



277 BLAIR BLVD.
EUGENE, OREGON 97402-4147
(541) 345-6877
FAX (541) 345-6277
www.amberscience.com

Instruction Manual Electrical Conductivity Meter Model 4083



Model 4083 shown with optional Dip Cell and Alarm Box

Ship Date: _____

Serial Number: _____

Calibrated By: _____

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Shipping Checklist

Upon receipt, the instrument should be carefully unpacked and inspected for shipping damage. All material in the container should be checked against the enclosed Packing List. If the instrument has been damaged in transit, retain all packing material and carton. Contact the Shipper and the Carrier to file a damage claim.

Model 4083 includes:

- (1)..... Model 4083 EC Meter
- (1)..... 9 Volt Ni-MH Battery (pre-installed)
- (1)..... AC Adaptor, Model Number: 35A-6-200
- (1)..... EC Data Recorder Program (CD Rom)
- (1)..... Cell holder (mounting bracket pre-attached)
- (1)..... Pint 1,409 micro Siemens Calibration Solution
- (1)..... Instruction Manual

Conductivity Cells

Order Conductivity Cell separately
800 Series, four wire Cell with embedded thermistors
Cell (K) constant approximately 10 cm⁻¹ (except # 829)

Part #	Description
815	Dip Cell (Au) with 48" cable
825	Dip Cell (Pt) with 48" cable
829	Micro Flow Cell S/S with 1 meter cable [K= 100 cm ⁻¹]
835	Multi-Purpose Cell (Au) with 48" cable
845	Multi-Purpose Cell (Pt) with 48" cable
855	Multi-Purpose Cell (Au) with 2 meter cable
865	Multi-Purpose Cell (Pt) with 2 meter cable
858	Macro Flow Cell S/S with 2 meter cable

Accessories (optional)

Part #	Description
4383	Audible Alarm Box – see page 9 for more information.
8030	Cell Switch Box (allows switching between two cells)
8060	Function Verifier (use to validate operation of ranges) pg. 19
8061	Function Verifier (use to validate operation of ranges) pg. 19
8501	Platinizing Station (use to replatinize (Pt) Cells) Note: Station does <i>not</i> include Platinizing Solution.
890	Cell cup – precision machined measuring vessel

Calibration Solution KCI Standard Reference Solutions.
Available in Pint, Quart or Gallon Sizes:

Value	Unit
74.7	Micro Siemens (μS) /cm @ 25°C
718	Micro Siemens (μS) /cm @ 25°C
1,409	Micro Siemens (μS) /cm @ 25°C
6,660	Micro Siemens (μS) /cm @ 25°C
58,700	Micro Siemens (μS) /cm @ 25°C

Introduction Model 4083

The Model 4083 is a microprocessor based, multi-function EC meter designed to precisely determine the conductivity, resistivity, TDS, salinity and temperature of aqueous solutions. The instrument covers six conductivity ranges (auto or manual) with a maximum full scale of 3300 counts. Measurement data is displayed on a 2 line by 20 characters each, backlit dot matrix (LCD) liquid crystal display. To use the display back light feature, the AC Adaptor must be used.

Six Front Panel Keypad Switches:

On / Off switch	Upon Power ON, the instrument will go through an Auto Check of all ranges. Upon Power OFF, the instrument will retain Parameter settings. Function / measurement data will not be retained in memory.
Range switch	Allows user to choose manual Range A – F or Auto Range.
Function switch	Selects Conductivity, Resistivity, Self Test, HP Water, Salinity or TDS.
Parameters [⌘]	Enables setting of scale factors: Calibrate to cell constant (K), Temperature Coefficient, Reference Temperature, TDS multiplier, RS-232 transmit, Reset all parameters, auto zero options and Alarm options.
Set UP [^] key	Allows for parameter selection and the [⌘] allows for selection to be saved.
Set DOWN [v] key	Allows for parameter selection and the [⌘] allows for selection to be saved.

Rear Panel Connectors:

Cell Connector	Remote Alarm	AC Adaptor Jack	RS-232 connector
8 pin circular DIN	8 pin mini terminal plug	6 V AC 200 mA	9 Pin D Sub (DB-9 Pin)

Instrument Placement and Operation

Place the instrument on a dry flat surface. Do not operate the instrument in direct sunlight, extreme temperatures, electro-magnetic fields or in explosive or corrosive environments. Do not allow fluids to run into the instrument. Keep all connectors on rear panel dry. If you have any questions regarding the operation of the instrument, please call telephone (541) 345-6877 and request Tech Support. Questions may also be e-mailed to info@amberscience.com and a reply will be sent as quickly as possible.

Environmental Limits

Temperature:	5 to 45°C (41 to 113°F)
Humidity:	10 to 90% (relative, non condensing)

Specifications: Note: Accuracy based on using EC Meter with an Amber Science 800 series Cell.

Conductivity Range

Manual and Auto Range from .001 micro Siemens (μ S) to 330.0 milli Siemens (mS).

