Infrared Gas Sensors Application Note 7

(Pros & Cons in different methods of signal handling/processing in Infrared Gas Sensors)

Intro

There are not many different methods for implementing the signal processing for SGX's Infrared (IR) Gas Sensors. This document will give you a simple short overview of the two main methods that SGX Sensortech (IS) Ltd is recommending, without getting into much detail on how those could be implemented in real life applications.

Methods

The first method for handling the analogue signals from SGX's IR Sensors is Hardware Oriented (HO). That means that the signal filtering and amplification are done by using analogue electronics outside the Microcontroller (MCU). That method consists of two stages amplification system by using zero drift, low noise operation amplifiers (see Application Note 4, for more details). This method needs efficient knowledge of analogue electronics and computations must be done for the resistors and capacitors of the filters. Because the signals would be amplified and filtered the Analogue-to-Digital Converter (ADC) does not have to use very high resolution, even a 14-bit one could sample the signals accurately.

The second method for handling the signals coming from an IR Gas Sensor is not including amplification or filtering circuit between the sensor and the MCU. That method is Software Oriented (SO) and needs experience in Digital Signal Processing techniques, in order to achieve the same results with the previous method. On the plus side we would like to mention here that digital filters usually are sharper than the Analogue equivalents and can be as fast.

In both the previous cases the knowledge of digital electronics required for the Firmware Engineer to create a set of Real Time Operating functions that will complete the Signal Processing and calculate the Gas Concentration (% or ppm) from the measured analogue signals. Those equations used in both cases can be found in the Application Note 2 (AN2) – Signal Processing for Infrared Gas Sensors.

Please find below in Table 1 the Pros & Cons for the two methods mentioned earlier:

Table 1 - Pros & Cons of the HO and SO Methods of signal handling for IR Gas Sensors

Methods	Pros	Cons
Hardware Oriented (HO)	Easier Digital Signal Processing	More PCB Space Required
	Using a cheaper MCU	Carefully Choose Components Used
	Using Lower Resolution ADC	Requires Knowledge of Analogue Circuits
	Sensor can be further away from the MCU	Slightly Higher Power Consumption
	Can be used in Logic Circuits Alarms	Less Flexible in changes
Software Oriented (SO)	Digital Filters can be sharper than Analogues	High Resolution ADC Required
	Signal Processing Algorithms Vastly Available	Sensor must be as close to the ADC as possible
	Less PCB Space Required	Signal More Vulnerable to Noise
	Compact design is easier	Low Impedance MCU Required
	Cheaper Bill of Materials (Fewer Components)	MCU more Vulnerable to ESD & RF
	Cannot be implemented without an MCU	Experienced Firmware Engineer Required
	Parameters can be changed easier	

Summary

In Summary, if space on the Printed Circuit Board is not a major issue SGX Sensortech (IS) Ltd is recommending using the Hardware Oriented (HO) Solution. A small signal processing algorithm in that case using a moving averaging filter would be efficient to produce accurate as well as stable measurements from the IR Gas Sensors. The Software Oriented Solution can be used in more compact projects, where space is of essence, then more complicated Digital Signal Processing algorithms can produce the same result. Though more time usually required spend in Software design and coding comparing with the first method.