

Conductivity Sensor



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Preface

- This manual is about the product's functions, technical indicators, wiring methods, maintenance, troubleshooting methods, etc.
- Please read this manual carefully before operation and use this product correctly to avoid unnecessary losses due to incorrect operation.
- After you have finished reading, please keep it in where at your reach for easy reference at any time during operation.

Note

- If the contents of this manual are modified due to function upgrades, etc., please refer to the newly released document.
- We strive to ensure the correctness of the manual contents. Nevertheless, if you find any errors, please contact us.
- Reproduction or duplication of the contents of this manual is strictly prohibited.
- Please use this product in accordance with its explosion-proof properties, the national and regional laws and regulations.
- The final right of interpretation of this manual belongs to our company.

Version

U- SUP-TDS-7001/7002 -EN6

Confirm the package:

After opening the box, please confirm the contents before starting any operation. If you find that the model or quantity is incorrect or there is any physical damage on the surface, please contact us.

Please refer to the following list for product packaging contents.

No.	Item	Quantity	Remark
1	Conductivity Sensor	1	
2	User Manual	1	
3	Certificate of Conformity	1	

Note: Customized products may differ slightly from standard products. Please refer to the order.

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1. Product Overview

1.1. Introduction

Conductivity sensors (or electrodes) are specially used for conductivity measurement of pure water, water treatment, etc., and are particularly suitable for conductivity measurement in thermal power plants and water treatment industries.

Table 1 Application areas

Electrode type	Two-pole type (stainless steel electrode)			Four-pole
	K=0.01	K=0.1	K=1.0 (Ambient temperature platinum black)	
Application scenarios	Pure water industry	Regular water disposal	Tap water	Water disposal, seawater, acid, and alkali measurement

1.2. Measurement principle

The operating principle of conductivity measurement is as follows:

Two electrodes (or cylindrical electrodes) are placed in parallel and at a fixed distance **L** apart in the solution under test. When the voltage is applied across the electrodes, ions in the solution move under the influence of the electric field: anions migrate toward the anode, and cations toward the cathode. The

ionic movement enables the solution to conduct electricity. By measuring the resulting current I between the electrodes, the conductivity γ of the solution can be determined.

In the four-pole conductivity electrode, the principle is slightly different: two electrodes generate the electric field, while the other two sense the potential difference. As such, the conductivity of the electrolyte solution is calculated.

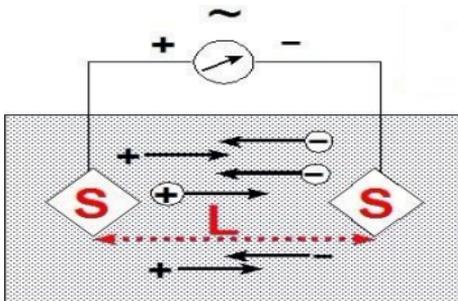


Figure 1 Conductivity measurement principle diagram

$$R = \frac{U}{I}; \quad G = \frac{1}{R}; \quad \gamma = K \times G = \frac{L}{S} \times \frac{1}{R}$$

Where:

R—solution resistance, Ω

G—solution resistivity, $\Omega \cdot \text{cm}$

L—distance between metal plates, cm

S—effective cross-sectional area of solution conductivity, cm^2

2. Technical Parameters

Table 2 Technical parameters of the conductivity stainless steel electrodes

Performance		
Measured variables	Conductivity, temperature	
Measuring range and electrode constant	Electrode constant	
	Conductivity measuring range	
	K=0.01	(0.01 ~20) $\mu\text{S/cm}$
	K=0.1	(0.1 ~200) $\mu\text{S/cm}$
	K=1.0	(1~2000) $\mu\text{S/cm}$
	Temperature measuring range: (0 ~ 50) $^{\circ}\text{C}$ or (0 ~100) $^{\circ}\text{C}$	
Accuracy	Conductivity: $\pm 2\%$ F.S	
	Temperature: $\pm 3^{\circ}\text{C}$	
Temperature compensation	Standard Pt 1000 (Pt 100, NTC10K, NTC 2.252K optional)	
Protection level	IP68	
Process conditions		
Process temperature	Ambient temperature: (0~50) $^{\circ}\text{C}$; High temperature: (0~ 100) $^{\circ}\text{C}$	
Process pressure	$\leq 5\text{bar}$ (electrode constant 0.01, 0.1,1.0)	
Mechanical structure		
Housing material	316 stainless steel	
Process connection	G3/4 thread or NPT3/4 thread	

