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STANDARD OPERATING PROCEDURE
Conductivity and Temperature Measurements

KEY WORDS-
Conductivity, temperature, calibration, cell

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Environmental Hazards Assessment Program (EHAP) organization and personnel such as management, senior scientist, quality assurance officer, project leader, etc. are defined and discussed in SOP ADMN002.

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1.0 INTRODUCTION

1.1 Purpose

To provide standardized instruction for the operation of the Orion® model 140 and 142 conductivity meters with a 4-electrode epoxy conductivity cell (probe).

1.2 Scope

This document will provide specific instructions for instrument set-up, calibration conductivity and temperature measurements in the field and instrument storage.

2.0 MATERIALS

2.1 Orion conductivity meter model 140 with model 014010 probe
2.2 Orion conductivity meter model 142 with model 013030 or 013010 probe
2.3 Conductivity standard solution, or pure KCl crystals, DI water and a scale
2.4 Deionized water

3.0 PROCEDURES

3.1 Routine Maintenance

The 4-electrode conductivity cells (all models) are highly resistant to incrustation or deposit. They are also unbreakable and have abrasion proof electrodes. Normally, the conductivity cell does not age, but special measuring media (hydrofluoric acid) or excessively high temperature shorten the lifetime. Thoroughly rinsing the probe with deionized water after each use and proper storage are the key factors to maintaining the cell. If the probe becomes contaminated, follow the external cleaning procedures below.

3.1.1	<u>contaminant</u>	<u>cleaning solution</u>	<u>recommended time</u>
	-water soluble contaminants	-rinse with deionized water	no limit
	-lubricants, oil	-warm water and liquid household detergent	no limit
		-ethanol or acetone	5 min. max.

contaminant	cleaning solution	recommended time
-lime or hydroxide coating	-10% acetic or hydrochloric acid	no limit

If contaminants cannot be removed by the above cleaning methods, concentrated acid (nitric or acetic) may be used with care, and for limited amounts of time.

3.1.2 Thoroughly rinse off any cleaning agents with copious amounts of deionized water.

3.1.3 Recalibrate the cell (see section 4.0).

3.2 System set-up for model 140

This set-up procedure is for measurements taken in "natural waters". If sampling sea water or other aqueous solutions, consult the instruction manual. Steps 3.2.1 through 3.2.4 need to be completed only if the meter's settings have been changed.

3.2.1 On the back panel of the meter, look for the area labeled "Tref". This is the reference temperature and should be set to 25^{0}C.

3.2.2 RESET meter by simultaneously pressing the S/cm-Sal key while pressing the On/Off key to turn the meter ON.

3.2.3 Wait approximately 2 seconds for the LCD display segment test to be completed.

3.2.4 Press the S/cm-Sal key 4 more times until cursor in left LCD display is at "µS/cm" and "0" is shown with no decimal point. The following data are now stored and will be the default settings on subsequent startups:

Temperature coefficient	nLF
Cell constant	0.609/cm
Measuring Range	0 to 1999 µS/cm
Range selection mode	Manual

The temperature coefficient nLF means the non-linear function mode is set (see manual for more detailed explanation.) If sampling agricultural waters or rivers where

the conductivity may exceed 1999 µS/cm, the range of conductivity measurement will have to be changed. The cell maximum measuring range is exceeded when "OFL" is visible in the left LCD display. To change the range, press the S/cm-Sal key one or two times depending on the preferred range. Pressing once gives the range 0.00 to 19.99 mS/cm, and pressing twice gives the range 0.0 to 199.9 mS/cm. The meter may also be switched to the AUTO-RANGING mode by turning the meter off, and switching the meter back on while pressing the ▲ scroll key at he same time. The meter will then choose the appropriate range for the water being measured.

3.3 System set-up for model 142

This set-up procedure is for measurements taken in "natural waters". If sampling sea water or other aqueous solutions, consult the instruction manual. Steps 3.3.1 through 3.3.2 need to be completed only if the meter's settings have been changed.

3.3.1 RESET meter by simultaneously pressing the RUN/ENTER key while pressing the ON/OFF key to turn the meter on.

3.3.2 *SEr On* will be displayed, wait approximately 2 seconds for the LCD display segment test to be completed. The following data are now stored and will be the default settings on subsequent startups:

Temperature coefficient	nLF
Cell constant	0.475/cm
Reference temperature	25 °C
Range selection mode	Automatic

Because the range selection mode is automatic, the meter will choose the range with the highest possible resolution for the water being measured. The measuring ranges are as follows:

Measuring range	**Resolution**
0.0 to 199.9 µS/cm	0.1 µS/cm
0 to 1999 µS/cm	1 µS/cm
0.0 to 19.99 mS/cm	0.01 mS/cm
0.0 to 199.9 mS/cm	0.1 mS/cm
0 to 500 mS/cm	1 mS/cm

3.4 Conductivity and temperature measurements with model 140 or 142

3.4.1 Turn on conductivity meter.

3.4.2 Rinse probe with deionized water or perform native rinse.

3.4.3 Immerse the conductivity cell into a well mixed area of the water body.

3.4.4 The temperature is shown on the LCD display simultaneously with the conductivity display. Take conductivity measurement in µS/cm and the temperature reading in ^{0}C.

