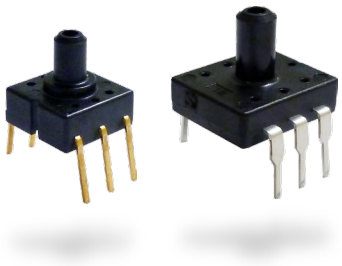
Panasonic
INDUSTRY

# Pressure Sensor

## PS (ADP4) series

## PF (ADP1) series



### High precision pressure sensor (without amp.)

## Feature

- Compact size (PS type)
- High accuracy and liner characteristic
- Broad line-up
- RoHS compliant

## Typical applications

- Industrial use : Pressure switches and pneumatic components, compressed air pressure measuring devices and airbeds
- Medical use : Airbeds
- Others : Pressure sensing devices for air pressure mediums

## Ordering information

**ADP** **4** **1** **4** **1** **0**

| Code | Product name |
|---|---|
| 1 | PF pressure sensor |
| 4 | PS pressure sensor |

Terminal profile and direction

1 : DIP terminal

(Direction opposite to the pressure inlet direction)

2 : DIP terminal

(Pressure inlet direction)

| Code | Rated pressure |
|---|---|
| 4 | 98.1 kPa |
| 5 | 196.1 kPa |
| 7 | 490.3 kPa |
| 9 | 980.7 kPa |

| Code | Type |
|---|---|
| 1 | Standard type (With glass base) |

| Code | Bridge resistance |
|---|---|
| Nil | PF 5 kΩ |
| 0 | PS 5 kΩ |
| 3 | 3.3 kΩ |

## Product types

Standard packing : Carton : 100 pcs.; Case : 1,000 pcs.

| Pressure | Terminal | Brige resistance | Part No. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | PS pressure sensor | | | | | PF pressure sensor | |
| | | | 5 kΩ | | | 3.3 kΩ | | 5 kΩ | |
| | | |  DIP terminal: Direction opposite to the pressure inlet direction |  DIP terminal: Pressure inlet direction |  SMD terminal |  DIP terminal: Direction opposite to the pressure inlet direction |  DIP terminal: Pressure inlet direction |  DIP terminal: Direction opposite to the pressure inlet direction |  DIP terminal: Pressure inlet direction |
| Standard type (with glass base) | | | | | | | | | |
| 98.1 kPa | | | ADP41410 | ADP42410 | ADP4932 | ADP41413 | ADP42413 | ADP1141 | ADP1241 |
| 196.1 kPa | | | ADP41510 | ADP42510 | – | – | – | ADP1151 | ADP1251 |
| 490.3 kPa | | | ADP41710 | ADP42710 | – | – | – | ADP1171 | ADP1271 |
| 980.7 kPa | | | ADP41910 | ADP42910 | ADP4933 | ADP41913 | ADP42913 | ADP1191 | ADP1291 |

## Rating

| | | | | | |
|---|---|---|---|---|---|
| Type | Standard type (With glass base) | | | | |
| Type of pressure | Gauge pressure | | | | |
| Pressure medium | Air[*1] | | | | |
| Rated pressure (kPa) | 98.1, 196.1 | 490.3 | 980.7 | 98.1[*2] | 980.7[*2] |
| Max. applied pressure | Twice of the rated pressure | | 1.5 times of the rated pressure | Twice of the rated pressure | 1.5 times of the rated pressure |
| Bridge resistance | 5,000 Ω ± 1,000 Ω | | | 3,300 Ω ± 700 Ω | |
| Ambient temperature | −20 ℃ to +100 ℃ −4 ℉ to +212 ℉ (no freezing or condensation) | | | | |
| Storage temperature | −40 ℃ to +120 ℃ −40 ℉ to +248 ℉ (no freezing or condensation) | | | | |
| Standard temperature | 25 ℃ 77 ℉ | | | 30 ℃ 86 ℉ | |
| Temperature compensation range | 0 ℃ to 50 ℃ 32 ℉ to +122 ℉ | | | 0 ℃ to 60 ℃ 32 ℉ to +140 ℉ | |
| Drive current (constant current) | 1.5 mA | | | 1.0 mA | |
| Output span voltage | 100 ± 40 mV | | | 65 ± 25 mV | |
| Offset voltage | ±20 mV | | | | |
| Linearity | ±0.3 %FS | ±0.5 %FS | ±0.6 %FS | ±1.0 %FS | |
| Pressure hysteresis | ±0.2 %FS | ±0.4 %FS | | ±1.0 %FS | |
| Offset voltage-temperature characteristics[*3] | ±5.0 %FS | | | ±3.5 %FS | |
| Sensitivity-temperature characteristics[*3] | ±2.5 %FS | | | | |

*1: Please consult us for pressure media other than dry air, nitrogen, oxygen, carbon dioxide.
*2: For PS pressure sensor only
*3: This is the regulation which applies within the compensation temperature range.
◆ Unless otherwise specified, measurements were taken with a drive current of ±0.01 mA and humidity ranging from 25% to 85%.
◆ Please consult us if the intended use involves a negative pressure.

