Discontinued some variations

CKD

SM－270661－A

INSTRUCTION MANUAL

PARECT PRESSURE SWITCH

PPD3(－S)

PPD3(Sensor integrated type) is discontinued.
PPD3(Sensor separate type) and PPD3-S are still o sale.

- 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

Discontinued some variations

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (to the level pursuant to JIS B 8370 Pneumatic System Rules).

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.

Notice about unit limitation after enforcement of revised measurement law

As the measurement law was revised, products with the unit other than the SI unit system (kPa) (including the unit switch function) could not be delivered to the domestic market from October, 1999.
This instruction manual also describes previous products for the customers using the products before enforcement of the revised measurement law. When using the product shipped after enforcement of the revised measurement law, units other than kPa cannot be used. Additionally, the unit switch function cannot be selected in the setup and test modes. Please accept the above contents and skip the descriptions related to the unit switch function.

[SM-270661-A]

Discontinued some variations

About design and selection

⚠ WARNING :

a) Use the product correctly under the specified conditions.

- If the product is operated under conditions other than those specified (such as application, voltage, impact, and/or environment), this may cause breakage or malfunction, as well as incidental or consequent trouble.

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

- Doing so may cause the sensor or product material to break, resulting in a large amount of fluid leak. This may also cause incidental or consequent trouble.

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 (1 cm^3/min ANR). The entire system must be designed based on this pre-condition.
- 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 and your experience with the technology for handling 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. (For example, oxygen shortage preventive measures must be taken in the N2 gas environment.)
- When using this product for the air (vacuum) or compressed air containing water or oil, such as confirmation of wet workpiece pickup, select the model PPD3-S (stainless diaphragm sensor specification). If the semi-conductor sensor type product is used in such environment, the sensor may be corroded or broken.
- The passage of the PPD3-S consists of SUS630, aluminum, and fluoro rubber parts (models -6HD and 6HT include nitrile rubber, PBT resin, and brass parts in addition to the above parts.) Do not use any fluid or material component that may affect these parts. The plug attached to the ports 6B and 6T is made of copper. If any corrosion problem is predicted, prepare a corrosion-resistant plug

b) Design the system so that the vacuum breakage pressure does not exceed the proof pressure.

- Control the vacuum breakage pressure level using the regulator and supply the vacuum pressure or shut-off the vacuum breakage pressure using the control valve so that it is not supplied.
  For units containing both vacuum generation and vacuum breakage, reduce the vacuum pressure to a level lower than the proof pressure and then supply the vacuum pressure.

⚠ CAUTION :

c) Design the system so that the main air blow pressure does not exceed the proof pressure.

- A pressure close to the main pressure is produced around the air blow nozzle. This blow pressure back flows from the adsorbing pad or seating jig to low-pressure units during cleaning, causing low-pressure units to break. Always design the system so that the blow pressure is regulated to a level lower than the proof pressure or the blow pressure is shut-off by the control valve.

d) Operating environment

- Do not installer use the product in a place where it is exposed to vibrations of 98 m/s^2 or to impact. Even though the vibration or impact is lower than the specified level, unexpected stress is applied to the product due to resonance among the frame, piping, and wiring. Strictly observe this caution.
- In addition to the temperature of the product installation environment, carefully check the temperature of the measuring fluid and that of the environment inside the piping. If the product is used in an application that the pressure is frequently increased and decreased repeatedly, the temperature rise due to compression may accumulate in the product, causing the product temperature to exceed the rated level.
- In this product, the protection performance IP65 is kept by introducing the dry atmospheric air through the atmospheric air introduction port. However, this design performance is intended only for city water. Therefore, do not install the product in a place where the chemical liquid, detergent, oil, solvent, hot water, or steam is splashed onto it, water content sticking to the product is frozen, a large amount of dust or cutting chip exists, or the pressure is increased or decreased. Additionally, design and/or adjust the work processes so that no water is splashed onto the product before the piping and wiring work has been completed. Always supply sufficiently dry air that does not cause dew condensation even though the ambient temperature changes rapidly.

e) 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.

f) 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.)

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.

⚠ CAUTION :

- 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) Always start operation of the control circuit 2 sec. after the power is tuned ON.

- This product dose 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) Use a stabilized power supply unit that can provide a noiseless power with a ripple voltage of 1%or less.

- Select a power supply unit with a large capacity that provides a sharp rise or fall waveform immediately after the power is turned ON or OFF.

k) 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 – 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 connection, 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 an AC power non-insulated DC power supply unit.

- Doing so may cause this product or power supply unit to break, resulting in an electrical shock or a fire. Always use an insulated DC stabilized power supply unit.

Discontinued some variations

⚠ 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.

⚠ CAUTION :

b) Protect lead wire ends when the protection performance IP65 is required.

- Water may enter the product through the lead wire ends. When using the product in an application requiring the protection performance IP65, always connect the wires in the waterproof relay box.

c) Install it and its wiring in remote area from noise source such as high tension line as far as possible.

- Provide some independent measure against power line which surge overrides to.

d) Before starting the wiring work Stop the machine completely, make sure the safety around it, and shut down the power completely.

- Discharge the static electricity from your body or tools (make a part of your body or tools in contact with the metallic frame of the machine) before touching the product or wires.

e) Use a DC stabilized power supply unit that can provide a noiseless power with a ripple voltage of 1% or less.

- Use a power supply unit with a large capacity that provides a sharp rise or fall waveform immediately after the power is turned ON or OFF.

f) Do not operate any control unit, device or machine just after the wiring of this product.

- First, carry out the energized test and set necessary switches with the control and machine units stopped. (The setup contents before starting operation are not guaranteed.)

g) Reverse current and overcurrent protection circuits

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

h) 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.

Discontinued some variations

⚠ CAUTION :

i) 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.

j) 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

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

k) Pay special attention to the following cautions for piping work.

- For push-in and barbed joints built-into the product, use recommended tubes.
- 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.)
- Even though resin tubes are used, secure and connect the tubes to the machine at intervals of 1 m so that the tube weight is not applied to the product.
- 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.

Discontinued some variations

About operation and maintenance

⚠ WARNING :

a) Before touching the installed product, stop the equipment and ensure safety

- The switch output is turned ON or OFF forcibly regardless of the pressure value while this product is being operated. Additionally, an unexpected output may be output due to incorrect data setting order or incorrect data. Such output may cause the machine to malfunction, as well as incidental or consequent trouble.
- Before starting operation of the machine, check the set values and operations after the setup work has been completed.

⚠ CAUTION :

a) 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 a second, whereas switch output takes place about 200 times a second.

- The display value cannot follow up rapid pressure changes. Therefore, even though the display value does not reach the switch set value, the switch operation may be started.

c) A value displayed on the PPD represents a range of AD converter values.

- Since the switch data is compared with the internal A/D converter values, the switch operation is not started unless the internal A/D converter value reaches the switch set value even after the display value reaches the switch set value. In this state, it seems apparently that the switch operation is not started even though the display value reaches the set value.

Discontinued some variations

INDEX

PPD3

Parect Pressure Switch

Manual No. SM-270661-A

1. PRODUCT

1.1 Specification

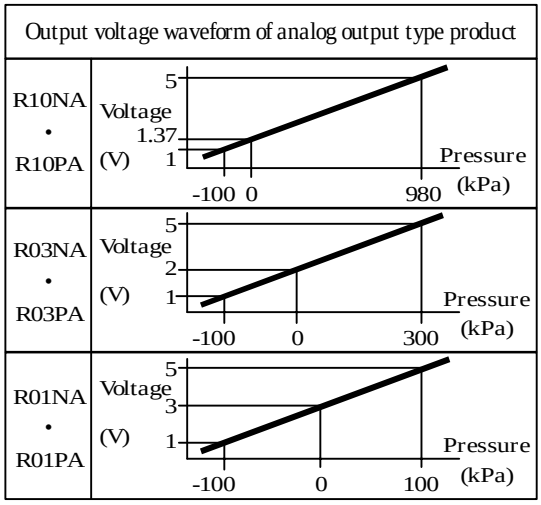
Model code / Item	PPD3-R10	PPD3-R03	PPD3-R01	PPD3-S-R10	PPD3-S-R03	PPD3-S-R01
Pressure sensing element	Diffused type semi-conductor pressure sensor			Stainless diaphragm type pressure sensor		
Applicable fluid	Air, Non-corrosive gas, incombustible gas			Compressed air mixed with water, oil, and drainage		
Type of pressure	Gage pressure					
Range of rated pressure	-100 – 980 kPa	-100 – 300 kPa	-100 – 100 kPa	-100 – 980 kPa	-100 – 300 kPa	-100 – 100 kPa
Guaranteed proof pressure	1.47MPa	0.6MPa	0.2MPa	1.47MPa	0.6MPa	0.6MPa
Leak	1 cm²/min (ANR) or less					
Display	3 digits, LED display, height of figure 8mm					
Display accuracy	±2% F.S.					±3% F.S.
Temperature characteristics	±4% F.S.					±5% F.S.
Power source	DC12V – 24V ±10% (Ripple 1% or less)					
Current consumption	50mA or lower					
Output response	Approx. 5m/sec					
Output formality	N : NPN transistor, open collector output 2 point P : PNP transistor, open collector output 2 point NA : NPN transistor, open collector output 1 point + analog output 1 point PA : PNP transistor, open collector output 1 point + analog output 1 point					
Rated output	50mA					
Voltage drop	2.4V or lower					
Analog output	1 – 5V±0.1V					1 – 5V±0.2V
Set value holding	E²PROM					
Lead cord	Oil proof vinyl cord 4-core (0.2mm²), 1m					
Temperature range	0 – 50(℃)					
Humidity range	0 – 85(% RH) (not to frozen)					
Protective structure	Equiv. To IP65					

Note 1. As the measurement law was revised, products with the unit other than the SI unit system (kPa) (including the unit switch function) could not be delivered to the domestic market from October, 1999. Even though the customer puts the product in the equipment or machine, and ships such equipment or machine to the overseas market, this restriction applies. Additionally, even if the customer currently uses the product with the unit other than kPa, only products with the kPa unit can be purchased after enforcement of the revised measurement law. Products with the unit other than kPa are no longer purchased. Please accept this notice.

	Unit No.					
	0	1	2	3	4	5
R10	kPa	Kgf/cm²	bar	psi	-	-
R03	kPa	Kgf/cm²	bar	psi	-	-
R01	kPa	Kgf/cm²	bar	psi	mmHg	In. Hg

