alarm
	ModBus-RTU Slave Interface	Supports external devices to interrogate the data in the monitoring host via ModBus-RTU protocol.
LED display interface	LED display interface	Support monochrome LED displays with a maximum dot matrix of 1024*256.

1 channel DC voltage acquisition	Acquisition range 0-100V	Acquisition accuracy $\pm 0.1V$ , input resistance $\geq 100K$ Monitoring host can set the conversion factor
3-channel 4-20mA Current Signal Acquisition Signal Acquisition	4-20mA current signal acquisition	Acquisition resolution 3000; input resistance $\leq 120 \Omega$ Monitoring host can set the conversion factor
1 channel water leak detection signal	Water leak detection available	Standard with leakage electrode, user can also choose the leakage rope, up to 30 m.
4 switch signal inputs	Dry contact on/off status can be detected	External passive dry contact , response time $\leq 0.2S$
2 relay outputs	Relay dry contact output	Relay capacity: 250VAC/30VDC 5A This relay can be associated to the upper and lower limits of any channel for alarm or automatic control.
1 channel tipping bucket rain gauge pulse impulse signal input	Collecting magnetic switch pulse signal for rainfall measurement	Default pulse equivalent: 0.2mm It can upload instantaneous rainfall (last minute), current rainfall ( today 00:00 to current), yesterday's rainfall (yesterday 00:00-24:00) and permanent cumulative rainfall value (the fourth switch is used as rain gauge input by default).
Data upload interval	1S~10000S	Data upload interval 1S~10000S can be set.
Built-in storage capacity	520,000	Built-in storage for up to 520,000 records
Power supply	External power supply	Supply voltage 24V

### 3.1.8.2 Function features

- 1 ModBus-RTU master interface can access all 485 water quality sensors in the system.
- 1 ModBus-RTU slave interface, which can be externally connected to the user's own monitoring host, PLC, configuration screen or configuration software.
- 1 channel 0-100V DC voltage and 3 channels 4-20mA current signals can be collected, and the conversion coefficient can be set on the monitoring host.
- 4 switching signal acquisition, the 4th of which can be used as an external tipping bucket rain gauge.
- With 1 channel water leakage detection, external water leakage electrode or rope, up

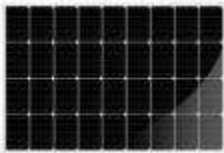

to 30 m.


- 2 relay outputs can be associated with any of the signal acquisition for alarm or automatic control.
- 1 RJ45 network port which can upload the weather monitoring data to the remote monitoring software platform.
- 1 channel multi-functional GPRS communication interface, simply insert a mobile card to upload data to the remote monitoring software platform.
- Powerful offline SMS alarm function , the alarm content can be customized.
- Large LCD display, simple and friendly interface.
- Built-in data storage, which can store 520,000 records, is automatically stored by the device when communication fails, and the stored data can be uploaded after communication is restored.
- External 1 channel outdoor LED monochrome display can be connected, supporting a maximum dot matrix of 1024\*256.
- External 24V DC power supply can also be used if solar panels are not used.
- The unique 8-digit address of the device makes it easy to manage and identify, and can be used with a variety of software platforms provided by our company.

### 3.2 Solar Power System

The system is equipped with solar power supply system to solve the inconvenience of power supply on site. The small size and light weight of the 20Ah lithium battery with high energy density is used as the energy source to ensure the power supply of the system to reduce the weight, which is conducive to the equipment to carry more sensors, and the overall center of gravity down to improve the anti-tipping ability, with the 30W solar panel, so that even in continuous rainy weather, it can last up to 3 days, without worrying about the weather. No need to worry about weather-related interruptions in data monitoring.

