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General information on Nemoto sensors

NEMOTO SENSORS

Nemoto produces GAS SENSORS and SMOKE SENSORS. Wide ranges of models are provided for users' convenience in the selection of the most suitable sensors for their applications from the view points of target gases, detection purposes, operating conditions, and required accuracy. Generally speaking, catalytic type gas sensors are the best for flammable gases. Semiconductor type sensors and electrochemical cells would be good for detection of toxic gases and contamination gases contained in air. And thermally conductive type sensors would be suited for inert gas detection. However, the suitable sensor may differ depending on target gas concentrations to be detected. Our suggestions and recommendations will be given upon request.

The features and characteristics of each sensor will be described later in this brochure, but rough ideas are shown below for the selection of a suitable sensor depending on the kinds and concentrations of target gases. Users who are going to use our sensor for the detection of a gas concentration near the border lines are recommended to contact us for technical assistance. As far as our smoke sensors are concerned, there is no limitation in the detection ranges and applications.

*** Flammable gases**

Hydrogen, Methane, Propane, Iso-butane, Gasoline vapor, Ethanol, etc.

Gas concentration	0.001%	0.01%	0.1%	1%	10%	
Type of sensors	<- No appropriate sensor ->			<- Catalytic type ->		<- Thermally conductive ->

*** Toxic gases**

H₂S, SO_x, HCl, Cl, CO, etc.

Gas concentration	0.1ppm	1ppm	10ppm	100ppm	0.1%	1%
Type of sensors	<- Electrochemical ->				<- Catalytic ->	

*** Incompletely combusted exhaust gases**

CO, Hydrogen, unburned or oxidized hydrocarbons

Gas concentration	0.1ppm	1ppm	10ppm	100ppm	0.1%	1%
Type of sensors	<- Electrochemical ->				<- Catalytic ->	

*** Inert gases**

Carbon dioxide, Freon gases

Gas concentration	0.01%	0.1%	1%	10%
Type of sensors	<- IR absorption ->			<- Thermally conductive ->

In addition to the above types of sensors, semiconductor type sensors are also on the market, however because of its inferior gas selectivity and complicated circuitry, we do not recommend this type of sensors for reliable gas detection and measurement.

Line-up of Nemoto sensor

Type	Target gases	Model No.	Detection range	Features
C A T A L Y T I C	General combustible gases	NAP - 2A	iso-Butane (0.03 - 1.0%)	Universal type
		NAP - 55A		Methane (0.05 - 2.5%)
		NAP - 56A	Low sensitivity to ethanol, Small size	
		NAP - 50A		
		NAP - 51A		
	LPG, hydrogen and organic solvent vapor	NAP - 3A	Hydrogen (0.04 - 2%)	Universal type
		NAP - 66A		Small sized, Lower power consumption
		NAP - 67A	iso-Butane (0.02 - 1%)	
	Combustible gases for commercial use	NAP - 100AM	Methane (0.03 - 5%)	High performance, Commercial application ,
		NAP - 100AC		
		NAP - 100AH	iso-Butane (0.02 - 1.8%)	For hydrogen only
		NAP - 100AD		High temp. resistivity
	Incomplete combustion flue gas	NAP - 78A	0.03 - 2% (1/2H ₂ + CO)	For gas boilers, oil boilers
		NAP - 79A		
	Combustible Gases, hydrogen	NAP - 130	Methane (0.05 - 5%)	For hydrogen fuel cell
NSU - 131A				
NSU - 131AF		Hydrogen (0.04 - 4%)		
Thermally conductive	Carbon di-oxide	NAP - 21A	2 - 100%	Universal type
Electro-chemical	Carbon mono-oxide	NAP - 505	CO 10 - 1000ppm	High accuracy,
		NAP - 503		Low sensitivity to hydrogen
	Formaldehyde	NAP - 740	0 - 50ppm	High accuracy, High reliability
Polymer Resistance type	Relative Humidity	NHS-12	10-90%RH	For low humidity
		NHS-20	20-95%RH	Standard type
		NHS-25	20-100%RH	Highly durable to dew condensation
Ionization Type	General smoke	NIS - 02A	0.5 - 5 % / foot**	Out of radioactive source (Lower than exemption)
		NIS - 02C		
		NIS - 09C		Universal type
		NIS - 05A		Lower radioactivity

** : Unit for light blockage ratio by smoke.

Catalytic type

Catalytic type gas sensors are Nemoto's specialty, and various kinds of gas sensors are provided for customers' selection. The main application is for gas detectors. Catalytic type sensors are much stable compared to semiconductor type gas sensors, and do not need any CPU for making detectors. Thus catalytic type gas sensors enable users to design flexible circuits for lower-cost gas detectors. The general features of Nemoto's catalytic gas sensors are as below.

1. Basic characteristics:

- * Good output linearity to gas concentrations up to LEL, especially excellent linearity in the range below 50% of LEL.
- * Excellent repeatability of gas sensitivity. Variability within a day would be less than +/- 5%.
- * Speedy response. 90% response time of residential models is less than 20 sec.
- * Hardly affected by ambient temperature and humidity. No compensation circuit is required for residential applications.
- * Least individual differences and simple calibration on detectors.
- * Short initial stabilization time.
- * Less affected by supply voltage variation. Stabilized supply voltage is not needed.

2. Durability, Long-term stability

- * Excellent stability under 60°C.
- * Durable under high temperature and humidity (50°C, 95% RH).
- * Not affected by long-term storage under high temperature and humidity (50°C, 95% RH).
- * Resistive against vibration and impact.
- * Durable against corrosive gases such as hydrogen sulfide.
- * Durable against silicone gases (HMDS 10ppm).
- * Acceleration tests have proved a long life more than 10 years.

3. Usage

- * Not like semiconductor type sensors, a long preparatory aging time is not necessary for performance stabilization.
- * In case of gas detector applications, aging for 10 minutes would be enough before calibration. Calibration can be done in air without a test gas.
- * Variation of ambient temperature & humidity or existence of noise gases does not affect to the characteristics of Nemoto sensors. It is not needed to create special ambient conditions for calibration.

4. Applications

- * Gas leakage detectors
- * Incomplete combustion alarms
- * For water heaters
- * Alcohol checkers, Gas densitometers
- * For gasoline feeders

Electrochemical type gas sensors

This is one of our main products in addition to the Hot-wire type sensors. Because of the limitation of its detection method, detectable gases are limited such as toxic gases and incompletely combusted flue gases etc., however electrochemical sensors show far superior accuracy and gas selectivity compared to semiconductor type sensors. It was said that electrochemical type sensors had a problem of a shorter life, but Nemoto electrochemical sensors are uniquely designed in the electrodes to have excellent accuracy and consistency so that these sensors can be applied for maintenance-free residential detectors. Nemoto electrochemical sensors have also an innovative structure to have realized the smallest size in the world. This small size gives flexibility in the component positioning when detectors are designed. There are two series of Nemoto electrochemical sensors, i.e. the 5 series for general use and the 7 series mainly used for industrial applications. The 5 series includes a special type which electrode pins can be directly soldered with PCBs. The superior features are described below.

1. Basic features:

- The output signal is linear in the practical detection range of various target gases.
- The excellent repeatability of gas sensitivity. Output signals fall into a range of $\pm 2\%$ or less.
- The faster response time. Electrochemical sensors generally do not have a quick response time, but Nemoto electrochemical sensors show a relatively quick response characteristic. 90% response time is within 30 seconds.
* When a simple temperature compensation circuit is added for the range of $20^{\circ}\text{C} \sim 50^{\circ}\text{C}$, the accuracy falls into $\pm 10\%$ tolerance. Nemoto electrochemical sensors are hardly affected by humidity.
- The individual differences are so small that alarm concentration can be adjusted by a uniformed calibration.
- Initial output is stabilized in a short time after energized.

2. Durability and long term stability

- Detection accuracy is unchanged after use for 5,000 hours under 60°C and 90%RH.
- Gas sensitivity is unchanged after use for 5,000 hours under 60°C and 15%RH.
- Excellent resistivity to vibrations and shocks that are expected in common environment.
- The sensors are not affected by silicon gases at all.
- 5 year life is guaranteed for the standard type NAP-505.

3. Usage

- Different from semiconductor type sensors, Nemoto electrochemical sensors do not need preparatory aging at all.
- In case of use for residential detectors, calibration is not required because the individual differences are negligible.
- False-alarm-free because of no response to noise gases.
- Battery operation is possible because the sensors do not have a heater.

4. Applications

- For incomplete combustion detectors, CO detectors, toxic gas detectors.
- For combustion controllers for stoking equipment, monitors for indoor environment.
- Various gas densitometers, measuring equipment.

NAP-2A

NAP-2A is a universal type of sensor for flammable gases and can be used for gas detectors as well as for gas densitometers. The following are the ratings and output characteristics of this sensor. It is recommended to refer to the individual user's manual for further information.

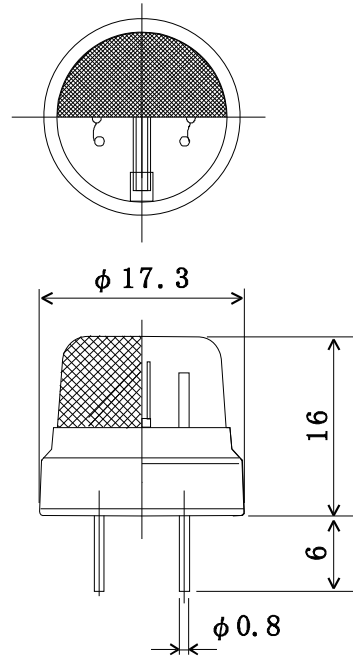
* Target gases and concentration

Gases		Detection range
Methane	CH ₄	0.05 ~ 5%(0.05 ~ 2%)
Propane	C ₃ H ₈	0.03 ~ 2.2%(0.03~ 1%)
Iso-butane	Iso-C ₄ H ₁₀	0.03 ~ 1.8%(0.03 ~ 0.8%)
Hydrogen	H ₂	0.05 ~ 4%(0.05 ~ 1.5%)
Ethanol	C ₂ H ₅ OH	0.05 ~ 3.2%(0.05 ~ 1.5%)
Hydrocarbons	C _n H _{2n+2}	1~100% LEL (1~50%LEL)

() is a detection range in high accuracy

* Ratings

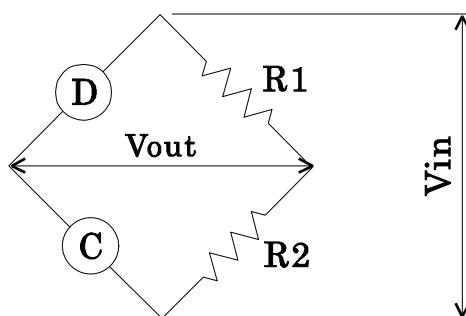
Items	Specifications
Supply voltage	DC 2.20 +/- 0.22V AC 2.20 +/- 0.22V (r.m.s. 50~60Hz)
Current (When 2.2V is supplied)	DC 340 ~ 380mA AC 340 ~ 380mA (r.m.s. 50~60Hz)
Ambient Temperature	In operation -10 ~ +50°C In storage -10 ~ +60°C
Ambient humidity	In operation 95%RH or less In storage 99%RH or less (No dew condensation)



Structure & appearance of NAP-2A

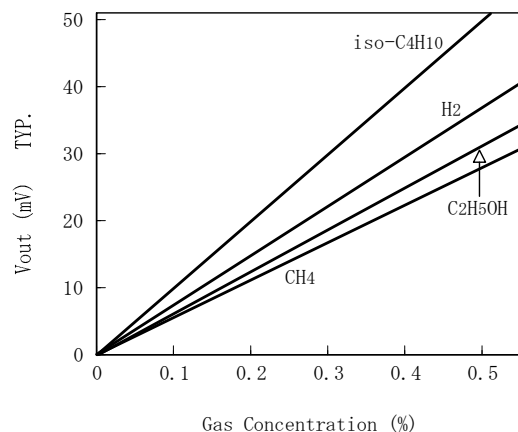
* Gas sensitivity characteristics

Gas & Concentration	Output voltage
Output in clean air	-35 ~ +35 mV
Methane 3000ppm	14 ~ 22 mV
Iso-butane 1400ppm	12 ~ 18 mV
Hydrogen 1400ppm	9 ~ 15 mV
Ethanol 1400ppm	Less than 15mV



R1,R2:200Ω Metal-covered

Recommended measuring circuit



Gas sensitivity characteristics

NAP-3A

NAP-3A is a universal type of LP Gas sensor, and is used for LP Gas detectors, leakage testers, and gas densitometers. The following are the ratings and output characteristics of this sensor. It is recommended to refer to the individual user's manual for further information.

