SENSORES DE GAS.

C-7241/7243

C-7241 = butano/propano TGS109.
C-7243 = monóxido de carbono TGS203.

FIGARO Gas Sensors

Figaro Engineering Inc. is the world's leading gas sensor manufacturer. Our technical and business expertise accumulated over the years have produced the most innovative sensors for the world market.
The Figaro Gas Sensor is a solid -state sensor mainly composed of sintered tin dioxide which detects gases through an increase in electrical conductivity when the reducing gases are adsorbed on the sensor's surface.
The excellent stability and performance of the sensor provides unique features in gas detection.

Between 1968 and 1995, over 80 million Figaro Gas Sensors have been used in all over the world. During this period, the application field of the Figaro Gas Sensor has been expanded from safety to health, control systems and instrumentation. Various new applications have been developed based on Figaro Gas Sensors. These applications include breath alcohol checkers, automatic cooking controls in microwave ovens, air quality/ventilation control systems for homes and automobiles, etc.
Based on our long and wide experience of developing and manufacturing gas sensors, Figaro continues to expand the field of detection.

Features
- Long life and good reliability
- High sensitivity
- Quick response
- High resistance to poisoning
- Excellent durability and shock proof
- Large output signal
- Low cost

Gas Detection Mechanism

When the sensor is heated to a high temperature, eg. 400°C, without the presence of oxygen, free electrons flow easily through the grain boundaries of the tin dioxide (SnO_{2-x}) particles.
In clean air, oxygen, which traps free electrons by its electron affinity, is absorbed on to the tin dioxide particle surface forming a potential barrier in the grain boundaries. This potential barrier (eVs in air) restricts the flow of electrons, causing the electric resistance to increase (Fig. 1-1).

When the sensor is exposed to an atmosphere containing reducing gases, eg. combustible gases, CO, etc, the tin dioxide surface adsorbs these gas molecules and causes oxidation (Fig. 1-2). This lowers the potential barrier, allowing electrons to flow more easily, thereby reducing the electrical resistance (Fig. 1-3).

The reaction between gases and surface oxygen will vary depending on the sensor element's temperature and the activity of sensor materials. Figaro provides various sensors which have different cross sensitivities by selecting the most suitable combinations of sensor temperature and activity of sensor materials.

Fig.1-1

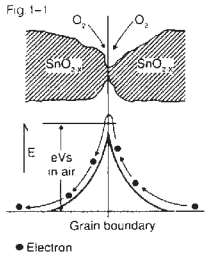
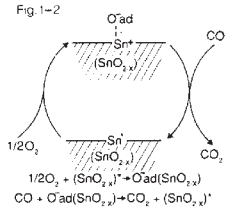
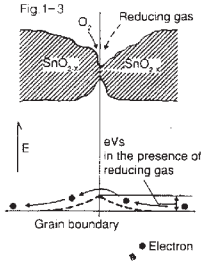


Fig.1-2



Scheme of the reaction between CO and adsorbed oxygen on the SnO_2 surface

Fig.1-3



Field of applications

Category	Domestic field	Commercial and Industrial field
Combustible gases –Methane –Propane –Hydrogen –Others	● Gas alarms for homes, recreational vehicles, boats	● Gas detection systems for commercial buildings, industrial plants, onshore and offshore gas and oil platforms, petrochemicals ● Portable gas detectors
Toxic gases –Carbon monoxide	● CO detectors for homes, recreational vehicles, boats, combustion appliances ● Fire alarms	● CO monitoring systems for car parks ● Fire detection systems
–Ammonia		● Ammonia leak detection in refrigerators ● Ammonia detection for the agricultural field ● Gas detection systems in industrial plants ● Portable detectors
–Hydrogen sulphide		
Alcohol	● Breath alcohol checkers	● Breath alcohol checkers for professionals
Solvent vapour		● Solvent detection for factories, semiconductor industry, dry cleaning industry
Halocarbon gases (CFCs, HCFCs, etc)		● Halocarbon detection for refrigerators, air conditioners, cleaning processes for electrical components, etc
Odour detection –Sulphide –Amine	● Mouth odour checkers ● Odour detection in refrigerators	● Odour monitors for dentists ● Odour measuring systems for the food industry
Others–Oxygen –Carbon dioxide –Humidity	● Oxygen monitors ● Indoor air quality control ● Air conditioner	● Oxygen detectors ● Carbon dioxide moniter ● Office air conditioning