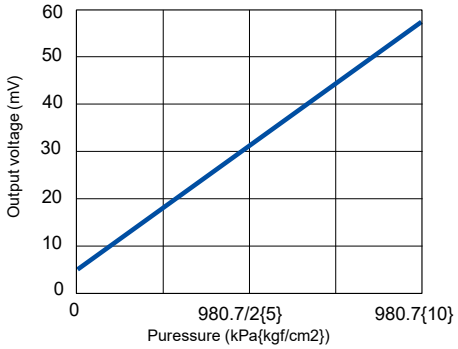
## Reference data

### [PS pressure sensor]

● Characteristics data

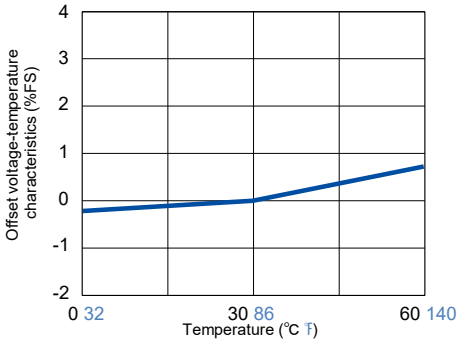
1.-(1) Output characteristics

(Representative example : ADP41913)
Drive current : 1.0 mA
Temperature : 30 °C 86 °F



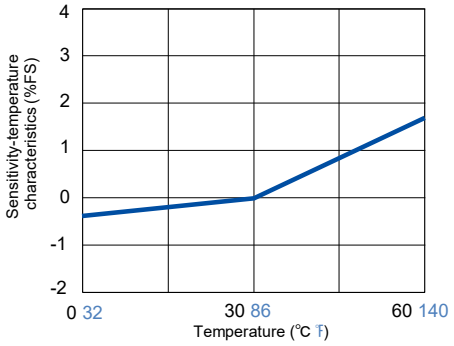

1.-(2) Offset voltage - temperature characteristics

(Representative example : ADP41913)
Drive current : 1.0 mA
Rating : ±3.5 % FS




1.-(3) Sensitivity -temperature characteristics

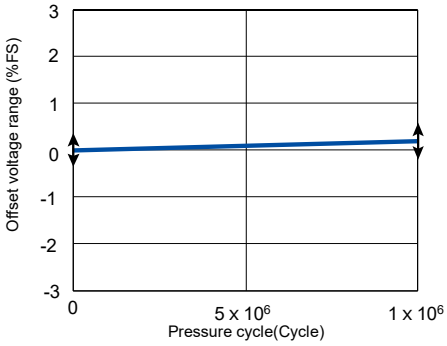
(Representative example : ADP41913)
Drive current : 1.0 mA
Rating : ±2.5 % FS



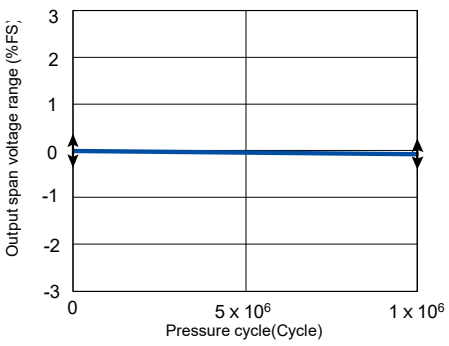

● Pressure cycle range (0 to rated pressure)

(Representative example : ADP41913)
Temperature : 100 °C 212 °F, No. of cycle: $1\times10^6$

Offset voltage range




Output span voltage range




(Representative example : ADP41913 Even after testing for 1 million times, the variations in the offset voltage and output span voltage are minimal.

