Auto calibration of gas sensors of E4000-NG probe

Ver	Date	Modification / Update
V1	Initial	Version Initial/Initial version
V2	Sept 2017	Switch from double source to double band NDIR CO2 sensor
V3	Sept 2018	NG version. Change to NDIR single band CO2 sensor and double band as an option.

Auto calibration of gas sensors

CO2 NDIR (Non Dispersive InfraRed) single band sensor

The sensor used has a single IR light source and an IR filter in a CO2 absorption band. The light source drifts slowly but an ABC (Automatic Background Calibration) algorithm compensates for this drift in the following way:
Over a period of 15 days the value of the lowest signal is recorded and it is considered that this measure corresponds to 400 ppm (outdoor value). So this type of sensor is not suitable for certain situations where the human presence is continuous like hospital bed rooms.

Double Band NDIR (Non Dispersive InfraRed) CO2 sensor

The sensor used a single IR light sources with two different IR filters. One filter use a IR band were no gas can reduce the signal call band of reference. If the signal of the reference band drift it is because the IR source has drifted. In such case the signal of the CO2 IR band is adjusted accordingly in real time. Self-calibration is based on actual measurement at any CO2 concentration.

This sensor is suitable for hospital and for particular case where human presence is continuous (police station, uninterrupted process control room....).

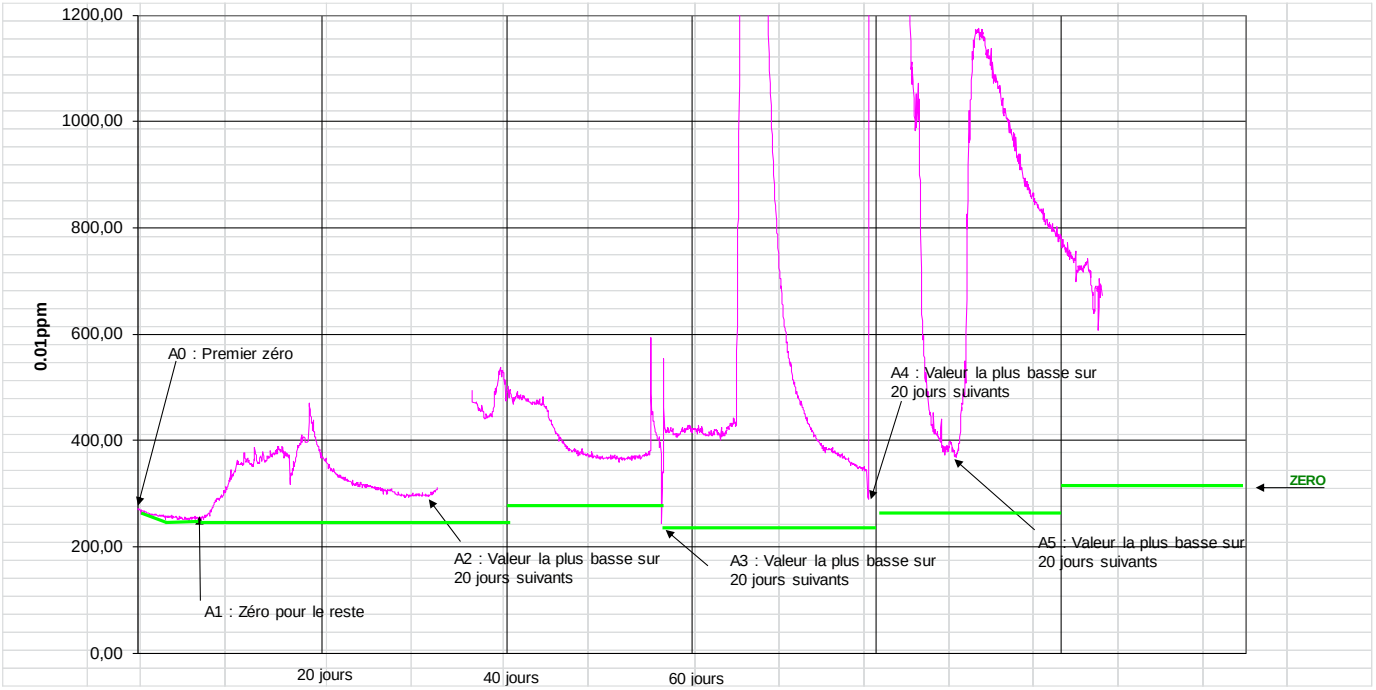
VOC sensor

The VOC sensor is initially heated for 3 days prior factory calibration.

It is then calibrated with an « air zero » (cleaned air) and several injections of VOCs to determine the response of each sensor in compliance with total VOC ISO 16000-29 standard.
Sensor drift is extremely low and auto zero process does not manage this drift. Auto zero is based on environmental conditions of the building. Auto zero also uses zero ABC algorithm (Automatic Background Calibration).
Indeed, the “air zero” is extremely difficult to obtain outside laboratories as outdoor air is rarely pure. It is therefore unrealistic to ventilate to reach such a low value. The only solution is to consider the lowest value measured as the target value (beyond it would be useless over ventilation).
However, it is possible to configure the VOC sensor in absolute measurement thanks to the LCD tool but the drift cannot be guaranteed because it depends on its exposure to contaminating gases.

The lowest value is treated as zero. If an even lower value is observed it becomes immediately the new zero.

On the 20 days period, the new zero is the average between the lowest value seen in this period of time and the current value. This value is therefore progressively averaged by period of 20 days unless a lower measured value instantly and automatically resets the zero. This method takes into account the evolution of the incoming outside air quality.
The graph below shows the algorithm of auto-zero over a long period of time (with a break of a few days around the 37th day.



To be noted that after waiting 30 seconds after tart up to condition the VOC sensor, the first measure is forced to zero and it is helpful to activate the ventilation with the minimum 10% or count on the CO2 to lower VOC concentration to automatically adjusts the zero. (See the beginning of the graph). It may be necessary to wait few days to take advantage of the maximum sensitivity of VOC sensor.

If the facility has a system for incoming air treatment by photocatalysis and / or activated charcoal, the probe will have a better sensitivity and indoor air quality will be significantly improved. This principle is recommended in urban areas and near roads with heavy traffic.