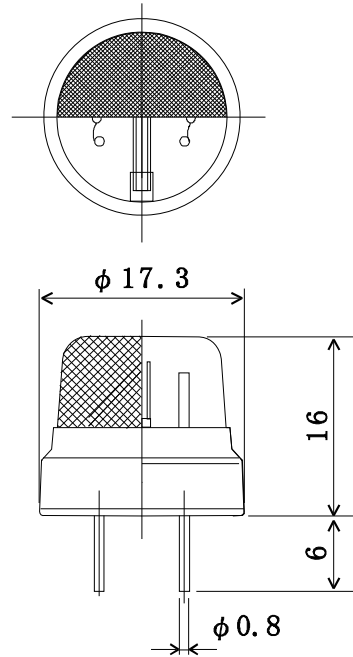
* Target gases and concentration

Gases		Detection range
Propane	C ₃ H ₈	0.03 ~ 2.2%(0.03 ~ 1%)
Iso-butane	Iso-C ₄ H ₁₀	0.03 ~ 1.8%(0.03 ~ 0.8%)
Hydrogen	H ₂	0.05 ~ 4%(0.05 ~ 1.5%)
Ethanol	C ₂ H ₅ OH	0.05 ~ 3.2%(0.05 ~ 1.5%)
Hydrocarbons	C _n H _{2n+2}	1~100%LEL(1~50%LEL)

() is a detection range in high accuracy

* Ratings

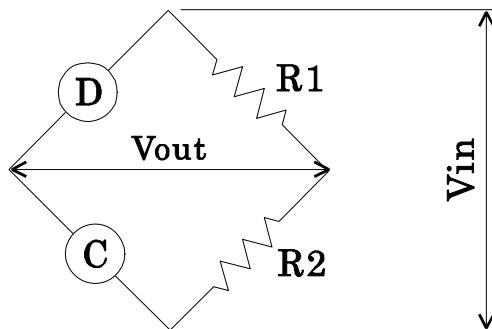
Items	Specifications
Supply voltage	DC 1.75 +/- 0.175V AC 1.75 +/- 0.175V (r.m.s. 50~60Hz)
Current (when 1.75V is applied)	DC 310 ~ 350mA AC 310 ~ 350mA (r.m.s. 50~60Hz)
Ambient Temperature	In operation -10 ~ +50°C In storage -10 ~ +60°C
Ambient humidity	In operation 95%RH or less In storage 99%RH or less (No dew condensation)



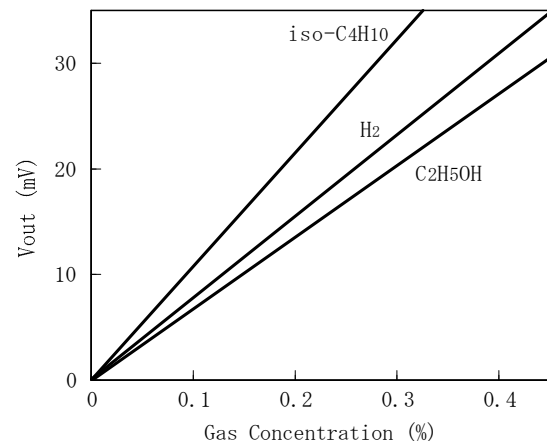
Structure & appearance of NAP-3A

Gas sensitivity characteristics

Gas and concentration	Output voltage
Output in clean air	-35 ~ +35mV
Iso-butane 1400ppm	12 ~ 18mV
Hydrogen 1400ppm	9 ~ 15mV
Ethanol 1400ppm	Less than 15mV



R1,R2;200Ω Metal-covered



Recommended measuring circuit

Gas sensitivity characteristics

NAP-66A

NAP-66A is a miniature & low power consumption type of NAP-3A, and is mainly used for gas detectors and leak testers. 66A is a half in height and needs a half in power consumption compared to 3A so that thinner and lighter-weight detectors can be produced. The following are the basic characteristics but it is recommended to refer to the individual user's manual for further information. A measuring circuit for sensor evaluation is the same as NAP-3A.

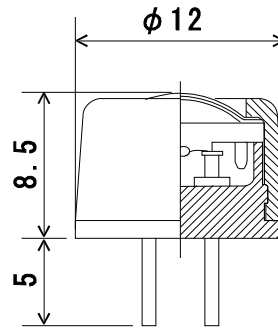
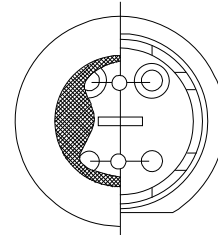
* Target gases and concentration

Gases		Detection range
Propane	C ₃ H ₈	0.03 ~ 2.2% (0.03 ~ 1%)
Iso-butane	Iso-C ₄ H ₁₀	0.03 ~ 1.8% (0.03 ~ 0.8%)
Hydrogen	H ₂	0.05 ~ 4% (0.05 ~ 1.5%)
Ethanol	C ₂ H ₅ OH	0.05 ~ 3.2% (0.05 ~ 1.5%)
Hydrocarbons	C _n H _{2n+2}	1~100% LEL (1~50%LEL)

() is a detection range in high accuracy

* Ratings

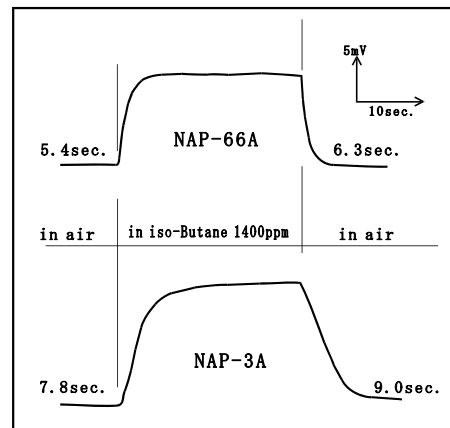
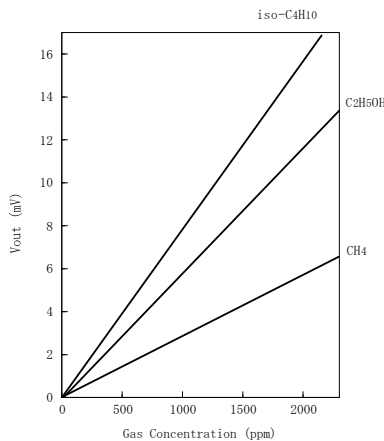
Items	Ratings
Supply Voltage	DC 2.0 ± 0.2V AC 2.0 ± 0.2V (r.m.s. 50~60Hz)
Current (When 2.0V is applied)	DC 140 ~ 160mA AC 140 ~ 160mA (r.m.s. 50~60Hz)
Ambient Temperature	In operation -10 ~ +50°C In storage -10 ~ +50°C
Ambient humidity	In operation 95%RH or less In storage 99%RH or less (No dew condensation)



Structure & appearance of NAP-66A

* Gas sensitivity characteristics

Gases and concentration	Output voltage
Output in clean air	-35 ~ +35mV
Iso-butane 1400ppm	10 ~ 15mV
Hydrogen 1400ppm	7 ~ 12mV
Ethanol 1400ppm	Less than 11mV



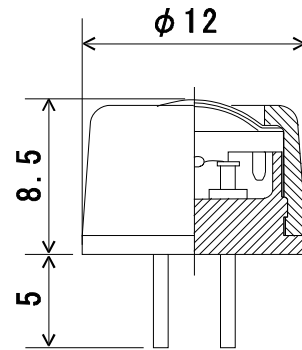
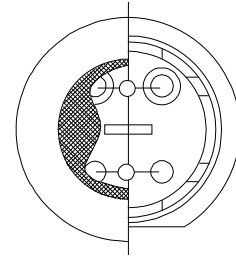
NAP-55A

NAP-55A is a miniature & low power consumption type of NAP-2A, and is mainly used for gas detectors and leak testers. 55A is a half in height and needs a half in power consumption compared to 2A so that thinner and lighter-weight detectors can be produced. The following are the basic characteristics but it is recommended to refer to the individual user's manual for further information. A measuring circuit for sensor evaluation is the same as NAP-2A.

* Target gases and concentration

Gases		Detection range
Methane	CH ₄	0.05 ~ 5% (0.05 ~ 2%)
Propane	C ₃ H ₈	0.03 ~ 2.2% (0.03 ~ 1%)
Iso-butane	Iso-C ₄ H ₁₀	0.03 ~ 1.8% (0.03 ~ 0.8%)
Hydrogen	H ₂	0.05 ~ 4% (0.05 ~ 1.5%)
Ethanol	C ₂ H ₅ OH	0.05 ~ 3.2% (0.05 ~ 1.5%)
Hydrocarbons	C _n H _{2n+2}	1~100%LEL (1~50%LEL)

() is a detection range in high accuracy



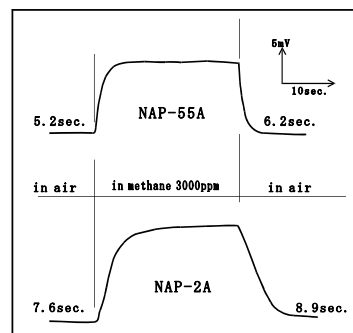
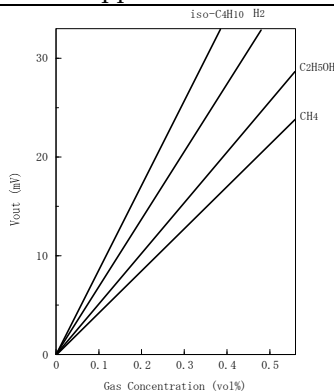
* Ratings

Items	Specifications
Supply Voltage	DC 2.5 +/- 0.25V AC 2.5 +/- 0.25V (r.m.s. 50~60Hz)
Current (When 2.5V is applied)	DC 150 ~ 170mA AC 150 ~ 170mA (r.m.s. 50~60Hz)
Ambient Temperature	In operation -10 ~ +50°C In storage -10 ~ +50°C
Ambient humidity	In operation 95%RH or less In storage 99%RH or less (No dew condensation)

Structure & Appearance of NAP-55A

* Gas sensitivity characteristics

Gases & concentration	Output voltage
Output in clean air	-35 ~ +35mV
Methane 3000ppm	10 ~ 16mV
Iso-butane 1400ppm	10 ~ 15mV
Hydrogen 1400ppm	7 ~ 12mV
Ethanol 1400ppm	Less than 11mV



Gas sensitivity characteristics

Response characteristics

NAP-50A

NAP-50A is a miniature & low power consumption type of NAP-2A, and is mainly used for gas detectors. Compared to NAP-55A, NAP-50A has a lower alcohol sensitivity to eliminate false alarms caused by alcohol, thus more reliable gas detectors can be produced with NAP-50A. The following are the basic characteristics but it is recommended to refer to the individual user's manual for further information. See NAP-2A for measuring circuit for sensor evaluation.