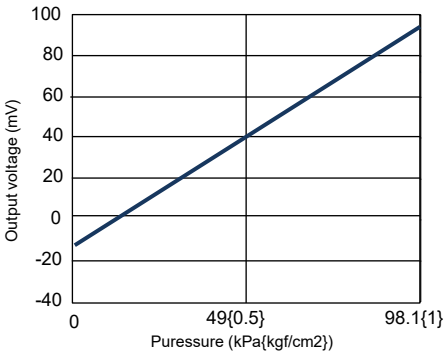
## Reference data

### [PF pressure sensor]

● Characteristics data

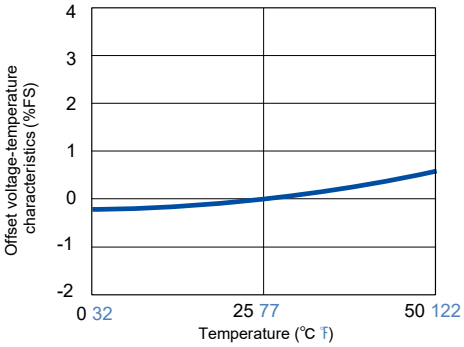
1. – ① Output characteristics

(Representative example : ADP1141)
Drive current : 1.5 mA
Temp. : 25 °C 77 °F



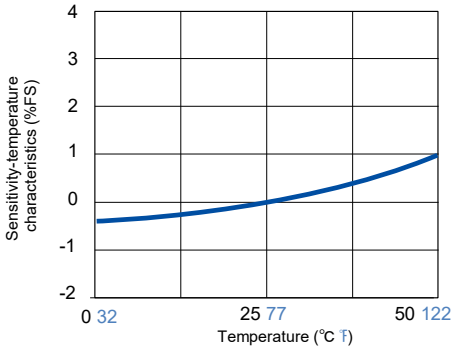

1. – ② Offset voltage - temperature characteristics

(Representative example : ADP1141)
Drive current : 1.5 mA
Rating : ±5 % FS




1. – ③ Sensitivity - temperature characteristics

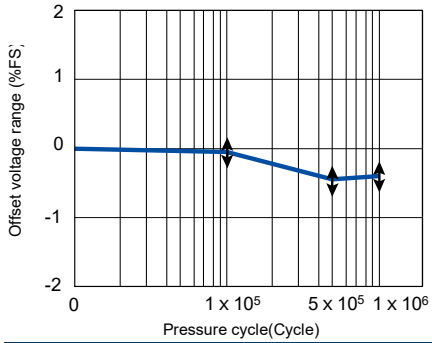
(Representative example : ADP1141)
Drive current : 1.5 mA
Rating : ±2.5% FS




● Pressure cycle range (0 to rated pressure)

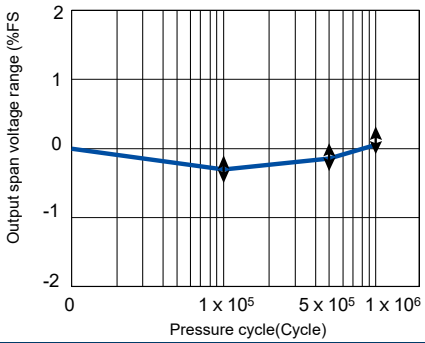
(Representative example : ADP1141)
Temperature : 25 °C 77 °F

Offset voltage range




(Representative example : ADP1141)

Output span voltage range




Even after testing for 1 million times, the variations in the offset voltage and output span voltage are minimal.

## Evaluation test

| Classifi cation | Tested item | Tested condition | Result |
|---|---|---|---|
| Environmental characteristics | Storage at high temperature | Temperature<br>Time<br>: Left in a 120 ℃ 248 ℉ constant temperature bath<br>: 1000 h | Passed |
| | Storage at low temperature | Temperature<br>Time<br>: Left in a −40 ℃ −40 ℉ constant temperature bath<br>: 1000 h | Passed |
| | Humidity | Temperature/humidity<br>Time<br>: Left at 40 ℃ 104 ℉, 90 % RH<br>: 1000 h | Passed |
| | Temperature cycle | Temperature<br>1 cycle<br>Times of cycle<br>: –40 ℃ to 120 ℃ –40 ℉ to 248 ℉<br>: 30 Min.<br>: 100 | Passed |
| Endurance characteristics | High temperature/ high humidity operation | Temperature/humidity<br>Operation times<br>: 40 ℃ 104 ℉, 90% RH<br>: $10^6$, rated voltage applied. | Passed |
| Mechanical characteristics | Vibration resistance | Double amplitude<br>Vibration<br>Applied vibration direction<br>Time<br>: 1.5 mm 0.059 inch<br>: 10 ~ 55 Hz<br>: X, Y, Z 3 directions<br>: 2 hrs each | Passed |
| | Dropping resistance | Dropping height<br>Times<br>: 75 cm<br>: 2 times | Passed |
| | Terminal strength | Pulling strength<br>Bending strength<br>: 9.8 N {1 kgf}, 10 sec.<br>: 4.9 N {0.5 kgf}, left and right 90 ° 1 time | Passed |
| Soldering characteristics | Solderbility | Temperature<br>Time<br>: 230 ℃ 446 ℉<br>: 5 sec | Passed |
| | Heat resistance (DIP) | Temperature<br>Time<br>: 260 ℃ 500 ℉<br>: 10 sec | Passed |

Note: For details other than listed above, please consult us.

| Items | Criteria |
|---|---|
| Offset valtage<br>Output span voltage | Variation amount<br>within ±5.0 %FS of value |

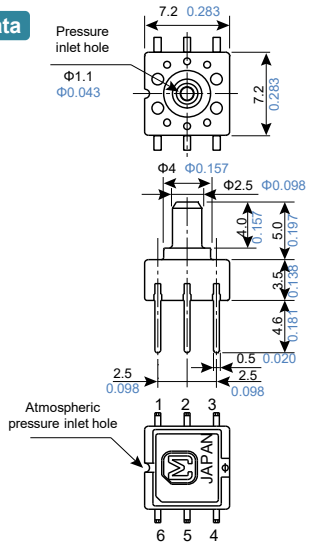
# Dimensions

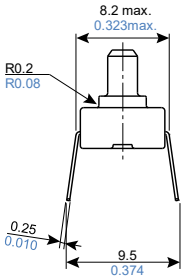
The CAD data of the products with a CAD data mark can be downloaded from: http://industrial.panasonic.com/

