

SP-42A-00

# FIS GAS SENSOR SP-42A-00

## for REFRIGERANT DETECTION

### (R134a,R-410a,R-407c)

The SP-42A is a tin dioxide semiconductor gas sensor which has a high sensitivity to HFCs (e.g. Freon: R-134a) with improved cross sensitivity to other gases. This model is suitable for R-134a, R-410a, R-407c and other new Freon family which contain R-134a.

**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 load 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 Specification table on the next page.

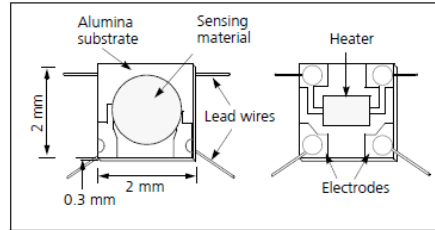


Fig 1a. Sensing element

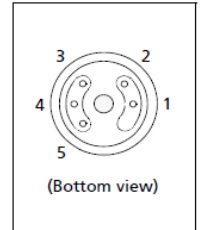


Fig 1c. Pin Layout

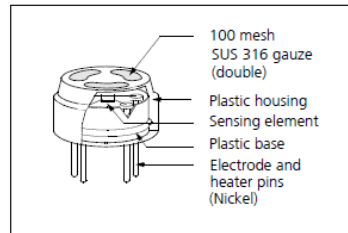


Fig 1b. Configuration

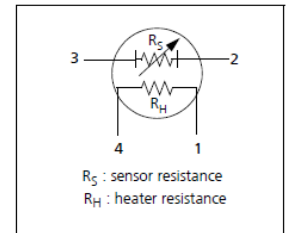


Fig 1d. Equivalent circuit

**Sensitivity characteristics**

Fig 3 shows the sensitivity characteristics curves of the SP-42A (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-42A is specified by the following parameters.

- Sensor resistance level: at R-134a 100 ppm
- Sensor resistance change ratio: between R-134a 100 ppm and 300 ppm

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

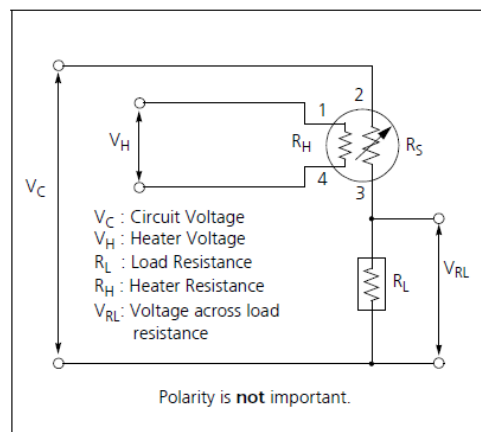


Fig 2. Standard circuit

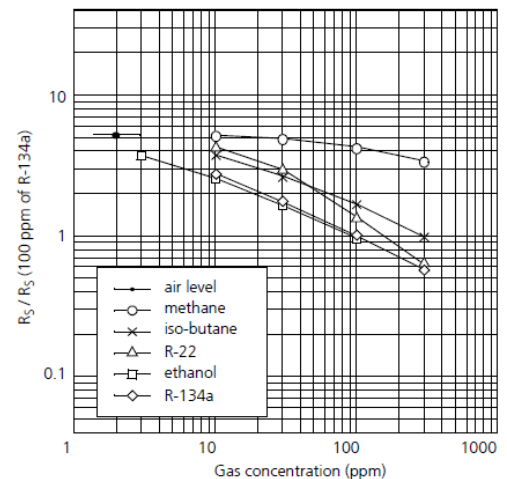


Fig 3. Sensitivity characteristics

## Specifications: SP-42A-00

### A. Standard Operating conditions

| Symbol | Parameter                            | Specification             | Conditions etc.                    |
|--------|--------------------------------------|---------------------------|------------------------------------|
| VH     | Heater voltage                       | 5.0 V ± 4%                | AC or DC                           |
| VC     | Circuit voltage                      | 5.0 V ± 4%                | AC or DC                           |
| RL     | Load resistance                      | Variable                  | P <sub>s</sub> < 15 mW             |
| RH     | Heater resistance                    | 40Ω ± 2Ω                  | at room temperature                |
| IH     | Heater current                       | 80 mA<br>(Typical value)  | IH = VH / RH                       |
| PH     | Heater power consumption             | 400 mW<br>(Typical value) | PH = VH <sup>2</sup> / RH          |
| PS     | Power dissipation of sensing element | Less than 15 mW           | $P_s = \frac{(V_C - V_{RL})^2}{R}$ |

