

SUCTION TYPE GAS DETECTOR

PE-2CC

PE-2DC

Instruction Manual

- Keep this manual for easy reference.
- Carefully read this manual prior to use.
- This manual describes the standard model. If your unit has end-user-specific options, this manual will be superseded by your delivery specifications.



NEW COSMOS ELECTRIC CO., LTD.

Instruction Manual No.

GAE-122-01

March 2023

Table of Contents

| | |
|---|----|
| 1. Introduction..... | 1 |
| 2. General Precautions..... | 2 |
| 3. Package Contents | 3 |
| 4. Unit Dimensions and Components | 4 |
| 5. Installation | 5 |
| 6. Wiring | 8 |
| 6-1. Wiring Connection..... | 8 |
| 6-2. Wiring and Connection | 11 |
| 7. Before Use | 13 |
| 7-1. Precautions during Use..... | 13 |
| 7-2. When an alarm is activated..... | 13 |
| 8. Maintenance..... | 14 |
| 8-1. Routine Check..... | 14 |
| 8-2. Annual Inspection | 15 |
| 8-3. Calibration Gas Preparation | 15 |
| 8-4. Gas Sensor Replacement | 17 |
| 8-5. Filter Replacement | 19 |
| 8-6. Manifold Plate Cleaning | 19 |
| 9. Specifications | 21 |
| 10. Warranty..... | 21 |
| 11. Detection Principles..... | 22 |
| 11-1. Catalytic Combustion Sensor | 22 |
| 11-2. Hot Wire Semiconductor Sensor | 22 |
| 11-3. Thermal Conductivity Sensor..... | 23 |
| 12. Glossary | 24 |

1. Introduction

Thank you for purchasing the New Cosmos PE-2CC/PE-2DC suction type gas detector.

To ensure reliable operation, please read this instruction manual prior to use.





The difference between PE-2CC and PE-2DC is the power source for the pump. The PE-2CC requires 100 VAC, while the PE-2DC requires 24 VDC for the pump's power source.

This gas detector can detect one of a variety of gases including combustible gases by installing one of the three sensor types, catalytic combustion sensor, hot wire semiconductor sensor, and thermal conductivity sensor.

Prior to use, please read the indicator unit's instruction manual. This unit is paired with an indicator unit (e.g., V2, V3), and these pairs can be used in conjunction with one alarm unit (e.g., VAL, VAS) to form a gas alarm system (e.g., UV-810). Install the gas detector at a location where detection of the target gas is necessary, and install the indicator unit at a location that is convenient for monitoring gas concentrations. The indicator unit displays the gas concentration detected by the corresponding gas detector on its bar graph display. In a paired setup, the indicator unit produces a visual alarm when the gas detector detects a concentration of the target gas that is higher than the preset limit. In a gas alarm system setup, the alarm unit produces audio-visual alarms, if the gas detector detects a leak of the target gas that is higher than the preset limit.

Symbols Used in this Instruction Manual

This manual uses Danger, Warning, Caution and Note symbols to draw attention to procedures, materials, methods, and processes, which require particular attention.

| | |
|--|---|
|  DANGER | Indicates an imminently hazardous situation that can result in death or serious injury. |
|  WARNING | Indicates a potentially hazardous situation that may result in death or serious injury. |
|  CAUTION | Indicates a hazardous situation that may result in minor injury or property damage. |
|  NOTE | Provides information on product handling. |

2. General Precautions

Carefully read this manual prior to use.

Follow the precautions below to ensure safe operation.

Only wire/install/use this product in accordance with applicable laws and regulations.

Only a qualified electrician with knowledge of wiring and installation procedures should perform wiring and installation.

For explosion-proof wiring and installation, only a qualified electrician with knowledge of explosion-proof components/installation procedures should perform wiring and installation.

WARNING

- Ground the product to prevent electric shocks.
- To prevent electric shocks, turn off the indicator unit or gas alarm system, or remove the power supply during wiring/installation/removal of the gas detector.
- To prevent lightning strikes, countermeasures against lightning should be taken on the power lines and cables installed outdoors.

CAUTION

- Do not disassemble, modify, or alter the structure of this unit or its electrical circuits. Doing so may compromise the performance of the product.
- This product is not drip-proof equipment, and should be kept away from splashing water.

3. Package Contents

This product is packed and shipped with the utmost care. If any items are missing or damaged, please contact New Cosmos or its distributor for replacement.

| Item | Qty. |
|---|----------------|
| Gas detector (PE-2CC or PE-2DC) | Per your order |
| Instruction manual (this document) | 1 per order |
| Filter unit (FC-32), with included flow meter | 1 per detector |
| Collecting cone (pipe flare) (PF-N3) *1 | 1 per detector |
| Hex wrench set (M2, M4, M5, and M8) | 1 per order |
| Hex screw (M6×25) with nut and washer | 4 per detector |
| Crimping terminal (V-1.25-F3, red color) | 6 per detector |

*1. The collecting cone is used by connecting it to the end of sampling pipe for water deflection purposes while raining or sprinkling, and should not be used for sampling gas in an enclosed area (e.g., inside duct, furnace, or device enclosure).

Optional items

| Item | Qty. |
|-----------------------------|----------------|
| Protective cover (PW-51) *2 | Per your order |
| Auto drain (AD-40) *3 | Per your order |

*2. Used on an outdoor installation.

*3. Auto drain is to automatically drain condensation formed while sampling gas at the furnace or piping pit.

