DO2N-300E Dissolved Oxygen Sensor

Overview

The DO2N-300E is a current to voltage adapter designed to work with a Clark-style oxygen electrode. This adapter delivers a polarizing voltage of -0.8V to the electrode to create a current, or flow of electrons, between the silver and platinum elements in the electrode. The flow of electrons between these elements increases and decreases as the concentration of oxygen in the polarograph chamber increases and decreases, respectively. The adapter then converts the changes in current to changes in voltage that can be recorded.

Specifications:

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Excitation Voltage	-0.8V
Voltage Output	+/- 5V

Operating Instructions:

1. Plug the IX-MYDAQ into the NI mydaq. Plug the mini din 7 end of the DO2N-300E into CH 1 or CH 2 of the IX-MYDAQ.
2. Take the electrode and place into the desired liquid concentration.
3. Plug in the USB cable and set the input range of the channel being used to +/-5V.
4. Record the output of the DO2N-200E.

Calibration Procedure

1. Plug the IX-MYDAQ into the NI mydaq. Plug the mini din 7 end of the DO2N-300E into CH 1 or CH 2 of the IX-MYDAQ.
2. Plug the clark style electrode into the DO2N-200E. Plug in the USB cable and set the input range of the channel being used to +/-5V.
3. Fill the polarograph chamber with fresh deionized water before proceeding with the calibration procedure.
4. Place the electrode in the chamber and turn up the speed of the stirrer to the maximum rate that allows the stir bar to rotate evenly. If the solution in the chamber is stirred, changes in oxygen concentration reach the electrode instantaneously. If a stirrer is not used, changes in the rate of oxygen production are limited by the rate of diffusion.

5. Begin recording the output of the oxygen electrode. Note on the recording that the measurement is from water saturated with oxygen at room temperature. Note the room temperature.

6. When the trace settles down to steady baseline, record for an additional 10 seconds before going to the next step.

7. Use a micropipette to add 10µl (microliters) of 1.5M Sodium Dithionite (oxygen depletion) solution to the water in the reaction chamber for every milliliter of water in the chamber. In a few seconds, this small amount of solution will deplete all the oxygen from the deionized water stirring in the chamber. Record the drop in the oxygen concentration in the chamber until the trace is a flat line at a lower amplitude. Note that this is the recording for water depleted of oxygen at room temperature.

8. Stop the recording.

9. Turn off the stirrer for the chamber. Remove the water and the oxygen depletion solution from the chamber with a plastic-tipped Pasteur pipet. Rinse the chamber 3 or 4 times with deionized water from a squirt bottle. Fill the chamber with deionized water and turn on the stirrer.

10. Determine the temperature (°C) and the barometric pressure in the lab. The oxygen concentrations in deionized water, over a short range of temperatures at 760mmHg, have been calculated and listed in Table 1. The absorption coefficients of oxygen and the vapor pressures of water at these temperatures are also listed.

11. The concentration of oxygen dissolved in deionized water, or its solubility (S), can be determined more accurately by using the following equation:

$S = (a/22.414)\ ((P-p)/P)\ (r\%/100)$

where a is the absorption coefficient of O_2 at temperature, p is the vapor pressure of water at temperature, P is the barometric pressure, and r% is the percent oxygen in the air. At 26°C and 760mmHg, assuming the concentration of oxygen in air is 21%, S = 252µMO_2:

(0.02783/22.414L/mole) ((760-25.09mmHg)/760mmHg) (21/100)

= 252µMO_2

Table 1: Oxygen Concentration [O_2] in Air-Saturated Deionized Water

at 760mm Hg

Temperature °C	O2 Absorbance Coefficient (a)	H2O Vapor Pressure (p) (mmHg)	O2 [µM)
20	0.03102	17.54	284
21	0.03044	18.65	278
22	0.02988	19.83	273
23	0.02934	21.07	267
24	0.02881	22.38	262
25	0.02831	23.76	257
26	0.02783	25.09	252
27	0.02736	26.74	247
28	0.02691	28.35	243
29	0.02649	30.04	238
30	0.02608	31.82	234