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Model 2052 Conductivity Meter Instruction Manual



Model 2052-B

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Serial Number: _____

Ship Date: _____

Calibrated By: _____

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1. Introduction

The Model 2052 digital conductivity meter features three modes of operation: one for self check; and two for measuring conductivity over six decades from 0 to 200 milli-Siemens (aka: milli-mhos). The Conductivity and Total Dissolved Solids (TDS) measurement readings are displayed on a 3 ½ digit LCD with a floating decimal. The Self Check feature provides verification of proper operation, the ability to adjust for cell constant variations and the Total Dissolved Solids (TDS) scale factor.

Please read this manual carefully before operating the conductivity meter. If you have any questions about the operation of the meter, call Amber Science, Inc. at (541) 345-6877 and request the Tech Support Department or questions may be e-mailed 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 2052 Digital Conductivity Meter includes: one spare (9 Volt) battery, 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	2.000 micro Siemens	.001 micro Siemens
B	20.00 micro Siemens	.01 micro Siemens
C	200.0 micro Siemens	.1 micro Siemens
D	2.000 milli Siemens	.001 milli Siemens
E	20.00 milli Siemens	.01 milli Siemens
F	200.0 milli Siemens	.1 milli Siemens

Instrument Accuracy

Accuracy at 25°C plus or minus one digit

RANGE	
A	.20% of Full Scale
B	.15% of Full Scale
C	.10% of Full Scale
D	.10% of Full Scale
E	.15% of Full Scale
F	.30% 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 alkaline battery (NEDA 1604). Battery life is approximately 220 hours. The “Lo Batt” indicator lights up when there is about 20 hours of operation left. Battery life is independent of the selected range and the measured solution. An optional AC adaptor can be used as a remote power source. [For AC Adaptor specifications, see page 3 ----► (D)].

Note: When using the optional AC Adaptor, keep the battery connected in the conductivity meter.

6. Environmental Limits

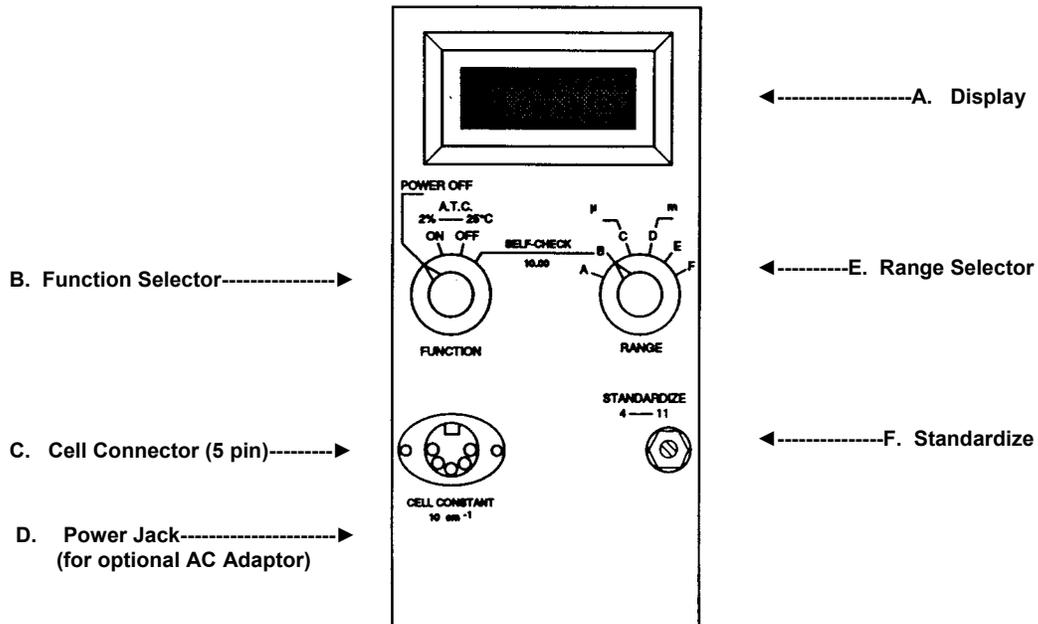
Temperature: 5 to 45°C
Humidity: 5 to 90% (relative, non condensing)