Control and Instrumentation
- Ventilation control, air quality control (for air purifiers, ventilation fans and extractors) for homes, buildings and automobiles
- Automatic cooking control for microwave ovens, cooking appliances
- Combustion monitoring/ control systems for heating appliances
- Fermentation control
- Gas analyzers

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Product List

Table-1 Gas Sensors

Application	Model	Typical detection range	Features
Combustible gas detection	TGS109	LP-gas (Propane, butane) 500~10,000ppm	●100V circuit voltage type ●Large output signal
	TGS109T	Natural gas 500~10,000ppm	
	TGS813 TGS816	General combustible gases 500~10,000ppm	●For various combustible gas detection ●TGS816 : Heat resistant type
	TGS842	Methane 500~10,000ppm	●Low sensitivity to interfering gases
	TGS821	Hydrogen 50~1,000ppm	●High selectivity and sensitivity to hydrogen
Toxic gas detection	TGS203	Carbon monoxide 50~1,000ppm	●High sensitivity and selectivity to carbon monoxide ●Microprocessor and hybrid IC available (see Table-3)
	TGS825	Hydrogen sulphide 5~100ppm	●High sensitivity to hydrogen sulphide
	TGS826	Ammonia 30~300ppm	●High sensitivity to ammonia
Solvent vapour detection	TGS822 TGS823	Alcohol, toluene, xylene, etc. 50~5,000ppm	●High sensitivity to alcohol and organic solvents TGS823 : Heat resistant type
Halocarbon gas detection	TGS830	R-113, R-22 100~3,000ppm	●High sensitivity to various CFCs, HCFCs ●High selectivity
	TGS831	R-21, R-22 100~3,000ppm	●Quick response to R-21, R-22
	TGS832	R-134a, R-22 100~3,000ppm	●High sensitivity to R-134a and R-22 ●High selectivity
Odour detection	TGS550	Sulphur compounds 0.1~10ppm	●High sensitivity ●Low power consumption ●For intermittent detection
	TGS551	Alcohol odour 10~300ppm	
	TGS855	Sulphur compounds 0.1~10ppm	●High sensitivity to sulphur compounds ●For continuous detection
Air quality control	TGS800	Air contaminants (Cigarette smoke, gasoline exhaust, etc.) 1~10ppm	●Highly sensitive detection of contaminants in air with microprocessors (see Table-3) ●Pre-calibrated sensor modules available (see Table-2)
Cooking control	TGS880 TGS881	Volatile gases and water vapour from food	●Total gas detection in cooking process ●TGS881 : Heat resistant type
	TGS882	Alcohol vapour from food 50~5,000ppm	●Alcohol gas detection in cooking process
	TGS883	Water vapour from food	●High sensitivity to water vapour in cooking process

Sensor structure and configuration

There are three types of sensor elements and six different configurations for Figaro Gas Sensors.

Structure

● **1-series** (Fig. 2-1) : These sensors have two coiled electrodes made of iridium/palladium alloy which are encapsulated inside the sintered sensor element, and one or both of these electrodes are used as a heater.

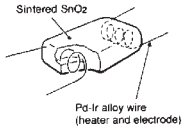


Fig. 2-1 : 1-series

● **5-series** (Fig. 2-2) : These sensors have miniaturized elements. Two electrodes and a thin layer of tin dioxide are formed onto an insulated straight wire heater by coating.

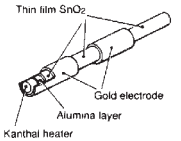


Fig. 2-2 : 5-series

● **8-series** (Fig. 2-3) : These sensors have a heater in an alumina ceramic tube and the semiconductor material is mounted on the tube with two printed gold electrodes.

