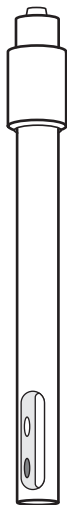


User Guide

Conductivity Cell



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ORION Series A meters and 900A printer are protected by U.S. patents 5,198,093, D334,208 and D346,753.

ionplus electrodes and Optimum Results solutions are protected by US Patent 5,830,338.

ROSS Ultra electrodes are protected by US patents 6,793,787.

Orion ORP Standard is protected by US Patent 6,350,367.

Orion NoCal electrodes with stabilized potential patent pending.

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This publication supersedes all previous publications on this subject.

Introduction

DuraProbe™ 4-Electrode Conductivity Cells

Thermo Scientific Orion DuraProbe cells are durable and extremely accurate under a wide range of conditions.

1. DuraProbe conductivity cells 013005MD, 013010MD, 013025MD, 013005A, 013010A, 013005D and 013010D are epoxy/graphite, have a nominal cell constant of 0.475 cm^{-1} and are intended for field or laboratory use.

Measurement range is $1\ \mu\text{S/cm}$ to $200\ \text{mS/cm}$.

2. DuraProbe conductivity cells 013605MD, 013610MD and 013610 are epoxy/graphite, have a nominal cell constant of 0.55 cm^{-1} and are intended for field or laboratory use.

Measurement range is $10\ \mu\text{S/cm}$ to $200\ \text{mS/cm}$.

2-Electrode Conductivity Cells

1. 2-Electrode conductivity cells 011010A and 011010 are glass/platinum, have a nominal cell constant of 1.0 cm^{-1} and are intended for laboratory use.

Measurement range is $1\ \mu\text{S/cm}$ – $200\ \text{mS/cm}$.

2. 2-Electrode conductivity cells 011020A, 011020 and 9902BN are glass/platinum, have a nominal cell constant of 0.1 cm^{-1} and are intended for laboratory use and ultra pure water.

Measurement range is $0.1\ \mu\text{S/cm}$ to $100\ \mu\text{S/cm}$.

3. 2-Electrode conductivity cells 011050MD, 011050A and 011050 are epoxy/platinum, have a nominal cell constant of 1.0 cm^{-1} and are intended for field or laboratory use.

Measurement range is $1\ \mu\text{S/cm}$ – $20\ \text{mS/cm}$.

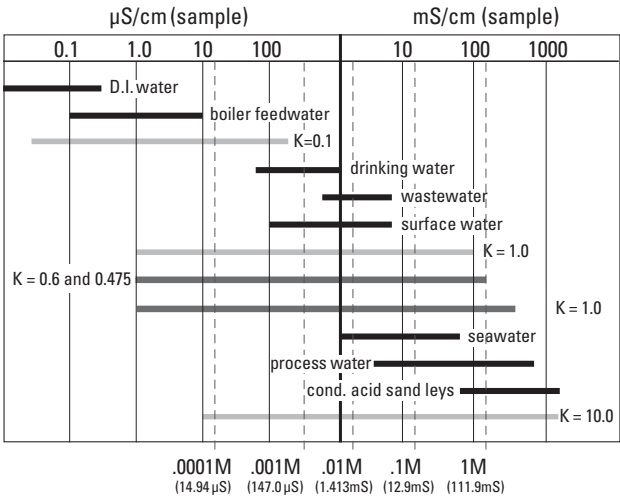
4. 2-Electrode conductivity cells 011510MD and 011510 are epoxy/graphite, have a nominal cell constant of 1.0 cm^{-1} and are intended for field or laboratory use.

Measurement range is $10\ \mu\text{S/cm}$ – $200\ \text{mS/cm}$.

5. 2-Electrode conductivity cells 013016MD, 013016A and 013016D are steel (V4A), have a nominal cell constant of 0.1 cm^{-1} and are intended for laboratory use and ultra pure water. **Measurement range is $0.01\ \mu\text{S/cm}$ to $300\ \mu\text{S/cm}$.**

6. 2-Electrode conductivity cell 018020MD is glass/platinum, has a nominal cell constant of 10 cm^{-1} and is intended for high electrolyte concentration solutions.

Measurement range is $10\ \mu\text{S/cm}$ – $2000\ \text{mS/cm}$.



Conventional 2-Electrode Cells
 Conventional 4-Electrode Cells

Figure 1:
General Conductivity Ranges of Common Samples

Conductivity measurement units are:
 1 mho = 1 S (Siemen) = 1,000 mS = 1,000,000 µS

Figure 1 represents the general guidelines for choosing a cell by application. Performance characteristics of some cells may vary.