Table 3 Technical parameters of the four-pole conductivity sensor

Performance	
Measured variables	Conductivity, temperature
Electrode constant	K= 0.01/K= 0.1 /K=1.0/K=1 0
Measuring range	Conductivity: 10 μ S/cm~100 mS/cm
	Temperature: (0 ~ 50) $^{\circ}$ C
Accuracy	Conductivity: \pm 2%FS
	Temperature: \pm 3 $^{\circ}$ C
Temperature compensation	Standard Pt1000, optional Pt100, NTC10K, NTC 2.252K
Protection level	IP68
Process conditions	
Process temperature	(0~50) $^{\circ}$ C
Process pressure	\leq 5bar
Mechanical structure	
Shell material	PBT
Process connection	NPT3/4 thread or G3/4 thread

3. Product Structure and Dimensions

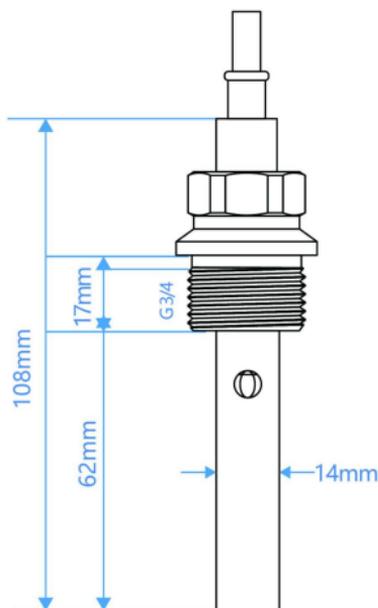
3.1. Dimensions of Stainless Steel Electrode

(1) Ambient temperature inline type

Table 4 Inline stainless steel electrode (G3/4 thread)

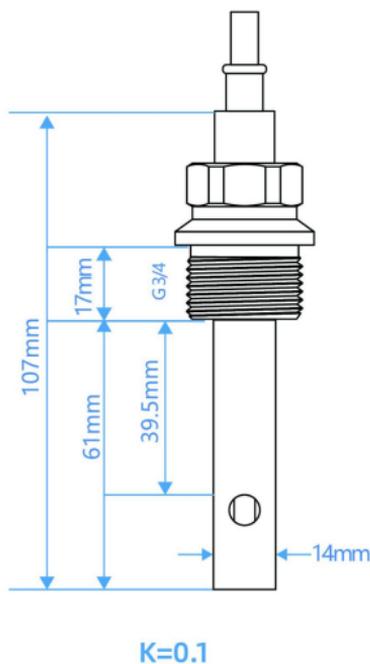
Unit: mm

K=0.01 ambient temperature stainless steel electrode (G3/4 thread)

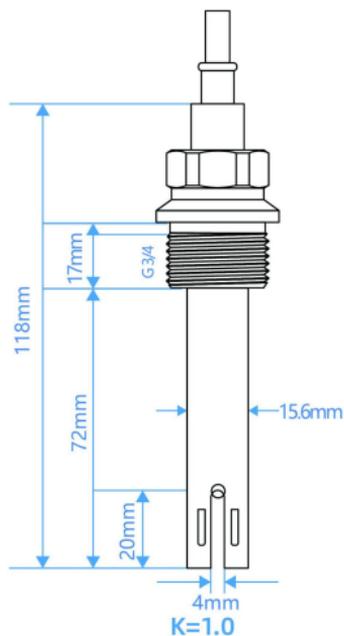


K=0.01

3 Product Structure and Dimensions



K=0.1 ambient temperature stainless steel electrode (G3/4 thread)

