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Technical Information

Electrochemical CO Gas Sensor

NE4-CO-SI

For Semi-Industrial Application

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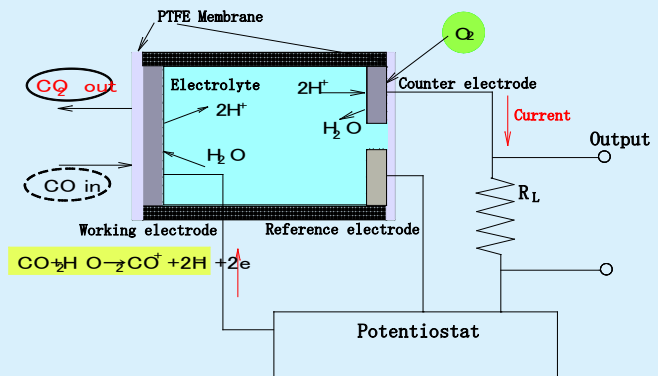


1. General

Nemoto NE series sensors were developed for industrial applications, and NE4-CO-SI is a standard type electrochemical CO gas sensor. Shape, pin positions and basic features are compatible with others, however the stability, repeatability, durability and reliability are superior to others, but the price is competitive with the others. Features and applications are as follows.

2. Detection principle

Electrochemical sensor consists of working electrode on which oxidization takes place, counter electrode on which reduction takes place, and reference electrode which can monitor and keep the voltage at constant. Structure of electrochemical sensor is shown in right figure, CO gas diffuses through membrane into working electrode, and CO is oxidized to CO₂ at working electrode. Generated proton at this reaction proceeds to counter electrode, and reacts with dissolved oxygen in electrolyte to water. Total reaction is in the above. CO gas concentration is proportional to the current that is generated by serial reaction.



3. Features

- Quick response and large sensitivity
- Excellent selectivity
- Good linearity and stability
- High reliability and long lifetime
- Excellent durability against high temperature and humidity

4. Detected gas

Carbon monoxide

5. Application

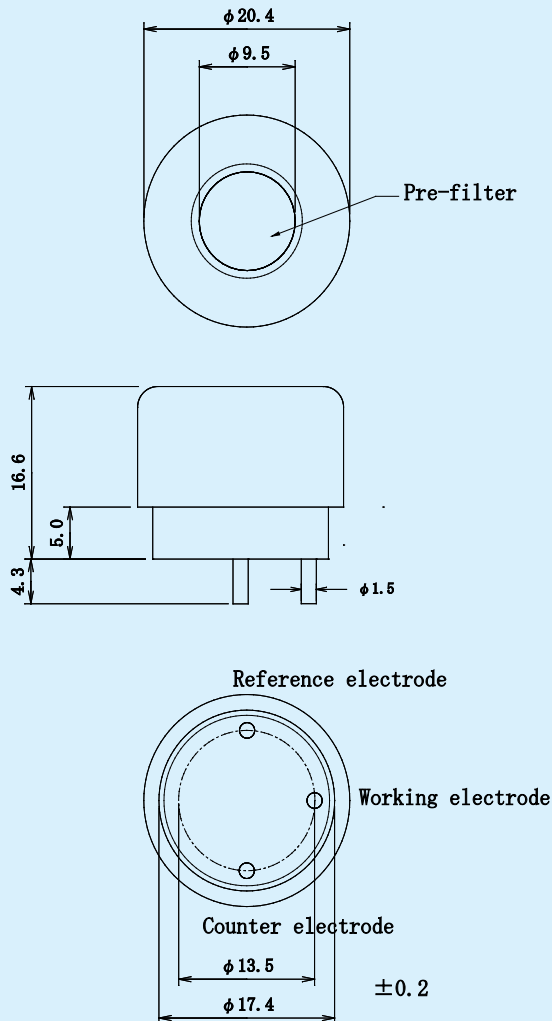
- CO gas densitometer for industrial application
- CO gas alarm for industrial equipment
- Handheld type CO gas leakage checker
- Environmental monitoring equipment
- Fire alarm

