

# D6F-PH

MEMS Differential pressure Sensor

## A Compact, High-accuracy Differential Pressure Sensor with Superior Resistance to Environments.

- High accuracy of  $\pm 3\%$  RD
- Linearized and temperature compensated
- Digital output (I2C communication)
- High flow impedance to reduce the influence of bypass configuration



RoHS Compliant



Refer to the *Safety Precautions* on page 4.

### Ordering Information

Model	Applicable fluid (See note 1.)	Measurement range (See note 3.)
D6F-PH0025AD1	Air (See note 2.)	0 to 250 Pa (0 to 1 in. H <sub>2</sub> O)
D6F-PH0505AD3		-50 to +50 Pa ( $\pm 0.2$ in. H <sub>2</sub> O)
D6F-PH5050AD3		-500 to +500 Pa ( $\pm 2$ in. H <sub>2</sub> O)

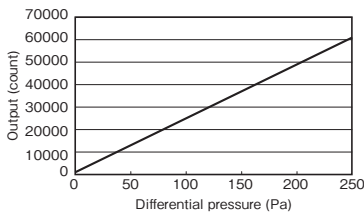
Note: 1. The Sensor be calibrated for different gas types. Consult your Omron representative.

Note: 2. Dry gas must not contain large particles, e.g., dust, oil, or mist.

Note: 3. At standard atmospheric pressure (1013.25 hPa)

### Output Characteristics

#### D6F-PH0025AD1



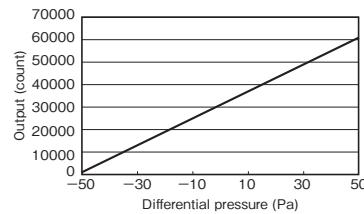
Differential pressure (Pa)	0	50	100	150	200	250
Output (HEX)	1024 (0x0400)	13024 (0x32E0)	25024 (0x61C0)	37024 (0x90A0)	49024 (0xBF80)	61024 (0xEE60)

Measurement conditions: Power supply voltage of  $3.3 \pm 0.1$  VDC, ambient temperature of  $25 \pm 5^\circ\text{C}$ , and ambient humidity of 25% to 75%.

Differential pressure conversion formula:  $Dp = (Op - 1024) / 60000 \times 250$

$Dp$  = Differential pressure,  $Op$  = Output

#### D6F-PH0505AD3



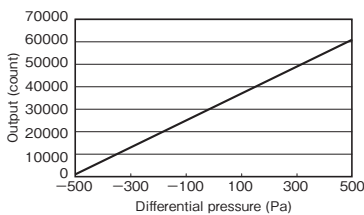
Differential pressure (Pa)	-50	-30	-10	0	10	30	50
Output (HEX)	1024 (0x0400)	13024 (0x32E0)	25024 (0x61C0)	31024 (0x7930)	37024 (0x90A0)	49024 (0xBF80)	61024 (0xEE60)

Measurement conditions: Power supply voltage of  $3.3 \pm 0.1$  VDC, ambient temperature of  $25 \pm 5^\circ\text{C}$ , and ambient humidity of 25% to 75%.

Differential pressure conversion formula:  $Dp = (Op - 1024) / 60000 \times 100 - 50$

$Dp$  = Differential pressure,  $Op$  = Output

#### D6F-PH5050AD3



Differential pressure (Pa)	-500	-300	-100	0	100	300	500
Output (HEX)	1024 (0x0400)	11024 (0x2B10)	13024 (0x32E0)	16024 (0x3E98)	21024 (0x5220)	31024 (0x7930)	61024 (0xEE60)

Measurement conditions: Power supply voltage of  $3.3 \pm 0.1$  VDC, ambient temperature of  $25 \pm 5^\circ\text{C}$ , and ambient humidity of 25% to 75%.

Differential pressure conversion formula:  $Dp = (Op - 1024) / 60000 \times 1000 - 500$

$Dp$  = Differential pressure,  $Op$  = Output

Note. Change of gas density affects the sensor output.

Change of atmospheric pressure is compensated by the following formula.