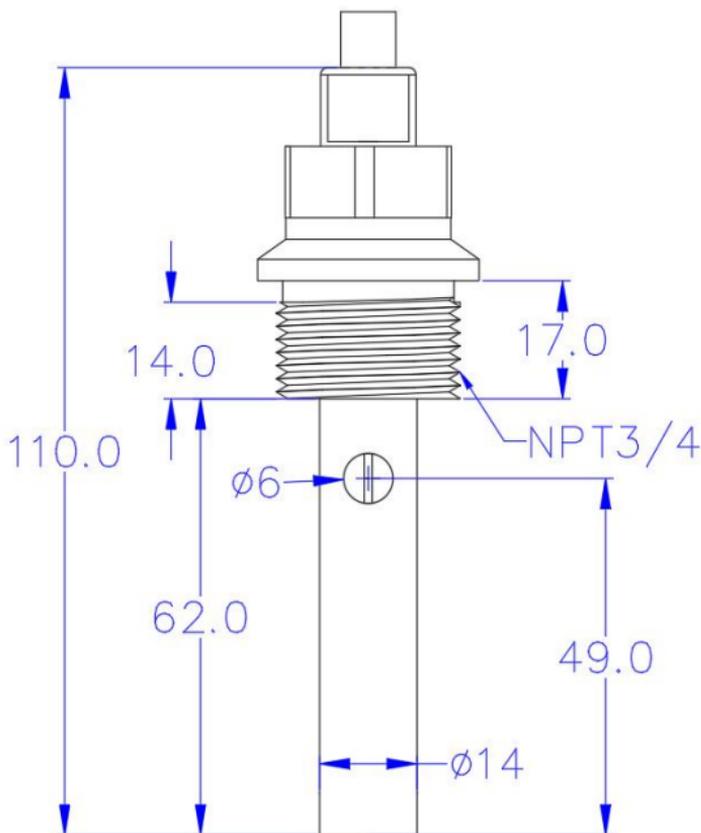


K= 1.0 ambient temperature stainless steel electrode (platinum black (G3/4 thread))

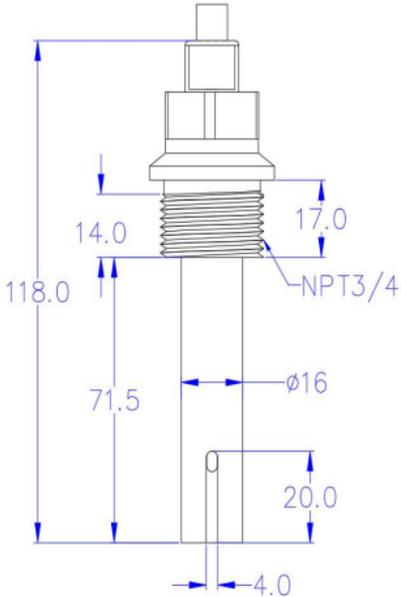
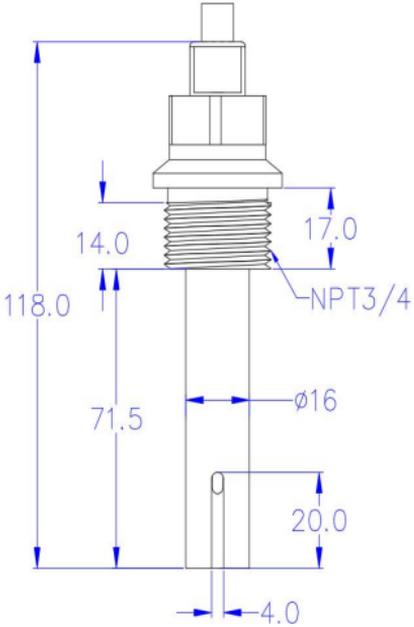
Table 5 Inline stainless steel electrodes (NPT3/4 thread)

Unit: mm

K=0.01 ambient temperature stainless steel electrode (NPT 3/4 thread)



