CKD

SM－309281－A

INSTRUCTION MANUAL

PARECT PRESSURE SWITCH

PPD3-D
PPD3-S-D

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (ISO 4414 *1, JIS B 8370 *2).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your application, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, **read this operation manual carefully for proper operation.**

Observe the cautions on handling described in this manual, as well as the following instructions:

⚠ DANGER : Failure to pay attention to DANGER notices may cause a situation that results in a fatality or serious injury and that requires urgent addressing.

⚠ WARNING : Failure to pay attention to WARNING notices may result in a fatality or serious injury.

⚠ CAUTION : Failure to pay attention to WARNING notices may result in injury or damage to equipment or facilities.

*1) ISO 4414 : Pneumatic fluid power ··· Recommendations for the application of equipment to transmission and control systems.

*2) JIS B 8370 : General rule for pneumatic systems

[SM-309281-A]

About design and selection

⚠ WARNING :

a) Use the product correctly under the specified conditions.

- Note that the product may be damaged or malfunction if it is used for a purpose for which it is not intended or subjected to a load current, voltage, temperature, shock, or environmental condition that is beyond the scope of the product specifications.

b) Never use the product with oxygen, corrosive or flammable gas, or toxic fluid.

c) Do not install this product inside a hermetically closed control box or room.

- Because an accidental leakage of the medium will change the pressure inside the closed space. Always use this product in a control box that has a safety device for preventing sudden pressure changes or in a room that allows ventilation with external air.

⚠ CAUTION :

a) Use of fluids other than those specified

- The product includes such mechanisms as O-ring type sealing and screw type joints that allow a very small amount of air to escape (1cm^3/min ANR).
- The acceptability of this product in an application that handles a corrosive but nonflammable gas should be judged in view of your knowledge about the gas. If you wish to use the product for such an application, do so at your own risk only after validating the safety and providing necessary safety measures.
- If the product is used for a purpose such as detecting the successful suction of a wet workpiece, the compressed air fed to the product may include water and/or oil. For such an application, choose a PPD□-S type switch that has a higher resistance to corrosion (with a stainless diaphragm sensor).
- The gas contact part of the sensor of the PPD3-S-D switch consists of SUS630, aluminum, and fluoro rubber materials. Therefore, do not use the media or component that may adversely affect such materials.

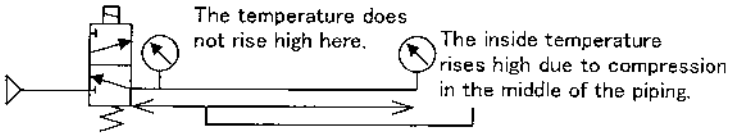
b) Be careful if you are going to use the product for detecting the successful suction of a workpiece using vacuum.

- The vacuum pressure must be controlled using the regulator so that it is less than the withstanding pressure to supply the proper vacuum pressure, or the vacuum break pressure must be separated and shut-down by the control valve so that the vacuum break pressure does not enter other circuits. For the vacuum generation and vacuum break integration unit, the supply pressure must be controlled to the withstanding pressure or less.

⚠ **CAUTION :**

c) Operating environment

- Do not install or use the product in a place where it is exposed to vibrations of 98 m/s^2 or to impact.
- Also, pay attention to the measured fluid temperature and the atmospheric temperature around the piping. If a pressure gauge is connected to the end of long piping, in which pressurization and depressurization take place repeatedly, the inside temperature of the piping increases, and the pressure gauge temperature also rises considerably and sometimes exceeds the rated temperature range due to compression at pressurization. The temperature of piping laid in a hot environment, in particular, is quite prone to exceed the operating temperature range. In this case, the product may be damaged even if it is installed in an environment within the operating temperature range, or the joint may become disconnected because of the tube softened by the heat. Take proper measures to prevent temperature rise such as installing a pressure gauge in the middle of the piping not at an end, adding dummy piping before the pressure gauge, and avoiding a hot environment.



- This product is an open type switch (equivalent to the IP40 in protective performance). Do not install or use the product in a place where a corrosive or combustible gas is generated, where the product is exposed to chemical, solvent, oil or water, in a place contaminated with dust or cutting chips, in a pressurized or depressurized environment, or in a place where the temperature significantly varies or highly humid air is produced.
- The protective structure of the sensor of this product conforms to IP65 or its equivalent. This protective performance is intended for the city water. Therefore, do not install this product in a place where any chemical, detergent, oil, solvent, hot water, or steam may splash onto it, sticking water content may be frozen, a large amount of dust or cutting chip may exist, or the pressure is increased or decreased.

d) Do not inject the water to nor use any high water pressure cleaning unit for the sensor of this product during cleaning work of the equipment. The impact or pressure of the injection water may break the protective structure of the sensor of this product.

e) The atmospheric pressure may affect the vacuum pressure around the rated lower limit.

- If the product is installed in an extremely low pressure place or place at a high altitude, the vacuum degree increases only by the atmospheric pressure in such place. (For example, if the product is installed in a place at −100kPa, the vacuum pump may not produce the vacuum depending on the weather conditions or altitude.)

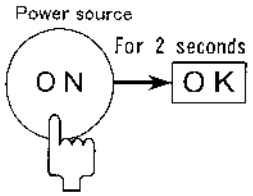
f) Determine the value to be set considering an error attributable to accuracy or temperature characteristics . Even if the pressure is constant, an error occurs due to the change of the detected value within the tolerance or due to the temperature.

g) When using the product for confirmation of the vacuum before charging, pay special attention so that the charging fluid does not enter the product. When using this product in a charging machine, use a filter to protect the product from entry of the charging fluid. If the fluid is water or oil, select the model PPD3-S to solve such trouble.

h) When using the product for confirmation of workpiece seating in a machine tool, pay special attention to back-flow of coolant

- The coolant may back flow when the pressure is not applied to or the blow pressure is applied to the jig, to which the pressure is applied for confirmation of workpiece seating. To prevent this trouble, install the product at a position higher than the seating jig, use a control valve to shut-off the passage, or use a check valve to prevent the coolant from back flowing.

i) This product does not start detecting immediately after turning power ON due to preliminary diagnoses of internal circuit being carried out. Design the control circuit so as to ignore signals output for approx. 2 sec. After charging power.



j) A voltage exceeding 5V may be output to the analog output of this product.

- If a pressure exceeding the rating is applied to this product, the analog output outputs a voltage beyond a range of 1 to 5V. Up to approximately 8V may be output. Additionally, if the negative power line (blue) is faulty, the positive power voltage is output to the analog output. When using an input circuit, which cannot accept a voltage exceeding 5V, an appropriate protective circuit is designed and added to it.

About mounting, installation, and adjustment

⚠ WARNING :

a) Take extreme care never to make a wrong connection.

- A mistake in connecting wires may cause fatal damage such as the burning of the components not only to this product but also to the peripheral devices.

b) Never use a DC power supply unit that not provide any isolation between the primary side (AC power) and the secondary side (output).

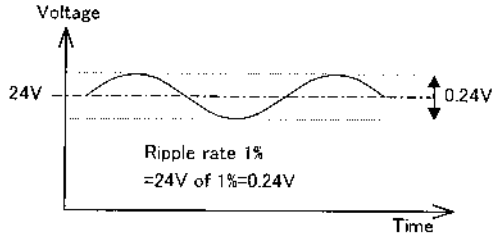
⚠ CAUTION :

a) Take care to protect the unit and lead wires from damage.

- Carefully avoid bouncing, dropping, charging an excessive load to the lead cord or giving frequent bending stress to the cord. They could result in an unsatisfactory level of accuracy, disconnection or failure.
- Use such flexible wires as robot wires for movable portions.

b) Wiring operation

- Cut the electrical power before starting any wiring operation.
  Before conducting a wiring operation, and from time to time during the wiring operation, discharge the static electricity from your body and the tool.



- Use a stabilized power supply unit that can provide a noiseless power with a ripple voltage of 1% or less.
- Install this product and wiring far away from the power distribution line and noise source. Always use a noiseless stabilized power supply unit insulated from the AC power supply. Do not use a power supply unit, in which the AC power regulated to the low voltage by the transformer is only rectified and smoothed.
  Additionally, use a power supply unit with a large capacity, and turn ON and OFF the power using sharp voltage rise and fall. If an unstable voltage lower than the rated level is supplied continuously, this may cause the product to malfunction and the product not to be recovered after the voltage is returned to the rated level. If this occurs, turn OFF the power, and then turn it ON again. Additionally, if the power voltage drops to a level lower than the rated level even instantaneously, turn OFF the power, and then turn it ON again.
- Do not operate the control and machine units immediately after the wiring to this product has been completed.
  Unintended unit or incorrect set value may cause unexpected signal to output. First, perform the energized test with the control and machine units stopped to set desired switch data.

c) Reverse current and over current protection circuits

- Protective circuit are effective against only some limited range of erroneous connections or short circuit but not necessarily all problems.

⚠ CAUTION :

- If the over-current protection circuit of this product detects an over-current, the output is turned ON repeatedly at short intervals to check whether or not the over-current status is reset.
  The over-current status during this short period of time may affect the product depending on the capacity of the power supply unit, causing the oscillation symptom or voltage-down to occur.

d) A unit producing a rush current exceeding the rated current level of this product cannot be driven.

- The rush current is detected as over-current and the power supply is stopped. Always check not only the normalizing current value, but also the rush current value of the driven unit.

e) The operation and accuracy cannot be guaranteed when using the product with the switch settings beyond the rating.

- The value beyond the rating can be set using the ON/OFF set values of the switch. However, the operation and accuracy cannot be guaranteed with such switch set values. Before using the product, always check that it functions correctly with desired switch set values.
- To ensure stable operation, put at least the following difference between the ON set value and OFF set value of the switch.

Operation mode	Set value difference	R10	R03	R01
Window operation	3%F.S.	33kPa	12kPa	6kPa
Hysteresis operation	1%F.S.	11kPa	4kPa	2kPa

f) Operation becomes unstable or does not function at all when the set value difference is lower than that shown above.

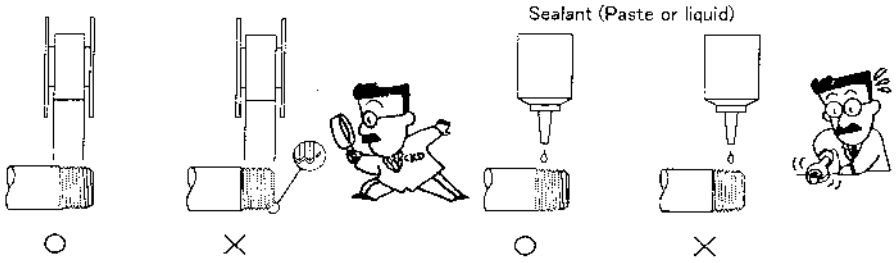
g) Piping operation

- For a product that has a one-touch joint, use a recommended tube for connection with it. After brushing the tube, connect it to the one-touch joint built into the product.

  ※ Recommended : Connectable types 6mm
  F1506, U-9506 (supplied by CKD) etc.

- If you chose a product that has a screw type joint, apply a seal tape or sealant to the connecting portion and screw a tube into the joint taking care not to apply an excessive torque. For tightening, apply a wrench to the metal portion.
- When applying a seal tape, start from a position 2-mm or more away from the end of the thread portion on the tube, to a direction opposite to the tip of the tube, and wind the tape around the tube in a direction reverse to the direction of the thread.

※ If a part of the seal tape is positioned closer to the tip of the tube than the thread portion, the tape may be threaded into pieces as the tube is screwed into the joint; they may go into the tube and cause trouble.



- The tube length should be about one meter. Eliminate any possibility of a tensile force or a shock transmitted though the tube. A longer tube may produce an unexpectedly large force by its own weight, by its swinging, or by transmitting a shock. To distribute the tube and joint weights, fix a part of the tube to the machinery or use an intermediate joint and fix it to the machinery.
- Do not insert a needle or the like into the pressure lead-in port in the bottom of the product or leave it clogged up with dust. The blocked port not only makes accurate measurement impossible but also damages the pressure sensor. Install a 5-micron filter on the primary side of the fluid circuit.

h) Do not connect the output from the product parallel to the output from a relay contact, an operation switch, or another device. Do not short the input terminal provided for the product to the negative (−) side power line for the purpose of testing the input device, because the output circuit of the product may be damaged.

About use and maintenance

⚠ CAUTION :

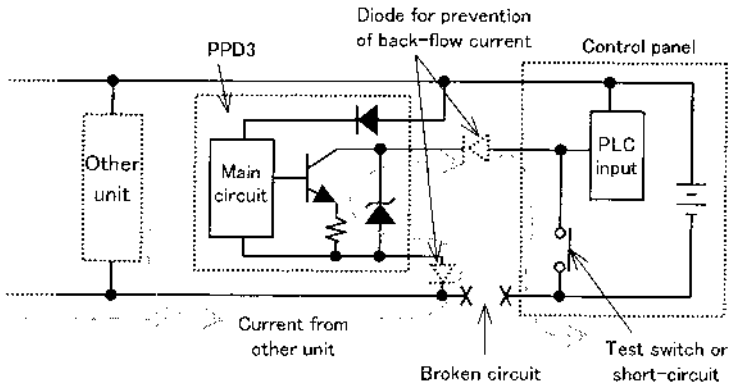
a) As a general rule, the product should not be disassembled.

- Disassembling may damage the product or decrease its performance. The manufacturer does not guarantee the performance of a product that has been disassembled. When replacing or relocating the product, be sure to remove the product together with its mount (pressurizing port).

b) The value displayed is updated four times second, whereas switch output takes place about 200 times a second. The pressure changes so fast that the display cannot follow it. The switch sometimes starts to operate although the displayed pressure value does not reach the set value. This is because the pressure varies at a very high rate and the pressure value display cannot track it.

c) The value displayed on the PPD represents a range of AD converter values. The switch data is compared with the AD converter value but not with the displayed value; the switch will not act until the AD converter value matches the switch value. For this reason, you may find sometimes that the switch has not acted yet even when the displayed value has reached the value set to the switch.