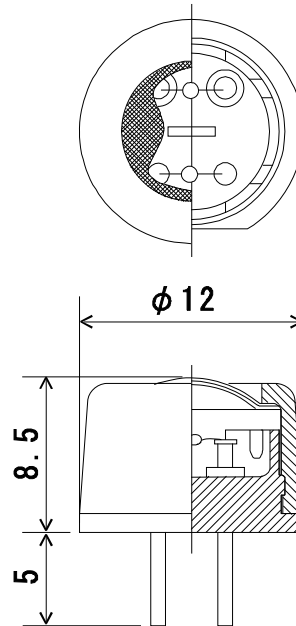
* Target gases and detection range

Gases		Detection range
Methane	CH ₄	0.05 ~ 5% (0.05 ~ 2%)
Ethane	C ₂ H ₆	0.05 ~ 3.2% (0.05 ~ 1.5%)
Iso-butane	Iso-C ₄ H ₁₀	0.03 ~ 1.8% (0.03 ~ 0.8%)
Hydrogen	H ₂	0.05 ~ 4% (0.05 ~ 1.5%)
Hydrocarbons	C _n H _{2n+2}	1~100% LEL (1~50%LEL)

() is a detection range in high accuracy

* Ratings

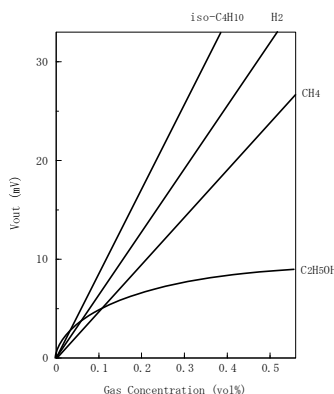
Items	Specifications
Supply voltage	DC 2.5 +/- 0.25V AC 2.5 +/- 0.25V (r.m.s. 50~60Hz)
Current (When 2.5V is applied)	DC 150 ~ 170mA AC 150 ~ 170mA (r.m.s. 50~60Hz)
Ambient Temperature	In operation -10 ~ +50°C In storage -10 ~ +50°C
Ambient humidity	In operation 95%RH or less In operation 99%RH or less (No dew condensation)



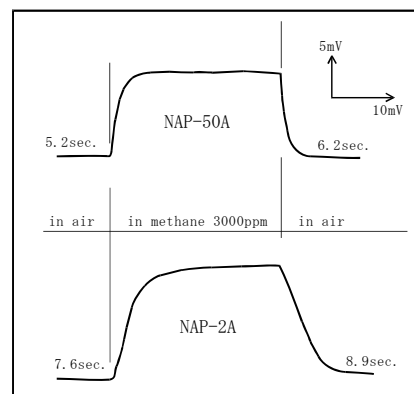
Structure & Appearance of NAP-50A

* Gas sensitivity characteristics

Gases & concentration	Output voltage
Output in air	-35 ~ +35mV
Methane 3000ppm	10 ~ 16mV
Iso-butane 1400ppm	9 ~ 14mV
Hydrogen 1400ppm	7 ~ 12mV
Ethanol 1%	Less than 10mV



Gas sensitivity characteristics



Response characteristics

NAP-56A

NAP-55A has been followed by a new version, NAP-56A that is not made with thermoplastics to achieve a higher temperature resistivity. The pin locations and dimensions are compatible to NAP-55A for the convenience of current users of Nemoto NAP-55A. The gas sensitivity is better than NAP-55A by about 15%. Users are to pay attention to this higher gas sensitivity upon calibration.

• Target gases & concentration

gases		Detection range
Methane	CH ₄	0.05 – 5% (0.05 – 2%)
Ethane	C ₂ H ₆	0.05 – 3.2% (0.05 – 1.5%)
Hydrogen	H ₂	0.05 – 4% (0.05 – 1.5%)
Hydro-carbons	C _n H _{2n+2}	1-100%LEL (1-50%LEL)

() = Detection range with high accuracy

• Ratings

Item	Ratings
Supply voltage	DC 2.5 ± 0.25V AC 2.5 ± 0.25V(RMS 50-60Hz)
Current (2.5Vapplied)	DC 150 – 170mA AC 150 – 170mA(RMS 50-60Hz)
Ambient temperature	Usage -10 ~ +50°C Storage -10 ~ +50°C
Ambient humidity	Usage 95%RH or less Storage 99%RH or less but no dew Condensation.

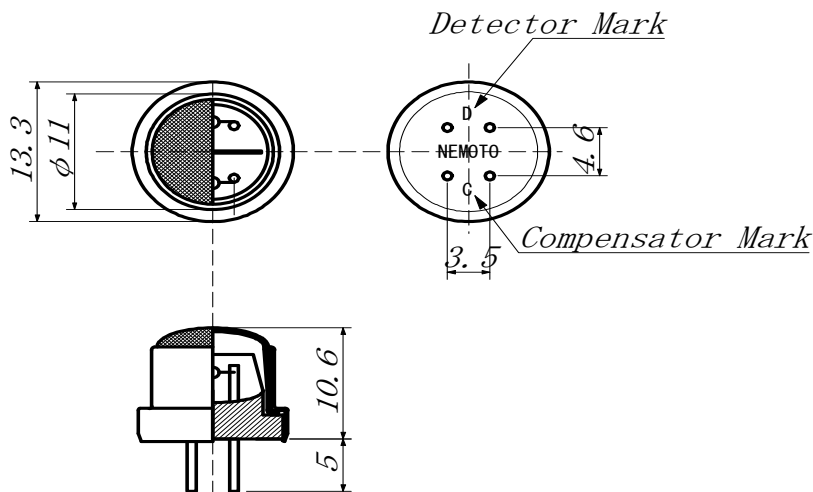
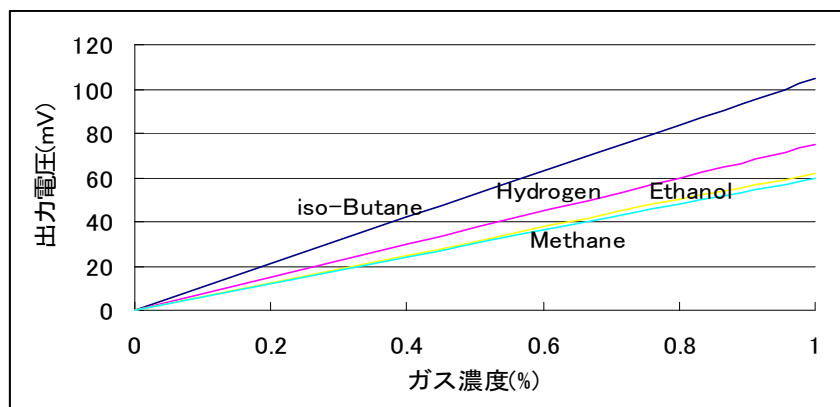


Fig. Appearance and structure of NAP-56A

• Gas sensitivity characteristics

Gases and concentration	Output values
Output in clean air	-35 ~ +35mV
Methane 3,000ppm	15 ~ 23mV
Iso-butane 1,400ppm	12 ~ 18mV
Hydrogen 1,400ppm	10 ~ 17mV



NAP-67A

NAP-66A has been followed by a new version, NAP-67A that is not made with thermoplastics to achieve a higher temperature resistivity. The pin locations and dimensions are compatible to NAP-66A for the convenience of current users of Nemoto NAP-66A. The gas sensitivity is better than NAP-66A by about 15%. Users are to pay attention to this higher gas sensitivity upon calibration.

• Gas sensitivity characteristics

Gases		Detection range
Propane	C ₃ H ₈	0.03–2.2% (0.03–1%)
Iso-butane	C ₄ H ₁₀	0.03–1.8% (0.03–1%)
Hydrogen	H ₂	0.05–4% (0.05–1.5%)
Hydro-carbons	C _n H _{2n+2}	1-100%LEL (1-50%LEL)

() = Detection range with high accuracy

• Ratings

Items	Ratings
Supply voltage	DC 2.0±0.2V AC 2.0±0.2V(RMS 50-60Hz)
current (2.0V applied)	DC 140–160mA AC 140–160mA(RMS 50-60Hz)
Ambient temperature	Usage -10 – +50°C Storage -10 – +50°C
Ambient humidity	Usage 95%RH or less Storage 99%RH or less but no dew condensation

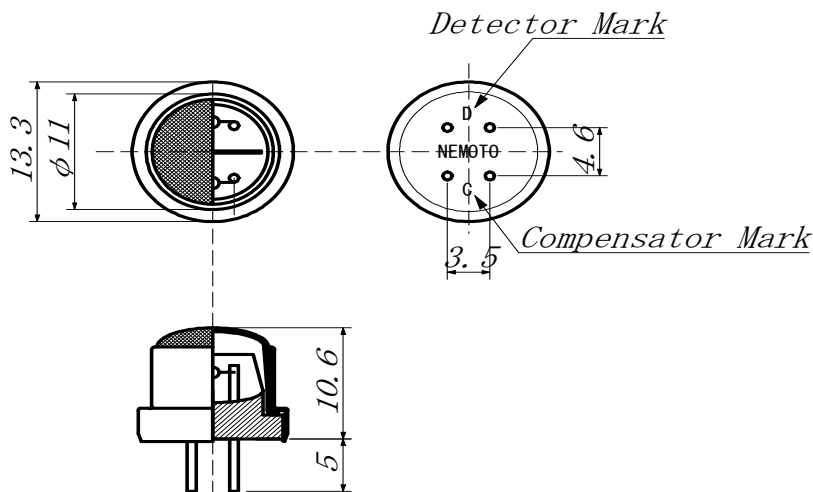
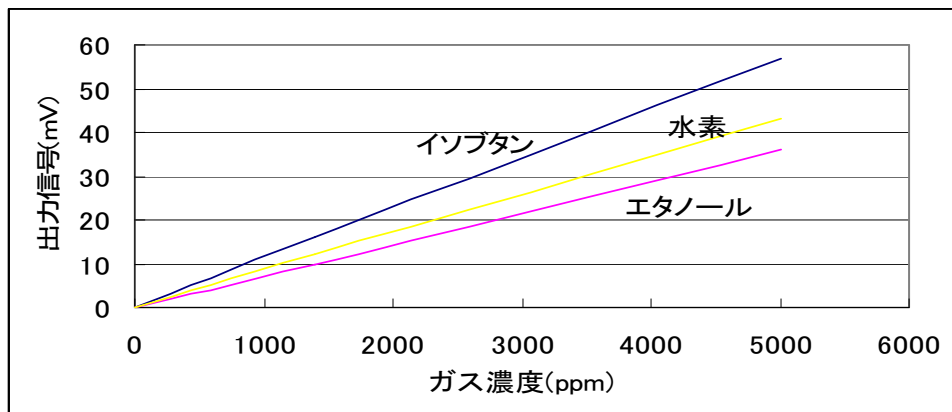


Fig. Appearance and structure of NAP–67A

• Gas sensitivity characteristics

Gases and concentration	Output values
Output in clean air	-35 ~ +35mV
Iso-butane 1,400ppm	12 ~ 18mV
Hydrogen 1,400ppm	10 ~ 17mV
Ethanol 1,400ppm	8 ~ 16mV

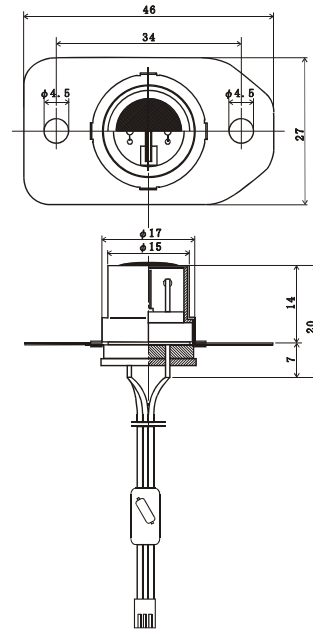


NAP-78A

NAP-78A is a gas sensor for monitoring incomplete combustion. 78A can be installed in a flue duct for direct monitoring on stoking equipment. Usually this type of sensor has individual temperature dependency to require an individual compensation circuit, but this has been the cause of the high cost of such sensors to eventually impede the popularization, however, 78A's temperature dependency can be compensated by a simple circuit and does not need an individual circuit.

* Ratings

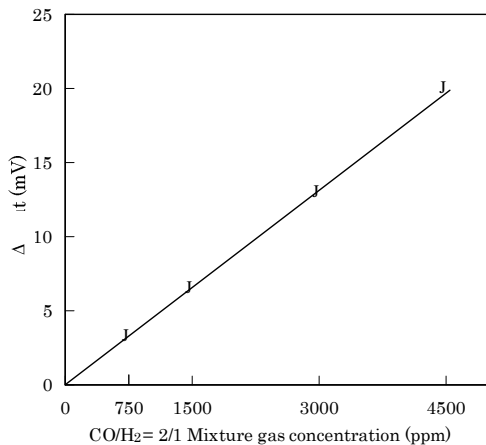
Item	Specifications
Supply voltage	DC 2.0 +/- 0.1V AC 2.0 +/- 0.1V (r.m.s. 50~60Hz)
Heat cleaning voltage	DC 2.75 +/- 0.1V AC 2.75 +/- 0.1V (r.m.s. 50~60Hz)
Heat cleaning cycles	1 min. only upon switch-on
O2 concentration	1 ~ 21%
CO/H ₂	1/1 ~ 1/4
Current (When 2.0V is applied)	DC140 ~ 160mA AC140 ~ 160mA (r.m.s. 50~60Hz)
Ambient temperature	In operation 0 ~ +200°C In storage -10 ~ +50°C
Ambient humidity	In operation 95%RH or less In storage 99%RH or less (No dew condensation)



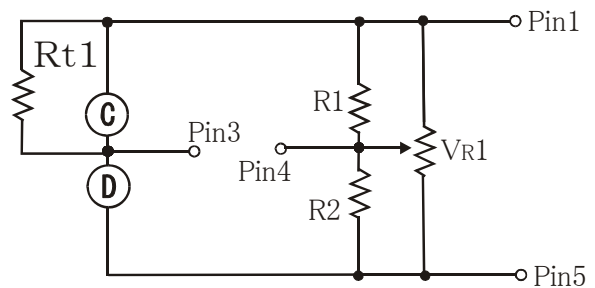
Structure & appearance of NAP-78A

* Gas sensitivity characteristics

Gases and concentration	Output voltage
Output in clean air	+8.0 ~ +12.0 mV
CO 1000ppm + H ₂ 500ppm	6 - 7mV (Normal Temp.), 4 - 5mV (200°C)
Temperature dependency at Zero point	Zero point variation +/- 1.0mV or less between normal temperature and 200°C



Gas sensitivity characteristics



Circuit with component

NAP-79A

NAP-79A is a moderately-priced version of NAP-78A, and to be installed in an exhaust duct of a stoking equipment for direct monitoring of the exhaust gas as same as the conventional version NAP-78A. Difference from NAP-78A, the components are minimized (Harness and intermediary PC board have been eliminated) so that this new version NAP-79A can be used for lower-priced stoking equipment. The equivalent performances as NAP-78A are guaranteed when an initial output value is read to set the zero point. Heat cleaning cycles are recommended for NAP-78A, but the cycles can be skipped for NAP-79A if simplified control is required.