Range	Full Scale	Resolution	Accuracy ± 1 count	Cell Drive Frequency
A	0 – 3.300 μ S	.001 micro Siemens	0.3%	36 Hz
B	0 – 33.00 μ S	.01	0.2%	108 Hz
C	0 – 330.0 μ S	.1	0.1%	355 Hz
D	0 – 3.300 mS	.001 milli Siemens	0.1%	1070 Hz
E	0 – 33.00 mS	.01	0.2%	3480 Hz
F	0 – 330.0 mS	.1	0.3%	10000 Hz
AUTO	0 – 330.0 mS	.001 μ S to .1 mS		

Auto Range Up Range @ 3300 Down Range @ 300

Cell Drive

The cell drive for the Model 4083 is a low distortion, amplitude stable sine wave. Frequency and amplitude are determined by range.

Resistivity Range

Manual and Auto range from 33.33 M ohms to 3.03 K ohms (as a function of conductivity)

Note: Resistivity is displayed in A, B, C and Auto Range only.

Range

A	33.33 M ohm 3.333 M ohm	To To	3.34 M ohm .303 M ohm
B	3.333 M ohm 333.3 K ohm	To To	.334 M ohm 30.3 K ohm
C	333.3 K ohm 33.33 K ohm	To To	33.4 K ohm 3.03 K ohm
AUTO	33.33 M ohm	To	3.03 K ohm

High Purity (HP) Water

High Purity Water (HP Water) is a function of the Algorithm and Temperature Coefficient. The High Purity Water Function will display conductivity from .055 micro Siemens to 3.300 micro Siemens. The Temperature Coefficient is preset to 2% and is adjustable from 1% to 3% with the Reference Temperature automatically set to 25°C. A gold (Au) plated multi-purpose cell in the flow configuration is recommended to measure high purity water. This will allow the solution to avoid contamination by atmospheric gases, which will result in a more accurate measurement.

HP WATER:

Range:	.055 micro Siemens to 3.300 micro Siemens
Temperature Coefficient:	Adjustable from 1% to 3% (preset at 2%)
Reference Temperature:	Automatically set to 25°C
Accuracy:	0.3% \pm 1 count

Salinity

Conductivity may also be used to determine the Salinity of seawater in Practical Salinity Units (SU). The Model 4083 displays Salinity from 2 to 42 Salinity Units (SU) at one atmosphere when the solution temperature is between 0 and 30°C.

SALINITY:

Range:	Automatically set to "F"
Reference Temperature:	Automatically set to 15°C
Temperature Range:	0.0 to 30.0°C
Temperature Coefficient:	Function of Algorithm
Accuracy:	0.3% ± 1 count

Total Dissolved Solids (TDS)

The Model 4083 automatically calculates the TDS from the conductivity reading by multiplying the preset factor [.625] or by the factor that the user enters using the Parameter [x] and Set keys [Λ] and [V]. Manual Range (A – F) and Auto Range displays TDS in Parts Per Million (PPM) or Parts Per Thousand (PPT) as a function of conductivity and the TDS multiplier. The TDS multiplier is adjustable from 40% to 90% (or .400 to .900).

Temperature Range and Accuracy

Temperature displays next to the measurement on the display.

Range:	0.0°C to 70.0°C
Accuracy:	± .2°C

Self Test

The Self Test function allows the user to display the Temperature Coefficient, Reference Temperature and the TDS multiplier for approximately 4 seconds then displays the Cell (K) constant set point until the function is changed.

Parameter Settings:

Cell Constant:	Adjustable from 8.00 to 12.00	Preset @ 10.00 cm ⁻¹
Temperature Coefficient:	Adjustable from .00% to 9.99%	Preset @ 1.91%
Reference Temperature:	Adjustable from 15.0°C to 35.0°C	Preset @ 25.0°C
TDS Multiplier:	Adjustable from .400 to .900	Preset @ .625
RS-232 (output):	Manual or Automatic transmit	User selectable
Reset (parameters):	Yes or No	User selectable
Auto Zero Check	Yes or No	User selectable
Alarm	Disable all alarms / or Set Alarm (High & Low) Limits	User selectable

Calibrate to Cell K

Calibrate to Cell K (constant) is used to calibrate the instrument with the conductivity cell to a known value conductivity Standard Reference Solution. Refer to page 15 for instructions on calibrating the instrument.

Temperature Coefficient

If the Temperature Coefficient (TC) is adjusted to .00%, the automatic temperature compensation (A.T.C.) is turned off. If unsure of the temperature coefficient, the preset parameter of 1.91% should be used. Refer to the *Standard Methods* (2510B) book for more information (pg. 19).

Reference Temperature

The reference temperature is preset at 25.0°C and is adjustable from 15.0 to 35.0°C. To change the reference temperature, press the Parameter [⌘] key until “Set Ref Temp” appears in display. Use the Set Keys [^] up or [V] down to enter the desired Reference Temperature then, when prompted press the Parameter [⌘] key to save the scale factor entered.