4. Unit Dimensions and Components

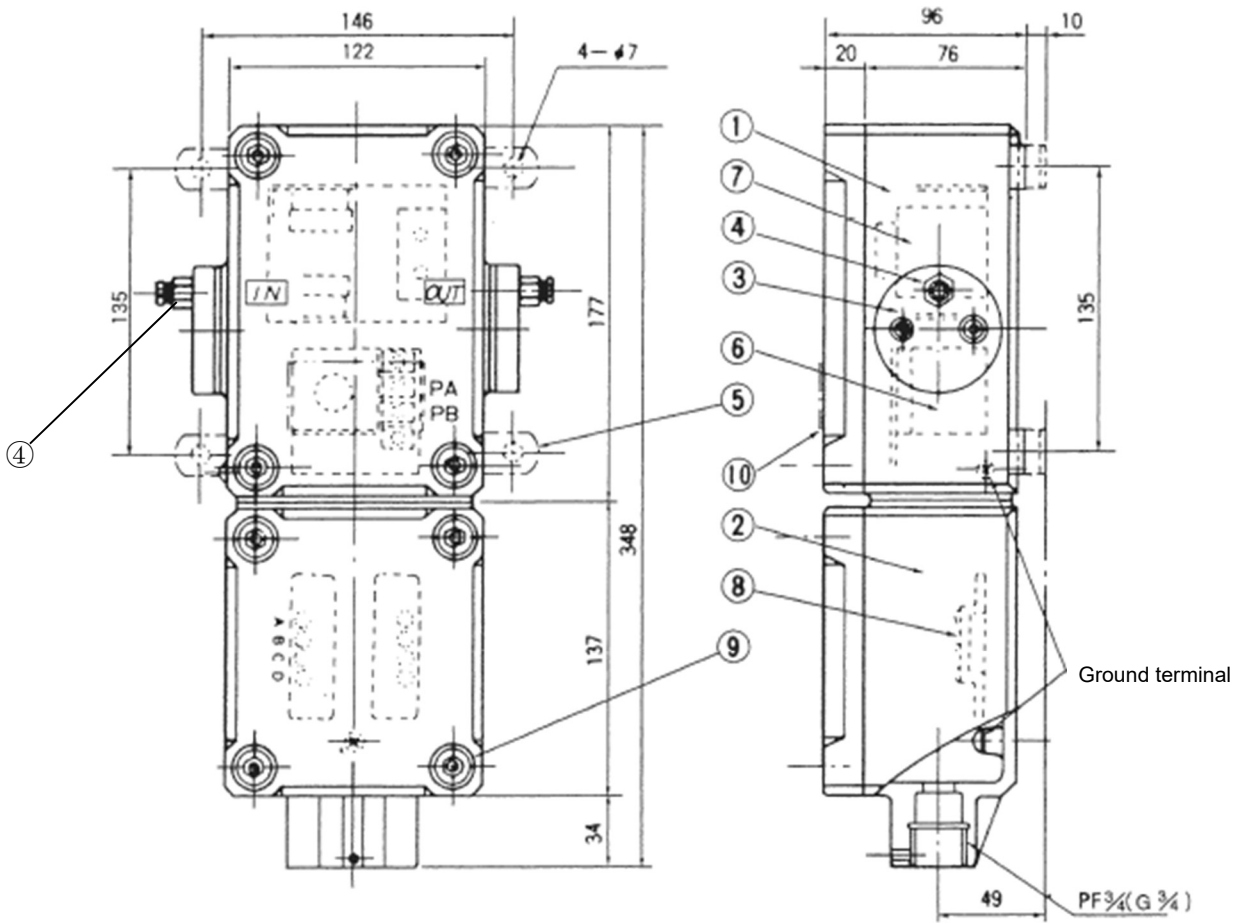


Figure 1. Outer Appearance

| Item | Component | Qty. | Description |
|------|------------------|------|-----------------|
| 1 | Case | 1 | |
| 2 | Terminal case | 1 | |
| 3 | Manifold plate | 2 | |
| 4 | Half joint | 2 | PT1/8(Rc1/8) ø6 |
| 5 | Mounting bracket | 2 | |
| 6 | Gas sensor | 1 | |
| 7 | Suction pump | 1 | |
| 8 | Terminal block | 2 | |
| 9 | Hex screw (M10) | 8 | |
| 10 | Name plate | 1 | |

5. Installation

CAUTION

- Joint surfaces are important members for ensuring the explosion-proof performance of the product. Do not damage or strike joint surfaces during installation. Keep joint surfaces clean and free from any damage. Contaminates such as scratches, fingerprints, dirt and oil may adversely affect the explosion-proof characteristics of the product.
- The pipe material (dia. 6/4) connected to the detector, should be suitable for the target gas. The pipe length should be 30m or less.
- Do not install the gas detector in the following conditions
 - Ambient temperature is outside the specified operating temperature range of -10°C to +40°C (-10°C to +70°C if your unit has the heat-proof option).
 - Condensation prone areas
 - Exposure to water spray
 - Presence of corrosive gas
 - Exposure to sunlight
 - Sudden temperature changes
 - In the vicinity of equipment which can generate high frequencies or a magnetic field
- Install the gas detector in a place free from vapor containing silicon compounds. Not doing so may compromise the gas sensor's performance.
- Install the gas detector in a place free from vibration.
- Avoid impacts to the gas detector.
- Use a protective cover (PW-51, sold separately) for outdoor installation.
- Use an auto drain (AD-40, sold separately) when installing the suction type gas detector in a place where it may draw water, e.g., near a vapor outlet.
- The detector should be installed in accordance with applicable laws and regulations. Refer the table below (Installation Height table) to determine the installation height of the sampling port based on the specific gravity of the target gas. Install the gas detector in a place where the target gas is likely to accumulate and the detector can be easily accessed for maintenance or inspection.
- The atmospheric pressure in a gas sampling location should be $\pm 1\text{kPa}$. If $\pm 1\text{kPa}$ is exceeded, consult with New Cosmos or its authorized representative.
- When exhausting the emission by connecting the gas detector's exhaust outlet to a duct etc., the back-pressure should be 1kPa or less.

Installation Height

| Gas type | Installing height | Remarks |
|---|---------------------------------|--|
| Gas heavier than air (e.g., LPG) | Maximum of 10cm above the floor | Determine the height by considering easy maintenance and inspection. |
| Gas near the specific gravity as air (e.g., Carbon monoxide) | 75 to 150 cm above the floor | Determine the height by considering the specific gravity of the target gas and mounting environment. |
| Gas lighter than air (e.g., Natural gas and hydrogen) | Near the ceiling | Determine the height by considering layout (e.g., scaffold) for easy maintenance. |

Install the detector's gas sampling port in the following places which are not easily accessed for maintenance or inspection, while the gas detector itself should be installed in a place that is easily accessible.

- (1) Inside a piping pit or at an enclosed place
- (2) in a furnace
- (3) At high or low temperature
- (4) At an elevated location

Connecting the Sampling Pipe to Gas Detector

Use pipes (dia. 6/4) suitable for the gas to be detected. Connect the pipe to the gas detector with a half joint (2 locations, gas in and out). Two joints with sleeve and nut for copper piping (dia.6/4) are pre-installed when shipped.

