

# INSTRUCTION MANUAL

## Head Separated Digital Pressure Sensor Controller DP5 Series For use outside Japan

MJE-DP5 No.6047-01

Thank you very much for using SUNX sensors. Please read this Instruction Manual carefully and thoroughly for the correct and optimum use of this sensor. Kindly keep this manual in a convenient place for quick reference.



### WARNING

- Never use this product in a device for personnel protection.
- In case of using devices for personnel protection, use products which meet standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.
- This sensor cannot be used within Japan, since use of pressure units in Japan is restricted to SI units.

## 1 SPECIFICATIONS

Type	NPN output type	PNP output type
Item Model No.	DP5-C	DP5-C-P
Applicable pressure sensor head	DPH-A00, DPH-A02, DPH-A07, DPH-A10, DPH-A12, DPH-A17, DPH-A20, DPH-A22, DPH-A27, DPH-A30	
Rated pressure range (Note 1)	0 to -101.3kPa / 0 to 1.000MPa / -100.0 to 100.0kPa	
Set pressure range (Note 1)	101.3 to -101.3kPa / -1.050 to 1.050MPa / -199.9 to 199.9kPa	
Supply voltage	12 to 24V DC $\pm 15\%$ Ripple P-P 10% or less	
Current consumption	60mA or less (not including pressure sensor head)	
Sensor supply voltage	Same as supply voltage	
Pressure sensor head input	Input voltage range: 1 to 5V DC (over rated pressure range)	
Input	<ul style="list-style-type: none"> <li>• Input condition: NPN non-contact input [operates in Low (fall) state]</li> <li>• Signal condition: High...5 to 30V, or open Low...0.4V or less Low level input time...2ms or more</li> </ul>	<ul style="list-style-type: none"> <li>• Input condition: PNP non-contact input [operates in High (rise) state]</li> <li>• Signal condition: High...5 to 30V Low...0.4V or less, or open High level input time...2ms or more</li> </ul>
Comparative output (Comparative Output 1) (Comparative Output 2)	NPN open-collector transistor (2 outputs) <ul style="list-style-type: none"> <li>• Maximum sink current: 100mA</li> <li>• Applied voltage: 30V DC or less (between comparative output and 0V)</li> <li>• Residual voltage: 1V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)</li> </ul>	PNP open-collector transistor (2 outputs) <ul style="list-style-type: none"> <li>• Maximum source current: 100mA</li> <li>• Applied voltage: Same as supply voltage (between comparative output and +V)</li> <li>• Residual voltage: 2V or less (at 100mA source current)</li> </ul>
Output operation	NO/NC, selectable by key operation	
Hysteresis	1 digit (however, 2 digits when using psi unit)	
Repeatability	With vacuum/positive pressure type sensor head connected: Within $\pm 0.2\%$ F.S. $\pm 1$ digit ( $\pm 3$ digits) With compound pressure type sensor head connected: Within $\pm 0.2\%$ F.S. $\pm 2$ digits ( $\pm 6$ digits)	
Response time	1ms, 16ms, 128ms, 512ms or less, selectable by key operation	
Analog voltage output	<ul style="list-style-type: none"> <li>• Output voltage: 1 to 5V DC (over rated pressure range)</li> <li>• Output impedance: 1k<math>\Omega</math> approx.</li> </ul>	
Zero point	With vacuum/positive pressure type sensor head connected: Within 1V $\pm 2.5\%$ F.S. With compound pressure type sensor head connected: Within 3V $\pm 3.5\%$ F.S.	
Span	Within 4V $\pm 4\%$ F.S.	
Linearity	Within $\pm 1\%$ F.S.	
Display	3 1/2 digit LCD display (with red and green backlight)	
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	
Temperature characteristics	Over ambient temperature range 0 to +50°C: within $\pm 0.5\%$ F.S. of detected pressure at +25°C (not including pressure sensor head)	
Material	Front case: ABS, LCD display section: PET, Rear case: PBT	
Weight	20g approx.	
Accessories	Vertical multiple panel mounting bracket (MS-DP-1): 1 set, Pressure unit label: 1 No. Connector cap: 1 No., Connector: 1 set (Housing: 1 No., Connector pin: 6 Nos.)	