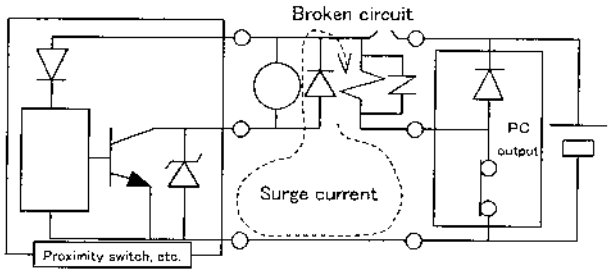
d) Pay special attention to the back-flow current caused by the faulty wiring or wiring resistance. If the switch output line and the negative power line are short-circuited to check the operation of the input unit of the control panel or the negative power line becomes faulty when other units including this product are connected to the same power supply as that used for this product, the back-flow current may flow through the switch output circuit of this product, causing the circuit to break.



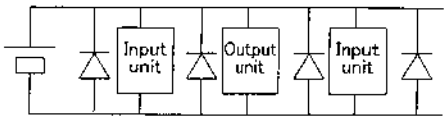
<Preventive measures against breakage caused by back-flow current>

- Pay special attention so that the current is not centralized to the power line, particularly the negative power line. Additionally, make the wiring as thick as possible.
- Limit the units to be connected to the same power supply as that used for this product.
- Connect an appropriate diode to the output line of this product in series to prevent the back-flow current.
- Connect an appropriate diode to the negative power line of this product in series to prevent the back-flow current.

e) Pay special attention to entry of surge current.
If the circuit is shut-down with the inductive load activated when this product and inductive loads producing the surge, such as solenoid valve or relay commonly use the same power supply, the surge current may enter the switch output circuit depending on the mounting position of the surge absorption element, causing the circuit to break.



- Take the following measures to prevent breakage caused by entry of surge current.
  - Make the output system for inductive loads, such as solenoid valve or relay, separated from the power supply input system of this product.
  - If another power supply cannot be used, connect surge absorption elements directly to all inductive loads.
  - It should be thought that the surge absorption element connected to the unit, such as PLC, protects only the connected unit.
  - Additionally, surge absorption elements are connected to appropriate locations of the power wiring as shown in the Fig. below as appropriate measures against the faulty wiring at any part.



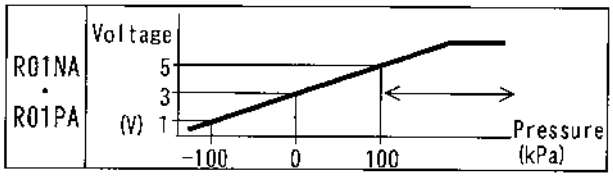
For the units connected by the connectors, if the connector is disconnected while the power is being supplied, the output circuit may be broken due to above phenomenon. To prevent such troubles, always turn OFF the power before connecting or disconnecting the connector.

⚠ CAUTION :

a) The analog output outputs 1 to 5V corresponding to the rated pressure range. However, a voltage exceeding this level may occur (be produced) in the following two cases.
Therefore, it is necessary to check that the circuit of the connected unit withstands this over-voltage. If necessary, take protective measures against the over-voltage to design an input circuit, which is not broken.

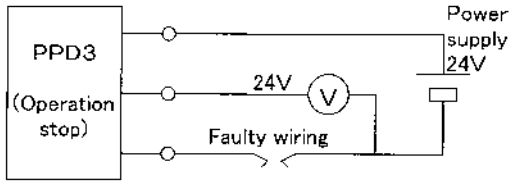
<Voltage beyond rated voltage occurrence case 1>

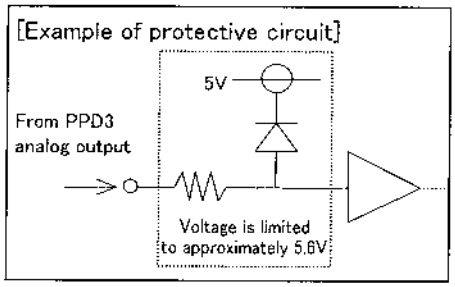
- If a pressure exceeding the rating is applied, an analog voltage exceeding 5V (Max. 6 to 8V) is output.
  (The pressure to be applied must not exceed the proof pressure.)



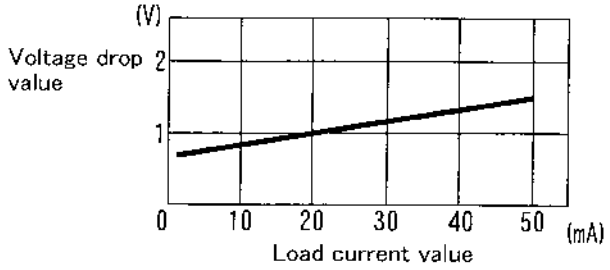
<Voltage beyond rated voltage occurrence case 2>

- If the negative power line (blue line) of the PPD3 wiring is not connected or faulty, the positive power voltage occurs in the analog output (24V is output when using 24V power supply unit). Particularly, if the connector is connected and disconnected with the power supplied when there are several connector connection parts in the wiring, this may produce the same state instantaneously.





- The voltage drop value of the PPD3 switch output may vary depending on the load current. For reference, an example of voltage drop is shown in the Fig. below.



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Manual No. SM-309281-A

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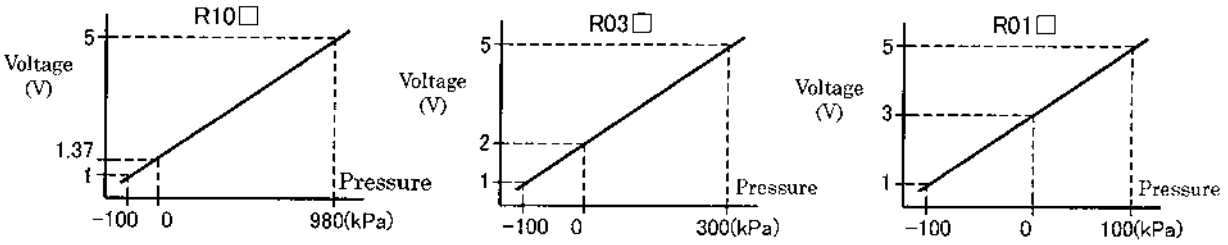
1. PRODUCT

1.1 Specification

Model code ※1 / Item	PPD3-R10□D	PPD3-R03□D	PPD3-R01□D	PPD3-S-R10□D	PPD3-S-R03□D	PPD3-S-R01□D
Pressure sensing element	Diffused type semi-conductor pressure sensor			Stainless diaphragm type pressure sensor		
Applicable fluid	Air, Non-corrosive gas, incombustible gas			Compressed air mixed with water. oil, and drainage		
Type of pressure	Gage pressure					
Rated pressure range	-100 to 980kPa	-100 to 300kPa	-100 to 100kPa	-100 to 980kPa	-100 to 300kPa	-100 to 100kPa
Proof pressure	1.47MPa	0.6MPa	0.3MPa	2.0MPa	0.6MPa	0.6MPa
Leak	1cm³/min (ANR) or less					
Display	3 digits, LED display, height of figure 8mm					
Minimum indication value	1kPa					
Display accuracy (25℃)	±2%F.S.					±3%F.S.
Temperature characteristics (0 to 50℃)	±4%F.S.					±5%F.S.
Power source	DC12 to 24V± 10% (Ripple 1% or less)					
Consumption current	60mA or lower					
Output response	Approx. 5msec					
Output model	NA : NPN transistor, open collector output 2 point + analog output 1 point PA : PNP transistor, open collector output 2 point + analog output 1 point					
Rated output	50mA					
Voltage drop	2.4Vor lower					
Analog output (25℃) ※2	1 to 5V±0.1V					
Set value holding	EEPROM					
Lead wire	Display : Oil proof vinyl cord 5-core (0.2mm²) 1m Sensor : Oil proof vinyl cord 3-core (0.15mm²) 3m					
Working temperature range	0 to 50℃					
Humidity range	0 to 85% R.H. (not to frozen)					
Degree of protection	Display : Equiv. To IP40 Sensor : Equiv. To IP65					

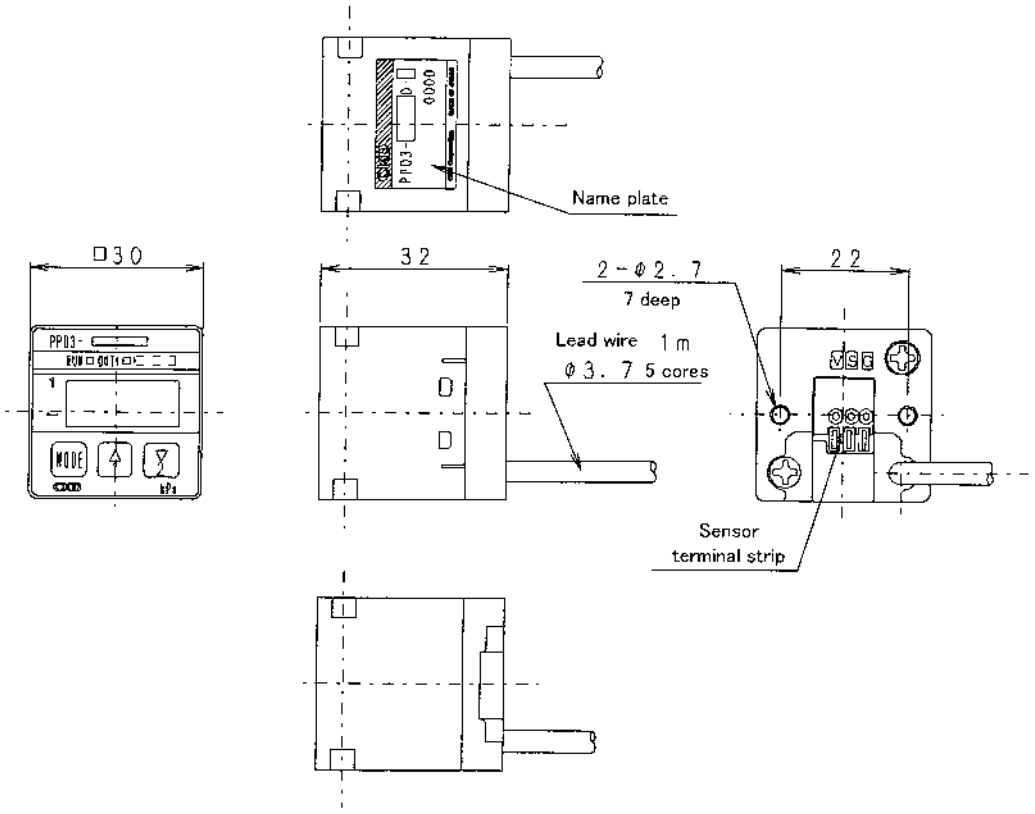
※1 This mark of the model is not full for the products. Check and select the mark which is mentioned in "5 HOW TO ORDER" at the case of selecting the detail of the product.

※2 Analog output voltage characteristics.