7. Conductivity Cells

515	Conductivity Dip Cell (Au)
525	Conductivity Dip Cell (Pt)
529	Conductivity Micro Flow Cell (S/S) --note: Cell K = 100 cm ⁻¹
535	Conductivity Multi-Purpose Cell (Au)
545	Conductivity Multi-Purpose Cell (Pt)

8. Controls, Connectors and Indicators

This manual contains information about the operation of the Model 2052. Please read before using the instrument. If you have any questions, please call Amber Science, Inc. at phone # (541) 345-6877 and request the Customer Service or Technical Support Department.



- (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) **Cell Connector:** Provides input/output access to the conductivity cell (5 pin circular din connector).
- (D) **Power Jack:** Remote power for operating instrument. Connect optional AC Adaptor (Class 2 Transformer: I/P: 120 V AC, 60 Hz, 3W, O/P: 6 V DC, 200 mA). **Note:** Adaptor is part of Lab Kit, Catalog # 6540. In the event the AC Adaptor is employed, the battery is to remain in the instrument and connected.
- (E) **Range Selector:** Allows operator to select from 6 Ranges (A - F) from 2 micro-Siemens (μS) full scale, to 200 milli-Siemens (mS) full scale. Note: Siemens = mho.
- (F) **Standardize:** Master calibration control. Use a small flat blade screwdriver to adjust the Standardize Pot.

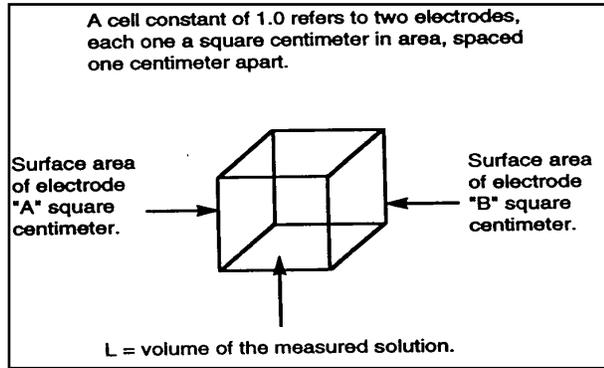
AC Adaptor Note- (Due to a re-design of the charging system):
Model 2052's shipped before December 22, 2003 use AC Adaptor:
I/P: 120V AC, 60Hz, 4W / OP: 9V DC, 100 mA
Model 2052's shipped after December 22, 2003 use AC Adaptor:
I/P: 120V AC, 60Hz, 3W / OP: 6V AC, 200 mA

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 2052 is designed to use a cell with a constant between 9 and 11.



The instrument has Automatic Temperature Compensation (ATC) for slope correction.

Total Dissolved Solids (TDS) in a conductive aqueous solution is not temperature sensitive, as is the conductivity. By multiplying conductivity by an empirical factor, TDS may be displayed. This empirical factor is determined by the components and temperature of the solution. When the conductivity has been corrected to 25°C, this factor is usually between 0.5 and 0.9. The Model 2052 allows for standardization with scale factors as low as 0.45 for direct display of TDS in parts per million (ppm) or parts per thousand (ppt).

10. Slope

The slope correction for the Model 2052 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:

<u>Temperature</u>	<u>Slope</u>	<u>Curve Trace Accuracy</u>
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. Calibration Standard Solutions

There are many different Conductivity Standards available. Choose a Standard that is close to the range you expect to measure and calibrate the conductivity instrument on a routine basis. Make sure the calibration solution is fresh and not expired. Record calibration data (see page 9). See next page for calibration standards solutions available from Amber Science.

