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Model 2053
Conductivity Meter
Instruction Manual

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09/2006

Ship Date:_____

Serial Number: _____

Calibrated By:_____

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1. Introduction

The Model 2053 digital conductivity meter features three modes of operation: one for self check; and two for measuring conductivity over four decades from 20 micro Siemens to 20 milli-Siemens (note: 20 milli Siemens [mS] = 20,000 micro Siemens [µS]). The conductivity measurement readings are displayed on a 3½ digit LCD with a floating decimal. The Self Check feature provides verification of proper operation, and the ability to adjust for cell constant variations

Please read this manual carefully before operating the conductivity meter. If you have any questions about the operation of the meter, call Amber Science at telephone # (541) 345-6877 and request the Tech Support Department or e-mail questions to: info@amberscience.com .

2. Shipping Checklist

Carefully unpack and inspect the instrument for shipping damage. Check all materials in the carton against the enclosed Packing List. If the instrument has been damaged in transit, contact Amber Science, Inc. and the carrier to file a damage claim. Please retain all items including the carton and packing materials.

Model 2053 Digital Conductivity Meter includes: one (9 Volt) Nickel Hydride rechargeable battery (battery is pre-installed), AC Adaptor (charger), one pint 718 micro-mho calibration standard solution and one instruction manual. See page 2 and 5 for Conductivity Cells available.

3. Specifications

Measurement Range and Resolution:

RANGE	FULL SCALE	RESOLUTION
A	20.00 micro Siemens	.01 micro Siemens
B	200.0 micro Siemens	.1 micro Siemens
C	2.000 milli Siemens	.001 milli Siemens
D	20.00 milli Siemens	.01 milli Siemens

Instrument Accuracy

Accuracy at 25°C plus or minus (±) one digit

RANGE	
A	.15% of Full Scale
B	.10% of Full Scale
C	.10% of Full Scale
D	.15% of Full Scale

Temperature Compensation

5 to 45°C – all ranges with reference temperature of 25°C

4. Display

Half inch high LCD, 3 ½ digit, dual slope A/D converter; 2,000 digits full scale with a floating decimal. The meter displays "1" for over-range. Display is updated two times per second.

5. Power requirements

One 9 Volt, Nickel Metal Hydride (Ni-MH) rechargeable battery is included with the instrument. Battery life is approximately 96 hours. When the "Lo Batt" indicator appears in the upper corner of the display, the battery should be recharged. Plug in the AC Adaptor (included) and allow the battery to fully recharge for approximately 24 hours. The battery life is independent of the range selected and the solution being measured. [For AC Adaptor specifications, see page 3 ----► (C)]. When using the AC Adaptor, the battery must remain connected in the conductivity meter. **Note**: A Nine Volt (9 volt) Alkaline or Lithium battery may also be used as a replacement battery. **See page 7 (Section 16) for battery replacement instructions.**

6. Environmental Limits

Temperature: 5 to 45°C
Humidity: 5 to 90% (relative, non condensing)

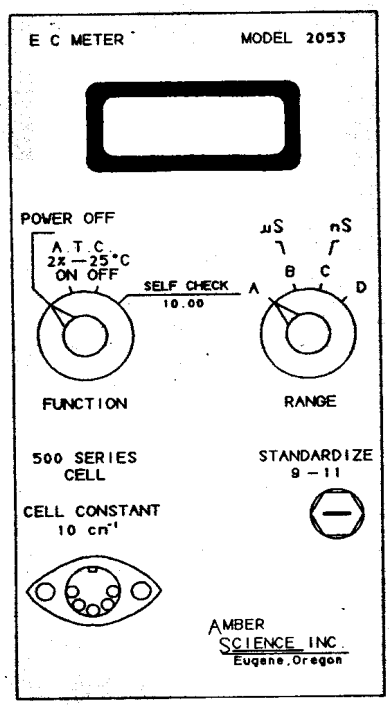
7. Conductivity Cells

Order Conductivity Cell separately. See page 5 for additional information on Cells.