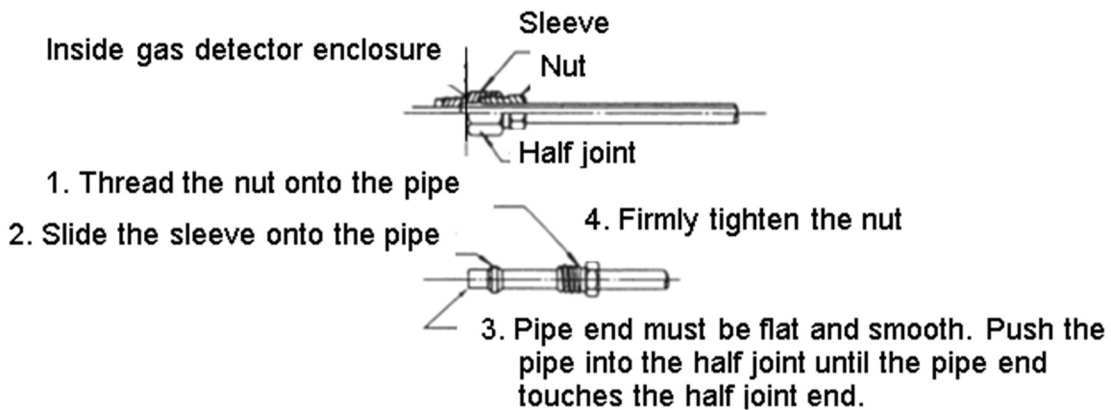


Figure 2. Pipe Connection with Half Joint

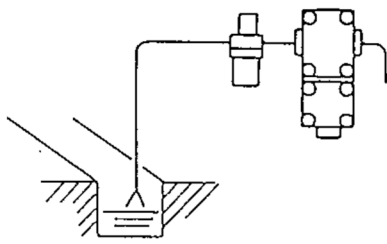


Figure 3. In Piping Pit

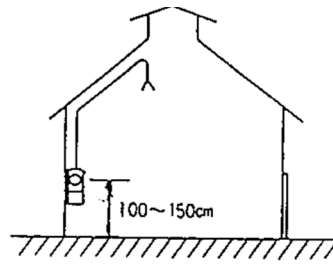


Figure 4. At Elevated Location

⚠ CAUTION

Install the collecting cone above any water so that it will not be drawn in.

Protective Cover and Auto Drain Installation

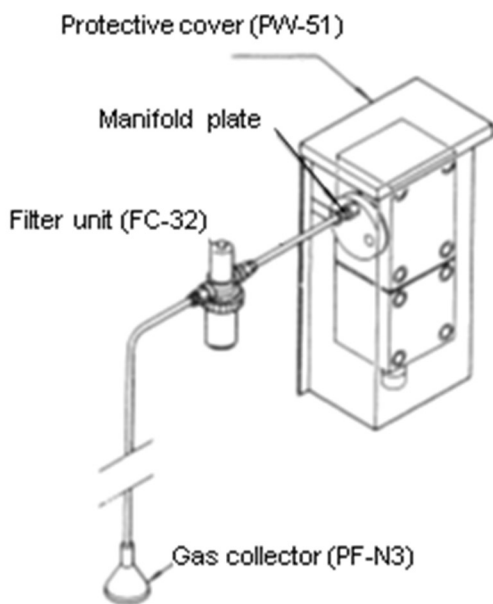


Figure 5. Protective Cover

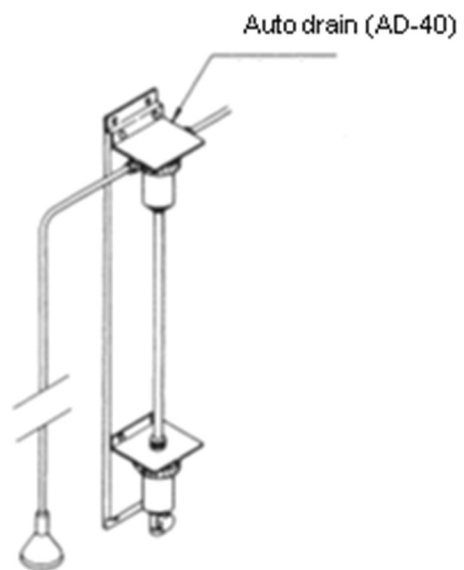


Figure 6. Auto Drain

⚠ CAUTION

Secure the protective cover in the event of forecasted high winds, storm, or a typhoon. E.g. tether, string, or lash.

6. Wiring

Please refer to the indicator unit's instruction manual along with this manual.

6-1. Wiring Connection

Perform explosion-proof enclosure wiring when installing the gas detector in a hazardous area.

(1) Wiring up to this product (here explained in case of using rigid steel conduits method)

CAUTION

- Only perform wiring and installation of this product in accordance with applicable laws and regulations.
- Only a qualified electrician with knowledge of components/installation procedures should perform wiring and installation.
- For explosion-proof wiring and installation, only a qualified electrician with knowledge of explosion-proof components/installation procedures should perform wiring and installation.
- Only use separate insulated wires when using the explosion-proof rigid steel conduit method (do not use a bundled cable).
- Use the appropriate rubber, vinyl, or polyethylene insulated wires based on the ambient humidity and temperature.
- Sheath all wires used in rigid steel conduits (JIS C 8305). To prevent the formation of a flame path for explosive gas or fire inside the conduits, use conduit sealing fittings filled with compounds.
- Do not use silicon type compounds for sealing the conduits. Doing so may compromise the performance of the gas sensor.
- When flexibility is required, use explosion and water proof flexible conduits. Rain or other liquid entry inside the gas detector may cause a function loss or malfunction of the detector.
- Waterproof joints between conduits, fittings and joint boxes. Rain or other liquid entry inside the gas detector may cause a function loss or malfunction of the detector.

Note

Use parallel pipe threads (JIS B 0202) for connections between conduits, fittings, and joint boxes. This gas detector comes with PF3/4 female threads (G3/4). Engage at least five threads per connection, and then firmly tighten with a lock nut.

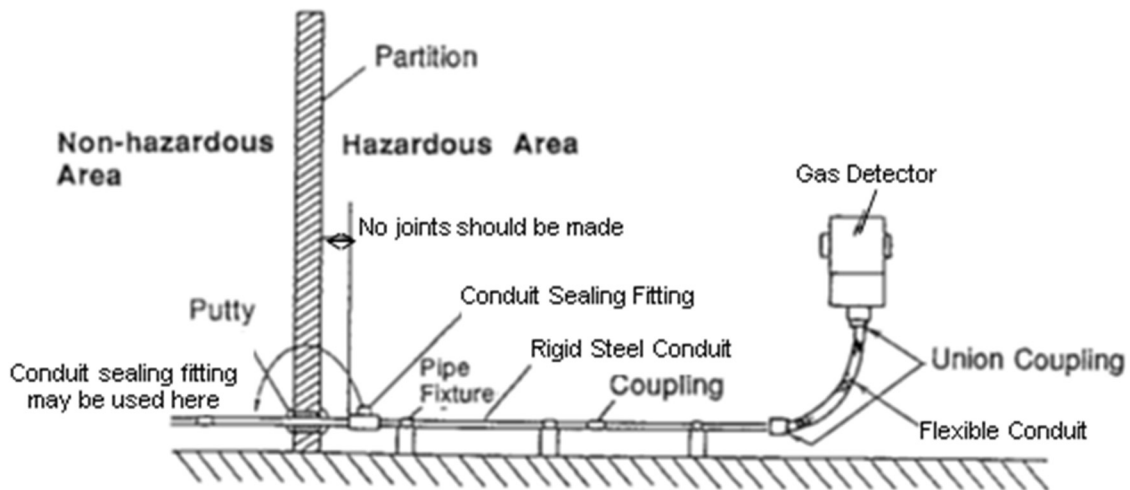


Figure 7. Typical Layout

(2) Wiring connection to this product

There are two wiring connection methods, rigid steel conduit method and pressure-resistant gasket type cable gland method. Below is the pressure-resistant gasket type cable gland method.

