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Model 1056
Digital Conductivity Meter
Instruction Manual

Model 1056 Conductivity Meter shown with a Multi-Purpose Cell

Printed in U.S.A.

Revised 10-2006

Ship Date:_____

Serial Number: _____

Calibrated By:_____

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1. Introduction

The Model 1056 digital conductivity meter is a bench top, line power instrument designed for the measurement of Conductivity covering six ranges from .001 micro Siemens (μS) to 199.9 milli Siemens (mS). The bright red 3 ½ digit L.E.D. display has a floating decimal and indicates whether the displayed measurement is in micro Siemens (μS) or milli Siemens (mS) [Note: mho = Siemens].

The meter features two front panel controls, one for selecting the Range (A – F) and one for the "Calibrate" control adjustment. The Model 1056 has a Function switch on the rear panel for selecting A.T.C. "On" or "Off", both referenced to 25°C. A self-test mode allows the user to check the calibration reference point (Cell K). The Power Entry Module (PEM) allows for either 115 V AC or 230 V AC operation. The recorder output is 1 volt per 1000 counts from a 1 K ohm source. A built-in tilt stand / handle and cell holder are included.

Please read this manual carefully before operating the conductivity meter. If you have any questions about the operation of the instrument, 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 the shipper and the carrier to file a damage claim. Please retain all items including the carton and packing materials for possible inspection by the carrier.

Model 1056 Digital Conductivity Meter includes the following:

1 - Model 1056 Digital Conductivity Meter
1 - U.S. Standard Power Cord (removable)
2 - Fuses (1/16 amp) for optional 230 V AC operation
1 - Analog Recorder Output Plug
1 - Pint 718 µS conductivity calibration solution
1 - Instruction Manual
1 - Calibration Tool (mini screwdriver)

3. Conductivity Cells

Order Conductivity Cell separately. See page 6 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)
P/N 529	Conductivity Micro Flow Cell (S/S)

4. Accessories

P/N 590	Cell Cup (for measuring ½ ml of solution)
P/N 500-6	Cell connector (5 pin) with 1 meter (39") cable and 6K Thermistor (kit to aid in fabrication of custom cell)
P/N 8501	Platinizing Station (for re-platinizing (Pt) cells) Note: Does not include Platinizing Solution

5. Calibration Solutions

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 Solutions are available in pint, quart or gallon sizes*:

74.7	Micro Siemens (micro mhos) @ 25°C
718	Micro Siemens (micro mhos) @ 25°C
1,409	Micro Siemens (micro mhos) @ 25°C
6,660	Micro Siemens (micro mhos) @ 25°C
58,700	Micro Siemens (micro mhos) @ 25°C

6. Specifications

Measurement Range and Resolution: Accuracy @ 25°C ± one digit

Range	Full Scale	Resolution	Frequency	Accuracy
A	1.999 micro Siemens	.001	35 Hz	± 0.3 %
B	19.99 micro Siemens	.01	234 Hz	± 0.2 %
C	199.9 micro Siemens	.1	234 Hz	± 0.1 %
D	1.999 milli Siemens	.001	1597 Hz	± 0.1 %
E	19.99 milli Siemens	.01	1597 Hz	± 0.2 %
F	199.9 milli Siemens	.1	6274 Hz	± 0.3 %

Note: µS = micro Siemens mS = milli Siemens
(1,999 micro Siemens = 1.999 milli Siemens)

Temperature Compensation

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

Temperature compensation and Slope

Temperature	Slope w/Reference @ 25°C
5°C	1.88 %
10°C	1.91 %
15°C	1.94 %
20°C	1.97 %
25°C----------	----------2.00 %
30°C	2.03 %
35°C	2.06 %
40°C	2.09 %
45°C	2.12 %

7. Display

The Model 1056 features a bright Red .43" high L.E.D. with floating decimal. The instrument displays "1." for over-range. Display is updated two times per second.

8. Power requirements

Line power: 115 / 230 V AC 50 / 60 Hz less than 5 watts
International safety recognized Power Entry Module (PEM) and transformer. Can be changed for either 115 V AC or 230 V AC operation. Instrument is shipped from the factory for 115 V AC operation. Includes a removable U.S. standard power cord with IEC 320 connector. See page 8 for instructions on how to change the power entry module for 230 V AC operation.

9. Environmental Limits

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

10. Placement of instrument

Place the instrument on a dry flat surface. Apply correct power to the instrument. See rear panel of instrument for power requirement and page 8 for more information on the power entry module (PEM). Do *not* operate the instrument in direct sunlight, extreme temperatures, electromagnetic fields or in explosive or corrosive atmospheres. Do *not* allow fluids to run into the instrument.