## [PS pressure sensor]

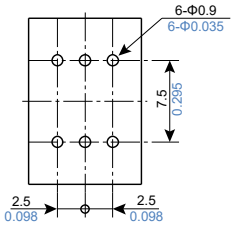
● Terminal direction : DIP terminal Direction opposite to the pressure inlet direction ADP41□□□

CAD data

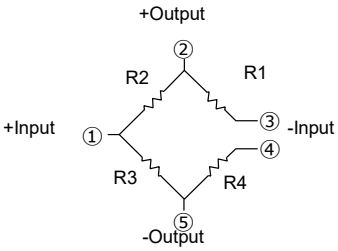



Recommended PC board pattern（BOTTOM VIEW）




Terminal connection diagram




⑥ is no connection

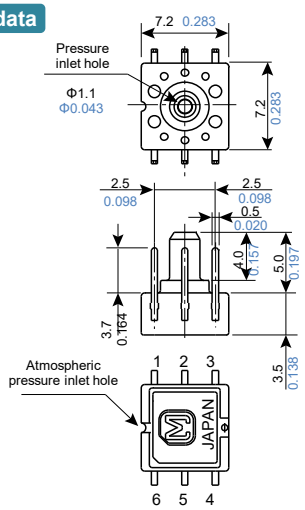
Unit : mm inch, General tolerance ±0.3 ±0.012

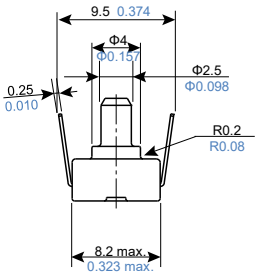
| Terminal No. | Name |
|---|---|
| 1 | Power supply (+) |
| 2 | Output (+) |
| 3 | Power supply (–) |
| 4 | Power supply (–) |
| 5 | Output (–) |
| 6 | NC (No connection) |

Note: Leave terminal 6 unconnected.

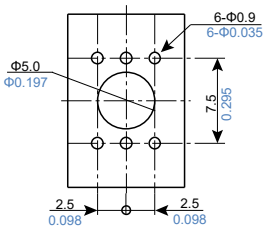
● Terminal direction : DIP terminal Pressure inlet direction ADP42□□□

CAD data

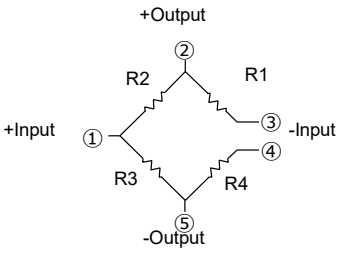



Recommended PC board pattern（BOTTOM VIEW）




Terminal connection diagram




⑥ is no connection

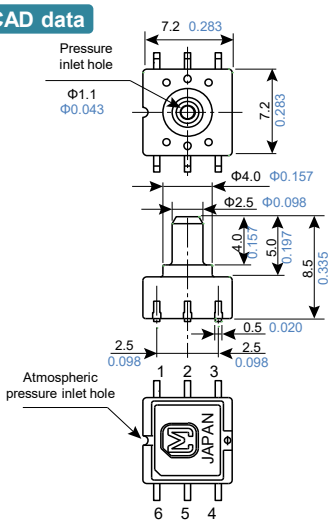
Unit : mm inch, General tolerance ±0.3 ±0.012

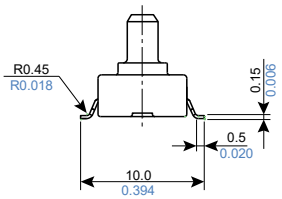
| Terminal No. | Name |
|---|---|
| 1 | Power supply (+) |
| 2 | Output (+) |
| 3 | Power supply (–) |
| 4 | Power supply (–) |
| 5 | Output (–) |
| 6 | NC (No connection) |

Note: Leave terminal 6 unconnected.

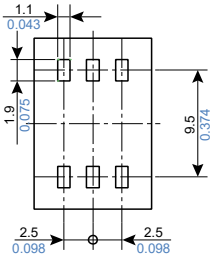
● Terminal direction : SMD terminal ADP4932, ADP4933

CAD data

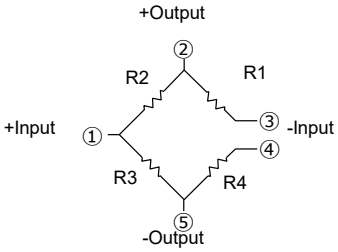



Recommended PC board pattern（BOTTOM VIEW）




Terminal connection diagram




⑥ is no connection

Unit : mm inch, General tolerance ±0.3 ±0.012

| Terminal No. | Name |
|---|---|
| 1 | Power supply (+) |
| 2 | Output (+) |
| 3 | Power supply (–) |
| 4 | Power supply (–) |
| 5 | Output (–) |
| 6 | NC (No connection) |

Note: Leave terminal 6 unconnected.