- Use a rubber, plastic or metal sheathed cable appropriate to the installation environment. The cable should have a circular cross section and its outer surface should be smooth and even. For protection, the cable may be sheathed in a protective casing, such as a metal conduit or carbon steel pipe. Other protective structures such as metal or concrete ducts are also acceptable.
- Connecting a cable to another cable outside the gas detector is not recommended. Direct or branching connections of cables should be done inside the gas detector or explosion-proof terminal box.

- Use cable whose outer diameter matches the inner diameter of the gasket by referring to the table below. Fully tighten the cable gland, to prevent the formation of a flame path for explosive gas or fire.

| Cable outer dia. | Gasket inner dia. | Washer inner dia. |
|------------------|-------------------|-------------------|
| 12 -12.9 | 13 | 14 |
| 13 -13.9 | 14 | 14 |
| 14 -14.9 | 15 | 15 |

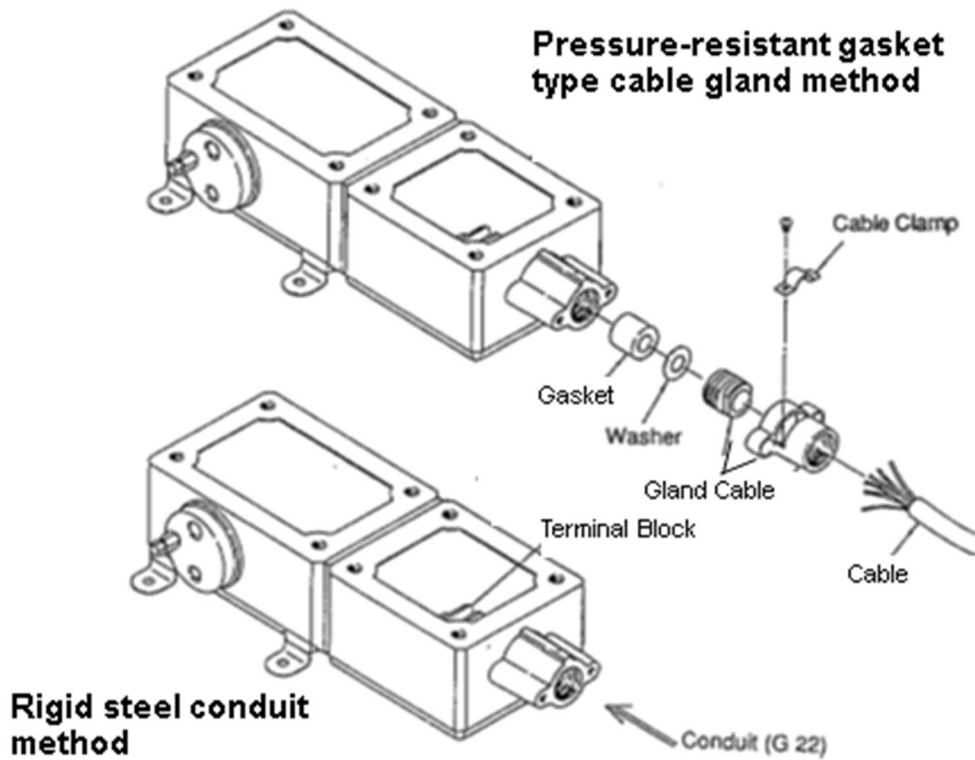


Figure 8. Gas Detector Connections

6-2. Wiring and Connection

(1) When connecting the power line,

Use a dedicated breaker for the power line going to the indicator unit which is connected to the gas detector.

(2) When connecting power and signal lines between the gas detector and indicator unit,

Use a cable, such as a 600V vinyl insulated (IV), VCT or CVV cable (with 0.75mm² to 2.0mm² wires).

Note

Ensure that the load resistance of the signal line, including the resistance of the wire, is 10 ohm or less. Refer to below for cable length.

0.75 mm² cable: 400m or less

1.25 mm² cable: 600m or less

2.00 mm² cable: 1km or less

⚠ WARNING

- Before opening any part of the gas detector, turn off the indicator unit connected to the gas detector to eliminate possible source ignition.
- Ground the gas detector to prevent electrical shocks.

⚠ CAUTION

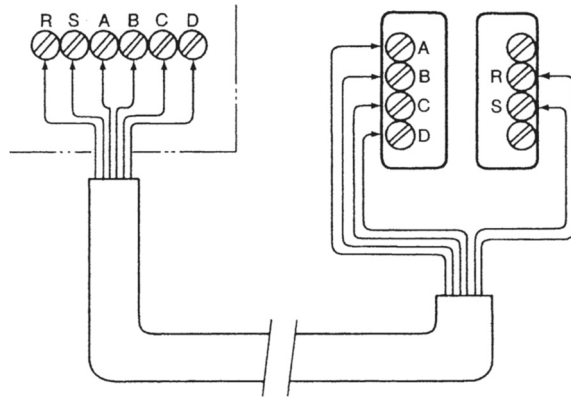
- Refer to the terminal markings to ensure that the wires are correctly connected between an indicator unit and a gas detector.
- Keep the connection cable (power/signal lines to gas detectors/alarm unit/indicator units) away from other power lines.
- Only perform wiring and installation of this product in accordance with applicable laws and regulations. Refer to 6-1. "Wiring Connection".
- When connecting the pump power lines to the PE-2DC unit, ensure that the polarity is correct. Connect so that the PA and PB terminals should be respectively positive and negative.
- The required power supply for the pump is different between PE-2CC and PE-2DC. 100VAC is required by PE-2CC and 24VDC by PE-2DC. Wire the correct source.

Note

Remove the sticker from the pump power terminals of the indicator unit, then connect the gas detector's pump power lines to them.

