DENVER INSTRUMENT

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Application Note

Nernst Equation

A pH electrode is needed to take pH measurements. pH electrodes work by exchanging ions at a glass surface. Unfortunately as temperature changes so does the response of the glass. Nernst's equation describes how the electrode efficiency changes as a result of temperature.

The Nernst equation can be expressed as:

$$E = E_X - \frac{2.3RT_K}{nF} \log (a_i)$$

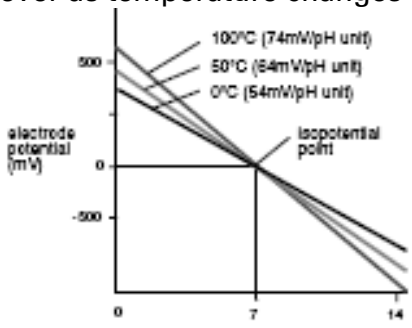
where:

E_X	=	constant depending upon reference electrode
R	=	constant 8.3143 (J/mol•K)
T_K	=	absolute temperature (Kelvin)
n	=	charge of the ion (including sign)
a_i	=	activity of the ion (this value is 1 for pH)

At 25 oC:

$\frac{2.3RT_K}{nF}$ = slope = 59.16 mV/pH = 100 % efficiency

However as temperature changes so does the slope of the electrode.



Typical pH electrode response as a function of temperature

Denver meters adjust the measured slope as the temperature changes, using the Nernst equation, in both pH and ion modes to calculate the most accurate pH and ion readings.