3.4.5 Rinse probe with deionized water.

4.0 Calibration

Periodic calibration of the conductivity cells is recommended (once a week to two times a day). Calibration frequency depends on sample and measurement conditions and is up to the project leader. Orion® conductivity cells require less frequent calibration because the 4-electrode design compensates for the effects of electrode contamination. For best results, choose a conductivity standard that is closest to the expected value of the water to be measured, or falls in the middle of the expected range of samples to be measured.

4.1 Calibration of model 140 with model 014010 probe

4.1.1 Reset the meter to its default settings according to section 3.2.

4.1.2 Press the ^{0}C-TC-C button two times until the cursor in the right LCD display is at C to reveal the cell constant. (It will be .609/cm when properly reset.)

4.1.3 Rinse the probe with deionized water, gently shake off excess water, and place the probe into a beaker filled with conductivity standard.

4.1.4 If the readout in the left LCD display is not exactly the same as the standard, press the ▲ or ▼ scroll key until you get to the number you are looking for. The cell constant also changes as you adjust the conductivity. When you reach the desired number of the standard, the cell is calibrated.

4.1.5 Press the °C-TC-C button one time to return the right LCD display to the temperature mode.

4.1.6 Turn the machine off to store the new cell constant.

4.1.7 Retest the calibration. To retest, turn the machine on, rinse the probe with deionized water, gently shake off the excess water, and reinsert the cell in the standard solution. If you do not get the correct conductivity, repeat steps 4.1.1 through 4.1.7.

4.1.8 Rinse the cell thoroughly with deionized water and store properly.

4.2 Calibration of model 142 with model 013010 or 013030 probe

4.2.1 Reset the meter to its default settings according to section 3.3.

4.2.2 Press the c button once to reveal the cell constant. (It will be .475/cm when properly reset.)

4.2.3 Rinse the probe with deionized water, gently shake off excess water, and place the probe into a beaker filled with conductivity standard.

4.2.4 If the readout in the LCD display is not exactly the same as the standard, press the ▲ or ▼ scroll key until you get to the number you are looking for. The cell constant also changes as you adjust the conductivity. When you reach the desired number of the standard, the cell is calibrated.

4.2.5 Press the x button once to switch from the cell constant to the temperature mode.

4.2.6 Turn the machine off to store the new cell constant.

4.2.7 Retest the calibration. To retest, turn the machine on, rinse the probe with deionized water, gently shake off the excess water, and reinsert the cell in the standard solution. If you do not get the correct conductivity, repeat steps 4.2.1 through 4.2.7.

4.2.8 Rinse the cell thoroughly with deionized water and store properly.

5.0 Recipe for laboratory prepared conductivity standard solution

5.1 Weigh out 1.4912 g of pure potassium chloride (KCl) crystals.

5.2 Measure 2 L of DI water and place in a clean container.

5.3 Add the crystals to the water and mix well, making sure all of the crystals have dissolved. This solution equals 0.01 molar KCl or 1413 µS at 25^{0}C. A 50% (706.5 µS) or 25% (353.3 µS) solution can be made by diluting the solution appropriately, or reducing the amount of KCl crystals proportionally.

