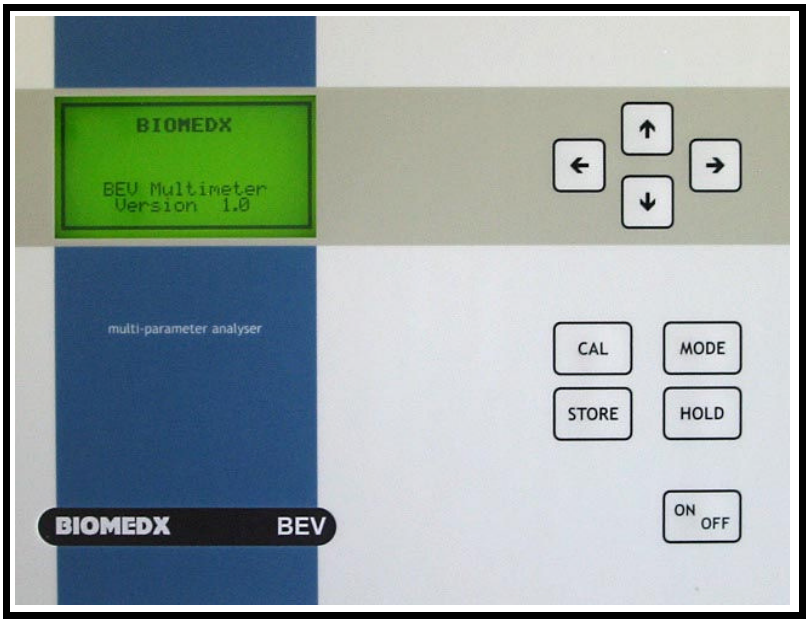
BIOMEDX BEV

multi-parameter analyser



Instructions

Blank.

BIOMEDX

BEV
Bio-Electronique Vincent

Multi-Parameter Fluid Analyser

Measuring:

pH, ORP, rH2,
resistivity, conductivity, TDS, salinity, Reams C,
microwatts.

The Biomedx BEV is the premier electronic instrument for easily measuring the electrical parameters of liquid (water based) mediums. BEV is the acronym for Bio-Electronique Vincent. It was the hydrologist Professor Louis Claude Vincent who immersed himself into the concepts of identifying the “perfect” parameters for water within an environment

In the 1950’s and 60’s Vincent published data showing why in certain areas of France there was a higher incidence of degenerative diseases like cardio vascular disease and cancer then there were in other areas. The reasons boiled down to the fact that the electrical properties of the water in the ill health districts were skewed away from the ideal electrical properties that support health. Differences in chlorination practices, anionic and cationic mineral ratios and filtration all affect the measurable electrical characteristics of water. There is a healthy range, and the range above and below that which is not conducive for ideal health.

The Biomedx BEV can be a cornerstone for measuring the parameters of the terrain of the soil on the farm, the qualities of the pond, the river, or the well behind the house, or even the internal fluid environment of the body.

