

DP-M SERIES

LED Display Differential Pressure Sensor

OBSOLETE



High Accuracy & Resolution

CE Marked
 Conforming to EMC Directive

High Accuracy and Resolution

Due to differential pressure sensing, the pressure can be set with a high resolution of 0.01 kPa.D {1 mmH₂O.D} over a pressure range of 0 to 2.00 kPa.D {0 to 204 mmH₂O.D} and, moreover, the detection accuracy is within $\pm 1\%$ F.S.

Setting resolution

**0.01 kPa.D
 {1 mmH₂O.D}**

Repeatability

Within $\pm 1\%$ F.S.

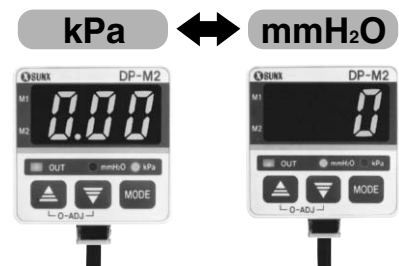
Bright Display • Easy Key Operation

Three bright red 7-segment LEDs, 12mm high, are incorporated in the compact body. They can be clearly read not only in a dark place, but also, in a well-lit place. Further, initialization or pressure settings can be easily done with key operation while looking at the display.



Pressure Unit Selectable

The pressure unit can be selected from 'kPa' and 'mmH₂O' according to your requirement. Further, during measurement, the pressure unit can be recognized at a glance from the pressure unit indicator.

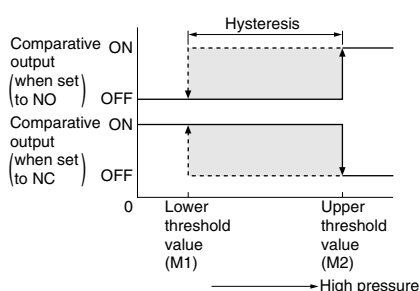


(When the pressure unit is changed, threshold values and the measured pressure value are automatically converted.)

Versatile Control with Two Output Modes

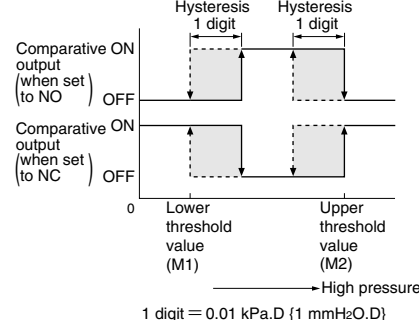
1 Hysteresis mode

The lower threshold value and the upper threshold value establish the hysteresis of the comparative output.



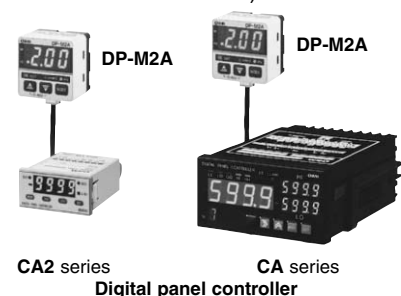
2 Window comparator mode

The comparative outputs can be made ON or OFF by a pressure within the limits set by the upper and the lower threshold levels.



Analog Current Output Type: DP-M2A

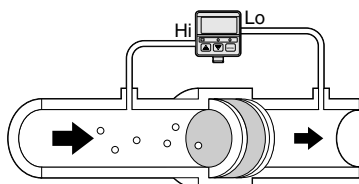
DP-M2A is incorporated also with the analog current output (4 to 20mA). Hence, it is ideally suited for real time monitoring and multi-point control in combination with an analog controller (ultra-compact digital panel controller CA2 series, or digital panel controller CA series).



APPLICATIONS

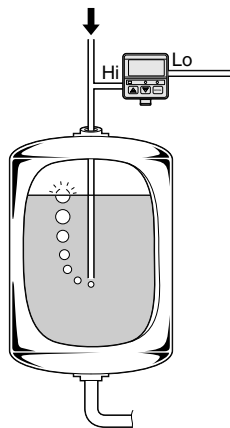
Detecting clogging of filter

The clogging of a filter can be reliably detected by the differential pressure, indicating the time for filter replacement.