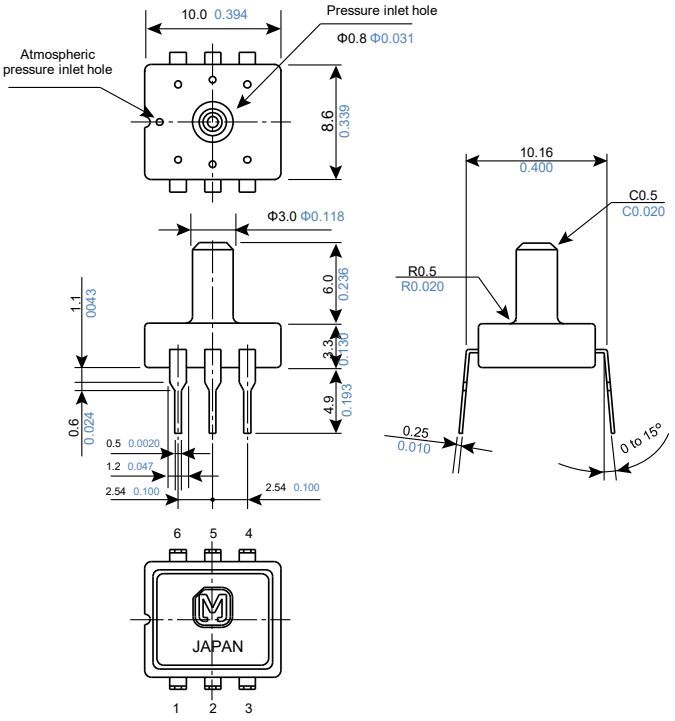
# Dimensions

The CAD data of the products with a CAD data mark can be downloaded from: http://industrial.panasonic.com/

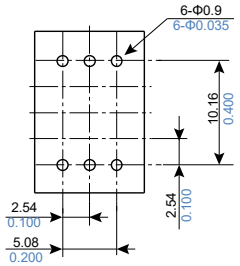
## 〔PF pressure sensor〕

● Terminal direction : DIP terminal Direction opposite to the pressure inlet direction ADP11□□

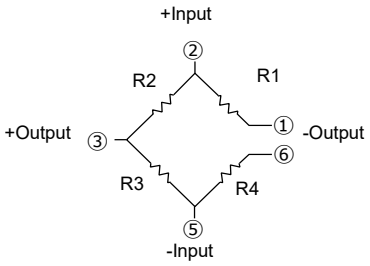
CAD data




Recommended PC board pattern（BOTTOM VIEW）




Terminal connection diagram



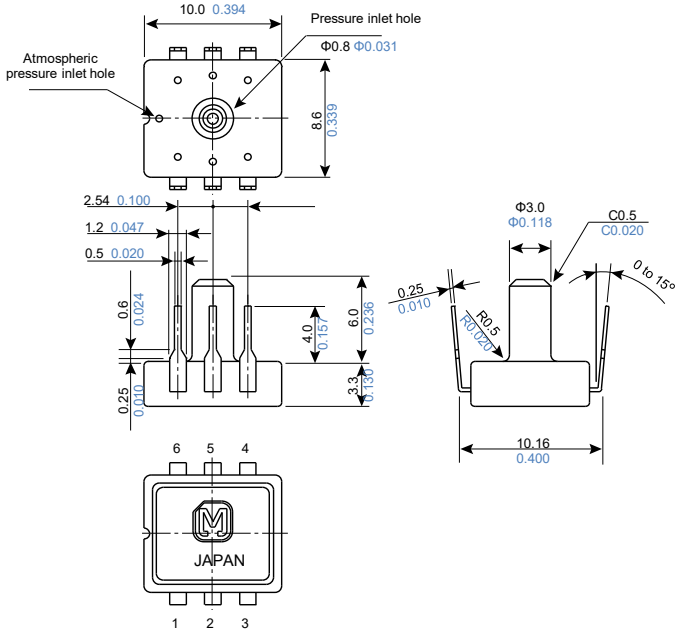

unit : mm inch、General tolerance : ±0.3 ±0.012

| Terminal No. | Name |
|---|---|
| 1 | -Output (-) |
| 2 | Power supply (+) |
| 3 | +Output (+) |
| 4 | No connection |
| 5 | Power supply (-) |
| 6 | -Output (-) |

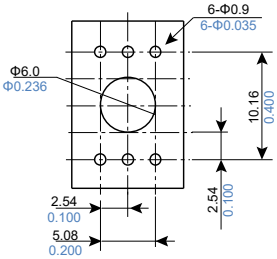
Note: Leave terminal 4 unconnected.

● Terminal direction : DIP terminal Pressure inlet direction ADP12□□

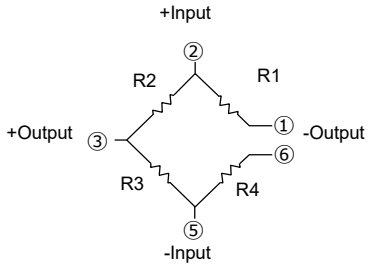
CAD data




Recommended PC board pattern（BOTTOM VIEW）




Terminal connection diagram




unit : mm inch、General tolerance : ±0.3 ±0.012

| Terminal No. | Name |
|---|---|
| 1 | -Output (-) |
| 2 | Power supply (+) |
| 3 | +Output (+) |
| 4 | No connection |
| 5 | Power supply (-) |
| 6 | -Output (-) |

Note: Leave terminal 4 unconnected.