Note.2

Output voltage waveform of analog output type product



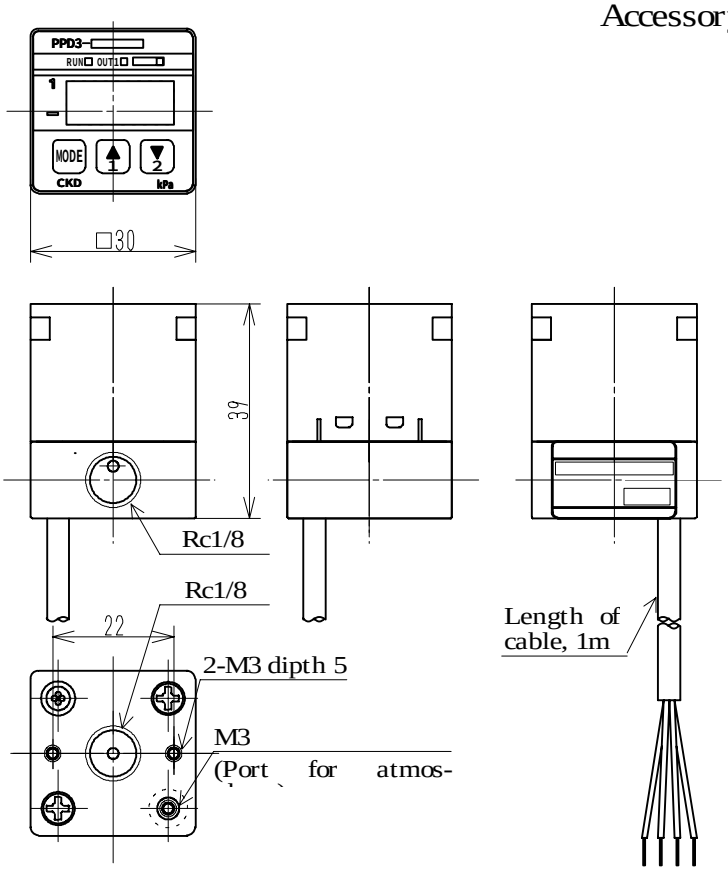
Discontinued some variations

PRODUCT

1.2 External Dimension

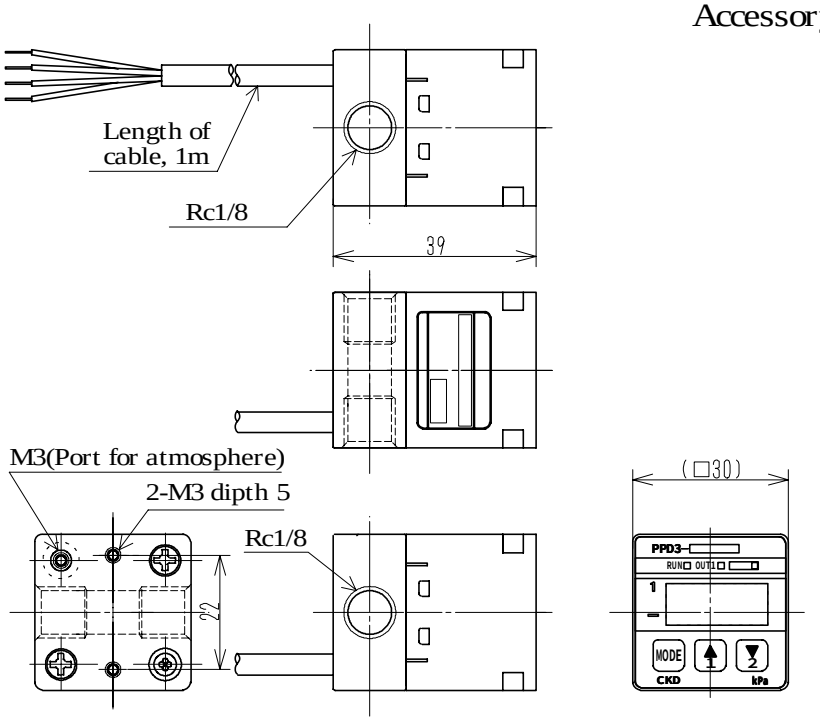
PPD3-*****-6B

Accessory : Plug



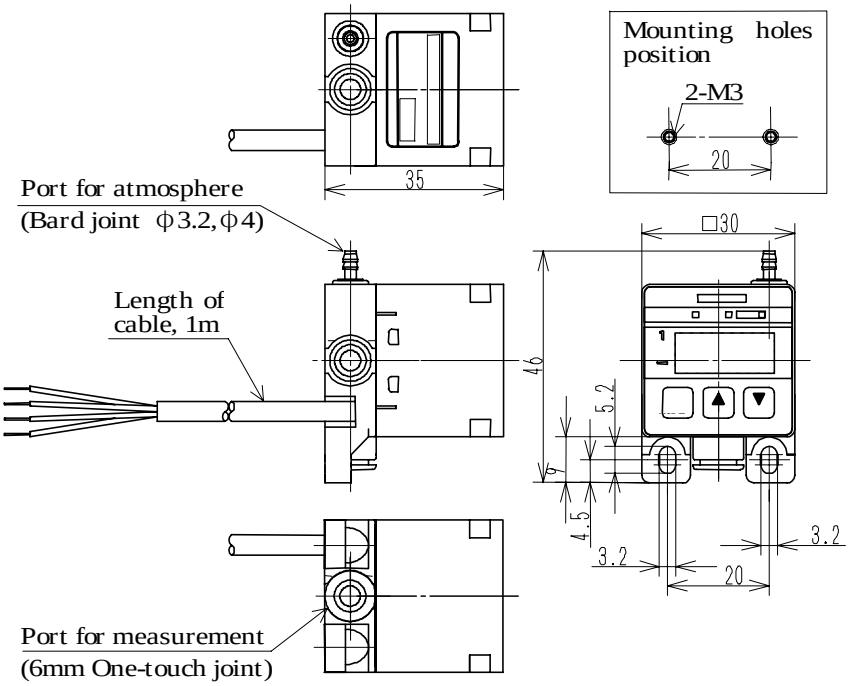
PPD3-*****-6T

Accessory : Plug

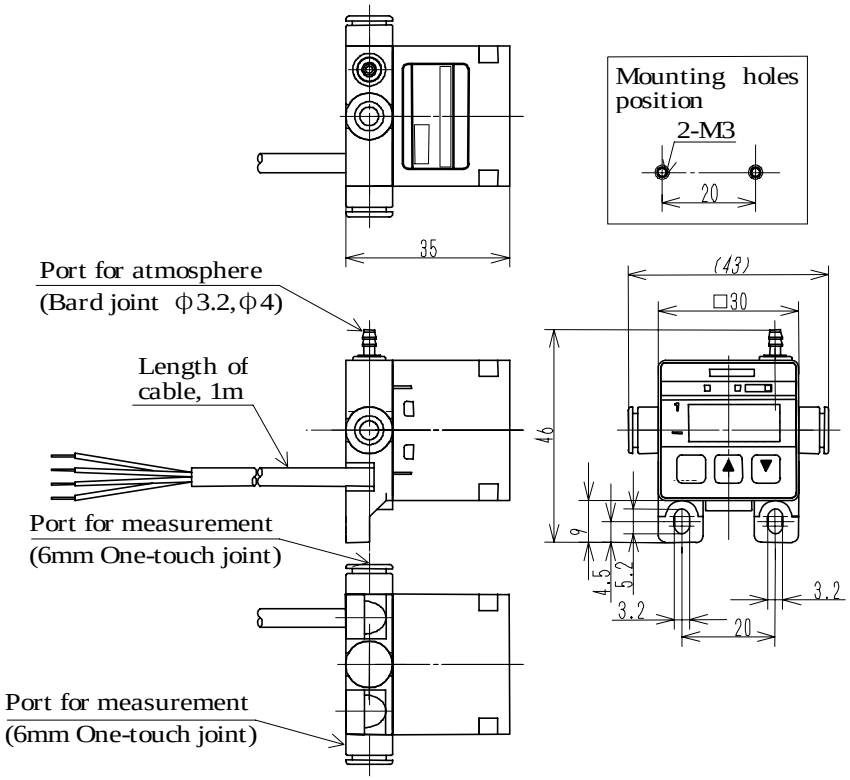


Discontinued some variations

PPD3-****-6HD



PPD3-****-6HT

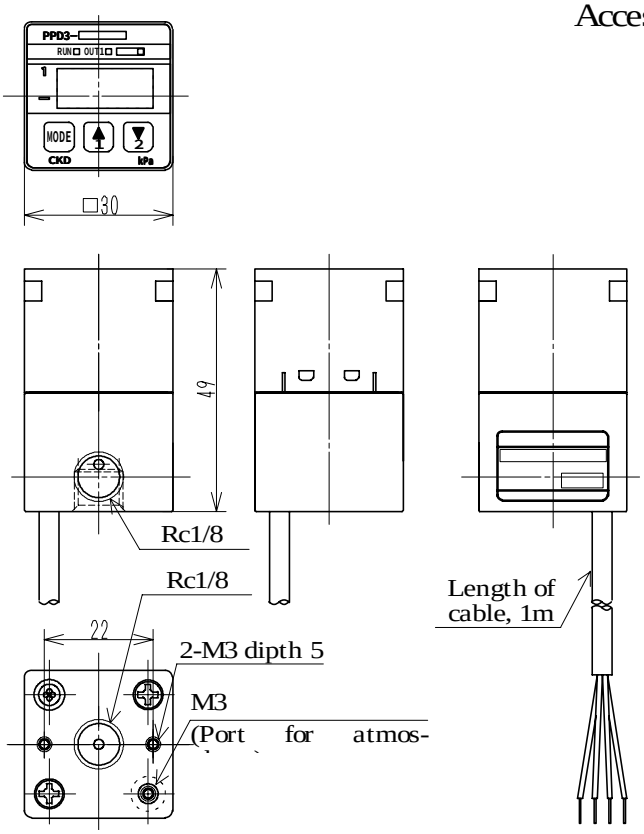


Discontinued some variations

1 PRODUCT

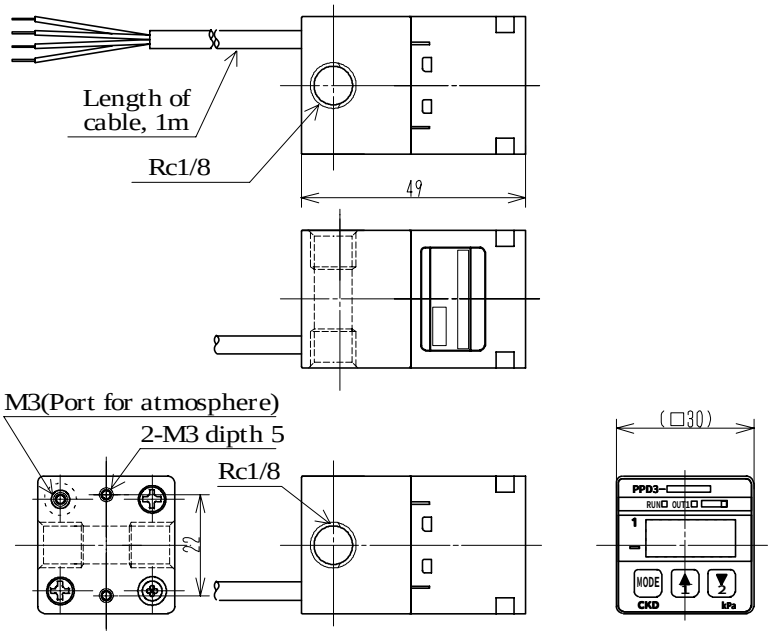
PPD3-S-****-6B

Accessory : Plug



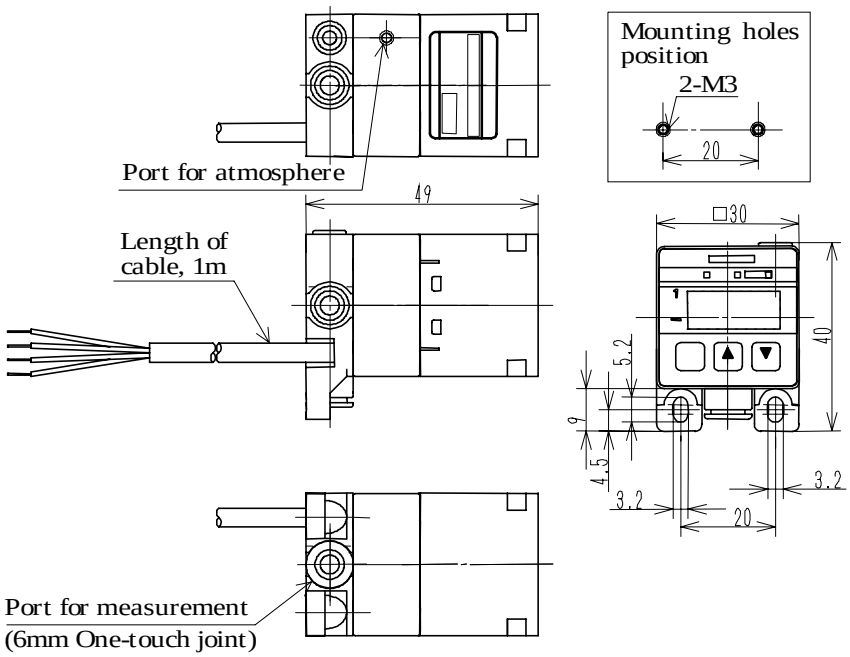
PPD3-S-****-6T

Accessory : Plug

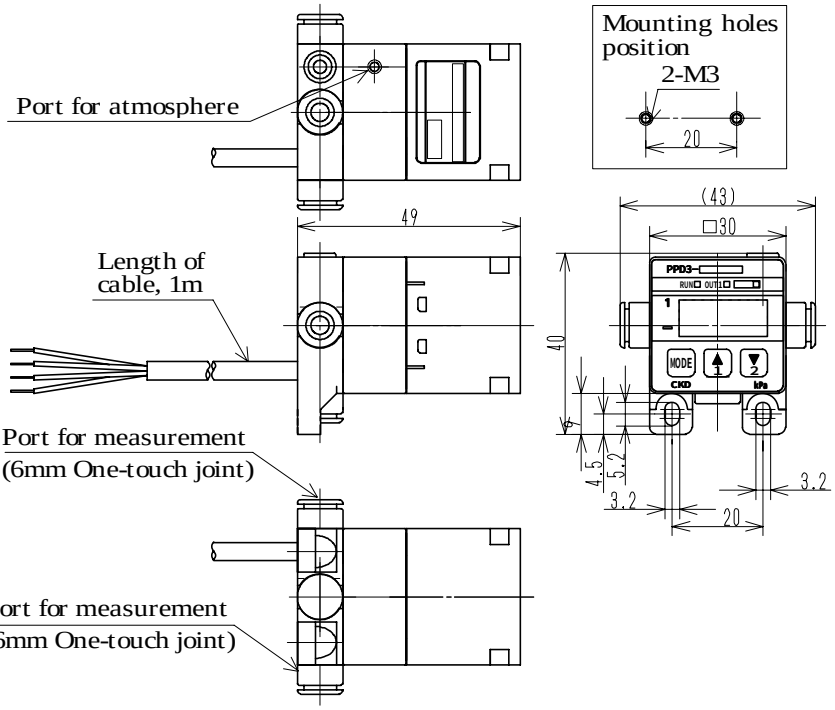


Discontinued some variations

PPD3-S-****-6HD



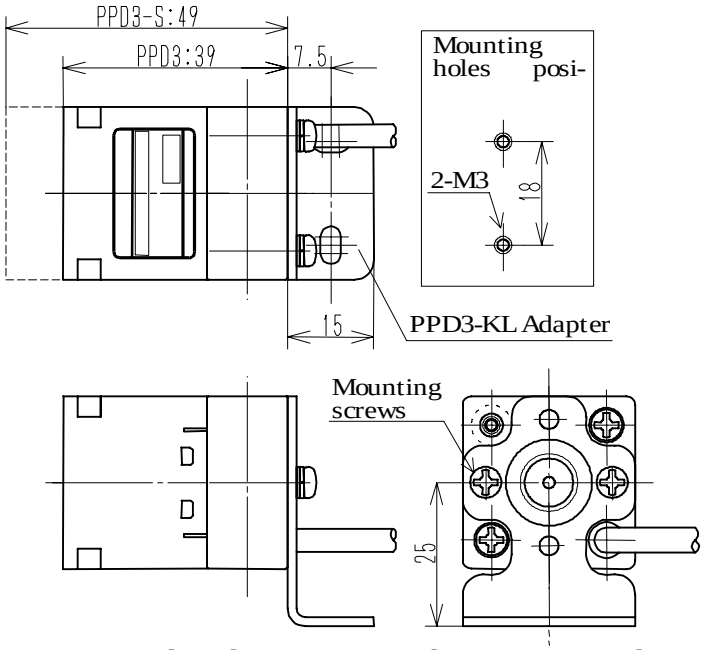
PPD3-S-****-6HT



Discontinued some variations

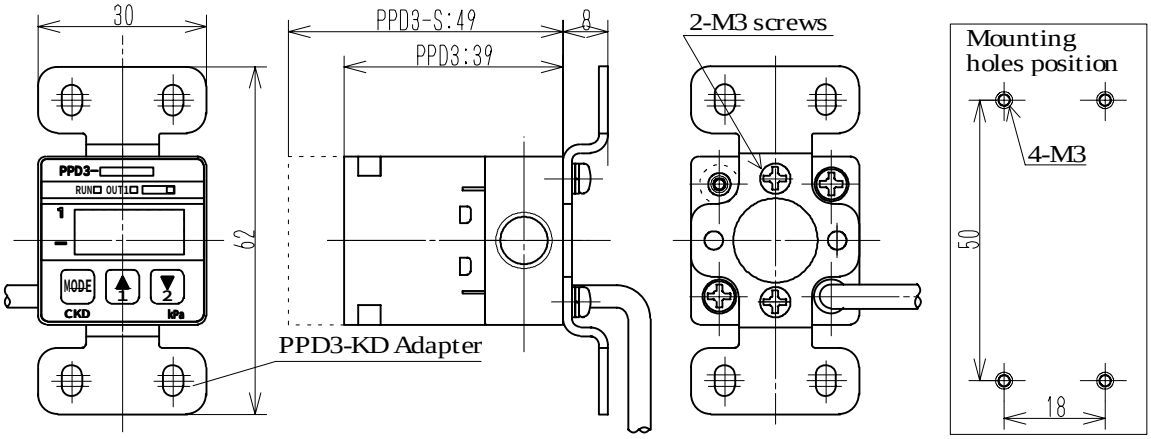
1 PRODUCT

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



Notes(1)If metallic pipes are used in this mounting, this may cause the metal bracket to be deformed excessively. Strictly observe this caution.
(2)If joints and pipes are screwed in when using this mounting metal bracket, this may cause the metal bracket to be deformed excessively. Strictly observe this caution.
(3)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.

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

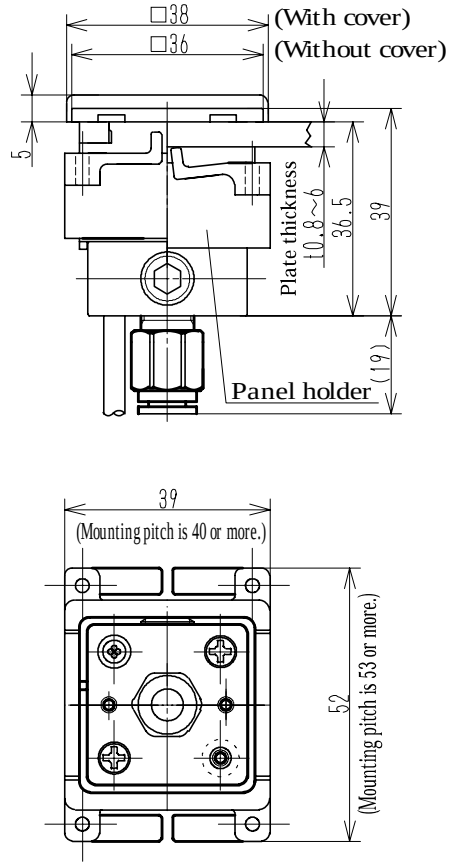


Notes(1)If metallic pipes are used in this mounting, this may cause the metal bracket to be deformed excessively. Strictly observe this caution.
(2)If joints and pipes are screwed in when using this mounting metal bracket, this may cause the metal bracket to be deformed excessively. Strictly observe this caution.
(3)The mounting direction of this metal bracket can be changed by 90°. Determine the mounting direction depending on the installation place.

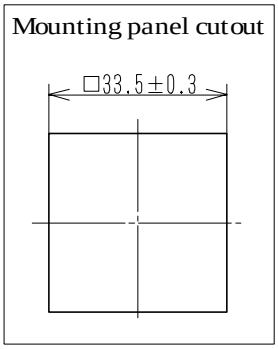
Discontinued some variations

PPD3-KHS (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

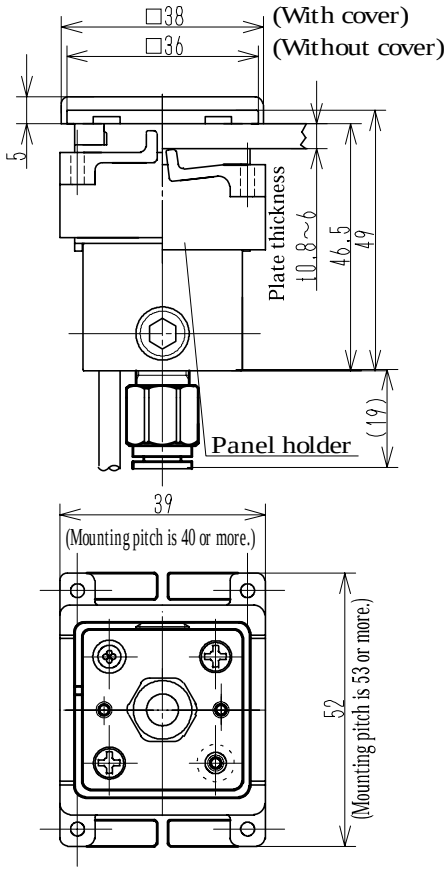
Combination with PPD3-R****-6B



Mounting panel cutout

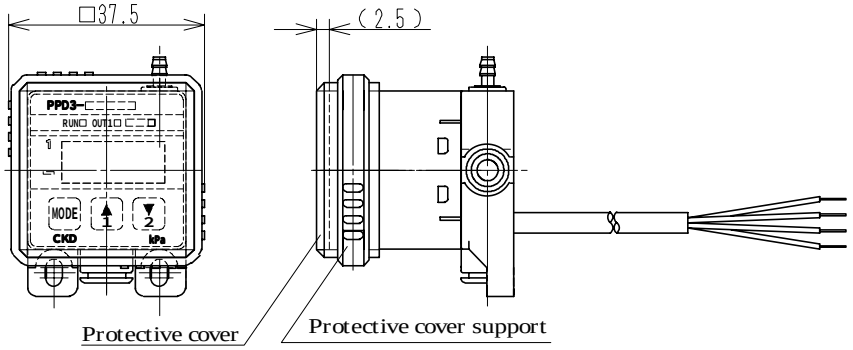


Combination with PPD3-S-R****-6B



Notes(1)The mounting direction of the panel holder can be changed by 90°.
(2)This panel mounting applies to the port 6B. This panel mounting cannot be used for other ports. Additionally, only bottom port is used and side port is closed using the plug.

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.

2
CAUSTION

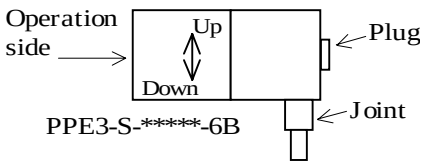
2. CAUTION

2.1 Cautions for handing of product

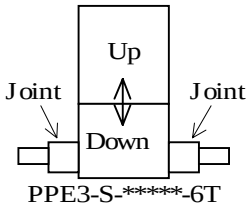
(1) Suspend the body of unit to handle it. Carefully avoid bouncing, dropping, charging an excessive load to the lead cord or giving frequent bending stress to the cord. They could result in an unsatisfactory level of accuracy, disconnection or failure.

