



Delfino Online Conductivity Sensor

User Manual

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Introduction

Dear user

Thank you very much for using the conductivity sensor of our company. Before you use it, please read this manual in detail, it will be of great help to the use and maintenance of this instrument, and can avoid unnecessary troubles due to improper operation and maintenance.

Please follow the operating procedures and precautions of this manual.

To ensure that the after-sales protection provided by this instrument is effective, please do not use and maintain this instrument by methods other than those specified in this manual.

Any failures and losses caused by non-compliance with the precautions specified in this manual are not covered by the manufacturer's warranty, and the manufacturer does not assume any related responsibilities. Please keep all documents in a safe place. If you have any questions, please contact our after-sales service department.

When receiving the instrument, please carefully open the package and check whether the instrument and accessories are damaged due to transportation. If any damage is found, please contact our after-sales service department and save the packaging for return processing.

When the instrument fails, please do not repair it by yourself, please contact our after-sales service department.

1 Product Overview



The four-electrode conductivity sensor adopts the world's leading four-electrode technology, RS485 digital interface, supports MODBUS protocol, and is environmentally friendly.

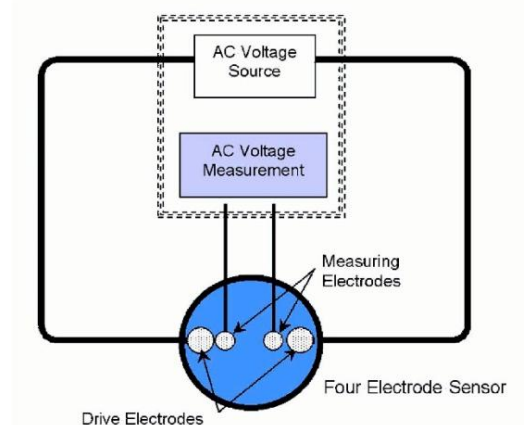
Compared with the traditional two-electrode conductivity sensor, it not only has higher accuracy, but also has a wider measurement range and excellent stability. The four-electrode conductivity sensor also has the unique advantages: first, it completely solves the polarization problem during high conductivity testing; second, it solves the problem of inaccurate readings caused by electrode pollution.

Sensor Features:

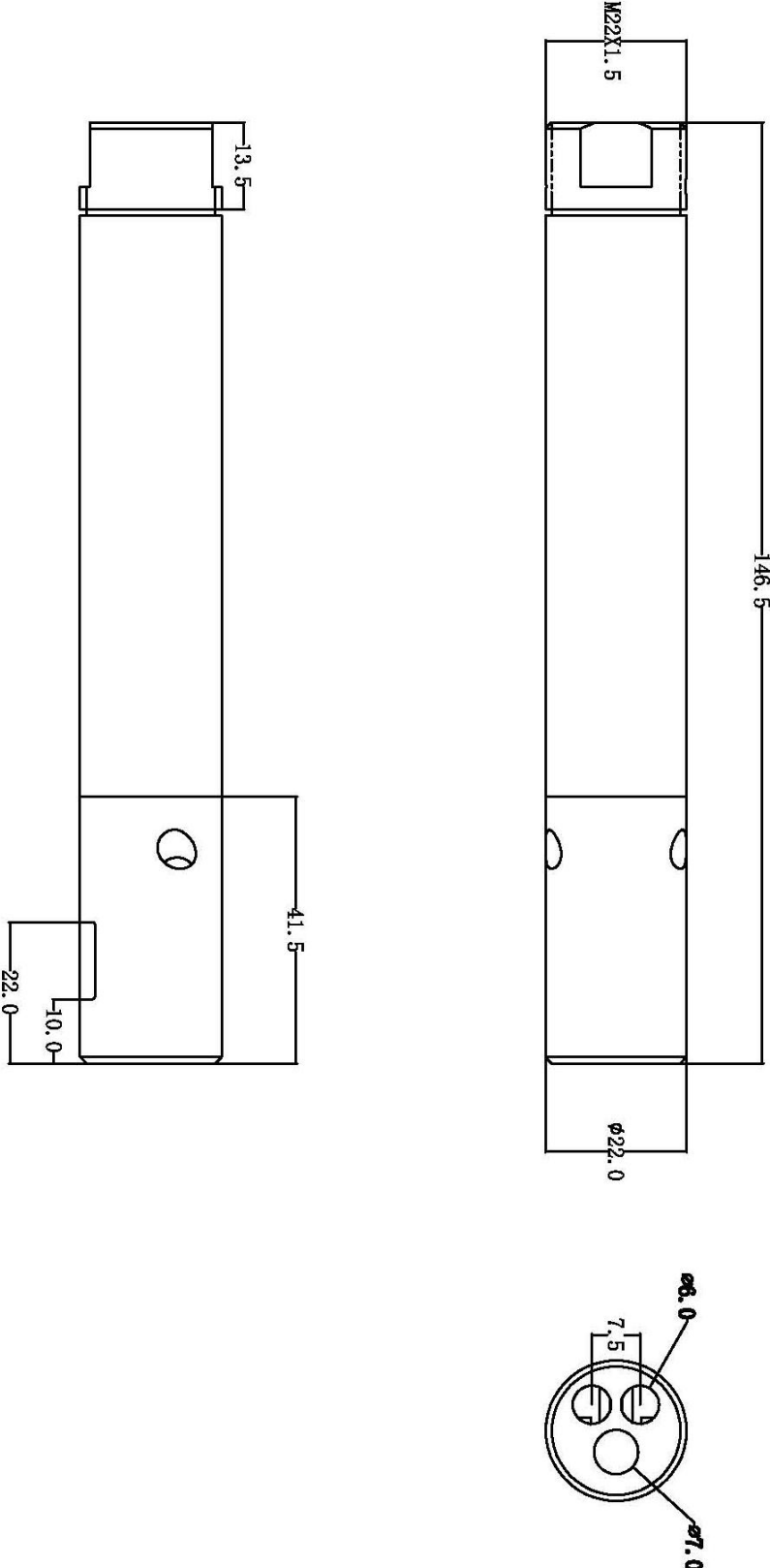
- ◆ 1uS/cm~100 mS/cm, accuracy <1%
- ◆ RS485 output, support Modbus, open communication protocol
- ◆ 0~50°C, protection grade IP68, maximum pressure 6bar
- ◆ No polarization, can be used continuously online
- ◆ Extremely wide range, wider application
- ◆ Very resistant to pollution, strong anti-interference ability
- ◆ The measurement is very stable and the accuracy is higher
- ◆ Strong and durable structure, longer service life