TDS Multiplier

The Total Dissolved Solids (TDS) in a solution does not change with temperature unlike Conductivity, which is sensitive to temperature. The Model 4083 automatically calculates the TDS from the conductivity reading by applying the appropriate factor that the user sets or by using the preset factor of .625. The TDS multiplier is adjustable from .400 to .900. The instrument displays TDS in Parts per Million (PPM) or Parts per Thousand (PPT). To change the TDS multiplier, press the Parameters [⌘] key until “set TDS mult” appears in the display. Use the Set Keys [^] up or [V] down to enter the desired scale factor and then, when prompted press the Parameter [⌘] key to save the scale factor entered.

RS-232 Output (Rear Panel)

9600 Baud	8 data bits	No parity bit	2 stop bits
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DB-9 pin assignment:

Pin 2	Data out (ASCII)
Pin 3	Command In
Pin 5	Ground Return

The RS-232 output can be used two ways:

Method # 1 - A DB-9 pin cable (not supplied) can be connected from the rear panel of the instrument to a serial printer or mini serial printer to allow for hard copy of measurement data. No computer is needed for this method.

Method # 2 – A DB-9 pin cable (not supplied) can be connected from the rear panel of the instrument and then to a PC (personal computer). The CD Rom containing the EC METER DATA RECORDER program application must then be installed on the PC. By connecting the instrument to a computer and installing the software application, measurement data can be saved to a file on the computer hard drive. This will also allow a user to export the file to a spreadsheet type application if desired to plot or graph data points.

Software Application for RS-232

The software program titled EC METER DATA RECORDER (included) is designed to record data from the conductivity meter via a serial connection to a PC (PC, printer and cable not supplied). For transmitting data to a PC, install the software application program (EC METER DATA RECORDER) onto a Personal Computer. Minimum PC requirements: a PC 286 or better and with an operating system of MS-DOS 5.0 or better. CD Rom drive required. Refer to page 12 for additional information on RS-232.

Reset Parameters

To reset the parameters press the [X] key six times until Reset All Parameters appears in the display. Then choose Set [Λ] key and confirm by pressing the [Λ] key again. The parameters will change to the following:

Reference Temperature:	25°C
Cell Constant:	10.00 cm ⁻¹
Temperature Coefficient:	1.91%
TDS Multiplier:	0.625

If parameters have been reset, the instrument should be re-calibrated before using. See pg. <u>15</u> .

Remote Alarm specifications

The Model 4083 features an audible alarm option when used in conjunction with the Model 4383 audible alarm box. This feature allows the user to set one high and one low limit for conductivity.

Switch closure specifications:

Connector:	8 pin mini terminal block
Max. Voltage:	24 Volts AC or DC
Max. Current:	100 milli Amps

To set the alarm limits, access this feature by pressing the Parameter [X] key 8 times until the alarm set point menu is reached. Follow the menu prompts to set one high and one low limit.

Note: The AC Adaptor must be employed to use the remote Alarm feature.

Auto Zero

Auto Zero check is made at Power On which requires about 8 seconds to complete, or by pressing the Parameter [X] key seven times until Auto Zero Check displays, then press Set [Λ] for Yes to complete the Auto Zero Check.

Power Requirements

There are two power options for the Model 4083:

For portability, the instrument will operate on a single 9 volt battery. The instrument comes with a 9 Volt Nickel Metal Hydride (rechargeable) battery preinstalled.

The second power option is using the supplied AC Adaptor. The battery must remain installed in the instrument when using the AC Adaptor. To use the display backlit feature and / or the Remote Alarm (Model 4383) feature, the AC Adaptor must be employed.

Power Requirements continued

Nine (9) Volt Battery

One 9 volt Nickel Metal Hydride (Ni-MH) battery is pre-installed in the instrument, which will provide approximately 100 operating hours under normal conditions. Low Battery will display when the battery voltage is approximately 7.2 Volts and recharging the battery will be required.

To recharge the 9 volt Ni-MH battery, plug the AC Adaptor plug into the Jack on the rear panel and the AC Adaptor into a 115 V AC electrical outlet. Allow a minimum of six hours to recharge the battery. The AC Adaptor can remain employed without damage to the battery.

If the nine volt battery power source will not be used for an extended period of time, it is suggested the battery be removed to prevent battery leakage onto the printed circuit board.

AC Adaptor Specifications:

The instrument includes one AC Adaptor, Model Number 35-A-6-200, with the following specifications:

Input:	120 V AC, 60 Hz, 3 Watts
Output:	6 V AC, 200 mA

The AC Adaptor is a UL listed, Class 2 transformer, designed for indoor use only.

Note: The AC Adaptor must be employed to use the Alarm or display back light feature.

Battery Replacement

To replace the 9 volt Nickel Metal Hydride (Ni-MH) battery, remove the 2 Philip head screws from the rear panel. Carefully slide the top cover to the rear of the case and carefully lift off cover to separate the cover from the bottom of the case.

Carefully turn top over to reveal the printed circuit board and the battery holder. Disconnect the 9 volt battery and replace with a new 9 volt nickel metal hydride battery. Make sure to snap battery correctly in place with the positive and negative terminals in the correct direction. Turn cover over and replace cover onto the bottom of the instrument case. Slide the top cover down until it snaps into place. Replace the 2 screws in the rear panel. Do not over tighten screws.