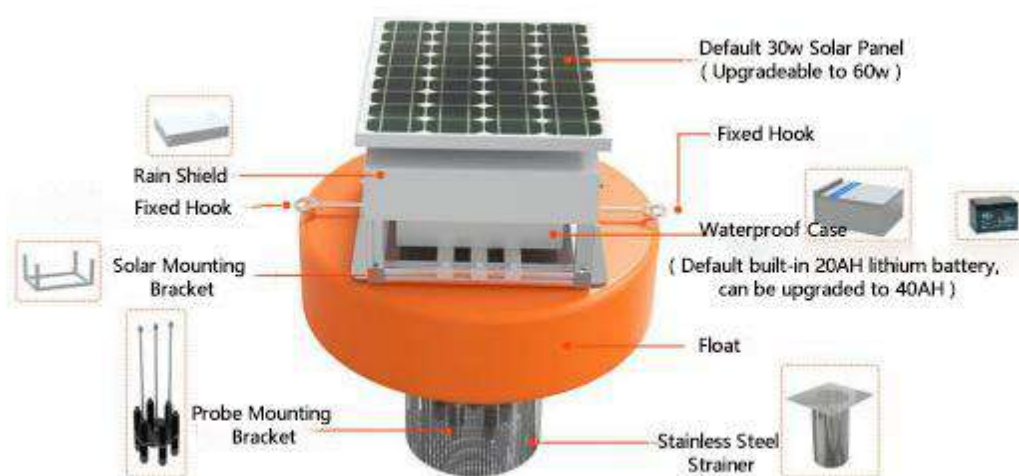
We offer two solar power scales for customers to choose from, as follows:




	<b>Program I</b>	<b>Program II</b>
	30W Solar panels	60W Solar panels
	20AH Lithium Battery	45AH Lithium Battery

	Solar Powered Converter	Solar Powered Converter
Function	3 days of continuous rainy days	7 days of continuous rainy days


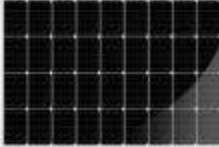


### 3.3 Basic support

Solar floating water quality monitoring station basic support consists of floating, stainless steel screen, probe mounting bracket, solar mounting bracket, waterproof box, rain cover.



	<b>Float:</b> It is used to fix and place the monitoring equipment in the water and plays the main supporting role.
	<b>Stainless steel screen:</b> It is fixed with the float and is equivalent to a "shield" on the periphery of the probe, avoiding hard contact between objects in the water and the probe, blocking a certain amount of impurities, reducing the pollution of the probe and ensuring the accuracy of the probe measurement.
	<b>Probe mounting bracket:</b> It is used to fix the probe, one mounting bracket can put four probes, and two reserved holes. Up to 8 probes can be connected according to user requirements.



	<p><b>Solar mounting bracket:</b> Used to fix solar panel and waterproof box.</p>
	<p><b>Solar panel:</b> The panel is placed horizontally, which can absorb sunlight comprehensively and improve solar energy utilization.</p>
	<p><b>Waterproof Box:</b> The interior is used to place data collectors, signal converters, batteries and other equipment.</p>
	<p><b>Rain Shield:</b> The main role is to block the rain, protect the waterproof box equipment inside and support the solar panels.</p>

## Chapter 4 Smart Control System

The monitoring software analyzes the monitored data intelligently and controls the operation of oxygenators, water changers, baiting machines and other equipment at relevant nodes through the IOT multi-functional control cabinet by sending wireless control commands according to the preset conditions of different stages of breeding to achieve automatic feeding, water changing, oxygenation, etc. and reduce breeding costs and realize fine and intelligent breeding.

The system supports local/remote manual control, automatic control, timed control and other control modes to remotely realize the breeding machinery and equipment on/off control, saving labor and reducing operating costs.


### 4.1 IOT multifunctional control cabinet

**IOT multi-functional control cabinet (Model: RS-MC\*-4G)** is a controller with integrated multiple relays. It is equipped with a 7 inch touch screen on the local side, and the multiple switch outputs can be used for instant control of various occasions, and can control devices less than 10A/250VAC/30VDC. Default 8 relay outputs, which can be expanded up to 16 relay outputs.