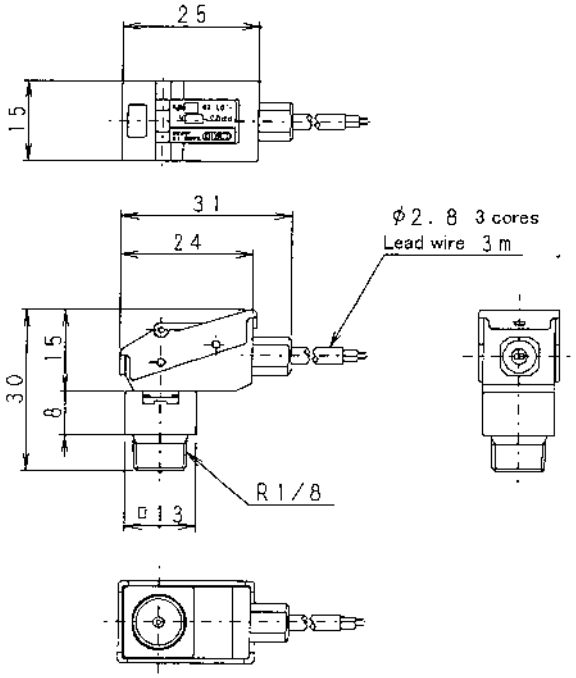


1.2 External Dimension

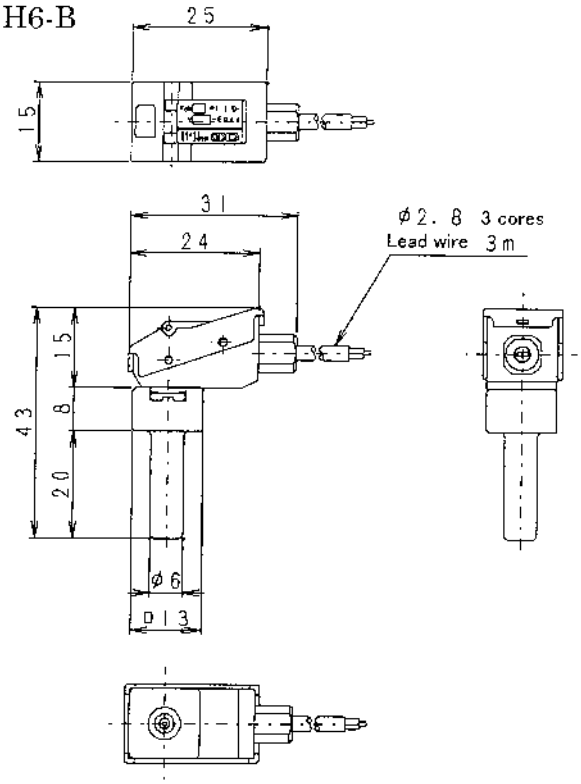
Display PPD3-******D



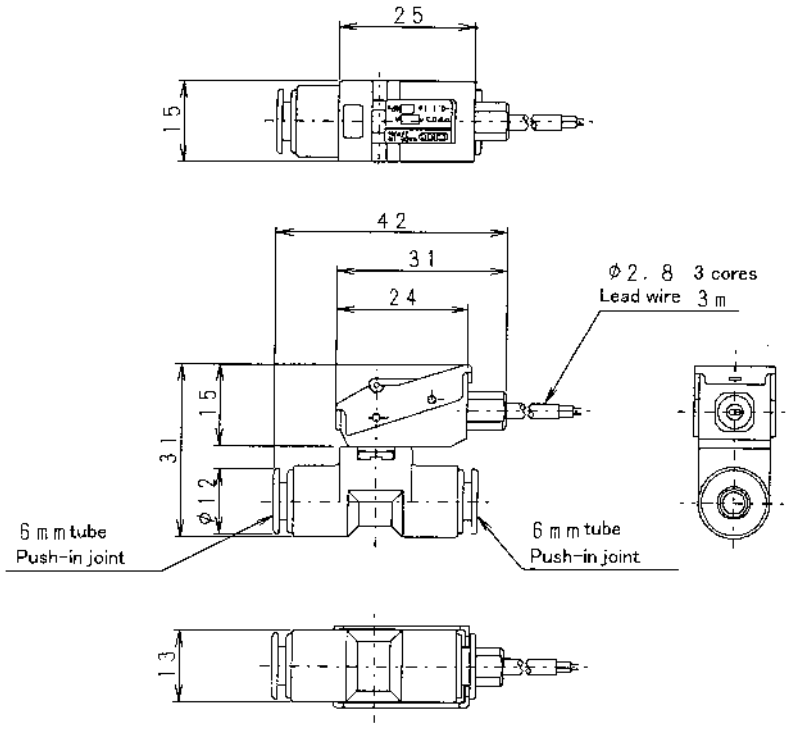
Sensor PPD3-******-6



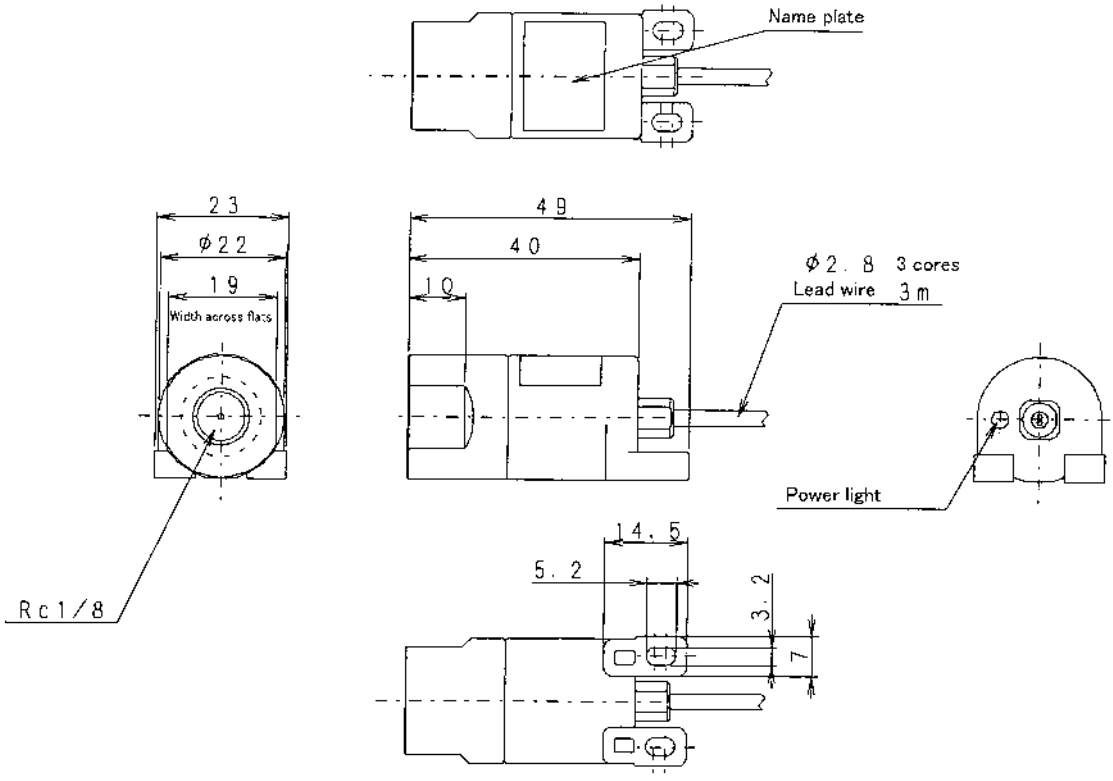
Sensor PPD3-******-H6-B



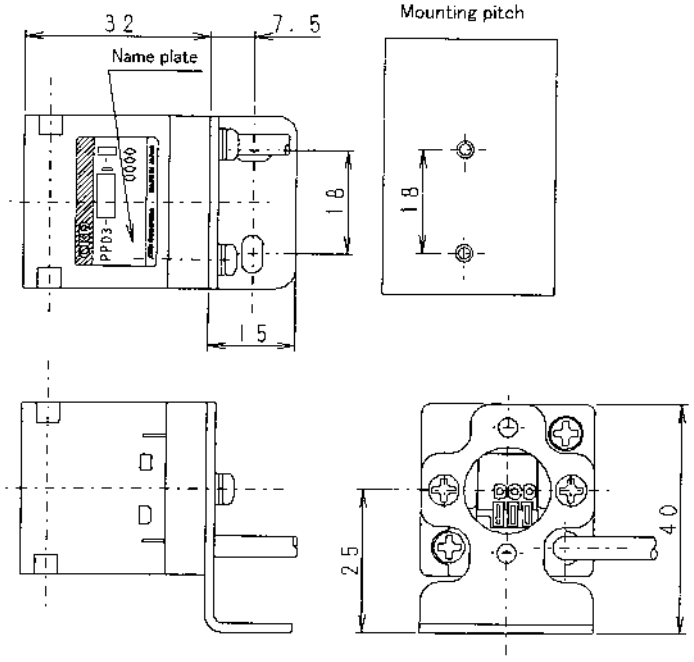
Sensor PPD3-******-H6



Sensor PPD3-S-******-6B

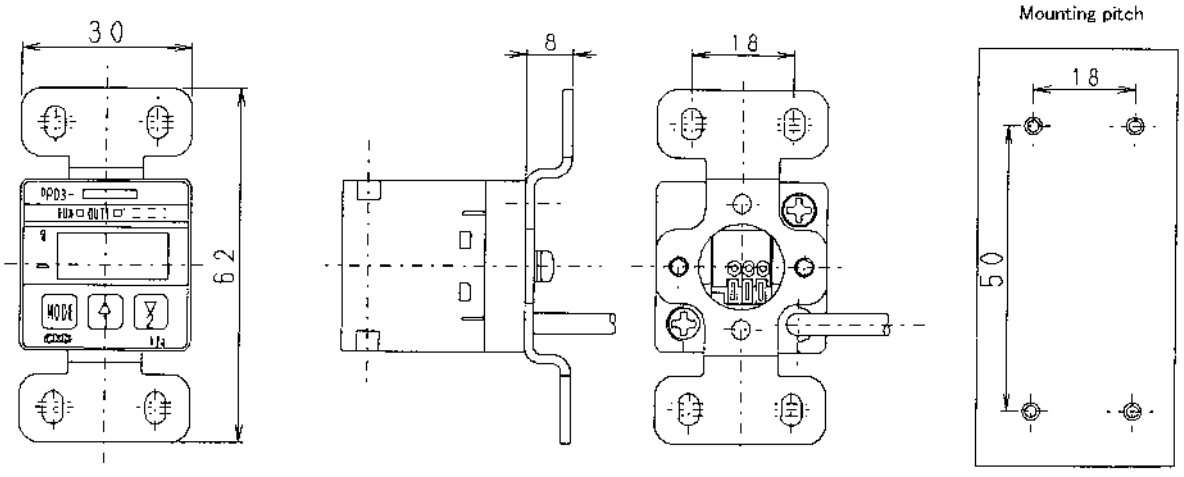


Option PPD3-KL-D (This product is to be purchased separately by specifying the model.)
(L-bracket and mounting screws) mounting drawing



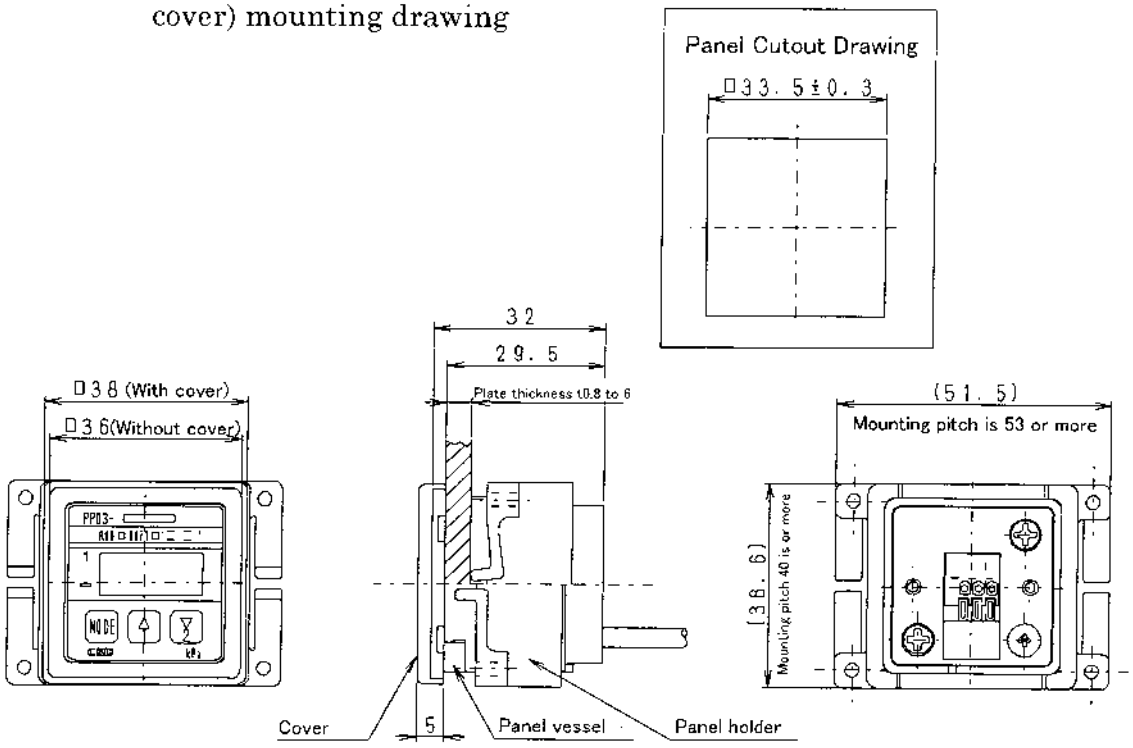
Note This mounting metal bracket can be mounted at intervals of 90° against the switch main body. Determine the mounting direction depending on the installation place.

Option PPD3-KD-D (This product is to be purchased separately by specifying the model.)
(D-bracket and mounting screws) mounting drawing



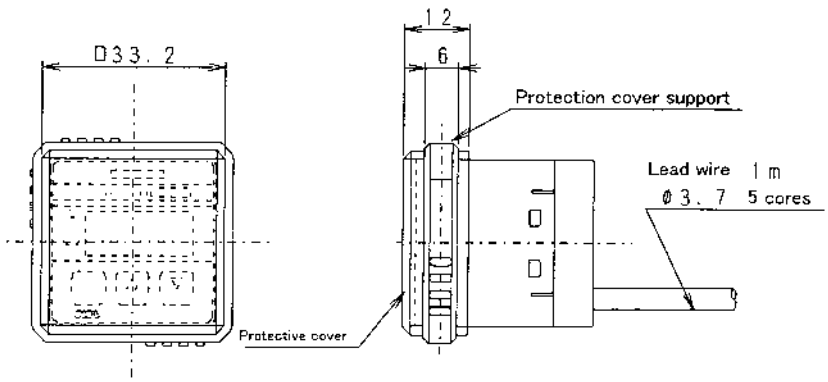
Note This mounting metal bracket can be mounted at intervals of 90° against the switch main body. Determine the mounting direction depending on the installation place.

Option PPD3-KHS-D (This product is to be purchased separately by specifying the model.)
(Panel vessel, panel holder, panel key, one-touch joint, and panel cover) mounting drawing



Note The mounting direction of the panel holder can be changed by 90° .

