

Introduction

There are several methods for processing the signals from SGX Infrared (IR) Gas Sensors. This document gives a short overview of the two main methods that SGX Sensortech recommends.

Methods

The first method for handling the analogue signals from SGX's IR Sensors is Hardware Oriented (HO). In this method, the signal filtering and amplification are performed using analogue electronics outside of the Microcontroller (MCU). The method consists of a two-stages amplification system using zero drift, low noise operation amplifiers (see Application Note 4, for more details). This method requires some knowledge of analogue electronics and calculations must be performed for the resistance and capacitance of the filters. Because the signals are amplified and filtered the Analogue-to-Digital Converter (ADC) does not require a very high resolution; 14-bit ADC would be sufficient.

The second method for handling the signals from an IR Gas Sensor does not include the amplification or filtering circuit between the sensor and the MCU. This method is Software Oriented (SO) and some experience in Digital Signal Processing techniques is required in order to achieve similar results compared with those from the previous method. One advantage of this method is that digital filters are usually sharper than the Analogue equivalents and can be as fast.

In both cases some knowledge of digital electronics is required in order that the Firmware Engineer can 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. The equations required in both cases can be found in the Application Note 2 (AN2) – Signal Processing for Infrared Gas Sensors.

Please find opposite a table of the pros and cons of the two methods mentioned earlier (Table 1).

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
	Uses a cheaper MCU	Careful choice of components is important
	Uses lower resolution ADC	Requires knowledge of Analogue circuits
	The 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 Analogue ones	High resolution ADC required
	Signal processing algorithms are widely available	Sensor must be as close to the ADC as possible
	Less PCB space required	The signal is more susceptible to noise
	The design can be made smaller	Low Impedance MCU Required
	Cheaper bill of materials	MCU is more susceptible to ESD & RF
	MCU required	Experience in firmware is required
	Parameters can be changed easier	

Summary

In conclusion, if space on the Printed Circuit Board is not a major issue, it is recommended to use the Hardware Oriented (HO) Solution. A small signal processing algorithm using a moving averaging filter would be efficient enough to produce accurate as well as stable measurements from the IR Gas Sensors.

The Software Oriented (SO) solution may be a better choice in designs where space is of the essence. In this case, higher level algorithms are required. This method will produce equally good results as the HO method although it will usually require a higher level of software coding.