

SP-41

FIS GAS SENSOR SP-41

for REFRIGERANT DETECTION: HCFCs (R-22)

The SP-41 is a tin di-oxide semiconductor gas sensor which has a high sensitivity to HCFCs (e.g. Freon: R-22) with reduced sensitivity to other gases such as alcohol.

Structure

Gas sensitive semiconductor material is formed on the alumina substrate on which the gold electrodes are printed. A thick film heater of ruthenium oxide is printed on the reverse of the substrate and placed in the plastic housing (Fig 1).

Operating conditions

Fig 2 shows the standard operating circuit for this model. The change of the sensor resistance (R_S) is obtained as the change of the output voltage across the fixed or variable resistor (R_L). In order to obtain the best performance and specified characteristics, the values of the heater voltage (V_H) circuit voltage (V_C) and load resistance (R_L) must be within the range of values given in the standard operating conditions shown in the Specification table on the next page.

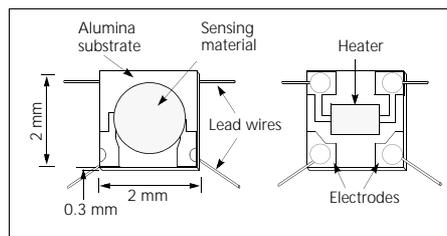


Fig 1a. Sensing element

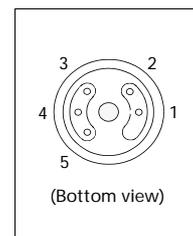


Fig 1c. Pin Layout

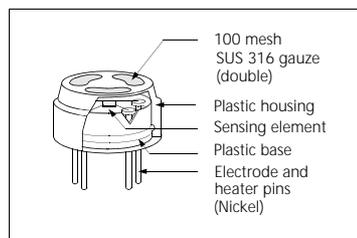


Fig 1b. Configuration

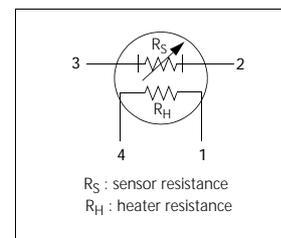


Fig 1d. Equivalent circuit

Sensitivity characteristics

Fig 3 shows the sensitivity characteristics curves of the SP-41 (typical data). Sensitivity characteristics of the FIS gas sensors are expressed by the relationship between the sensor resistance and gas concentration. The sensor resistance decreases with an increase of gas concentration based on a logarithmic function.

The sensitivity characteristics of the SP-41 is specified by the following parameters.

- Sensor resistance level: at R-22 1000 ppm
- Sensor resistance change ratio: between R-22 1000 ppm and 3000 ppm

See the specification table on the next page for further details.

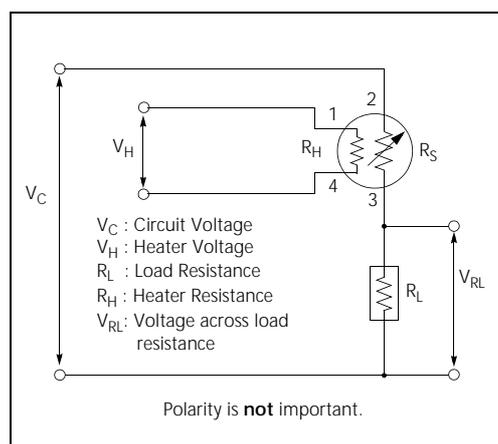


Fig 2. Standard circuit

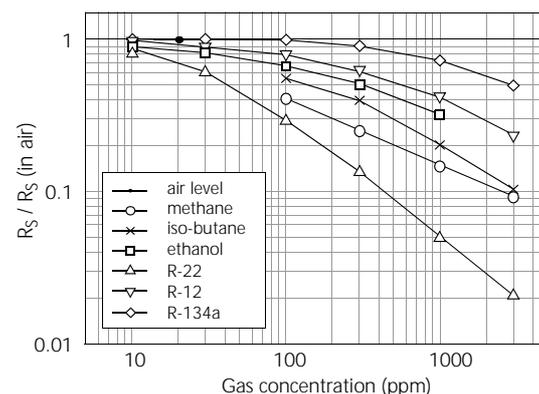


Fig 3. Sensitivity characteristics

SPECIFICATIONS

Specifications

A. Standard Operating conditions

| Symbol | Parameter | Specification | Conditions etc. |
|--------|--------------------------------------|--------------------------|--------------------------------------|
| V_H | Heater voltage | $5.0 V \pm 4 \%$ | AC or DC |
| V_C | Circuit voltage | $5.0 V \pm 4 \%$ | AC or DC |
| R_L | Load resistance | Variable | $P_S < 15 \text{ mW}$ |
| R_H | Heater resistance | $40 \Omega \pm 2 \Omega$ | at room temperature |
| P_H | Heater power consumption | 400 mW (Typical value) | $P_H = V_H^2 / R_H$ |
| P_S | Power dissipation of sensing element | Less than 15 mW | $P_S = \frac{(V_C - V_{RL})^2}{R_S}$ |