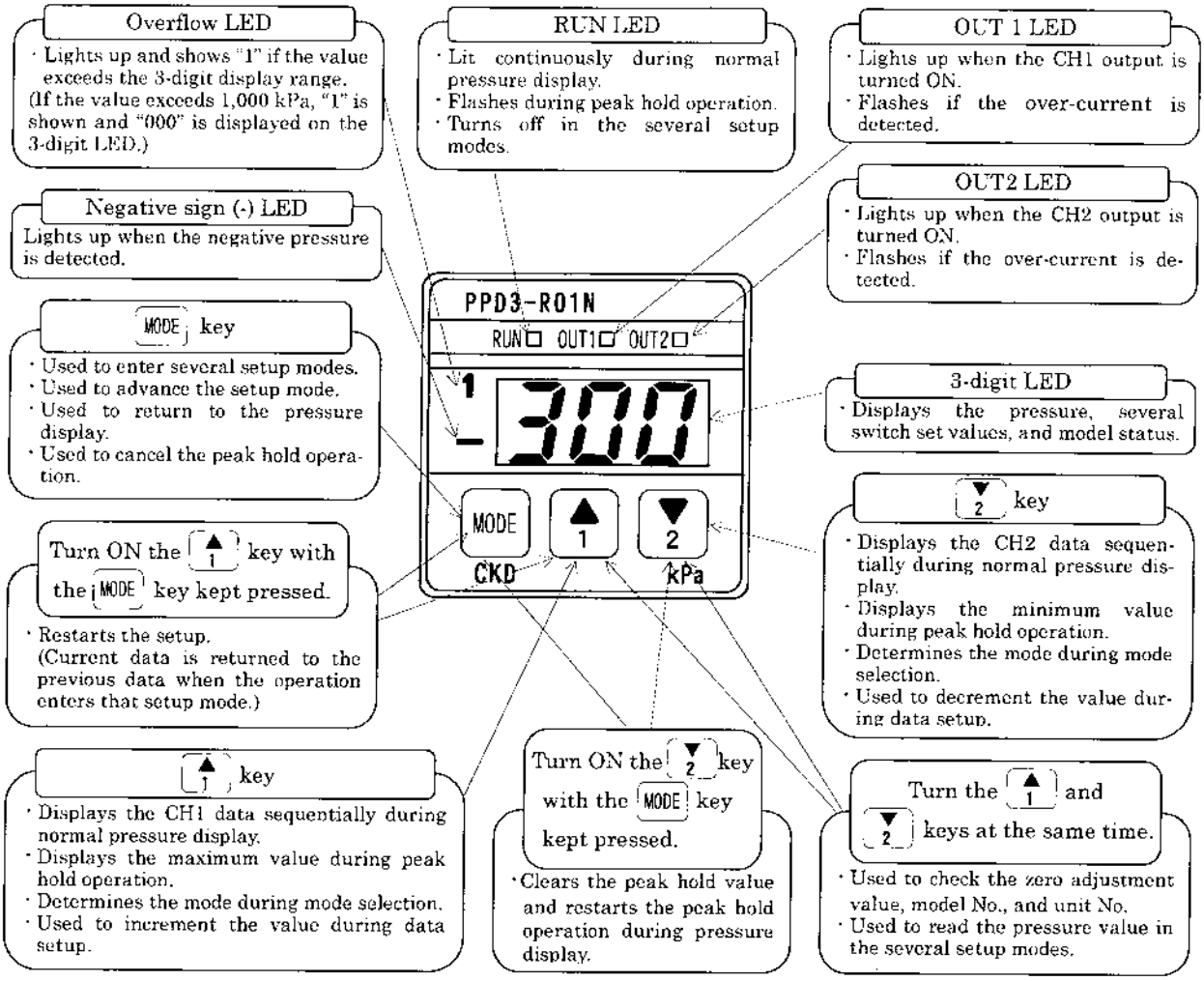
Option PPD3-KC (This product is to be purchased separately by specifying the model.)
(Protective cover and protective cover support) mounting drawing



Note:This product can be combined with all ports other then PPD3-KHS-D.

2. OPERATION

2.1 Display and Operation Panel



LED display

· Displays numbers and alphanumeric characters shown below by combination of LED lamps. Displays the pressure value, switch model, and switch status.

Number	0	1	2	3	4	5	6	7	8	9
Number displayed	0	1	2	3	4	5	6	7	8	9

Alphabetic character	A	B (b)	H	I (i)	J	L	N (n)	O (o)	P	C (c)	D (d)
Character displayed	A	b	H	i	J	L	n	o	P	C	d

LED display

Rated pressure	980kPa	300kPa	100kPa
Model	R10	R03	R01
Pressure symbol	J	L	H

Unit No.	0
R10	kPa
R03	kPa
R01	kPa

Output model	NPN output	PNP output
Model	NA	PA
Output type symbol	N n	P P

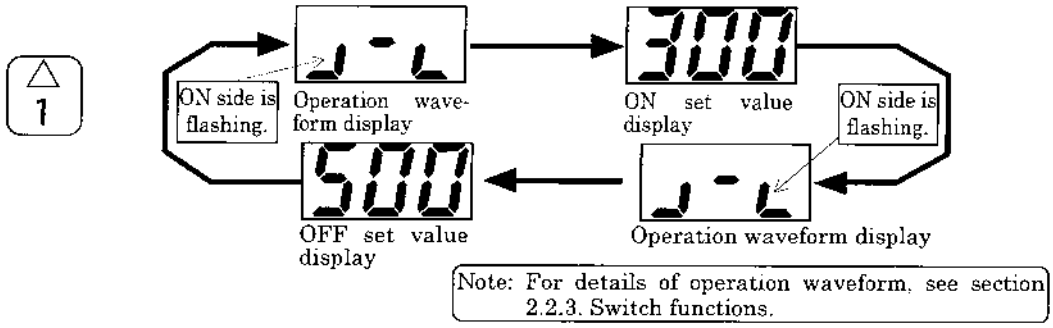
2.2 Operational procedures

Use of this switch makes it possible to confirm each set value, switch the unit, and perform the zero adjustment and switch data setup. See section 2.2.8, Operation flowchart (one page 32) and read relevant operational procedures.

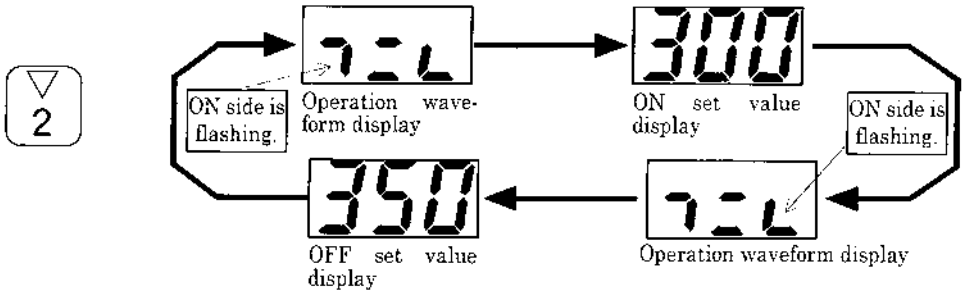
2.2.1 Confirming a set value

By pressing relevant key in the pressure display state, it is possible to display and confirm the switch data ON set value, OFF set value, operation waveform, zero adjustment value, pressure range, unit setting, and output format. Note that the following operation does not affect the switch operation. Additionally, the [▲ 1] and [▼ 2] keys function individually while the peak hold is being operated (RUN lamp is flashing).
Always confirm a set value after canceling the peak hold operation.

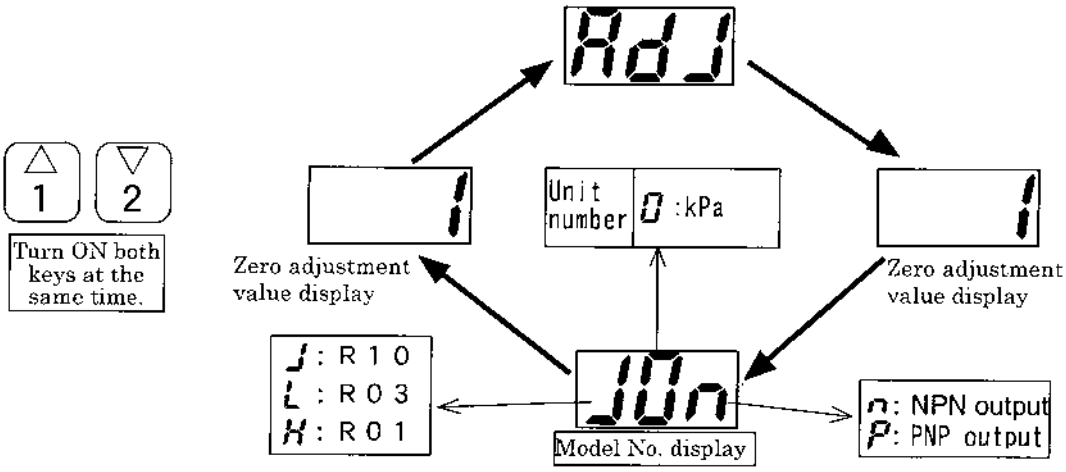
① Confirming the CH1 switch set value
It is possible to confirm the operation pattern and ON/OFF set value alternately while keeping the [▲ 1] key pressed. However, the numeric value is not displayed when the operation is stopped.



② Confirming the CH2 switch set value
It is possible to confirm the operation pattern and ON/OFF set value alternately while keeping the [▼ 2] key pressed. However, the numeric value is not displayed when the operation is stopped.

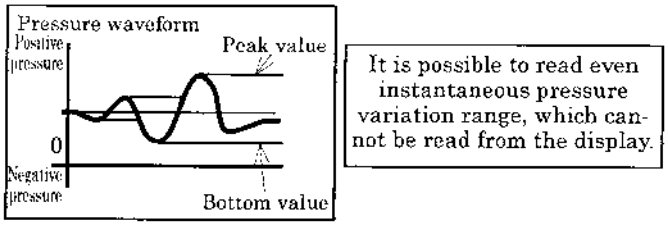


③ Confirming the zero adjustment value and model No.
It is possible to display the zero adjustment value and model No. alternately while keeping the ▲1 and ▼2 keys pressed.

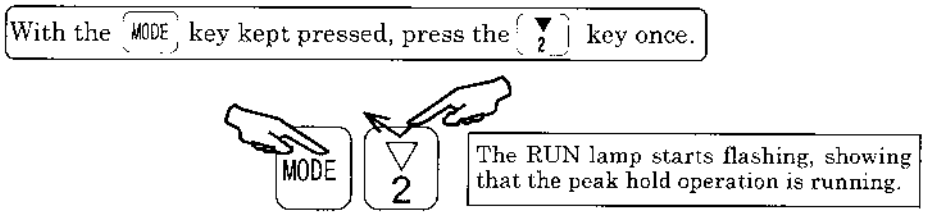


2.2.2 Peak hold operational procedures

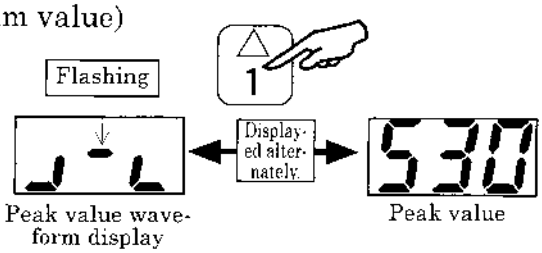
In this operation mode, it is possible to check the maximum and minimum pressure values within a certain period of time. This operation is used to check the stability of the main pressure and supply pressure. Note that the peak hold operation does not affect the basic functions of this product, such as switch operation and pressure display.



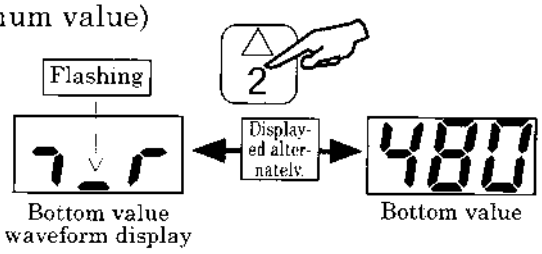
① **Starting the peak hold operation**
With the MODE key kept pressed, press the ▼2 key once. The RUN lamp starts flashing, showing that the peak hold operation is running.



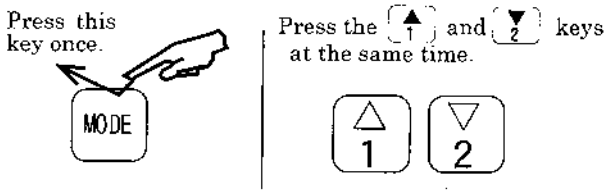
② **Displaying the peak value** (maximum value)
The past peak value and waveform showing the peak value are displayed alternately while keeping the [▲ 1] key pressed.



③ **Displaying the bottom value** (minimum value)
The past bottom value and waveform showing the bottom value are displayed alternately while keeping the [▼ 2] key pressed.



④ **Canceling the peak hold operation**
When the [MODE] key is pressed once, the peak hold operation is canceled and operation returns to the normal pressure display.
Additionally, pressing the [▲ 1] and [▼ 2] keys at the same time will also cancel the peak hold operation. Either key operation can be used to cancel the peak hold operation.



Notes 1: The peak hold operation records the instantaneous maximum and minimum pressure values, different from the normal pressure display that shows the average value. Therefore, the peak value operation may show the value extremely different from the display value.

2: When the MODE key is pressed, such as switch data setup, the peak hold operation is canceled.

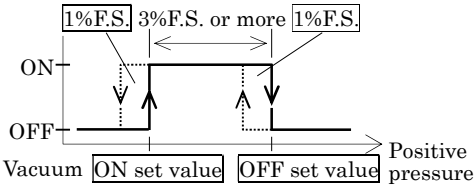
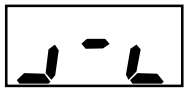
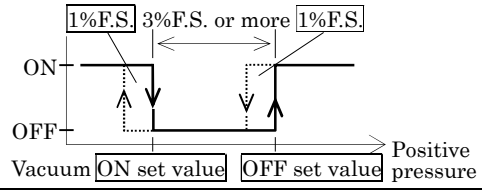
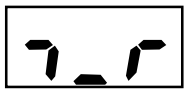
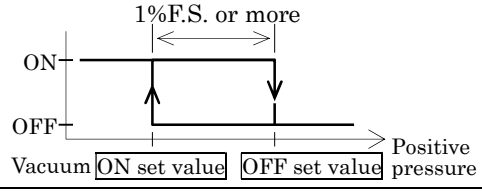
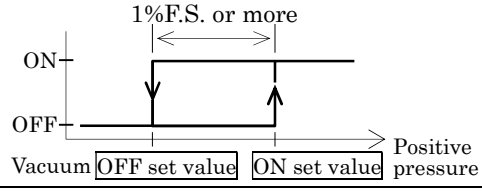
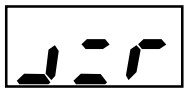
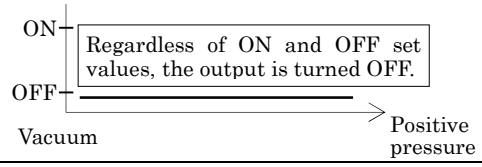
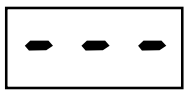
3: When the power is turned OFF, the peak hold operation is canceled.

4: The switch set value and zero adjustment value cannot be checked while the peak hold operation is running. These values are checked after the peak hold operation is canceled.

