ECO SENSORS, INC.
Sales@ecosensors.com
www.ecosensors.com

TECH NOTE C21-101

Calibration Procedures

For Models C-21

and Earlier Eco Sensors VOC Instruments

The Eco Sensors C-21 responds to most reducing VOCs, but not with the same degree of response for each VOC. The response is essentially logarithmic. For the first half of the scale (to about the 2nd yellow bar), the response is approximately linear. After that, it gets sharply logarithmic (much more concentration is required to get to the next bar than from the preceding bar). For example, perc is all green=20 ppm, third yellow=40 ppm, one red=50 ppm, three red=140 ppm.

The instrument can be calibrated against a certified standard gas mixture of known concentration, against another instrument of known calibration, against detector tubes for the gas of interest, or from dilutions of a known liquid or gas concentrate. In any case, Eco Sensors, Inc. does not have a laboratory equipped for these calibrations. All our calibration equipment is for ozone.

It is important to get a flow of sample gas through the sensor via the mesh grill without cooling the sensor. We recommend controlling the flow to about 100 cc per minute (.1 liters per minute). The gas flow should be through a “T” with the opposite leg vented to the atmosphere or scrubber, and the perpendicular leg of the “T” attached to the sensor by a cap.

Span adjustment is made with the potentiometer found by the nearest edge of the circuit board seen after removing the back cover of the instrument. This is a knurled head potentiometer for the discontinued models C-11 and C-20 and a screwdriver actuated potentiometer for the C-21. The instrument should warm up for at least 15 minutes and the gas sample should flow across the sensor for at least 30 seconds.

The most basic method of calibration is performed with either liquid materials or gas concentrates with presentation of the calibration standard to the instrument made with a large syringe (60-250 cc). If gas concentrates are used, simply fill the syringe with the concentrate. The syringe then may be exhausted and filled with clean room air or with a charcoal scrubber attached to the syringe inlet to provide “zero” grade dilution air. The exhausting and filling of the syringe is done to yield the appropriate dilution required. Once the required dilution has been prepared, attach a “cap” to the syringe tip that will fit over the sensor grid and exhaust the syringe slowly over the sensor. Adjust the span control to indicate the value at a convent place on the LED bargraph (such as the first red bar), and repeat this procedure for several other concentrations and mark their response on the LED bargraph scale.

If liquid standards are used, the procedure involves injecting a small volume (usually microliters) of the liquid into a dilution vessel, allowing the material to vaporize, and presenting the vapor to the instrument via the large syringe. A convenient vessel is a clean and dry several liter glass bottle.

To calculate the amount of liquid to inject into the dilution vessel, use the following formula:

$$ppm = \frac{d\ (ul)\ (22.4)\ (1{,}000)}{M\ (V)}$$

Where: ppm = the final concentration in the dilution vessel

d = the density of the liquid in grams per cubic cc

M = the molecular weight of the pure liquid

22.4 = liters per mole of an ideal gas

V = the volume of the dilution vessel in liters

ul = microliters of liquid injected

If very low concentrations are required, a master dilution can be prepared as above and then serially diluted in the large syringe by exhausting and filling with scrubbed room air to achieve the required concentration.

Glass syringes and non-rubber syringe seals and O rings are preferred because some gases react with plastic and rubber and some gases have a tendency to cling to the plastic and rubber surfaces.