Battery Options:

The instrument uses one nine volt battery. It is recommended that when replacing the battery, a new Nickel Metal Hydride (Ni-MH) battery be used as the replacement. A Nickel Metal Hydride is a rechargeable type battery and under normal conditions, it can be charged and discharged up to approximately 500 cycles.

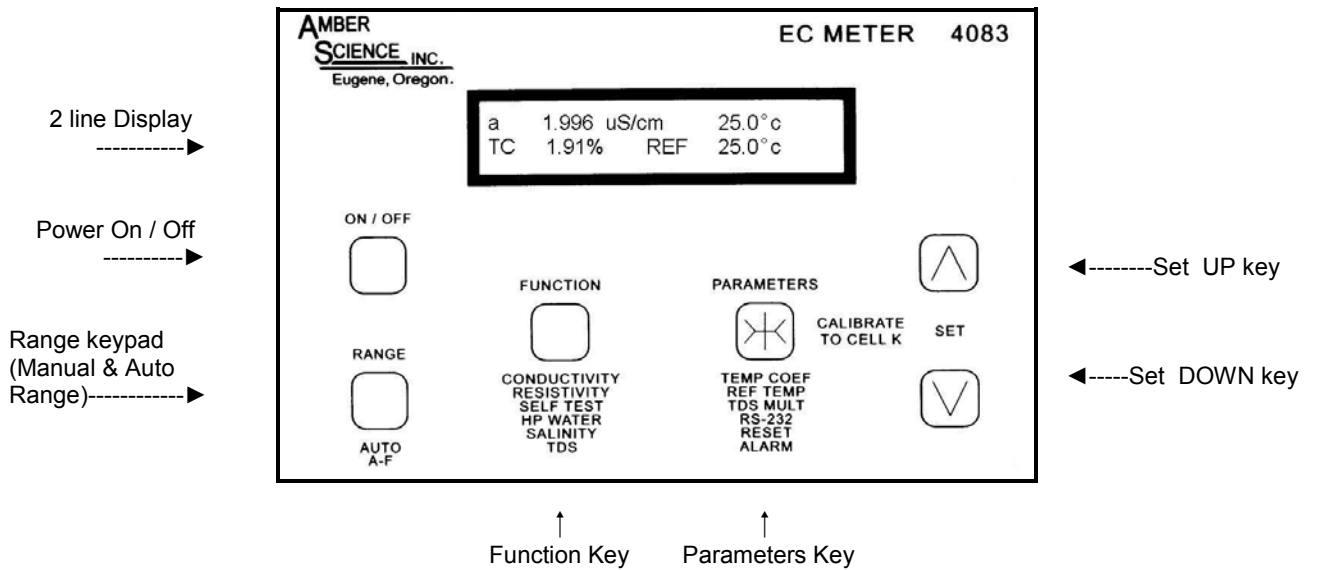
Nickel Metal Hydride (Ni-MH) Battery	Recommended
Nickel Cadmium (NiCad) Battery	Not Recommended
Lithium Battery (non rechargeable)	Acceptable
Alkaline Battery (non rechargeable)	Acceptable

Battery Disposal information:

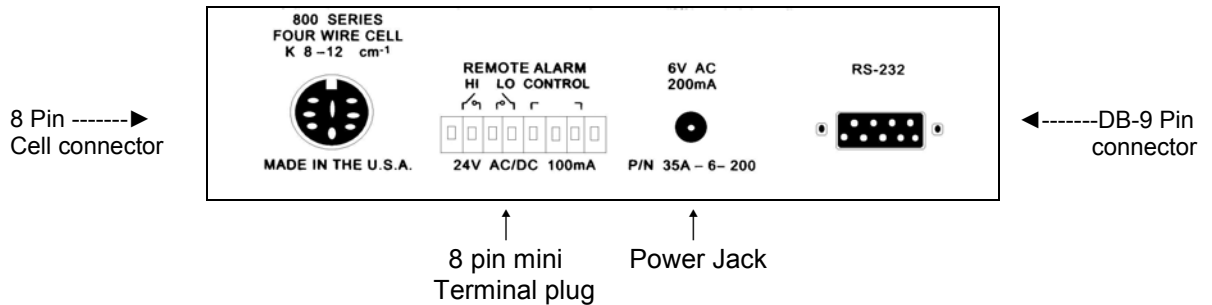
Disposal regulations and policies are different in each State and Country and are subject to frequent changes. Contact your local jurisdiction for specific disposal information guidelines.

Front Panel Diagram

Note: Drawings not to scale.



Rear Panel Diagram



! Caution: Do not allow fluids to come in contact with the connectors on the backside of instrument. Keep connections clean and dry.

! Caution: The instrument will display incorrect measurement data if using a Conductivity Cell other than the 800 series designed to be used with this instrument.

Note: To use the Alarm or display back light feature, the AC Adaptor must be used.

RS-232 Output

The RS-232 feature can be used two ways:

1. Output data directly to a serial printer.
2. Output data directly to a PC using Data Recorder Software.

Software Application is not necessary when transmitting data to a serial printer (option #1). Software Application (supplied on a CD Rom) is required to transmit data to a PC (option #2).