• Ratings

Please refer to the page of NAP-78A since every item is exactly same as NAP-78A.

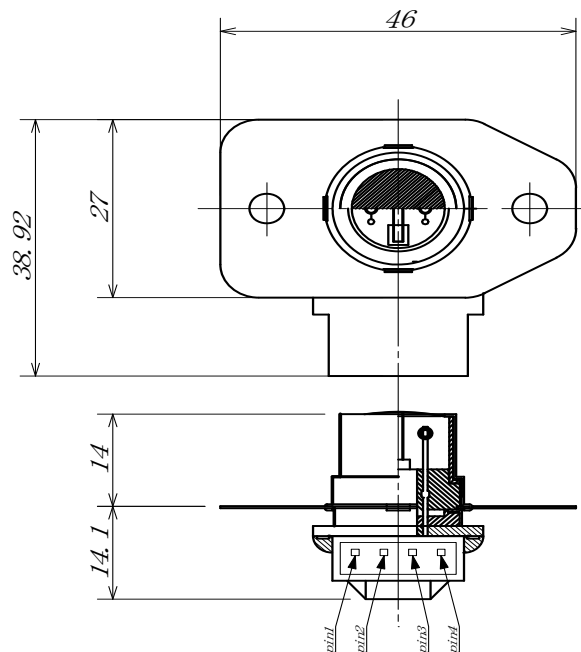
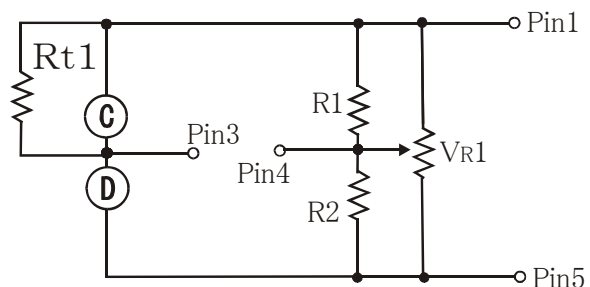
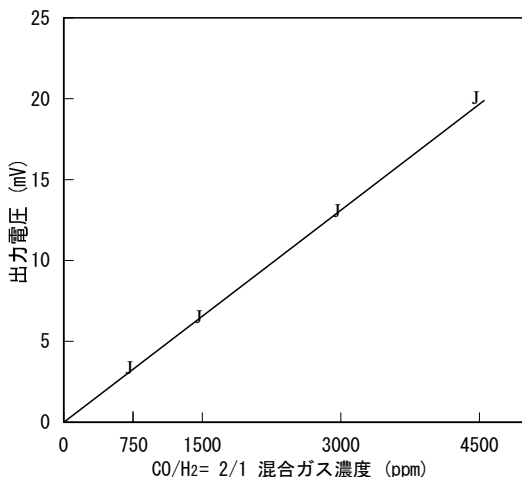


Fig. Appearance and structure of NAP-79A

• Gas sensitivity characteristics

Gases and concentration	Output values
Output in clean air	40~120mV
CO 1,000ppm + H ₂ 500ppm	7 ~ 9mV (room Temp.), 5 ~ 7mV(200°C)
Temperature characteristics at Zero point	Output variation between room temperature and Zero point = less than ± 1.0mV

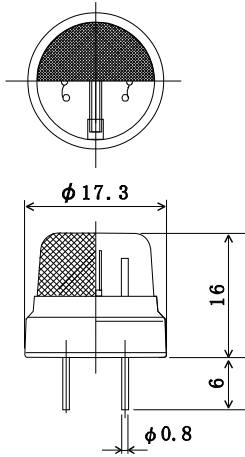


NAP-100 Series

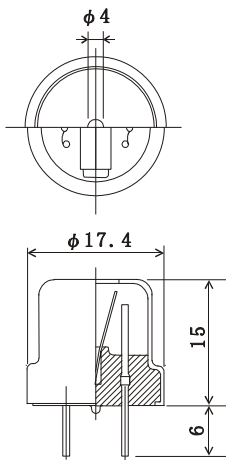
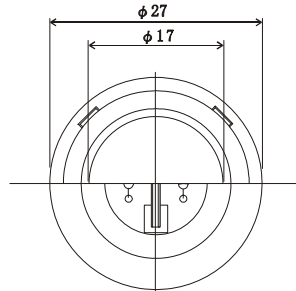
NAP-100 series are flammable gas sensors for industrial applications, and 4 types are provided for users' choice. For detailed technical information, please refer to the individual user's manuals.

* Ratings and gas sensitivity

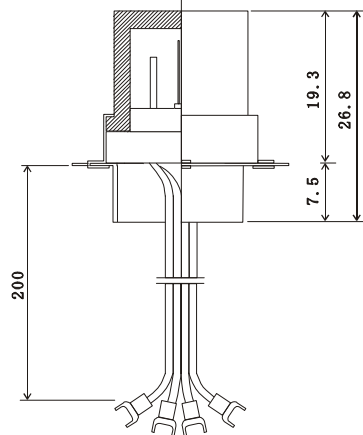
Items	NAP-100AM	NAP-100AC	NAP-100AD	NAP-100AH
Supply voltage	2.6V	2.6V	2.6V	1.6V
Current	160 ~ 180mA	160 ~ 180mA	160 ~ 180mA	120 ~ 140mA
Ambient temp. & humidity in operation	-10 ~ +50°C 95%RH or less	-10 ~ +50°C 95%RH or less	260°C or less 95%RH or less	260°C or less 95%RH or less
Ambient temp. & humidity in storage	-20 ~ +60°C 99%RH or less	-20 ~ +60°C 99%RH or less	-20 ~ +60°C 99%RH or less	-20 ~ +60°C 99%RH or less
Applications	Universal type	For higher conc.	For high temp.	For H ₂ only
Target gases	Flammable	Flammable	Flammable	H ₂ , CO
Detection range in high accuracy	1 ~ 50%LEL	3 ~ 100%LEL	1 ~ 50%LEL	1 ~ 50%LEL



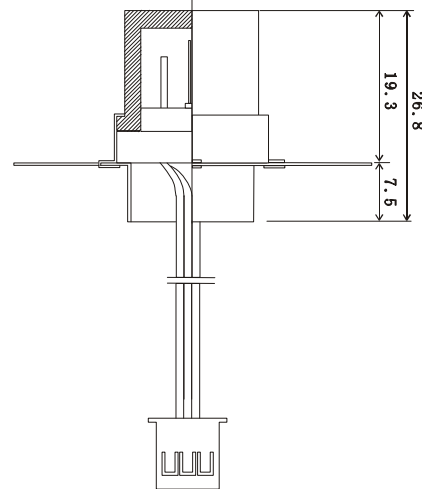
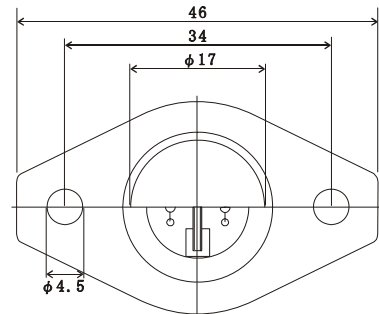
Structure of NAP-100AM



Structure of 100AC



Structure of 100AD



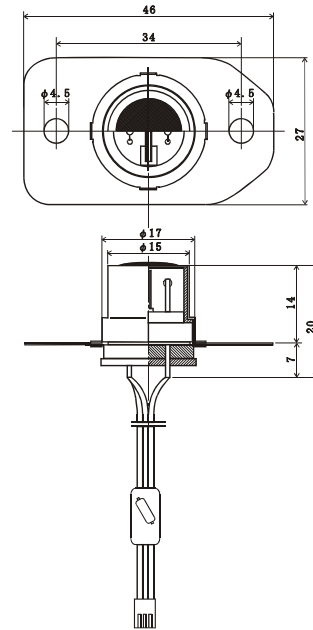
Structure of 100AH

NAP-130A

NAP-130 is a simple gas sensing unit which output voltage in air has been calibrated. When the rated DC voltage is supplied to the unit, it puts out in mV order and reaches to 0mV in the existence of around 10%LEL of methane or hydrogen gas. Calibration is done depending on users' requirements, but setting at around 10%LEL is recommended for reliable gas detection in consideration of variation of temperature/humidity and presence of tiny quantity of noise gases.

* Ratings and specifications

Item	Specifications
Supply voltage	DC 2.5 +/- 0.1V
Current	DC 150 – 170mA (2.5V is supplied.)
Ambient temperature	In operation -20 - +80 degree C In storage -20 - +70 degree C
Ambient humidity	Less than 95%RH, not dew condensation
Recommended initial insensitive time	90sec.
Response time	T90 : Less than 30sec.
Recommended calibration	10 +/- 1%LEL, Methane : 4500 – 5500ppm,Hydrogen : 3600 – 4400ppm
Acceptable calibration	5 – 25%LEL
Output in air	-27 - -33mV



Structure & appearance of NAP-130

*Terminal explanation

No.1	+2.5V	Red
2	Unused	-
3	Output (+)	Yellow
4	Output (-)	Green
5	GND.	Black

Remarks) GND. does not have to short-circuit with output (-).

This sensor is installed in outer cases of fixed type fuel cells and gas engines for the purpose of gas leakage detection. Wire length should be less than 2m long, and please do not use connectors other than our recommended ones.

NSU-131A、NSU-131AF

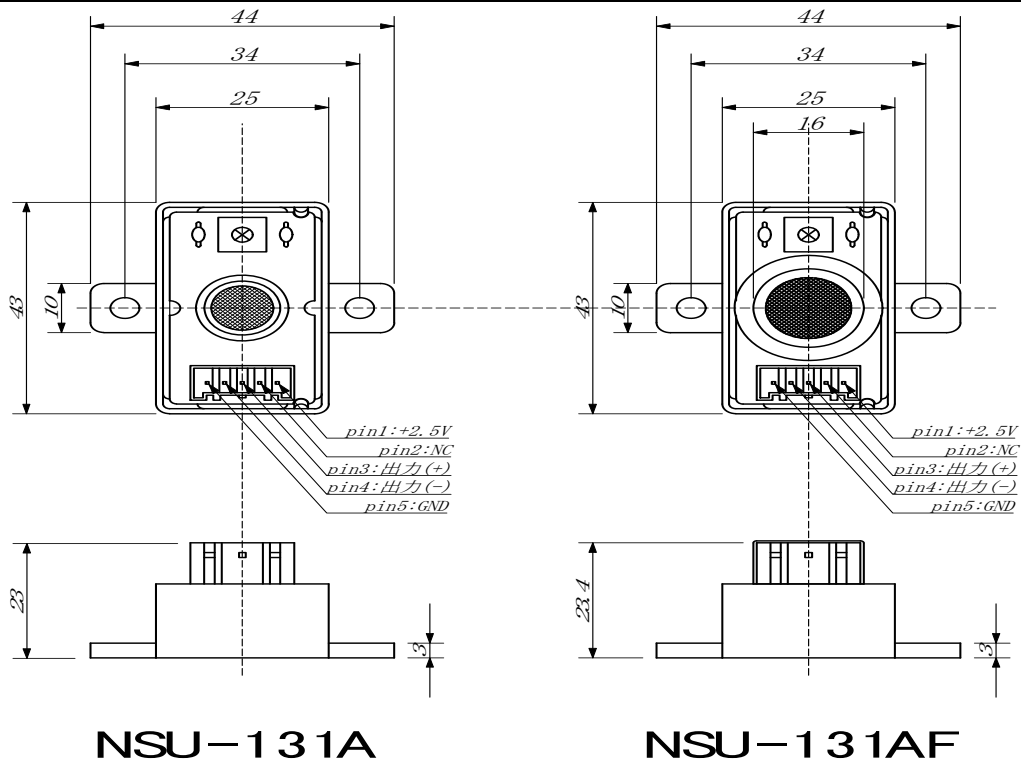
NSU-131A and 131AF are ready-for-use units with Nemoto's hot-wire type gas sensors already calibrated. Outputs are obtained in mV order when the rated DC voltage is supplied to the units. The alarm concentration is preset at 10% of LEL of natural gas or hydrogen gas, but custom calibration is available upon request.