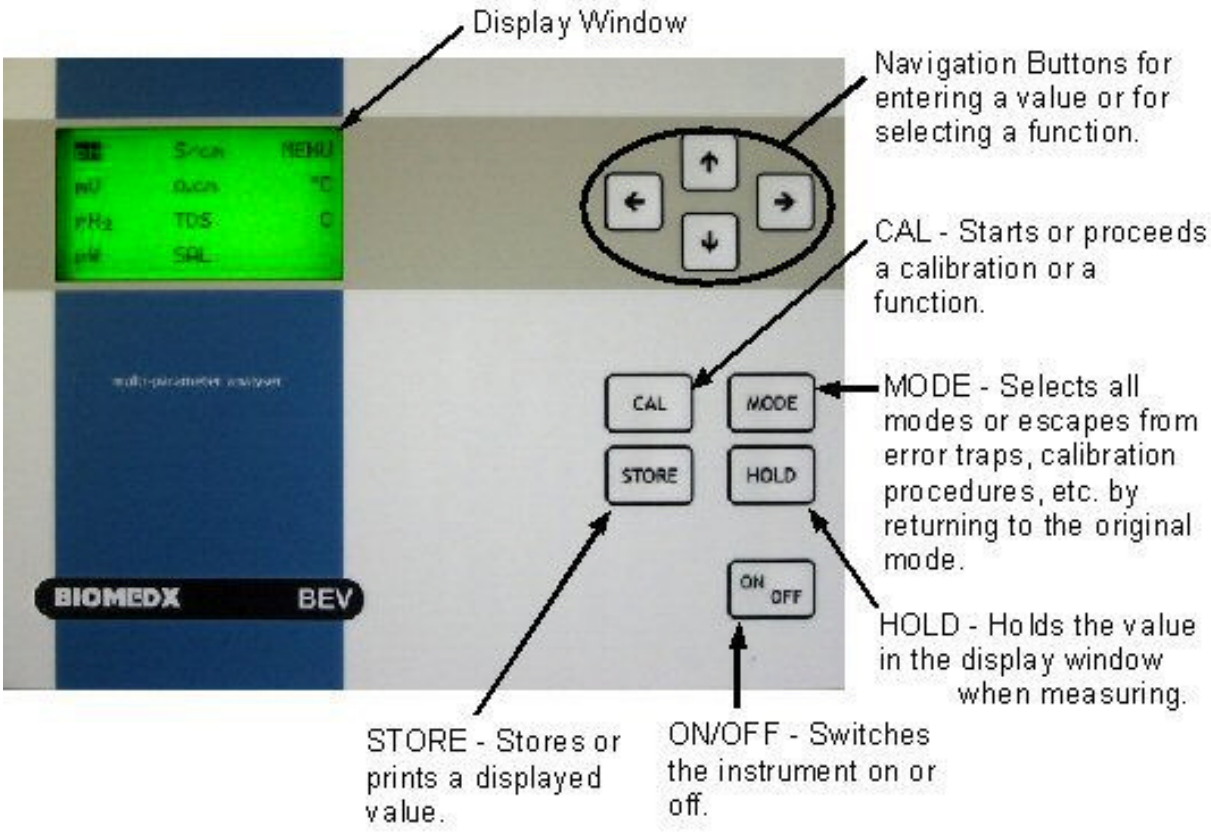
OVERVIEW

When you turn the BEV unit on the display window will first come up and state BIOMEDX for a few seconds and then it will generally go to the last operating mode it was in prior to being turned off. If this happened to be pH and no probe was attached to the unit or your probe is not in a solution, an error message might show on the display window.

The easiest way to become familiar with the way the function buttons work is to hook up some probes and observe the display window while you press the various selector keys.

Here is a review of the front panel layout.

Front Panel and Selector Keys



Your first concern when installing a new unit is to plug the probes into the back of the unit, turn it on, go through the initial set-up procedure for your particular preferences, and then calibrate your probes.

Plug the pH probe into CH. 1, the ORP probe into CH. 2, and the conductivity probe into EC.

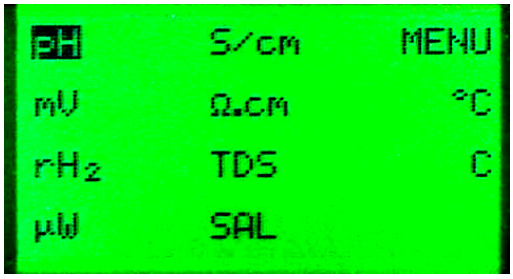
The ^{o}C is for a PT1000 temperature probe, the REC is for a recording device and RS232 port is for a computer tie-in. Many individuals will set their device for the room temperature they will be measuring in so no temp probe is required. If no temperature probe is plugged in, the unit automatically will default to the manual temperature mode. The recorder and computer interface can be ignored unless you are using those functions.

Plug the AC to DC power supply to the DC jack and plug the transformer into an appropriate AC outlet.

NOTE: If you have a Biomedx probe set you will need to reference the **pH and ORP instruction notes in Appendix 1** for these probes as they need to be filled with KCI solution (potassium chloride gel) prior to using. If you have not already done so you should do that now so you can proceed with your overview of this instrument. See the section entitled “Preparation” to properly prepare your probes for use.

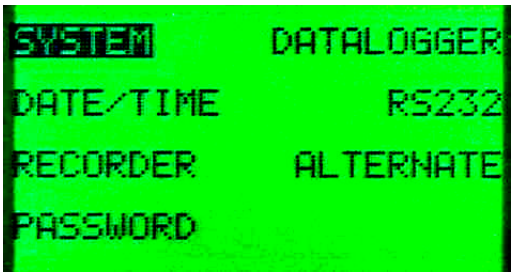
INITIAL SET-UP

Press the **MODE** button and get to the primary measurement selection screen. It will look like this:



Press the arrow keys to highlight MENU and press **MODE** again.