Indicator Unit Terminal Block

Gas Detector Terminal Block

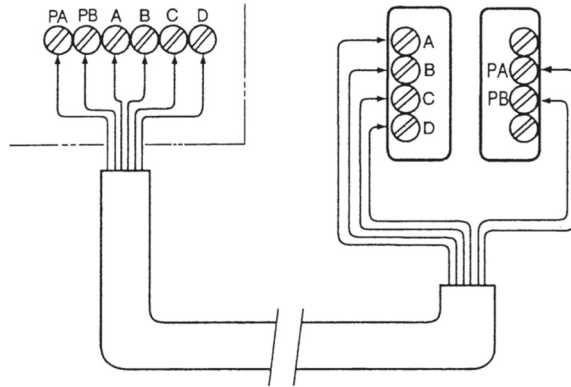


| | |
|---|---------------|
| R | Pump Power |
| S | Supply AC100V |
| A | Gas Detector |
| B | |
| C | |
| D | |

Figure 9. PE-2CC Wiring Diagram

Indicator Unit Terminal Block

Gas Detector Terminal Block



| | |
|--------|--------------|
| PA (+) | Pump Power |
| PB (-) | Supply 24VDC |
| A | Gas Detector |
| B | |
| C | |
| D | |

Figure 10. PE-2DC Wiring Diagram

7. Before Use

 **CAUTION**

Before turning on the unit, check that all the components are connected correctly. The markings on the indicator unit and gas detector must match.

7-1. Precautions during Use

 **DANGER**

Do not place your face closer to the exhaust port of the gas detector. Deoxygenated air or gas harmful to humans may be inhaled.

7-2. When an alarm is activated

 **DANGER**

Remain calm and check that there is no fire present. Do not touch any electric switches under any conditions. Sparks caused by turning on or off electric switches may cause an ignition.

 **CAUTION**

If there is a gas leak alarm, take the necessary measures specified by your company.

8. Maintenance

Routine checks are carried out by the user, while annual inspections are performed by New Cosmos or its authorized representative.

8-1. Routine Check

(1) Visual check (min. one per month)

- Check the gas detector for corrosion.
- Check the mounting brackets, screws, fittings, piping, etc. for corrosion.

Visually check and replace any worn or damaged parts.

(2) Flow rate check (min. one per month)

Measure the flow rate with the filter unit (FC-32).

A flow rate greater than 0.7 l/min, indicates a normal flow rate.

If the flow rate is lower, the probable cause is clogging at the following locations. Visually check the locations below for clogging and clean or replace the parts as needed.

- Sampling port (collecting cone)
- Sampling pipe
- Manifold plate
- Filter

If the flow rate does not change after filter replacement, check the sampling port, pipe, and manifold plate for problems. Replace the suction pump with a new one if needed.

(3) Alarm test by using an actual gas (min. every 2 or 3 months)

Remove the cap from the filter unit (FC-32). Connect a gas bag (which contains calibration gas) to the inlet port of the filter unit. Apply the calibration gas into the inlet port and check the operation of the alarm. Refer to Figure 11.

For the method on how to prepare the calibration gas, refer to 8-3. "Calibration Gas Preparation".

(4) Check gas detector surroundings

Ensure that there is no obstacle around the sampling port which may prevent gas detection.

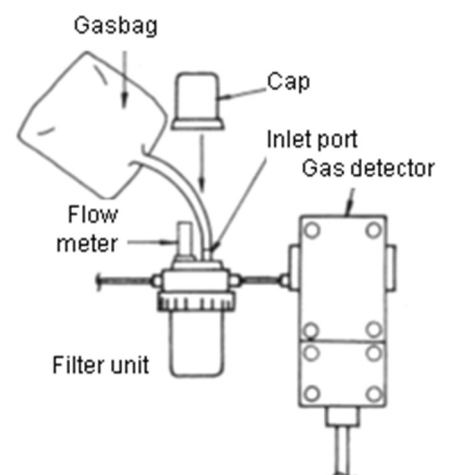


Figure 11. Alarm Test

8-2. Annual Inspection (min. one per year)

Important Notice for Annual Inspection

In order to ensure the reliability of the gas detection and alarm system, it is vital to perform periodic maintenance and inspections. Further, it is necessary to perform inspections and calibrations by using actual gas (combustible or poisonous gas). It is highly recommended that a maintenance contract with a local New Cosmos representative be made for the performance of annual inspections.

Installation, inspection, maintenance, calibration and proof testing shall only be performed by trained personnel.

Please contact your local representative for more information.

8-3. Calibration Gas Preparation

Prepare calibration gas (2X higher than the alarm set concentration) for use in an alarm test given in 8-1. (3) "Alarm test by using actual gas" on the previous page.

Typical method to prepare calibration gas, 0.9 vol% (50%LEL) isobutane, is given below as an example.

Target gas: Isobutene
100%LEL = 1.8vol%
Alarm set value: 0.45vol% (25%LEL)
Calibration gas: 0.9 vol% (50%LEL)

(A) When a commercially prepared gas cylinder is available,

Completely remove air from a gasbag. If residual air remains inside the bag before filling, incorrect measurements will result. Connect the gasbag to the cylinder. Fill the prepared gas into the gasbag as shown in Figure 12.

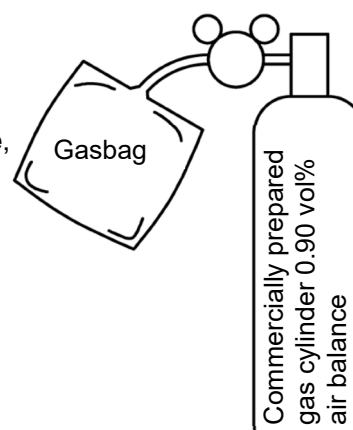


Figure 12. Gas Cylinder

Note

Use a urethane gasbag. Leave the gas inside the bag for approx. 30 minutes before use, to allow the humidity of the gas inside to approximate to the ambient humidity.

(B) When a commercially prepared gas cylinder is not available,

Use a gas calibration kit (not included) and a pure gas cylinder (isobutane at 99vol% or more). Dilute pure isobutane with air to produce 0.9vol% (50%LEL) calibration gas.

⚠ DANGER

Ensure that there is no open flame or source of ignition when handling a flammable gas with the concentration exceeding the LEL.

- (1) Completely remove air from a gasbag. Connect the gasbag to a pure gas filled cylinder. Draw a little more than needed amount of gas from the cylinder into the gasbag. Bend the tube of the bag and pinch it using a pinchcock to ensure a leak-proof seal.
- (2) Connect a 10ml syringe to the gasbag. Collect 9.0ml of pure gas into the syringe. (You can collect a little more than needed, then discharge the excess to obtain 9.0ml.)
- (3) Connect the syringe to the inlet port of a measuring pump. Pull the plunger of the pump drawing the gas into the pump. Remove the syringe from the inlet port. Pull the plunger of the pump to the limit (100ml).
- (4) Connect an empty gasbag to the outlet port of the pump. Push the plunger of the pump. Cycle the plunger of the pump nine times to inflate the bag with the diluted gas.