P/N 515	Conductivity Dip Cell (Au)
P/N 525	Conductivity Dip Cell (Pt)
P/N 535	Conductivity Multi-Purpose Cell (Au)
P/N 545	Conductivity Multi-Purpose Cell (Pt)

8. Controls, connectors and indicators

This section contains information about the installation and operation of the Model 2053. Please read before using the instrument. If you have any problems, please call Amber Science at telephone # (541) 345-6877 and request the Tech Support Department.



◄----------A. Display

B. Function Selector---------►

◄---------E. Range Selector

◄----------F. Standardize

D. Cell Connector (5 pin)-----►

C. AC Adaptor Jack----------►

(A) Display: 3 ½ Digit LCD with floating decimal and "Lo Batt" (low battery) indicator.

(B) Function Switch: Selects Power "Off", power "On" with ATC "On", power "On" with ATC "Off" and Self Check.

(C) AC Adaptor Jack: AC Adaptor jack for recharging (9 Volt, Ni-MH) battery. Connect AC Adaptor (Class 2 Transformer: I/P: 120 V AC, 60 Hz, 4 W, O/P: 9 V DC, 100 mA). Note: When the AC Adaptor is employed, the battery is to remain in the instrument and connected. For battery replacement, please refer to Section 16, page 7.

(D) Cell Connector: Provides input/output access to the conductivity cell (5 pin circular din connector).

(E) Range Selector: Allows operator to select from 4 Ranges (A - D) from 20 micro-Siemens (µS) full scale, to 20 milli-Siemens (mS) full scale. Note: Siemens = mho.

(F) Standardize: Master calibration control. Use a small flat blade screwdriver to adjust the Standardize Pot.

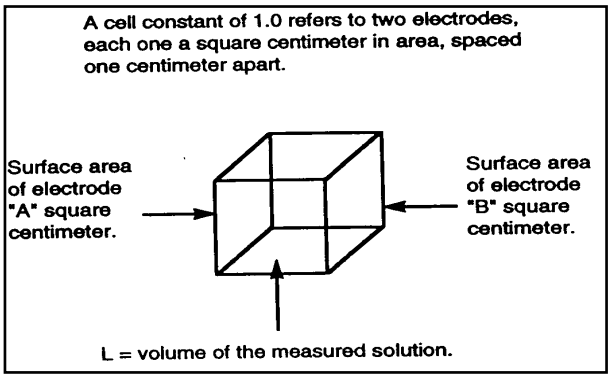
Note: An optional Lab Stand with Cell holder is available for use with the Model 2053 EC Meter. Order Part # 6530.

9. Conductivity

The basic unit of resistance is the ohm. The inverse of resistance is conductance and its basic unit of measurement is the mho (international system of units for mho is Siemens [S]).

Conductivity cells usually consist of two metallic plates of a determined size mounted in a defined area. The cell constant "K" is the length "L" (or distance between the plates) of the conducting path in centimeters divided by the effective cross sectional area "A" of the conducting path in square centimeters (K=L/A).

The Model 2053 is designed to use a cell with a constant between 9 and 11.



The instrument has automatic temperature compensation (ATC) for slope correction.

10. Slope

The slope correction for the Model 2053 is set to an average of 0.1, 0.01 and 0.001 M of the following solution: Potassium Chloride, Sodium Chloride, Ammonium Chloride, Lithium Chloride and Potassium Nitrate. The following is a representation of that average:

Temperature	Slope	Curve Trace Accuracy
5°C	**1.88% / °C**	**- 0.4%**
10°C	**1.91% / °C**	**0**
15°C	**1.94% / °C**	**+0.2%**
20°C	**1.97% / °C**	**+0.2%**
25°C----------	**----------2.00% / °C**	**----------0**
30°C	**2.03% / °C**	**- 0.2%**
35°C	**2.06% / °C**	**- 0.2%**
40°C	**2.09% / °C**	**0**
45°C	**2.12% / °C**	**+0.4%**

11. Conductivity standards

There are several Conductivity Standards available. Choose a Standard that is close to the range you expect to measure and calibrate the conductivity instrument periodically. Conductivity Calibration Standards are available in pint, quart or gallon sizes:

74.7	Micro Siemens (µS) @ 25°C
718	Micro Siemens (µS) @ 25°C
1,409	Micro Siemens (µS) @ 25°C
6,660	Micro Siemens (µS) @ 25°C
58,700	Out of Range for the 2053

12. Conductivity Cells

Several Conductivity Cells are available; choose one that is suitable for your application.