The set-up display as shown below will now be shown in your window:



Pressing the arrow keys will move you among the selections. Pressing **CAL** when any selection is highlighted will move you to the next display for that selection.

SYSTEM - Allows you to set the contrast and the language shown in the Display Window.

DATE/TIME - Allows you to set date and time.

RECORDER - Allows you to select which measurement will be directed to a lab recorder.

PASSWORD - Allows you to set a password for instrument access.

DATALOGGER - Allows you to activate the storage function for automatic data logging, recall previously stored values, and erase/clear the internal storage memory.

RS232 - Allows you to set computer communication baud rate, the sending interval and a unit ID number.

ALTERNATE - Allows you to select which measurements will be rotated through automatically when the START selection is entered. For example, if you highlighted CH.1 (the pH probe) and press **CAL**, a checkmark will appear next to CH.1. Highlight rH2 and press **CAL**, and a checkmark will appear next to rH2. Then highlight START and press **CAL**, and the unit will automatically cycle through those selected measurements every few seconds. Pressing **MODE** exits you from that operation as it would from any other operation.

Setting your room temperature on the instrument.

You will want to set the temperature on the instrument to your room temperature using the manual mode if you are not using a temperature probe. (Your specimen being measured will typically equilibrate to that temperature if you are using small sample sizes once the specimen goes into a test tube or microtainer and the probe contacts the specimen.)

From the primary measurement selection screen, highlight ^{o}C and press **MODE**. Move the up or down arrow to your room temperature and press **MODE** again. This sets the temperature.

For many measurements depending upon the type of lab work and the amount of accuracy required, this will not be hugely critical as the variation in measurement with a degree or two of temperature difference is not that large.

Manual Temperature Reference ^{o}F *to* ^{o}C

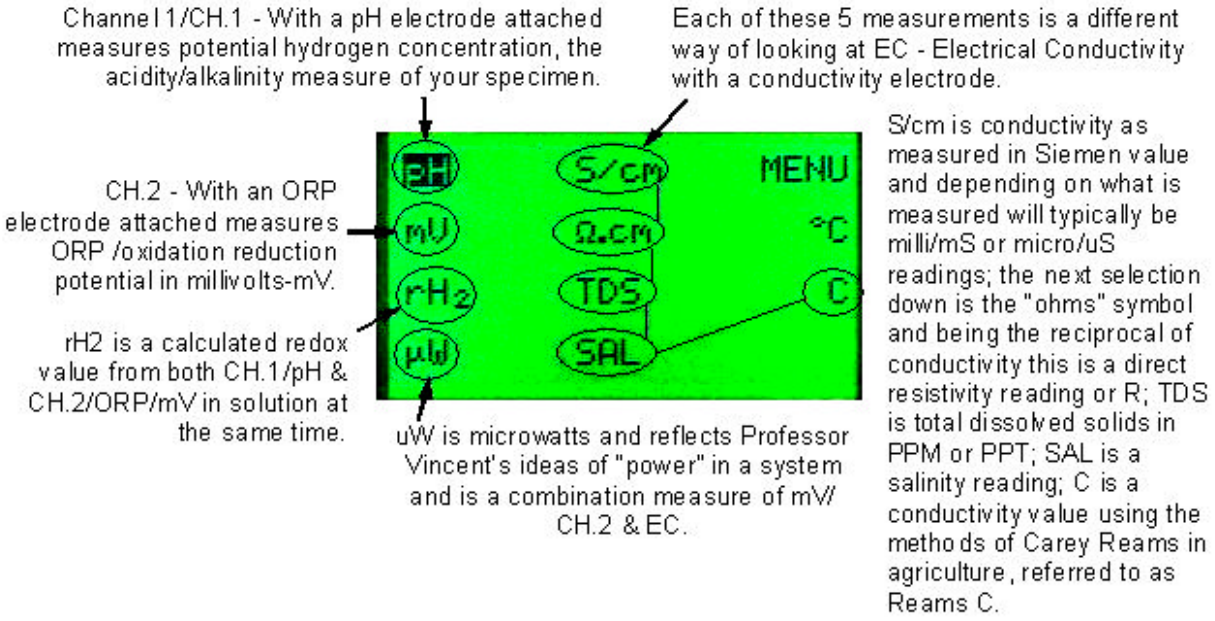
67^{o}F = 19.5^{o}C	73^{o}F = 23^{o}C
68^{o}F = 20^{o}C	74^{o}F = 23.5^{o}C
69^{o}F = 20.5^{o}C	75^{o}F = 24^{o}C
70^{o}F = 21^{o}C	76^{o}F = 24.5^{o}C
71^{o}F = 21.5^{o}C	77^{o}F = 25^{o}C
72^{o}F = 22^{o}C	78^{o}F = 25.5^{o}C

If a Pt1000 temperature probe is plugged into the back of the unit, the instrument will shift to automatic mode for temperature readings.