3 Product Structure and Dimensions

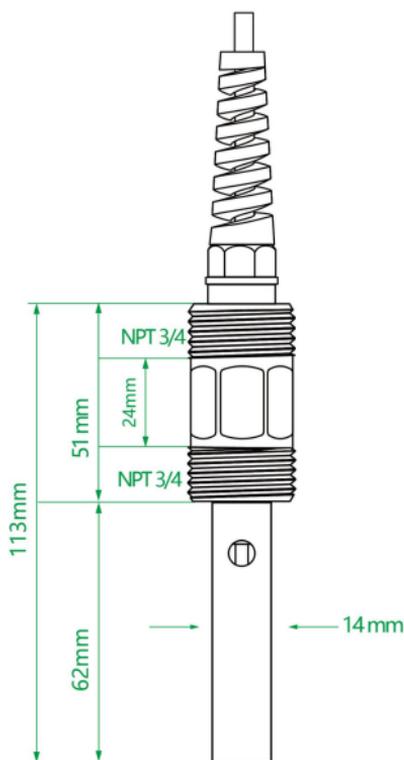
 <p>Technical drawing of a stainless steel electrode (K=0.1) showing dimensions. The drawing includes a side view and a detail of the electrode tip. The main dimensions are: total height 118.0, distance from base to the start of the threaded section 71.5, diameter of the main shaft $\phi 16$, and a detail of the electrode tip with a diameter of 4.0 and a height of 20.0. The threaded section has a height of 17.0 and a diameter of 14.0. The connection is labeled NPT3/4.</p>	 <p>Technical drawing of a stainless steel electrode (K=1.0) showing dimensions. The drawing includes a side view and a detail of the electrode tip. The main dimensions are: total height 118.0, distance from base to the start of the threaded section 71.5, diameter of the main shaft $\phi 16$, and a detail of the electrode tip with a diameter of 4.0 and a height of 20.0. The threaded section has a height of 17.0 and a diameter of 14.0. The connection is labeled NPT3/4.</p>
<p>K=0.1 Normal temperature stainless steel electrode (NPT 3/4 thread)</p>	<p>K=1.0 Normal temperature stainless steel electrode (platinum black) (NPT 3/4 thread)</p>

(2) Ambient temperature submersible type

Table 6 Submersible stainless steel electrode (NPT3/4 thread)

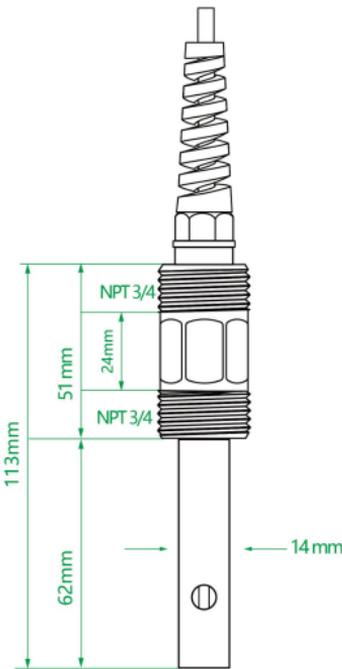
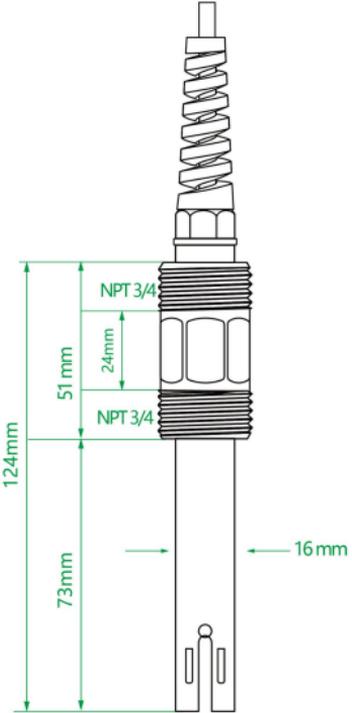
Unit: mm

K=0.01 ambient temperature stainless steel electrode (NPT3/4 thread)