• Ratings

items	NSU-131A	NSU-131AF
Supply voltage	DC 2.5 ± 0.1V	DC 2.5 ± 0.1V
Current when rated voltage is supplied	DC150 ~ 170mA	DC150 ~ 170mA
Ambient temperature	Usage -20 ~ +80°C Storage -20 ~ +70°C	
Ambient humidity	Usage <95%RH, Storage <95%RH (without dew condensation)	

• Standard specifications

Items	NSU-131A	NSU-131AF
Delay at initially energized	90 Seconds	
Response speed	90% response within 30 seconds	
Calibrated Alarm concentration	10 ± 1% LEL、Methane 4,500 ~ 5,500ppm, Hydrogen 3,600 ~ 4,400ppm	
Calibration range	5 ~ 25% LEL	
Output in clean air	-23 ~ -29mV	-18 ~ -22mV



• Terminals

No.1	+2.50V
2	Not used
3	Output signal (+)
4	Output signal (-)
5	GND.

Remarks) GND and output signal (-) terminals are separately provided.

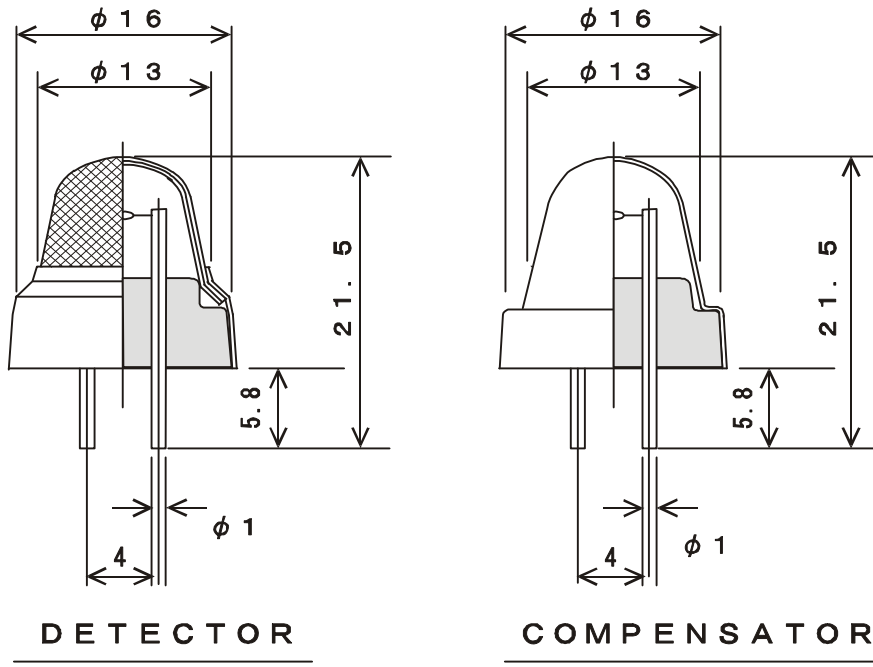
Please do not short circuit these terminals. TEL:0755-83376549 FAX:0755-83376182 E-MAIL:szss20@163.com

NAP-21A

NAP-21A is a thermal-conductive type gas sensor to detect gases making use of the variation of the thermal conductivity of a target gas. This sensor is suitable for detection of highly concentrated gases more than percent order or inert gases that are not chemically reacted.

* Ratings and Gas sensitivity

Items	NAP-21A
Supply voltage	DC 1.8 ± 0.1V
Current	120 ~ 130mA (1.8V applied)
Ambient Temp. & humidity in operation	-10 ~ +50°C, 95%RH or less
Ambient Temp. & humidity in operation	-20 ~ +60°C, 99%RH or less
CO ₂ gas sensitivity	0.2mV / %CO ₂



Structure of NAP-21A

This sensor detects the changes of outputs when the thermal conductivity of the ambient atmosphere becomes different from the conductivity of the air. More specifically, the output shifts towards (+) side when the target gas has a larger molecular weight than the air, and shifts towards (-) side in case of a smaller molecular weight. The output characteristic of this sensor shows excellent linearity to the gas concentrations that is good enough to measure concentrations up to 100%. However, this sensor is humidity-dependent (As “humidity is “steam” which makes the output shift towards (-) side.), a compensation circuit would be needed upon designing circuits. Because of these characteristics, this sensor is suitable for CO₂ gas measurement & CO₂ gas monitoring in containers for vegetables & fruits etc.

NAP-503

NAP-503 is a newly-developed version of NAP-505. The appearance and structure are exactly same as NAP-505, but this new version has a lower sensitivity to hydrogen gas. While NAP-505's sensitivity to hydrogen gas is about 40% of the sensitivity to CO gas, but NAP-503's sensitivity to hydrogen gas is only about 10% of the sensitivity to CO gas. Thus NAP-503 has much better gas selectivity. An appropriate type can be selected depending on users' applications. As there are various types of NAP-503 as shown below, please contact us for detailed information.

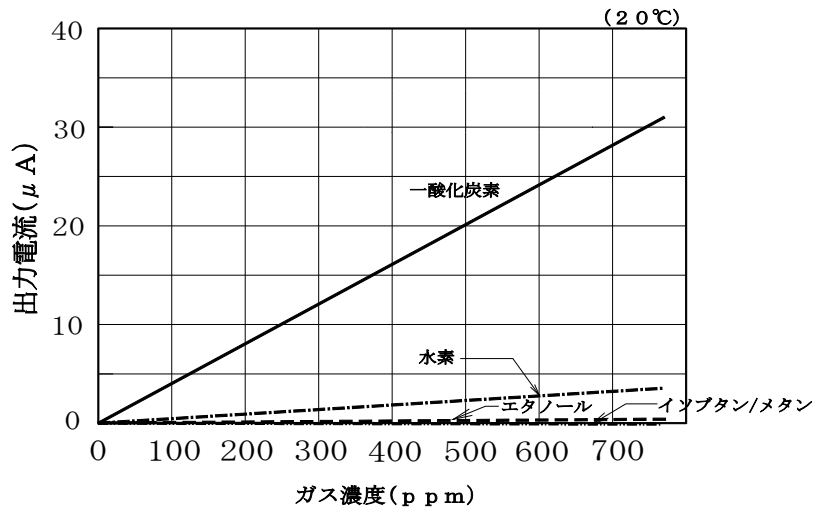
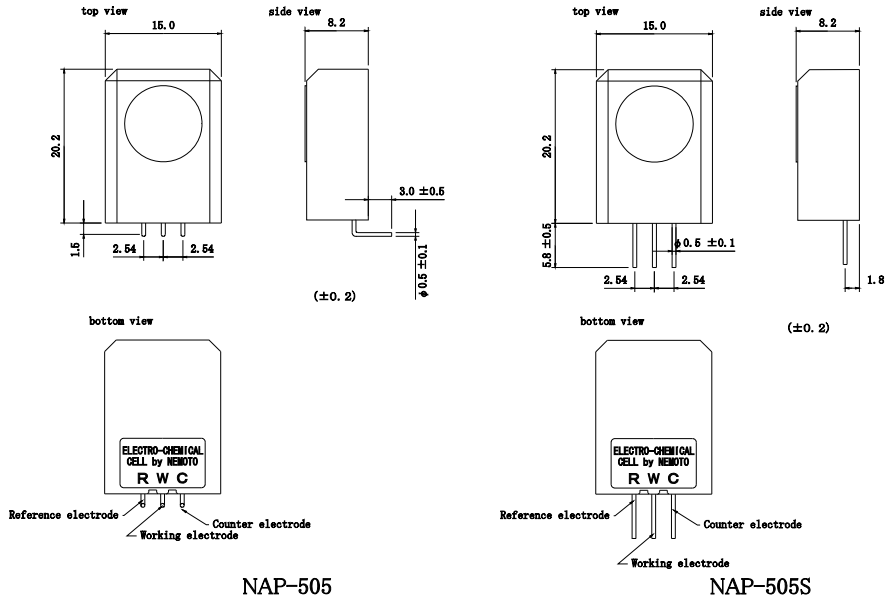


Fig. Gas sensitivity of NAP-503

• Characteristics

Detection range	CO 0 ~ 1,000ppm	Zero point drift	<10ppm (-20 ~ 50°C)
Output current	40 ± 10nA/ppmCO	Temp. & humidity	-20 ~ 50°C, 15 ~ 90%RH
Repeatability	Less than ± 2%	Span drift	Less than 5%/Year
Response time	T90: Within 30 sec.	Life	More than 5 years

NAP-505

NAP-505 gas sensor is our standard type of electrochemical CO gas sensor for a CO detector for domestic use. Detection principle is quite the same as conventional one, but quite cheaper than conventional ones due to unique structure and renovated electrodes. NAP-505 has already been approved by UL. (UL2034 – Residential CO detectors) As there are various types of NAP-505 as shown below, please contact us for detailed information.

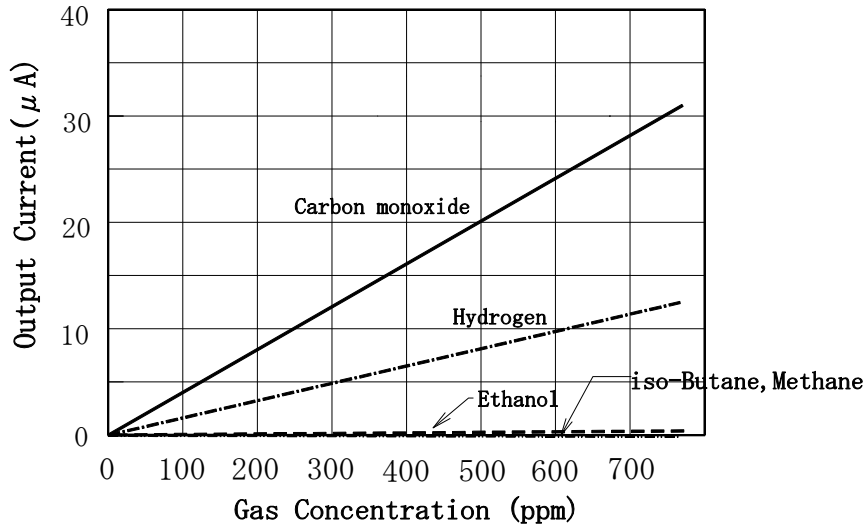
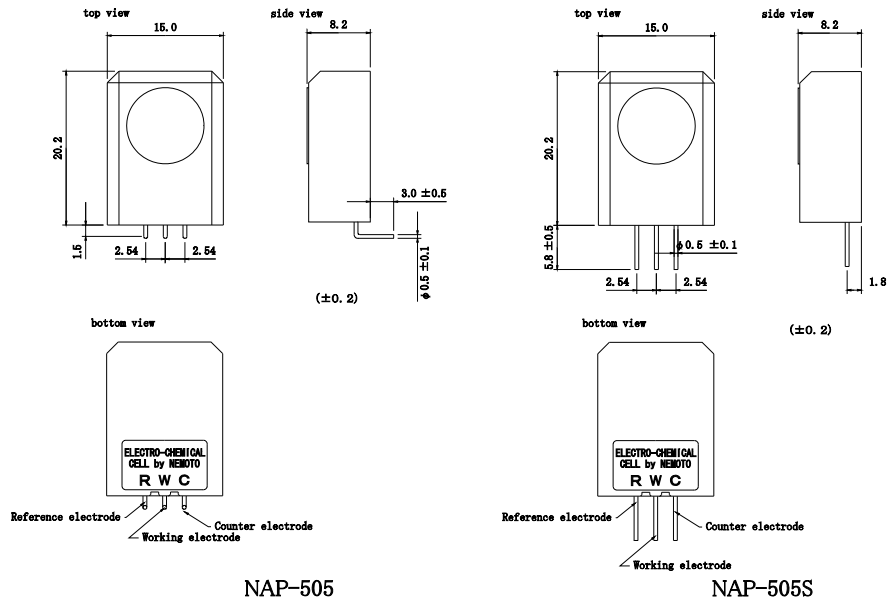


Fig. Gas sensitivity of NAP-505

• Characteristics

Detection range	CO 0 ~ 1,000ppm	Zero point drift	Below 10ppm(-20~50°C)
Output current	40 ± 10nA/ppmCO	Temp. and humidity	-20~50°C、 15-90%RH
Repeatability	Less than ±2%	Span drift	Less than 5%/year
Response time	T90 : less than 30sec.	Lifetime	Over 5 years

NAP-780

NAP-780 is a newly developed oxygen sensor with the principle of detecting voltage that is different from ordinary electric current detection type sensors. Therefore NAP-780 can be operated by a much simplified circuit compared to the ordinary type of sensors. Also as this sensor is hardly affected by CO₂ gas, it can be used for measuring oxygen concentrations in breath or monitoring the air in green houses.