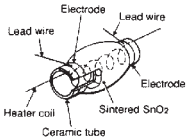


Fig. 2-3 : 8-series

Configuration

Fig. No.	Sensor structure	Remarks	Models
Fig. 3-1	1-series	Standard type, resin base with mesh cover	TGS109, TGS109T
Fig. 3-2	1-series	With an active charcoal filter package	TGS203
Fig. 3-3	5-series	Miniaturized metal package	TGS550, TGS551
Fig. 3-4	8-series	Standard type, with resin base and package	TGS813, TGS842, TGS822, TGS800, TGS855
Fig. 3-5	8-series	Heat resistant ceramic base with mesh cover	TGS816, TGS821, TGS823, TGS825, TGS826, TGS330, TGS831, TGS832
Fig. 3-6	8-series	Resin/ceramic base with mesh cover	TGS880/TGS881, TGS882, TGS883

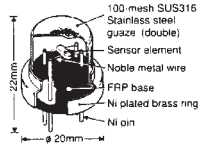


Fig. 3-1

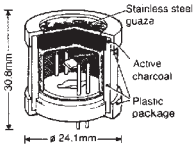


Fig. 3-2

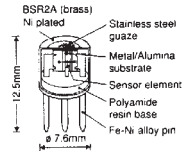


Fig. 3-3

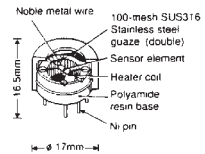


Fig. 3-4

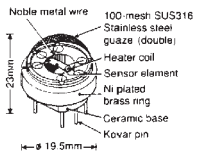


Fig. 3-5

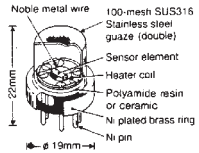


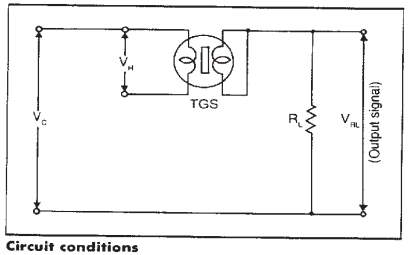
Fig. 3-6

SENSORES DE GAS.

C-7241/7243

Basic measuring circuits and circuit conditions

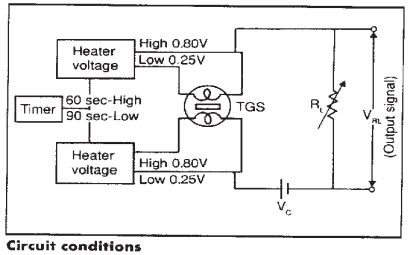
1-series



Circuit conditions

Circuit voltage (V_C) : 100V AC or DC
Heater voltage (V_H) : 1.0V AC or DC (TGS109)
1.1V AC or DC (TGS 109T)
Load resistance (R_L) : 4kΩ

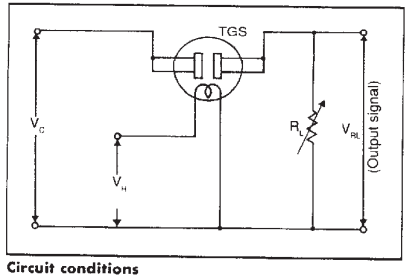
1-series (TGS203 : cyclic temperature change operation)



Circuit conditions

Circuit voltage (V_C) : 12V max. AC or DC
Heater voltage (V_H) : High 0.80V (60sec) AC or DC
Low 0.25V (90sec) AC or DC
Load resistance (R_L) : variable (Ps<15mW)

8-series



Circuit conditions

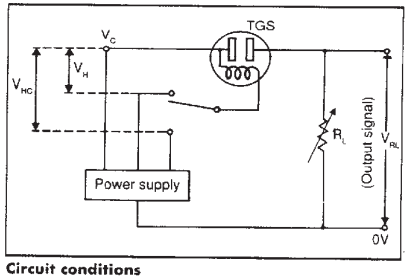
Circuit voltage (V_C) : 24V max. AC or DC
Heater voltage (V_H) : 5.0V AC or DC
Load resistance (R_L) : variable (P_S<15mW)

Depending on the sensor resistance (R_S) changes, output voltage across the load resistance (V_{RL}) changes. The relationship between R_S and V_{RL} is expressed by the following equation.

$$R_S = \frac{V_C \cdot R_L}{V_{RL}} - R_L$$

The V_{RL} value changes in accordance with R_S changes.