$Dpeff = Dp \times (Pstd / Pamb)$

$Dpeff$ : Effective differential pressure

$Dp$ : Differential pressure of the sensor output

$Pstd$ : Standard atmospheric pressure (1013.25 hPa)

$Pamb$ : Actual ambient atmospheric pressure (hPa)

## Characteristics/Performance

Model	D6F-PH0025AD1	D6F-PH0505AD3	D6F-PH5050AD3
Measurement range (See note 1)	0 to 250 Pa	±50 Pa	±500 Pa
Calibration Gas (See note 2.)	Air		
Port Type	Barb joint, Maximum outside diameter: 4.9 mm		
Power Supply	2.3 to 3.6 VDC		
Current Consumption	6 mA max. with no load and Vcc of 3.3 VDC, GND = 0 VDC, 25°C		
Resolution	12 bit		
Zero point tolerance	±0.2 Pa		
Span tolerance	±3% R.D.		
Temperature-compensation	yes		
Span shift due to temperature variation	±0.5% R.D. per 10°C max.		
Response time	25 ms typical at 12 bit resolution (50 ms max.) The processing time is 6 ms typical at 12 bit resolution.		
Gas flow through sensor (See note 3.)	63 mL/min max.	23 mL/min max.	100 mL/min max.
Interface	I2C		
Case material	PPS		
Degree of Protection	IEC IP40		
Withstand Pressure	10 kPa		
Operating temperature	-20 to +80°C (with no condensation or icing)		
Operating humidity	35 to 85 %RH (with no condensation or icing)		
Storage temperature	-40 to +80°C (with no condensation or icing)		
Storage humidity	35 to 85 %RH (with no condensation or icing)		
Insulation Resistance	Between Sensor outer cover and lead terminals: 20 MΩ min. (at 500 VDC)		
Dielectric Strength	Between Sensor outer cover and lead terminals: 500 VAC, 50/60 Hz min. for 1 min (leakage current: 1 mA max.)		
Weight	5.2 g		

Note: 1. At standard atmospheric pressure (1013.25 hPa)

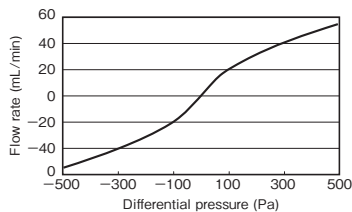
Note: 2. Dry gas must not contain large particles, e.g., dust, oil, or mist.

Note: 3. Type D6F-PH is based on thermal flow principle. Air flow is needed to measure the differential pressure.

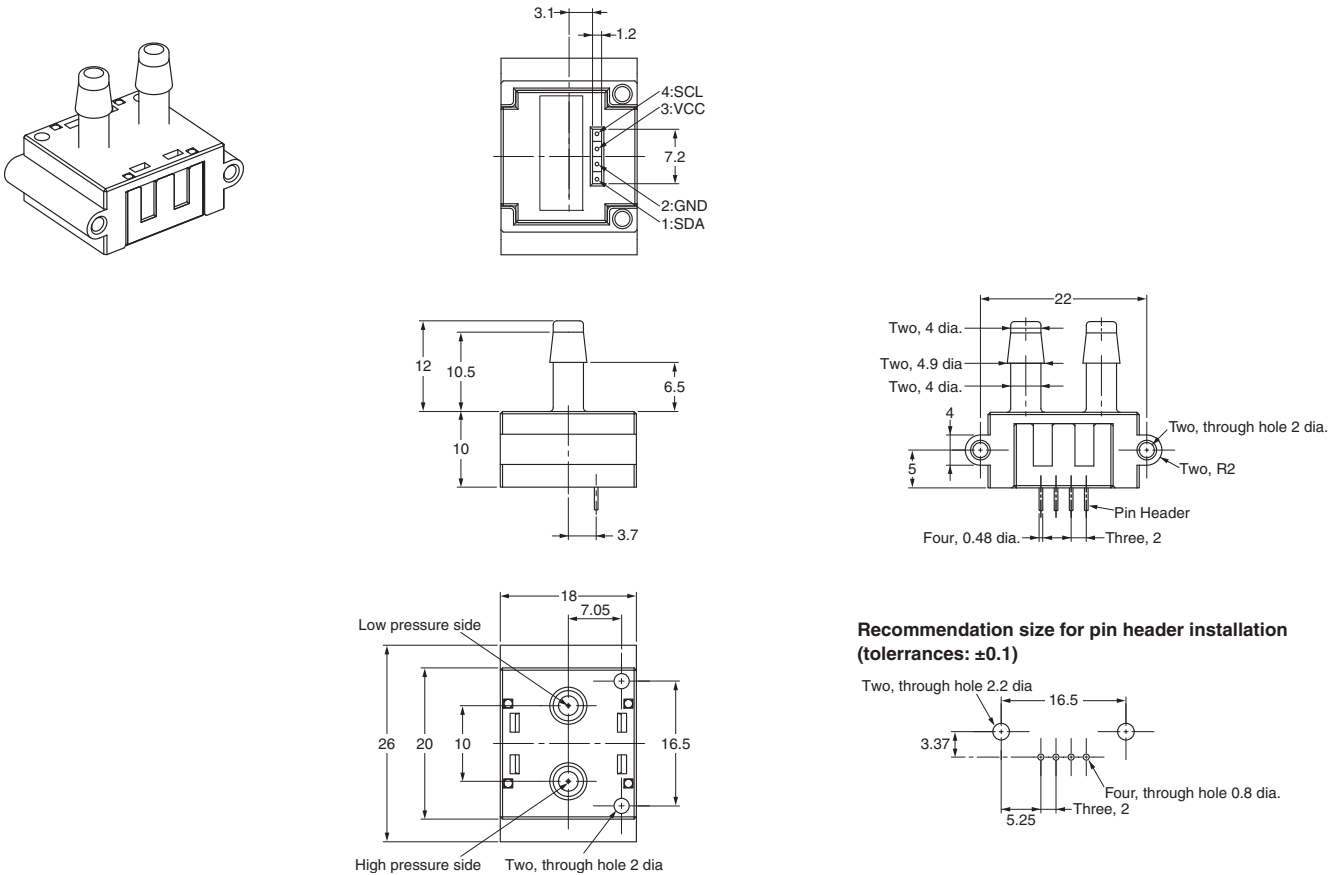
Typical characteristic of air flow by differential pressure is below.