For example, collect 9.0ml of pure isobutane gas in the pump, connect the pump to a completely empty gasbag, then cycle the plunger 10 times. (100ml per push), yielding a 0.9 vol% gas or 50%LEL gas:

$$9.0\text{ml} / (100\text{ml} \times 10) = 0.0090 \text{ (0.9vol \% diluted gas).}$$

The LEL of isobutane is 1.8vol%.

$$0.9/1.8 \times 100 = 50 \text{ (50\%LEL diluted gas)}$$

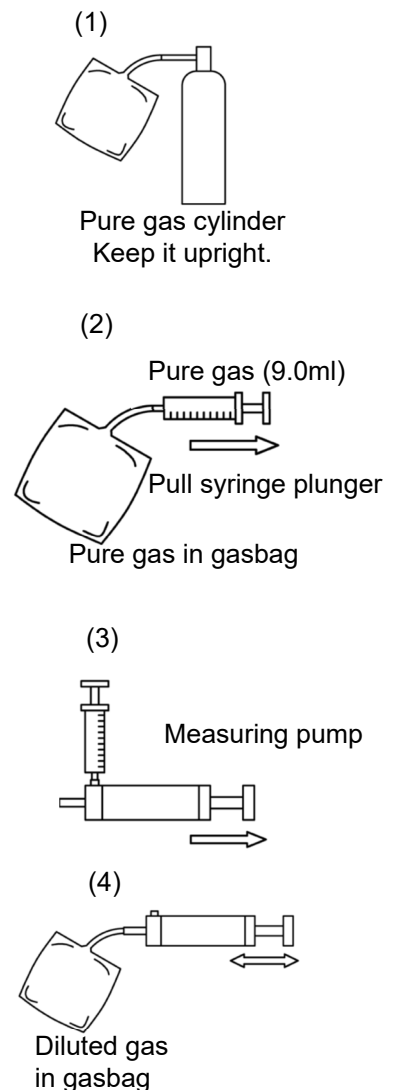


Figure 13. Gas Preparation

8-4. Gas Sensor Replacement

WARNING

Before opening any part of the gas detector, turn off the indicator unit connected to the gas detector to eliminate possible source ignition.

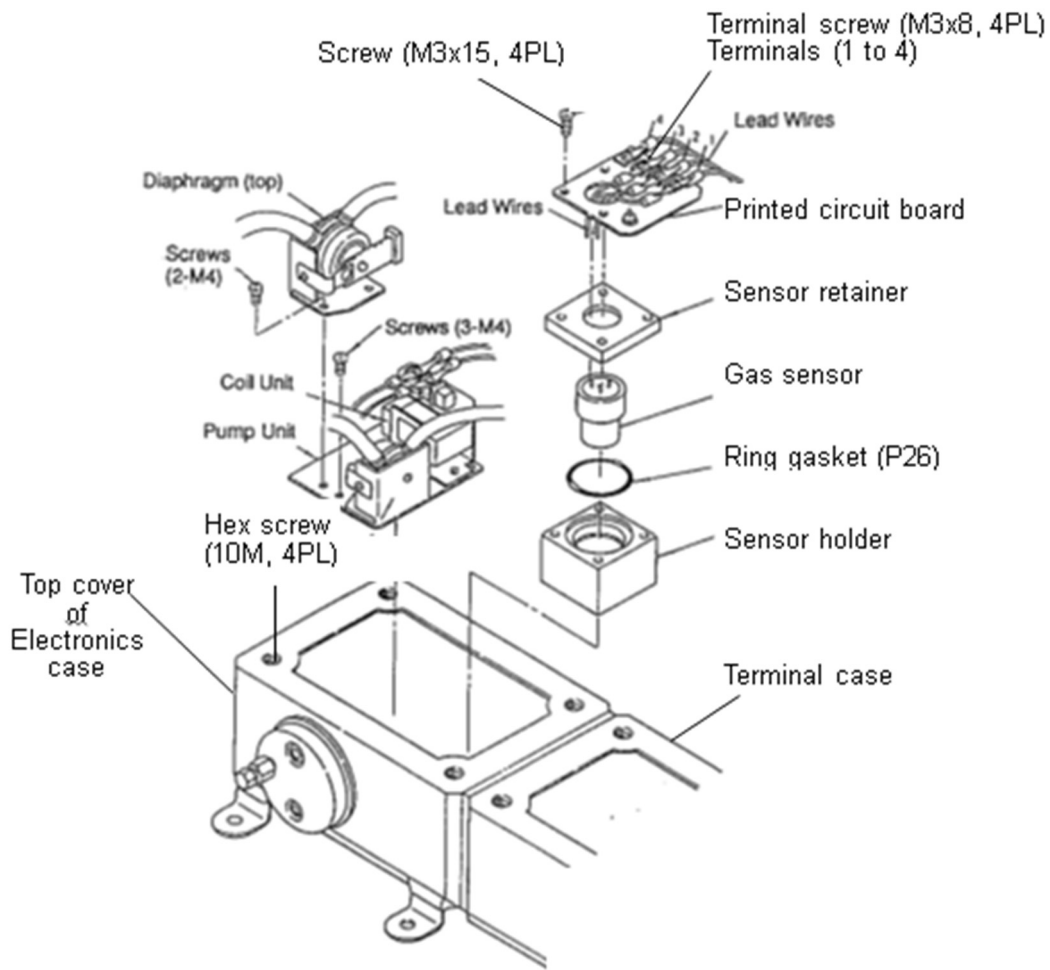
CAUTION

Joint surfaces are important members for ensuring the explosion-proof performance of the product. Do not damage or strike joint surfaces during replacement. Keep joint surfaces clean and free from any damage. Contaminates such as scratches, fingerprints, dirt and oil may adversely affect the explosion-proof characteristics of the product.

- (1) Remove the four hex screws (M10) from the electronics case with a hex wrench, and remove the cover from the case.
- (2) Remove the four terminal screws (M3×8) and washers to free the crimping terminals from the terminals (1 to 4).
- (3) Remove the four screws (M3×15) and washers attaching the printed circuit board to the electronics case. Remove the printed circuit board and sensor retainer.
- (4) Pull to remove the gas sensor. Place the ring gasket (P26) in the sensor holder, then place a new gas sensor on the ring gasket. A “●” mark is printed on each gas sensor. Install the new sensor so that its “●” mark faces toward the gas inlet (facing diagonally up and left when viewed from the front).
- (5) Feed the sensor’s lead wires through the hole of the sensor retainer and printed circuit board.
Place the sensor retainer and printed circuit board on the top of the sensor holder, then tighten the four screws (M3×15) and washers.
Install the sensor retainer in a correct orientation.
- (6) Match the colors of the lead wires from the sensor and the lead wires from the gas detector by referring to the table below. Color combination differs depending on the sensor type.
Tighten the terminal screws (M3×8) to secure the lead wires.
- (7) Install the top cover in the electronics case and tighten the four hex screws (M10).

Note

Return used gas sensors to New Cosmos Electric.