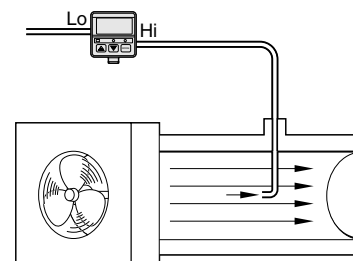
Detecting liquid level with air supply

The air supply pressure varies with the depth of the pipe in the liquid, and hence, the liquid level can be detected.



Monitoring air-flow

The sensor can be used to monitor whether the air-flow is normal.



ORDER GUIDE

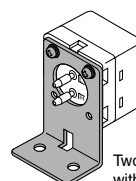
Type	Appearance	Rated pressure range	Model No.
Standard		0 to 2.00 kPa.D {0 to 204 mmH ₂ O.D}	DP-M2
With analog current output		0 to 2.00 kPa.D {0 to 204 mmH ₂ O.D}	DP-M2A

DP-M

OPTIONS

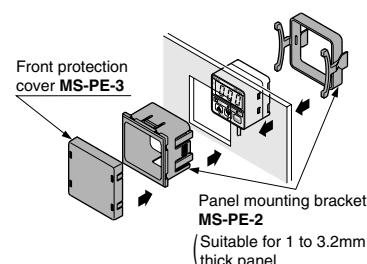
Designation	Model No.	Description	
Sensor mounting bracket	MS-PE-1	L-shaped bracket [Two M3 (length 8mm) screws with washers are attached.]	
Panel mounting bracket	MS-PE-2	It can be used for mounting on a panel (1 to 3.2mm thick). [Two M3 (length 8mm) screws with washers are attached.]	
Front protection cover	MS-PE-3	It protects the sensor's adjustment panel. (It can be fitted when the panel mounting bracket is used.)	
Digital panel controller	CA2-T1	NPN open-collector transistor	This is a very small controller which allows two independent threshold level settings. • Supply voltage: 24V DC \pm 10% • No. of inputs: 1 No. (sensor input) • Input range: 4 to 20mA • Main functions: Threshold level setting function, zero-adjust function, scale setting function, hysteresis setting function, start/hold function, auto-reference function, power supply ON-delay function, etc.
	CA-R1	Relay contact	This is a multi-functional controller having mathematical functions, hold function, etc. • Supply voltage: 100 to 240V AC \pm 10% • No. of inputs: 2 Nos. (sensor inputs) • Input range: 4 to 20mA • Power supply for sensor: 12V DC, 150mA • Main functions: Mathematical functions, process number selection function, hold function, scaling function, auto-reference function, power supply ON-delay function, measurement start delay function, hysteresis setting function, etc.
	CA-T1	NPN open-collector transistor	
	CA-B1	NPN open-collector transistor With BCD output	

Sensor mounting bracket



Two M3 (length 8mm) screws with washers are attached.

Panel mounting bracket, Front protection cover



Panel mounting bracket **MS-PE-2**
(Suitable for 1 to 3.2mm thick panel)