6. Ratings

- | | |
|--|---|
| 1) Ambient temperature and humidity in operation | Temperature : -20 - +50 degree C
Humidity : 15 - 90%RH |
| 2) Recommended ambient temperature and humidity in storage | Temperature : 0 - 20 degree C
Humidity : 15 - 90%RH |
| 3) Operating pressure range | 0.9 - 1.1 atm |



- 4) Detection range 0 - 1,000ppm
- 5) Maximum overload 1,500ppm
- 6) Recommended load resistor 10 ohm
- 7. Specifications
 - 1) Output signal 50 +/- 10nA/ppm.CO at 20 degree C
 - 2) Zero offset at 20 degree C < +/-5ppm of CO equivalent
 - 3) Response time (T90) < 30sec.
 - 4) Repeatability in the same day < 2% of signal
 - 5) Annual zero offset drift at 20 degree C < +/-5ppm of CO equivalent
 - 6) Zero offset temperature dependence (-20 ~ +50 degree C) < +/-10ppm of CO equivalent
 - 7) Sensitivity reduction in long term < 5% signal loss/year
 - 8) Lifetime warranty 24 months
 - 9) Recommended storage time < 6 months
- 8. Dimensions and appearance





Case Material	PPO
Cap Color	Dark blue
Weight	5 g (approx.)

Fig.1 : Appearance and dimensions of NE4-CO-SI

9. Electrical properties

9-1. Typical gas sensitivity

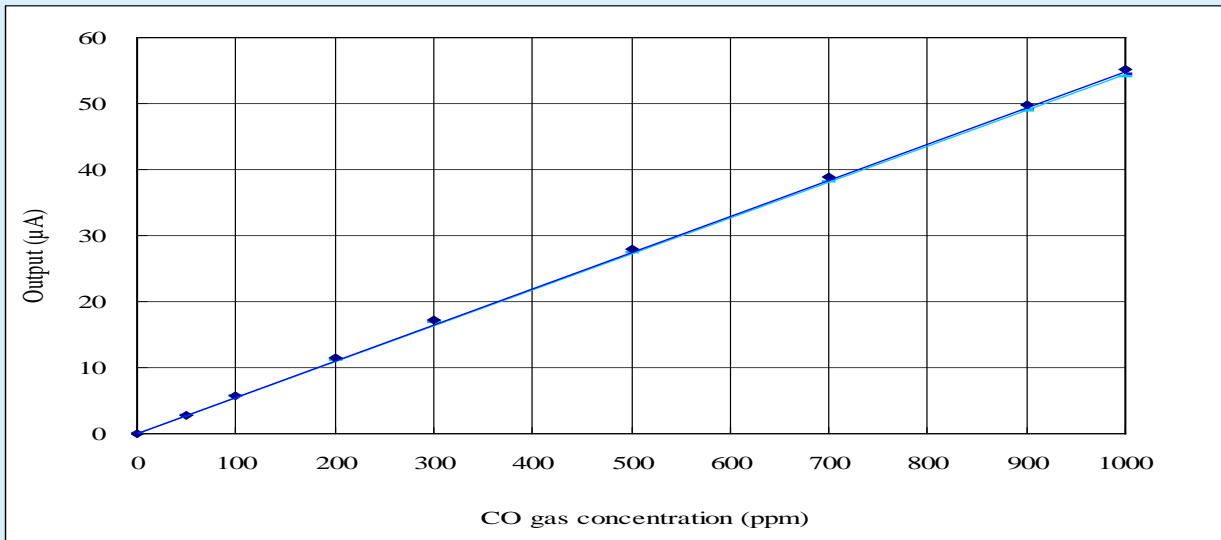


Fig.2 : Gas Sensitivity of NE4-CO-SI

9-2. Cross Sensitivity

Table 1 : Cross Sensitivity of NE4-CO-SI

Detected gases	Relative sensitivity (Sensitivity to CO is 100.)
Carbon-monoxide	100
Hydrogen	40
Methane	0
Iso-butane	0
Carbon-dioxide	0
Sulfur-dioxide	0
Hydrogen Sulfide	0
Nitric Oxide	Less than 30
Nitrogen Dioxide	0
Ammonia	0
Ethyl Acetate	0
Heptane	0
Ethanol	Less than 5*
Chlorine	0
Ethylene	Less than 80

