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**pH SENSOR
CALIBRATION AND PERFORMANCE CHECKS
(T-611, T-611P, T-612, T-617)**

The pH sensor consists of a combined reference and measuring electrode assembly (Ag/AgCl). The ORP sensor shares the same reference electrode. Contact between the reference electrode and the sample solution is via a porous Teflon* plug.

Potential errors:

The measurement of pH may be subject to errors, these being:

- Incorrect calibration.
- Contaminated buffer solutions.
- Blocked Teflon* porous plug i.e. liquid junction.
- Scratched glass membrane.
- Poisoning ions which either react with the Ag or the electrolyte to form a precipitate on and/or in the liquid junction. This causes internal coating and clogging of the junction resulting in a short lived reference half cell. Typical poisoning ions are from sulphur compounds, chlorine compounds and ammonia.
- Dehydration of the glass membrane occurs when the electrode is left in a non-wetted environment. Prolonged and repeated dehydration may render the electrode useless.
- If the reference electrode is allowed to dry out, salt crystals from the electrolyte or precipitates of the solution being measured will form bridges either within or on the surface of the liquid junction, this results in a higher reference impedance.
- All of the above cause the isopotential point shifts.

All or some of the above errors can occur over a period of time. It is important to regularly check and calibrate the sensor.

Factory Calibration:

Two point or single point calibration is available on the T-611, T-611P and T-612 instruments. The factory does a 2 point calibration to set the zero point and the slope. Buffer solutions of pH 4.0, 7.0 and 10.0 are prepared using the Standard Methods Handbook (ref: Durst, R.A. 1975 Standard Reference Materials: Standardization of pH Measurements NBS Spec Publ. 260-53, National Bur. Standards, Washington D.C.) Other buffers of different values are accommodated, these can be dialled up in the calibration routine on the instruments.

User Calibration:

Place the probe into buffers between 4.0 and 7.2 ideally 7.0 and calibrate. Rinse with distilled water and shake off excess water. Place probe into buffer between 7.0 and 10.0 and calibrate. The coefficients offset and slope with the date and time will be held in memory and can be downloaded onto a disk or printed out for future reference. All new instruments have the coefficients printed out and enclosed with the user manual. These coefficients should be kept to compare with future calibrations. This will give an indication of:

1. The stability of the electrode.
2. Accidental or unauthorised calibration.

If the probe is to be used over a wide range of pH values it is a good practice check the pH electrode in buffers 4.0 7.0 and 10.0 to be sure the readings are in the stated accuracy range.

Recalibration:

Set-point or zero-point and slope stability depend entirely on the nature of the sample solution and the degree of accuracy required. No hard and fast answer can be given to the usual question " How often do I recalibrate?" However the rule of thumb has proved itself in practice:

When carrying out measurements in a sample substance or solution which has never been tried before, it is advisable to recalibrate frequently. If no significant variation in value is found, the calibration interval can be correspondingly increased eg weekly.

A comparison check between the electrode slope of the probe when new and at its next calibration can be made. For example, if the pH sensor factory coefficients are:

Calibration Date/Time	Offset	Slope
02/04/97 08:48 pH	4706.539	-698.273

The slope should remain within limits of:

-5% to +2% ==> -663.359 to -712.238

If the slope is outside this range the probe must be serviced or it may be necessary to change the pH sensor.

Measurement of Junction Potential:

A comparison check between the electrode offset of the probe when new and at its next calibration can be made.

For the pH sensor factory coefficient in the previous example, if the offset changes by 3%, ie outside the range 4706.539 to 4800.669 the electrode needs attention.

The effect of the junction potential can be checked by measuring the pH at 7. Use a pH phosphate buffer solution and compare it with the pH of the same solution diluted with 9 parts of freshly boiled deionised water. The pH of the diluted buffer should be 0.2 +/- 0.05 units higher than the original buffer. If the values are outside this range, the reference electrode needs attention. It is suggested that this test be carried out every four months as a cross check for the above.

Electrode life:

If the electrode has not suffered due to misuse or contaminated electrodes then the probable main cause of electrode failure is exhausted reference electrolyte. Then the probe will need to be replaced. If the electrode is used regularly and stored in probe keeping solution the electrode life and calibration stability will be extended.

While all care has been taken to prepare this Bulletin, Turo Technology Pty Ltd accepts no responsibility for the accuracy of its contents. It is based on experience and published literature from manufacturers of pH sensors and testing organisations. The final responsibility is with the user. Further information is welcome from individual users or organisations.