Digital panel controller

• CA2 series



• CA series



SPECIFICATIONS

Item	Type	Standard type	With analog current output type
	Model No.	DP-M2	DP-M2A
Type of pressure	Differential pressure		
Rated pressure range	0 to 2.00 kPa.D {0 to 204 mmH ₂ O.D}		
Set pressure range	0 to 2.00 kPa.D {0 to 204 mmH ₂ O.D}		
Set pressure resolution	0.01 kPa.D {1 mmH ₂ O.D}		
Pressure withstandability	6 kPa.D {612 mmH ₂ O.D}		
Applicable fluid	Non-corrosive gas		
Selectable units	kPa, mmH ₂ O		
Supply voltage	12 to 24V DC $\pm 10\%$ Ripple P-P 10% or less		
Current consumption	50mA or less	75mA or less	
Comparative output	NPN open-collector transistor		
	<ul style="list-style-type: none"> • Maximum sink current: 100mA • Applied voltage: 30V DC or less (between comparative output and 0V) • Residual voltage: 1V or less (at 100mA sink current) 0.4V or less (at 16mA sink current) 		
	Utilization category	DC-12 or DC-13	
	Output operation	Selectable either normally open (NO) or normally closed (NC) by the key (Note)	
	Hysteresis	0.01 kPa.D {1 mmH ₂ O.D}	
	Repeatability	Within $\pm 1\%$ F.S.	
	Response time	10ms or less	
Short-circuit protection	Incorporated		
Analog current output		Output current: 4 to 20mA (from 0 to 1.96 kPa.D {0 to 200 mmH ₂ O.D}) Zero-point: within 4mA $\pm 1\%$ F.S. Span: within 16mA $\pm 3\%$ F.S. Linearity: within $\pm 1\%$ F.S. Load resistance: 0 to 250 Ω	
Display	3 digit red LED display (Sampling rate: 4 times/sec. approx.)		
Displayable pressure range	- 0.05 to 2.10 kPa.D { - 5 to 210 mmH ₂ O.D}		
Indicator	Operation	Orange LED (lights up when the comparative output is ON)	
	Pressure unit	Red LED (The indicator corresponding to the selected unit lights up during the sensing mode.)	
	M1 setting	Red LED (blinks in the M1 setting mode)	
	M2 setting	Red LED (blinks in the M2 setting mode)	
Environmental resistance	Pollution degree	3 (Industrial environment)	
	Ambient temperature	0 to + 50°C (No dew condensation), Storage: - 10 to + 60°C	
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH	
	EMC	Emission: EN50081-2, Immunity: EN50082-2	
	Voltage withstandability	1,000V AC for one min. between all supply terminals connected together and enclosure	
	Insulation resistance	50M Ω , or more, with 500V DC megger between all supply terminals connected together and enclosure	
	Vibration resistance	10 to 150Hz frequency, 0.75mm amplitude in X, Y and Z directions for two hours each	
Shock resistance	100m/s ² acceleration (10G approx.) in X, Y and Z directions for three times each		
Temperature characteristics	Over ambient temperature range 0 to + 50°C: within $\pm 3\%$ F.S. of detected pressure at 25°C		
Pressure port	ϕ 4.8mm resin pipe		
Material	Front case: ABS, Rear case: ABS, LED display: Acrylic, Pressure port: PA		
Cable	0.18mm ² 3-core oil resistant cabtyre cable, 2m long	0.18mm ² 4-core oil resistant cabtyre cable, 2m long	
Cable extension	Extension up to total 100m is possible with 0.3mm ² , or more, cable.		
Weight	75g approx.		