Exposure time : * 30 minutes



9-3. Temperature dependence

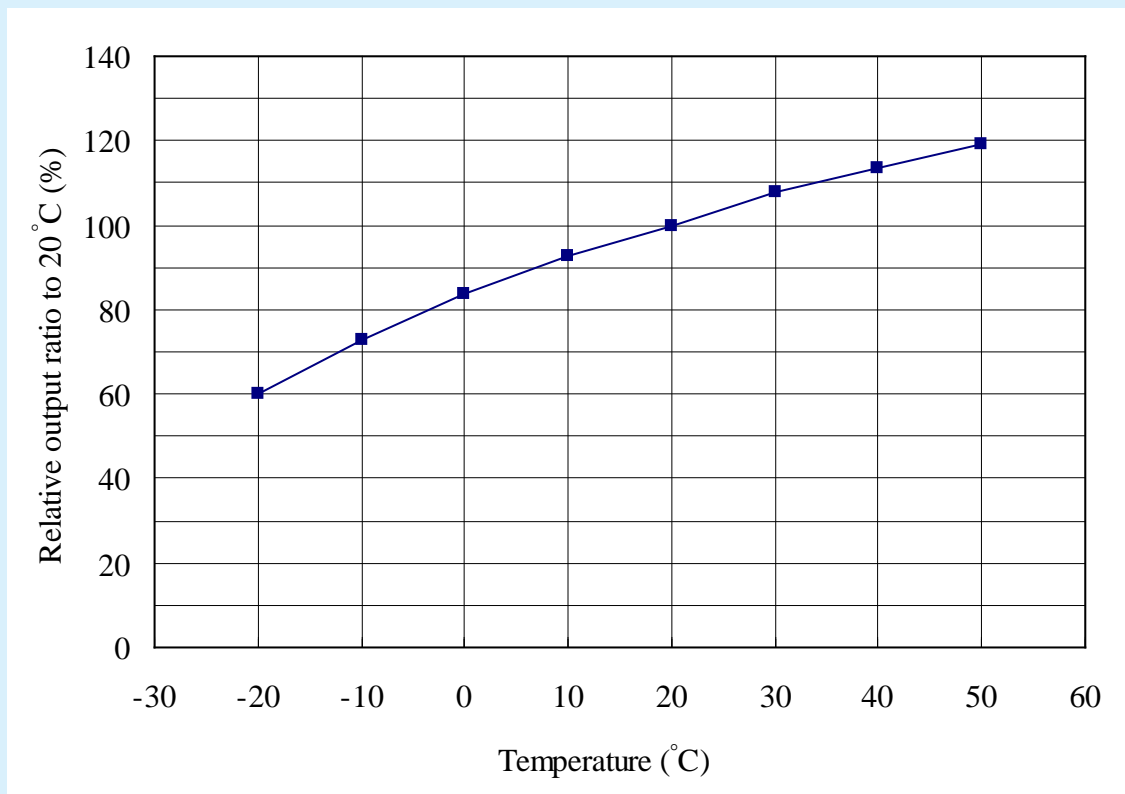


Fig. 3 Temperature dependence of NE4-CO-SI

10. Durability

Since various durability characteristics are almost the same as NE4-CO, please refer the technical information of NE4-CO.

11. Recommended circuit diagram

Recommended circuit diagram for evaluation of NE4-CO-SI is shown in figure 10. In this circuit diagram, OP97 as operational amplifier is employed, however the other low price one is to be applicable for actual use. And, thermistor is employed, resistance value of 10Kohm at 25 degree C and around 3500 as B constant is recommended. Ishizuka thermistor is not pointed, and another one is also available.