(2) Instead of applying hand tools over the resin part of the unit, always apply it on the metal part of the port during the work of laying pipes of connecting joints. Avoid over-tightening. (Range of tightening torque, 0.5 – 0.7N-m)
For the model PPD3(-S)-******-6B, only one of two ports is used and the other port is closed using the plug supplied with the product. (The passage between two ports is metered. Therefore, it is not practical to flow the fluid into the passage between two ports.) In the model PPD3-S, water or drain may accumulate in the gap of the port, to which the plug is attached, causing decomposition or corrosion. If a trouble caused by fluid retention is predicted, replace the plug with a corrosion resistant one and select the mounting method to prevent the fluid retention shown in the Fig. below. Additionally, use of the model PPD3-S-*****-6T is taken into consideration.

<Retention prevention mounting direction 1>



<Retention prevention mounting direction 2>



(3) From a viewpoint of safety, applicable fluid is limited to air and dry compressed air for the product model PPD3, and air and compressed air (including water, oil, and drain contents) for the product model PPD3-S.
Since the product uses the O-ring seal and/or screw joint, it allows a very slight air leak (1 cm^3/min. ANR). If an excessive pressure beyond the rating is applied or corrosive fluid enters in the fault mode caused by improper operation of this product, this may cause the sensor to break, resulting in a large amount of fluid leak. Such leak of fluid other than air may cause serious incidental or consequent trouble.
Therefore, to ensure the safety, the applicable fluid is limited only to air. Note that troubles caused by use of fluid other than air, and incidental or consequent trouble caused by these troubles are beyond the scope of the guarantee. **If the customer uses fluid other than that specified, the customer shall be held responsible for such use and take appropriate safety checks and measures.**

Discontinued some variations

2
CAUSTION

<References>・**Use of product with non-corrosive or non-flammable gas other than air**

When using non-corrosive or non-flammable gas other than air, the special knowledge and handling skill about such fluid is absolutely required. The safety system must be constructed under supervising or control of the special engineers (authorized engineers) even if the fluid leaks outside the system due to improper operation or trouble. The customer shall take appropriate measures and determine whether or not the system is accepted.

For example, if non-corrosive gas, such as nitrogen gas is used, the air is replaced with nitrogen gas, causing an oxygen shortage trouble. To prevent such trouble, appropriate measures, such as forced ventilation and/or separation of gas box must be taken to ensure the safety of the entire system.

Never use such gas without taking of safety measures.

⚠ WARNING : About use of oxygen, corrosive gas, and flammable fluid and liquid. Never use such fluids.