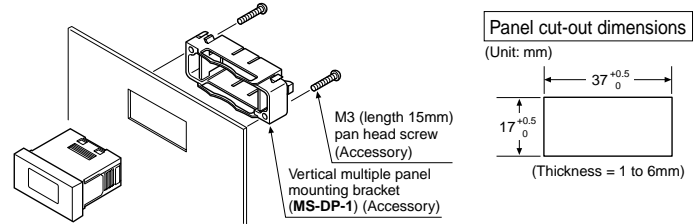
Note: It changes automatically according to the connected pressure sensor head.

## 2 CAUTIONS

- Use within the rated pressure range.
- Make sure to carry out the wiring in the power supply off condition.
- Take care that wrong wiring will damage the sensor.
- 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 use during the initial transient time (3 sec. approx.) after the power supply is switched on.
- If the used power supply generates a surge, connect a surge absorber to the power supply to absorb the surge.
- 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.
- In order to reduce noise, make the wiring as short as possible.
- 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 operate the keys with pointed or sharp objects.

## 3 MOUNTING

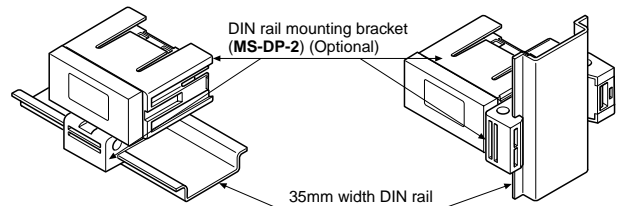
- Mount the enclosed vertical multiple panel mounting bracket (MS-DP-1) as shown in the figure below. The tightening torque should be 0.15N·m or less. Further, tighten both the right and the left screw gradually and equally, so that the panel mounting bracket does not tilt. Horizontal multiple panel mounting bracket (MS-DP-5) for horizontal multiple mounting is also available.



- DIN rail mounting bracket (MS-DP-2), which can fit on a 35mm width DIN rail, is also available.