B. Environmental conditions

| Symbol | Parameter | Specification | Conditions etc. |
|----------|-----------------------|--|---------------------------------------|
| T_{ao} | Operating temperature | -10°C to 60°C | Recommended range |
| T_{as} | Storage temp | -20°C to 70°C | |
| RH | Relative humidity | Less than 95% RH | |
| (O_2) | Oxygen concentration | 21% (Standard condition) The sensitivity characteristics are influenced by the variation in oxygen concentration. | Absolute minimum level: more than 18% |

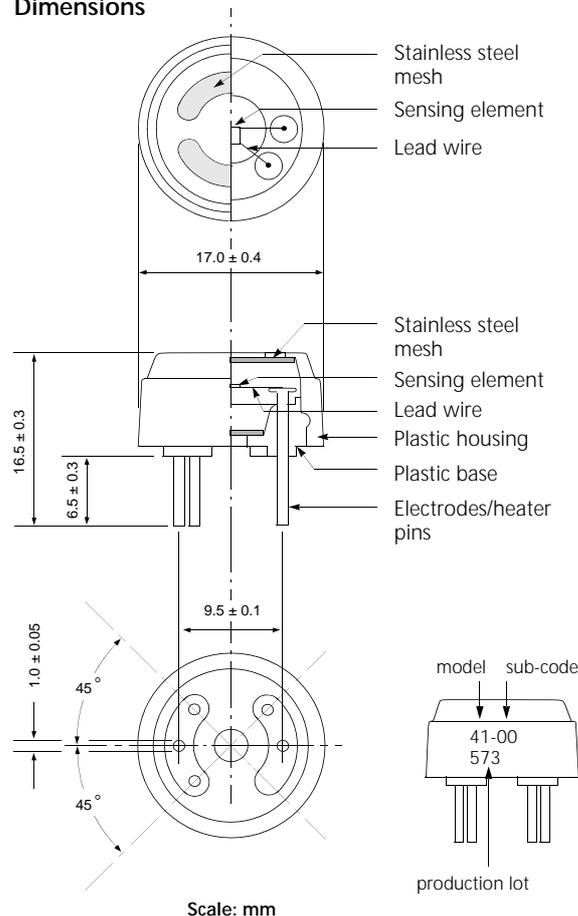
C. Sensitivity characteristics

| Model | SP-41-00 | | |
|--|----------------------------|-------------------------------|---|
| Symbol | Parameter | Specification | Conditions etc. |
| R_S | Sensor resistance | 1 k Ω to 10 k Ω | At 1000 ppm of R-22/air |
| β | Ratio of sensor resistance | 0.25 to 0.55 | $\frac{R_S \text{ at } 3000 \text{ ppm of R-22}}{R_S \text{ at } 1000 \text{ ppm of R-22}}$ |
| Standard Test Conditions: Temp: $20^\circ\text{C} \pm 2^\circ\text{C}$ Humidity: $65\% \pm 5\%$ (in clean air) Pre-heating time: more than 96 hours $V_C : 10.0 V \pm 1\%$ $V_H : 5.0 V \pm 1\%$ $R_L : 10.0 k\Omega \pm 5\%$ | | | |

D. Mechanical characteristics

| Items | Conditions | Specifications |
|-----------|----------------------------|---|
| Vibration | Frequency: 100 cpm | Should satisfy the specifications shown in the sensitivity characteristics. |
| | Vertical amplitude: 4 mm | |
| | Duration: 1 hour | |
| Shock | Acceleration: 100 G | |
| | Number of impacts: 5 times | |

Dimensions



E. Parts and Materials

| No. | Parts | Materials |
|-----|-----------------------|---|
| 1 | Sensing element | Tin dioxide (SnO ₂) |
| 2 | Substrate | Alumina (Al ₂ O ₃) |
| 3 | Lead wire | Noble metal alloy (Au-Pd-Mo) |
| 4 | Heater | Ruthenium oxide (RuO ₂) |
| 5 | Electrode | Gold (Au) |
| 6 | Plastic housing | Nylon 46 (UL94HB) |
| 7 | Plastic base | Nylon 66 (UL94HB) |
| 8 | Stainless steel mesh | SUS 316 (100 mesh, double) |
| 9 | Heater/electrode pins | Nickel |

Please contact

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