The oxygen gas itself does not burn. However, this gas may burn metallic materials or non-flammable resin materials excessively, which do not burn in the normal air environment. Accordingly, the rich oxygen air is dangerous depending on its oxygen concentration. Corrosive, flammable, or toxic fluid may cause the sensor to break and the fluid to leak outside the system, resulting in incidental or consequent trouble, such as fire or personal injury.

The following shows the major materials of the passage. Pay special attention so that the fluid and components of the fluid do not corrode these materials.

Materials of PPD3 passage : Aluminum alloy and nitrile rubber. PBT resin and brass are additionally used for the port 6HD/6HT.

Materials of PPD3-S passage : SUS630, aluminum alloy, and fluoro rubber. PBT resin, nitrile rubber, and brass are additionally used for the port 6HD/6HT.

The material of the plug attached to the port 6B/6T is copper. If corrosion due to water may arise, prepare a corrosion resistant plug.

・Do not use the product model PPD3-S only with liquid (water or oil). If the flow rate varies when the valve is turned ON or OFF, this may cause the surge pressure to occur. This surge pressure level may become several ten times larger than the working pressure. Therefore, it becomes very difficult to suppress this pressure to a level less than the proof pressure in its operating range. Thus, use of only liquid is excepted from the applicable fluid.

(It is said that use of orifice may prevent transmission of the surge pressure. However, to check the effect, an expensive measuring instrument is required, and therefore such preventive measures are not used normally. Additionally, it is also difficult to say that use of orifice can eliminate the transmission of the surge pressure completely. Therefore, use of only liquid is excepted from the applicable fluid.)

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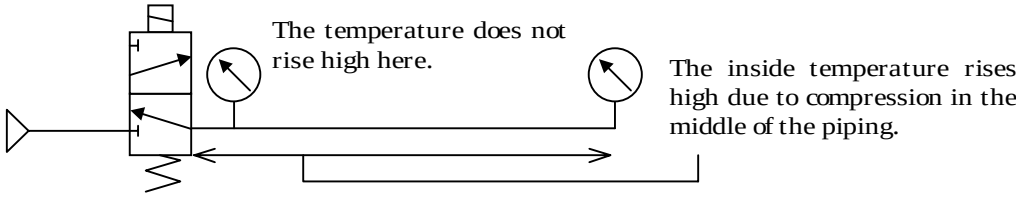
・Also, pay attention to the measured fluid temperature and the atmospheric temperature around the piping. If a pressure gauge is connected to the end of long piping, in which pressurization and depressurization take place repeatedly, the inside temperature of the piping increases, and the pressure gauge 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.



・Do not used the model PPD3 to confirm seating of a wet workpiece. The water content may corrode or break the sensor. Use the product model PPD3-S for such application.

・When using the model PPD3 in a charging machine to confirm the evacuation before charging, protect the product using a filter so that the splash of the injection fluid does not enter this product. If the splash is only water or oil, use of the model PPD3-S may eliminate such troubles. However, if the splash includes resin contents or solid materials, or is hardened after dried, the pressure measurement cannot be made properly and the product needs to be replaced.
Additionally, if the injection liquid retains inside this product or in the connection pipe, this may greatly affect the measurement accuracy in a low-pressure or vacuum area. (Oil with high viscosity may shut off the pressure, causing the measurement not to be made.) Always pay special attention to the product or piping installation place, direction, and running method so that the liquid does not retain.

・When the suction and pressurization are repeated, the sucked atmospheric air is pressurized and compacted to condense the moisture content included in the atmospheric air. This condensed water content may cause the model PPD3 to break. If dew condensation may occur in the piping, it is recommended to use the model PPD3-S.

Discontinued some variations

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・In the main pressure confirmation application, when a lubricator is installed on the secondary side, the oil supplied to the piping may back flow and enter the product if the relief function is activated due to primary pressure drop or lowering of the set pressure. Use of the model PPD3-S may eliminate such troubles. However, do not use the model PPD3 together with the lubricator or protect it from entry of oil using a check valve.

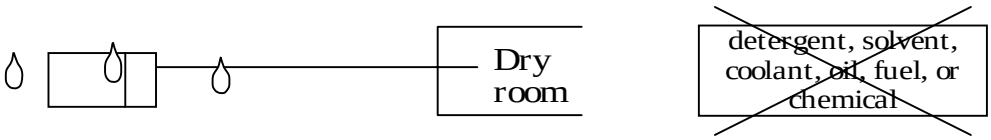
・When using the product for confirmation of the vacuum pickup, the positive pressure for vacuum break or blow out must be controlled using the regulator so that it is less than the rated proof pressure. When the pressure is reduced by the pressure loss of the metering valve, the pressure increases to the main pressure level, causing the sensor to break if the vacuum break pressure is applied to the product with the pickup pad kept pressed. (Since most of vacuum pickup and vacuum break combined units use the metering valve method, it is necessary to suppress the main pressure to a level lower than the proof pressure. For details, contact relevant manufacturers.) The proof pressure of the models PPD3-R03, PPD3-S-R03, and PPD3-S-R01 is 0.6 MPa. These models cover such applications.

・For models PPD3(-S)-****-6T and 6HT, it is possible to flow the fluid into the passage between two ports. However, the accurate pressure measurement cannot be performed depending on the flow rate. For pickup confirmation and seating confirmation, the flow rate may become almost “0” during confirmation. Therefore, there are no problems in such applications.

(4) 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.

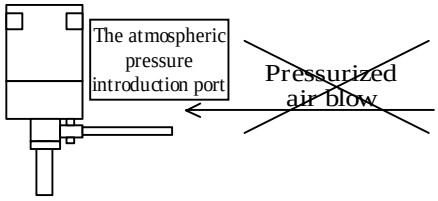
(5) The degree of protection of this product is equivalent to IP65. However, the product does not show its protection performance unless the atmospheric pressure introduction port is processed correctly. In an application that water is splashed onto the product, always connect the dry atmospheric air to the atmospheric pressure introduction port. If water enters the product through the atmospheric pressure introduction port, this may cause the product to malfunction or the accuracy to lower. Always supply sufficiently dry air so that it is not condensed at a temperature of the product installation environment. If fluid other than water, such as detergent, solvent, coolant, oil, fuel, or chemical splashes onto the product, this may cause the case, lead wire, seal part, or glue to deteriorate, resulting in lowering of the protection performance. The high-pressure or impact water, such as that produced from high-pressure water cleaning machine or steam cleaning machine may cause the degree of protection to lower. Do not use the product in a place where such water may splash onto it.

2
CAUSTION



⚠ CAUTION : Do not apply pressurized air to the atmosphere pressure lead-in port. Doing so may cause the product to break or to be damaged, resulting in scattering of case parts.

Always connect the product to a dry environment with the same atmospheric pressure as that in the operating environment.
(If the product is connected to an airtight control box where the dry air is introduced from the external environment or a clean room where the positive pressure is applied, the pressure may differ from the external pressure, causing an error.)
Make the diameter or color of the pipe different from those of the other pressure lines to prevent mixed or incorrect connections.



The atmospheric pressure introduction port of the models PPD3(-S)-******-6B and 6T uses M3 screws. Therefore, use the following parts for these models.
CKD Barb joint, DTS4-M3, FTL4-M3
Tube, FH-3224, U-9532, U-9504
When using the product together with the mounting fixture PPD3-KD, use the barbed fitting FTL-M3.
The atmospheric pressure introduction port of the models PPD3(-S)-******-6HD and 6HT uses CKD's barbed nipple FTS-0. For this port, use CKD's tubes FH-3224, U-9532, and U-9504.

(6) Do not install this product in a place where the corrosive or flammable gas is produced, dust or cutting chip exists, or the pressure is increased or decreased. Additionally, do not install the product in an environment where the splashed water content may be frozen. Doing so may cause the degree of protection to lower or not to be kept, resulting in malfunction.
Do not use this product in a place where the temperature changes rapidly or air with high humidity is produced. The dew condensation may occur inside the product, causing a malfunction. In this case, connection of the dry atmospheric air to the atmospheric pressure introduction port may prevent internal dew condensation and malfunction.

(7) 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).

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(8) Do not install or use the product in a place where it is exposed to vibrations of 98m/s2 or to impact. In addition to the product main body, carefully check vibration, impact, or resonance applied to the lead wires, and wiring and piping parts. When using long piping tubes or wires, secure them to the frame close to this product, and then connect them to the product.

(9) Before setting data A and data B, turn OFF the machine or device for safety. The response of the switch output may be delayed excessively or the switch output is turned OFF forcibly while this product is being operated. Additionally, incorrect switch output is output during operation depending on the switch data settings. Pay special attention so that such output does not cause the machine to malfunction.
Accordingly, when using the switch test mode, stop the machine units so that the output signal does not cause the machine units to malfunction. The switch test mode is used only to check whether or not the output signal is transmitted to the input unit correctly. Do not use the switch test mode to check the program sequence while the machine is being operated.

(10) The value for data beyond normal pressure setting or unrealistically rated value may be set. However, in this case accuracy cannot be guaranteed. Whether it suits the operational purpose or not has to be verified, individually.
(For example, PPD-P10PKN is capable approximately sensing in the negative pressure bound, making use of this feature, it is used to confirm adsorption or blasting)

(11) This product displays the pressure value and performs the switch operation even though the pressure value is beyond the rated pressure range (approximately 10% F.S., this may vary depending on the zero adjustment). In this case, however, the display range and accuracy cannot be guaranteed. Always use the product after checking that the product performs the intended display and operation. Additionally, strictly observe the proof pressure at any time.

(12) The product may fail to display 0 during release of pressure to the air because of aging. The zero adjustment function is intended to display 0 for convenience's sake by subtracting the pressure value at the time of setting a zero adjustment value from the displayed value. For this intended function, do not set a value for zero adjustment under pressure intentionally.
To clear the set zero adjustment value (or to set 0), apply pressure exceeding 20% F.S. and perform zero adjustment.

2
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(13)The display range of values out of the rated range depends on zero adjustment. The switch cannot operate as expected if the set switch data beyond the rated range is out of the display range. When switch data deviating from the rated range is set, actually operate the switch after zero adjustment to confirm whether it displays a value and functions properly.

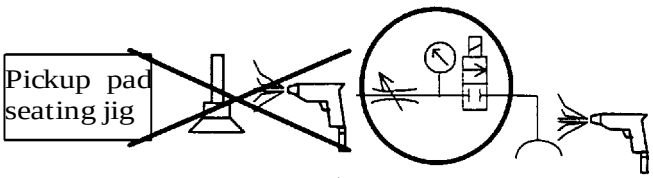
(14)The value displayed is updated four times a second, whereas switch output takes place about 200 times a second. The pressure changes so fast that the display cannot follow it. The switch sometimes starts to operate although the displayed pressure value does not reach the set value. This is because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

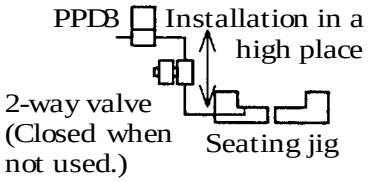
(15)A value displayed on the PPD represents a range of AD converter values. The switch data is compared with the AD converter value but not with the displayed value; the switch will not act until the AD converter value matches the switch value. For this reason, you may find sometimes that the switch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

(16)The set value is determined by taking the accuracy and error due to temperature characteristics into consideration. Even though the pressure is constant, an error may occur due to variation in detection value or change in temperature within the allowable error range. For example, when the model PPD3-R10 is used with positive pressure applied to detect the atmospheric pressure, and the ON set value and OFF set value are set to –20 kPa and 20 kPa, respectively, 10 kPa is displayed and the signal is not output if the zero point deviates due to error and temperature characteristics. As described above, if the product is used to detect the atmospheric pressure, it is possible to keep the accuracy for a short period of time when the zero adjustment is performed in the atmospheric pressure state. The atmospheric pressure state is always checked and the zero adjustment is performed if the zero point deviates.
Additionally, when using the product in the vacuum application, set the set value by taking the atmospheric pressure into consideration. In the vacuum pump, the vacuum degree is increased by the atmospheric pressure at that point. If the product is used in an area at a low pressure where the typhoon is strong or an area at a high altitude, the high vacuum value (for example, -100 kPa) cannot be produced. If this set value is used, the target vacuum degree is not achieved, the vacuum pump may not function. It is necessary to set the set value by taking the error and tolerance into consideration. To steadily detect the high vacuum degree, it is recommended to use the absolute pressure sensor type model PPS2-series.