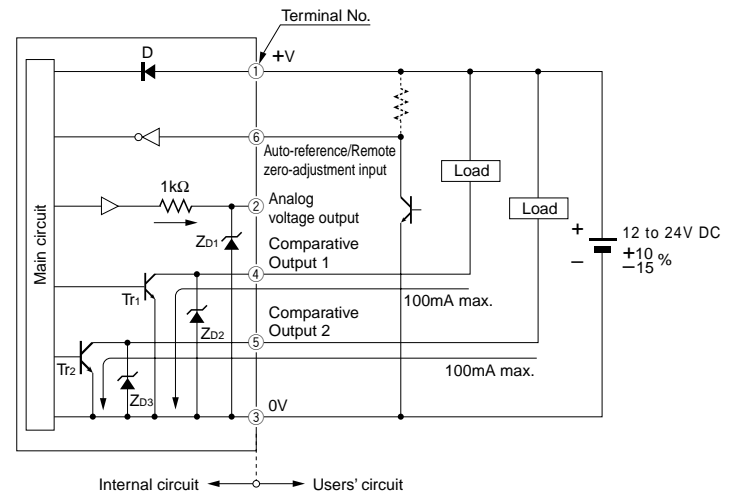
### Horizontal mounting

### Vertical mounting



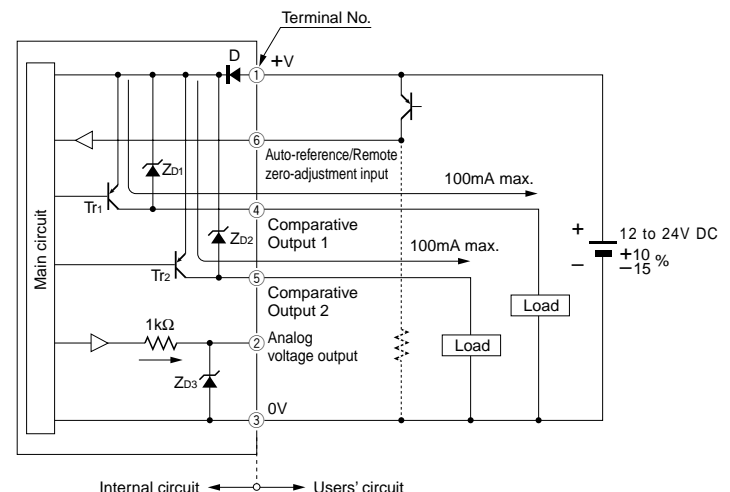
## 4 I/O CIRCUIT DIAGRAM

### ● DP5-C/NPN output type



Symbols ...D: Reverse supply polarity protection diode  
Zb1, Zb2, Zb3: Surge absorption zener diode  
Tr1, Tr2: NPN output transistor

### ● DP5-C-P/PNP output type



Symbols ...D: Reverse supply polarity protection diode  
Zb1, Zb2, Zb3: Surge absorption zener diode  
Tr1, Tr2: PNP output transistor

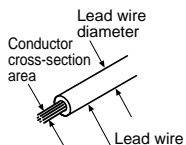
## 5 ASSEMBLY OF CONNECTOR

- ① Using a suitable cable having the following specifications, prepare its end with a stripper, etc., as given in the figure below.  
Further, the cable extension can be less than 10m with 0.3mm<sup>2</sup>, or more, cable. However, if CE conformity is not required, the cable extension can be up to 100m with 0.3mm<sup>2</sup>, or more, cable.

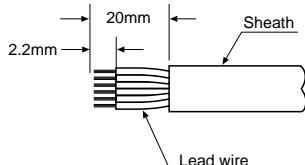
### • Cable specifications

Conductor cross-section area	0.16 to 0.32mm <sup>2</sup> (AWG 25 to 22)
Lead wire diameter	1.2 to 1.8mm
Wire material	Tin plated, soft, twisted copper wire

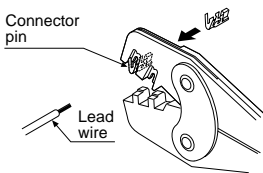
Note: If the wire length is 2m or more, use 0.3mm<sup>2</sup> or more cable.



### In case of cable cable



- ② Setting the connector pin in the groove of the exclusive crimp tool as shown in the right figure, insert the lead wire into the connector pin and crimp.

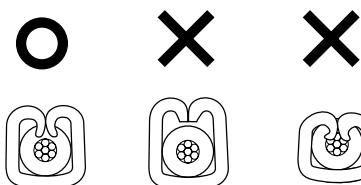
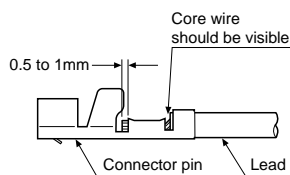


<Recommended>

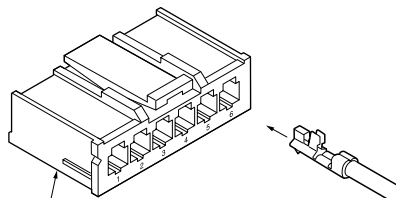
Crimping tool: YC-690R manufactured by J.S.T. MFG CO., LTD.

Connector pin: BXA-001T-P0.6 manufactured by J.S.T. MFG CO., LTD.

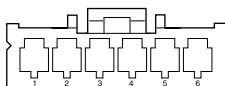
- ③ After crimping, make sure to confirm that the crimping is proper, as shown in the figure below.  
In case the crimping is incorrect, cut the cable and repeat the procedure from Step ①.



- ④ As shown in the figure below, insert the connector pin till the end of the housing.  
After inserting, make sure to confirm that the locking is proper by pulling lightly (10N or less) at the cable.



### • Pin position



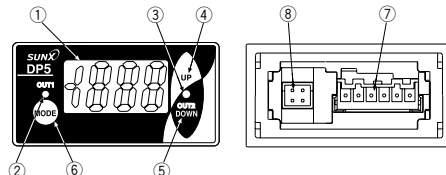
Terminal No.	Description	Terminal No.	Description
1	+V	4	Comparative Output 1
2	Analog voltage output	5	Comparative Output 2
3	0V	6	Auto-reference/Remote zero-adjustment input

<Recommended>

Housing: XAP-06V-1 manufactured by J.S.T. MFG CO., LTD.