Note: 4. The zero point tolerance and span tolerance are independent uncertainties and add according to the principles of error propagation.

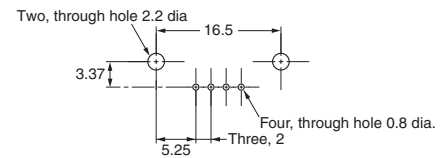
### Relation between pressure and flow rate



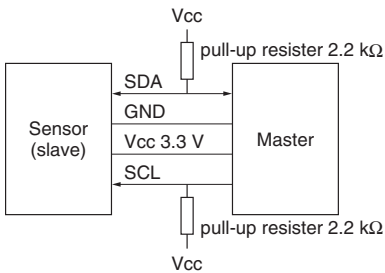
## Connections/Dimensions (Unit: mm)



### Recommendation size for pin header installation (tolerances: $\pm 0.1$ )



## Electrical connection



## Communication

Serial Interface	I2C
Master/Slave	Slave / Address: HEX : 0x6C BIN : 110_1100 (7bit)
Speed mode	Fast Mode 400kHz
Signal	
SCL	Serial Clock
SDA	Data Signal

## Safety Precautions

### WARNING

The D6F is built for use with general-purpose devices. In cases such as those described below, where safety is required, implement measures to ensure the safety of the system and all devices, such as fail-safe designs, redundancy designs, and regular maintenance.

- Safety devices for ensuring safety for persons
- Transportation equipment control (such as applications to stop operation)
- Aviation and space equipment
- Nuclear power equipment

Do not use the D6F for applications in which D6F operation would directly affect human life.

### Caution

Make sure that the power to all equipment is turned OFF before you install the Sensor. Installing the Sensor while the power supply is ON may result in electrical shock or abnormal operation.