(17)Do not install this product in an airtight control box or indoor place. If the fluid leaks for some reason, this may cause the internal pressure in the airtight space to change, resulting in a hazard. Always use the product in a control box equipped with safety devices that limits the internal pressure or in an indoor place where the difference between the external and internal pressure levels is small. In such operating environment, this product detects the gauge pressure based on the internal pressure of the airtight place. Carefully observe this instruction.

(18)When using this product for confirmation of pickup and seating, pay special attention to the air blow used for cleaning of the pickup pad or seating jig. The pressure at the top of the nozzle becomes almost equivalent to the main pressure during air blow, causing the low-pressure circuit units to break. Before starting the air blow, lower the blow pressure to a level less than the proof pressure of the unit or shut off the blow pressure using a 2-way valve. As the cleaning work is performed carefully, the nozzle needs to get close to the jig, causing breakage trouble. Additionally, when using the product in a good environment not requiring the protection performance, it can be operated with the atmospheric pressure introduction port open. At this time, however, do not blow the air to the atmospheric pressure introduction port. Doing so may cause the case to break or scatter.
When the product is used for confirmation of seating of the jig in a cutting tool and/or cleaning machine, onto which the coolant or cleaning fluid may splash, the coolant or cleaning fluid may back flow to the product or other units due to stopping of the pressurization or air blow. Appropriate black-flow prevention measures, such as shut-down of the circuit using a 2-way valve or check valve, or installation of the product in a place higher than the jig position.



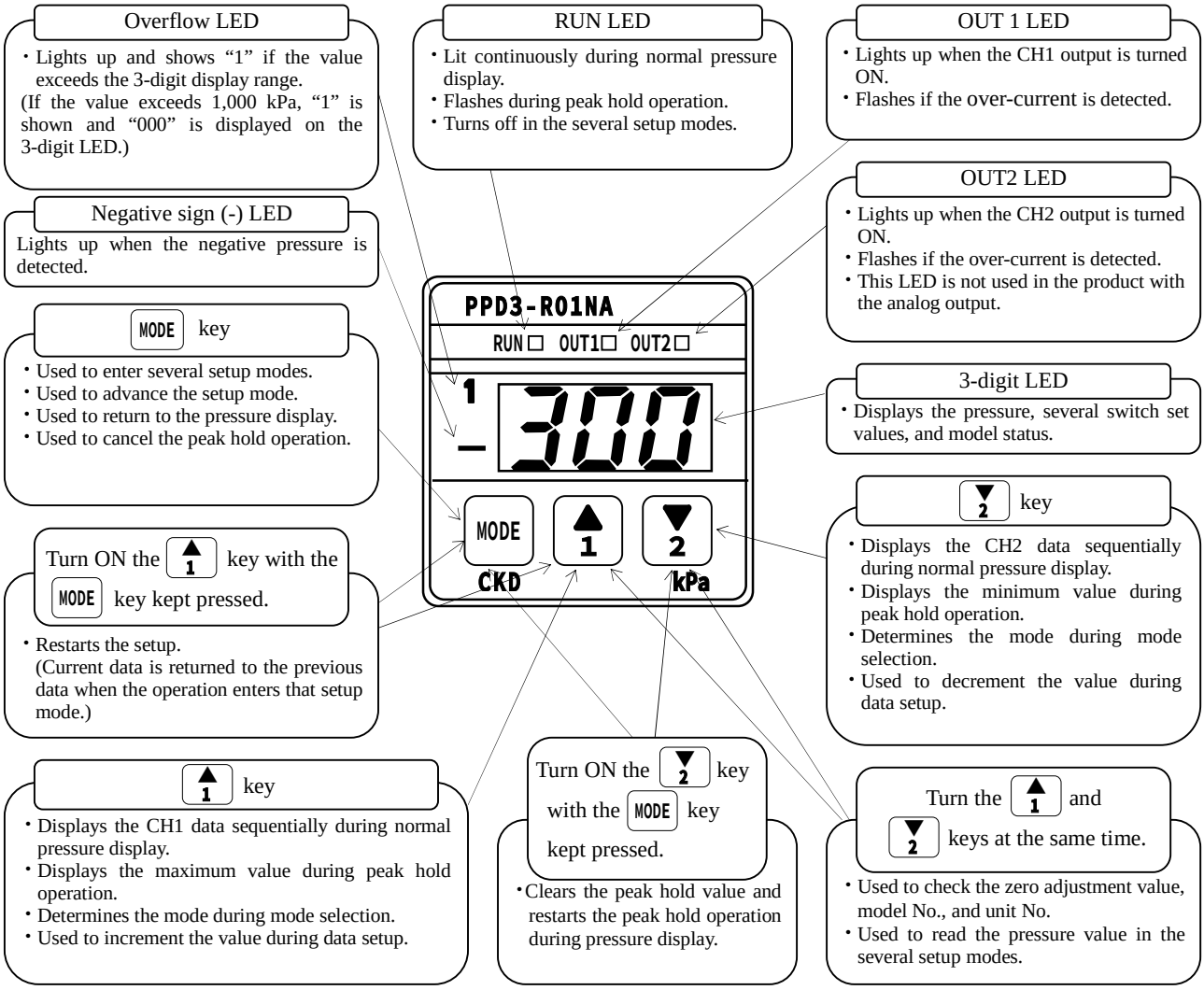


When flushing the piping to remove dust, supply the air, the pressure of which is regulated so that it does not exceed the proof pressure of the product or peripheral device.

In addition to above, see also section 4.4.2, Cautions for wiring (on page 46).

3. OPERATION

3.1 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 J	L L	H H

Unit No.	0	1	2	3	4	5
R10	kPa	Kgf/cm^2	bar	psi		—
R03	kPa	Kgf/cm^2	bar	psi	—	—
R01	kPa	Kgf/cm^2	bar	psi	mmHg	In. Hg

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

Note: As the measurement law was revised, the unit was fixed to “kPa” and the unit switch function was eliminated. After that, products with the unit switch function were no longer shipped. Please accept this notice.

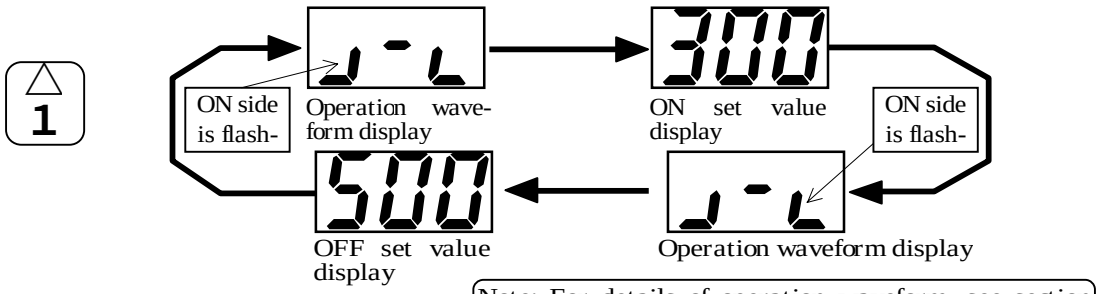
3.2 Operational procedures

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 3.2.9, Operation flowchart (one page 38) and read relevant operational procedures.

3.2.1 Confirming a set value

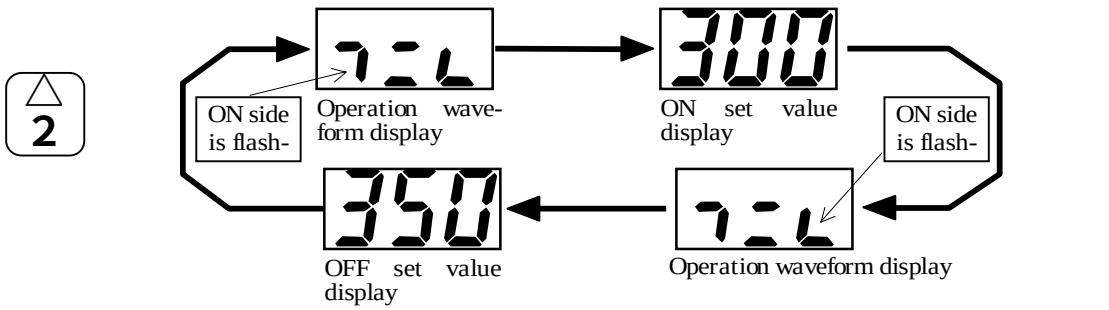
By pressing relevant key in the pressure display state, it is possible to display and confirm the switch data ON set value, OFF set value, operation waveform, zero adjustment value, pressure range, unit setting, and output format. Note that the following operation does not affect the switch operation. 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.

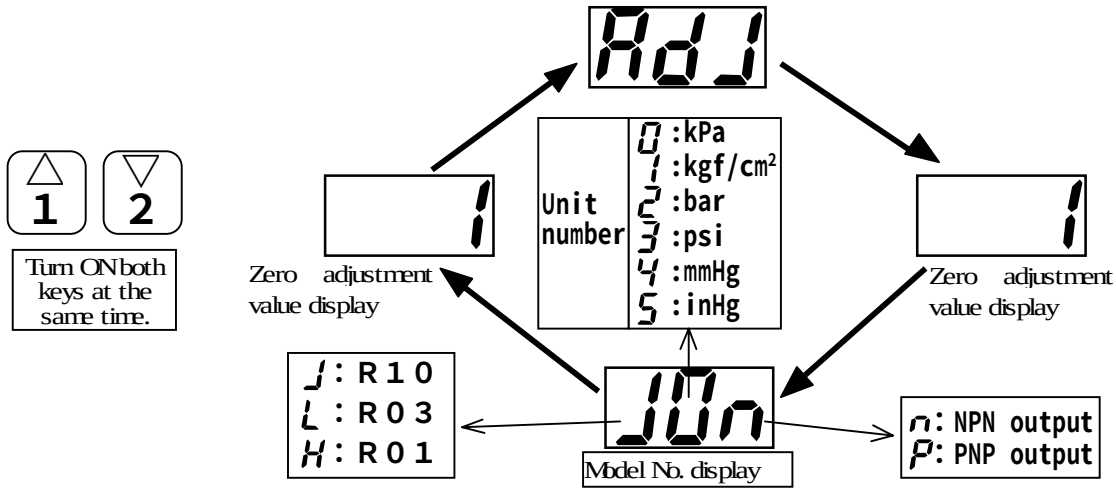


Note: For details of operation waveform, see section 3.2.3, Switch functions.

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.

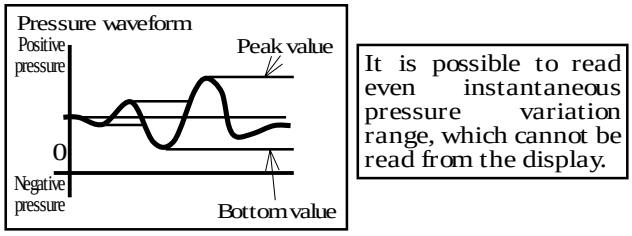


③ Confirming the zero adjustment value and model No.
It is possible to display the zero adjustment value and model No. alternately while keeping the ▲1 and ▼2 keys pressed.

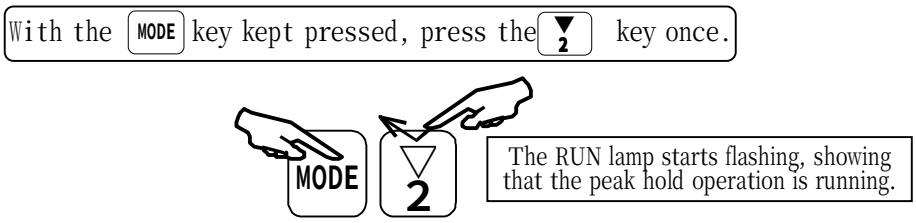


3.2.2 Peak hold operational procedures

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.

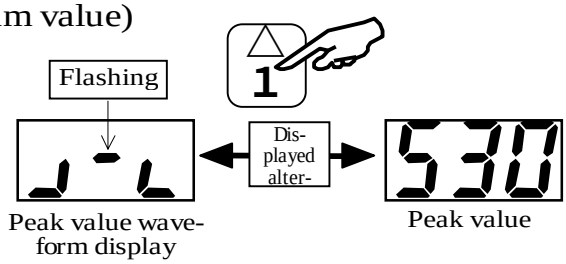


① **Starting the peak hold operation**
With the MODE key kept pressed, press the ▼2 key once. The RUN lamp starts flashing, showing that the peak hold operation is running.