Dip Cells
Dip Cells are used to dip into a test tube or beaker. They require a minimum sample of 1 ml in the smallest diameter test tube the cell will fit into (i.e. 10 mm ID diameter test tube). The Dip Cell is available in gold (Au) or platinum (Pt) plated electrodes.

Multi-Purpose Cells
A Multi-purpose Cell is available which can be used three ways – dip cell, flow cell or as a pipette cell. The multi-purpose cell is also available in gold (Au) or platinum (Pt) plated electrodes. For measuring high purity water, choose a gold plated multi-purpose cell and use it in the flow configuration to avoid exposing a high purity water sample to atmospheric gases, which can contaminate a sample. **Note:** Model 2053 is not designed for measuring high purity water.

(Au) & (Pt) Cells
A gold (Au) cell will work well for measuring the four ranges of conductivity that the Model 2053 measures. A Platinum (Pt) plated cell has a coating of sponge black platinum on the plates of the cell, this coating is required to measure high conductivity solutions such as sea water or solution above 20 milli Siemens.

Re-platinizing (Pt) Cells
The platinum (Pt) plated cells are coated with a sponge black platinum. This coating gives the plates additional effective surface area required for good linearity. Should any part of this coating be removed in any way, the cell may be non-linear and may produce erroneous readings. Re-platinizing the cell will be necessary on occasion. This can be accomplished (for a nominal charge) by sending the Cell back to Amber Science, Inc., or by using the Model 8501 Platinizing Station and ASTM D-1125 Platinizing Solution.

Cleaning Cells
It is important to remember that the conductivity cell is delicate and should be cared for properly. To clean a conductivity dip or multi-purpose cell, wet a cotton tipped applicator with a solvent appropriate to remove any residue that has contaminated the plates of the cell. Choose a solvent (i.e. Isopropanol 99%) that will not damage the epoxy tube the cell is constructed of (do ***not*** use Aqua Regia to clean cell or remove old platinum). Insert a wetted cotton tipped applicator through the bottom opening of the cell. Use a push and pull motion a few times and remove the swab. Then clean the cell with a mild soap and water solution with a final rinse in DI water. *Remember*, if the cell has (Pt) plates, it will need to be re-platinized after cleaning. Conductivity cells should be stored clean and dry when not in use.

Use of Conductivity Cells
A conductivity dip cell needs to be immersed at least 1.5 inches into the solution for proper measurement. Dip and multi-purpose cells include an o-ring, which may be used to vertically position the cell in the “Cell Holder” which is part of the optional Lab Stand, P/N # 6530.

13. Calibration

Supplies required: conductivity meter, cell, graduated beakers or cylinders, small screwdriver, calibration solution (not expired), calibration sticker, writing instrument (pen) and calibration data form (page 8) if applicable.

Procedure

1. Carefully connect the conductivity cell into the 5-pin connector on the meter. Make sure pins line up correctly. The conductivity cell should be clean and dry.
2. Turn the Function switch to ATC "On".
3. If you are using the 718 micro-mho (µS) calibration solution that was included with the meter, set the Range switch to "C". If you are using another calibration solution, select the appropriate Range suitable for your solution.
4. Prepare three samples of the 718 micro-mho standard solution (example – three clean test tubes or beakers filled at least 1.5 inches from the bottom). Hold solution at 25°C or as close to 25°C as possible.
5. Dip the Cell into the first sample of calibration solution. Wait a few seconds for the cell to temperature equilibrate to the standard solution.
6. Remove the Cell and carefully shake off excess solution. Do not touch or wipe off the cell.
7. Repeat steps 5 and 6 for the second sample of standard solution.
8. Place the Cell into the third sample of standard solution. Using a small screwdriver, adjust the master calibration / standardize control to read the value of the standard solution (or .718 if using the 718 micro-mho solution that was included with the meter).
9. To check the Cell Constant, change Function switch to the "Self Check" position and the Range switch to "A". The cell constant reference point may be read directly from the display (example – 9.96, 10.04, 10.09 – all cells have a slightly different cell constant).
10. Record calibration information on data form and if applicable, affix a calibration sticker to the instrument. The meter and cell are now ready to make precise conductivity measurements.

