

# MI-730, 8-730 and 16-730 O2 MICROELECTRODES OPERATING INSTRUCTIONS

The MI-730, 8-730 or the 16-730 Electrode Kit contains the following:

- 1 Oxygen Electrode with membrane housing
- 6 Replaceable membrane housings
- 1 Bottle of electrolyte
- 1 Filling tip
- 1 Set of instructions
- 5 Polishing pads.

## Electrode Assembly and Preparation

1. Remove the acrylic housing from the Oxygen electrode by unscrewing it from the electrode body. This housing, with affixed Teflon membrane, does not contain the necessary oxygen electrolyte solution.
2. Add oxygen electrolyte solution to the acrylic housing. This is accomplished by attaching a filling tip to the bottle of electrolyte and adding the electrolyte to the housing to a minimum height of 6 mm. Gently place the bubble-free end of the filling tip against the Teflon membrane and release the electrolyte to the minimum height.
3. Insert the housing on to the Oxygen electrode, being careful not to trap any air bubbles near the electrode tip. The housing is screwed clockwise into the body of the electrode until it stops. Check the tip of the electrode for proper seating of the housing against the electrode. The electrode is properly seated if the electrode protrudes slightly beyond the end of the housing.

## Calibration

Calibration of the electrode requires the use of two standard gases with percent values that are close to the percent values of Oxygen to be measured. Common values used are 0% Oxygen for zeroing and 21% Oxygen (Ambient Air) for sloping or gain.

### A. Calibration for gas samples:

When samples to be measured are gaseous, then calibration should be performed with humidified gases. Two possible setups for calibrating the electrode are shown below. Keep the tip of the electrode as far as possible from the surface of the water. The bubbling rate of the gas should be slow (3 - 6 bubbles per second). Although bubbling at a faster rate will flush the chamber more quickly, it will also cause a cooling effect on the electrode.

1. Bubble the 0% gas through the chamber and adjust the zero of the meter after a stable reading is obtained. It may take up to 15 minutes to de-gas the chamber of contaminants, however bubbling the gas vigorously will cause droplets to collect on the tip of the electrode. This will make the electrode response time appear to be slow.
2. Bubble the 21% gas (or any other percent value you decided to use for your application) through the chamber until a stable reading is obtained. Adjust the calibration control to 21%.
3. This procedure of alternating between the two gases should be continued until you become confident of stability and reproducibility. The electrode is now ready to use.

### B. Calibration for liquid samples

To decrease calibration time, two separate calibration chambers should be used. One for the 0% gas and another for the sloping gas such as 21%. When setting up the calibration chambers initially, it will take up to 30 minutes to flush each chamber to obtain a steady state oxygen level and a constant temperature. Again the bubbling rate should be carefully regulated (3 - 6 bubbles per second) so that both calibrating liquids are at the same temperature.

Calibrating standards and samples must be at the same temperature for accurate Oxygen measurements.

1. Immerse the tip of the electrode into the 0% standard and adjust the zero of the meter after a stable reading is obtained.
2. Remove the electrode from the first standard and place it into the second standard. Adjust the calibration control to the value of the second standard (ex: 21%)

Alternate between the two standards until you become confident of stability and reproducibility. The electrode is now ready to use.

## Handling

When necessary, the membrane of the electrode can be replaced by following the assembly procedure above. When removing and replacing a membrane as well as when calibrating or making measurements, be careful not to apply pressure against the internal electrode. Any excessive pressure against the internal electrode can cause the electrode to crack rendering it useless and unrepeatable

## Cleaning

When using the electrode in solutions containing protein, the electrode should be soaked in an enzyme cleaning solution such as Terg-a-zyme (Alconox, Inc.) after each use for a couple of minutes to remove the protein from the membrane surface. This will prolong the useful life of the membrane.

## Storage

*Always clean the microelectrode before storing:*

**Long-term** (over 1 month): Remove the membrane housing from the electrode. Rinse the internal electrode with distilled water and pat dry. Place a new, unfilled membrane housing over the internal electrode and attach loosely (Do not seat completely). This membrane will serve to keep the dust off of the electrode tip.

**Short-term:** The electrode can be left in room air with membrane housing still attached.

## Output Conversion

Formula for conversion of percent oxygen to solubility in moles/liter:

$$S = (a/22.414) \times (760-p)/760 \times (r\%/100)$$

S = solubility of gas in moles per liter

a = absorption coefficient of gas at temperature

P = vapor pressure of water at temperature

r% = actual reading in percent Oxygen

**Temperature (T) vs. absorption coefficient (a) for oxygen in water:**

Degrees Celsius	Absorption Coefficient	Degrees Celsius	Absorption Coefficient
5	0.04287	19	0.03161
6	0.0418	20	0.03102
7	0.04080	21	0.03044
8	0.03983	22	0.02988
9	0.03891	23	0.02934
10	0.03802	24	0.02881
11	0.03718	25	0.02831
12	0.03637	26	0.02783
13	0.03559	27	0.02736
14	0.03486	28	0.02691
15	0.03415	29	0.02649
16	0.03348	30	0.02608
17	0.03283	35	0.02440
18	0.03220	40	0.02306

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