Working Principle:

This product adopts 4-electrode technology, which consists of 2 driving electrodes and 2 measuring electrodes. The two driving electrodes apply a potential, and the potential will drive the movement of ions in the solution. The two measuring electrodes measure this potential again, so no ions are attached.



1.1 Product Structure Diagram



DEC351 Four-electrode conductivity sensor structure diagram

1.2 Cable Definition

- Sensor Dimension

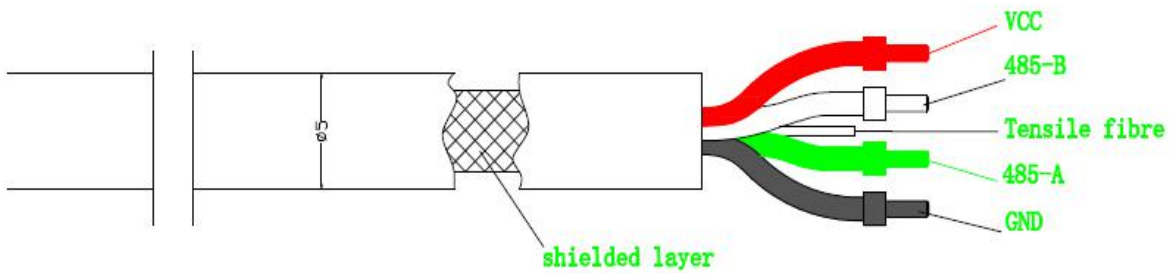
22x146.5 mm(Φ xL)

- Power

The power supply must be DC 5~12V \pm 5%, current <50mA

- Sensor Cable

4 wire AWG-24 or AWG-26 shielding wire. Conductance=5mm



1. Red wire—Power(VCC)
2. White wire—485_B
3. Green wire—485_A
4. Black wire—Ground wire (GND)
5. Bare wire—Shield

1.3 Technical Parameter

Model	DEC351
Measuring Range	1uS/cm~100 mS/cm or 0-5000 uS/cm
Response Time	<10 sec
Housing IP Rating	IP68
Accuracy	<1%
Electrode Material	Nickel
Sheath Material	PEEK
Storage Temperature	-20~60°C
Temperature Range	0 ~ 50°C
Interface	Support RS-485, MODBUS
Power	DC 5~12V, Current <50mA
Temperature Sensor Type	NTC
Dimension	22x146.5 mm(Φ xL)
Cable Length	10m standard, other length can be customized
Calibration	One point or two points

2 Calibration

2.1 Brief Introduction

1. The four-electrode conductivity sensor supports 1-point or 2-point calibration (for data frame format, please refer to the modbus documentation). KCl solution was used as the standard material.
2. The preparation and method of the conductivity standard solution are shown in the following table:

Conductivity standard solution concentration and its conductivity value

Solution Number	Reference solution KCL g/1000g (in vacuum)	Reference solution KCL g/1000mL (room temp at 20°C)	Conductivity/(S• cm ⁻¹)				
			15°C	18°C	20°C	25°C	35°C
1	71.1352	74.2457	0.09212	0.09780	0.10170	0.11131	0.13110
2	7.41913	7.4365	0.010455	0.011163	0.011644	0.012852	0.015353
3	0.745263	0.7440	0.0011414	0.0012200	0.0012737	0.0014083	0.0016876
4	0.074528	Dilute 100mL of solution No. 3 to 1000mL	0.0001185	0.0001267	0.0001322	0.0001465	0.0001765

