pH Meter Two-Point Calibration: Slope, Offset and Sample pH

Electrode slope, percent of the Nernst slope and zero-point offset from two buffer readings, and the pH of a sample from its millivolt reading.

Method: Two-point calibration of a glass electrode

Input parameters

Unit system: SI

Parameter	Value	Unit
Buffer 1 pH	7.0000	
Reading in buffer 1	-3.0000	mV
Buffer 2 pH	4.0100	
Reading in buffer 2	166.50	mV
Calibration temperature	25.000	°C
Sample reading	50.000	mV

Calculated results

Parameter	Value	Unit
Electrode slope	56.689	mV
Theoretical Nernst slope	59.159	mV
Slope efficiency	95.824	%
Offset (reading at pH 7)	-3.0000	mV
Sample pH	6.0651	

Notes for this case

• The glass electrode follows E = E₀ − s(pH − 7). Two buffers fix the slope s (mV per pH, positive as entered) and the offset at pH 7. The theoretical slope is ln10·RT/F (59.16 mV/pH at 25 °C). A healthy electrode shows 95–102 % slope and an offset within about ±30 mV; lower slopes mean an ageing or dirty membrane. Measure the sample at the calibration temperature, or apply temperature compensation.

Formula and method

$$s = \frac{E_2 - E_1}{pH_1 - pH_2}, \quad s_N = \frac{\ln 10\, RT}{F}, \quad pH_x = 7 - \frac{E_x - E_{pH7}}{s}$$

Variables

pH_1	Buffer 1 pH	-
E_1	Reading in buffer 1	V
pH_2	Buffer 2 pH	-
E_2	Reading in buffer 2	V
T	Calibration temperature	K
E_x	Sample reading	V
s	Electrode slope	V
s_N	Theoretical Nernst slope	V
s/s_N	Slope efficiency	-
E_{pH7}	Offset (reading at pH 7)	V

pH_x	Sample pH	-

Method and standards

pH calibration.

Assumptions and limits

- Linear electrode response between buffers; buffers at stated pH for the temperature.

References

Two-point calibration of a glass electrode

Report details

Report reference	FCC-TNZJ-P8MG (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/analysers/ph-two-point-calibration

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.