The equipment can be connected to the site of the **oxygen pump, baiting machine, water change machine** and other aquaculture machinery and equipment to achieve **manual, automatic, timing control** of various types of equipment, greatly reducing

the amount of construction, reduce construction costs and maintenance costs, and improve the efficiency of aquaculture.

## 4.2 Technical Parameter

Equipment	Technical Parameter	
<b>Multifunctional control cabinet</b>  <b>Model: RS-MC-*-4G</b>  	Supply voltage: 220VAC, 50HZ	
	Power consumption: 20W	
	Communication mode: 4G	
	Working Environment	Working temperature: -10℃~+50℃
		Working humidity: 10%RH~85%RH
	Relay with load capacity: 30V/10A-DC, 255V/10A-AC	
	Equipment size: 360*300*125 (Unit: mm)	
Installation method: wall mounted		

## 4.3 Function Features

■ **Local LCD touch screen manual control:** The equipment has a 7" touch screen for the breeder to view/modify the working status of each relay in real time. When a node of the relay (oxygenation pump, circulation pump, etc.) is changed to the active state, the oxygenation pump, circulation pump, etc. will start to run; when it is changed to the off state, the equipment will automatically stop running.

■ **Remote manual control:** You can manually operate the relay related nodes via PC or mobile APP. When the relay node (oxygenation pump, circulation pump, etc.) is changed to the active state, the oxygenation pump, circulation pump will start to operate; when it is changed to the disconnected state, the equipment will stop automatically.

■ **Automatic control:** The upper and lower limits of each water quality monitoring element (PH, dissolved oxygen, ammonia nitrogen, nitrite, etc.) can be set in advance in the monitoring software platform. When the water oxygen content, PH, reduction is lower than the lower limit, PH, ammonia nitrogen, nitrite and other toxic substances content is higher than the upper limit, the system will

automatically alarm and close the relay to open the oxygen pump oxygenation, water pump for water, when any water quality indicators are normal, automatically disconnect the relay.

- Timed control: By adding a relay to a certain equipment node (such as baiting machine) sucking or disconnecting the time point, support the addition of multiple time points to achieve automatic feeding at regular intervals, to achieve scientific breeding. Combined with the water quality monitoring parameters, farmers can make timely adjustments to avoid overfeeding, reduce the waste of feed and water pollution.
- Upload data via 4G to reduce construction and maintenance costs.
- Simple and easy configuration of device parameters via software.
- Automatic disconnection relay after power failure.
- Support a variety of free software platforms provided by our company, users can also develop their own platform.
- Ac 220V power supply, can work in outdoor all year round.

## Chapter 5 Integrated Environmental Monitoring Cloud Platform

### 5.1 Overview

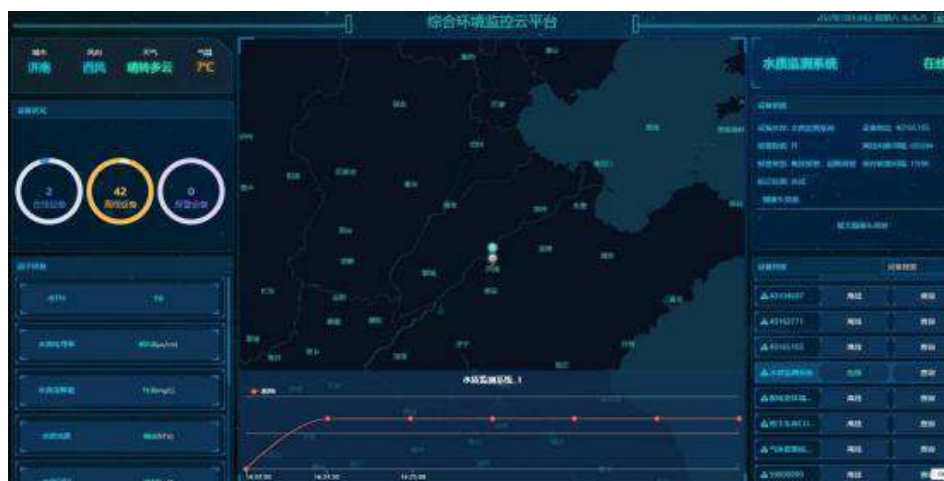
The integrated environmental monitoring cloud platform ([www.0531yun.com](http://www.0531yun.com)) is based on advanced information collection system, Internet of Things, cloud platform, big data and Internet and other information technology, users at all levels can access the platform data through various channels such as WEB on PC, APP client and WeChat terminal to realize remote system management functions. Users can monitor and manage each important parameter of the project in real time, and realize remote manual, automatic and regular control based on the platform.