Catalytic combustion sensor

| Lead wire from sensor | Terminal | Lead wire from terminal case |
|-----------------------|----------|------------------------------|
| Pink | 1 | Red |
| Black | 2 | Black |
| White | 3 | White |
| | 4 | Green |

Hot wire semiconductor sensor

| Lead wire from sensor | Terminal | Lead wire from terminal case |
|-----------------------|----------|------------------------------|
| Orange | 1 | Red |
| Black | 2 | Black |
| White | 3 | White |
| | 4 | Green |

Thermal Conductivity sensor

| Lead wire from sensor | Terminal | Lead wire from terminal case |
|-----------------------|----------|------------------------------|
| Brown | 1 | Red |
| Black | 2 | Black |
| White | 3 | White |
| | 4 | Green |

Figure 14. Gas Sensor Replacement

8-5. Filter Replacement

If the disposable filter inside the filter unit (FC-32) is dirty, replace it with a new one.

A dirty filter will result in a decreased flow rate.

- (1) Loosen the clamp ring to remove the cup and ring gasket.
- (2) Pull and twist the filter to take it off.
- (3) Clean the inside of the cup with water and dry it completely.
- (4) Push and twist on a new filter until seated.
- (5) Connect the cup and ring gasket. Tighten the clamp ring to secure them.

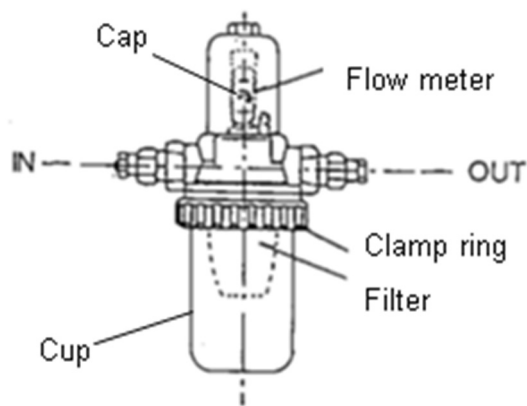


Figure 15. Filter Unit (FC-32)

8-6. Manifold Plate Cleaning

⚠ WARNING

To prevent a fire or explosion, turn off the gas detector before cleaning the manifold plate.

⚠ CAUTION

Joint surfaces are important members for ensuring the explosion-proof performance of the product. Do not damage or strike joint surfaces during cleaning. Keep joint surfaces clean and free from any damage. Contaminates such as scratches, fingerprints, dirt and oil may adversely affect the explosion-proof characteristics of the product.

- (1) Remove the two hex screws (M5x15 and M6x15) with spring washers from the unit with the hex wrenches (M5 and M6).
- (2) Slowly remove the manifold plate. Remove the three ring gaskets (P5, P6 and TPG-6).
- (3) Clean the manifold plate and gas detector's surface with a soft cloth to remove dust and dirt.
- (4) Reinstall the manifold plate in the reverse order (1) to (3). Confirm that the two spring washers and three ring gaskets are in place.

Note If removal of the filter unit is needed before taking the above steps, loosen the joints and remove it.

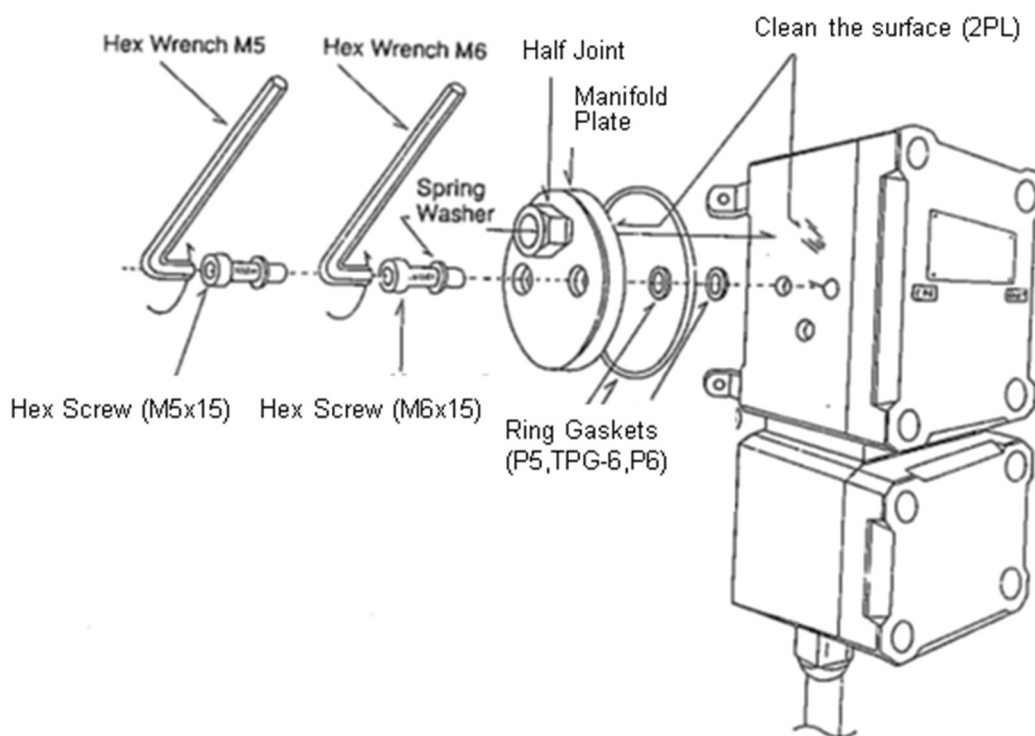


Figure 16. Manifold Plate Cleaning

9. Specifications

| | | |
|------------------------------------|--|--------|
| Model | PE-2CC | PE-2DC |
| Pump power | 100 VAC | 24 VDC |
| Sampling method | Suction type | |
| Detection principle | Catalytic combustion sensor, Hot wire semiconductor sensor, or Thermal conductivity sensor | |
| Target gas and indication range | As per delivery specification. | |
| Number of cores | 6-core cable | |
| Applicable cable | 600V vinyl insulated (IV), VCT or CVV cable with 0.75mm ² to 2.0mm ² wires | |
| Applicable conduit | G22 | |
| Explosion-proof enclosure | d2G4 ^{*1} | |
| Operating temperature and humidity | -10 to 40°C ^{*2} , 30 to 85%RH. No condensation. | |

*1. Not hydrogen or acetylene explosion-proof.

*2. -10 to 70°C, if your unit has the heat-proof option.

10. Warranty

The warranty period is one (1) year from the date of purchase.

You are entitled to the limited warranty, if the product malfunctions due to a manufacturing defect during normal use in accordance with the instruction manual, specifications and labels.

Warranty Scope

If the product fails or is found to be damaged due to a manufacturing defect during the warranty period, and used in accordance with the instruction manual and specifications, we will provide a free replacement and repair service. This warranty covers the New Cosmos product/parts only and not third party product/parts.