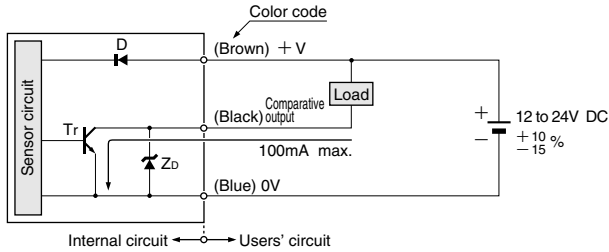
DP-M

I/O CIRCUIT AND WIRING DIAGRAMS

DP-M2

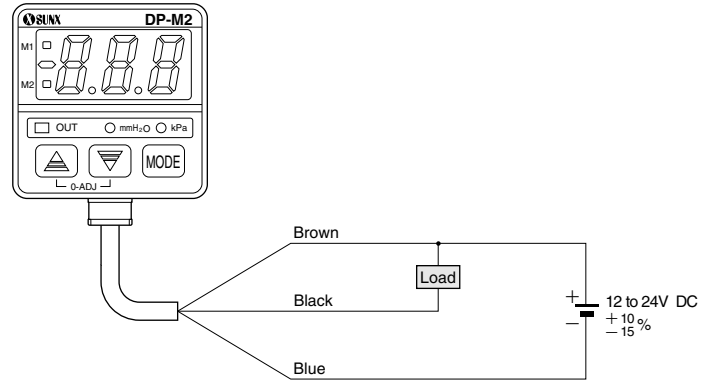
Standard type

I/O circuit diagram



Symbols ... D: Reverse supply polarity protection diode
Z₀: Surge absorption zener diode
Tr: NPN output transistor

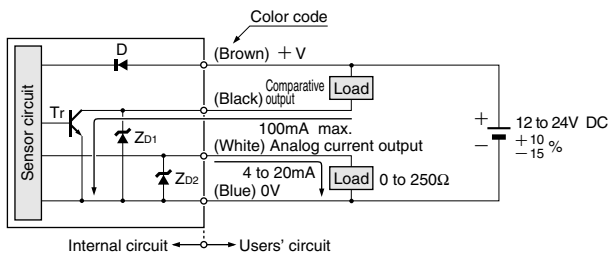
Wiring diagram



DP-M2A

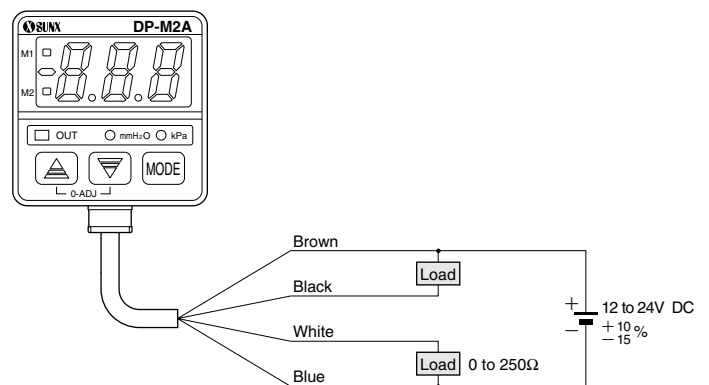
With analog current output type

I/O circuit diagram



Symbols ... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr: NPN output transistor

Wiring diagram



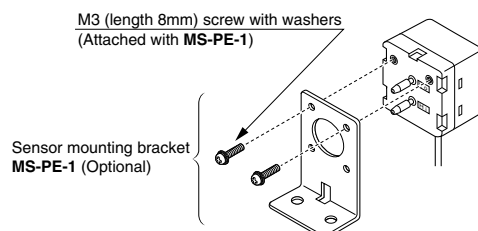
PRECAUTIONS FOR PROPER USE



- This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal pressure detection sensor.
- The **DP-M** series is designed for use with non-corrosive gas. It cannot be used for liquid or corrosive gas.

Mounting

- The displayed value may vary by 1 digit (0.01 kPa.D {1 mmH₂O.D}) maximum depending on whether the sensor is installed vertically or horizontally.
- A sensor mounting bracket **MS-PE-1** (optional) may be used. When mounting the sensor with the sensor mounting bracket, etc., the tightening torque should be 0.5N·m or less.



PRECAUTIONS FOR PROPER USE

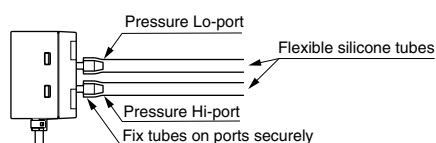
Piping

• Apply higher pressure to the Hi-port and lower pressure to the Lo-port.

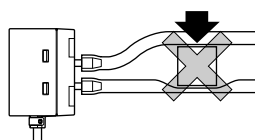
- Use flexible silicone tubes that can fit the $\phi 4.8\text{mm}$ ports. The tubes should cover more than half the length of the pressure ports.