2.2.3 Switch functions

The PPD3 (-S) has 2- or 1-point switch output and provides the following four operations patterns and operation stop. When desired operation pattern and two set values (ON and OFF set values) specifying the operating pressure are set, the switch functions are then started.
Before starting the setup work, it is absolutely necessary to determine desired operation pattern, and ON and OFF set values.

- Pressure switch operation waveform (switch operation waveform when the pressure is reciprocated between positive and negative pressure levels.)

Operation pattern name	Operation waveform	LED operation Waveform display	Example of usage
1 Window operation 1 (ON operation within specified range)			If the product is used to confirm the main pressure, the ON signal is output as normal signal when the main pressure is within appropriate range.
2 Window operation 2 (ON operation beyond specified range)			If the product is used to confirm the main pressure, the ON signal is output as abnormal signal when the main pressure is within appropriate range.
3 Hysteresys operation 1 (Low-pressure ON operation)			If the product is used to confirm the pickup, the ON signal is output when the pickup pressure used to pick up a workpiece lowers sufficiently (vacuum).
4 Hysteresys operation 2 (High-pressure ON operation)			If the product is used to confirm the seating, the ON signal is output when the workpiece is held and the pressure rises sufficiently.
5 Operation stop			If the switch output is not used, this operation stop is used to prevent breakage trouble.

Notes 1. In the window operation, an interval of 3% F.S. is put between two set values.
A hysteresis of 1% F.S is automatically added to each of ON and OFF sides.

2. In the hysteresis operation, an interval of 1% F.S. is put between two set values.
If there are no differences between two set values above, the operation is not started or becomes unstable.

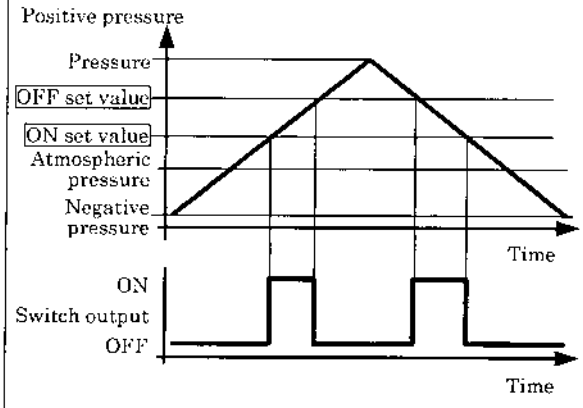
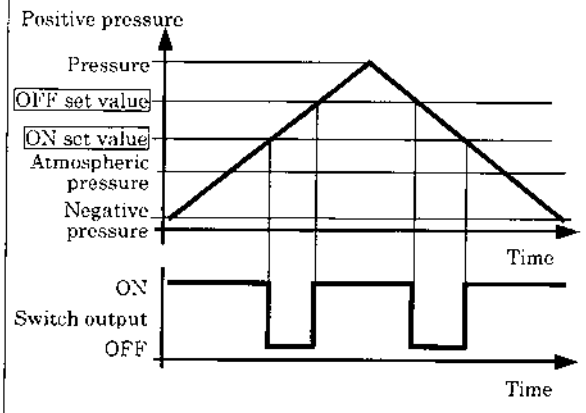
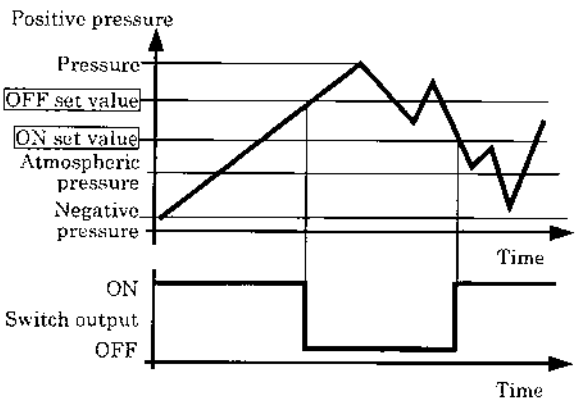
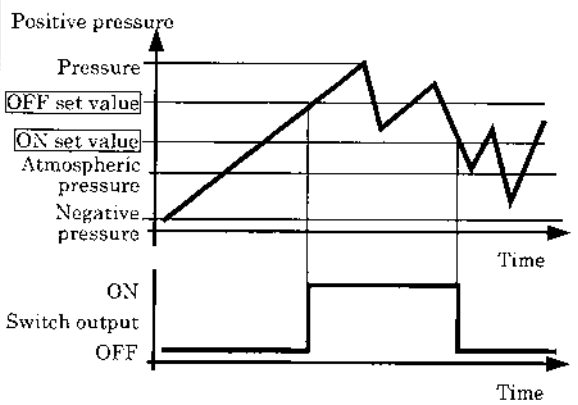
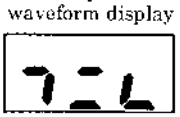
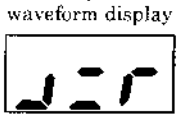
3. In the window operation, the ON and OFF set values mean pressure values, at which the switch output is turned ON and OFF when the pressure is changed from the negative pressure side to the positive pressure side.
In the hysteresis operation, they mean pressure values, at which the switch output is turned ON and OFF when the pressure is changed reciprocally between the negative pressure and positive pressure.
In the operation waveform, the left side shows the negative pressure while the right side shows the positive pressure.

4. As the waveform pattern is determined, the large/small relationship between the ON and OFF set values is determined. The opposite relationship is not allowed. However, running of specified operation pattern takes precedence over others in this product. Therefore, when two set values are input, the large/small relationship between these values is judged automatically. Subsequently, the judgment is processed appropriately with the ON and OFF set values. That is, even though the ON and OFF set values are input in the reverse order, they are recognized as correct ON and OFF set values, and operation is always performed with the specified operation pattern.

Note that the window and hysteresis operations are named by the pressure-switch operation waveform described on the previous page.

The following shows the time chart of the switch output for reference.

- Switch operation time chart
  (Switch operation waveform when the pressure is changed in order, negative pressure → positive pressure → negative pressure.)

<table>
<tr><td>1 Window operation 1
(ON operation within specified range)</td><td>2 Window operation 2
(ON operation beyond specified range)</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>LED: Operation waveform display
 
If the product is used to confirm the main pressure, the ON signal is output as normal signal when the main pressure is within appropriate range.</td><td>LED: Operation waveform display
 
If the product is used to confirm the main pressure, the ON signal is output as abnormal signal when the main pressure is an abnormal value.</td></tr>
<tr><td>3 Hysteresis operation 1
(Low-pressure ON operation)</td><td>4 Hysteresis operation 2
(High-pressure ON operation)</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>LED: Operation waveform display
 
If the product is used to confirm the pickup, the ON signal is output when the pickup pressure used to pick up a workpiece lowers sufficiently (vacuum).</td><td>LED: Operation waveform display
 
If the product is used to confirm the seating, the ON signal is output when the workpiece is held and the pressure rises sufficiently.</td></tr>
</table>

Note : Note that the above time chart waveforms do not show operation waveforms displayed on the LED.

2.2.4 Selecting a setup or test mode

This product provides the following setup and test modes that affect the pressure switch functions.

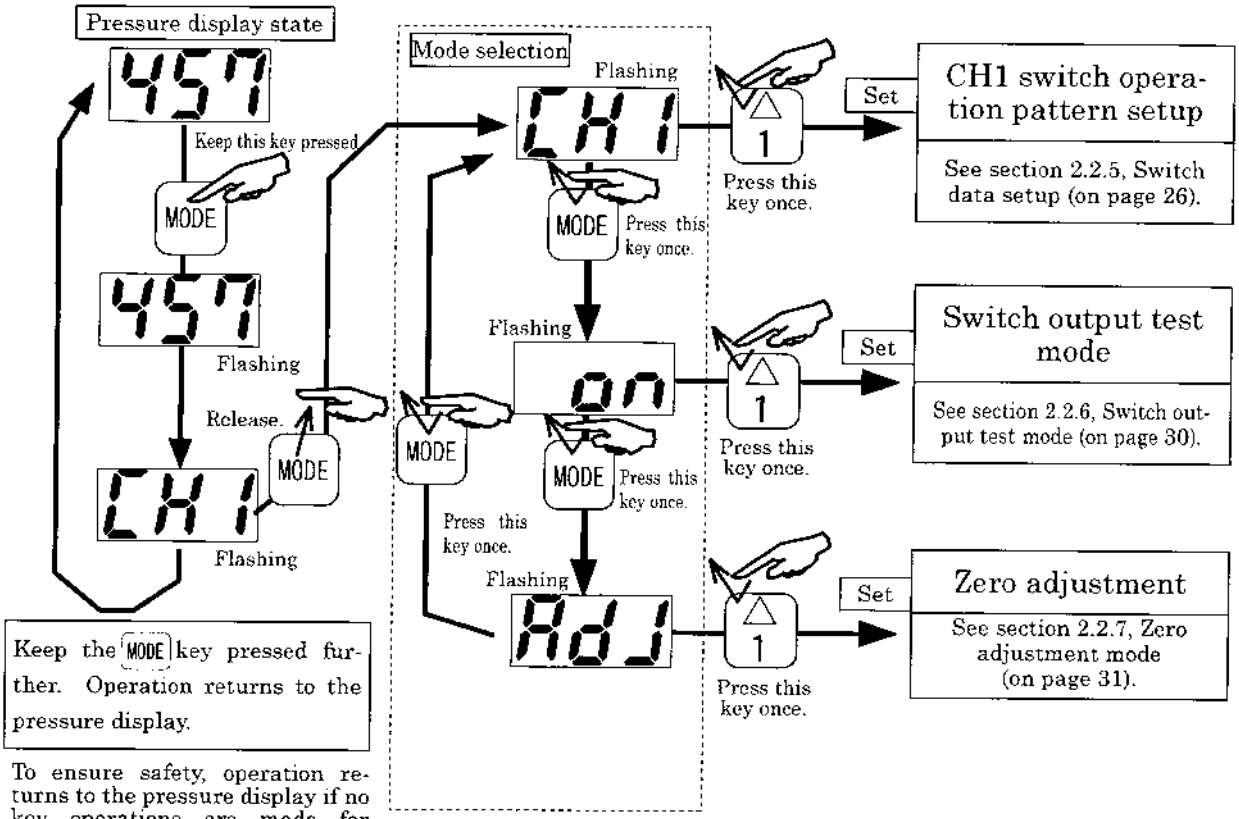
(1) Data setup mode for 2-point output
The following six data is selected and set.
CH1:Operation pattern, CH1:ON set value, CH1:OFF set value
CH2:Operation pattern, CH2:ON set value, CH2:OFF set value

(2) Switch output test mode
The switch output is tuned ON forcibly, and wiring connection and initial operation of the input unit are checked.

(3) Zero adjustment mode
Display deviation from 0 is corrected with the atmospheric pressure applied.
The above setup and test may greatly affect the output signals and display values. Before starting operation, stop the machine using this product and make sure the safety of the machine even if malfunction or incorrect display occurs. Do not attempt to start the setup or test while the machine is being operated. Doing so may cause malfunction or incorrect display, resulting in hazard.
To avoid improper operation, start the setup or test from the mode selection by keeping the [MODE] switch pressed for a certain period of time.

Selecting a setup or test mode.

Keep the MODE key pressed. When CH1 is displayed, release the MODE key once. Press the MODE key several times until a desired mode is displayed. After that, press the ▲ 1 or ▼ 2 key once.



2.2.5 Switch data setup

In the mode setup, press the [▲ 1] or [▼ 2] key when CH1 is displayed. Operation then enters the CH1 switch operation pattern setup mode. Subsequently, perform the data setup necessary for switch operation in order.

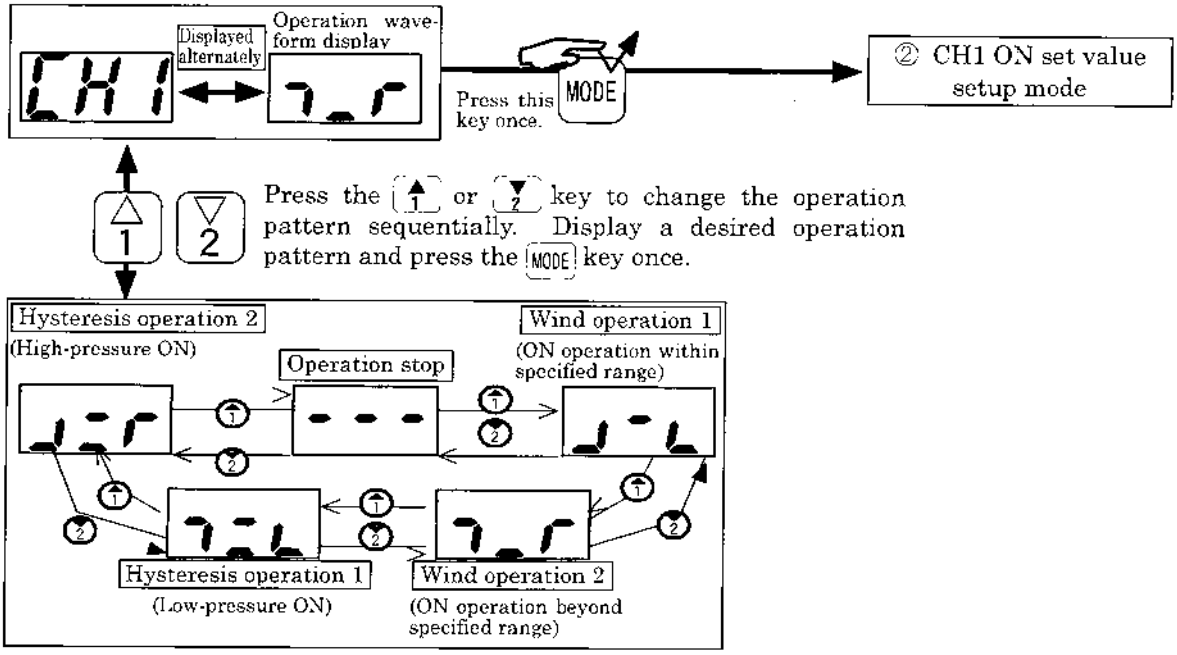
① CH1 switch operation pattern setup mode

A waveform for the output signal from OUT1 is selected.