CALIBRATING PROBES AND MAKING MEASUREMENTS

You move to a particular measurement mode (ph, mV, rH2, conductivity/resistivity, etc.) by simply pressing the **MODE** button, then with the arrow buttons you would select the measurement value you are desiring to measure, and then press **MODE** again to go to that measurement mode.

Here is an overview of each of the measurements you are capable of selecting.



NOTE: Before you can use the BEV meter with your pH and ORP/redox electodes, you must set-up the electrodes for use, therefore…

READ THE INSTRUCTIONS FOR THE IJ44 & IJ64 pH and REDOX ELECTRODES. See the section entitled “Preparation” to properly prepare your probes for use.

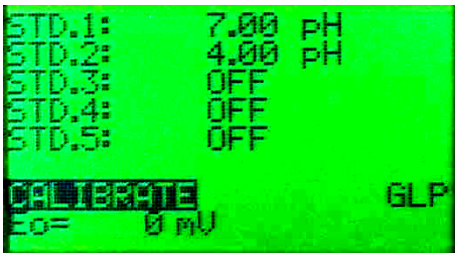
*pH Measurement & Calibration*_____

1. Select [pH] from the measurement selection screen by pressing **MODE**. The display will immediately show the measured value according to the previous calibration or if you have your electrodes in a sample specimen, it will return a value.

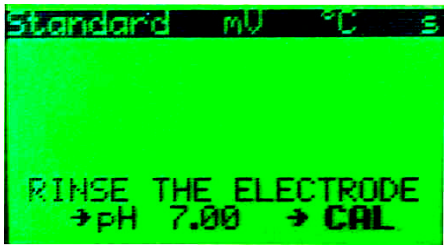
Should you want to recalibrate, press **CAL**.

2. The display shows up to five of the 9 buffers (calibration standards) in memory, e.g. [7.00] and [4.00]. For our purposes here, select two buffer standards to calibrate, a pH buffer of [7.00] and [4.00] - these are the calibration fluid standards that come with the instrument and those values are likely the default values stored in the unit when it was sent from our facility.

Select the proper values (or you could also manually enter special values if you had different buffers to use) and press **CAL**. The unused buffers should be switched off. Your display window will show:



After pressing **CAL**…



Note that after pressing **CAL** the display is telling you what to do:
Rinse the Electrode, put it in a pH 7.00 buffer, press **CAL**.
So that is what we do.

3. Rinse the pH electrode with distilled water, pat dry the electrode with a paper towel, and immerse the electrode into the first buffer solution. In this case that is a pH 7.00. Select [CALIBRATE], press **CAL**.

The next display will blink as the unit calibrates to 7.00 pH.
After the 7.00 calibration the display will ask you to put your electrode into the pH 4.00 buffer.
You repeat the process of rinse, dry, put the electrode into the buffer and press **CAL**.

Once the second point is calibrated (if that is all the points you are calibrating) you are ready to make a measurement.

4. After rinsing the electrodes with distilled water and patting dry, immerse them in your samples and read the display.

Press the \/ down arrow to change the resolution of the display from 0.1 to 0.001 pH. Note that the higher accuracy of the .001 scale will demand more time to lock on a number, and for this level of accuracy you would calibrate as close to your expected value as possible, set the exact temperature or use a pt1000 temp probe, and then make your measurement. For most day to day use where the utmost accuracy is not critical, using 0.1 or 0.01 resolution is usually sufficient. Depending upon your sample stirring the solution during the measurement promotes homogeneity and is also recommended.

After any measurement, rinse with distilled water and store your electrodes in 3…4 M KCl solution if you're leaving them overnight or over a weekend or longer. If you are working during the day, you can rinse, pat dry, and store your electrodes in a test tube filled with pH 4.00 buffer.

Your BEV instrument does not need to have pH calibrated with every measurement, or even every day. If you have a test tube filled with 4.00pH buffer, and store your electrode during the day in that buffer solution, you will know if you need to recalibrate just by observing where your pH value reads. It should be close to pH 4 plus or minus a few hundredths.