• Basic feature and Ratings

Items	Features
Detection range	Oxygen 0 ~ 30%
Output voltage	6.0 ± 1.5mV (in 20°C clean air)
Response speed	T90: Less than 15 sec.
Maximum exposure concentration	Oxygen 100%
Long-term output drift	Less than 2%/month
Life	More than 2 years
Temperature in operation	-10 ~ +50°C
Humidity in operation	Less than 99%RH

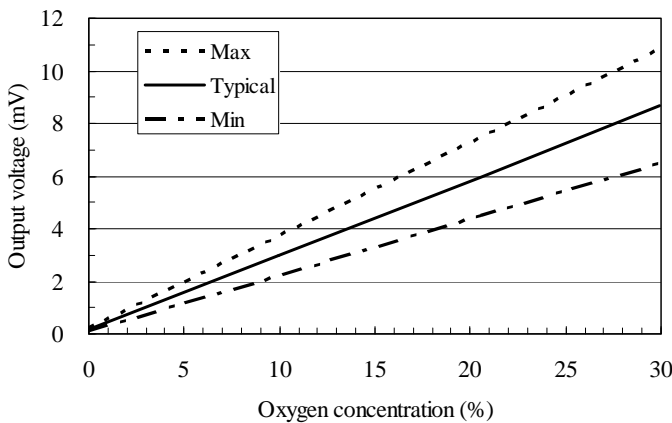


Fig. Oxygen gas concentration characteristics

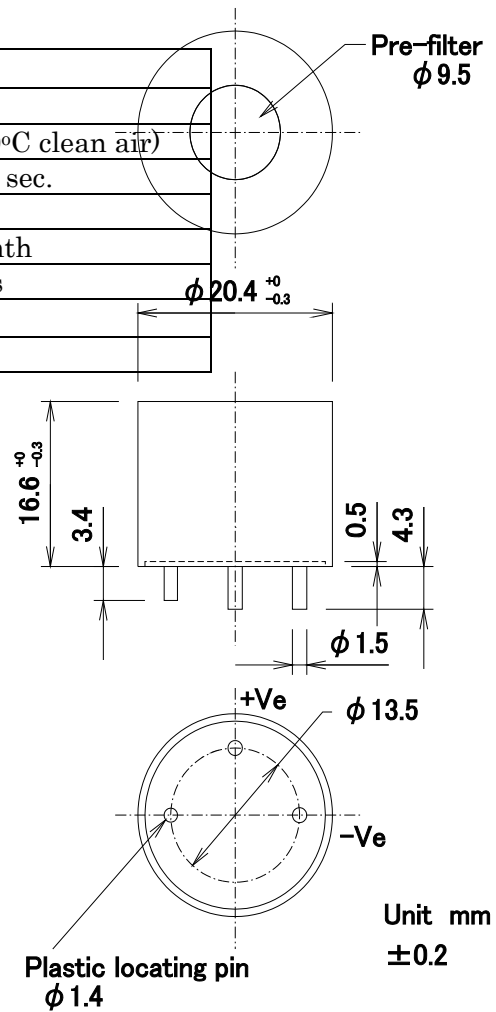


Fig. Appearance of NAP-780

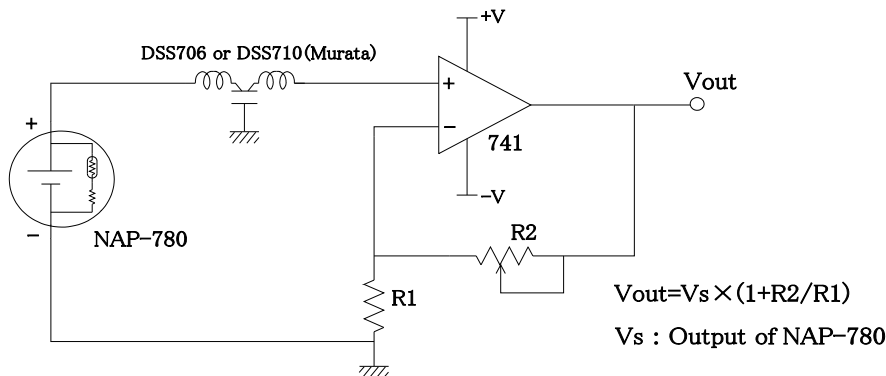


Fig. Basic measuring circuit

NAP-740

NAP-740 is a formaldehyde sensor and is recommended to use for detecting residues of formaldehyde used for sterilization and disinfection as well as for detecting formaldehyde gas generated from building materials.

• Characteristics

Items	Characteristics
Detection range	HCHO 0 ~ 50ppm
Output current	80 ± 20nA/ppm
Repeatability	Less than ± 2%
Response time	T90: Less than 30 sec.
Zero point drift	Less than 3ppm (-20 ~ 50°C)
Ambient Temp.	-20 ~ +50°C
Ambient humidity	15 ~ 90%RH

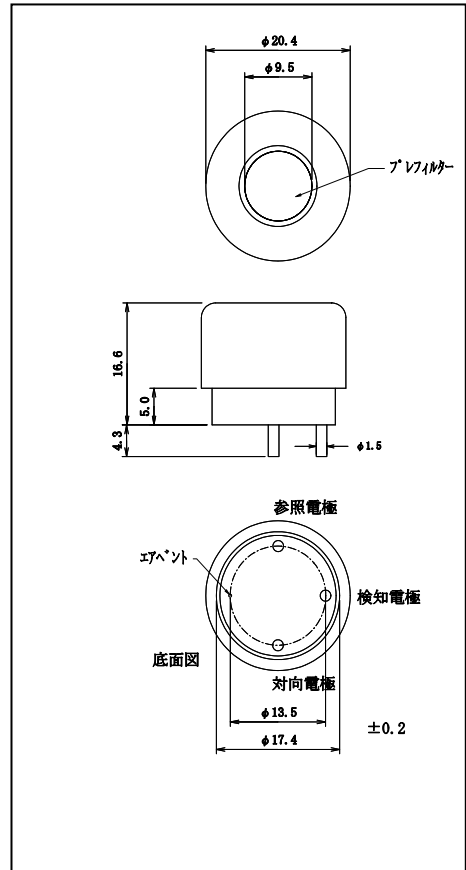
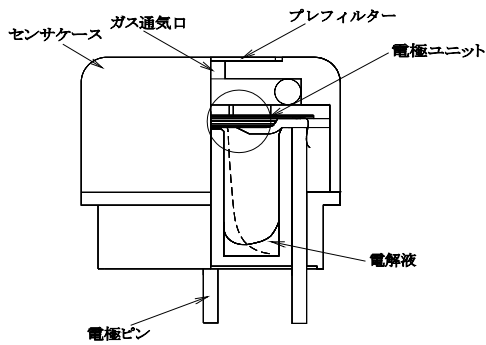


Fig. Structure of NAP-740

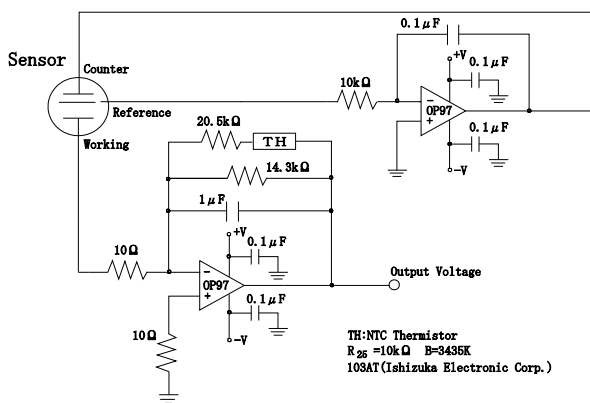
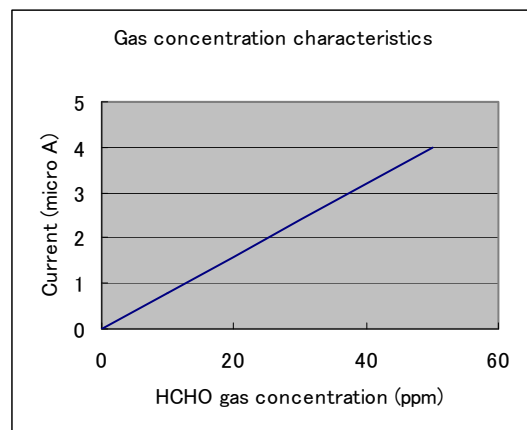


Fig. Recommended circuit

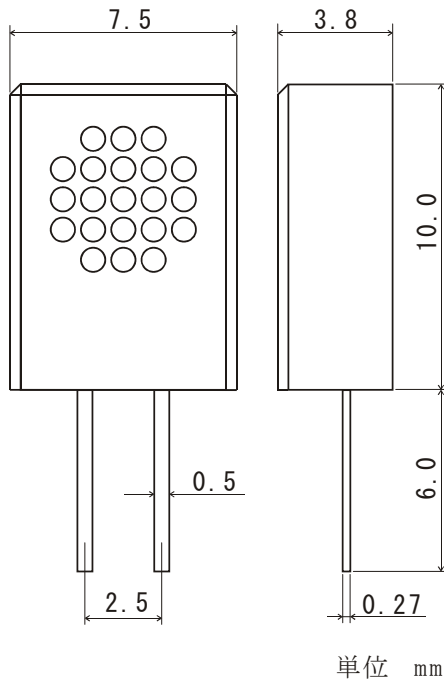


NHS-12

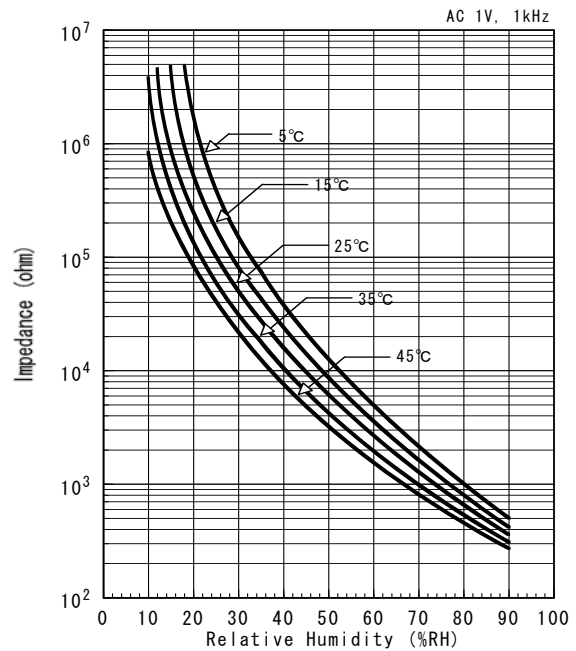
NHS-12 is a polymer type humidity sensor that keeps high performances for a longer period. This sensor has a unique feature which resistance value does not extremely increase in the lower humidity ranges. It means that very accurate measurement is possible in a wider humidity range. Additionally, just a simple measuring circuit is required because of its smaller temperature dependency and narrower distribution of resistance values.

