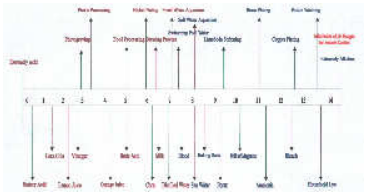
contents

Section 1 - Electrode Construction

What is pH?

It is a unit of measurement describing the acidity or alkalinity of a solution, measured over a scale of 0-14.



See attached sheet

The measurement is carried out using a pH Meter, together with a pH electrode, either a separate pH glass electrode and a reference electrode, or a combination electrode, which is an electrode comprising the pH and reference together.

pH Meter

&

pH Combination Electrode

OR

pH Meter

&

pH Electrode & Reference Electrode

1) The pH Sensitive Membrane

The most common type of sensitive membrane used on pH electrode is a blown glass bulb or rod. The glass used on SENTEK electrodes is suitable for most applications situations.

Bulb

Rod

If, however, the customer's application involves the constant monitoring of high temperature liquids, or high pH (above pH 13), then an alternative glass type can be specified.

A bulb configuration will provide a fast response and accurate results when used in a sample of low ionic strength whereas a rod or bullet shaped membrane is very rugged and will be more resistant to breakage.

Fast Response

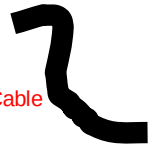
2. The Reference Cell

Housed within the outer chamber of the pH electrode is a reference system, which is designed to provide a stable reference voltage for the sensor. This reference "half-cell" will maintain a constant output in all liquids. Reference cells consist of an internal element, usually an Ag/AgCl wire, electrolyte (usually KCl), and a liquid junction. The liquid junction provides a leak path for the internal electrolyte to "weep" into the samples chamber and provide an electrical contact with the liquid to be measured. If the liquid junction is not efficient then measurement will be inaccurate.

3. The Cap/Cable/Connector

Electrodes used in labs are usually fitted with 16mm diameter caps to fit cantilever electrode arms. The cable used is a high grade, screened coaxial type with low noise characteristics. Because of the high impedance of pH electrodes, typically 100 megohms, connectors should always be kept clean and dry. Detachable cable electrode should not be used in very humid environments.

16mm diameter cap to fit electrode arm



Cable

Connector

Section 2 - How to Specify an Electrode

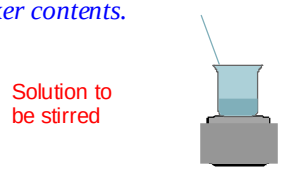
Many users of pH electrodes know the type of electrode required for their applications. However, there are many who do not and some will tend to seek advice from their laboratory supplier for new applications.

The following check list, when used with our application chart, will help to identify the products required.

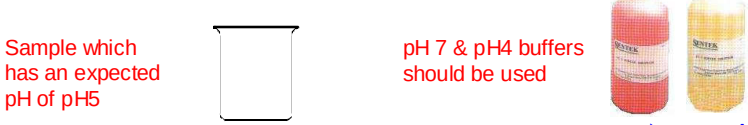
Section 3 - Calibration of pH Meter / Electrode

To achieve accurate, reproducible results a great deal of attention needs to be paid to the calibration method. A decision should be made on the accuracy required for the measurement. This will enable the user to choose the types of calibration required, and also the appropriate type of equipment to be used. Our following recommendations are listed to achieve the best levels of accuracy possible.

a) *All solutions should be stirred gently when measuring to ensure the sensor is measuring a true representation of the beaker contents.*

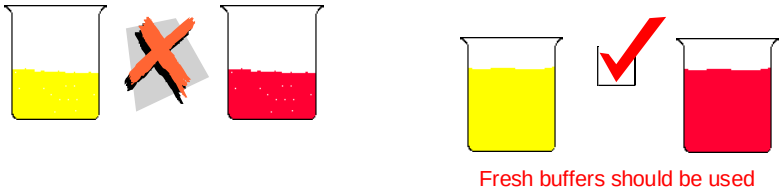


b) *Calibration buffers should be chosen which have pH values either side of the expected sample value i.e. for a sample which has an expected pH of pH 5, pH buffers with a value of pH 7 and pH 4 should be used.*



c) *Always use a "control" buffer to keep a check on the drift of the electrode. A method commonly used is to place the electrode into a buffer, which has a value close to the sample pH, between measurements.*

d) *Fresh buffer solutions should be used. Changing all solutions daily is good practice.*



e) *All solutions should be maintained at equal temperature.*

f) *Rinse the electrode thoroughly in de-ionised water between measurements.*

g) *When calibrating the electrodes allow sufficient time to lapse for the reading to stabilise before adjusting the meter. At least 1 minute, preferably longer.*

Section 4 -
Procedure for Calibrating the pH Meter

Equipment Required:

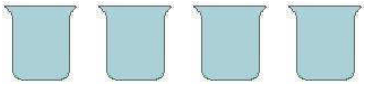
1 x high quality pH/mV Meter 

100ml pH 7.00 buffer solution 

100ml pH 4.00 buffer solution 

100ml pH 5.00 buffer solution

1 x calibrated glass thermometer 

4 x 200ml beakers 

3 x Teflon stirrer paddles 

1 x magnetic stirrer 

1 x cantilever electrode arm 

1 x fast flow wash bottle (DI water) 

1 x temperature controlled water bath (required if the sample value is different from ambient)