5-series



Circuit conditions

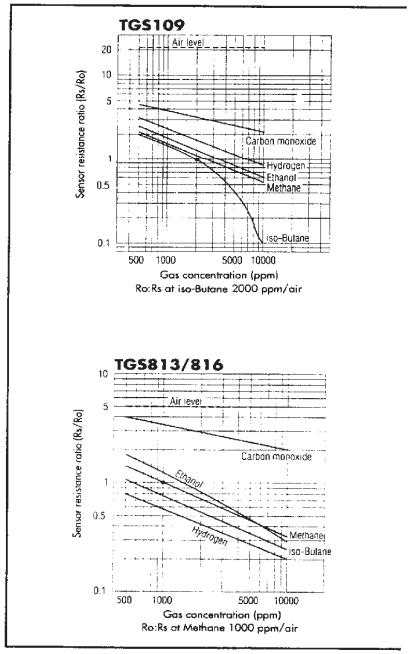
Circuit voltage (V_C) : 5.0V max. DC
Heater voltage (V_H) : 0.55V DC (TGS550)
0.67V DC (TGS551)
Heat cleaning voltage (V_{HC}) : 0.67V DC*
Heat cleaning time (T_{HC}) : between 10 sec. and 5 min.
Load resistance (R_L) : variable≧10kΩ

*TGS551 requires no heat cleaning.

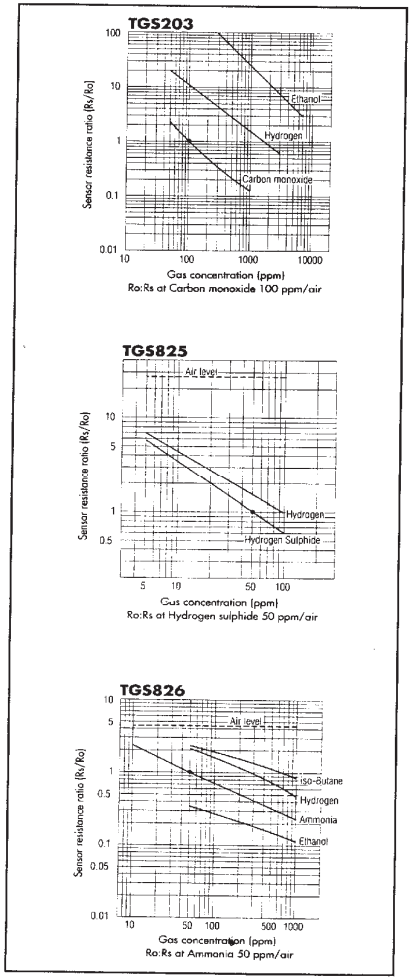
Sensitivity characteristics

The sensitivity of the Figaro Gas Sensor is defined by the relationship between gas concentration changes and the sensor resistance changes and is based on a logarithmic function.
Sensitivity characteristics of Figaro sensors are shown in the following figures.
In these figures, the sensor resistance values (R_S) is normalized by the sensor resistance (R_O) at specified conditions for each model, and the Y-axis is indicated as sensor resistance ratio : R_S/R_O.
All the sensor characteristics in this catalogue represent typical characteristics.
The characteristics of each sensor may vary over a narrow defined range.

Combustible gas detection



Toxic gas detection



CONSIDERACIONES.

Este componente está destinado para su uso por parte de profesionales, o usuarios con un nivel técnico o conocimientos suficientes, que les permita desarrollar por sí mismos los proyectos o aplicaciones deseados. Por este motivo no se facilitará asistencia técnica sobre problemas de implementación del citado componente en las aplicaciones en las que sea empleado.
Para cualquier problema relativo al funcionamiento del producto (excluidos los problemas de aplicación), póngase en contacto con nuestro **departamento técnico**. **Fax 93 432 29 95.**
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