Data can be transmitted two ways:

- Auto transmit mode.
- Manual transmit mode (on command).

Two additional ways when used with a PC:

- Remote Command from a PC keyboard.
- Time interval command from PC.

Auto Transmit Note: Auto transmit mode will transmit only when data changes by two counts or more. Manual transmit can be accomplished in Auto transmit mode by pressing the [Λ] key.

Remote Command Note: The PC will send a print command two ways. At a time selected interval OR by pressing the CR [Enter] key.

Step 1: Connect a DB-9 pin cable (not supplied) to connector on rear of instrument. Connect the other end of the cable to either a serial printer or PC. If connection is to be made to a serial printer, then proceed to Step 2. If connection is made to a PC, proceed to Step 3.

Step 2: Decide on method of transmitting data: A) AUTO or B) MANUAL and follow steps listed.

Step 3: Load software program to computer (drive, location, etc is user's choice). Once software is loaded on the PC and the COM port selected, review HELP screen and then follow steps listed:

RS-232 Manual Transmit

Press the Parameter [ж] key five times until RS-232 MAN. Transmit appears in the display. Press the [Λ] UP Set key for Yes.
Next prompt: MAN. Transmit [Λ] or off [V]. For manual transmit press the [Λ] key. This will transmit data to your serial printer or PC display.
Press the [Λ] key each time to command a manual transmit.
Hold down the [Λ] key to continually transmit data.
To Exit Manual (MAN.) transmit, press the [V] key for off.

Next display will prompt user for Auto Transmit
Press [Λ] key for YES or the [V] key for NO.
User can also press the Parameter [ж] key anytime to return to parameter prompts OR continue to press the Parameter [ж] key to return to measurement data mode.

RS-232 Auto Transmit

Press the Parameter [ж] key five times until RS-232 MAN. Transmit appears in the display. Press the [V] key to decline manual (MAN.) transmit
Display will prompt user for RS-232 AUTO TRANSMIT: Press [Λ] key for yes.
Auto transmit will appear in display.
Measurement data should now transmit to the PC Display or serial printer.

RS-232 Auto Transmit continued

The user can also force a manual transmit while in the Auto transmit mode by simply pressing the UP [^] key on the front panel of the instrument or by pressing the CR [ENTER] key on the computer keyboard.

Note: If auto transmit fails to transmit data, check all connections.

Anytime measurement data changes by two counts or more, it will automatically transmit.

To Exit Auto Transmit Press the [V] key for off.

User can also press the Parameter [X] key anytime to return to parameter prompts OR continue to press the Parameter [X] key to return to measurement data mode.

EC Data Recorder Software Program

The PC application program is used to monitor and record data from the EC Meter via a serial port. This software application is an ASCII format program and is supplied on a CD Rom. The minimum PC requirement to install this program is a 286 MHz processor or better. Minimum operating system requirement is DOS 5.0 or better with a CD Rom drive.

Install the software program on the drive and directory of choice.

After the program has been installed, a command list will be displayed at the bottom of the screen which allows the user to select the COM port and activate commands. Most commands are activated by first holding down the ALT key and pressing a letter key.

<Esc = Quit> Ends the program and returns to the DOS or Windows operating system.

<Alt + S = Select COM port> Allows selection of COM port 1 or 2 (F1)

Settings: Baud rate = 9600, Data bits = 8, Stop bits = 2, No Parity

<Alt + F = Select Format> One line or three lines data display. Note: Choose one line if user would like to export data to a spreadsheet to plot or graph data points.

<Alt + P = Printer On/Off> Enables the printer port to output data as displayed on the screen. Note: Printer On or Off is displayed on the status line.

<Alt + R = Record to file> Will prompt user to enter a file name, choose to start a new file or append to a file, and then will begin recording the same data that is displayed into that file.

Note: Record File On or Off is displayed on the status line.

<Alt + Q = Quit Record File> Will quit recording and close recorded file.

<Alt + T = Type Text> Will copy typed text to screen for printing or recording.

Note: Set Record to File and Print Data On / Off FIRST.

<Alt + C = Print Configuration> Will print the current settings of all Functions, Cell Constant, Reference Temperature, Temperature Coefficient, TDS Multiplier and Transmit Mode.

<Alt + I = Activate Print Interval> Forces print command at time interval from 1 – 480 minutes.

<Enter = Force print> Transmit print command to EC Meter.

Note: When EC Meter is in transmit mode, the parameters cannot be changed.

Conductivity Cells

There are several types of cells available. Choose one that is suitable for your application.

Gold (Au) Cells

The (Au) cell is recommended for measurement of low conductivity or high purity solutions. Use the (Au) cell when measuring conductivity in Ranges A thru D. The (Au) cells have much less tendency to carry over solution from one measurement to the next and the (Au) cell requires less maintenance than the (Pt) cell since no re-platinizing is required.

For measuring High Purity Water choose the (Au) Multi-purpose Cell and use it in the Flow configuration to avoid exposing high purity water to atmospheric gases, which will cause contamination and the conductivity to rise.