1 x combination pH electrode 

Method

a) *Assemble all equipment.*
b) *Lower fill hole sleeve on the electrode (if fitted) and thoroughly rinse the electrode tip.*
c) *Lower electrode into gently stirred pH 7.00 buffer and allow to stabilise.*
d) *Check the temperature of the calibration solutions and adjust the default reading on the pH meter, if applicable.*
e) *After 1-2 minutes adjust the calibration control on the pH meter to the appropriate pH value. (consult pH buffer temperature versus pH chart).*
f) *Raise electrode from beaker and thoroughly rinse with DI water.*
g) *Lower electrode into gently stirred pH 4.00 buffer and allow to stabilise.*
h) *After 1-2 minutes adjust the slope control on the pH meter to the appropriate temperature corrected value.*

NOTE: ***Many modern microprocessor pH meters have automatic buffer recognition. Consult the instrument manual for specific adjustment information.***

i) *Rinse the electrode and repeat stages c) - h) to confirm calibration.*
j) *Rinse the electrode and lower into pH 5.00 buffer.*
k) *After stabilising, record the reading in pH 5.00 buffer.*
l) *Between measurements in the sample, rinse and lower the electrode into the control buffer for comparison with the recorded reading. (remember to check temperature pH versus pH values).*

Section 5 - Care & Maintenance of Electrodes

By following this advice, it is possible to significantly increase the expected life of an electrode, and also greatly improve the quality of measurement results.

* *pH electrodes must always be stored wet. There are many opinions on which stored solution is best. SENTEK electrodes are all supplied soaked in a saturated KCl solution, except double junction electrodes, which are stored in the appropriate refill electrolyte for their application.*

Electrode are all supplied soaked in saturated KCl (in the soaking boot)

* *For short term storage soak the electrode in KCl*

* *For long term storage fill the soaking boot and fit over the end of the electrode and seal with parafilm.*

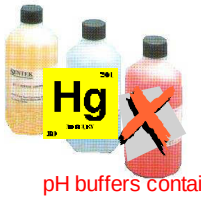
* *Electrodes should never be stored in any of the following liquids:*

De-ionised water, sample, solvents, hydrofluoric acid, pH buffers containing mercury based preservatives.

DI Water

Sample

Hydrofluoric Acid



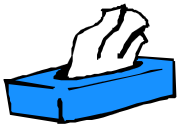
pH buffers containing Mercury based preservatives

* *Sensing tips should always be rinsed after use.*

* *Reference cells should be kept regularly topped up with electrolyte.*

* *Connectors must be kept clean and dry.*

* *If the electrode needs to be cleaned physically, always use soft tissue soaked in a mild detergent or propanol.*



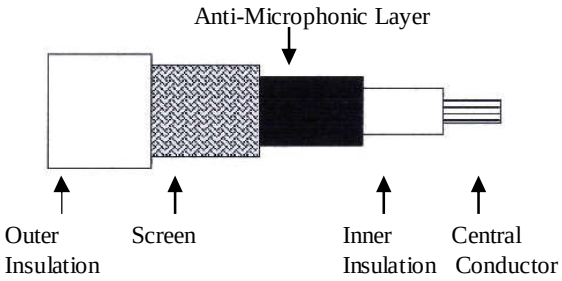
* *Regularly inspect the glass pH sensitive membrane for cracks or chips.*

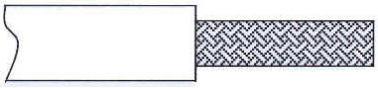
section 6

Techniques for Re-Terminating the Electrode Cable

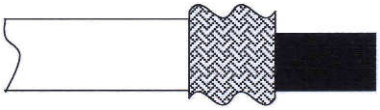
The cable used for pH and ORP electrodes is a special screened low noise cable. The electrode is a high impedance device and is coupled to a high impedance measuring instrument.

The cable incorporates a special conductive rubber material known as an anti-micro phonic layer. This prevents voltages being generated when the cable is moved or vibrated.

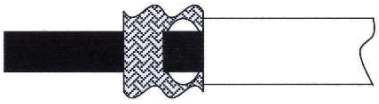




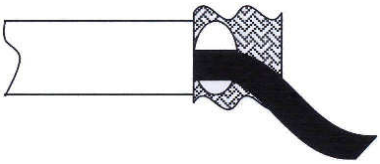
1) Bare cable back approx. 30mm



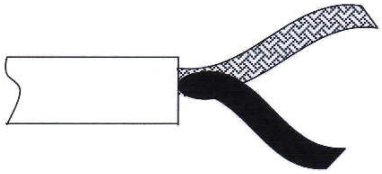
2) Push braided screen back



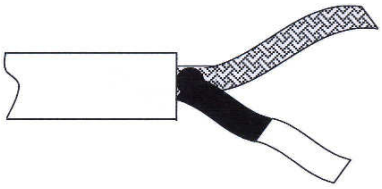
3) Make hole in braided screen using pointed tool, taking care not to break strands



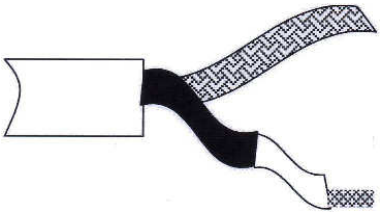
4) Using pointed tool, carefully pull inner core through hole



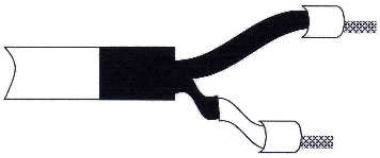
5) Pull/stretch braided screen



6) Carefully remove black conductive layer



7) Carefully remove white insulation



8) Optional.
Neaten up the connections by fitting heat-shrink insulation and bootlace connectors

Most electrode are supplied with a BNC connector fitted. It is often necessary to remove the BNC connector or shorten the cable suitable for connecting to screw terminals.

IMPORTANT: When re-terminating the cable, the anti-microphonic layer must be stripped back from the centre conductor to prevent a short circuit in the cable.