K=0.01

3 Product Structure and Dimensions

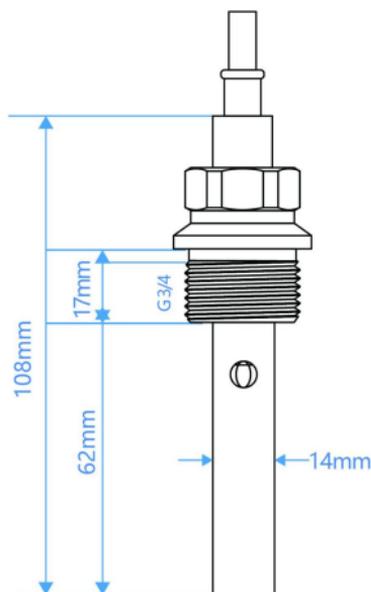
 <p style="text-align: center;">K=0.1</p>	 <p style="text-align: center;">K=1.0</p>
<p>K=0.1 Ambient temperature stainless steel electrode (NPT3/4 thread)</p>	<p>K= 1.0 Ambient temperature stainless steel electrode (NPT3/4 thread)</p>

(3) High temperature inline type

Table 7 Inline stainless steel electrode (G3/4 thread)

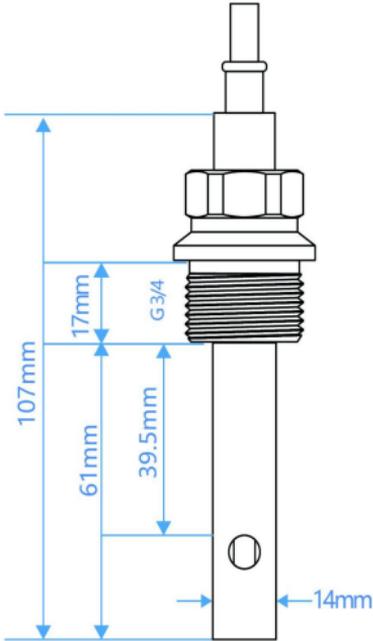
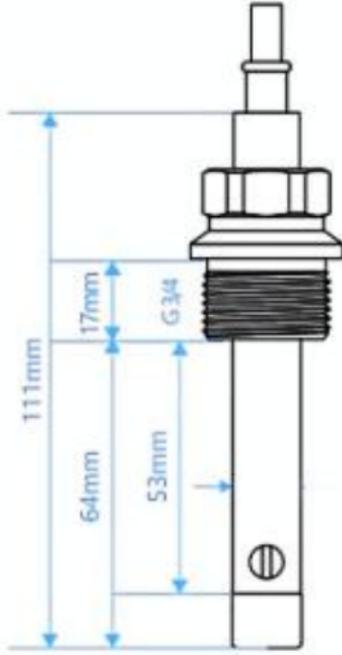
Unit: mm

K=0.01 High temperature stainless steel electrode (G3/4 thread)



K=0.01

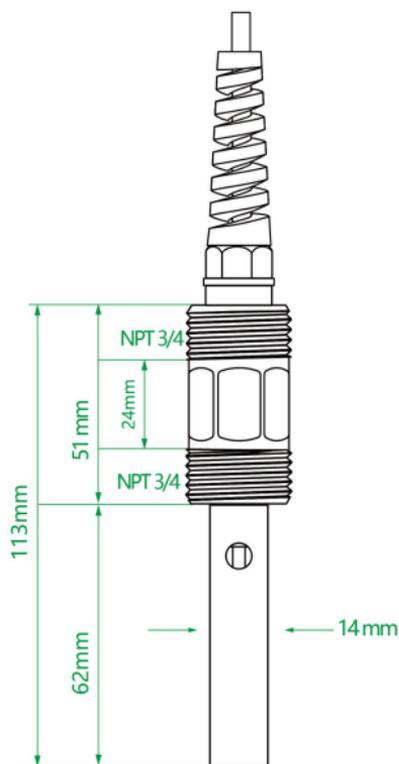
3 Product Structure and Dimensions

 <p>K=0.1</p>	 <p>K=1.0</p>
<p>K=0.1 High temperature stainless steel electrode (G3/4 thread)</p>	<p>K=1.0 High temperature stainless steel electrode (G3/4 thread)</p>