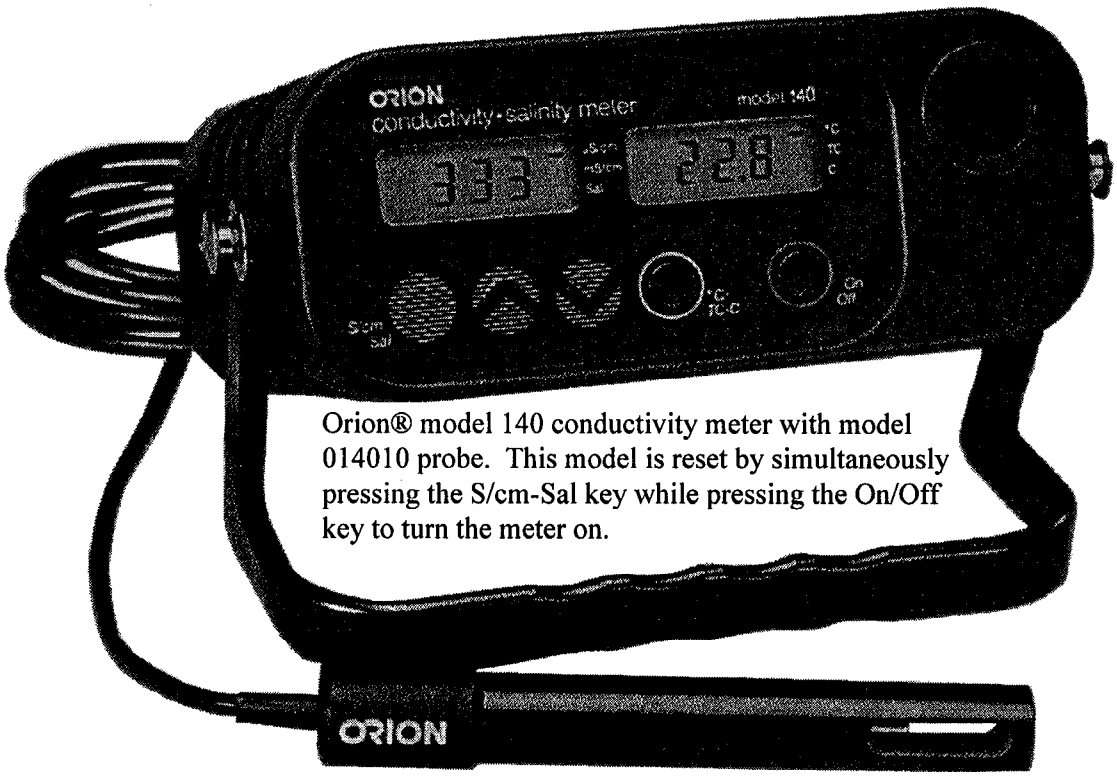
6.0 Meter/probe storage

6.1 Between measurements and when en route to and from the field, keep the probe secured in the protective sleeve on the meter face.

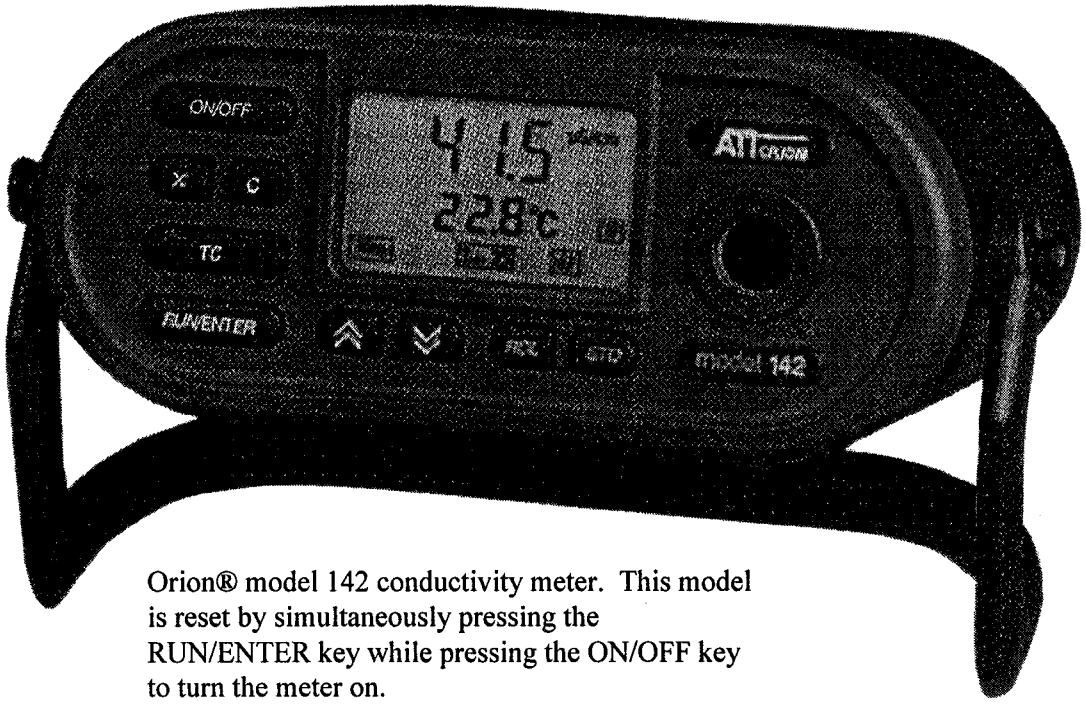
6.2 Upon return to the lab, rinse probe with deionized water to ensure removal of particulates and water soluble chemicals.

6.3 Plug in power source to back panel of the meter to ensure a proper charge for future use.

6.4 For overnight or longer, cells should be stored clean and dry.



Orion® model 140 conductivity meter with model 014010 probe. This model is reset by simultaneously pressing the S/cm-Sal key while pressing the On/Off key to turn the meter on.



Orion® model 142 conductivity meter. This model is reset by simultaneously pressing the RUN/ENTER key while pressing the ON/OFF key to turn the meter on.