Recommended silicone tube

- LABORAN[®] silicone tube, size: internal dia 4mm, external dia 6mm, made by Tigers Polymer.
- TYGON[®] tube R-3603, size: internal dia 4mm, external dia 6mm, made by NORTON.



- Notes: 1) LABORAN and TYGON are registered trademarks of Tigers Polymer and NORTON, respectively.
- 2) Ensure that excessive pressure is not applied to the pressure ports. Since this sensor is designed for detecting small pressures, if excessive pressure or shock is applied to the pressure ports, the diaphragm (pressure sensing device) in the sensor may get damaged.
 - 3) Please do not compress the silicone tube. If the silicone tube is compressed, pressure exceeding the rated value may be generated, damaging the diaphragm (pressure sensing device).



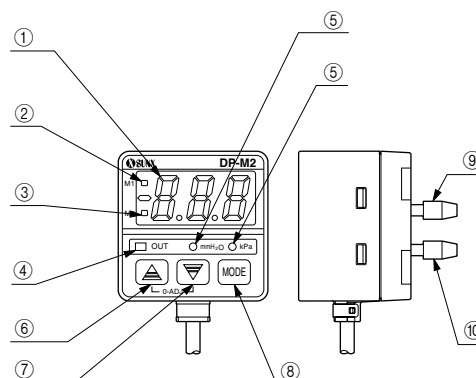
Wiring

- Make sure to carry out the wiring in the power supply off condition.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this sensor, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- The analog current output is not incorporated with a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

Others

- Use within the rated pressure range.
- Do not apply pressure exceeding the pressure withstandability value. The diaphragm will get damaged and correct operation shall not be maintained.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Avoid dust, dirt, and steam.
- Take care that the sensor does not come in direct contact with water, oil, grease, or organic solvents, such as, thinner, etc.
- Do not insert wires, etc., into the pressure port. The diaphragm will get damaged and correct operation shall not be maintained.
- Do not operate the keys with pointed or sharp objects.

Functional description



	Description	Function
①	3 digit LED display (Red)	The measured differential pressure level, setting values, error codes, and key protection sign are displayed.
②	M1 setting indicator (Red)	Blinks in the lower threshold value (M1) setting mode.
③	M2 setting indicator (Red)	Blinks in the upper threshold value (M2) setting mode.
④	Operation indicator (Orange)	Lights up when the comparative output is ON.
⑤	Pressure unit indicator (mmH ₂ O, kPa) (Red)	<ul style="list-style-type: none"> • The indicator of the selected unit lights up during the sensing mode. • Both indicators light off during the initial setting mode and during an error occurrence. • The indicator of the selected unit blinks during the upper and lower threshold value setting mode.
⑥	Increment key (▲)	<ul style="list-style-type: none"> • The settable digit is shifted cyclically at every press of the key during the initial setting mode. • Pressing the key increases the set value, in the upper and lower threshold value setting mode.
⑦	Decrement key (▼)	<ul style="list-style-type: none"> • The set condition changes at every press of the key during the initial setting mode. • Pressing the key decreases the set value, in the upper and lower threshold value setting mode.
⑧	Mode selection key (MODE)	<ul style="list-style-type: none"> • Three modes, the sensing mode, the lower threshold value (M1) setting mode, and the upper threshold value (M2) setting mode, are cyclically selected at every press of the key. • During the sensing mode, pressing the key for 4 sec., or more, can make the key protection either effective or ineffective. • Holding the increment key and simultaneously pressing the mode selection key brings the sensor from the sensing mode to the initial setting mode.
⑨	Pressure Lo-port	Lower pressure should be applied.
⑩	Pressure Hi-port	Higher pressure should be applied.

Error messages

- When an error occurs, take the following corrective action.