When you come in after a time away from your instrument, taking your pH electrode from your electrode storage solution, rinse with distilled water, pat dry, and place into your pH 4.00 buffer solution. If you are reading in the 4.00 range, you don't need to recalibrate for the electrode is already reading what it should.

Using pH electrodes with an abnormal zero point:

1. Select [Eo = x mV] and press **CAL**.
2. Enter the zero point of the electrode and press **CAL**.

GLP.

GLP refers to Good Laboratory Practice (or Protocols) and will reflect the calibration details stored in the unit.

pH Probe maintenance notes:

A pH electrode is active and stable only after wetting! For this purpose it must be immersed for at least ten hours in a 3...4 M KCl solution (this is your basic electrode storage solution included with your supplies. During short interruptions (e.g. whenever you are not going to be using it and for storage) the electrode should be immersed in a 3...4 M KCl solution. In doing this it is always kept ready for use. When the interruption is longer than a month, fill the electrode end cap or a microtainer/1.5ml centrifuge tube with 3...4 M KCI and plug it on the electrode tip in order to protect the glass bulb. Before use, ensure that the reference part of the electrode is topped up with a 3...4 M KCI gel solution. Refer to the electrode instruction manual.

*mV/ORP Measurement & Calibration*_____

1. Select [mV] from the measurement selection screen by pressing **MODE**. The display will immediately show the measured value according to the previous calibration or if you have your redox electrode in a sample specimen, it will return a value.

Should you want to recalibrate, press **CAL**.

You are offered three choices in the mV calibration window:

CALIBRATE
GLP
REF. = AgCL [or CALOMEL]

GLP refers to Good Laboratory Practice as referenced on the last page.
REF.= is referring to the type of redox electrode you are using. The Biomedx electrode is AgCL so that must be selected if you are using that electrode. If it shows REF.=CALOMEL then you would change this by highlighting it and then pressing **CAL** and then the up or down arrow to select REF.=AgCL then **CAL** or **MODE** to set it in place.

Highlighting CALIBRATE and pressing **CAL** takes you to the mV calibration routine which is very easy.

2. Rinse the redox electrode with distilled water, pat dry with a paper towel, and immerse the electrode into a standard solution of known potential - like a 200mV ORP solution. If your electrode is not reading 200mV, adjust the display window to the proper value by simply pressing the up or down arrow to the correct mV potential (200mV) and press **CAL**.

Press **HOLD** to reset the calibration.

Press the \/ down arrow button to change the resolution from 1 to 0.1 mV.

Note the upper left of the display shows you what back panel connector you are reading. In this example it is CH.2 - channel 2 - which is where the ORP/redox probe should be connected.

The upper right shows the temperature that was manually entered.

The mV tells you that you are reading ORP in mV.

mV.H readings. If you press the /\ up arrow, the mV will change to mV.H which are readings referred to a standard hydrogen electrode. If you see mV.H pop up on your display, the up arrow key was likely pressed and simply press it again to return to the standard mV reading. With mV.H in view, you will not be able to set a 200mV ORP calibration point.

After any measurement, rinse with distilled water and store your electrode in 3…4 M KCl solution if you're leaving them overnight or over a weekend or longer. If you are working during the day, you can rinse, pat dry, and store your electrodes in a test tube filled with 200mV OPR solution.

Your BEV instrument does not need to have mV calibrated with every measurement, or even every day. If you have a test tube filled with a 200mV ORP solution, and store your electrode during the day in that solution, you will know if you need to recalibrate just by observing where your mV value reads. It should be close to 200mV plus or minus a few points.

When you come into your lab after some time away from your instrument, take your mV electrode from your electrode storage solution, rinse with distilled water, pat dry, and place into your 200 mV ORP calibration standard. If you are reading in the 200mV range, you don't need to recalibrate for the electrode is already reading what it should.

rH_2 Measurement

The raw ORP reading in millivolts is used in conjunction with the pH reading to ascertain the rH2 value. BOTH probes must be in your solution to get a rH2 reading.

1. Select [rH2] by pressing **MODE**.

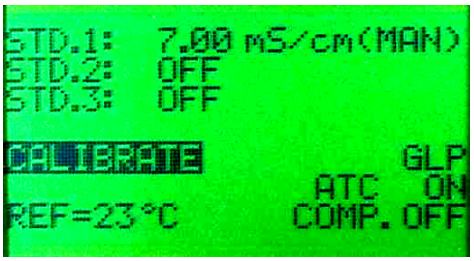
2. After calibrating and rinsing the pH and redox electrodes with distilled water and patting dry, immerse them in the sample to be measured and read the display.