Note: Do not reuse a connector pin which has been crimped once or inserted into the housing, as its performance cannot be guaranteed.  
Please procure the optional connector (CN-66) (10 Nos./set) or the recommended product.  
A 6-core connector attached cable (CN-66-C2) (cable length: 2m) is also available.

## 6 FUNCTIONAL DESCRIPTION



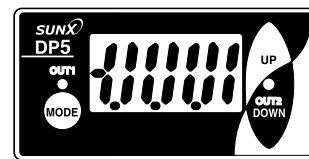
	Description	Function
①	3 1/2 digit LCD display (with red and green backlight)	<ul style="list-style-type: none"> <li>Displays measured pressure, settings, error messages and key-protect status.</li> <li>Its lighting up can be set as Red when ON/ Green when OFF with respect to either Comparative Output 1 or Comparative Output 2, according to the display color relation selection during the supplementary setting mode.</li> </ul>
②	Comparative Output 1 operation indicator (Orange)	<ul style="list-style-type: none"> <li>Lights up when Comparative Output 1 is ON.</li> </ul>
③	Comparative Output 2 operation indicator (Green)	<ul style="list-style-type: none"> <li>Lights up when Comparative Output 2 is ON.</li> </ul>
④	UP key	<ul style="list-style-type: none"> <li>In the initial setting mode and supplementary setting mode, pressing the key changes the setting item.</li> <li>In the pressure value setting mode, pressing the key changes the set value.</li> <li>In the sensing mode, pressing the key continuously for 4 sec., or more, displays the peak hold value.</li> <li>In the sensing mode, if both keys are simultaneously pressed continuously, zero-point adjustment is done.</li> </ul>
⑤	DOWN key	<ul style="list-style-type: none"> <li>In the initial setting mode and supplementary setting mode, pressing the key changes the set conditions.</li> <li>In the pressure value setting mode, pressing the key changes the set value.</li> <li>In the sensing mode, pressing the key continuously for 4 sec., or more, displays the bottom hold value.</li> </ul>
⑥	MODE key	<ul style="list-style-type: none"> <li>In the pressure value setting mode, pressing the key changes the setting item.</li> <li>In the sensing mode, pressing the key continuously for 4 sec., or more, can set/cancel the key-protect.</li> <li>In the sensing mode, pressing both UP key and MODE key simultaneously changes the mode to the initial setting mode. Whereas, pressing both DOWN key and MODE key simultaneously changes the mode to the supplementary setting mode.</li> </ul>
⑦	Connector for power supply/I-O cable connection	<ul style="list-style-type: none"> <li>It is the connector for connection of power supply/I-O cable.</li> </ul>
⑧	Connector for pressure sensor head connection	<ul style="list-style-type: none"> <li>It is the connector for connection of pressure sensor head.</li> </ul>

## 7 ERROR MESSAGES

Error message	Cause	Corrective action
E-0	The controller, pressure sensor head and the intermediate cable are not correctly connected.	Connect the pressure sensor head and the intermediate cable correctly.
E-1	Pressure sensor head cable or intermediate cable have a cable break.	Check the pressure sensor head cable and the intermediate cable and replace the cable having a break.
E-3	The pressure sensor head is damaged.	Replace the pressure sensor head.
E-1	Overcurrent due to short-circuit.	Switch off the power supply and check the load.
E-3	Pressure is being applied during zero-point adjustment.	Applied pressure at the pressure port should be brought to atmospheric pressure and zero-point adjustment should be done again.
Lo	The remote zero adjust input is done in the state that the applied pressure exceeds the lower limit (reverse pressure) of the rated pressure range.	Applied pressure should be brought within the rated pressure range before using the remote zero adjust input.
UP	The remote zero adjust input is done in the state that the applied pressure exceeds the upper limit of the rated pressure range.	Applied pressure should be brought within the rated pressure range.
---	Positive pressure and compound pressure types	Applied pressure exceeds the upper limit of displayable pressure range.
---	Vacuum pressure type	Applied pressure exceeds the lower limit (reverse pressure) of displayable pressure range.
---	Positive pressure and compound pressure types	Applied pressure exceeds the upper limit of displayable pressure range.
---	Vacuum pressure type	Applied pressure exceeds the lower limit of displayable pressure range.