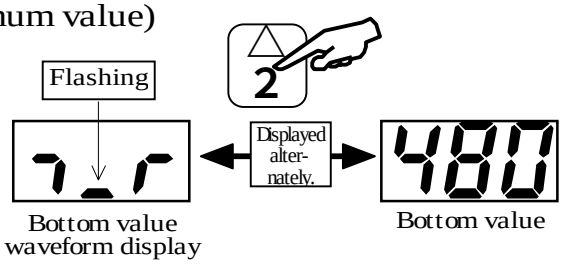
② **Displaying the peak value** (maximum value)

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)

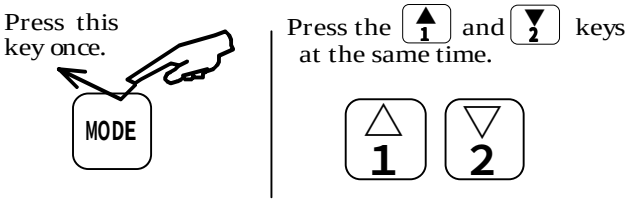
The past bottom value and waveform showing the bottom value are displayed alternately while keeping the ▼2 key pressed.



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.



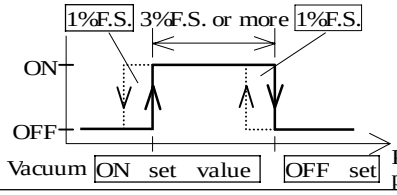
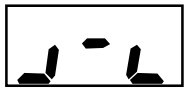
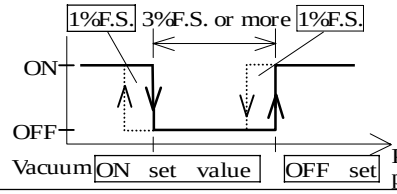
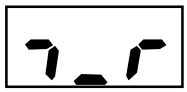
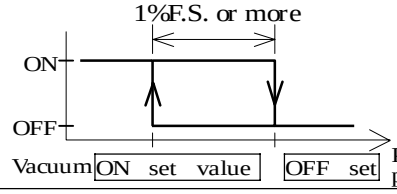
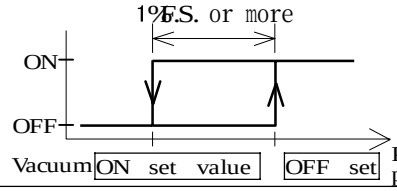
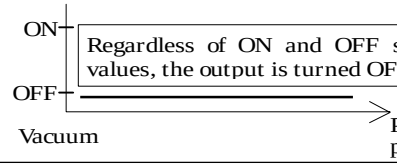
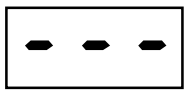
Notes 1: The peak hold operation records the instantaneous maximum and minimum pressure values, different from the normal pressure display that shows the average value. Therefore, the peak value operation may show the value extremely different from the display value.
2: When the MODE key is pressed,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

3.2.3 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.

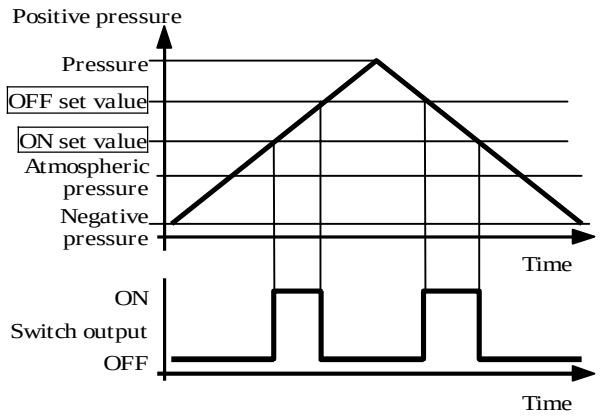
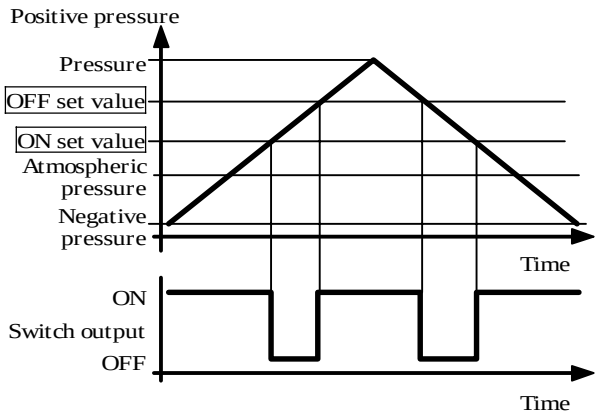
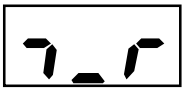
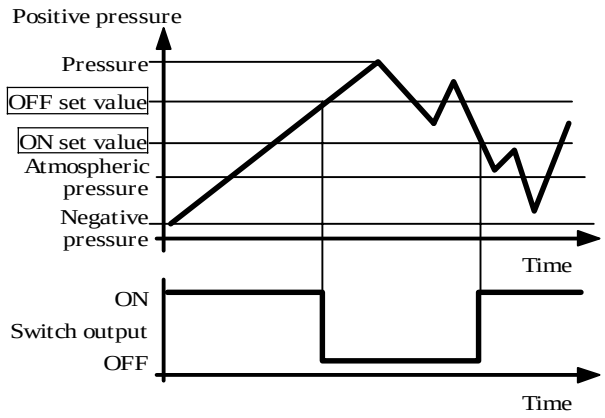
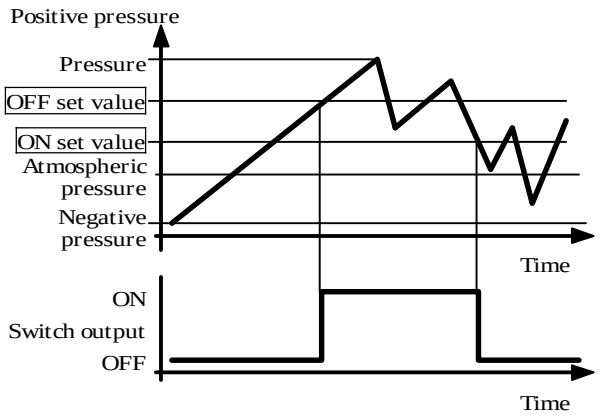
3. In the window operation, the ON and OFF set values mean pressure values, at which the switch output is turned ON and OFF when the pressure is changed from the negative pressure side to the positive pressure side.
In the hysteresis operation, they mean pressure values, at which the switch output is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

3.2.4 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
(For some products with analog output, CH2 settings are ignored automatically. Even though the CH2 setup is made in such models, this does not affect operation.)

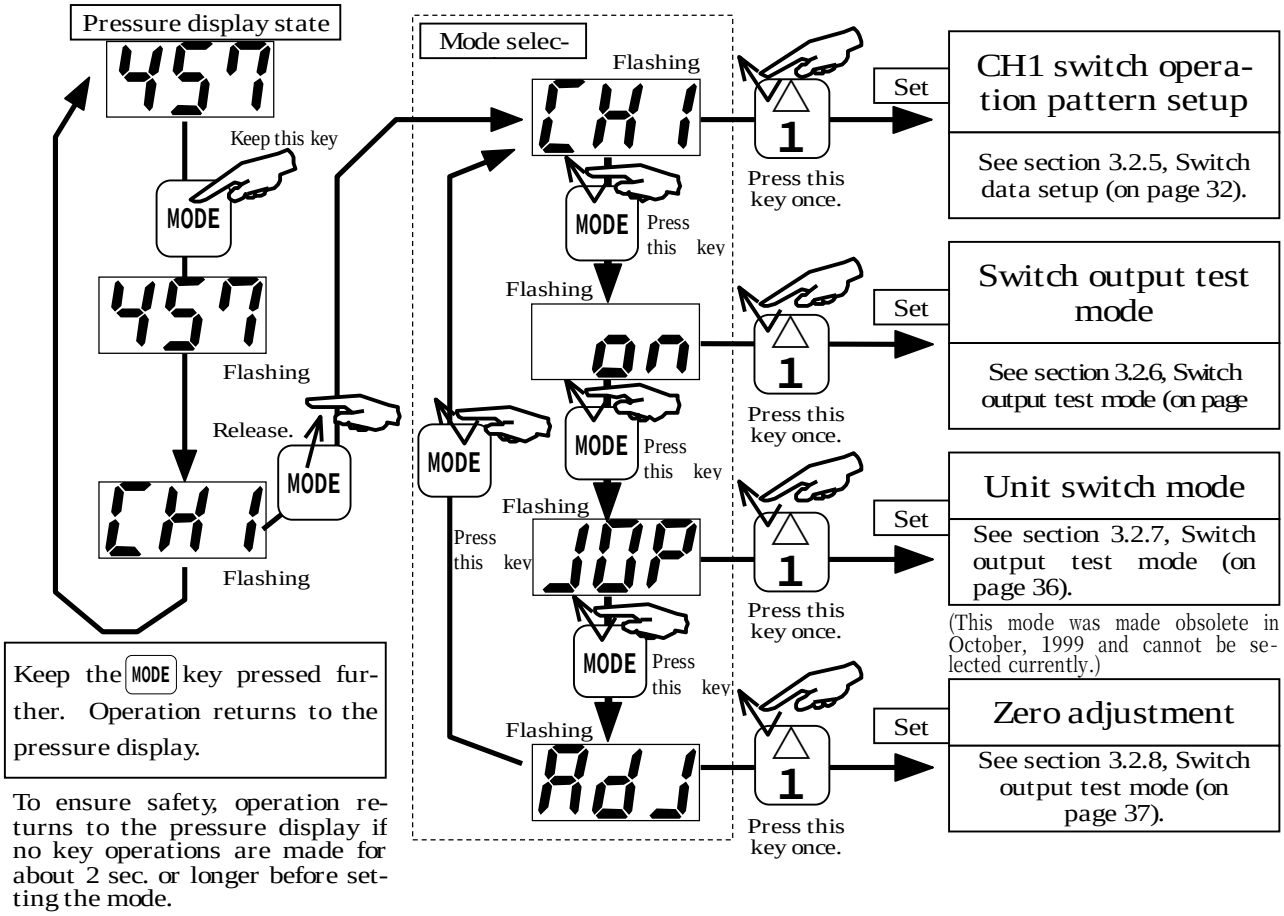
(2) Switch output test mode
The switch output is tuned ON forcibly, and wiring connection and initial operation of the input unit are checked.

(3) Unit switch mode **(This mode was made obsolete in November, 1999 and cannot be selected currently.)**
A desired unit is selected from four or six kinds of units.

(4) 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.



3.2.5 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.

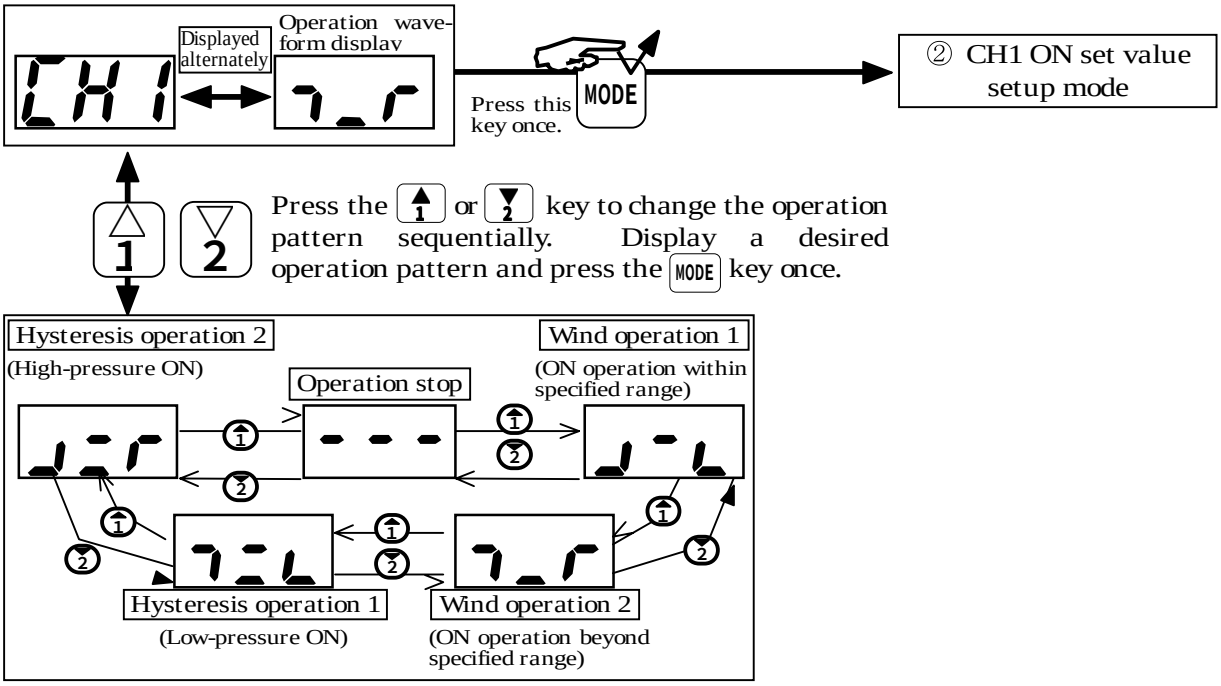
① CH1 switch operation pattern setup mode

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 3.2.3, Switch functions (one page 27).)