When operation enters this mode, CH1 and current waveform are displayed alternately.

(For details about how to read the waveform display, see section 2.2.3, Switch functions (one page 21).)

The waveform display may change sequentially every time the [▲ 1] or [▼ 2] key is pressed. When the [MODE] key is pressed once while the necessary waveform is being displayed, this operation waveform is recorded and operation enters the CH1 ON set value setup mode.

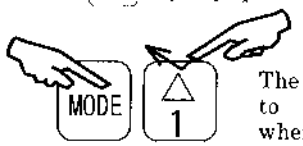


Convenient operational procedures

The following operational procedures are valid in the switch operation pattern setup, ON/OFF set value setup, unit switch, and zero adjustment modes.

Setup data reset operation

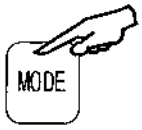
Press the [▲ 1] key once with the [MODE] key kept pressed.



The set data is returned to the previous data when operation enters this mode.

Setup stop operation

Keep the [MODE] key pressed for approximately 5 sec. or longer.



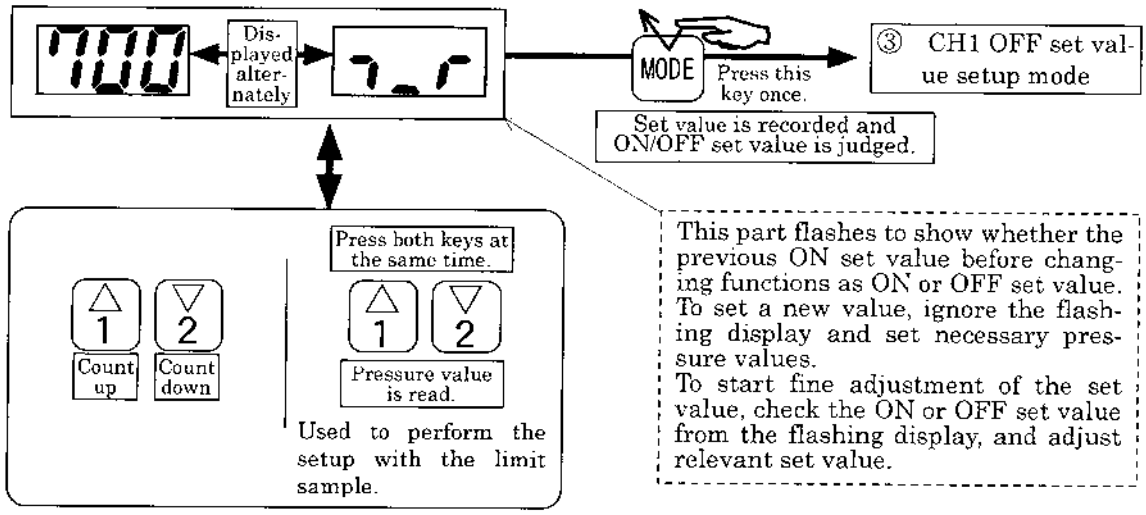
The setup operation is stopped and operation returns to the normal pressure display without recording of changed data.

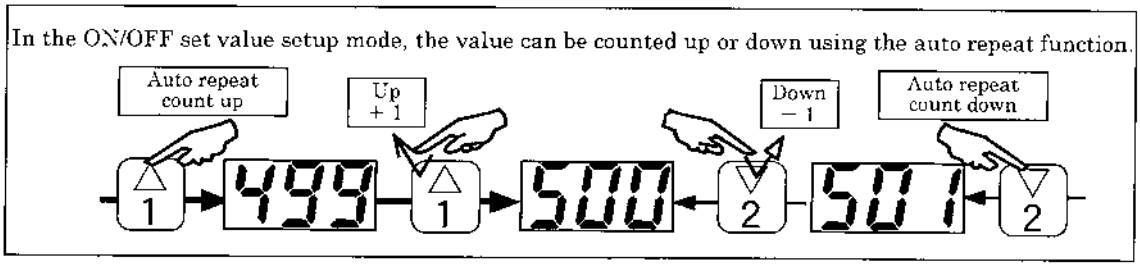
② CH1 ON set value setup mode

The first set pressure value is set, at which the output signal from OUT 1 is operated. Normally, the ON set value is set. (The product functions even though the OFF set value, and then ON set value are set in that order in this setup mode. However, it is recommended to set the ON set value first in order to prevent incorrect setup.)

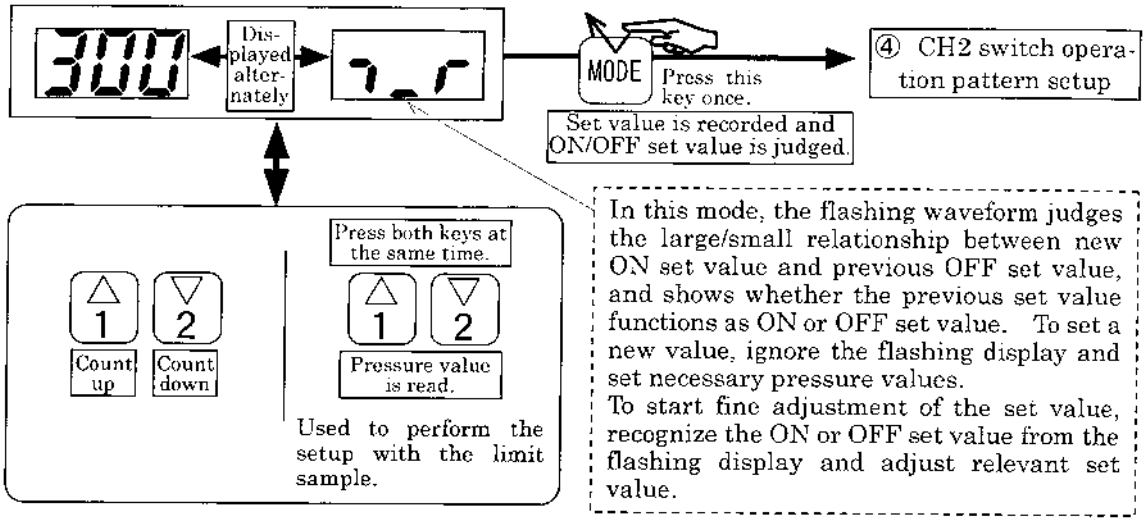
When operation enters this mode, the current set value and current waveform are displayed alternately, and the waveform flashes to show that the current value functions with the waveform display ON or OFF. (For details about how to read the waveform display, see section 2.2.3, Switch functions (one page 21).)

Display a desired pressure value using the [▲ 1] or [▼ 2] key, and press the [MODE] key to record that set value. Operation then enters the CH1 OFF set value setup mode.

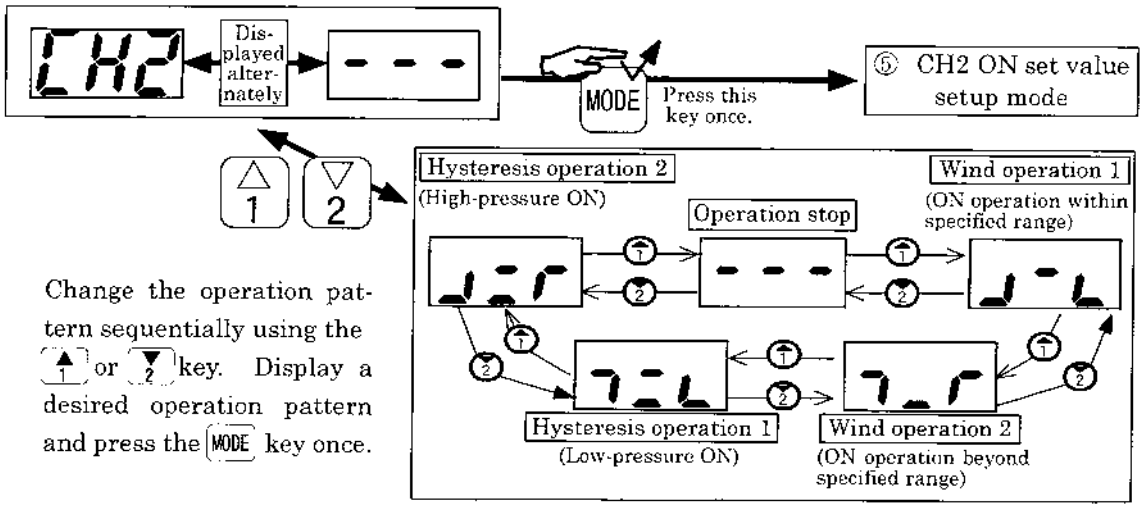




③ CH1 OFF set value setup mode
Next, set the second set value in the same manner.

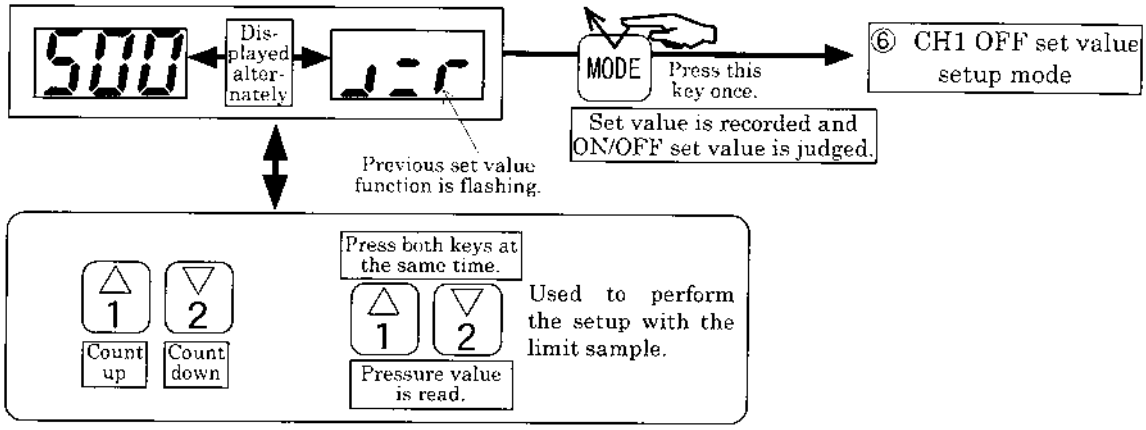


④ CH2 switch operation pattern setup mode
A waveform for the output signal from OUT2 is selected.
Select a desired operation pattern in the same manner as described in the section, CH1 switch operation pattern setup mode.



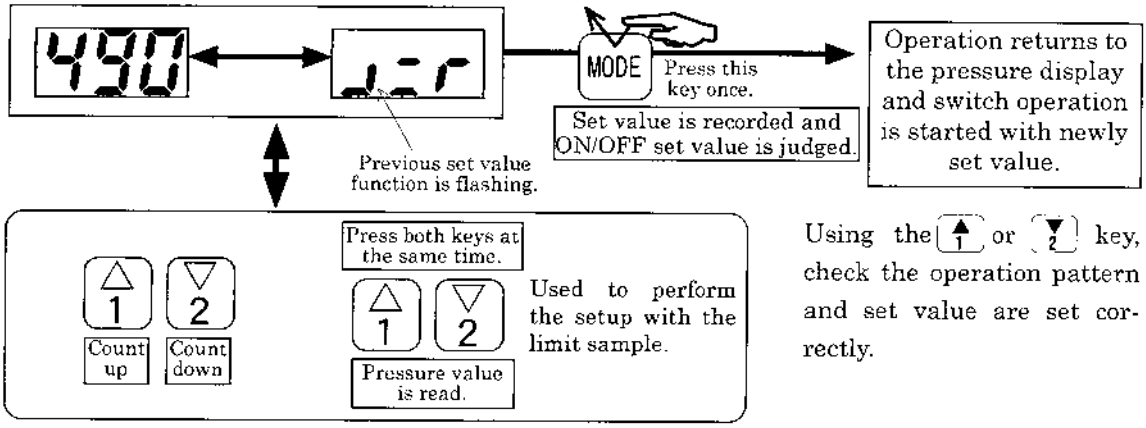
⑤ CH2 ON set value setup mode

The first set pressure value is set, at which the output signal from OUT 2 is operated. Normally, the ON set value is set. Set the CH2 ON set value in the same manner as described in the section, CH1 ON set value setup mode.



⑥ CH2 OFF set value setup mode

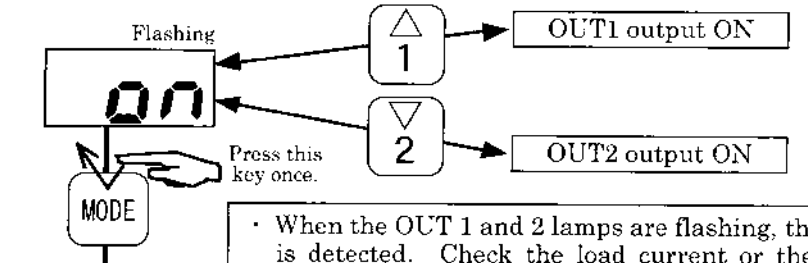
Next, set the second set value in the same manner.



Using the [1] or [2] key, check the operation pattern and set value are set correctly.

2.2.6 Switch output test mode

If the [1] or [2] key is pressed when "on" is displayed in the mode setup, operation enters the switch output test mode. The display flashes in this mode.
When the [1] key is pressed, the OUT1 output is turned ON. When the [2] key is pressed, the OUT2 output is turned ON.
When the [MODE] key is pressed once, operation returns to the normal pressure display.



The OUT1 lamp is lit and the OUT1 output is ON while keeping the key pressed.

The OUT2 lamp is lit and the OUT2 output is ON while keeping the key pressed.