Error message	Cause	Corrective action
	Overcurrent due to short-circuit.	Switch off the power supply and check the load.
	Pressure (differential pressure) is being applied during zero-point adjustment.	Applied pressure at the Hi-port and the Lo-port should be brought to atmospheric pressure and zero-point adjustment should be done again.
	Applied pressure (differential pressure) exceeds the upper limit of displayable pressure range (2.10 kPa.D {210 mmH ₂ O.D})	Applied pressure should be brought within the rated pressure range.
	Applied pressure (differential pressure) exceeds the lower limit of displayable pressure range (-0.05 kPa.D {-5 mmH ₂ O.D}).	(0 to 2.00 kPa.D {0 to 204 mmH ₂ O.D})

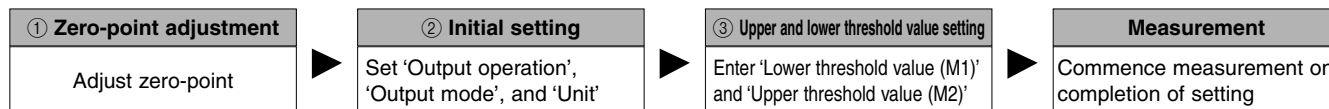
DP-M

PRECAUTIONS FOR PROPER USE

Setting

- If key-protect has been set, make sure to release key-protect before operating the keys.
(Please refer to 'Key-protect function' for the procedure.)
- The conditions which are set are stored in an EEPROM. Kindly note that the EEPROM has a life span and its guaranteed life is 100,000 write operation cycles.

Setting procedure



① Zero-point adjustment

- The displayed differential pressure when the pressure port is left open is adjusted to zero.

Set to sensing mode

- The sensor will automatically enter the sensing mode when power is supplied.
- The figure on the left shows the display when the pressure unit is set to 'mmHzO'.
- $\overline{000}$ is displayed if the pressure unit is set to 'kPa'.

Perform zero-point adjustment

- Let the pressure ports (Hi-port and Lo-port) be at atmospheric pressure (i.e., no applied pressure condition), and press, simultaneously, Δ key and ∇ key continuously.
- $\overline{000}$ is displayed and, when the fingers are released, zero-point adjustment is completed and the sensor returns to the sensing mode.

• When the unit of 'kPa' has been selected, $\overline{000}$ blinks once after the keys are released.

② Initial setting

- 'Output operation' and 'Output mode' of the comparative outputs, and pressure 'Unit' are set.

Set to initial setting mode

- In the sensing mode, press \square key while pressing Δ key.
- Initial setting is displayed.
- If sensor is being used for the first time, \overline{UHQ} is displayed.

Set initial conditions

- The settable digit blinks.
- The settable digit changes when Δ key is pressed.

Change with Δ key.

3rd digit	2nd digit	1st digit
U	H	Q
↓	↓	↓
P	E	E
⋮	⋮	⋮
Unit U: mmHzO P: kPa	Output mode H: Hysteresis mode E: Window comparator mode	Output operation Q: Normally open (NO) E: Normally closed (NC)

- Change the setting of each digit as desired.
- The setting is changed when ∇ key is pressed.

Set to sensing mode

- Press \square key.
- Your set data is registered and the sensor enters into the sensing mode.
- The above figure shows the display when the pressure unit is set to 'mmHzO'.

• Output mode and output operation

Hysteresis mode (H) (M1 < M2)

Window comparator mode (E) (M1 < M2)

1 digit = 0.01 kPa.D (1 mmHzO.D)

- When operating in window comparator mode (E) lower threshold value (M1) and upper threshold value (M2) should be set with a difference of 3 digits (0.03 kPa.D (3 mmHzO.D)) or more.

PRECAUTIONS FOR PROPER USE

③ Upper and lower threshold value setting

- 'Lower threshold value (M1)' and 'upper threshold value (M2)' of the comparative outputs are set.