Platinum (Pt) Cells

The (Pt) cells are needed for measuring solutions with high conductivity such as Sea Water. The (Pt) cells will require re-platinizing on occasion. Anytime a (Pt) cell is cleaned it should be re-platinized. This can be accomplished with the Model 8501 Platinizing Station and with (ASTM D-1125) Platinizing Solution. The cell may also be returned to Amber Science for cleaning and re-platinizing for a nominal charge.

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. 12 mm ID test tube). Dip cells are available with (Au) or (Pt) plates, with each cell having a cell constant of approximately 10 cm^{-1} . An instruction sheet is included with each dip cell outlining care, cleaning and use of the cell.

Multi-Purpose Cells

The multi-purpose cell can be used three ways: dip cell, flow cell or pipette cell. The multi-purpose cell is also available with (Au) or (Pt) plates with each cell having a cell constant of approximately 10 cm^{-1} . Each multi-purpose cell includes an instruction sheet with guidelines on the care, cleaning and use of the cell.

Micro Flow Cell

The micro flow cell with S/S plates is designed for measuring high conductivity solutions. When using the P/N 829 micro flow cell (which has a cell constant of 100 cm^{-1}) all displayed readings must be multiplied by 10. Use only non-metallic tubing or fittings for connections on the stainless steel tubing. The maximum temperature is 50°C and the maximum pressure is 50 P.S.I. Mount the micro flow cell so that the solution flows upward. This will help clear any air bubbles. A separate instruction sheet is included with the micro flow cell that offers tips for mounting and using the micro flow cell.

Macro Flow Cell

The macro flow cell is a large diameter flow cell constructed of durable epoxy tubing with S/S plates. The P/N 858 macro flow cell is capable of flowing up to four gallons of solution per minute at sixty PSI. Like the Dip and Multi-purpose Cell, the Macro Flow Cell has an approximate Cell constant of 10 cm^{-1} . A separate instruction sheet is included with the macro flow cell that offers tips for mounting and using the macro flow cell.

Care for Cells

It is important to remember that the conductivity cell is a delicate sensor and should be cared for properly. After use, rinse the cell in DI water or a solvent appropriate to remove any residue, which may have contaminated the plates of the Cell. *Caution:* Do not use Aqua Regia to clean a cell. Carefully shake off excess solution and dry with a clean lab wipe. Conductivity cells should be stored dry when not in use. Periodically examine the conductivity cell and replace when necessary.

Calibrate to Cell Constant (K)

Suggested Materials needed:

1. Calibration Solution of known value (close to range of expected measurement).
2. Conductivity Cell (Clean and Dry). Connect at rear panel of instrument.
3. Conductivity Meter (Power On). Instrument will perform an Auto Zero Check.
4. Test Tubes or Beakers for Calibration Solution (Clean and Dry) x 3.
5. One clean Beaker containing de-ionized (DI) water [for rinsing Cell].
6. Calibration Data Form (Copy last page in this manual) to record calibration.
7. Writing instrument (Pen).

Select a Conductivity Calibration Solution of a known value above 50 micro Siemens. Values less than 50 micro Siemens are not always reliable and can become easily contaminated.

There are two methods that can be used to Standardize the instrument:

1. "Three Test Tube Method"
2. "One Beaker Method"

Note: The Three Test Tube Method is the preferred choice, but if time is limited the One Beaker Method may suffice. Make sure the calibration solution is not expired and has been stored properly if not new. Do not fill test tube or beaker more than half way, this will prevent spill out when cell is inserted. Discard Calibration Solution after use. Do not re-use calibration solution.

Three Test Tube Method:

- A. Line up three **clean** test tubes and fill Test Tube # 1 with calibration solution.
- B. Swirl solution around in test tube then pour into Test Tube # 2.
- C. Swirl solution around in Test Tube # 2 and Pour into Test Tube # 3. Now only Test Tube # 3 contains calibration solution.
- D. Pour calibration solution from bottle into Test Tube # 1, swirl around and pour into Test Tube # 2. Now Test Tubes # 2 and # 3 both contain calibration solution.
- E. Pour calibration solution from bottle into Test Tube # 1. Now all three Test Tubes contain calibration solution and Test Tube # 1 is the least contaminated and # 3 is the most contaminated.
- F. When calibrating – Start with Test Tube # 3 and work down to Test Tube # 1.

Calibrating Procedure:

1. If practical hold the calibration solution at 25°C.
2. Dip Cell into a beaker containing only DI water and soak cell for one to two minutes. This helps to wet the plates of the cell. Remove cell from DI water and gently shake off excess water.
3. Next dip cell into the 3rd Test Tube (most contaminated) of calibration solution. Gently move up and down a few times to dislodge any air bubbles that may have become trapped. Remove Cell, shake off excess solution and place into Test Tube # 2.
4. Repeat the process above by moving cell up and down a few times and again remove cell from beaker and shake off excess solution. Place Cell into beaker #1 (least contaminated calibration solution).
5. Once Cell has been placed into beaker number # 1 you are ready to standardize. Follow step # 6.
6. Press Parameter [x] key one time and "Calibrate" will appear in display. Use the Set key and press up [^] or down [v] to make the display read the value of the solution. Wait a few seconds and the instrument will prompt the user to save the setting. Press the Parameter [x] key to save. Fill in the information requested on the Calibration Data Form and note the Cell constant (K). The instrument is now calibrated.