*Specifications

Measuring range	10 ~ 90% RH
Operational temperature range	0 ~ 60 °C
Storage temperature range	-20 ~ 60 °C
Measuring accuracy	Less than ± 5% RH
Supply voltage	Less than AC 3V (AC 1V is recommended.)
Response speed	T90 : less than 60 sec.
Frequency	50 ~ 10,000Hz (1kHz is recommended.)
Housing material	ABS resin (Black)



Appearance & dimensions



Humidity characteristics

This sensor works with various flexible operational methods without strict restrictions, and has excellent resistivity to low humidity, high temperature/high humidity, and contamination by oil mists or cigarette smokes etc. The most suitable application would be for air conditioners, dehumidifiers, humidifiers, automatic dampers for green houses, etc. It is recommended to use this sensor for detecting or monitoring lower humidity ranges, such as living environment monitors, as the accuracy in higher humidity ranges may be slightly lowered. In addition to the sensor it self, a ready-for-use measuring unit (NHU-12) is also available.

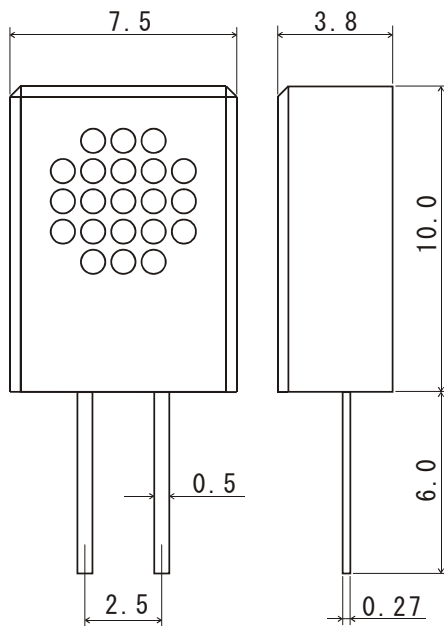
A recommended measuring circuit is available upon request.

NHS-20

NHS-20 is also a high-performance and long life high polymer type humidity sensor. Since the impedance of NHS-20 is around one digit higher than NHS-12, it shows more accuracy in high humid area than NHS-12. Additionally, just simple measuring circuit is required because of its smaller temperature dependency and narrower distribution of resistance values as same as NHS-12. Appearance and dimensions are the quite same as NHS-12.

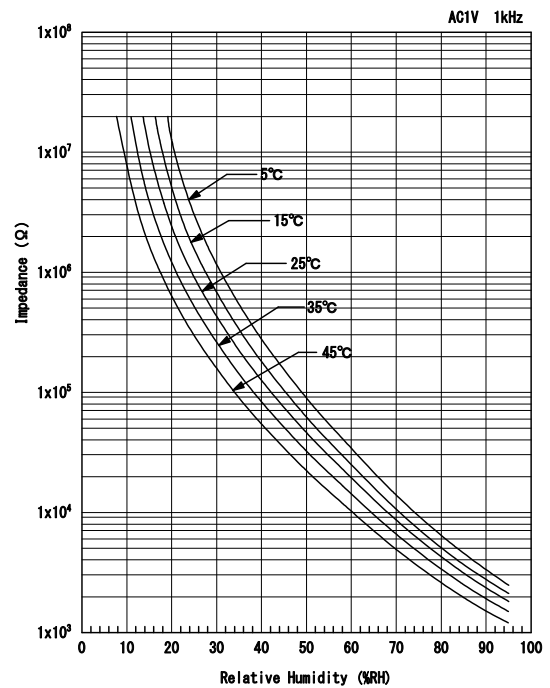
*Specifications

Measuring range	20 ~ 95% RH
Operational temperature range	0 ~ 60 °C
Storage temperature range	-20 ~ 60 °C
Measuring accuracy	Less than ± 5% RH
Supply voltage	Less than AC 3V (AC 1V is recommended.)
Response speed	T90 : less than 60sec.
Frequency	50 ~ 10,000Hz (1kHz is recommended.)
Housing material	ABS resin (Dark blue)



单位 mm

Appearance & dimensions



Humidity characteristics

This sensor works with various flexible operational methods without strict restrictions, and has excellent resistivity to low humidity, high temperature/high humidity, and contamination by oil mists or cigarette smokes etc. The most suitable application would be for air conditioners, dehumidifiers, humidifiers, automatic dampers for green houses, etc.

This sensor shows high and constant accuracy from a lower range to higher range of humidity. In addition to the sensor it self, a ready-for-use measuring unit is also available.

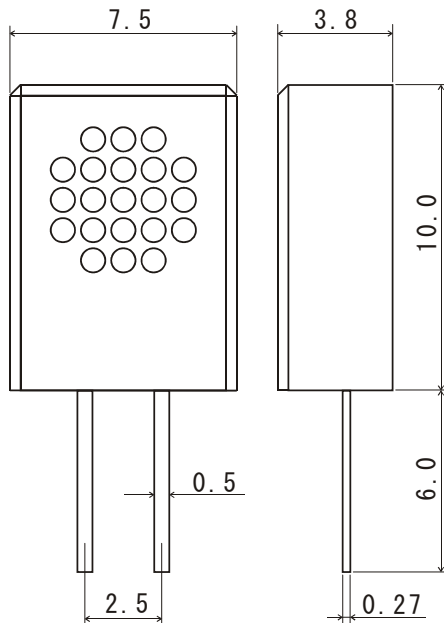
A recommended measuring circuit is available upon request.

NHS-25

NHS-25 is also a high-performance and long life high polymer type humidity sensor. The impedance and humidity characteristics are the same as NHS-20, but NHS-25 is more resistive to dew condensation than NHS-20 because the surface of polymer membrane is treated to be hydrophobic. Then, this sensor keeps the excellent performances even if experienced repeated dew condensations. Additionally, just a simple measuring circuit is required because of its smaller temperature dependence and also narrower distribution of resistance values as same as NHS-12 and NHS-20. Appearance and dimensions are same as NHS-20.

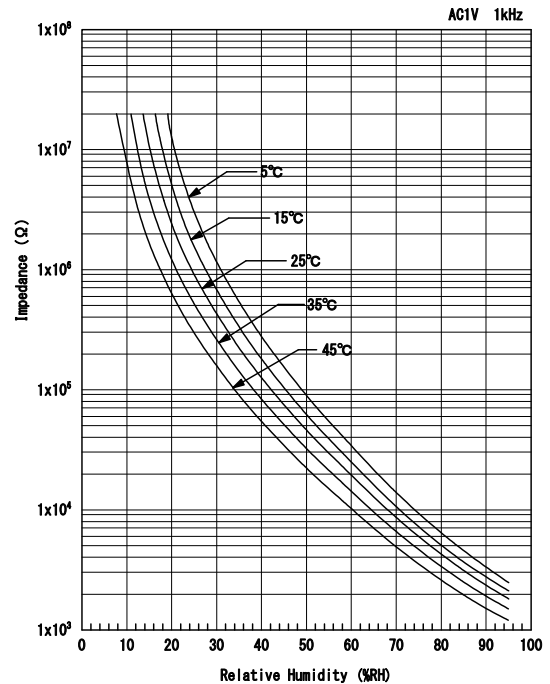
*Specifications

Measuring range	20 ~ 100% RH
Operational temperature range	0 ~ 60 °C
Storage temperature range	-20 ~ 60 °C
Measuring accuracy	Less than ± 5% RH
Supply voltage	Less than AC 3V (AC 1V is recommended.)
Response speed	T90 : less than 60 sec.
Frequency	50 ~ 10,000Hz (1kHz is recommended.)
Housing material	ABS resin (Light blue)



單位 mm

Appearance & dimensions



Humidity characteristics

This sensor can be operated with a wide operational condition range, and has excellent durability to low humidity, high temperature and high humidity, and contamination by such as oil mists or cigarette smoke. Adequate application would be for air conditioners, dehumidifiers, humidifiers, automatic dampers for green house, etc. A recommended measuring circuit is available on request. This sensor can be used for dehumidifiers and room drying apparatus. Modules for exclusive applications will be available upon request.

NIS-09C

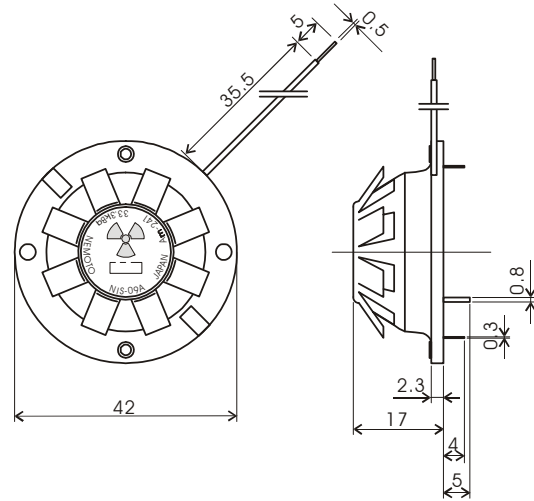
NIS-09C is an ionization type smoke sensor containing a tiny amount of ²⁴¹Am radioisotope, however, the sensor itself is fully covered by metallic housing so that no radiation leaks outside of the sensor.

* Ratings

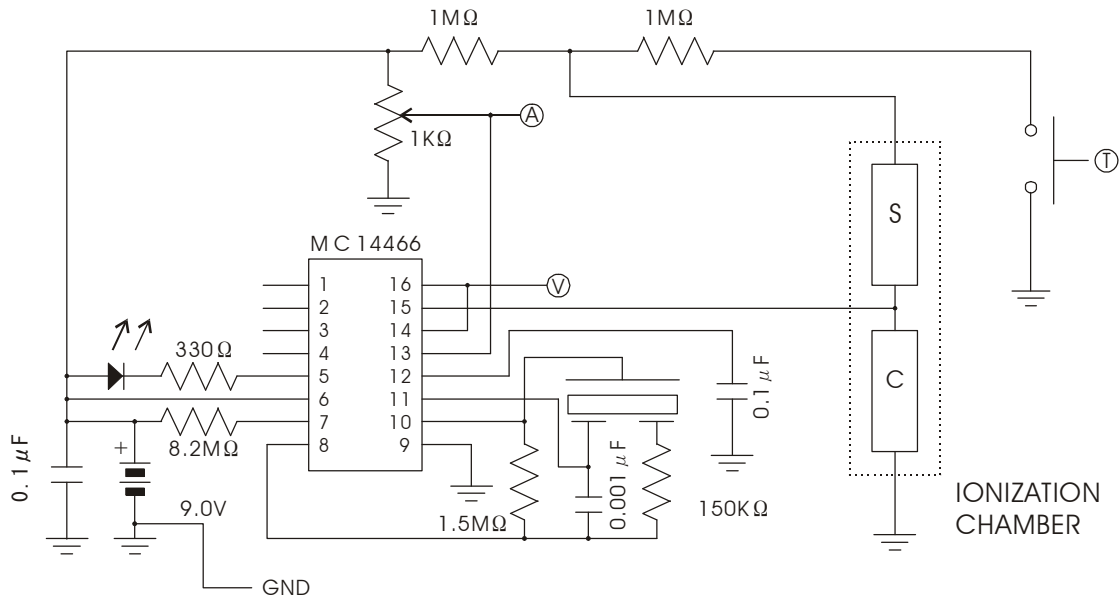
Items	Specifications
Supply voltage	Less than DC 7 ~ 12V
Current	27 ± 3pA
Radiation source	Americium-241, 33.3KBq
Ambient temp.	0 ~ 50°C
Ambient humidity	Less than 95% RH

* Characteristics

Items	Specifications
Output in clean air	5.6 ± 0.4V When 9V is supplied.
Smoke sensitivity 2%/foot Cotton thread	0.6 ± 0.1V



Structure



Recommended circuit

Remarks) The IC appeared in the above circuit, MC14466 may not be on the market any more. Compatible ICs will be MC14468, A5367, and A5368 etc.

NIS-05A

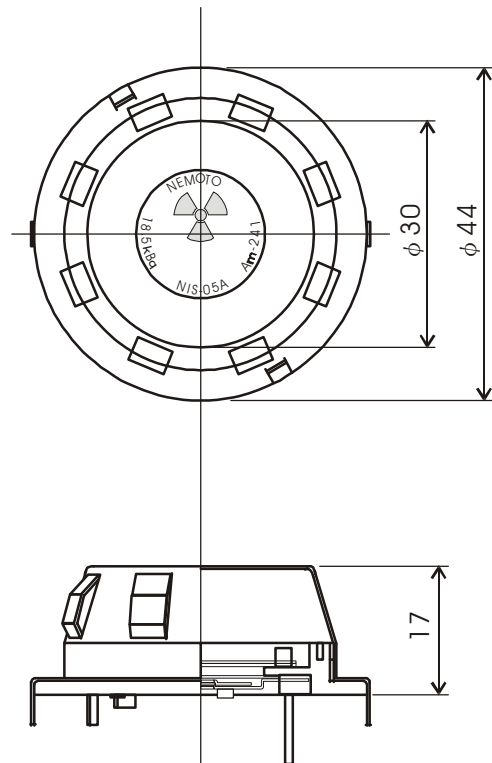
NIS-05A is also an ionization type smoke sensor. The radioisotope ^{241}Am is used as the radiation source, but the radioactivity is about 55% of NIS-09C and the whole sensor is covered with metallic housing which eliminates the fear of radiation leakage. The pin location and the performances are compatible to sensors produced by other manufacturer than Nemoto.