• The lower threshold value (M1) and the upper threshold value (M2) can be entered under the following conditions.
 M1 < M2
 No vacuum values

Set to lower threshold value (M1) set mode	Enter lower threshold value (M1)	Set to upper threshold value (M2) set mode	Enter upper threshold value (M2)	Set to sensing mode
<ul style="list-style-type: none"> • In the sensing mode, press MODE key. • The registered lower threshold value (M1) appears and blinks. The M1 setting indicator and the pressure unit indicator also blink. 	<ul style="list-style-type: none"> • Enter using ▲ key and ▼ key. • If the set pressure range is exceeded, either UP (upper limit exceeded) or LD (lower limit exceeded) is displayed. 	<ul style="list-style-type: none"> • In the lower threshold value (M1) set mode, press MODE key. • If set value M1 is larger than the registered upper threshold value (M2), the sum of the M1 value plus 1 digit appears and blinks. Otherwise, the registered upper threshold value (M2) appears and blinks. The M2 setting indicator and the pressure unit indicator also blink. 	<ul style="list-style-type: none"> • Using ▲ key and ▼ key, enter in a manner similar to that for entering lower threshold value (M1). • If the set pressure range is exceeded, either UP (upper limit exceeded) or LD (lower limit exceeded) is displayed. 	<ul style="list-style-type: none"> • Press MODE key. • The sensor returns to sensing mode after lower threshold value (M1) and upper threshold value (M2) have been set.
<ul style="list-style-type: none"> • When the window comparator mode has been selected during the initial setting, the lower threshold value (M1) and the upper threshold value (M2) should be set with a difference of 3 digits (0.03 kPa.D {3 mmH₂O.D}) or more. 				

Key-protect function

- Key-protect is a function which prevents any unintentional change in the conditions which have been entered in each setting mode by making the sensor not to respond to the key operations.

Setting of key-protect	Release of key-protect
<ul style="list-style-type: none"> • In the sensing mode, press MODE key continuously until 0n appears (4 sec. approx.). • Once 0n is displayed, release the key. Then the key-protect is set and the sensor enters into the sensing mode again. 	<ul style="list-style-type: none"> • In the sensing mode, press MODE key continuously until 0FF appears (4 sec. approx.). • Once 0FF is displayed, release the key. Then the key-protect is cancelled and the sensor enters into the sensing mode again.
<ul style="list-style-type: none"> • Since the key-protect information is stored in an EEPROM, it is not erased even if the power supply is switched off. • Please take care to remember if key-protect has been set. 	<ul style="list-style-type: none"> • When the keys are to be operated, make sure that key-protect is released.

Conversion of pressure units

- The conversion to different pressure units can be obtained by multiplying the values by the coefficients given in the table on the right.

Conversion procedure

- For example, if 2kPa is to be expressed in kgf/cm², since 1kPa = 1.01972 × 10⁻²kgf/cm², 2kPa becomes 2 × 1.01972 × 10⁻² ≐ 0.020kgf/cm².

- In the DP-M series, the pressure unit (kPa, mmH₂O) can be easily selected by key operation.

