Electrochemical (EC) Gas Sensor Specifications

- **Nominal Range:** The gas sensor outputs show the best linearity in this range.

- **Maximum Overload:** The sensor still works above nominal range, but the linearity is not guaranteed. Therefore, it may result inaccurate outputs to the actual target gas concentrations. After released from the target gas, the sensor may take a long time to recover for the next use. Some toxic gas sensors, such as NH3, HF, HCL, HCN, may result in reduction of life span.

- **Sensitivity:** It refers to the sensor output current per PPM (Parts per Million) of the target gas.

- **Response Time (T90):** It is a measurement of the response time of a gas sensor. To get a meaningful method of measuring the response time, the time taken to reach 90% of the applied target gas concentration or its stable reading is defined as T90. Response time or T90 of sensors is not only the indicator of the sensor performance, but also dependent on test conditions, such as calibration gas flow rate and ambient temperature.

- **Zero Signal:** It is the sensor output current in clean air.

- **Baseline Shift:** The sensor drift consists of small and non-deterministic temporal variations of the sensor response when it is exposed to the target gas under identical conditions. It affects the ability to measure the target gas accurately and results in false alarming. This problem is generally considered to be due to sensor's design deficiencies, manufacturing defects, and aging, but it has also been attributed to a variety of sources like environmental factors such as presence of interfering gases, ambient pressure, temperature and humidity variations. Frequently calibration and by compensating for the shift either in the hardware or software of the instrument using gas sensors, the baseline shift can be resolved or reduced.

- **Resolution:** A measure of the smallest separation between two adjacent target gas concentration points that can be detected by the gas sensor. The resolution of gas sensors and instruments may be different. The resolution of instruments is not only dependent on the sensor resolution, but also the software written in instruments mainly like the sampling data collection and analysis. In general, the more sampling data are collected, the better resolution can be shown in the instrument display.

- **Linearity:** In general the outputs of electrochemical gas sensors are linear in the nominal range. In other words, a good electrochemical gas sensor should provide fairly good linearity in its specified nominal range.

- **Bias Voltage:** Some electrochemical gas sensors require a bias voltage or circuit known as a potentiostat to function correctly although most do not. The biased gas sensor requires a warm-up time about 6 hours or

more after it is installed on the instrument for the baseline to become stable enough before the initial calibration and test. It is recommended that the instrument be designed with the correct bias voltage for such sensors to avoid the warm-up time prior each use regardless the instrument is on or off. To avoid the biased sensor warm-up time before the initial installation, a simple electronic device supplying the correct bias voltage to warm up such sensors is recommended. The unbiased gas sensor is shipped with a shorting spring connecting two of the three pins to keep the sensor stabilized during storage. The shorting spring must be removed before the sensor is installed on the instrument, and the sensor requires about 10 minutes for the baseline to become stable before the initial calibration.

- **Temperature Range:** It is the normal operating temperature for the electrochemical gas sensors. The electrochemical gas sensors in a lower and higher temperature environment may result slower and faster response time reprehensively. It also may damage the sensors permanently. Some gas sensors may have a transient response to sudden temperature changes, and it may result in false alarming for a short time on the instrument using such sensors.

- **Pressure Range:** It is the normal operating pressure for the electrochemical gas sensors. Typically it is one atmospheric (14.7 psi) ± 10%. Some gas sensors may have a transient response to sudden pressure changes, and it may result in false alarming for a short time on the instrument using such sensors.

- **Humidity Range:** It is the normal operating humidity for the electrochemical gas sensors. Typically it is 15% to 95% relative humidity with non-condensing. Exposure to condensing humidity may block the built-in dust filter in the gas sensor to affect the diffusion pathway for the target gas flowing through. High humidity can dilute the electrolyte inside the sensor and cause the electrolyte leaking outside of the sensor enclosure. Low humidity (less than 10% RH) may dry out the electrolyte and then make the sensor inoperable.

- **Long Time Output Drift:** The amount the sensor output may change over time in percentage %. It affects the ability to measure the target gas accurately and results in false alarming. It is generally due to sensor's aging, but it can also be caused by dust, and variations of ambient pressure, temperature and humidity. This output drift of a gas sensor can be eliminated by calibrating the instrument.

- **Recommended Storage Temperature:** It is the recommended temperature in which the gas sensor should be stored prior to use.

- **Expected Operating Life:** It is the life span or expected useable life of the sensor after it is installed in an instrument, as long as the "Storage Life" was not exceeded before being installed in an instrument.

- **Storage Life:** It is the maximum time for a gas sensor to be stored in its original packaging before being

installed in an instrument.

- **Cross-Sensitivity:** Cross sensitivity is a gas sensor's reaction to interfering gases (off gases) rather than the target gas. Cross-sensitivity can result in either positively or negatively skewed results. Positively skewed results can lead to the belief that there is too much of the target gas present, which will result in false alarms on the instrument using such a gas sensor. Negative effects produced by cross-sensitivity results in lower reading on the instrument using such a gas sensor than the actual target gas concentration in the environment, which creates a dangerous and life threatening situation. In order to fully accept the reading as accurate, it's important to be aware of and to take into account the hazards in the environment may produce "off gases" or unforeseen consequences that could potentially impact the performance of the instrument. Gas sensor manufacturers attempt to design each type of gas sensor only for a specific target gas or vapor, however, quite often the target gas is not the only gas detected by such a gas sensor as a result of cross-sensitivity.

- **Temperature Data:** It shows the temperature dependence of gas sensor outputs. The temperature data are used for compensating the temperature impacts to a gas sensor either in the hardware or software of the instrument when developing the instrument using such gas sensors. With temperature compensation, the reading on the instrument could be independent to the ambient temperature within the range specified in the sensor temperature data.