## 5.2 Function Introduction

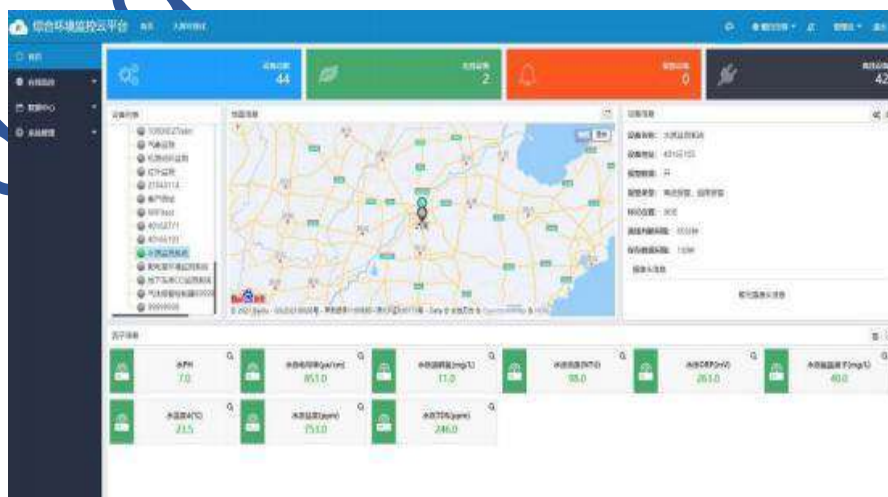
### 5.2.1 Large screen visualization

It can be displayed on the screen, automatically refreshed, scrolling all equipment information, clear and intuitive data, easy for the administrator to view the system.



### 5.2.2 Real time data monitoring

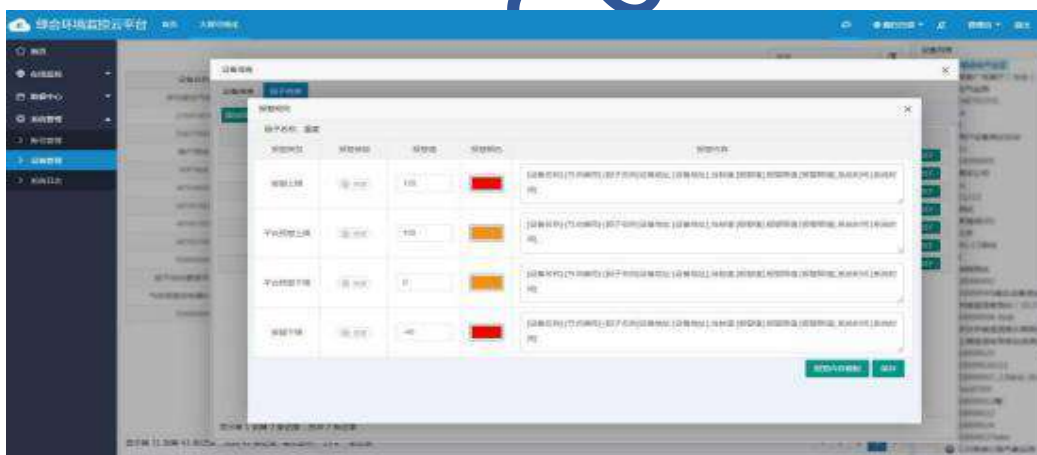
The platform supports real-time viewing of the measured water environment data. Data can be reflected through a graphical interface, a list, etc. The advantage of the graphical interface is to allow users to visualize the data and the relative position of the sensors, and the list is more convenient for users to compare the data.