* Ratings

Items	Characteristics
Supply voltage	Less than DC 6 ~ 12V
Supply current	$15 \pm 3\mu\text{A}$
Radiation source	Americium-241, 18.5KBq
Ambient Temp.	0 ~ 50°C
Ambient humidity	Less than 95%RH

* Characteristics

Item	Characteristics
Output in clean air	$5.5 \pm 0.5\text{V}$ When 9V is supplied.
Smoke sensitivity 2%/foot Cotton thread	$1.2 \pm 0.3\text{V}$



Structure

The recommended circuit is the same as the one for NIS-09C.

NIS-02A

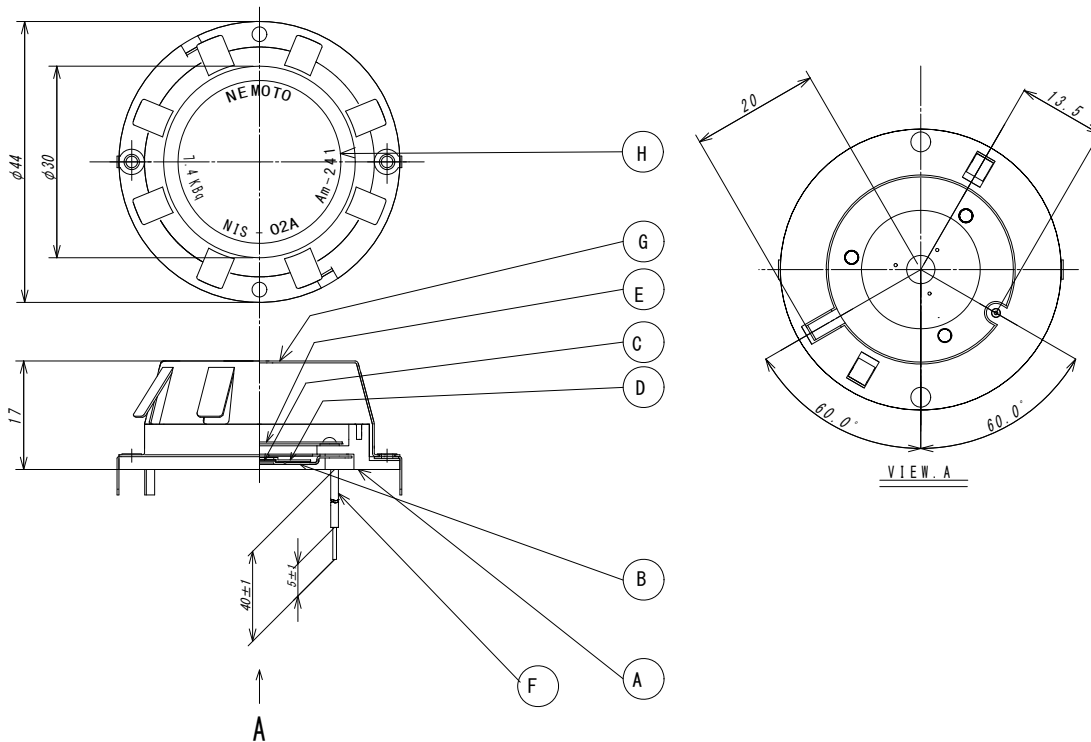
NIS-02A is the newest version of our ionization smoke chamber containing a radioisotope ^{241}Am as well. However the radioactivity is less than 10 KBq that is the border line stipulated in BSS (Basic Safety Standard) issued by IAEA (International Atomic Energy Association), therefore this sensor does not need to be treated as a radioactive product. Thus no restriction is applied on its storage, usage, and disposal. This NAP-02A is designed to have complete compatibility with NIS-05A in its dimensions, appearance, and smoke sensitivity for users' easy replacement of the smoke chamber currently used.

• Rating

Items	Values
Supply voltage	Less than DC6 ~ 12V
Current	$7 \pm 2\text{pA}$
Nuclide	Americium241, 7.4KBq
Ambient Temp.	0 ~ 50°C
Ambient humidity	Less than 95% RH

• Characteristics

Items	Values
Output in clean air	$5.5 \pm 0.5\text{V}$ When 9V is supplied.
Sensitivity, cotton thread, 2%/foot	$1.1 \pm 0.3\text{V}$



Structure of NIS-02A

NIS-02C

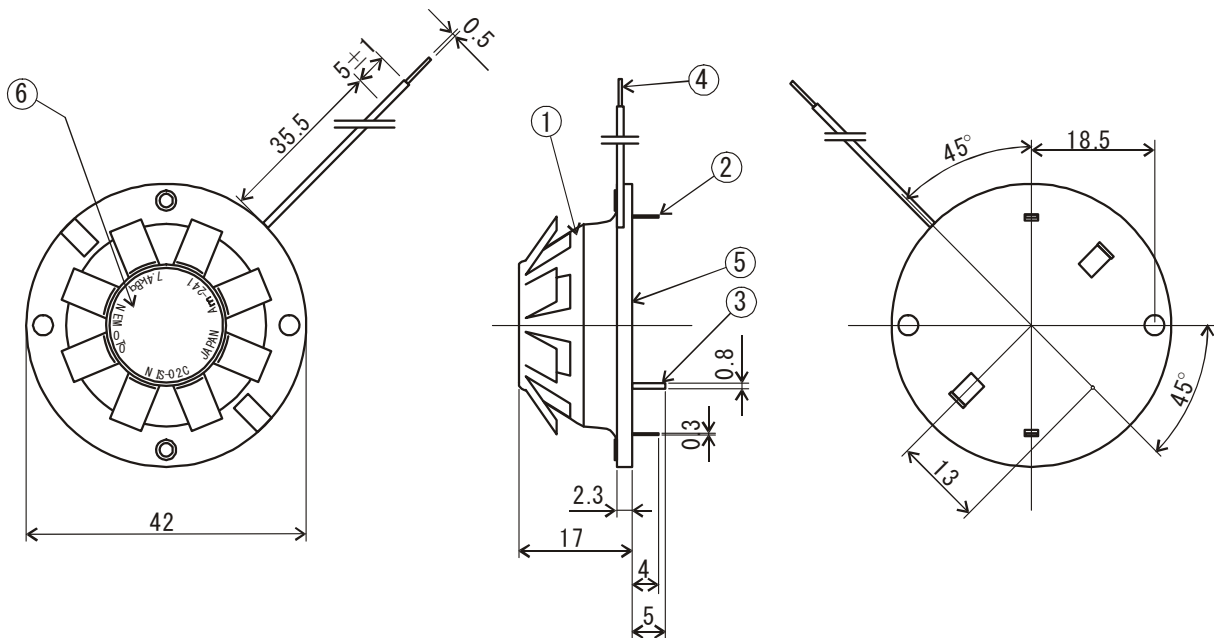
NIS-02C is the newest version of our ionization smoke chamber containing a radioisotope ^{241}Am as well. However the radioactivity is less than 10 KBq that is the border line stipulated in BSS (Basic Safety Standard) issued by IAEA (International Atomic Energy Association), therefore this sensor does not need to be treated as a radioactive product. Thus no restriction is applied on its storage, usage, and disposal. This NAP-02C is designed to have complete compatibility with NIS-09C in its dimensions, appearance, and smoke sensitivity for users' easy replacement of the smoke chamber currently used.

• Rating

Items	Values
Supply voltage	Less than DC6 ~ 12V
Current	$7 \pm 2\text{pA}$
Nuclide	Americium241, 7.4KBq
Ambient Temp.	0 ~ 50°C
Ambient humidity	Less than 95% RH

• Characteristics

Items	Values
Output in clean air	$5.6 \pm 0.5\text{V}$ When 9V is supplied.
Sensitivity, cotton thread, 2%/foot	$0.7 \pm 0.2\text{V}$



Structure of NIS-02C

SUNSTAR商斯达实业集团是集研发、生产、工程、销售、代理经销、技术咨询、信息服务等为一体的高科技企业，是专业高科技电子产品生产厂家，是具有10多年历史的专业电子元器件供应商，是中国最早和最大的仓储式连锁规模经营大型综合电子零部件代理分销商之一，是一家专业代理和分销世界各大品牌IC芯片和电子元器件的连锁经营综合性国际公司。在香港、北京、深圳、上海、西安、成都等全国主要电子市场设有直属分公司和产品展示展销窗口门市部专卖店及代理分销商，已在全国范围内建成强大统一的供货和代理分销网络。我们专业代理经销、开发生产电子元器件、集成电路、传感器、微波光电元器件、工控机/DOC/DOM电子盘、专用电路、单片机开发、MCU/DSP/ARM/FPGA软件硬件、二极管、三极管、模块等，是您可靠的一站式现货配套供应商、方案提供商、部件功能模块开发配套商。专业以现代信息产业（计算机、通讯及传感器）三大支柱之一的传感器为主营业务，专业经营各类传感器的代理、销售生产、网络信息、科技图书资料及配套产品设计、工程开发。我们的专业网站——**中国传感器科技信息网（全球传感器数据库）www.SENSOR-IC.COM** 服务于全球高科技生产商及贸易商，为企业科技产品开发提供技术交流平台。欢迎各厂商互通有无、交换信息、交换链接、发布寻求代理信息。欢迎国外高科技传感器、变送器、执行器、自动控制产品厂商介绍产品到**中国**，共同开拓市场。本网站是关于各种传感器-变送器-仪器仪表及工业自动化大型专业网站，深入到工业控制、系统工程计 测量、自动化、安防报警、消费电子等众多领域，把最新的传感器-变送器-仪器仪表买卖信息，最新技术供求，最新采购商，行业动态，发展方向，最新的技术应用和市场资讯及时的传递给广大科技开发、科学研究、产品设计人员。本网站已成功为石油、化工、电力、医药、生物、航空、航天、国防、能源、冶金、电子、工业、农业、交通、汽车、矿山、煤炭、纺织、信息、通信、IT、安防、环保、印刷、科研、气象、仪器仪表等领域从事科学研究、产品设计、开发、生产制造的科技人员、管理人员、和采购人员提供满意服务。**我公司专业生产、代理、经销、销售各种传感器、变送器、敏感元器件、开关、执行器、仪器仪表、自动化控制系统：**专门从事设计、生产、销售各种传感器、变送器、各种测控仪表、热工仪表、现场控制器、计算机控制系统、数据采集系统、各类环境监控系统、专用控制系统应用软件以及嵌入式系统开发及应用等工作。如热敏电阻、压敏电阻、温度传感器、温度变送器、湿度传感器、湿度变送器、气体传感器、气体变送器、压力传感器、压力变送、称重传感器、物（液）位传感器、物（液）位变送器、流量传感器、流量变送器、电流（压）传感器、溶氧传感器、霍尔传感器、图像传感器、超声波传感器、位移传感器、速度传感器、加速度传感器、扭距传感器、红外传感器、紫外传感器、火焰传感器、激光传感器、振动传感器、轴角传感器、光电传感器、接近传感器、干簧管传感器、继电器传感器、微型电泵、磁敏（阻）传感器、压力开关、接近开关、光电开关、色标传感器、光纤传感器、齿轮测速传感器、时间继电器、计数器、计米器、温控仪、固态继电器、调压模块、电磁铁、电压表、电流表等特殊传感器。同时承接传感器应用电路、产品设计和自动化工程项目。

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地址：深圳市福田区福华路福庆街鸿图大厦1602室

电话：0755-83607652 83376489 83376549 83370250 83370251 82500323

传真：0755-83376182 (0) 13902971329 MSN: SUNS888@hotmail.com

邮编：518033 E-mail: szss20@163.com QQ: 195847376

深圳赛格展销部：深圳华强北路赛格电子市场2583号 电话：0755-83665529

技术支持：0755-83394033 13501568376