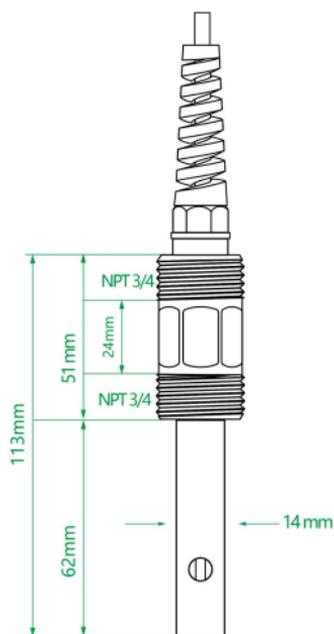
(4) High-temperature submersible type

Table 8 Submersible stainless steel electrodes Unit: mm

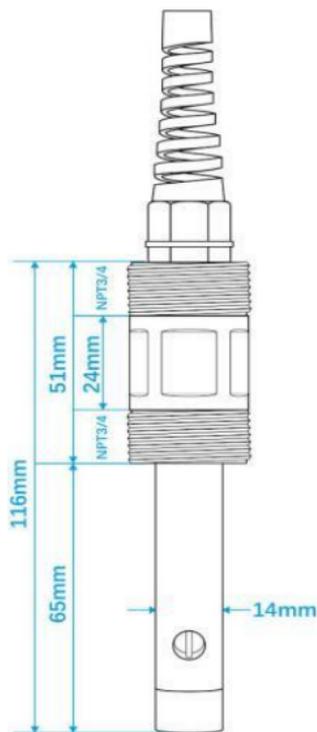
K=0.01 high temperature stainless steel electrode (NPT3/4 thread)

**K=0.01**

3 Product Structure and Dimensions



K=0.1



1.0

K=0.1 high temperature stainless steel electrode (NPT3/4 thread)

K= 1.0 High temperature stainless steel electrode (NPT3/4 thread)

3.2. Dimensions of Four-Ring Conductivity Sensor

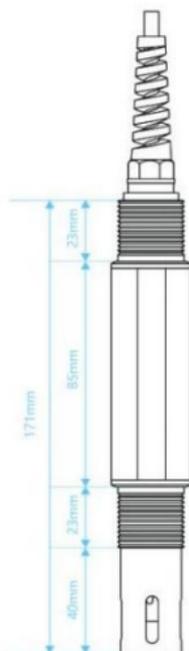


Figure 4 Quadrupole Electrode Dimensions NPT3/4 Thread (Unit: mm)

4. Installation

The electrode installation is pivotal for obtaining accurate measurement data, as incorrect mounting can lead to errors. To ensure data reliability, the installation location is supposed to be selected with great care.

Wrong: if the electrode fitting is too long, the immersion depth of the electrode becomes insufficient. This prevents effective fluid renewal inside the electrode, resulting in measurement errors.

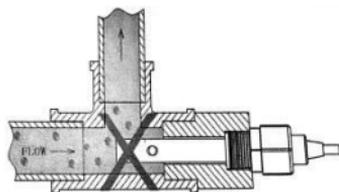


Fig.1

Correct: part of process fluid should continuously flow through the electrode to ensure accurate measurement. Therefore, the sensor opening must face the flow direction.

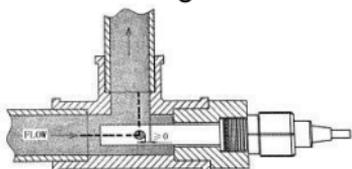


Fig.2

Wrong: if an air pocket forms in the upper part of the pipeline, no fluid will flow through the electrode, even if the sensor opening faces the flow direction. In this case, the measurement data will be unstable and of no practical value.

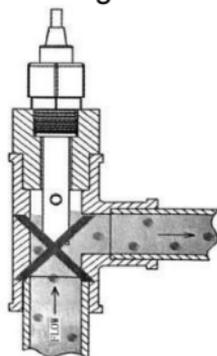


Fig.3

Correct:

When the electrode's side port is positioned within the fluid, part of the flow passes through the electrode and is continuously refreshed, ensuring accurate measurements.

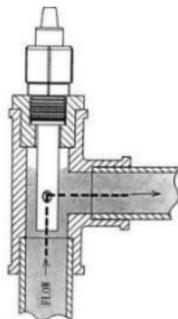


Fig.4

Wrong:

If there's no full flow in the pipelines, descending water will create air pockets in higher sections. This makes the electrode constant indeterminate, leading to invalid and unstable data.