Required Equipment

1. Thermo Scientific Orion conductivity meter, such as the 3-Star conductivity meter, 4-Star pH/conductivity meter or 5-Star pH/ISE/DO/conductivity meter.
2. Thermo Scientific Orion conductivity cell.
 - The 013005MD, 013010MD, 013025MD, 0130605MD, 013610MD, 011050MD, 011510MD, 013016MD and 018020MD conductivity cells have a connector that is compatible with the Star Series conductivity meters.
 - The 013005A, 013010A, 013610, 011010A, 011020A, 011050A and 013016A and conductivity cells have a connector that is compatible with the 555A, 550A, 162A, 136S, 135A, 131S and 130A conductivity meters.
 - The 013005D, 013010D, 011010, 011020, 011050, 011510 and 013016D conductivity cells have a connector that is compatible with the A+ Series conductivity meters.
3. Conductivity standard solutions.
4. Magnetic stirrer or Orion stirrer probe, Cat. No. 096019. The Orion stirrer probe can be used with 3-Star, 4-Star and 5-Star benchtop meters.
5. Beakers, plastic or glass.
6. Distilled or deionized water.

Optional Accessories

The following protective guards are available for 013005MD, 013010MD, 013025MD, 013005A, 013010A, 013005D and 013010D conductivity cells.

Cat. No 013045 - Stainless steel protective guard

Cat. No. 080045 - Stainless steel and plastic protective guard

Cat. No. 081045 - Plastic protective guard

Conductivity Cell Calibration

A conductivity cell is formed by two square electrodes spaced a certain distance apart. The cell constant (K) is defined as the ratio of the distance between the electrodes (d) to the electrode area (A). However, the fringe-field effect (AR) alters the electrode area, therefore $K = d / (A + AR)$. It is normally impossible to measure the fringe-field effect, so the actual cell constant of a conductivity cell is calculated using a standard solution with a known conductivity value. Calibration is essential since the cell constant can vary as much as 10% from the nominal cell constant and the actual cell constant may change over time. Calibration frequency depends on the type of conductivity cell and the application. The most common methods of calibration are manual or automatic calibration.

An automatic calibration (AutoCal) is performed by entering the nominal cell constant in the meter, immersing the conductivity cell in a Thermo Scientific Orion conductivity standard and initiating the calibration. When the reading stabilizes, the meter displays the calibration standard value at 25 °C. Once the calibration is accepted, the meter calculates and displays the actual cell constant.

A manual calibration is performed by immersing the conductivity cell in a calibration standard and then manually adjusting the cell constant value until the correct calibration standard value at the measured temperature is displayed. A manual calibration requires a chart of the calibration standard values at different temperatures or the calibration can be performed with the calibration standard at 25 °C.

Note: Refer to the meter user guide for detailed calibration instructions. ▲

Conductivity Cell Storage

Conductivity cells can be stored in distilled or deionized water between measurements. For overnight storage or long-term storage, conductivity cells should be thoroughly rinsed and stored dry.

Conductivity Cell Maintenance

DuraProbe Cleaning Recommendations

Contaminant	Cleaning Solution	Recommended Time
Water soluble contaminants	Rinse with deionized water	No limit
Lubricants and oils	Soak in warm water and liquid detergent	No limit
Lubricants and oils	Soak in ethanol or acetone	No more than 5 minutes
Lime or hydroxide coating	Soak in 10% acetic acid or 10% hydrochloric acid	No limit

2-Electrode Cleaning Recommendations

Contaminant	Cleaning Solution	Recommended Time
Water soluble contaminants	Rinse with deionized water	No limit
Lubricants and oils	Soak in warm water and liquid detergent	10 to 30 minutes
Lubricants and oils	Soak in ethanol or acetone (glass cells only)	10 to 30 minutes
Lime or hydroxide coating	Soak in 10% acetic acid or 10% hydrochloric acid	10 to 30 minutes

Replatinization

Platinized cells are covered with platinum black to create a more effective surface area for conductivity measurements. The platinum deposit is quite durable and usually resistant to contamination and removal. However, replatinization of the cell may be required when measurements become slow, erratic or inconsistent or when the cell constant shifts more than 10% from the nominal cell constant. Platinizing the cell deposits a complete, fresh layer of platinum black on the plate surface that restores performance and reliability. Complete platinizing instructions are included with the platinizing kit, Cat. No. 0105PK. The platinizing kit is for use with 011020, 011010, 011050, 011050MD and 018020MD conductivity cells only. An adapter, Cat. No. 1010901, is required for platinizing the 011050MD and 018020MD conductivity cells.