### Precautions for Correct Use

#### ● Fluids, Tubes, and Sensor Installation

##### All Models

- (1) Use clean fluids. Dust and mist can affect the characteristics of the Sensor or damage the Sensor. Install a filter and mist separator on the upstream tube.  
(Not required for the D6F-W□A1 or D6F-V or D6F-P and D6F-PH.)
- (2) Do not use combustible gases (e.g., hydrogen), corrosive gases (e.g., chlorine, sulfur, acidic, or alkali gas), or other non-approved fluids. They may damage the Sensor.
- (3) The performance specifications that are given for the G6F do not apply if any fluids other than the specified applicable fluid are used.
- (4) Foreign matter in the tubes that are connected to the Sensor may damage the Sensor. Prevent any foreign matter from entering the tubes after the Sensor is removed from its packaging.
- (5) Attach the tubes so that fluid flows only in the direction designated by the arrows on the Sensor. Correct measurements cannot be obtained if the fluid flows in the wrong direction.
- (6) We recommend that you install the tubes horizontally. If the tubes are not installed horizontally, an error of  $\pm 1\%$  FS or higher may result.  
(This does not apply to the D6F-03A3.)
- (7) Install the Sensor on a flat surface. Incorrect installation may damage the Sensor and make it impossible to obtain correct measurements.
- (8) After the Sensor is installed, check to confirm that it operates correctly.
- (9) Do not drop the Sensor, remove the cover, or attempt to disassemble the Sensor in any way.

#### D6F-PH0025AD1, D6F-PH0505AD3, and D6F-PH5050AD3

- (1) Depending on the ambient environment and installation location, dust, dirt, and other foreign matter may come in inside the Sensor and block a part or all of the flow path or accumulate on internal components. This may result in the Sensor not being able to perform to the specifications given above. Always perform a pre-evaluation on your actual equipment and be aware of the possible problems that may occur before you use the Sensor with the actual equipment.

- (2) Attach all tubes so that the fluid flows only in the direction from the high pressure side (+) to the low pressure side (-).
- (3) Use M1.8 panhead screws or equivalent tapping screws to mount the Sensor, and tighten the screws to a maximum torque of 0.36 N•m.
- (4) The sensor output is affected with the length of a tube. The error is less than 1% with a tube (ID:4mm) length up to 800mm.
- (5) Soldering
  - Please solder properly
  - Do not use flow soldering.
  - Please solder after fixed on the circuit board by screw.
  - Please use a soldering iron

Soldering condition	Pressure	Max.100gf
	Temperature	350 degree C
	Time	Max.5s
- (6) About handling
  - The sensor is a precision device, and if large shock and load is applied, it may cause a failure or characteristic change. Please do not use the sensor which is added excessive shock to the terminals, discompose the cover, or has fallen.
  - The sensor shall only be handled in electrostatic discharge protected areas (EPA) under protected and controlled conditions.

#### ● Operating Environment

Do not use the Sensor in the following locations:

- Locations directly subject to heat radiated from heating equipment
- Locations subject to water or oil
- Locations subject to direct sunlight
- Locations subject to intense temperature changes
- Locations subject to icing or condensation
- Locations subject to excessive vibration or shock

#### ● Countermeasures against Noise

Noise may make it impossible to obtain correct measurements.

Consider the following countermeasures.

- Allow as much space as possible between the Sensor and devices that generates high frequencies (such as high-frequency welders and high-frequency sewing machines) or surges.
- Attach surge absorbers or noise filters to noise-generating devices that are near the Sensor (in particular, equipment with inductance, such as motors, transformers, solenoids, and magnetic coils).  
(It also helps to separate pipes and ducts, and to use shielded cables.)

#### ● Power Supply

- Wire with the correct terminal names and polarities. Incorrect wiring will cause failure of internal components.
- When using a commercially available switching regulator, ground the FG (frame ground) and G (ground) terminals.

### RoHS Directive

The RoHS mark is displayed on the packing of products for which the six substances banned by the RoHS Directive have been abolished (both in processing and in the electronic components mounted to the PCBs).

\* RoHS marking may be terminated if it is later determined that parts that were previously treated as RoHS compliant are not compliant due to circumstances at the supplier of the parts.

#### ● RoHS Compliance Criteria

The following standards are used to determine RoHS compliance for the six banned substances.

(Items to which the RoHS Directive is not applicable are not given.)

- Lead: 1,000 ppm max.
- Hexavalent chromium: 1,000 ppm max.
- Mercury: 1,000 ppm max.
- PBB: 1,000 ppm max.
- Cadmium: 100 ppm max.
- PBDE: 1,000 ppm max.

- Application examples provided in this document are for reference only. In actual applications, confirm equipment functions and safety before using the product.
- Consult your OMRON representative before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems or equipment that may have a serious influence on lives and property if used improperly. Make sure that the ratings and performance characteristics of the product provide a margin of safety for the system or equipment, and be sure to provide the system or equipment with double safety mechanisms.