11. Front and Rear Panels

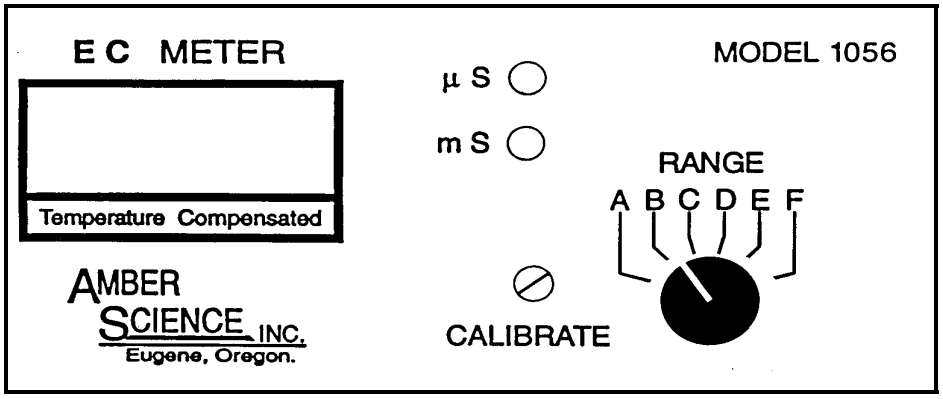


Figure 1- Front Panel (drawing not to scale).

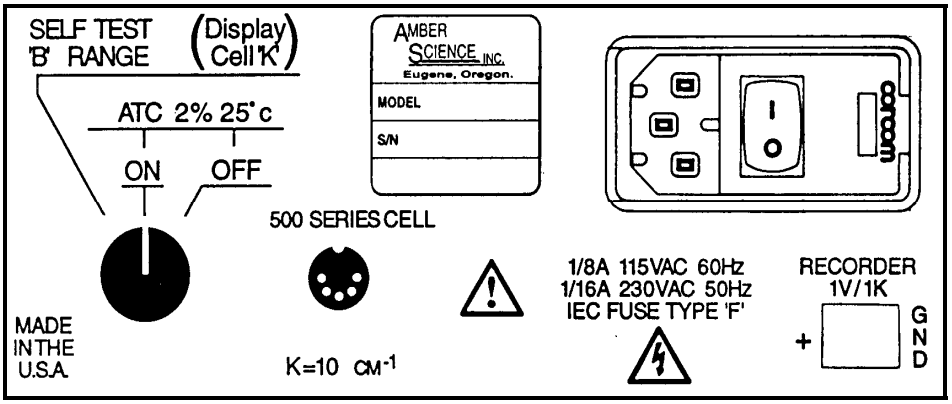


Figure 2- Rear Panel (drawing not to scale).

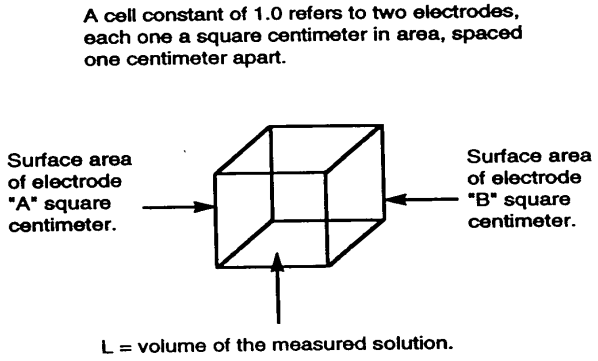
Figure 1 - illustrates the front panel design. Located on the front panel is the display area with annunciators for μS and mS, a knob for Range selection (A - F) and the inset Calibrate control.

Figure 2 - illustrates the rear panel design. Located on the rear panel is the Power Entry Module (PEM) with fuse access panel, a knob for selection of Self -Test, A.T.C. “On” or “Off”, the 5 pin Cell connector and the Recorder output connector.

12. 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]).

The resistance of a conductor is inversely proportional to its cross sectional area and directly proportional to its length. In the measurement of aqueous solution, conductivity is based on the reciprocal of the resistance of a 1^{-}cm cube of material measured between opposite faces. This configuration would be a cell with a constant of 1.



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 1056 is designed to use a cell with a constant of 10 cm^{-1}.

Conduction in aqueous solution is by ionic movement and increases with temperature. This change is expressed in percent per degree Celsius relative to 25°C and is called the slope of the solution.

The Model 1056 has Automatic Temperature Compensation (ATC) for slope correction.

The Total Dissolved Solids (TDS) in an aqueous solution that provides conduction 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 0.7. The Model 1056 allows calibration with scale factors as low as 0.45 for direct display of TDS in Parts per Million (PPM).