Calibration Solutions continued:

Value	Unit of Measurement	Size
74.7	Micro-Siemens @ 25.0°C	Pint (16 ounces)
718	Micro-Siemens @ 25.0°C	Pint (16 ounces)
6,660	Micro-Siemens @ 25.0°C	Pint (16 ounces)
58,700	Micro-Siemens @ 25.0°C	Pint (16 ounces)

A Quart and Gallon size of each standard is also available.

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.

(Au) & (Pt) Cells

Choose a gold cell for measuring low conductivity or solutions below 2,000 micro Siemens. Choose a Platinum plated cell for measuring solutions above 2,000 micro Siemens (or 2 milli Siemens).

Re-platinizing (Pt) Cells

The (Pt) electrodes in the cells are coated with 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 7568 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.

Micro Flow Cell

The Micro Flow Cell has a cell constant of 100 cm⁻¹, all readings must be multiplied by 10 after standardizing. Refer to the instruction sheet included with the Micro Flow Cell for additional information.

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 Kit, catalog # 6540.

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 9) 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 "D". 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 "B". 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 times 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. Total Dissolved Solids

Before making TDS measurements, you must first determine the scale factor to be used and know the cell constant of the cell being used. To determine cell constant, refer to instructions for calibrating the meter.

Example of some Scale Factors

Sodium Chloride

	<u>Gram per liter</u>	<u>Conductivity</u>	<u>Scale Factor</u>
	1	1.7 milli-Siemens	.588
	5	8.2	.610
	10.1	16.0	.631
	15.1	23.2	.651
	20.2	30.2	.669
	41.1	57.3	.717
	53.8	72.6	.741
Potassium Chloride	5	8.2	.609
Ammonium Chloride	5	10.5	.476
Lithium Chloride	5	10.1	.495
Potassium Nitrate	5	5.5	.909

How to determine a Scale Factor:

One gram per liter of KCl (Potassium Chloride) = 1000 ppm or 1 ppt and will yield a conductivity of 1793 micro Siemens (μS) or 1.793 milli Siemens. $1000 \text{ ppm} \div 1793 \mu\text{S} =$ a scale factor of .55772. If this is multiplied by the cell constant (example 10.04) a new standardizing factor will be given: $.55772 \times 10.04 = 5.6$

When this new cell constant factor is used and the example solution of one gram per liter of KCl is measured, the display will show 1.000 in "D" range or 1 part per thousand (ppt) TDS (Total Dissolved Solids).

16. Making TDS Measurements

Once the scale factor has been determined, multiply it by the cell constant to determine the new cell constant factor to be used.

1. Change Function selector to "Self Check" and Range to "B".
2. Adjust the master standardize control with a small screwdriver to read the newly determined cell constant factor (example: 5.6).
3. Switch Function to ATC "On" and the Range selector to the appropriate Range (A,B, C = Parts per million (PPM) and D,E & F range = Parts per thousand (PPT)).
4. Place the conductivity cell in the sample of unknown solution and the TDS can now be read directly from the display. Record the measurement.

Optional method for determining TDS

To quickly and easily determine the TDS of a solution, measure the conductivity of the solution and divide the measurement by 2. This method is commonly used, but the resulting value is only an estimate of the actual value and is not highly accurate.

17. Maintenance

Preventive maintenance:

1. The Model 2052 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 18.

18. Battery Replacement

When the low battery “Lo Batt” indicator illuminates in the upper corner of the display, there is approximately 20 hours on average of battery life remaining. To replace the (9 Volt) battery, turn the Function selector to “Off”. Remove battery door on rear of instrument and carefully remove battery from battery snap. Replace used battery with a new 9 Volt alkaline battery by properly attaching battery snap to the new battery. Replace battery door.

19. Repair

Should the instrument become in need of repair, please contact Amber Science, Inc. at telephone number (541) 345-6877 and request the Customer Service Department. 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 will not be responsible for damage or loss during transit.

20. Warranty

Amber Science, Inc., warrants this product to be free from significant deviations in material and workmanship for a period of one year from date of purchase. If any repairs or adjustments are necessary please contact Amber Science and request Customer Service.

21. 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.

22. 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, Inc. 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.

