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# Conductivity Sensor

U-SUP-TDS-6012/6013-EN2

## 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-6012/6013-EN2

**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.

# Contents

# 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 applications in thermal power plants and water treatment industries.

Table 1 Application areas

| **Electrode type** | **Stainless steel electrode** | | | **PSF electrode** |
|---|---|---|---|---|
| | **K=0.01** | **K=0.1** | **K=1.0** | **K=10.0** |
| Application scenarios | Power plant; water treatment industry | | Water treatment | |

## 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 $\gamma$ 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.

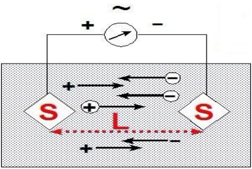



Figure 1 Conductivity measurement principle diagram

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

Where:

R——solution resistance, Ω

G——solution resistivity, Ω · cm

L——distance between metal plates, cm

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

## 1.3. Features

- Stainless-steel electrode with a dual concentric cylinder design: Made of titanium alloy, which naturally forms a chemically passive oxide layer. Its impermeable conductive surface is resistant to all liquids except hydrofluoric acid.
- Temperature compensation elements available: NTC 2.252K, 2K, 10K, 20K, 30K, Pt100, Pt1000, etc., selectable by the user.
- Polysulfone electrode: Features a large-area (long-path) platinum structure, offering excellent resistance to strong acids, strong alkalis, and fouling. It is primarily used for online conductivity measurement in specialized industrial applications.

# 2. Technical Parameters

Table 2 The stainlesss steel electrode

| Performance | | |
|---|---|---|
| Measured variables | Conductivity, temperature | |
| Measuring range and eletrode constant | Electrode constant | Conductivity measuring range |
| | K=0.01 | (0 ~20) μS /cm |
| | K=0.1 | (0 ~200) μS /cm |
| | K=1.0 | (0~2000) μS/cm |
| | Temperature: (0 ~60)℃ | |
| Accuracy | Conductivity: 1% F.S | |
| | Temperature: ±0.5℃ | |
| Temperature compensation | Standard supply Pt 1000<br>(Pt 100, NTC 2.252K, 2K, 10K, 20K, 30K optional) | |
| Protection level | IP54 | |
| **Process conditions** | | |
| Process pressure | ≤ 0.4MPa | |
| **Mechanical structure** | | |
| Housing material | 304SS, 316SS | |
| Electrode material | 304SS, 316SS or platinum | |
| Process connection | G3/4 thread, NPT3/4 thread or clamp | |

Table 3 Technical parameters of the PSF electrode

| **Performance** | |
| --- | --- |
| Measured variables | Conductivity, temperature |
| Electrode constant | K=10 |
| Measuring range | Conductivity: 0 μS/cm~20000 mS/cm |
| | Temperature: (0 ~ 60) ℃ |
| Accuracy | Conductivity: 1%FS |
| | Temperature: ±0.5℃ |
| Temperature compensation | Standard supply Pt 1000<br>(Pt 100, NTC 2.252K, 2K, 10K, 20K, 30K optional) |
| Protection level | IP54 |
| **Process conditions** | |
| Process temperature | (0~60)℃ |
| Process pressure | ≤0.3MPa |
| **Mechanical structure** | |
| Shell material | Polysulfone (PSF) |
| Process connection | 3/4 thread |

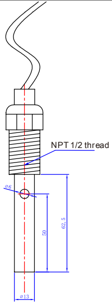
# 3. Product Structure and Dimensions

## 3.1. Dimensions of Stainless Steel Electrode

### （1）Inline type

Table 4 Inline stainless steel electrode

Unit: mm

<table>
<tr><th>K=0.01</th><th>K=0.1</th><th>K=1.0</th></tr>
<tr>
<td>
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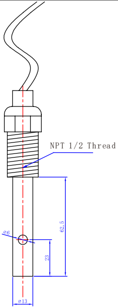
<td>
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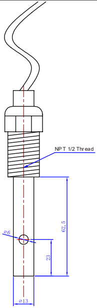
<td>
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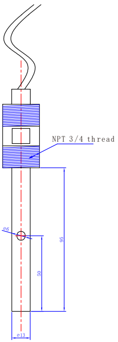
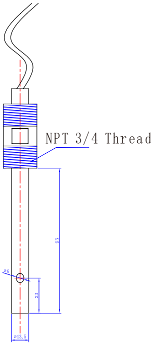
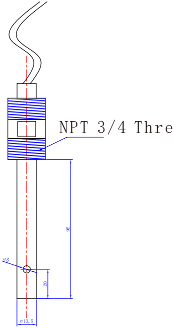
## （2）Submersible type