### B. Environmental conditions

| Symbol            | Parameter             | Specification  | Conditions etc.                         |
|-------------------|-----------------------|--|---|
| T <sub>ao</sub>   | Operating temperature | -10 °C to 50 °C  |   |
| T <sub>as</sub>   | Storage temp          | -20 °C to 60 °C  |   |
| RH                | Relative humidity     | Less than 95%RH  |   |
| (O <sub>2</sub> ) | Oxygen concentration  | 21% ± 1%<br>(Standard condition)   | Absolute minimum level : more than 18%. |
|                   |                       | The sensitivity characteristics are influenced by the variation in oxygen concentration. Please consult FIS for details. |   |

### C. Sensitivity characteristics

| Model                               | SP-42A-00                    |  |  |
|-------------------------------------|------------------------------|--|--|
| Symbol                              | Parameter                    | Specification  | Conditions etc.  |
| R <sub>s</sub>                      | Sensor resistance            | 4 kΩ to 40kΩ   | at 100 ppm of R-134a   |
| β                                   | Sensitivity slope            | 0.50 to 0.65   | <u>R<sub>s</sub> at 300ppm of R-134a</u><br>R <sub>s</sub> at 100ppm of R-134a |
| R/Rair                              | Resistance change in gas/air | ≤ 0.40   | <u>R<sub>s</sub> at 100 ppm of 134a</u><br>R <sub>s</sub> in air               |
| Standard Test Conditions:           |                              | Temp: 20 °C ± 2 °C<br>Humidity: 65% ± 5%<br>(in clean air) | VC: 5.0 ± 1%<br>VH: 5.0 ± 1%<br>RH: 10 kΩ ± 5%                                 |
| Pre-heating time: more than 48 hour |                              |  |  |

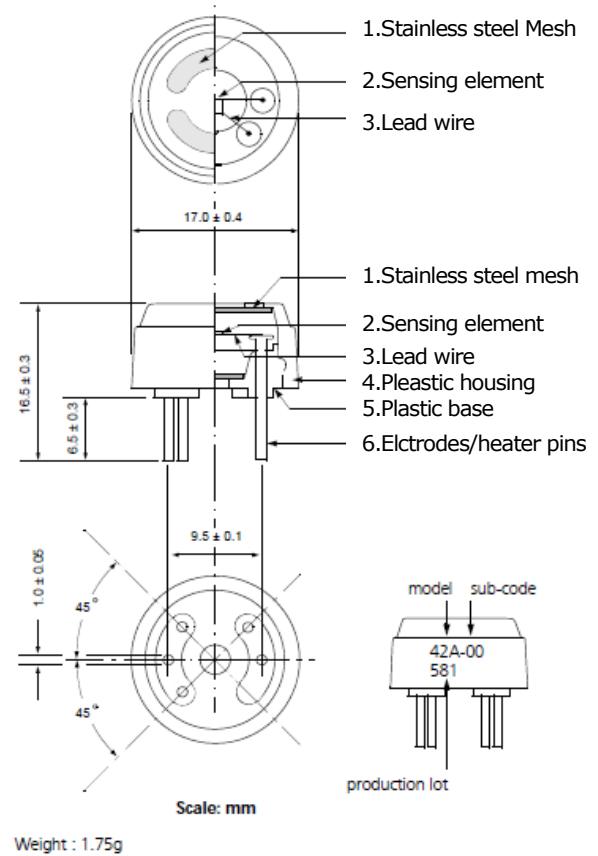
### D. Mechanical characteristics

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

Please contact

In the interest of continued product improvement, we reserve the right to change design features without prior notice.

### Dimensions



### E. Parts and Materials

| No. | Parts                 | Materials                       |
|-----|-----------------------|---------------------------------|
| 1   | Stainless steel mesh  | SUS 316 (100 mesh, double)      |
| 2   | Sensing element       | Tin dioxide (SnO <sub>2</sub> ) |
| 3   | Lead wire             | Gold alloy (Au-Pd-Mo)           |
| 4   | Plastic housing       | Nylon 46 (UL94HB)               |
| 5   | Plastic base          | Nylon 66 (UL94HB)               |
| 6   | Heater/electrode pins | Nickel                          |

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