Calibrate to Cell Constant (K) continued

One Beaker Method:

1. Fill one **clean** beaker with a known value of calibration solution. Make sure the calibration solution is not expired and has been stored properly if not new. Do not fill beaker more than half way. This will prevent spilling over when cell is inserted.
2. If practical hold the calibration solution at 25°C.
3. Next dip cell into the beaker that contains calibration solution of known value. Gently move up and down a few times to dislodge any air bubbles that may have become trapped. Wait for reading to become stable then press the Parameter [⌘] key one time "Calibrate" will appear in display. Use the Set key and press up [^] or down [v] to make the display read the value of the solution. Wait a few seconds and the instrument will prompt the user to save the setting. Press the Parameter [⌘] key to save. Fill in the information requested on the Calibration Data Form and note the Cell constant (K). The instrument is now calibrated.

Making Conductivity Measurements

Once the instrument has been calibrated by one of the two methods previously listed, the user will now be ready to make determinations of unknown conductivity values.

Select RANGE either Auto or appropriate manual range.
Set REFERENCE TEMPERATURE if different than 25°C.
Set TEMPERATURE COEFFICIENT if different than 1.91% (if unsure, leave at 1.91%).
(Note: To turn A.T.C. off, adjust TEMP COEF to .00%)

Rinse Conductivity Cell in de-ionized (DI) water and gently shake off excess water.
Place the cell in a sample of the unknown solution to be measured.
Move the cell in an up and down motion a few times (agitate cell) to dislodge any air bubbles.
Wait until reading on display becomes stable then record measurement.

Making Resistivity Measurements

Calibrate the instrument with the Cell using a Conductivity Calibration Solution.
Refer to Calibrate to Cell K section, page 15.

To make resistivity measurements, select Resistivity from the Function keypad. The display will read 'out of range' until the cell is placed in solution.
Resistivity measurements will display in A, B,C, or Auto Range only. If the meter is in the manual C Range and the display reads 'out of range' press the Range key until you go to B Range. If the display still reads 'out of range' press Range key until A or Auto Range is reached. Record Resistivity measurement once it becomes stable.

Note: If display continues to read 'out of range' in all Resistivity Ranges, press the Function key five times to reach the Conductivity Function and take the measurement in Conductivity instead.

Cell K Note: The Cell (K) constant cannot be changed when in the Resistivity Function.

Making HP Water Measurements

A Multi-purpose (Au) Cell installed in the flow configuration should be used when measuring high purity water (HP Water) in order to avoid contamination from atmospheric gases, dust and other airborne contaminants. Prior to measuring high purity water, calibrate the instrument using a calibration solution between 50 and 100 micro Siemens. Use a fresh calibration solution and a very clean (Au) Cell. Follow the instructions on Page 15 to Calibrate to Cell K. After calibrating, press the Function Keypad until the HP Water mode is displayed. Connect tubing to the Conductivity Cell and begin flowing high purity water thru the Cell. If instrument displays 'out of range' then the solution being measured is greater than 3.3 micro Siemens. Change the instrument to the Conductivity Function by pressing the Function keypad three times until the Conductivity mode is displayed. Take measurement in Conductivity instead then, determine why the high purity water sample is exceeding the HP Water Range.

Cell K Note: The Cell (K) constant cannot be changed when in the HP Water Function.

Making Salinity Measurements

Calibrate the instrument and a (Pt) Cell in SALINITY Function using a KCl solution having a Practical Salinity value of 35.0 at 15°C. Follow the instructions on page 15 to Calibrate to Cell Constant (K) EXCEPT hold solution at 15°C instead of 25°C.

When in SALINITY function, Reference Temperature and Temperature Coefficient cannot be set. The Range is automatically set to "F" Range and the maximum solution temperature is 30°C.

Salinity Reference Solution

<u>Reference solution @ 15°C</u>	<u>Grams of KCl per 1 kilogram of solution</u>
35.0 Practical Salinity Units (SU)	32.4356

For additional information on Salinity, refer to Reference Book titled:

Standard Methods for the Examination of Water and Wastewater, 20th edition.
ISBN 0-87553-235-7 Page 2-48 "2520 SALINITY"
2520 A. Introduction and 2520 B. Electrical Conductivity Method.

Making TDS Measurements

When making Total Dissolved Solids (TDS) determinations, the preset multiplier of .625 may be used or the user may set a different TDS multiplier (between .400 and .900). Before setting the TDS multiplier the EC meter should be calibrated to the Cell K with a conductivity standard calibration solution (see page 15). Caution: If the solution temperature changes, the Reference Temperature must be changed to match the solution temperature to avoid incorrect TDS readings. This is due to the fact that Conductivity is sensitive to temperature changes and TDS is not. The TDS is determined by the processor multiplying the conductivity by the TDS multiplier. Note: The Reference Temperature can only be changed in the Conductivity Function but not the TDS function. See *Standard Methods* book (1030E) for more information (see pg. 19).