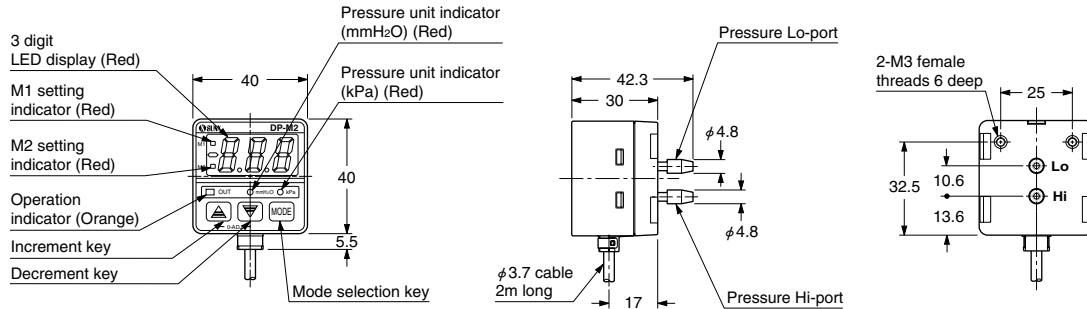
Conversion table for pressure units

	kPa	mmH ₂ O	mmHg (Torr)	kgf/cm ²	atm
1kPa	1	1.01972 × 10 ²	7.50062	1.01972 × 10 ⁻²	9.86923 × 10 ⁻³
1mmH ₂ O	9.80665 × 10 ⁻³	1	7.35559 × 10 ⁻²	1 × 10 ⁻⁴	9.67841 × 10 ⁻⁵
1mmHg (1Torr)	1.33322 × 10 ⁻¹	1.35951 × 10	1	1.35951 × 10 ⁻³	1.31579 × 10 ⁻³
1kgf/cm ²	9.80665 × 10	1 × 10 ⁴	7.35559 × 10 ²	1	9.67841 × 10 ⁻¹
1atm	1.01325 × 10 ²	1.03323 × 10 ⁴	7.60000 × 10 ²	1.03323	1

DP-M

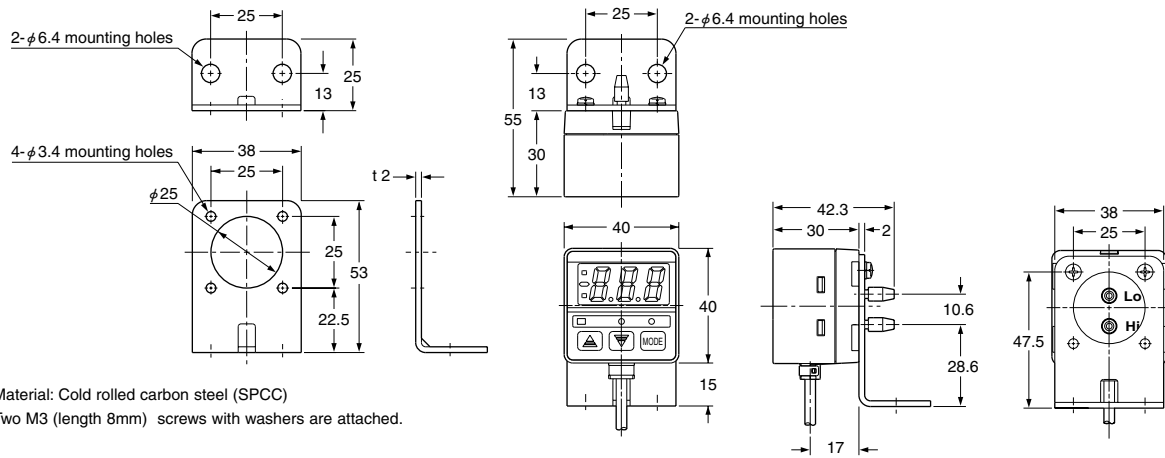
DIMENSIONS (Unit: mm)

DP-M2 DP-M2A Sensor



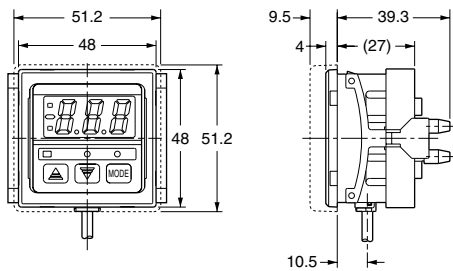
MS-PE-1 Sensor mounting bracket (Optional)

Assembly dimensions



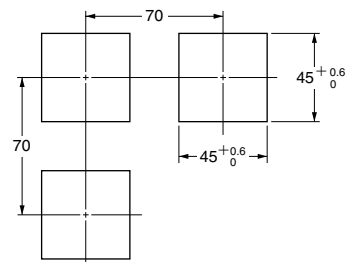
MS-PE-2 MS-PE-3 Panel mounting bracket, front protection cover (Optional)

Assembly dimensions



□ portion shows the front protection cover.
 Material: Polycarbonate (Front protection cover)
 Nylon 6, Polyacetal (Panel mounting bracket)

Panel cut-out dimensions



Note: The panel thickness should be 1 to 3.2mm.

