Conductivity probes for the widest range of applications

Specifications for Orion Conductivity Probes with a 2-Electrode Cell design

Applications

- Ultrapure lab water
- Deionized and reverse osmosis water
- Concentrated chemicals
- Clean-in-place method
- Water for injection
- Low–ionic strength solutions
- Industrial wash and rinse water
- Food and beverage
- Aquaculture

Thermo Scientific™ Orion™ 2-Electrode Cells are suited for a variety of lab and field applications where it is necessary to measure clean, low-conductivity solutions, such as pure water; chemically reactive substances, such as lye; or highly conductive samples, such as water runoff.

Determining the conductivity of a solution with the Orion 2-Electrode Cell

Using the Orion 2-Electrode Cell is a routine method for measuring conductivity. A conductivity reading is determined by applying a voltage between two electrodes immersed in a solution and measuring the resulting current. In a water solution, the higher the concentration of ions, the higher the conductivity. Pure water at a certain temperature always has the same conductivity. Examples of other common conductivity values can be found in Table 1.

Orion 2-Electrode Cells.
Cat. No. 011510MD (top) and Cat. No. 0130116MD (bottom).

Table 1. Conductivity values of typical solvents.

Sample at 25°C	Conductivity (µS/cm)
Ultrapure water	0.055
Power plant boiler water	1.0
Drinking water	50
Ocean water	53,000
5% NaOH	223,000
50% NaOH	150,000
10% HCl	700,000
32% HCl	700,000
31% HNO_3 (highest known conductivity)	865,000

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Each acid, base, or ion has its own characteristic curve for concentration vs. conductivity. Modifying the temperature also affects the conductivity of a solution in a specific way. Typically, the conductivity varies about 1 to 3% per degree Celsius. See Table 2 for some common temperature coefficients.

Table 2. Temperature coefficients of typical solvents.

Sample	Percent change/°C (at 25°C)
Ultrapure water	4.55 (at 25°C only, non-linear)
Salt solution (NaCl)	2.12
5% NaOH	1.72
Dilute ammonia solution	1.88
10% HCl	1.32
5% sulfuric acid	0.96
98% sulfuric acid	2.84
Sugar syrup	5.64

Measuring more than conductivity

Certain applications may call for measurements of other attributes in relation to conductivity; these include resistivity, salinity, and total dissolved solids (TDS).

Resistivity

The reciprocal of conductivity is resistivity, which is an important parameter to measure when working with or making ultrapure water. Ultrapure water has a high resistivity (>18.18 MΩ·cm at 25°C) and therefore very low levels of conductivity (0.055 µS/cm at 25°C), which can be accurately measured with a conductivity probe and meter.

Total dissolved solids

Often in environmental applications, total dissolved solids (TDS) is used to determine the amount of minerals, salts, or metals dissolved in water, potentially indicating pollution. The standard method of determining TDS is by evaporating the sample to dryness at 180°C and weighing the residue. Conductivity can be used as a rapid and convenient method to estimate TDS, which allows for field testing and continuous measurements. The standard formula is TDS = k x EC (in 25°C), whereby k is a function of the type of water being measured and EC is the conductivity.

Salinity

Practical salinity measurements of seawater based on relating the sample conductivity measurement to the reading of a standard potassium chloride solution at 15C. The practical salinity S of reference seawater is S = 35. Orion meters automatically calculate salinity per oceanographic equations and compensate to 15°C per accepted conventions.

Benefits of Orion 2-Electrode Cells

- Choose from electrodes designed for a variety of samples, including low-conductivity, chemically reactive, or highly conductive solutions (Table 3)
- Constructed using durable materials and designed for a variety of lab and field applications
- Built-in automatic temperature control (ATC) sensor for accurate measurement
- Ideal for measuring conductivity, TDS, and salinity determination in aqueous samples
- Appropriate for both lab and field measurements with a selection of cord lengths from 1 to 3 meters
- Compatible with a wide range of Thermo Scientific™ Orion Star™ A and Orion™ Versa Star™ Pro benchtop and portable conductivity meters (Table 4)
- Over 60 years of experience and innovation in the field of electrochemistry can help you achieve optimal efficiency with precise and accurate measurements

Table 3. Orion 2-Electrode Cells.* Orion 2-Electrode Cells are ideally suited for use with the Orion Star A and Orion Versa Star Pro multiparameter and conductivity meters. See Table 4 below for more details.

