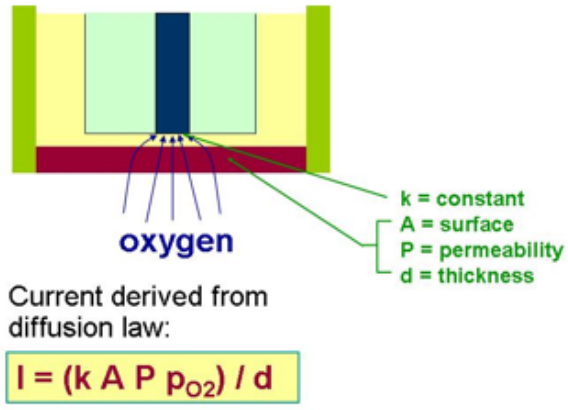
TruDO Sensor Reliability

In this application note, the reliability benefits of the TruDO sensor design are presented. TruDO sensors offer greater robustness and longer operating lifetimes owing to their thicker, steel-mesh-reinforced, double-layered membrane.

Higher Reliability

TruDO dissolved oxygen (DO) sensors are designed to more than meet the reliability standards of the biotechnology industry. Other DO sensors used for biopharmaceutical applications frequently show less reliable performance, shorter lifetime, and higher maintenance requirements, all of which result in increased operating costs. The TruDO sensor family resolves many of these problems, and provides not only improved performance, but also reduced maintenance costs.

As described in the technical note entitled "Dissolved Oxygen Sensor Primer", DO sensors operate by reducing the oxygen at the cathode surface (Figure 1a), and producing an output current between the anode and cathode that is proportional to the oxygen content of the liquid sample. TruDO sensor cathodes are covered with a gas permeable membrane, so that any oxygen diffusing through the membrane is completely reduced at the cathode (Clark's principle). Without appropriate protection of the cathode, however, interference from other substances can occur. Therefore, the design of the membrane is critical to achieving accurate results.



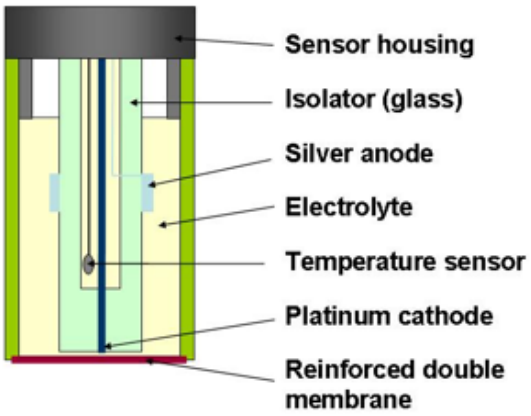


Figure 1 (left) Relationship between current and partial pressure of oxygen in a Clark electrode, and (right) schematic diagram of a TruDO sensor.

A schematic diagram of a TruDO sensor is shown in Figure 1b. TruDO sensors utilize a new, proprietary membrane material that is thicker than the conventional membrane designs found in competing products. Furthermore, the TruDO membrane is steel-mesh-reinforced and double-layered. This novel membrane enables TruDO sensors to withstand high operating pressures such as those encountered inside a bioreactor, while maintaining high oxygen diffusion rates and therefore short response times. The membrane materials and sensor design also ensure that liquid flow rates (and consequently turbulence, such as is produced by high agitation) have a minimal effect on the measurement. Moreover, this special double-layer membrane is less sensitive to (and, in fact actively repels) contamination by proteins, cells and other potential biofouling agents. Additionally, TruDO membranes are autoclavable.

The unique TruDO sensor construction continues to provide excellent stability, even after numerous sterilizations (such as autoclaving). Figure 2 illustrates continuous and stable operation of a TruDO sensor for up to 50 steam sterilization cycles with no user maintenance. Note that TruDO membranes are able to maintain a high calibration current, without any need for cleaning, recalibration, or regeneration after many more cycles than conventional DO sensors.

Finesse, LLC
3350 Scott Boulevard #1
Santa Clara, CA 95054

9351 Irvine Boulevard
Irvine, CA 92618

www.finesse-inc.com

TruDO

Typically, other DO sensors must be regenerated or recalibrated at most after 5 to 10 steam sterilizations, as shown in Figure 2. For optimal performance and maximum accuracy, however, it is recommended that the TruDO sensor be recalibrated prior to every process run.

Finally, the polarization time (time needed to eliminate all of the oxygen around the cathode before the sensor provides a stable reading at initial start up) of TruDO sensors is one sixth to one eighth that of conventional steam sterilizable DO sensors. Typically, TruDO sensors require less than 1 hour for full polarization, whereas competing products require 6 to 8 hours for full polarization.

Because TruDO sensors have improved reliability and a reduced requirement for maintenance and regeneration, they enable both time and operating cost savings for an end user. Although these savings may be small for research processes, they can add up quickly when running a production facility having numerous reactors running continuously.

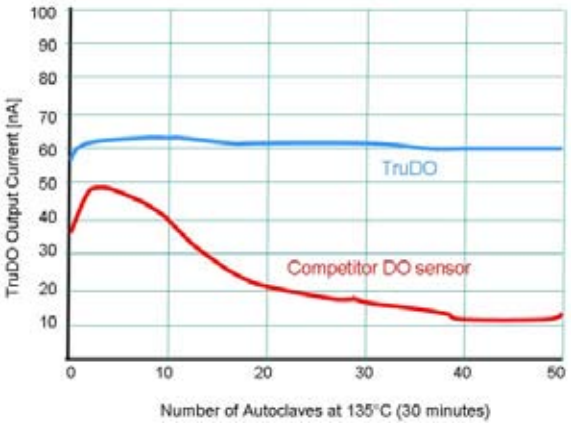


Figure 2 Response of TruDO sensor after 50 autoclave cycles compared to competitor DO sensors, showing greater robustness of the membrane design.

Finesse, LLC
3350 Scott Boulevard #1
Santa Clara, CA 95054

9351 Irvine Boulevard
Irvine, CA 92618

www.finesse-inc.com