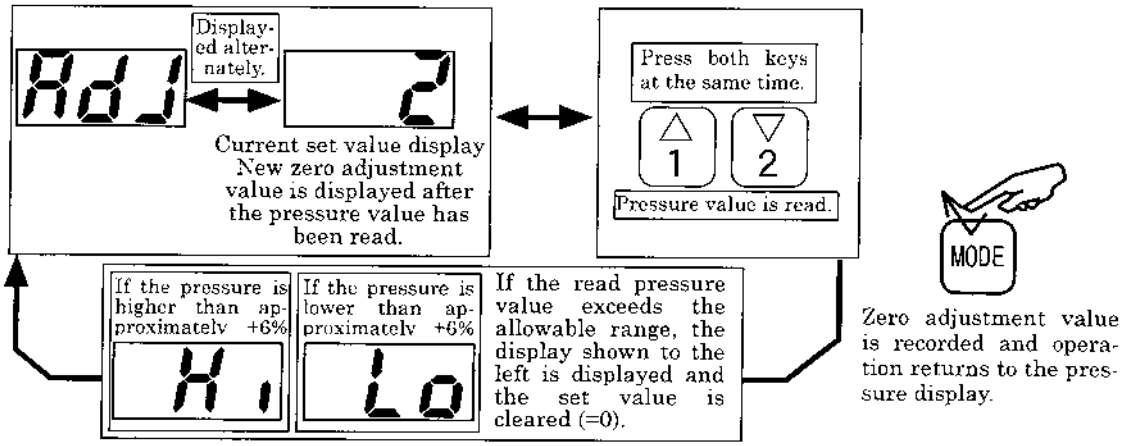
Operation is returned to the pressure display and switch operation is restarted.

- When the OUT 1 and 2 lamps are flashing, this shows that the over-current is detected. Check the load current or the output and power lines for short-circuit. If no faults are found, the output circuit may be broken.
- If the output signal is not output even when the OUT1 and 2 lamps are lit, check the output line for faulty wiring or connection. If no faults are found, the output circuit may be broken.
- If the output signal is output even when the OUT1 and 2 lamps are off, check the output and power lines for short-circuit. If no faults are found, the output circuit may be broken.

Note 1 This test function is used to check the wiring connections and operation of the input unit. Do not use this function as actual signals to run the sequence program while the machine is being operated.

2.2.7 Zero adjustment mode

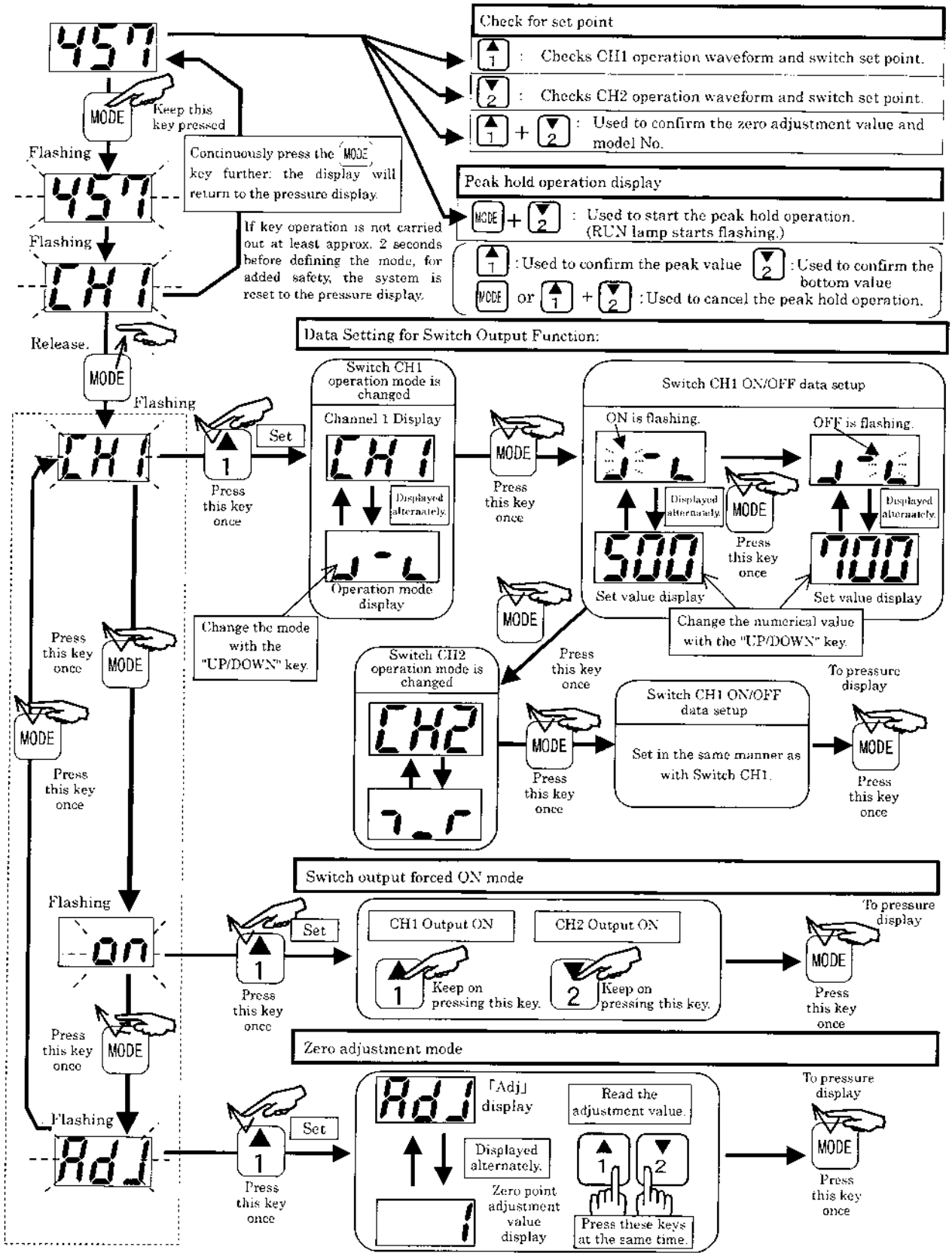
If the ▲1 or ▼2 key is pressed when AdJ is displayed in the mode setup, operation enters the zero adjustment mode. AdJ and current zero adjustment value are displayed alternately in this mode.
When the ▲1 and ▼2 keys are pressed at the same time, the current pressure value is read and displayed as new zero adjustment value.
When the MODE key is pressed once, the currently displayed zero adjustment value is recorded and the pressure corrected with newly set zero adjustment value is then displayed.



Notes 1. In the zero adjustment, do not stick to complete zero display. Always consider the accuracy range and allow a deviation within the accuracy range. The zero point may deviate immediately after the power to the pressure switch is turned ON or after a certain period of time has elapsed. Always perform the zero adjustment under stable conditions close to the operating conditions. Additionally, the zero point may vary depending on changes in ambient temperature.

2. Perform the zero adjustment with the pressure released to the atmospheric pressure level. Do not perform the zero adjustment with the pressure applied. Such operation is beyond the scope of guarantee and the reliability of the display value lowers. Even if the pressure is controlled to "0" using the regulator, the residual pressure may remain due to structure of the check valve. Disconnect the residual pressure release valve and pipe to put the product in the atmosphere release state.
3. The zero adjustment may affect the display pressure range. The pressure is not displayed at around the upper or lower limit of the rating even though the pressure level is within the rated pressure range.
4. When reading the pressure value during zero adjustment, instantaneous pressure value at that time is read. If the zero adjustment pressure varies, a change in pressure is read and deviation in zero adjustment value increases. Changes in pressure fluctuation at the zero point, as well as electrical noise may result in changes in pressure. After checking that the read value is correct, record the zero adjustment value.
5. To clear the zero adjustment value, perform the zero adjustment with a pressure of 20% F.S. or more applied. (This ensures reliable clear process.)

2.2.8 Operation flowchart

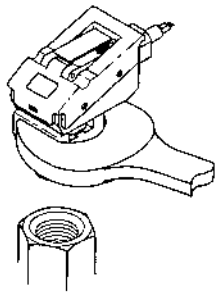


3. INSTALLATION

3.1 Piping

1) PPD3-[ ]-6

Place seal tape or a sealing material and use a wrench at the width across flats (13mm) of the R1/8 joint for installation.

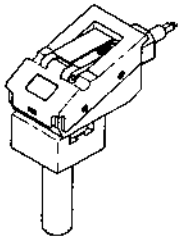


(Precautions)

The tightening torque must be 1.0 to 1.5 N・m or less. Since it is made of resin, excessive tightening may break the pipe.

2) PPD3-[ ]-H6-B

This type should be installed onto CKD 6mm push-in joint.

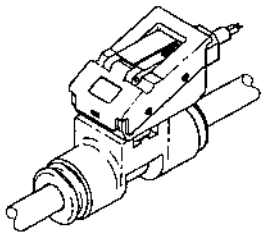


(Precautions)

- Plug part should be inserted firmly and before use, plug should be checked that it is not inserted to the end, plug can be come out and leakage may happen.
- Following push-in joints are recommended, GZ series, GW series and GM series.

3) PPD3-[ ]-H6

Insert 6mm tubes into 2 quick joints for use.



(Precautions)

- Following tubes are recommended nylon tubes, Urethane tube, non-inflammable tube.

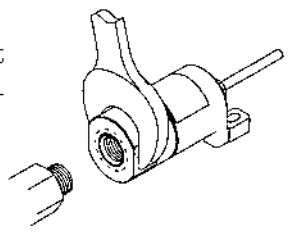
Allowable tolerance for tube (outer diameter)

Nylon tube	Blow ±0.1mm
Soft nylon tube	
Polyurethane tube	Blow +0.1mm −0.2mm
Urethane tube	

- Tubes should be inserted firmly and before use tube should be checked that it is not come out. In case the tube is not inserted to the end, tube can be come out and leakage may happen.
- Cut the tube vertically.

4) PPD3-S-[ ]-6B

Place seal tape or a sealing material and use a wrench at the width across flats (19mm) of the Rc1/8 joint for installation.



(Precautions)

- The tightening torque must be 3 to 5N・m or less.

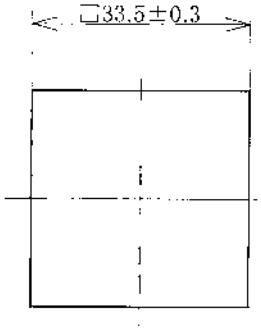
3.2 Mounting the PPD3-KHS-D (panel mounting)

(This product is to be purchased separately by specifying the model.)

> **⚠ CAUTION :** In this panel mounting, the seal structure between the front and rear of the panel cannot be kept. This mounting method cannot be used if the panel requires the protection structure.
> (The PPD3 main body has the protection performance IP65.)

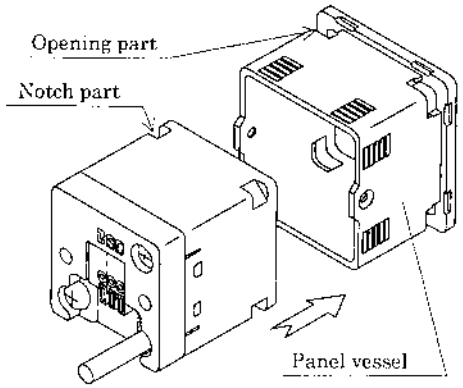
3.2.1 Mounting

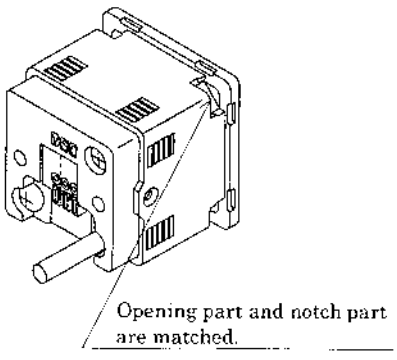
① Make the mounting hole in the panel.
Make the mounting hole as shown in the Fig. below.



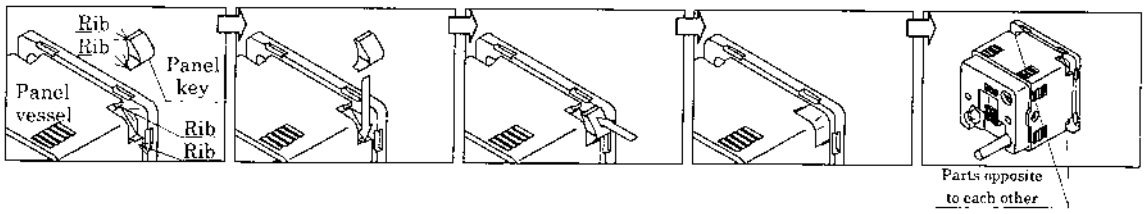
The following shows the mounting pitches when the panel holders are aligned in the same direction.
·Mounting pitch in the longitudinal direction : 53 or more
·Mounting pitch in the lateral direction : 40 or more
The mounting direction of the panel holder can be changed by 90° . Determine an appropriate mounting direction applicable to the operation method.

③ Insert the PPD3 main body into the panel vessel so that both front parts are aligned. At this time, the opening part at the side edge is matched with the notch on the PPD3 main body.





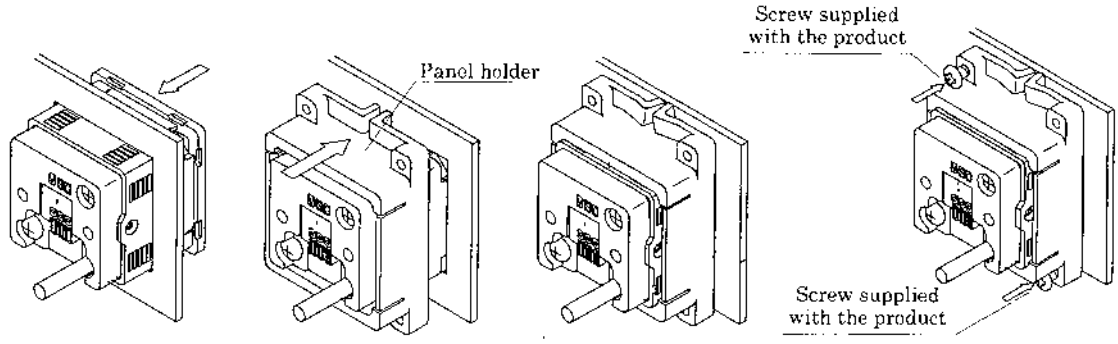
④ Attach the panel key to the notch part at the side edge. Four panel keys are supplied with the product. To keep the sufficient strength, it is necessary to attach the panel key to at least two positions opposite to each other. Other two keys are used as spare parts or attached to the remaining notch parts.
Put the rib of the panel key so that it is engaged with the rib of the panel vessel. This engagement point is used as a fulcrum. Turn the panel key and press fit another rib.