## Explanation of terms

### ■ Pressure object

This is what can be used to activate the pressure sensor.
(The Panasonic Corporation pressure sensor can beused with gas.)

### ■ Rated pressure

The pressure value up to which the specifications of the pressure sensor are guaranteed.

### ■ Maximum applied pressure

The maximum pressure that can be applied to the pressure sensor, after which, when the pressure is returned to below the rated pressure range, the specifications of the pressure sensor are guaranteed.

### ■ Temperature compensation range

The temperature range across which the specification values of the pressure sensor are guaranteed.

### ■ Drive current (voltage)

The supply current (voltage) required to drive a pressure sensor.

### ■ Output span voltage

The difference between the rated output voltage and the offset voltage. The output span voltage is also called the full-scale voltage (FS).

### ■ Offset voltage

The output voltage of a pressure sensor when no pressure is applied.

### ■ Rated pressure output voltage

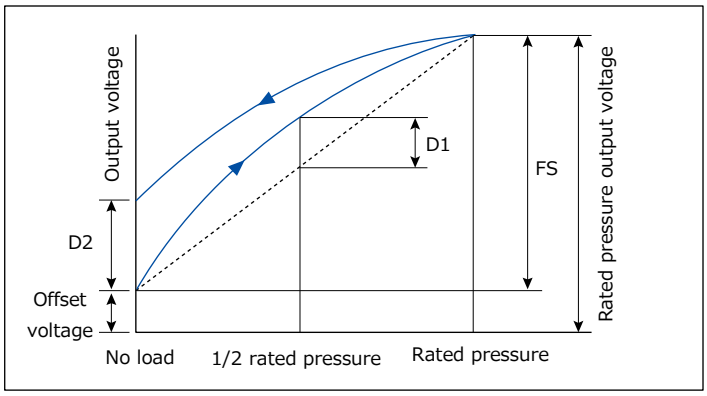
Output voltage when rated pressure is applied.

### ■ Linearity

When the pressure is varied from no load to the rated pressure, the linearity is the amount of shift between the straight line that joins the no-load voltage value and the rated pressure voltage value (expressed as the ratio of the amount of shift (D1) at half of the rated pressure value with respect to the full scale voltage (FS)).

### ■ Output hysteresis

The ratio of the difference (D2) in the noload output voltages when the pressure is varied from no load to the rated pressure then reduced back to no load, with respect to the full scale voltage (FS).



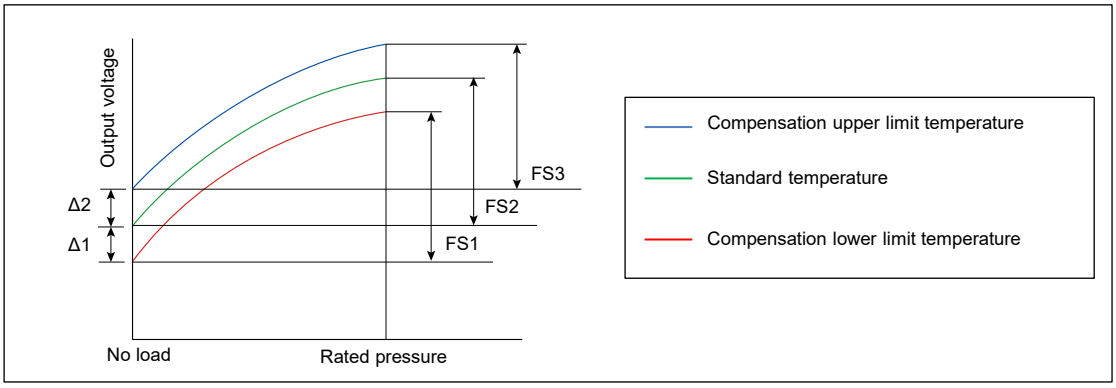

### ■ Offset voltage temperature characteristic

The variation of the offset voltage with changes in ambient temperature. The difference between the offset voltage at the standard temperature and the offset values at the compensation lower limit temperature (low temperature) (D1) and compensation upper limit temperature (high temperature) (D2) are obtained, and the offset voltage temperature characteristic is expressed as the ratio of the larger of these two differences (absolute) with respect to the full scale voltage (FS).