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.

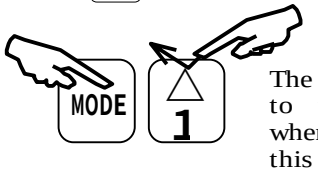


Convenient operational procedures

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

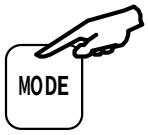
Press the ▲1 key once with the MODE key kept pressed.



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.



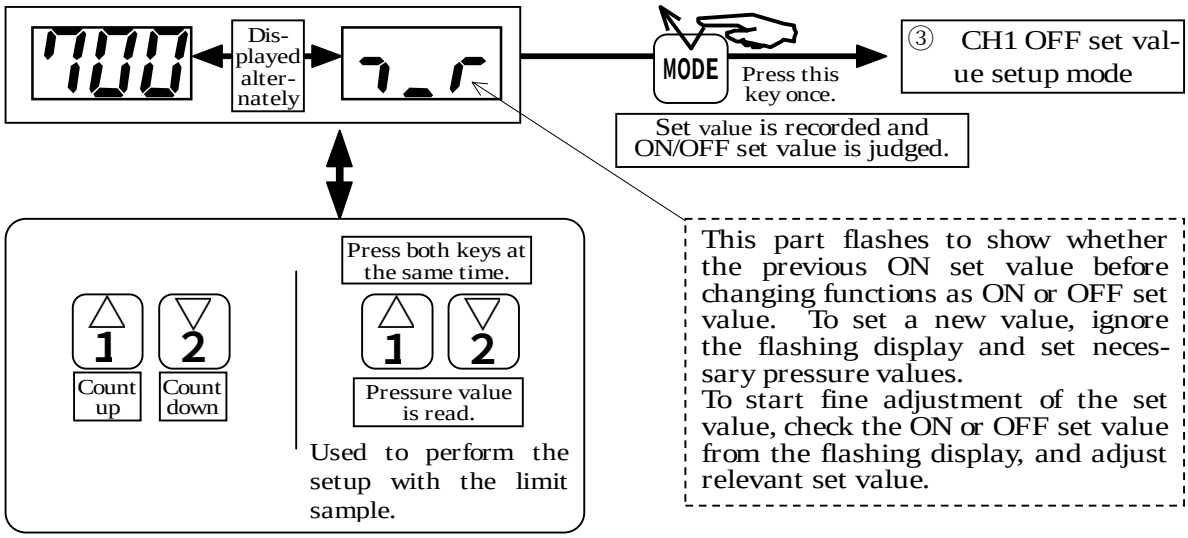
The setup operation is stopped and operation returns to the normal pressure display without recording of changed data.

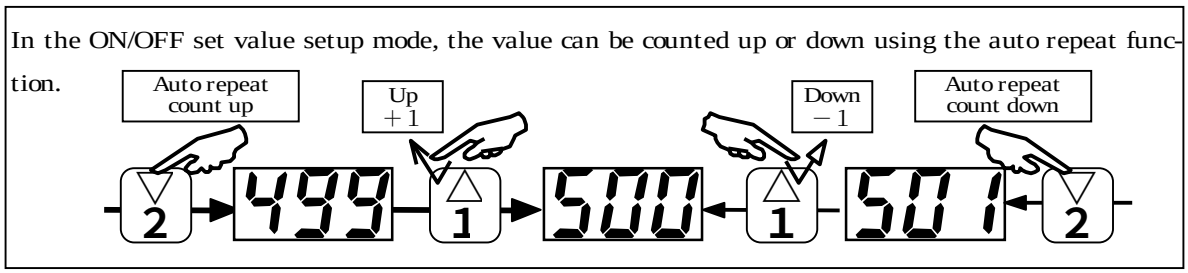
② CH1 ON set value setup mode

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.)

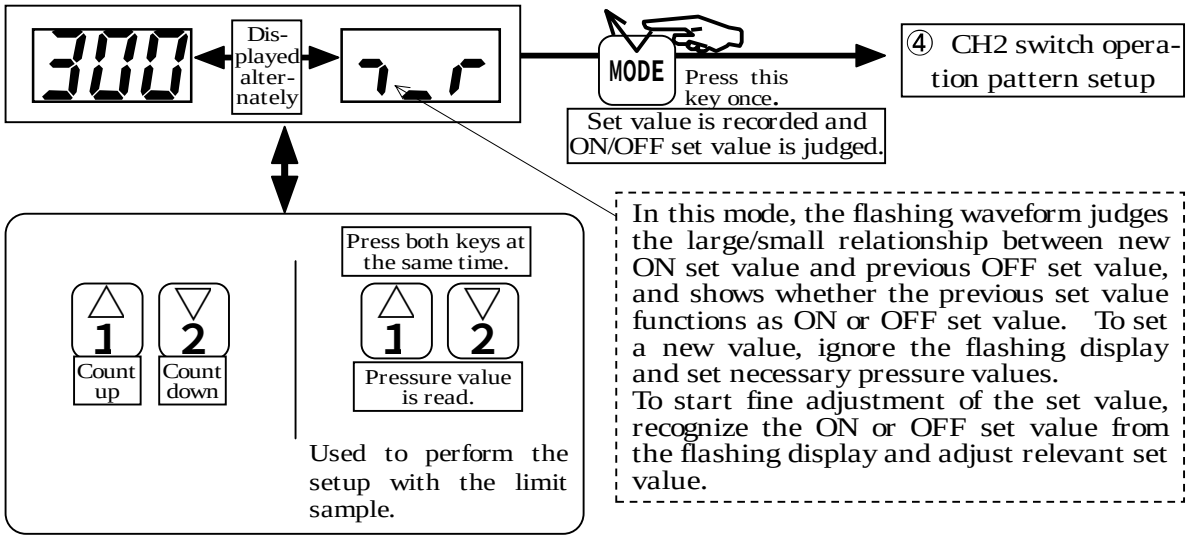
When operation enters this mode, the current set value and current waveform are displayed alternately, and the waveform flashes to show that the current value functions with the waveform display ON or OFF. (For details about how to read the waveform display, see section 3.2.3, Switch functions (one page 27).)

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.

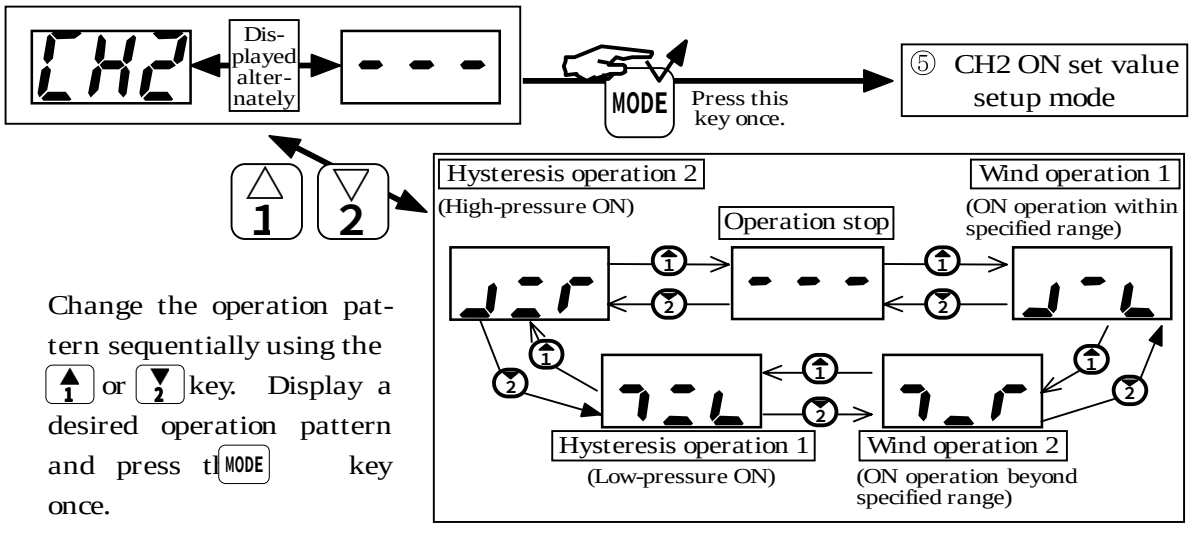




③ CH1 OFF set value setup mode
Next, set the second set value in the same manner.

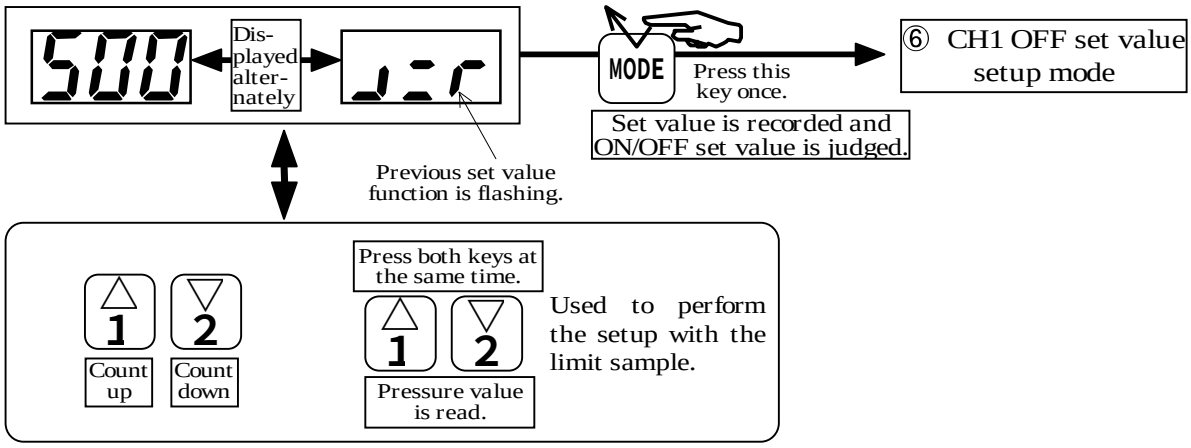


④ CH2 switch operation pattern setup mode
A waveform for the output signal from OUT2 is selected.
Select a desired operation pattern in the same manner as described in the section, CH1 switch operation pattern setup mode. (For products with the analog output, this mode may be skipped automatically and operation returns to the pressure display.)



