

Calibration calculation

Only the "Calibration curve = linear" selection is concerned by this section.

A linear regression is used to calculate the following calibration results:

E'_0	Sensor potential at pH_{iso} (mV).
S_{25}	Sensor slope at 25°C (mV/pH).
$pH_{0_{25}}$	pH at which a 0mV potential is issued from the sensor at 25°C (pH).
P_{25}	Normalized slope (% of theoretical slope at 25°C).

In a first step, each new buffer is processed in order to calculate a ΔpH_i transform:

$$\Delta pH_i = (pH_{buf.i}(T_i) - pH_{iso}) * T_i / T_{25}$$

T_{25}	Reference temperature ($T_{25} = 25 + 273.15 = 298.15^\circ K$).
T_i	Buffer temperature ($^\circ K$).
pH_{iso}	pH value at which the temperature has no effect (pH). Default 7pH or this value will be contained in the probe definition, or entered if using a legacy adapter.
$pH_{buf.i}(T_i)$	pH of the buffer at temperature T_i (pH). Calculated from equation (1) or entered by the user.

Then the meter processes the slope S_{25} :

$$S_{25} = \frac{N * \sum(\Delta pH_i * E_i) - (\sum \Delta pH_i * \sum E_i)}{N * \sum \Delta pH_i^2 - (\sum \Delta pH_i)^2}$$

N	Number of available calibration points (from 2 to n).
E_i	Measured potential in buffer i (mV).

The E'_0 value is given by:

$$E'_0 = \frac{[\sum E_i * \sum (\Delta pH_i)^2] - [\sum \Delta pH_i * \sum (\Delta pH_i * E_i)]}{N * \sum \Delta pH_i^2 - (\sum \Delta pH_i)^2}$$

For the first buffer, or when a single buffer is used for calibration, E'_0 is calculated as follows:

$$E'_0 = E_1 - S_{25} * (pH_{buf.1}(T_1) - pH_{iso}) * T_1 / T_{25}$$

S_{25}	Sensor slope at 25°C (mV/pH). Result of a previous calibration, with a reset value of -59.16 mV/pH if the sensor is calibrated for the first time.
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As an indication to the user, the slope P and the zero pH pH_0 are also calculated:

$$pH_0 = pH_{iso} - E'_0 / S_{25}$$

$$P = 100 * S_{25} / (-59.16)$$

pH determination

After the sensor has been calibrated, the pH of samples is calculated as follows:

$$pH_{\text{smp}} = pH_{\text{iso}} + \frac{E_{\text{smp}} - E'_0}{S_{25}} \cdot \frac{T_{25}}{T_{\text{smp}}} \quad (2)$$

pH_{smp}	pH of the sample at sample temperature (pH).
pH_{iso}	pH value at which the temperature has no effect (pH). Default 7pH or this value will be contained in the probe definition, or entered if using a legacy adapter.
E_{smp}	Potential measured in the sample (mV).
E'_0	Sensor potential at pH_{iso} (mV). Calibration result.
S_{25}	Sensor slope at 25°C (mV/pH). Calibration result.
T_{25}	Reference temperature ($T_{25} = 25 + 273.15 = 298.15^\circ\text{K}$).
T_{smp}	Sample temperature ($^\circ\text{K}$)