Application Note AN-107

May 2016

SPEC Sensor™ Characterization & Calibration Considerations

Scope

This document is provided to describe the considerations needed to characterize, calibrate, verify and validate the measurement performance of the complete system that incorporates a SPEC Sensor™ product. Sensors for Toxic gases involve measurement of a chemical property using a chemical reaction. As such the principles are guided by the kinetics and thermodynamic of reactions and sampling systems. Overall, the measurement of a gas concentration in air or any matrix gas is a "systems" property and depends on the system which includes sampling, electronics, and signal conditioning as well as the sensors themselves. SPEC Sensors offers these characterization testing services at their facilities for those that do not wish to invest in this infrastructure or have this expertise.

NOTE: *The following document provides insights into the approaches used to characterize sensor systems but is only a brief exposure to the art of metrology and gas sensors. One should consult an expert in this field in order to design systems and make measurements properly. The sufficiency of any approach or system is left to an expert. There are standards setting bodies that can define sufficiency in certain applications and the user must be familiar with the standards that apply in a given situation.*

SPEC Sensor™ Calibration

SPEC Sensors have been thoroughly characterized and are very linear over the recommended concentration range. Manufacturing is done using high volume processes and SPEC Sensors calibrates 100% of the sensors in batches unless otherwise noted in our specification. A two-point sensitivity test (0 ppm and a mid-range concentration) is performed on the sensors at the "sheet-level" under standard conditions, and a "calibration factor" (CF) is generated. The target gas concentration is typically referenced to a NIST Standard gas cylinder, when available, and the temperature and humidity measurements are done with NIST traceable instrumentation or references wherever possible. The CF is provided on the sensor label and can be used to set up the sensor but since precision and accuracy is a "systems" property, the sensor and system [electronics and sampling system and housing] should be calibrated together for best results. Especially with reactive gases, e.g. ozone, NO2, and at low levels, the calibration of the system becomes very important and applications are highly varied and often unique. Please read the label for the specific model number and product designation for this information about the sensor and its proper use.

Where the most accurate measurements are desired, SPEC Sensors recommends a calibration of the sensor in the finished device or system in which it is deployed. Electrochemical sensor responses are highly linear. This means a simple, two point calibration (zero and one concentration at the mid- or high-end of the intended measurement range) will provide accuracy across the full range of the electrochemical sensor operation. Care must be taken to calibrate sensors properly with certified gases and controlled and repeatable conditions and validate that the "system" does not degrade the sensor performance. In addition, the normal temperature dependency of the nA/ppm Sensitivity specification has been characterized for each gas sensor product. The typical effect on baseline and span are provided in each sensor product Specification Sheet. These coefficients are the average for a representative sample of