

# Semi-Conductor Method

## Sensor: SG

Stationary sensor  
Example: SGF-8562



Stationary sensor  
Example: SG-8581



### 1. Brief description

This sensor uses a metal oxide semiconductor, which changes in resistance when it comes into contact with a detectable gas. The sensor detects this change in resistance as the gas concentration. It is a general-purpose sensor that detects all types of gases ranging from toxic gases to combustible gases.

Category	Detectable gas
Solid	Combustible
	Toxic

### 2. Structure and principles

#### [Structure]

The sensor consists of a heater coil and a metal oxide semiconductor ( $\text{SnO}_2$ ) formed on an alumina tube. The tube is equipped with two Au electrodes at its ends to measure the resistance of the semiconductor.

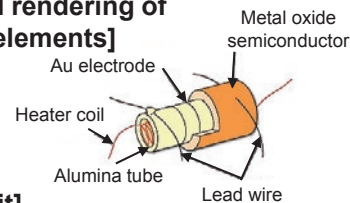
#### [Principles]

The heater coil heats the surface of the metal oxide semiconductor to 350 to 400°C. With atmospheric oxygen adsorbed on this surface in forms of O and  $\text{O}^{2-}$ , the semiconductor keeps a constant resistance. Then, methane gas or the like comes into contact with the surface and becomes chemisorbed by it, which is in turn oxidized by  $\text{O}^{2-}$  ions and separated. The reaction occurring on the surface of the sensor is represented as follows:

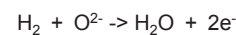
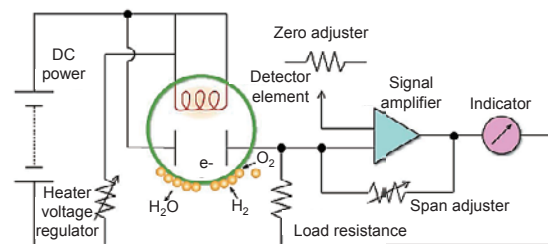


In short, methane gas adsorbs on the surface of the sensor and takes the absorbed oxygen away; this increases free electrons inside the sensor, reducing the resistance. By measuring the change in resistance, the sensor determines the gas concentration.

#### [Conceptual rendering of the sensor elements]



#### [Drive circuit]

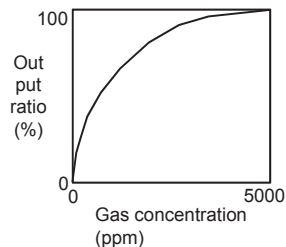


### 3. Features (of the sensor SG-8521 as an example)

#### o Output characteristics

The sensor detects changes in the resistance of the semiconductor, meaning that it detects even low concentrations (ppm level) that cannot be detected by new ceramic-based sensors.

The sensor is highly sensitive with a high sensor output level for low concentrations.



#### o Aging characteristics

The sensor maintains stability over the long term with a long life. Compared with the catalytic combustion-based sensor, this type sensor is highly resistant to toxicity and severe atmosphere.

#### o Detection of toxic gases

Since, in principle, the resistance changes according to changes in the number of electrons and the electron mobility, the sensor detects a variety of gases, including toxic gases, which produce less combustion heat.

#### o Gas selectivity

Adding an impurity to the semiconductor material changes the interference effect. This characteristic allows the sensor to selectively detect some gases.

### 4. Detectable gas, molecular formula, model, and detection range (examples)

Detectable gas	Molecular formula	Model #	Detection range
Hydrogen sulfide	$\text{H}_2\text{S}$	SGF-8562	0-100ppm
Ethylene oxide	$\text{C}_2\text{H}_4\text{O}$	SGF-8563	0-100ppm
Solvents Combustible gases in general	-	SG-8511	0-5000 ppm
		SG-8521	
Hydrogen	$\text{H}_2$	SG-8541	0-200 ppm
Methane	$\text{CH}_4$	SG-8581	

### 5. Products of this type (examples)

#### o Stationary products

... SD-3GH, SD-3DGH, GD-84D-EX, GD-A80V, GD-A80DV, GD-70D, SD-1GH, SD-D58·DC·GH

GD-70D