Conductivity Cell Conditioning

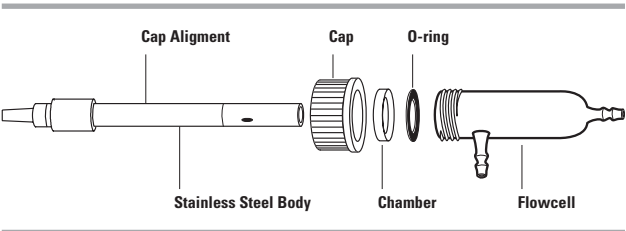
Cell conditioning is recommended to optimize the performance of the 011050MD, 011050 and 011050A conductivity cells in high range conductivity samples.

1. Pour the conditioning solution, Cat. No. 011001, into a beaker
2. Soak the conductivity cell in the conditioning solution overnight and up to 72 hours.
3. Remove the cell from the conditioning solution and thoroughly rinse with deionized water.
4. Blot the cell dry with a lint-free tissue.
5. Dispose of the used conditioning solution.

Flow Cell Assembly

The 013016MD, 013016A and 013016D conductivity cells include a detachable flow cell, Cat. No. 013017.

To insure a proper seal of the flow cell assembly, slide the cap onto the conductivity cell, then slide the chamber onto the conductivity cell, and finally slide the O-ring gasket onto the conductivity cell. The flow cell can then be placed over the conductivity cell and screwed into the cap. Do not force the conductivity cell into the pre-assembled flow cell; the O-ring will be forced into the flow cell.



Troubleshooting

The most important principle in troubleshooting is to isolate the components of the system and check each in turn. The components of the system are the meter, conductivity cell, standard and sample.

Meter

The meter is the easiest component to eliminate as a possible cause of error. Thermo Scientific Orion meters include an instrument checkout procedure. Consult the meter user guide for instructions and verify that the instrument operates as indicated.

Conductivity Cell

Rinse the cells thoroughly with distilled water and follow the cleaning procedures in the **Conductivity Cell Maintenance** section. If readings continue to be erratic and unstable, platinum cells may need to be replatinized or the cell may need to be replaced.

Standard

The quality of results depends greatly upon the quality of the standards. Always prepare fresh standards when problems arise.

Sample

If the cell works properly in standards but not in the sample, look for possible interferences or substances that could affect the response of the cell or physically damage the cell. If possible, determine the composition of the sample and check for problems.

Assistance

After troubleshooting all components of your measurement system, contact Technical Support. Within the United States call 1.800.225.1480 and outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit www.thermo.com/water.

Warranty

For the most current warranty information, visit www.thermo.com/water.

Ordering Information

Conductivity Cells

Refer to the **Introduction** section for a complete list of conductivity cells.

Accessories

Cat. No.	Description
011008	100 $\mu\text{S}/\text{cm}$ conductivity/TDS standard, 5 x 60 mL bottles
01100910	147 $\mu\text{S}/\text{cm}$ conductivity standard, 10 pouches
011007	1413 $\mu\text{S}/\text{cm}$ conductivity/TDS standard, 5 x 60 mL bottles
01100710	1413 $\mu\text{S}/\text{cm}$ conductivity/TDS standard, 10 pouches
011006	12.9 mS/cm conductivity/TDS standard, 5 x 60 mL bottles
01100610	12.9 mS/cm conductivity/TDS standard, 10 pouches
011005	111 mS/cm conductivity standard, 5 x 60 mL bottles
01100510	111 mS/cm conductivity standard, 10 pouches
990106	0.1 M KCl conductivity standard, 475 mL bottle
1010001	Conductivity calibration resistor kit for Orion Star Series conductivity meters, 8 pin MiniDIN connection
011220	Conductivity calibration resistor kit for 105A+, 115A+, 125A+, 145A+, and 150A+ meters, 8 pin DIN connection
011221	Conductivity calibration resistor kit for 130A, 131S, 135A, 136S, 162A, 550A, and 555A meters, 8 pin waterproof DIN connection
011001	Conditioning solution for 011050, 011050A, and 011050MD conductivity cells
0105PK	Platinizing kit, includes fixture and solutions
010010	Platinizing solution and vessel
013017	Replacement flow cell
013045	Stainless steel protective cell guard
080045	Stainless steel and plastic protective cell guard
081045	Plastic protective cell guard
1010900	Adapter, 8 pin MiniDIN conductivity cell to 8 pin waterproof DIN conductivity meter (130A, 131S, 135A, 136S, 162A, 550A, and 555A meters)
1010901	Adapter, 8 pin MiniDIN conductivity cell to 8 pin DIN conductivity meter (A+ Series meters)

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