### 5.2.3 Over limit alarm

When any factor exceeds the preset alarm value and the device is offline, the system can provide alarm methods such as platform interface alarm, SMS alarm, telephone alarm, email alarm, etc., and record the event for calling and analysis.



It supports upper and lower alarm limits for all monitoring factors, upper and lower warning limit settings, abnormal font color change for factor data, and user-definable color for factor alarm data.

There is a special alarm contact management list for SMS, ringing, WeChat and email alarm methods, which is easy to quickly check, add and delete when the alarm contact changes.



### 5.2.6 Relay Control

It supports remote manual control of field device relays on PC and APP terminals, and the relay names can be customized and edited, and whether the corresponding relay control function is enabled or not can be edited by customers.



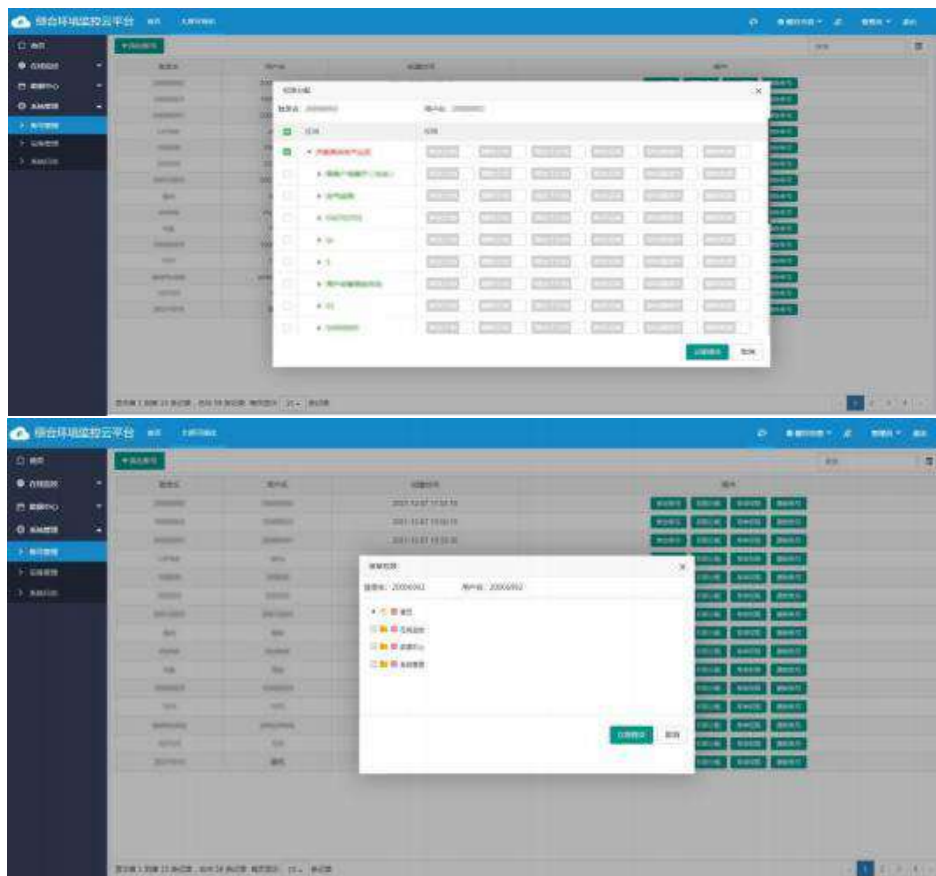
### 5.2.7 Mobile APP

For the convenience of mobile users to monitor data, the "Cloud Control" mobile APP is launched to facilitate users to monitor 24 hours a day in real time. You can login to the cloud platform through the account password and control thousands of devices with one click. It supports video view, equipment failure/abnormality alarm, offline alarm function, real-time data view, historical data curve view, and Bluetooth printer connection for data printing.