*EC Electrical Conductivity Measurement & Calibration*_____

1. Select [S/cm] from the measurement selection screen by pressing **MODE**. The display will immediately show the measured value according to the previous calibration or if you have your conductivity electrode filled with a specimen solution, it will return a value.

Should you want to recalibrate, press **CAL**.

2. The display shows the three standards in memory. Select the proper values or enter manually special values and press **CAL**. The unused standards should be switched off. Biomedx sends out 7.00mS conductivity solution for calibration purposes and your instrument has likely been set to this value prior to leaving our facility. Your display window will show similar to this:



Note: If STD.1: which is standard #1, does not have 7.00mS in place, you will need to manually put it there if you are using 7.00mS calibration standard. STD.2 and STD.3 should be turned off. It might take some playing around with the unit to get used to how it works.

When the CALIBRATE mode is highlighted as shown above but the STD.1 is something other than 7.00mS, you will need to press the up arrow button to go to STD.1. If STD.2 and STD.3 have some value listed other than OFF, you can stop at that spot, press CAL, the number will be highlighted, then press the arrow buttons left or right until you come upon OFF. Once there, press CAL and then arrow up to STD.1. In STD.1 press CAL until the number is highlighted, then press the arrow button right or left until you come upon a number with (MAN) showing and press CAL. There are now two steps involved. The first is to select the range of measurement. You want the display to be 2.00mS to 20.00mS. Make sure it is mS and not uS. Once the proper 2.00mS to 20mS range is highlighted, press CAL. Next the unit is asking for the exact number within the just chosen range. Arrow up or down until you reach 7.00mS then press CAL. The unit should now display STD.1: 7.00mS/cm(MAN) and STD.2 and STD.3 should be off.

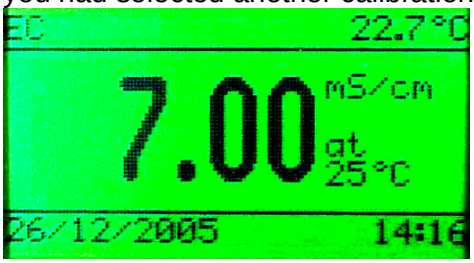
Sometimes due to electrical spikes in a power line, static electricity etc., the 7.00mS might disappear and some other number will be in its place. You will have to go through this process to set the 7.00mS back into the STD.1 slot, sometimes cycling around a few times as the numbers shift from STD.1, 2 or 3. Go around a few times and you should get it to lock in.

3. Select the temperature to which all future measurements will be referred to (REF=25°C) and press **CAL**. You might set this to a close approximate to what your room temperature and likely sample temperature will be, but generally 25°C is fine because automatic temperature compensation can be turned on.

4. Select automatic temperature compensation ATC ON so the instrument will compensate for your REF= temp in relation to your manually input room temperature which is what your sample is assumed to be. Press **CAL**.

5. After rinsing the electrode several times with the first standard solution (7.00mS), suck up some solution into the probe. (We are assuming for this example that you are using a Biomedx small sample conductivity electrode.) Note that your sample solution must COVER the two electrodes near the bottom of the probe with NO air bubbles between the electrodes. The solution temperature is not so critical but should lie between 0°C and 30°C. (When no Pt1000 is used, do not forget to enter your manual temperature.) Select [CALIBRATE], press **CAL** and follow the instructions on the screen until the calibration is finished.

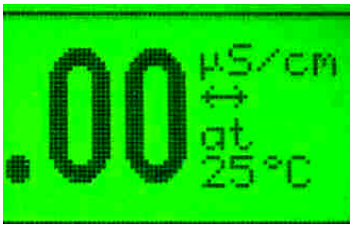
The display instructions will say “Stir!” but we have a small sample size and special probe so this will not be done. The display will blink while calibration is being performed. Once the unit locks into a calibration for the probe, it will shift to the EC mode and present the EC reading. If you had selected another calibration point it would ask for that next calibration solution.



Here the display shows EC - Electrical Conductivity reading of 7.00 mS/cm assumed at 25°C with a current sample temp manually set at 22.7°C. With these parameters and the ATC set to ON this is an accurate reading. If you manually move your room temperature reading to something other then 22.7 as in this example, the instrument would need to be recalibrated. However, you should know that a few degrees difference with many measurement scenarios is not going to effect the outcome greatly particularly when you are simply looking to find where in the ballpark you may be with any given reading.