Warranty Exclusions

The following will be repaired at the cost of customer even during the warranty period.

- (1) Failures and damages incurred by incorrect use, deliberate acts or negligence of the user.

- (2) Failures and damages caused by disaster, earthquake, storm and flood, lightning, extreme climate, abnormal power supply voltage, excessive electromagnetic interferences, or other acts of God.
- (3) Failures and damages resulting from repair and/or modification by non-New Cosmos certified technicians.
- (4) Consumables and failures and damages resulting from improper consumable replacement.
- (5) Other failures and damages not attributable to the manufacturer.

11. Detection Principles

11-1. Catalytic Combustion Sensor

Catalytic combustion occurs on the catalytic layer applied on a platinum coil even if the gas concentration is well below the lower combustion limit. This causes a rise in temperature of the platinum coil and increases its electrical resistance. This change is read as a differential voltage using a bridge circuit. This process enables detection of combustible gases in air up to the lower explosive limit (LEL).

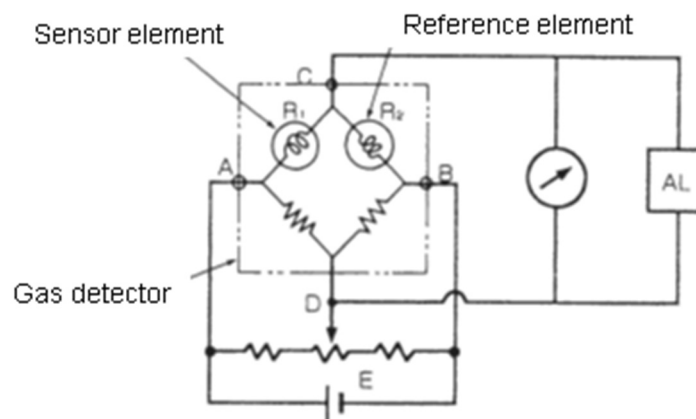


Figure 17. Catalytic Combustion Sensor

11-2. Hot Wire Semiconductor Sensor

A small amount of metal oxide semiconductor is deposited on a platinum coil, then the platinum coil is heated to a high temperature. When combustible gases react with oxygen absorbed on the surface of the semiconductor, free electrons increase in the semiconductor. As a result, the resistance of the semiconductor decreases. This resistance change is read as differential voltage using a bridge circuit for gas detection purpose. This type of sensor is very sensitive and thus suitable for low concentration gas detection.

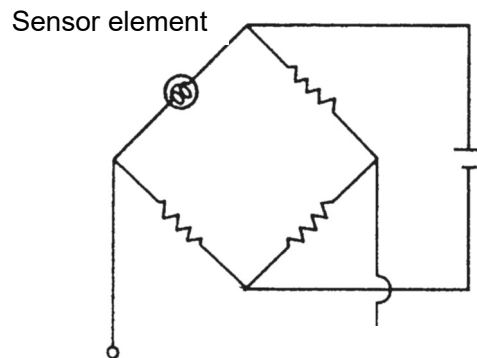


Figure 18. Hot Wire Semiconductor Sensor

11-3. Thermal Conductivity Sensor

A thermal conductivity sensor is based on the principle that some gases have a different thermal conductivity from air.

When a gas comes in contact with a heated platinum coil coated with an inert substance (sensor element), the gas will conduct the heat from the coil more or less efficiently than air. This results in a change of the temperature of the sensor element, causing a change in the resistance of the platinum coil. The resistance change is read as differential voltage using a bridge circuit. The differential voltage is near proportional to the gas concentration.

This type of sensor is limited to detection of gases whose thermal conductivity is different from air but it can detect gases in the range from 0 to 100 vol%.

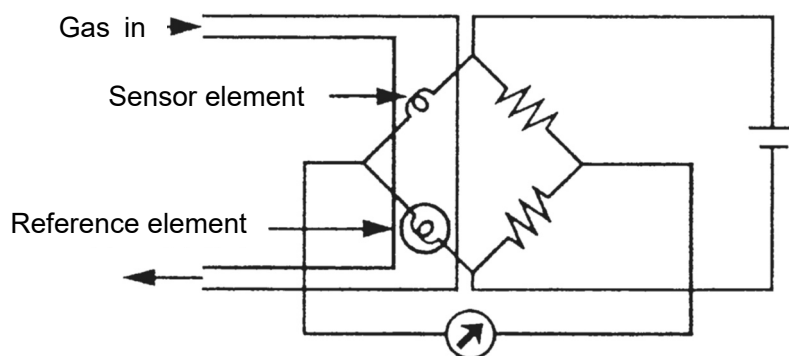


Figure 19. Thermal Conductivity Sensor

12. Glossary

| Term | Definition |
|---|--|
| Flow meter | Equipment for measuring the flow rate in the piping. |
| Collecting cone | Use for increased gas collection efficiency, and as a water deflection at the sampling port. Connected to the end of the sampling pipe/tube. Dust and water proof. |
| Flameproof enclosure (explosion-proof enclosure) | Enclosure in which the parts which can ignite an explosive atmosphere are placed. This enclosure can withstand the pressure created during an internal explosion of an explosive mixture, and prevent the ignition of an explosive atmosphere outside the enclosure. |
| Target gas | Specific gas to be detected, concentration displayed, and used to trigger alarms. |
| Alarm set value | Preset gas concentration level at which an alarm is triggered. |
| Detection range | A range of target gas concentrations that can be displayed and trigger alarms. |
| Operating temperature and humidity ranges | Ambient temperature and humidity ranges in which the gas detection and alarm system can operate normally. |
| Maintenance and inspection | Tasks performed to ensure that equipment operates normally and correctly. |
| Calibration gas or test gas | Gas specifically prepared to calibrate/adjust the gas detection and alarm system. |
| Hazardous area | An area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus. |
| Non-hazardous area | An area in which an explosive atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus. |
| Explosive atmosphere | Mixture of air and flammable substances in the form of dust or vapor which are within their explosive limits. |
| LEL | Lower Explosive Limit. Lowest concentration (percentage) of a gas or vapor in air capable of producing a flash fire, or explosion in the presence of an ignition source like arc, flame or heat. |

This page intentionally left blank

Revision History

| Document No. | Date | Revision |
|---------------------|-------------|-----------------|
| GAE-122-00 | March 2018 | Original issue |
| GAE-122-01 | March 2023 | 01 |
| | | |

Additional copies of this instruction manual may be purchased.

Contact New Cosmos or its authorized representative for ordering.

Authorized representative:

Manufacturer:

NEW COSMOS ELECTRIC CO., LTD.

2-5-4 Mitsuya-naka, Yodogawa-ku,
Osaka 532-0036, Japan

www.newcosmos-global.com