14. Making conductivity measurements

Once the instrument has been properly calibrated / standardized, it is now ready to make conductivity measurements of unknown solutions.

1. In making measurements of unknown solutions, select the appropriate Range, and switch the Function selector to the ATC "On" position.
2. If possible, prepare 3 individual samples of the unknown solution. If only a minimal amount is available then prepare one sample in a clean container. Minimum amount required for an accurate measurement is 1 ml in a 10 mm (ID) test tube.

One Sample Method

1. Dip the cell into the container holding the unknown solution. Gently move the cell up and down a few time to dislodge any air bubbles. Allow the cell to temperature equilibrate to the solution (about 10 –15 seconds) then record measurement.

Three Sample Method

1. Rinse cell in the first sample of the unknown solution by inserting cell into container and moving up and down a few times to dislodge any air bubbles. Remove cell and carefully shake off excess solution, do not touch or wipe off the cell.
2. Place cell into second sample and repeat step 1.
3. Place cell into third sample of unknown solution, allow cell to temperature equilibrate to solution (about 10-15 seconds). Record measurement.

Note: if display reads "1" meter is over-ranged, change Range selector until correct reading is displayed.

15. Maintenance

Preventive maintenance:

1. The Model 2053 requires no periodic maintenance, other than calibration.
2. Cleaning the instrument should be done with a mild soap solution and a damp cloth. Caution: Do **not** allow fluids to run into the instrument
3. Conductivity Cells should be cleaned & inspected periodically. Replace when necessary.
4. Battery will require periodic replacement. See Battery replacement section 16.

16. Battery replacement

The Nickel Metal Hydride rechargeable battery included with the instrument can be recharged approximately 1000 times. To replace the (9 Volt) battery, turn the Function selector to "Off". Remove four screws on rear cover of instrument and carefully remove battery from battery snap. Replace used battery with a new 9 Volt (Nickel Metal Hydride [Ni-MH], Lithium or Alkaline) battery by properly attaching battery snap to the new battery. Carefully replace rear cover and four screws. **Note:** Do **not** use AC Adaptor (Charger) if a Lithium or Alkaline battery is installed.

17. Repair

Should the instrument become in need of repair please contact Amber Science, Inc. at telephone # (541) 345-6877 and request the Customer Service Department to obtain a Return Authorization number (RA#). If instrument has not been subject to abuse or misuse, please return freight prepaid and adjustments will be made under warranty. Out of warranty items will be repaired on a charge basis with customer approval. When returning an item, please include any data regarding the reason for return. For your protection, items should be carefully packed to prevent damage in transit and insured against possible damage or loss. Amber Science, Inc. will not be responsible for damage or loss during transit.

18. Warranty

Amber Science, Inc. warrants this product to be free defects in material and workmanship for a period of one year from date shipped. Warranty will be allowed whenever possible. However, Amber Science, Inc will review all warranty claims.

19. Exclusions from Warranty

This warranty shall not apply to fuses, disposable batteries, (conductivity cells are warranted for 90 days) or any product or part which, have been subject to misuse, neglect, tampering, accident or abnormal conditions of operation.

20. Limited Liability

Amber Science, Inc. is pleased to offer suggestions on the use of this product: however, we have no control over its use or intended use. No representation or warranty, whether of merchantability, fitness for any particular purpose, is made beyond the repair, replacement or refund of purchase price at the sole discretion of Amber Science, Inc.. In no event shall Amber Science be liable for special or consequential damages for injury to person or property, which may result from the use of this product. Users shall determine the suitability of this product for its intended applications before using and users shall assume all risk and liability whatsoever in connection therewith regardless of our suggestions as to applications or constructions. Amber Science reserves the right to make changes in specifications, design, construction and appearance of products without notice.

21. Calibration data

Calibrating / standardizing the instrument with a known calibration solution should be performed on a routine basis. Frequency (daily, weekly or before each use) is a determination made by the user. Record calibration data below.

Model #:_____ Serial #:_____ Cell Part #_____ Mfd. _____

Date (mm-dd-yy)	Standard Value /µS	Lot # / Mfd. Date	Self Check (cell K)	Employee name

This form may be duplicated without restriction.