## Explanation of terms

### ■ Temperature sensitivity characteristic

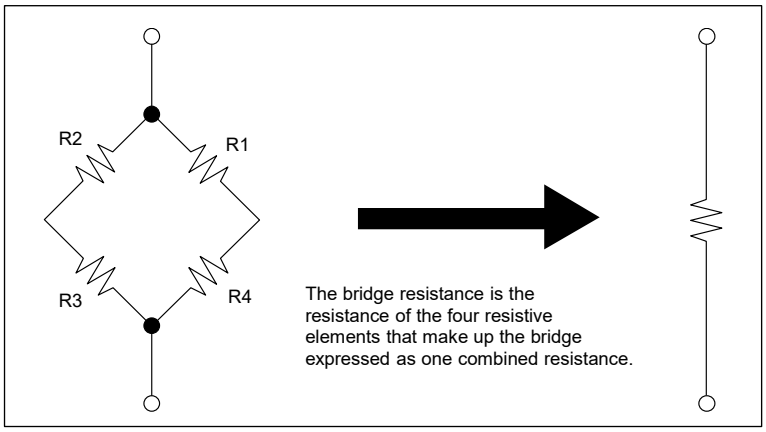
The variation of the sensitivity with changes in ambient temperature (variation in full scale (FS)).
The difference between the full scale voltage at the standard temperature (FS) and the full scale values at the compensation lower limit temperature (low temperature) (FS1) and compensation upper limit temperature (high temperature) (FS2) are obtained, and the offset voltage temperature characteristic is expressed as the ratio of the larger of these two differences (FS1 - FS and FS2 - FS (absolute)) with respect to the full scale voltage (FS).




### ■ Bridge resistance

Refers to the resistance value of a piezo resistance formed on a monolithic silicon substrate.
For example, the values of the resistances R1 to R4 in the bridge are typically 5 kΩ each.

✻ When the resistances of the resistive elements R1 to R4 that comprise the bridge are 5 kΩ each, the equivalent composite resistance of the bridge is 5kΩ (3 kΩ bridges are also available).




### ■ Overall accuracy

Accuracy of offset voltage and rated pressure output voltage within the temperature compensation range.

# Guidelines and precautions regarding the technical information and use of our products described in this online catalog.

■ If you want to use our products described in this online catalog for applications requiring special qualities or reliability, or for applications where the failure or malfunction of the products may directly jeopardize human life or potentially cause personal injury (e.g. aircraft and aerospace equipment, traffic and transportation equipment, combustion equipment, medical equipment, accident prevention, anti-crime equipment, and/or safety equipment), it is necessary to verify whether the specifications of our products fit to such applications. Please ensure that you will ask and check with our inquiry desk as to whether the specifications of our products fit to such applications use before you use our products.

■ The quality and performance of our products as described in this online catalog only apply to our products when used in isolation. Therefore, please ensure you evaluate and verify our products under the specific circumstances in which our products are assembled in your own products and in which our products will actually be used.

■ Please ensure the safety by means of protection circuit, redundant circuit etc. in your system design in order to prevent the occurrence of life crisis and other serious damages due to the failure of our products.

■ The products and product specifications described in this online catalog are subject to change for improvement without prior notice. Therefore, please be sure to request and confirm the latest product specifications which explain the specifications of our products in detail, before you finalize the design of your applications, purchase, or use our products.

■ The technical information in this online catalog provides examples of our products' typical operations and application circuits. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right, or interest in our intellectual property.

■ If any of our products, product specifications and/or technical information in this catalog is to be exported, the laws and regulations of the exporting country, especially with regard to security and export control, shall be observed.

# <Regarding the Certificate of Compliance with the EU RoHS Directive/REACH Regulations>

■ The switchover date for compliance with the RoHS Directive/REACH Regulations varies depending on the part number or series of our products.

■ When you use the inventory of our products for which it is unclear whether those products are compliant with the RoHS Directive/REACH Regulation, please select "Sales Inquiry" in the website inquiry form and contact us.

**Please note that we do not owe any liability and responsibility if our products are used beyond the description of this catalog or without complying with precautions in this catalog.**

# ⚠ Application Guidelines (PS, PF)

## 1. Mounting

Use the land of the printed-circuit board on which the sensor is securely fixed.

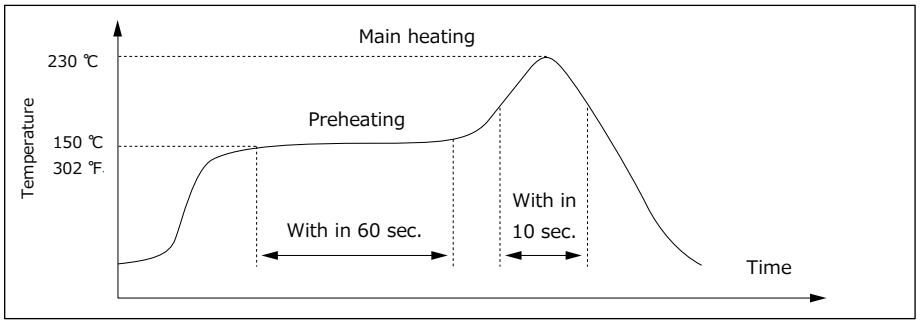
## 2. Soldering

Avoid the external thermal influence as the product has a limited thermal capacity due to its compact structure.
Heat deformation may damage the sensor or deteriorate its performance. Use the non-corrosive rosin flux.
Prevent the flux from entering into the inside of the product as the sensor is exposed to the atmosphere.