6. Rinse the conductivity electrode always after use and store it in distilled water.

Special situation: When starting a titration, press the \/ down arrow button to lock the actual range and avoid crossover errors due to differences in the measuring frequency. Press **MODE** to return to the normal measuring mode. A left and right pointing arrow will appear on the display when you lock the range. Should you see this arrow and you are not performing a titration, you can press the \/ down arrow button and the display arrow will be removed.



Capacitive compensation:

1. Capacitive compensation increases accuracy in the very low conductivity ranges (<10 µS/cm). Select whether or not this compensation should be applied. Verify if the attached electrode is completely dry and press **CAL.**

Select [COMP.ON] or [COMP.OFF] and press **CAL**. Follow the instructions on the screen.

EC Electrical Conductivity can be read in may different ways, but they all mean the same thing.

Siemens - What we read above, expressed as millisiemen mS/cm or microsiemen µS/cm, siemen has also been referred to as mhos which is ohms spelled backwards.
Resistivity - Ω.cm, the reciprocal of conductivity read in ohms or R.
Salinity - Salinity
TDS - Total dissolved solids read in parts per million or parts per thousand.
Reams C - This is not a direct correlation but a mathematical derivative of EC on a slightly different scale. Reams C reads higher then siemen readings.

Resistivity measurement_____

1. Select [Ω.cm] by pressing **MODE**. The display will immediately show the measured value according to the previous calibration. Should you want to recalibrate, press **CAL**. Proceed as for conductivity.

Salinity measurement_____

1. Select [SAL] by pressing **MODE**. The display will immediately show the measured value according to the previous calibration. Should you want to recalibrate, press **CAL**. Proceed as for conductivity.

TDS measurement_____

1. Select [TDS] by pressing **MODE**. The display will immediately show the measured value according to the previous calibration. Should you want to recalibrate, press **CAL**. Proceed as for conductivity.

Reams C measurement_____

1. Select [C] by pressing **MODE**. The display will immediately show the measured value according to the previous calibration. Should you want to recalibrate, press **CAL**. Proceed as for conductivity.

A blinking decimal point warns you for unstable measurements. The decimal point will stop blinking when a stable measurement is reached.

Stirring the solution prior to sucking it up the conductivity probe for the measurement promotes the homogeneity and is therefore always recommended.

*µW Measurement*_____

1. Select [µW] by pressing **MODE**.

2. After calibrating and rinsing the pH, ORP and conductivity electrodes with distilled water, immerse them in the solution to be measured and read the power in µW.

Maintenance of pH electrodes

A pH electrode is active and stable only after wetting! For this purpose it must be immersed for **at least ten hours** in a 3...4 M KCl solution. During short interruptions (e.g. storage) the electrode should be immersed in a 3...4 M KCl solution. In doing this it is always kept ready for use. When the interruption is longer than a month, refill the closing cap with 3...4 M KCl and plug it on the electrode tip in order to protect the glass bulb. Before use, ensure that the reference part of the electrode is topped up with a 3...4 M KCl solution.

A polluted electrode may be cleaned with a soft detergent or 0.1 M HCl. Greasy substances may be removed with acetone or alcohol **(never do this with plastic electrodes!)**. If the electrode is polluted by proteinaceous materials (such as blood), it should stand in a cleaning solution overnight and then be cleaned with distilled water before use. The pH electrode wears away by being used. If the electrode tends to respond slower and calibration becomes difficult, even after cleaning, it should be replaced by a new one.

Maintenance of metal electrodes

Metal electrodes (Pt, Ag, Au): Metal electrodes are always ready for use. During short interruptions they are immersed in distilled water.

They should be cleaned regularly:
• Silver electrodes are immersed in a concentrated ammonia solution for one hour.
• Platinum or gold electrodes are immersed in concentrated nitric acid for one hour.

Maintenance of conductivity electrodes

A conductivity cell is active and stable only after wetting! For this purpose it is good to keep it wet in distilled water for 30 or 60 minutes prior to use. Rinse the cell always after use in distilled water. You can store it dry over night or for extended periods of time (months/years).

A polluted cell (the platinum electrode wires) may be cleaned with a soft detergent or diluted nitric acid. This is done by squishing the solution in and out and just storing the probe in the solution for a short while. DO NOT PUT ANY CLEANING TOOL INSIDE THE PROBE TO RUB THE ELECTRODE WIRES. The wires have a spongy platinum coating and rubbing them manually will wipe the platinum off.