Table 5  Submersible conductivity electrodes

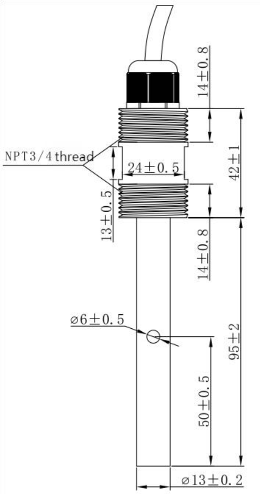
Unit: mm

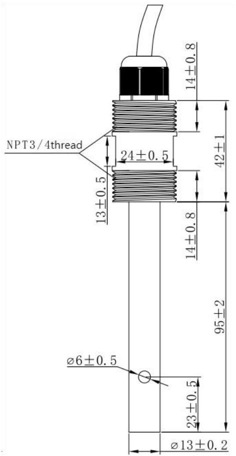
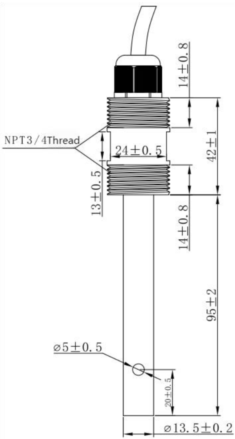
| K=0.01 | K=0.1 | K=1.0 |
|---|---|---|
|  |  |  |

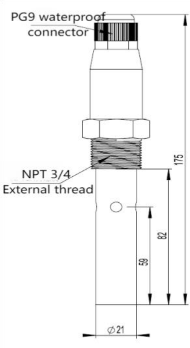
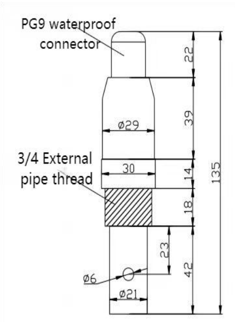
## （3）High temperature (Threaded connection)

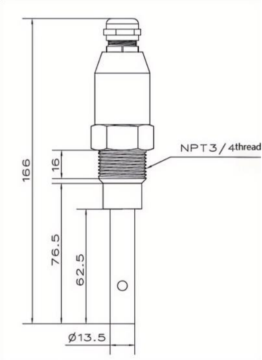
Table 6 High temperature (threaded connection) type

Unit: mm

| K=0.01 high temperature type (Top-bottom threaded type) |
|---|
|  |

| K=0.1 high temperature type (Top-bottom threaded type) | K=10 high temperature type (Top-bottom threaded type) |
| --- | --- |
|  |  |

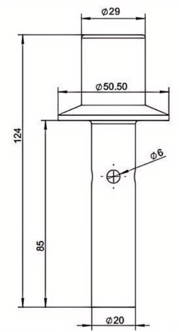
| K=0.01 high temperature type (Bottom threaded type) | K=0.1 high temperature type (Bottom threaded type) |
|---|---|
|  |  |

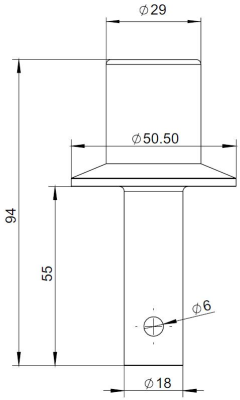
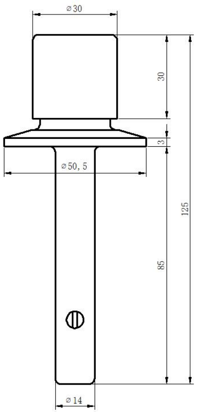
| K=0.1 high temperatur type (Bottom threaded type) |
|---|
|   |

**(3) High temperature Clamp-on type**

Table 7 High temperature (clamp-on) type

Unit: mm

| K=0.01 High temperature (clamp-on) type |
| --- |
|  |

| K=0.1 High temperature (clamp-on) type | K=1.0 High temperature (clamp-on) type |
|---|---|
|   |   |

## 3.2. Dimensions of PSF Electrode

Unit: mm

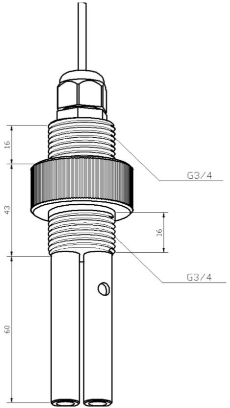



Figure 4 K=10.0 Dimensions (Unit: mm)

# 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.

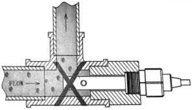



Fig.1

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

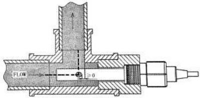



Fig.2

**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.

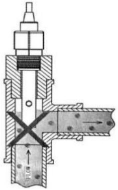


Fig.3

**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.

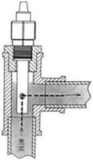


Fig.4

**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.

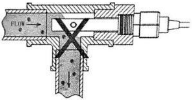



Fig.5

**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.

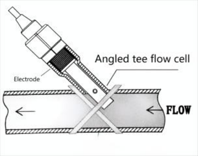



Fig.6

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

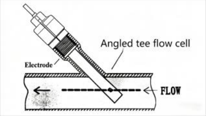



Fig.7 .

# 5. Electrical Connections

The conductivity sensor is connected to the controller with power cable. The wiring diagram refers to the controller's description manual. The diagram of sensor terminal is shown below:

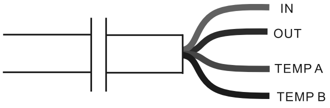



Fig.8 Wiring diagram

The wiring mark and description:

IN: conductivity interface 1

OUT: conductivity interface 1

TEMP A, TEMP B: temperature compensation output

# 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.

# 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 throughly 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.

# 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.