Making TDS Measurements continued

Suggested Materials needed:

- A. Calibration Solution of known TDS value (fresh and not expired).
- B. Conductivity Cell (Clean and Dry). Connect to rear panel of instrument.
- C. Conductivity Meter (Power On). Instrument will perform an Auto Zero Check.
- D. One Beaker for Calibration Solution (Clean and Dry).
- E. One clean Beaker containing DI Water (for rinsing Cell).
- F. Writing instrument (Pen) and Paper to record data if desired.

1. Select AUTO Range or appropriate manual Range (A-F).
2. Press Function keypad to change to TDS mode if not already in the TDS mode.
3. Press Parameter keypad to change to TDS MULT.
4. Dip Conductivity Cell in beaker of TDS standard solution.
5. Press the up [Λ] or down [V] key to set the value of the solution in PPM or PPT.
6. The display will prompt user to 'Save' by pressing the Parameter [⌘] key.
7. Make Note of the new TDS multiplier as displayed.
8. Rinse Cell in DI water and gently shake off excess solution.
9. Proceed to measure unknown solution.

TDS will display in PPM (Parts per Million) or PPT (Parts per Thousand).

Note: When in TDS Function: Cell Constant, Ref. Temp. & Temp. Coefficient cannot be changed.

Self Test Function

The Self Test Function can be used to verify the following settings:

TC	Temperature Coefficient
RT	Reference Temperature
TDS MULT	TDS multiplier
CELL K	Cell constant

Note: These settings are subject to change when the instrument is re-calibrated or when Reset Parameters is chosen. Upon Power OFF, the Parameter settings will be saved in memory. However, only Parameter settings are retained when instrument is turned off, any Function measurement data will not be retained in memory upon power off.

Reset Parameters

To reset parameters back to the instrument's preset parameters, press the Parameter [⌘] key until Reset Parameters appears in display. Then choose yes by pressing the up [Λ] key. The instrument will prompt the user to confirm change by pressing the [Λ] key again. The parameters will change to the following:

Reference Temperature:	25°C
Cell Constant:	10.00 cm ⁻¹
Temperature Coefficient:	1.91%
TDS Multiplier:	0.625

If parameters have been reset, the instrument should be calibrated before using. See page 15.

Checking Instrument

The Models: 8060 and 8061 Function Verifier's are optional accessories for the Model 4083. The Function Verifier's are portable units designed to be used in place of the conductivity cell to simulate conductivity ranges. The Model 8060 is used to validate the proper operation of the conductivity, resistivity, TDS, salinity and temperature functions. The Model 8061 is used to validate the proper operation of the conductivity and temperature ranges only.

Calibration Frequency

The Model 4083 should be calibrated on a routine basis with a known value Conductivity Calibration (Standard Reference) Solution. A record of the calibration data should be maintained (see page 21). Only a qualified electronic technician should perform internal calibration of the instrument. Internal calibration will be necessary if any repairs are made to the instrument.

Reference Literature

Books:

Annual Book of ASTM Standards 2000, Volume 11.01 Water (I), Revised Annually, ISBN 0-8031-2814-2, ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428 Tel (610) 832-5000 Fax (610) 832-9555

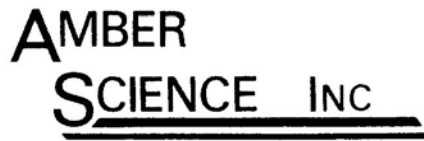
Standard Methods for the Examination of Water and Wastewater, 20th Edition, ISBN 0-87553-235-7, Publication office, American Public Health Association, 1015 Fifteenth Street NW, Washington DC 20005-2605

Maintenance and Repair Service

The Model 4083 requires no periodic maintenance other than routine re-calibration at regular intervals. Keep the connectors on the rear panel dry. Do *not* allow fluids to run into the instrument's enclosure. Should the instrument be in need of repair, contact Amber Science by Telephone (541) 345-6877, Fax (541) 345-6277 or E-mail - info@amberscience.com, to request a Return Authorization number and instructions for returning the instrument for repair service.

Technical Support

Amber Science Technical Support department can be reached by calling telephone number (541) 345-6877 during normal business hours (7 am – 4 pm Pacific Time Zone, Monday thru Friday, excluding Holidays) or questions may be e-mailed to: info@amberscience.com. Please provide the Model number, Serial number and Part number of the Conductivity Cell being used when contacting the Technical Support department with any questions.



277 BLAIR BLVD.
EUGENE, OREGON 97402-4147
(541) 345-6877
FAX (541) 345-6277
www.amberscience.com

Warranty

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

Exclusions

This warranty shall not apply to fuses, disposable batteries, (rechargeable type batteries, temperature probes and 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.

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.

Return of Items

Authorizations must be obtained from the Amber Science Customer Service Department [Call telephone (541) 345-6877 or e-mail: 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 and insured against loss and shipping damage. Amber Science, Inc. will not be responsible for any loss or damage that may occur during transit. Items being returned without prior authorization may not be accepted.

Design Changes

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