****

Special Laboratory Use

GLP
1. Select the desired range by pressing **MODE** and then press **CAL**.
2. Select [GLP] and press **CAL**.
3. Select [SHOW REPORT] and press **CAL**. Browse with the arrow buttons to show a complete calibration report. Press **STORE** to print the report.

Calibration reminder
1. Select the desired range by pressing **MODE** and then press **CAL**.
2. Select [INTERVAL] and press **CAL**.
3. Select the desired time interval between each automatic warning for a new calibration of the electrodes and press **CAL**.

Data-logging
1. Select [MENU] by pressing **MODE**.
2. Select [DATALOGGER] and press **CAL**.

Start the data-logging:
1. Select [STORE] and press **CAL**.
2. Select [RANGE] and press **CAL**.
3. Select the desired range and press **CAL**.
4. Select [INTERVAL] and press **CAL**.
5. Select the desired time interval between the data-logging and press **CAL**.
6. Select [NUMBER] and press **CAL**.
7. Select the desired number of values to be data-logged and press **CAL**.
8. Select [START] and press **CAL**.
9. Starts the data-logging according to the previous settings while a blinking [LOG] appears. When manual data-logging has been selected, press **STORE** to put a next measurement into memory. In the meantime the display shows the logging-number e.g. [#00027].

View the stored values on the display:
1. Select [RECALL] and press **CAL**.
2. Select [TABLE] or [PRINT] to display or print the stored data and press **CAL** to continue. Follow the instructions on the screen.

Erase the stored values:
1. Select [ERASE] and press **CAL**. Follow the instructions on the screen.

RS232
1. Select [MENU] by pressing **MODE**.
2. Select [RS232] and press **CAL**.
3. Select [BAUDRATE] and press **CAL**.
4. Select the desired baudrate and press **CAL**.
5. Select [INTERVAL] and press **CAL**.
6. Select the desired interval between the transmitted data and press **CAL**. Preset to zero if no automatic transmitting is required.
7. Select [IDENTIF. No.] and press **CAL**.
8. Enter an identification number for the transmitted data and press **CAL**.

Alternating measurements
1. Select [MENU] by pressing **MODE**.
2. Select [ALTERNATE] and press **CAL**.
3. Select the desired modes and press each time **CAL**. Eventually press **CAL** again to unselect.
4. Select [START] and press **CAL**. The display alternates between the selected modes with an interval of ca. 5 s. Pressing **STORE** will send all values of the selected modes to the RS232 output.

Specifications

Ranges
pH -2...+l6pH
mV ±2000 mV
rH_2 0.. .42 rH_2
uW 0.. .400000 uW

Conductivity
cc = 0.1 cm' 0.001 uS/cm ... 20 mS/cm
cc = 1 cm' : 0.01 uS/cm ... 200 mS/cm
cc = 10 cm' :0.1 uS/cm ... 2000 mS/cm

Resistivity
cc = 0.1 cm' :100 ohms.cm ... 200 Mohms.cm
cc = 1 cm' :10 ohms cm ... 20 Mohms.cm
cc = 10cm' :1 ohms.cm ... 2Mohms.cm

TDS
cc = 0.1 cm' :0.01mg/I ... 20 gIL
cc = 1 cm' :0.01mg/I ... 100 g/L
cc = 10 cm' :0.1 mg/I ... 100 gIL

Salinity 0 ... 70 ppt
^{o}C 0 ... 100^{o}C

Resolution: 0.1/0.01/0.001 pH, 1/0.1 mV, 0.01 rH_2, 0.1°C, 0.01/0.001 uS/cm, 1 Ω.cm, 1% ion, 0.1/0.01 mg/I

Inputs: 1 BNC input for pH, 1 BNC input for mV, 1 BNC input for a conductivity cell
1 BANANA input for a Pt1000 temperature probe

Temp. Comp.: automatic with Pt1000 or manual

Digital output: programmable RS232, 150...4800 b/s, for bi-directional communication with a computer or printer

Analogue output: 0.. .2 V, ca 8 k~, programmable 8 bit DAC

Display: LCD 128x64 pixels

Keys: 9 tactile membrane keys

Ambient temp.: 4...40°C

Rel. Humidity: 0.. .90 % (non-condensing!)

Power supply: 9 volt DC input to BEV unit.

Cabinet:: P65 cabinet

Dimensions: 260 x 180 x 90mm

Weight: 1 kg