(1) Manual soldering
- Raise the temperature of the soldering tip between 260 and 300 °C 500 and 572 °F (30 W) and solder within 5 seconds.
- The sensor output may vary if the load is applied on the terminal during soldering.
- Keep the soldering tip clean.

(2) DIP soldering (DIP Terminal)
- Keep the temperature of the DIP solder tank below 260 °C 500 °F and solder within 5 seconds.
- To avoid heat deformation, do not perform DIP soldering when mounting on the circuit board which has a small thermal capacity.

(3) Reflow soldering (SMD Terminal)
- The recommended reflow temperature profile conditions are given below.




- We recommend the screen solder printing method as the method of cream.
- Please refer to the recommended PC board specification diagram for the PC board foot pattern.
- Self alignment may not always work as expected, therefore, please carefully the position of the terminals and pattern.
- The temperature of the profile is assumed to be a value measured with the printed wiring board of the terminal neighborhood.
- Please evaluate solderbility under the actual mounting conditions since welding and deformation of the pressure inlet port may occur due to heat stress depending on equipments or conditions.

(4) Rework soldering
- Complete rework at a time.
- Use a flattened soldering tip when performing rework on the solder bridge. Do not add the flux.
- Keep the soldering tip below the temperature described in the specifications.

(5) Avoid drop and rough handling as excessive force may deform the terminal and damage soldering and rough handling as excessive force may deform the terminal and damage soldering

(6) Keep the circuit board warpage within 0.05 mm of the full width of the sensor.

(7) After soldering, do not apply stress on the soldered part when cutting or bending the circuit board.

(8) Prevent human hands or metal pieces from contacting with the sensor terminal.
Such contact may cause anomalous outlets as the terminal is exposed to the atmosphere.

(9) After soldering, prevent chemical agents from adhering to the sensor when applying coating to avoid insulation deterioration of the circuit board.

(10) Please consult us concerning leadfree soldering.

## 3. Cleaning

(1) Prevent cleaning liquid from entering the inside of the product as the sensor is exposed to the atmosphere.

(2) Do not perform ultrasonic cleaning in order to prevent damages to the product.

## 4. Environment

(1) Avoid use and storage in the corrosive gas (organic solvent, sulfurous acid and hydrogen sulfide gases) which negatively affects the product.
(2) Avoid use in a place where these products come in contact with water as the sensor does not have a splashproof construction.
(3) Avoid use in an environment where these products cause dew condensation.
When water attached to the sensor chip freezes, the sensor output may be fluctuated or damaged.
(4) Due to the structure of the pressure sensor chip, the output varies under light.
Do not expose the sensor chip to light when applying a voltage by using a transparent tube.
(5) Do not apply high-frequency oscillation, such as ultrasonic waves, to the product.

## 5. Quality check under actual use conditions

These specifications are for individual components. Before use, carefully check the performance and quality under actual use conditions to enhance stability.

## 6. Other precautions

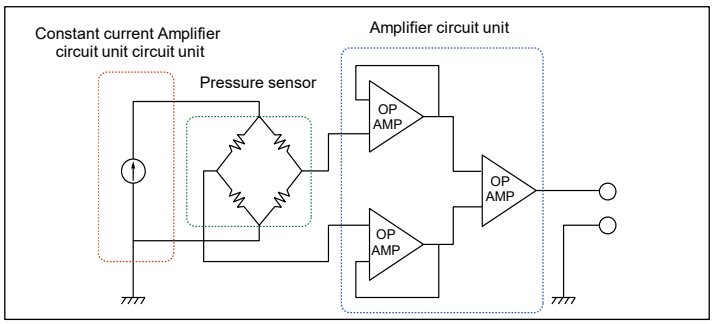
(1) The wrong mounting method and the pressure range may invite the risk of accidents.
(2) Only applicable pressure medium is dry air. Avoid use in the corrosive gas (organic solvent, sulfurous acid and hydrogen sulfide gases) or other mediums containing moisture or foreign substances. Such mediums may damage or break the product.
(3) The pressure sensor chip is located inside the pressure introduction port. Do not insert foreign substances, such as wires, into the port as those substances may damage the chip and close the port. Do not block the atmosphere introduction port.
(4) Use electric power within the rated power range. Use beyond the range may damage the product.
(5) Follow below instructions as static electricity may damage the product.
- For Storage, short the circuit between terminals by using conductive substances or wrap the whole chip with aluminum foil. For storage and transportation, avoid plastic containers which are easily electrified.
- Before use, connect electrified materials on desk and operators to the ground in order to safely discharge static electricity.

(6) Carefully select and fix tubes, introduction pipes and products based on the working voltage. Please contact us for any inquires.

## 7. Application circuit diagram (Example)

The pressure sensor converts a voltage by constant current drive and if necessary, amplifies the voltage.

The circuit on the right is a typical use example.




## 8. Mounting method

The general method of air pressure transmission varies depending on the low/high pressure condition.

- Usage note
① Select a study pressure introduction pipe to avoid pressure leak.
② Securely fix the pressure introduction pipe to avoid pressure leak.
③ Do not block the pressure introduction pipe.

Methods of transmitting air pressures