13. Reference Literature

Amber Science conductivity instruments meet the requirements for the determination of electrical conductivity of water under ASTM method D 1125. For additional information about conductivity determinations and methods, the following books are recommended:

Standard Methods	20th Edition	ISBN 0-87553-235-7
ASTM Standards 2000	Volume 11.01	ISBN 0-8031-2814-2

14. 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 (or solutions less than 2.0 micro Siemens), 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
A gold (Au) cell will work well for measuring the first four Conductivity Ranges (A – D). 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 solutions above 20 milli Siemens (or 2,000 micro 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 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.

Use of Conductivity Cells
A conductivity dip cell needs to be immersed at least 1.25 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 built onto the right side of the Model 1056.

Micro Flow Cells
When using the Part Number 529 Micro Flow Cell which has a cell constant of 100 cm^{-1}, all displayed readings must be multiplied by a factor of 10. Use only non-metallic tubing or fittings for connections on the stainless steel tubing. The maximum temperature is 50°C and the maximum recommended pressure is 50 P.S.I.. Mount the Micro Flow Cell so that the solution flows upward. This will help to clear any air bubbles. Read the instruction sheet included with each Micro Flow Cell before using.

15. 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 10).

Procedure

1. Carefully connect the conductivity cell into the 5-pin connector on the rear panel of the meter. Make sure pins line up correctly. The conductivity cell should be clean and dry.
2. Turn the Function switch on the rear panel 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 (minimum depth of 1.5") 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 calibration control on the front panel to display 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 (on rear panel) to the "Self Test" position and the Range switch (front panel) 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 (see page 10) and if applicable, affix a calibration sticker to the instrument. The meter and cell are now ready to make precise conductivity measurements.

16. 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 (or start in **F** 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) if display is incorrect, down range from **F** range until the proper reading appears 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). If display is incorrect, down range from **F** range until the proper reading appears then record measurement.

17. Over Range

If display reads “1” the meter is over-ranged, change Range selector on front panel until correct reading is displayed.

18. Cell Constant

By changing the Function switch (rear panel) to Self-Test and the Range switch (front panel) to B Range, the cell constant may be read directly from the display. The cell constant (K) displayed should read between 9.00 and 11.0 if using a dip or multi-purpose cell. Note: Micro Flow Cells have a cell constant of 100 cm^{-1} and when using a P/N 529, all readings displayed should be multiplied by a factor of 10.

19. Maintenance

Preventive maintenance:

1. The Model 1056 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. If instrument has been damaged, dropped or does not function properly, remove from service. Have instrument evaluated by a qualified electronic technician or return to the manufacturer for inspection or repair.

20. Calibration Frequency

The calibration frequency (daily, weekly or monthly) is a determination made by the user. It is recommended that calibration be performed periodically and the information recorded. The last page of this manual (page 10) contains a form, which may be used for recording calibration data.

21. Power Entry Module (PEM)

The Model 1056 is factory shipped for 115 V AC operation. The international safety recognized power entry module (PEM) can be changed for either 115 V AC or 230 V AC operation.

Caution: Servicing (repair and/or internal calibration) of the instrument and changing the fuses should be performed by an electronic technician or qualified personnel.

If it is necessary to change the instrument to operate on 230 V AC: **Disconnect** the power cord from the outlet *and* instrument. Use a small flat blade screwdriver to open the cover (Fuse access panel) on the power entry module, which is located on the rear panel. Use the screw driver to carefully remove the fuse holder. Replace the (2) 1/8 amp fuses with the (2) 1/16 amp fuses supplied with the instrument. Rotate 180° and insert the fuse holder into the PEM and with the access panel door closed, 230 V will appear in window.

22. Repair

Should the instrument become in need of repair, please contact Amber Science, Inc. at telephone # (541) 345-6877 (or via email *info@amberscience.com)* 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 that may occur during transit.

23. Warranty

Amber Science, Inc. warrants this product to be free from 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.

24. 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.

25. 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.

26. Return of items

Authorization must be obtained from our Customer Service department (Call telephone number (541) 345-6877 *or email info@amberscience.com*) before returning any item for any reason. When applying for authorization, please include any data regarding the reason the item is being returned. All items must be carefully packed as to prevent shipping damage. Amber Science will not be responsible for any shipping damage or loss during transit. Items being returned without prior authorization may not be accepted.

27. Design changes

Amber Science reserves the right to make changes in specifications, design, construction and appearance of products without notice.

28. Calibration data

Calibrating / standardizing the instrument with a known calibration solution should be performed periodically. Calibration frequency (daily or weekly) is a determination made by the user. Below is a form that can be duplicated to record calibration data. Note: If NIST traceability is a requirement for your company, use a NIST or NIST traceable calibration solution. Determine the uncertainty and properly document the calibration. The *Guidelines for Expressing Uncertainty* is NIST Technical Note 1297. More information is available on the web at www.nist.gov/traceability

Model #:_____Serial #:_____Cell Part#_____Cell Date Code_____

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

Note: This Form may be reprinted without restriction.