Note: The following conditions must be observed when applying the above standard solutions:

1. The standard values listed in the table deduct the conductivity of the water in which the standard solution is prepared.
2. The standard solution can be prepared only after the conductivity solid standard material is baked at 110°C for 4 hours.
3. Prepare the reference material according to the environmental conditions specified in Table 2.
4. It is recommended to use a first-class 1L volumetric flask and a balance with a division value of 0.1mg.

2.2 Two Points Calibration

1. Reset user calibration data to default, K=1, B=0 (see modbus document for details).
2. Put the sensor into the air (this is the sensor 0 point), then read the conductivity value and record it as X.
3. Put the sensor into one of the above 4 standard solutions, such as 12.852mS/cm and repeat step 2, record the value as Y. (The selection of standard solution can refer to the actual use environment)
4. Record the K and B values as follows:

$$K=(12.852-0)/(Y-X), B= - KX$$
5. Write the K, B values to the sensor.

Required equipment and raw materials:

KCl Analytical Reagent	Electronic balance	Distilled or deionized water	Volumetric flask (1000mL)
Beaker	pipette	Gloves	Magnetic stirrer

2.3 Precautions

1. Due to the mutual interference between the electric fields, when testing the conductivity, one container is allowed to place one sensor for testing. And during the test, the conductivity of the solution should be uniform, and the temperature of the solution should be uniform and stable.
2. In order to make the electric field generate and spread smoothly, the distance between the sensor and the bottom of the cup, the wall of the cup and the liquid level should be more than 2cm during the test. During long-term testing, it is recommended to stir the standard solution regularly. (As shown below)



3. Due to the solution error and personnel operation problems, it is recommended that the user obtain the conductivity sensor and perform user calibration before testing. User calibration is divided into single-point and double-point calibration. Single-point calibration changes the k value, and double-point calibration changes the k and b values.
4. When replacing the conductivity liquid, the conductivity electrode should be cleaned with 0 conductivity liquid and dried, and then put into another conductivity liquid. (Before the test, it must be cleaned with 0 conductivity liquid and dried.) It is recommended that the conductivity liquid be tested from small to large. After the test is completed, keep it clean and dry.
5. When testing the temperature compensation accuracy, perform a single-point calibration on a solution of 1.413mS/cm at 25°C before testing. And after the temperature is stable, the sensor should be placed in the solution for more than 15 minutes, so that the temperature of the sensor is also stable (the temperature is stable at 0.1°C), and then the test is carried out.

3 Maintenance

3.1 Maintenance Cycle

Unlike two-electrode conductivity sensor technology, four-electrode conductivity probes are highly resistant to contamination, do not polarize, and do not require frequent cleaning (except when used in viscous liquids).

Maintenance Task	Recommended maintenance frequency
Wash the sensor	Clean every 30 days
Calibrate the sensor	According to the maintenance schedule required by the competent authority

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

3.2 Maintenance Method

1) The outer surface of the sensor:

Clean the outer surface of the sensor with tap water. If there is still debris, wipe it with a damp soft cloth. For some stubborn dirt, you can add some household detergent to the tap water to clean it;

2) Sensor inlet and outlet holes

Wipe with a cotton swab or a soft cloth. For some stubborn dirt, you can add household detergent to tap water to clean it;

3) Check the cable of the sensor:

The cable should not be taut during normal operation, otherwise it is easy to break the inner wire of the cable, causing the sensor to not work normally;

4) Check whether the housing of the sensor is damaged due to corrosion or other reasons.

3.3 Precautions

The probe contains sensitive optical and electronic components. Make sure that the probe is not subject to severe mechanical shocks. There are no parts inside the probe that need user maintenance.

3.4 Frequently Asked Questions

Fault	Possible reasons	Solution
The operation interface cannot be connected;	Controller and cable connection error	Reconnect the controller and cables
The measurement result is not displayed	Cable failure	Please contact us

4 Warranty Description

This quality guarantee does not cover the following situations:

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

This quality assurance includes all the content of the quality assurance provided by its products.

This quality assurance constitutes a final, complete and exclusive statement about the terms of the quality assurance. No one or agent is authorized to formulate other warranties in the name of our company.

The above-mentioned remedial measures such as repair, replacement or refund of the purchase price are special cases that do not violate this warranty, and the remedial measures such as replacement or refund of the purchase price are all for the company's product itself. Based on strict liability obligations or other legal theories, the company is not liable for any other damage caused by product defects or negligence in operation, including subsequent damages that have a causal relationship with these conditions.