## 8 ANALOG BAR DISPLAY

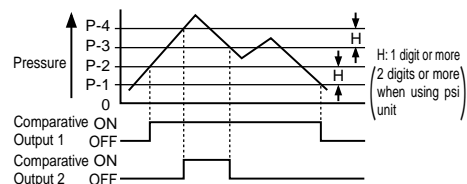
- Pressure changes are displayed in an analog fashion by using LCD bar. Hence, any sudden changes in pressure can be detected at a glance.
- The analog bar display shows the measured pressure, in steps of 14% F.S. approx.



## 9 OUTPUT MODES & THEIR CHARACTERISTICS

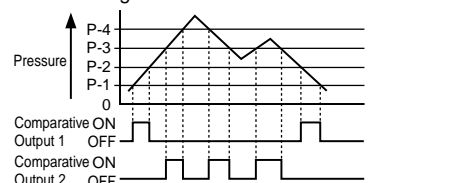
### Hysteresis mode

- The hysteresis of the comparative outputs can be set arbitrarily by the set values for ON/OFF control.



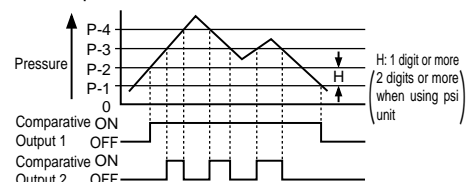
### Window comparator mode

- The comparative output can be turned ON or OFF by a pressure which is within the set pressure range.



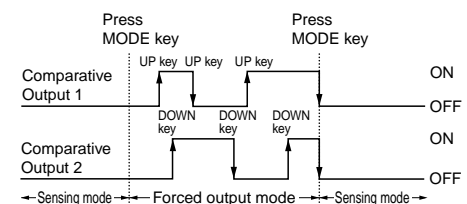
### Leak test mode

- It is suitable for a leak test since Comparative Output 1 can be set to the hysteresis mode and Comparative Output 2 can be set to the window comparator mode.