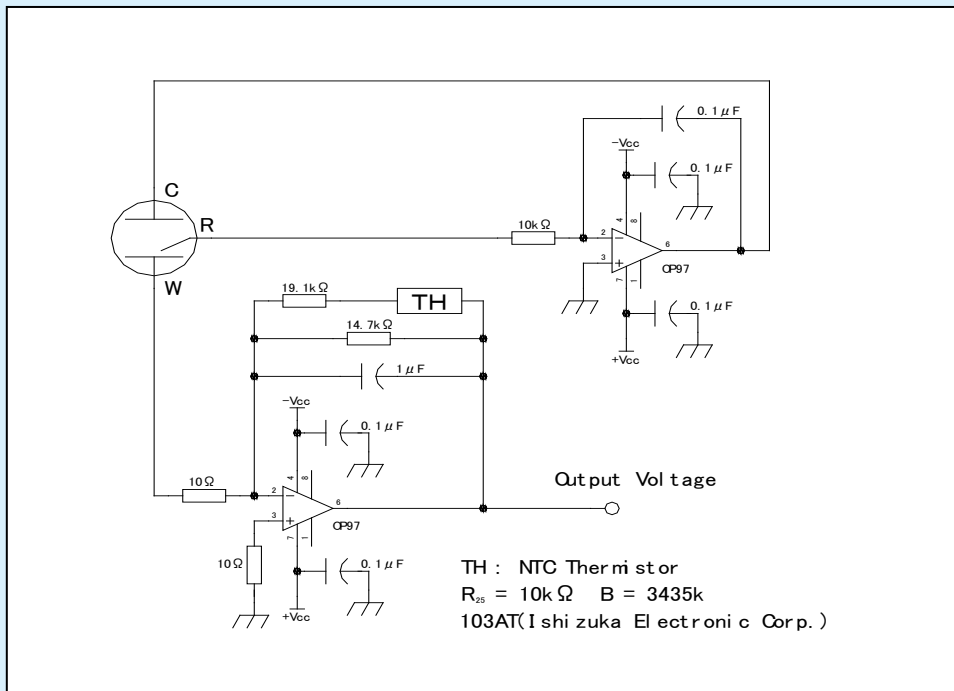


Fig. 4 : Measuring circuit diagram for evaluation

12. Notice on handling

12-1. Seasonal variation of sensitivity

Highly hygroscopic electrolyte is normally employed for electrochemical sensor, and then the sensitivity varies according to change of temperature and humidity, i.e. sensitivity is little lower in low humidity than in high humidity. Since it is because of amount of electrolyte, this seasonal variation of sensitivity should be taken into account in case that precise measurement is necessary. However, this variation is reversible phenomenon.

12-2. Design of gas alarm or gas densitometer

- Calibration of gas alarm or gas densitometer is to be carried out in clean air after the output was stabilized.
- Gas sensitivity reduction ratio of 5% per year is to be taken into account at designing of gas alarm as recommendation. In case that precise detection is required, periodical calibration once or twice a year is recommended.
- In case that water drop or oil is on the pre-filter, accurate measurement may not be available because of low diffusion of detected gas to sensor. If such accident may be conceived, design of prevention from such one is to be considered.
- Warranty time is 2 years in case of being used in normal circumstance.

12-3. Storage of sensor

It is recommended that electrochemical sensor should be stored in normal temperature and humidity, possibly 0-20 degree C, of clean air.

Recommended storage time after delivery is less than 6 months. If the storage time is extended, the warranty term is to be shortened. It is because the lifetime of electrochemical sensor is not dependent



on being electrified or not like semi-conductive type or catalytic type, and then this matter is to be correctly comprehensive in order to keep quality.

12-4. General notice

- Use only within specified conditions.
- Sensor characteristics must be measured in clean air.
- Electrode pins must be correctly connected. Wrong connection does not allow correct functions.
- Do not apply voltage directly to electrode pins.
- Do not bend pins.
- Do not put excess vibration or shocks.
- If sensor housing is damaged or scratched, do not use.
- Do not blow organic solvents, paints, chemical agents, oils, or high concentration gases directly onto sensors.
- Do not solder pins of sensor directly. Use exclusive sockets.
- Do not disassemble or change any parts.
- In case that sensor is stored by detachment from circuit board, it is recommended that working electrode pin should be short-circuited with reference electrode pin in order to shorten the initial stabilization time.
- If sensor is used under irregular atmosphere, contact us.

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