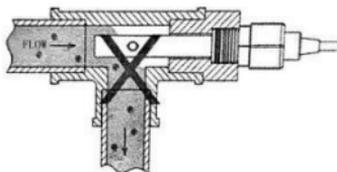


Fig.5

Wrong: The fluid flowing through the electrode which was installed with the angled tee flow cell cannot pass through the electrode's side port. The air pocket in side the electrode may bring about invalid measurement data and instability.

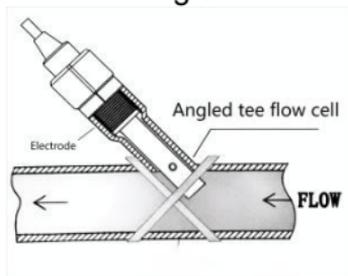


Fig.6

Correct: part of flow passes through the electrode's side port and will be refreshed, ensuring the measurement data correct, stable and authentic.

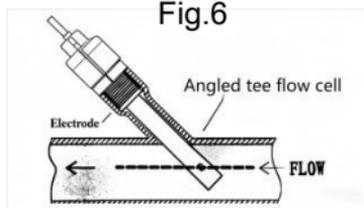


Fig.7 .

5. Electrical Connections

5.1. Wiring Instruction for Two-Pole Conductivity Sensor

Table 4 Definition of the line color for the two-pole conductivity sensor

Linecolor	Transparent	Blue	White	Black
Description	S+	S-	TEMP	TEMP

5.2. Wiring Instruction for Four-Pole Conductivity Electrode

Table 5 Definition of the line colors for four-pole conductivity sensor

Line color	brown	blue	gray	green	white	black	yellow-green
Description	CELL1	CELL2	CELL3	CELL4	TEMP6	TEMP7	SHIELD

6. Polarization and Calibration

6.1. Electrode Polarization

Polarization method: after connecting the electrode to the transmitter, the electrode is supposed to be placed into the solution to be tested. Once powered on, the polarization starts.

6.2. Electrode Calibration

- (1) Conductivity sensors are generally pre-calibrated before shipping, sparing users from calibration when putting them into service.
- (2) To ensure the measurement accuracy of the conductivity sensor, the electrode constant should be recalibrated with the conductivity electrode before use. At the same time, the electrode constant should be calibrated regularly. If a large error occurs, the conductivity electrode should be replaced in time.
- (3) Recommended calibration: every 1 to 2 months.
- (4) For detailed calibration steps, refer to the operating instructions for connecting the transmitter.

7. Precautions for Use

- (1) The electrode needs to be cleaned away the dirt in time. Clean it with 50% warm detergent (for adhesive taint, soak it in 2% hydrochloric acid or 5% nitric acid solution). Scrub the inner and outer surfaces with a nylon brush, then rinse thoroughly with distilled water. Avoid touching the electrode directly with your hands.
- (2) The conductivity electrode needs to be dried before storage. Do not store the electrode in distilled water or deionized water.
- (3) High-purity water should be measured quickly after being put into the container. This is because CO_2 in the air will continuously dissolve in the water sample to generate carbonate ions with strong conductivity. The conductivity will continue to rise, and the measured data will be inaccurate.
- (4) The container of the solution to be tested must be clean and free of ionic contamination.
- (5) Improper use of electrodes often causes malfunction of the instrument. When installing the electrodes, they should be completely immersed in the solution.

Platinum black electrode:

The electrodes are designed to be applied in tap water, at ambient temperature and pressure. They are not resistant to high temperatures and should not be used in chemical environments or with thick liquids.

- Do not wipe the electrode directly, which will put the platinum black at risk of falling off.
- When cleaning the electrode, do not wipe it, but rinse it repeatedly with distilled water.

8. Warranty and After-Sales Service

We promise that during the warranty period, any product with quality issues will be covered under our unconditional warranty service of repair, replacement, and refund. All non-customized products are eligible for return or exchange within 7 days (excluding products damaged by misoperation). For customized products, the warranty terms will be based on the agreement specified in the contract.

Disclaimer:

During the warranty period, product malfunction caused by the following reasons does not fall into the scope of the warranty service of repair, replacement, and refund:

- (1) Product malfunction resulting from improper use by customers.
- (2) Quality issues caused by disassembly, repairing, and refitting the product.