### Forced output mode

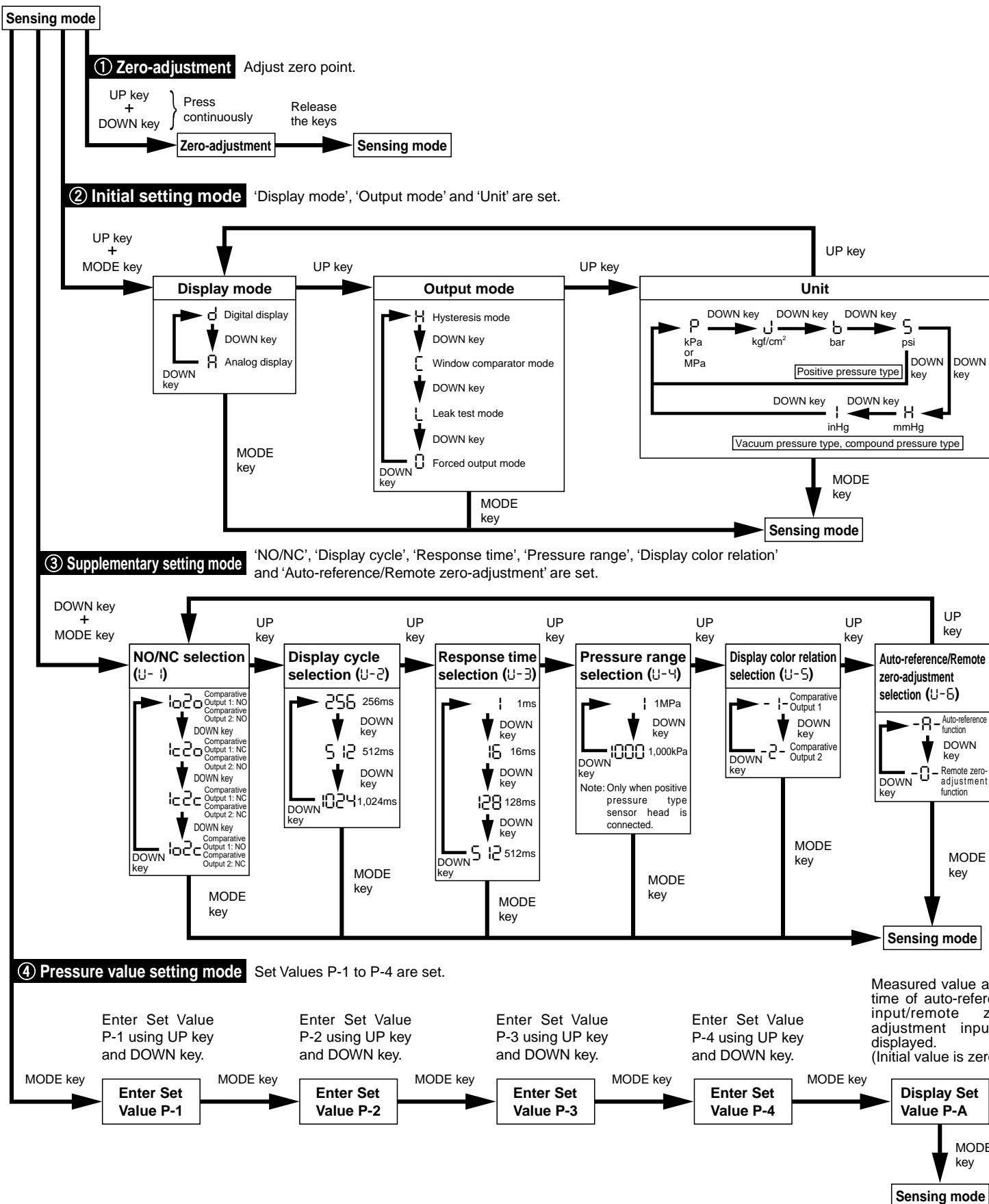
- The comparative outputs are forcibly maintained at OFF level in the sensing mode, irrespective of the set values. Hence, it is convenient for only displaying the pressure value without using the comparative outputs.  
Further, since the comparative outputs can be forcibly switched ON or OFF with key operation, without actually applying pressure, this mode is suitable for an operation check or a start-up check.



## 10 SETTING

- If key-protect has been set, make sure to release key-protect before operating the keys.
- Pressure value setting can be done only if the output mode is set to the hysteresis mode, window comparator mode or the leak test mode. Pressure values cannot be set if the output mode is set to the forced output mode.
- Set Values P-1 to P-4 can be common for all the output modes.
- In the positive pressure type and the compound pressure type, Set Value P-2 can be set only towards the higher pressure side with respect to Set Value P-1 and Set Value P-4 can be set only towards the higher pressure side with respect to Set Value P-3. Further, in the vacuum pressure type, Set Value P-2 can be set only towards the higher vacuum side with respect to Set Value P-1 and Set Value P-4 can be set only towards the higher vacuum side with respect to Set Value P-3.
- The auto-reference function affects only Set Value P-3 and Set Value P-4.
- Set Value P-A is the pressure value when the auto-reference input or the remote zero-adjustment input is applied. When the auto-reference input or the remote zero-adjustment input is not applied, Set Value P-A is zero.
- The set conditions are written and stored into an EEPROM. However, note that the EEPROM has a life span and its guaranteed life is 100,000 write operation cycles. Further, since the auto-reference input value and the remote zero-adjustment input value are not stored in the EEPROM, they are not included in the number of write operation cycles.

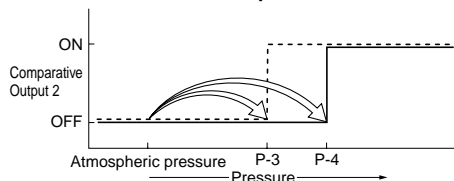
### <Setting procedure>



## 11 AUTO-REFERENCE FUNCTION

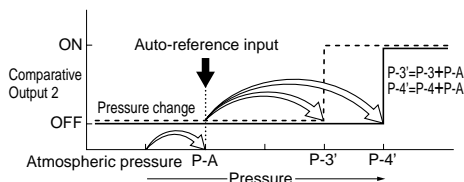
- Auto-reference function corrects Set Value P-3 and Set Value P-4 of Comparative Output 2 by taking the pressure measured at the time of auto-reference input as the reference pressure.