Description	Measurement range	Nominal constant (K)	Cable length	Material	Temperature range	Cat. No.
Orion Ultrapure Cell	0.01–300 µS/cm	0.1 cm^{-1}	1.5 m	Stainless steel (V4A) body and electrodes	0 - 90°C (ATC)	013016MD
Orion Precise Epoxy/Platinum Cell	1 µS/cm–20 mS/cm	1.0 cm^{-1}	1.5 m	Epoxy body with platinum cell	0 - 90°C (ATC)	011050MD
Orion Rugged Cell	10 µS/cm–200 mS/cm	1.0 cm^{-1}	3 m	Epoxy body with graphite electrodes	0 - 80°C (ATC)	011510MD
Orion High-Range Cell	10 µS/cm–2,000 mS/cm	10 cm^{-1}	1.5 m	Glass body with platinized Pt electrodes	0 - 90°C (no ATC)	018020MD

* Warranty: 24 months from date of purchase, other terms and conditions may apply.

ATC - automatic temperature compensation sensor integrated

Table 4. Compatible Orion Star and Orion Versa Star Pro meters for conductivity and TDS measurements.

Meter format	No. of available parameters	Parameter options	Meter model
Portable	1 with temperature	Conductivity, TDS	**Orion Star A122 Conductivity Meter**
	1 with temperature	Conductivity, TDS, salinity, resistivity	**Orion Star A222 Conductivity Meter**
	1 with temperature	Conductivity, TDS, salinity, resistivity	**Orion Star A322 Conductivity Meter**
	2 with temperature	Conductivity, TDS, salinity, resistivity, pH, mV, RmV, oxidation reduction potential (ORP)	**Orion Star A325 pH/Conductivity Multiparameter Meter**
	2 with temperature	Conductivity, TDS, salinity, resistivity, pH, mV, relative mV (RmV), ORP, ion-selective electrode (ISE), dissolved oxygen (DO)	**Orion Star A329 pH/ISE/Conductivity/DO Multiparameter Meter**
Benchtop	1 with temperature	Conductivity, TDS	**Orion Star A112 Conductivity Meter**
	1 with temperature	Conductivity, TDS, salinity, resistivity	**Orion Star A212 Conductivity Meter**
	2 with temperature	Conductivity, TDS, salinity, resistivity, pH, mV, RmV, ORP	**Orion Star A215 pH/Conductivity Multiparameter Meter**
	1 with temperature, option to add modules for more parameters	Conductivity, TDS, salinity, resistivity	**Orion Versa Star Pro 20 Conductivity Meter**
	2 with temperature, option to add modules for more parameters	Conductivity, TDS, salinity, resistivity, pH, mV, RmV, ORP	**Orion Versa Star Pro 50 pH/Conductivity Multiparameter Meter**
	3 with temperature, option to add modules for more parameters	Conductivity, TDS, salinity, resistivity, pH, mV, RmV, ORP, ISE, DO	**Orion Versa Star Pro 90 pH/ISE/ Conductivity/DO Multiparameter Meter**
	4 with temperature	Conductivity, TDS, salinity, resistivity; pH, mV, RmV, ORP, ISE; pH, mV, RmV, ORP, ISE, DO	**Orion Versa Star Pro 91 pH/ISE/ Conductivity/DO Multiparameter Meter**

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A variety of Thermo Scientific Orion standards and solutions are available to help keep your conductivity probes clean between uses.

Electrode maintenance and care

Caring for an Orion Conductivity Probe is especially important for ensuring accurate measurements. When deposits collect on the probe surface area, conductivity readings may appear lower than the actual value. Frequent calibration, cleaning, and proper storage of your conductivity electrode can lead to long-lasting, accurate readings. A variety of Thermo Scientific™ Orion™ conductivity standards and solutions are available, including single-use pouches to prevent contamination. After repeated or prolonged use in dirty samples, soaking your probe first in conditioner and then in storage solution for up to two hours after use will help ensure that the surface of your conductivity electrode probe remains unaltered. Store probes dry between uses.

Ordering information

Product	Quantity	Cat. No.
Standard or Solution		
147 µS/cm conductivity standard	10 pouches	01100910
111.9 mS/cm conductivity standard	5 x 60 mL bottles	011005
111.9 mS/cm conductivity standard	10 pouches	01100510
0.1 M KCl conductivity standard	475 mL bottle	990106
100 µS/cm conductivity/TDS standard	5 x 60 mL bottles	011008
1413 µS/cm conductivity/TDS standard	5 x 60 mL bottles	011007
1413 µS/cm conductivity/TDS standard	10 pouches	01100710
12.9 mS/cm conductivity/TDS standard	5 x 60 mL bottles	011006
12.9 mS/cm conductivity/TDS standard	10 pouches	01100610
Electrode rinse solution	10 pouches	911110
Accessory		
Orion Conductivity Calibration Resistor Kit with 8 Pin Mini DIN Connection	–	1010001
Conditioning solution for 011050 and 011050MD conductivity probes	–	011001
Replacement flow cell for use with 2-electrode cells for ultrapure water	–	013017
Orion Swing Arm Electrode Stand	–	090043
Orion Star A Series Electrode Holder for Electrode Stands	–	STARA-ELHD

Find out more at **thermofisher.com/conductivityprobes**

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