Four panel keys are put as they are connected to the runner. Cut the panel keys using diagonal cutters, and then attach them. Additionally, the runner is used as a handle and attach the panel key to the opening part. After that, cut the panel key or turn the runner part to twist and cut the panel key while pressing it.

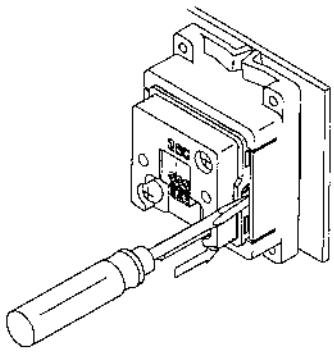
⑤ As shown in the Fig. below, put the panel vessel into the hole in the panel from the front of the panel and push the panel holder from the rear until play is eliminated. After that, connect the wires and pipes.

⑥ If the panel holder has a large play, screw-in the P-tight screws supplied with the product at the positions opposite to each other to push the rear of the panel by their ends.
(At this time, note that the rear surface of the panel is damaged.)

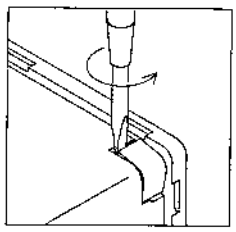


3.2.2 Removing

① Put a small standard screwdriver in the panel holder slit and raise the ratchet part to disengage it. If the PPD3 cannot be removed by elasticity of the panel holder, push the PPD3 main body from the rear toward the panel to remove it.



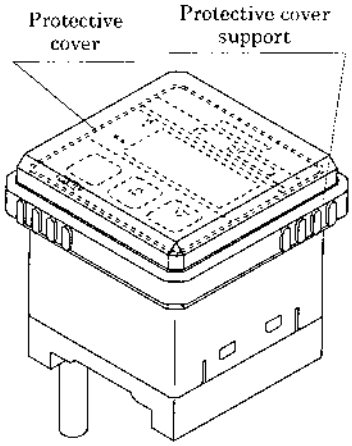
② Put a precision standard screwdriver in the side gap and turn it to disengage the rib. Carefully remove the panel keys so that they are not fallen or missing. After that, remove the panel vessel.



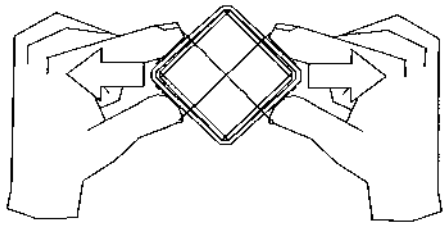
3.3 Using the PPD3-KC protective cover (This product is to be purchased separately by specifying the model.)

To protect the operation and display panels, and prevent changing of set values, a protective cover can be added to the PPD-3. If this product is used in an important process or the set values of the product are used as important control values, it is strongly recommended to use this protective cover.

① Mounting the PPD3-KC

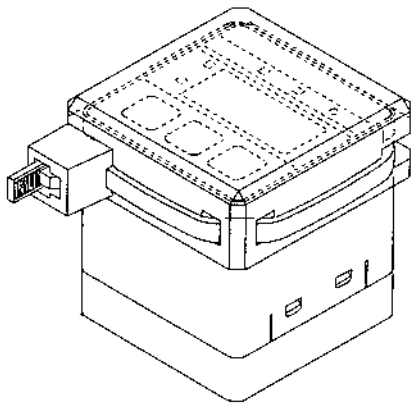


Pick and pull the projections on the both sides of the protective cover (approximately 2mm) to mount or remove the cover.



<Application>

- Remove the protective cover support (rubber) supplied with the product and put the protective cover on the groove and slit hole in the protective cover using binding bands. This can be used as simple sealing. At this time, it is necessary to cut the binding band when removing the cover.



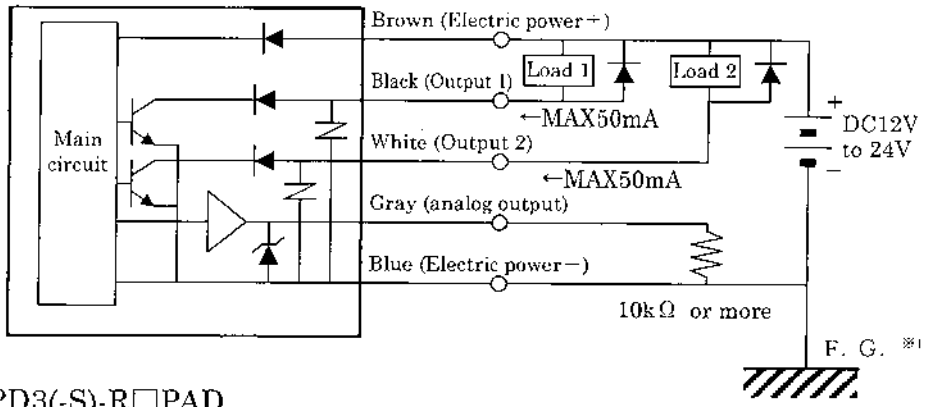
Use of binding bands makes it possible to perform the simple sealing.

3.4 Wiring

3.4.1 Circuit and connections

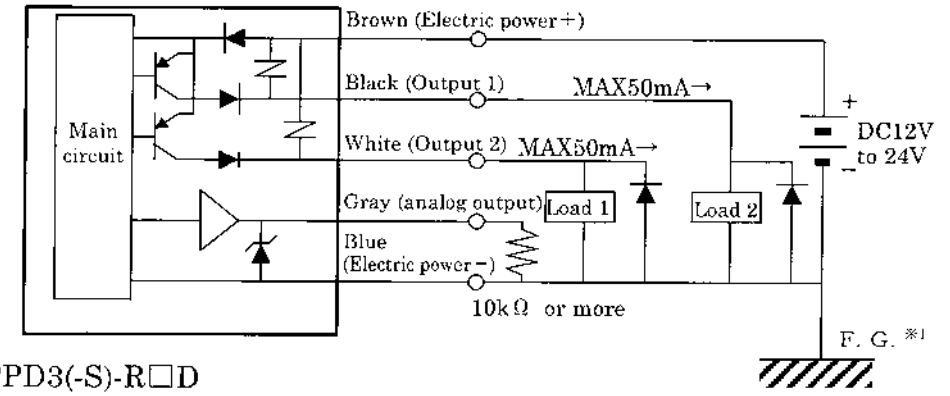
<Circuit connection examples>

● PPD3(-S)-R□NAD



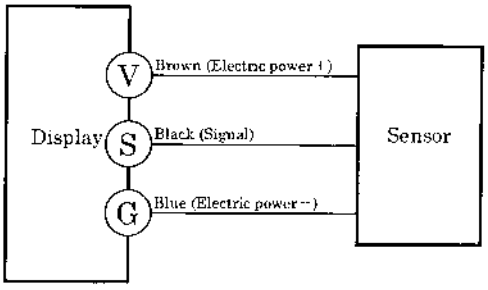
※1. Only PPD3-S-D is connected.

● PPD3(-S)-R□PAD

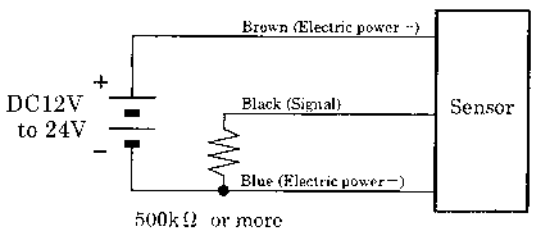


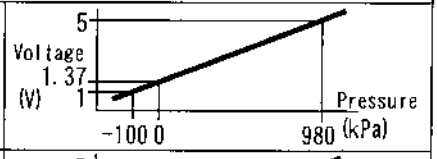
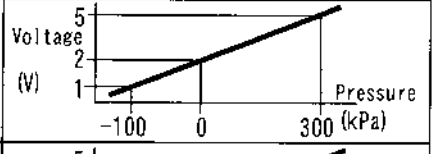
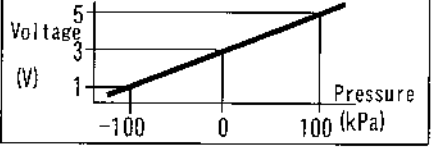
※1. Only PPD3-S-D is connected.

● PPD3(-S)-R□D



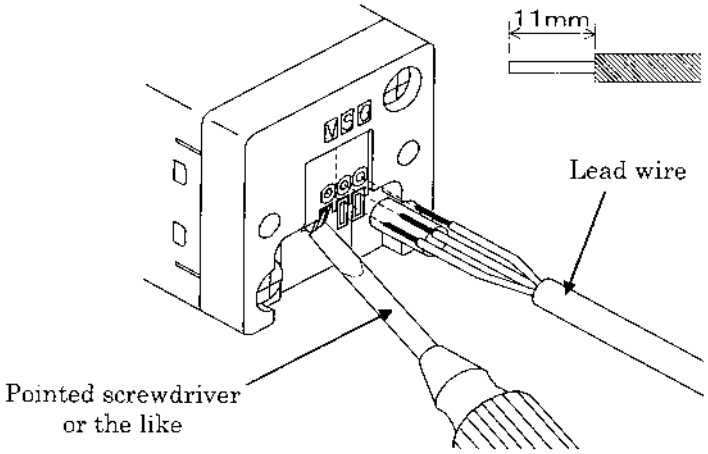
● Connection when the sensor unit is used



Output voltage waveform of analog output type product	
R10NA - R10PA	
R03NA - R03PA	
R01NA - R01PA	

3.4.2 Sensor Connection Method

(1) The sensor is to be connected to the terminal strip. With the yellow claw on the terminal strip pressed, insert the lead wire. Twist the lead wire tip for each lead wire and make arrangements so that it is not shortcircuited with other lead wires.



Symbol	Wire Color
V	Brown
S	Black
G	Blue

(2) Where a lead wire other than this product is used for the terminal strip, refer to the following specifications.

- Single wire ··· 0.14mm^2 to 0.5mm^2
- Single wire ··· 0.14mm^2 to 0.5mm^2
- AWG ··· 26 to 20

(3) Avoid connecting other than the sensor of this product; otherwise, wrong display is not only made but damage may be caused to the sensor and display unit.

4. MAINTENANCE

4.1 Trouble shooting

Trouble symptom	Cause	Remedy
Pressure is not displayed.	· Wiring is faulty.	· Replace the PPD3. · Recheck or repair the external wiring.
	· Power supply unit is not connected correctly.	· Connect the rated power supply unit correctly.
	· Product malfunctions due to noise.	· Put the PPD3 main body and cables far away from the noise source.
	· PPD3 is faulty.	· Replace the PPD3.
Incorrect pressure is displayed.	· Power supply voltage is faulty. (Voltage or power capacity is insufficient.)	· Supply the rated voltage. · Keep a sufficient power capacity.
	· Product malfunctions due to noise.	· Put the PPD3 main body and cables far away from the noise source.
	· Zero adjustment value is set incorrectly.	· Set the zero adjustment value again.
	· Breakage (Hi or Lo display) or leak occurs due to excessive pressure.	· Replace the PPD3.
Switch output is not turned ON or output.	· Wiring is faulty.	· Recheck or repair the external wiring. Replace the PPD3.
	· Load (input circuit) is short-circuited.	· Recheck or repair the external wiring.
	· Switch data ON/OFF set values are set incorrectly.	· Check or correct the setup contents.
	· Input circuit is selected incorrectly.	· Check or correct the input circuit.
	· Output circuit is broken.	· Replace the PPD3.
Switch output is not turned OFF.	· Switch data ON/OFF set values are set incorrectly.	· Check or correct the setup contents.
	· Input circuit is selected incorrectly.	· Check or correct the input circuit.
	· Output circuit is broken.	· Replace the PPD3.
Leak sound is heard.	· Sensor part is broken due to excessive pressure.	· Replace the PPD3. Review the pressure and range.
	· Sensor part is corroded or broken.	· Replace the PPD3. Review the fluid and investigate use of PPD3-S.
	· O-ring is broken.	· Replace the PPD3. Review the fluid and take ozone prevention measures.

Note 1: This product uses electronics parts. These parts are in the ON or OFF state in the fault mode of the output circuit caused by over-voltage or over-current.
Therefore, it is not sufficient to take only measures against the specific fault mode.

5. HOW TO ORDER

The model coding for PPD3-D Series shall be as specified below.

PPD3－①－②③D－④

① Sensor type	
No-mark	Diffused type semi-conductor pressure sensor
S	Stainless diaphragm sensor

② Pressure range	
R10	-100 to 980kPa
R03	-100 to 300kPa
R01	-100 to 100kPa

③ Output formality	
NA	NPN transistor output, 2 point and analog output, 1 point
PA	PNP transistor output, 2 point and analog output, 1 point

④ Mounting Configuration		
6	R1/8	PPD3 (Diffused type semi-conductor pressure sensor)
H6-B	φ6mm plug	
H6	φ6mm push-in joint	
6B	Rc1/8	PPD3-S (Stainless diaphragm sensor)

Model No. for Sensor Separate Type

- Display unit model No.

PPD3－①－②③D

- Sensor unit model No.

PPD3－①－②A－④

Metal brackets and kits.

PPD3－⑤

⑤ Model code	
KL-D	One-side mounting foot (L-shape mounting)
KD-D	Both-side mounting foot (parallel mounting)
KHS-D	Set of panel mounting metal brackets, cover is provided.
KC ※1	Operation protective cover

※ 1. This unit is common to the sensor built-in type.