### <Before auto-reference input>



- When there is no auto-reference input, the atmospheric pressure is taken as the reference pressure for Set Value P-3 and Set Value P-4.

### <After auto-reference input>



- At the time of auto-reference input, the pressure value detected at that instant is temporarily recorded as Set Value P-A and becomes the reference pressure.
- With Set Value P-A as the reference pressure, Set Value P-3 and Set Value P-4 are automatically corrected to 'Set Value P-3 + Set Value P-A' and 'Set Value P-4 + Set Value P-A', respectively.

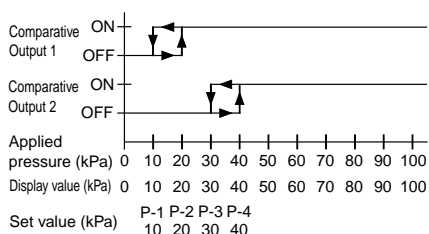
### Settable range and set pressure range after correction

- The settable range of Set Value P-3 and Set Value P-4 is wider than the rated pressure range to cater to the auto-reference function.

- At the time of auto-reference input, if the corrected set value exceeds the set pressure range, the set value is automatically corrected to be within the set pressure range. Hence, please see that the set pressure range is not exceeded.

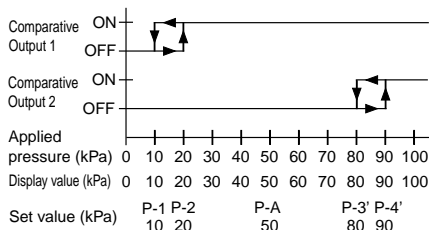
### Operation chart

#### <Normal operation (comparative outputs set to NO)>



#### <With auto-reference input (comparative outputs set to NO)>

- Auto-reference input: 50kPa
- Output mode: Hysteresis mode



Note: As in the case of the hysteresis mode, Set Value P-3 and Set Value P-4 are shifted also in case the output is set to the window comparator mode or the leak test mode.

- Maintain the pressure at a constant level for at least 2ms after the auto-reference input is made Low (High in case of PNP output type). If used in a transient state, it will result in wrong operation.
- Use Comparative Output 2 at least 'set response time + 2ms' after the auto-reference input is made Low (High in case of PNP output type).
- At the time of auto-reference input,  $\square \text{in}$  is displayed on the 3 1/2 digit display for 1 sec. approx.
- The auto-reference input value (Set Value P-A) becomes zero when the power supply is switched off and then on again.
- Although it is not possible to display the corrected Set Value P-3' and Set Value P-4', it is possible to display the auto-reference input value (Set Value P-A).

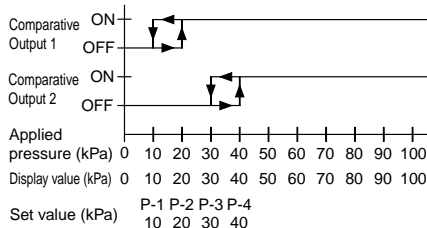
## 12 REMOTE ZERO-ADJUSTMENT FUNCTION

- The remote zero-adjustment function forcibly sets the pressure value at the time of application of an external input signal to zero.

- At the time of remote zero-adjustment input, the set values are not corrected. When using the remote zero-adjustment function, make sure that the pressure and the set values do not exceed the rated pressure range.

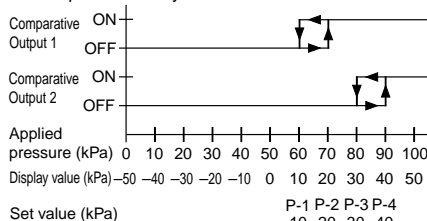
### Operation chart

#### <Normal operation (comparative outputs set to NO)>



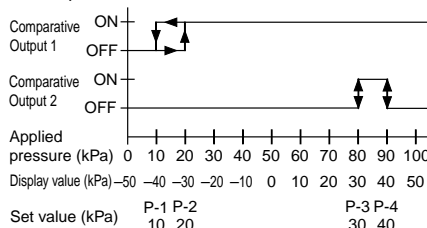
#### <With remote zero-adjustment input (comparative outputs set to NO)>

- Remote zero-adjustment input: 50kPa
- Output mode: Hysteresis mode



Note: As in the case of the hysteresis mode, the displayed values and the ON/OFF points of the output are shifted also in case the output mode is set to the window comparator mode.