### 5.2.10 Equipment Management

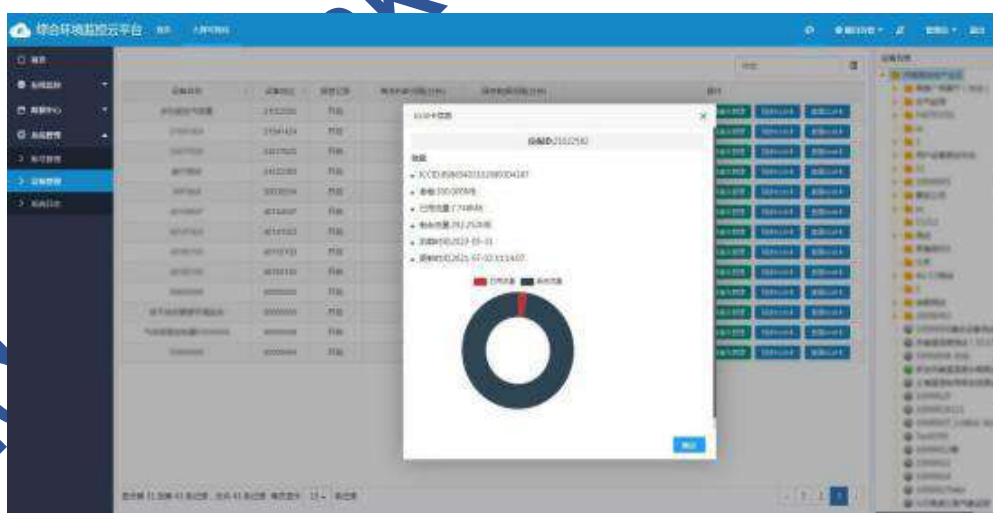
Node, alarm, and storage can be set for the device.

Name	Description
Equipment Name	Fill in the device name , the default name is the device address
Equipment Address	Displays the device address, which cannot be changed
Equipment latitude and longitude	Write the latitude and longitude of the device to view the location of the device in the map. (Note: If the device comes with latitude and longitude information, you can not fill in here).
Alarm Record	Turn on alarm logging, when the device alarms, alarm information will be recorded in the database, turn off alarm logging, then alarm logging cannot be queried.
Off-line SMS	Enable offline SMS, when the device is offline will send alarm SMS to the bound Mobile phone number.

Off-line Email	Enable offline email, when the device is offline, it will send alarm email to the bound mailbox.
Off-line judgment interval	Set the device offline time, and when the device comes back online within the set time, the platform will default recognizes that the device is not offline.
SMS alarm interval	When the device alarms in the platform, the alarm message is sent at the set interval SMS, the minimum time setting is 5 minutes.
Email alert interval	When the device alarms in the platform, the alarm information is sent at the set time interval email.
Save data interval	Set the time interval to save the device data.
Max. number of SMS messages sent	Prevent the device from exceeding the limit for too long, keep sending alarm SMS, can set the maximum The maximum number of SMS messages can be set.
Node List	Device node settings, see Node Information Settings for details.

### 5.2.11 Mobile data card warning function

Real-time access to the site 4G IoT device card number, automatic analysis of the card number remaining traffic, automatic analysis, expiration time warning reminders, so that project management staff to recharge in a timely manner, to prevent the expiration of the traffic card operator pin number caused by the project stalled.



### 5.2.12 Secondary development

The cloud platform provided by our company is completely free, the interface is completely neutral, and supports secondary development by users.

### 5.2.13 Different interfaces

For small-scale application users, the cloud platform provides configurable "different interfaces" interface and private domain name resolution services, customers only need to invest a few tens of dollars to buy a domain name, and after successful filing, they can have their own private login link, and the login interface platform name can be changed according to user requirements.

## Chapter 6 Case Shows