- Remote zero-adjustment input: 50kPa
- Output mode: Leak test mode



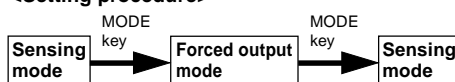
Note: In the leak test mode, the zero-adjustment function is applied only to Comparative Output 2. Comparative Output 1 operates with the atmospheric pressure as the reference.

- Maintain the pressure at a constant level for at least 2ms after the remote zero-adjustment input is made Low (High in case of PNP output type). If used in a transient state, it will result in wrong operation.
- Use the comparative outputs at least 'set response time + 2ms' after the remote adjustment input is made Low (High in case of PNP output type).
- At the time of remote zero-adjustment input,  $\square \text{in}$  is displayed on the 3 1/2 digit display for 1 sec. approx.
- If the power supply is switched off and then on again, the remote zero-adjustment input value is cleared and the sensor returns to normal operation with atmospheric pressure as the reference.

## 13 FORCED OUTPUT MODE

- In the initial setting mode, if the output mode is set to the forced output mode, the comparative outputs are forcibly maintained at OFF level in the sensing mode, irrespective of Set Values P-1 to P-4. Further, if the keys are operated as per the procedure given below, the comparative outputs can be forcibly switched either ON or OFF without applying pressure at the pressure port. This is convenient for an operation check of the comparative outputs or for an inspection before commencing work.

### <Setting procedure>



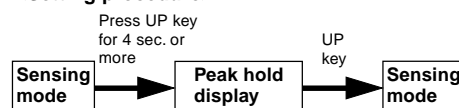
Each time UP key is pressed, Comparative Output 1 switches to ON and OFF, alternately. Each time DOWN key is pressed, Comparative Output 2 switches to ON and OFF, alternately.

## 14 PEAK HOLD & BOTTOM HOLD FUNCTIONS

- Peak hold and bottom hold functions enable the display of the peak value and the bottom value.
- These functions are convenient for finding the pressure variation range or determining the reference for pressure setting.

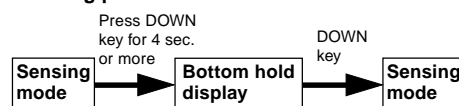
### Peak hold display

#### <Setting procedure>



### Bottom hold display

#### <Setting procedure>

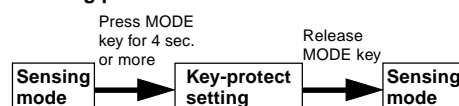


## 15 KEY-PROTECT FUNCTION

- 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 respond to the key operations.

### Setting of key-protect

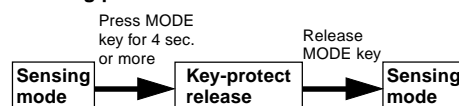
#### <Setting procedure>



- 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 the key-protect function has been set.

### Release of key-protect

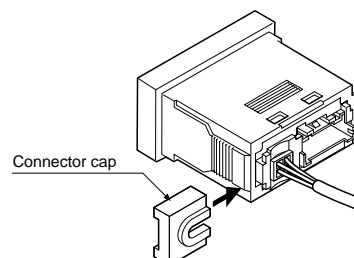
#### <Setting procedure>



- When the keys are to be operated, make sure that key-protect is released.

## 16 CONNECTOR CAP

- When connecting the intermediate cable (DPH-CC□) to this sensor, make sure to fit the accessory connector cap by sliding it as shown in the figure below. If the connector cap is not fitted, the intermediate cable may come off from the sensor.



- Please refer to the instruction manual of the pressure sensor head for the method of connecting the controller to the pressure sensor head.

## SUNX Limited

<http://www.sunx.co.jp/>

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