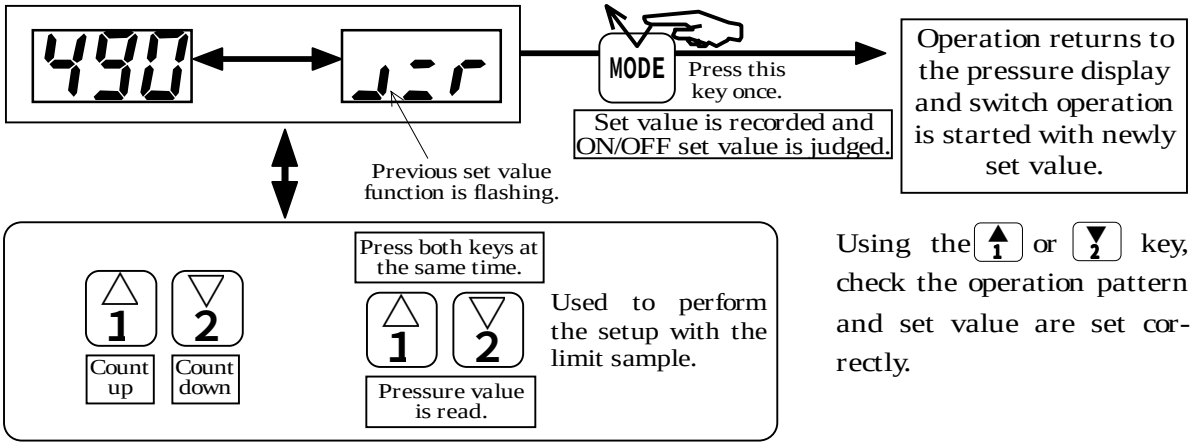
⑤ CH2 ON set value setup mode

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 ON set value setup mode

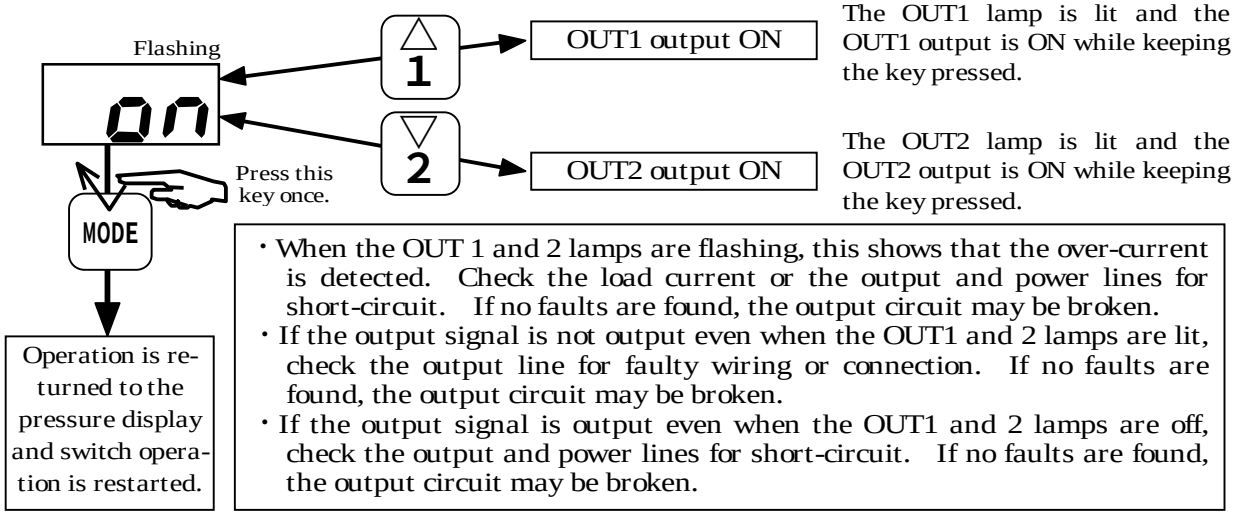
Next, set the second set value in the same manner.



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

3.2.6 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.

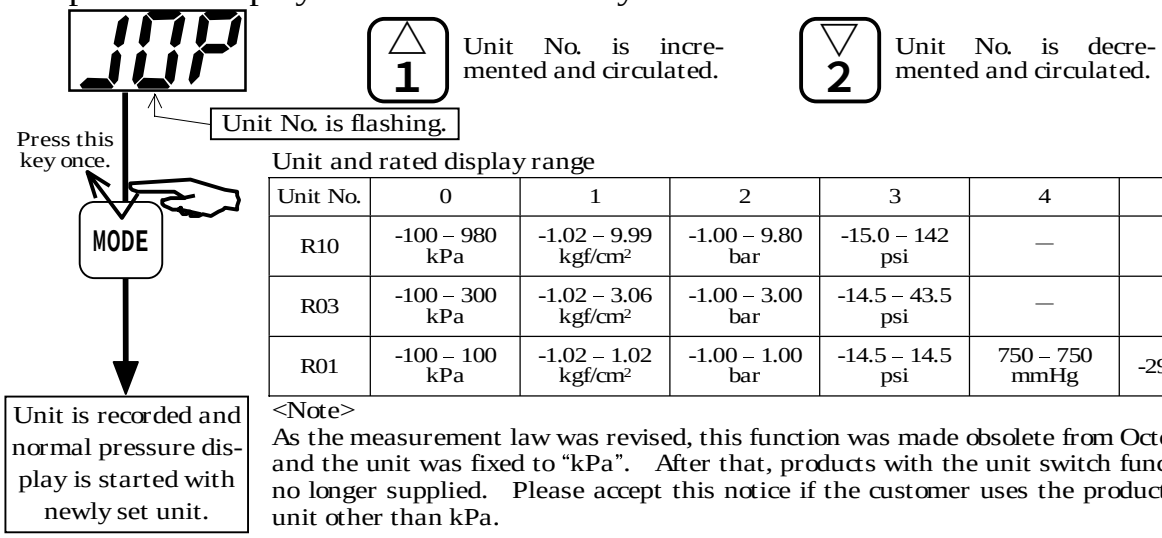


Note 1 This test function is used to check the wiring connections and operation of the input unit. Do not use this function as actual signals to run the sequence program while the machine is being operated.

3.2.7 Switching the unit

(This mode was made obsolete in November, 1999 and cannot be selected currently.)

If the ▲1 or ▼2 key is pressed once when "10n" is displayed in the mode setup, operation enters the unit setup mode. The unit No. flashes in this mode.
When the ▲1 key is pressed, the unit No. is incremented. When the ▼2 key is pressed, the unit No. is decremented.
When the MODE key is pressed once, the selected unit is recorded and the normal pressure display is started with newly set unit.



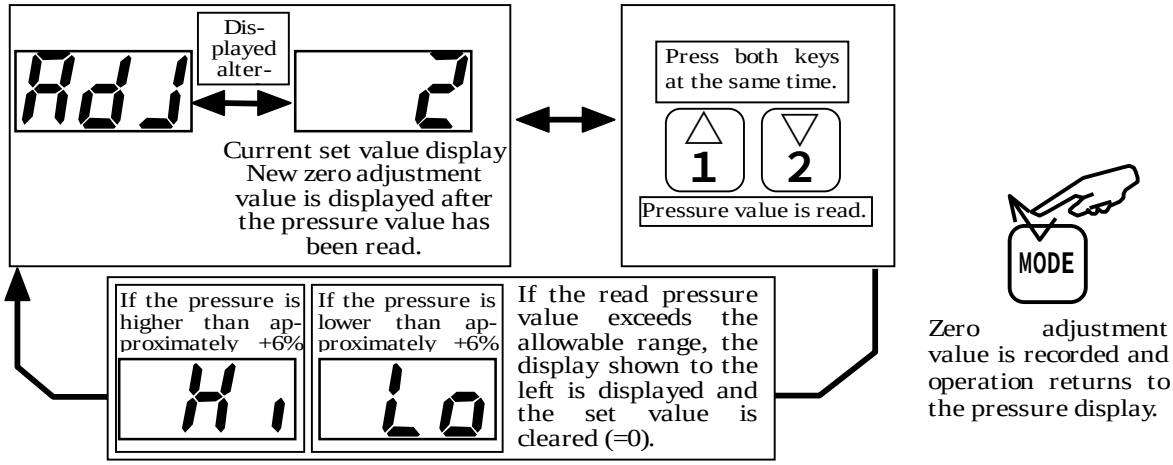
Unit and rated display range

Unit No.	0	1	2	3	4	5
R10	-100 – 980 kPa	-1.02 – 9.99 kgf/cm²	-1.00 – 9.80 bar	-15.0 – 142 psi	—	—
R03	-100 – 300 kPa	-1.02 – 3.06 kgf/cm²	-1.00 – 3.00 bar	-14.5 – 43.5 psi	—	—
R01	-100 – 100 kPa	-1.02 – 1.02 kgf/cm²	-1.00 – 1.00 bar	-14.5 – 14.5 psi	750 – 750 mmHg	-29.5 – 29.5

<Note>
As the measurement law was revised, this function was made obsolete from October, 1999 and the unit was fixed to "kPa". After that, products with the unit switch function were no longer supplied. Please accept this notice if the customer uses the product with the unit other than kPa.

3.2.8 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.

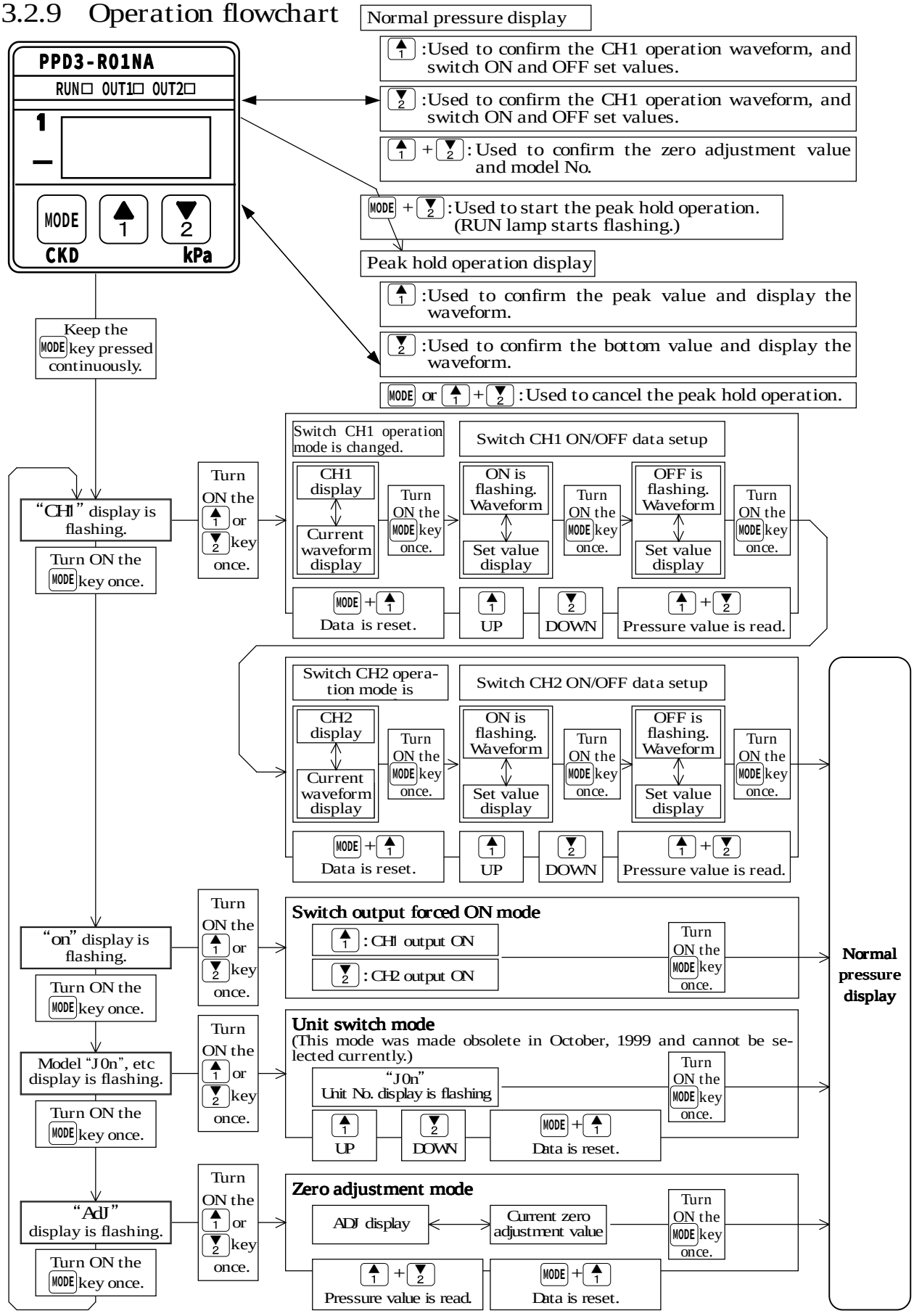
2. Perform the zero adjustment with the pressure released to the atmospheric pressure level. Do not perform the zero adjustment with the pressure applied. Such operation is beyond the scope of guarantee and the reliability of the display value lowers. Even if the pressure is controlled to "0" using the 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.)

3.2.9 Operation flowchart

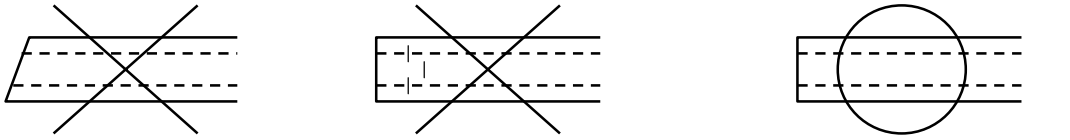


4. INSTALLATION

4.1 Using joints for 6HD and 6HT

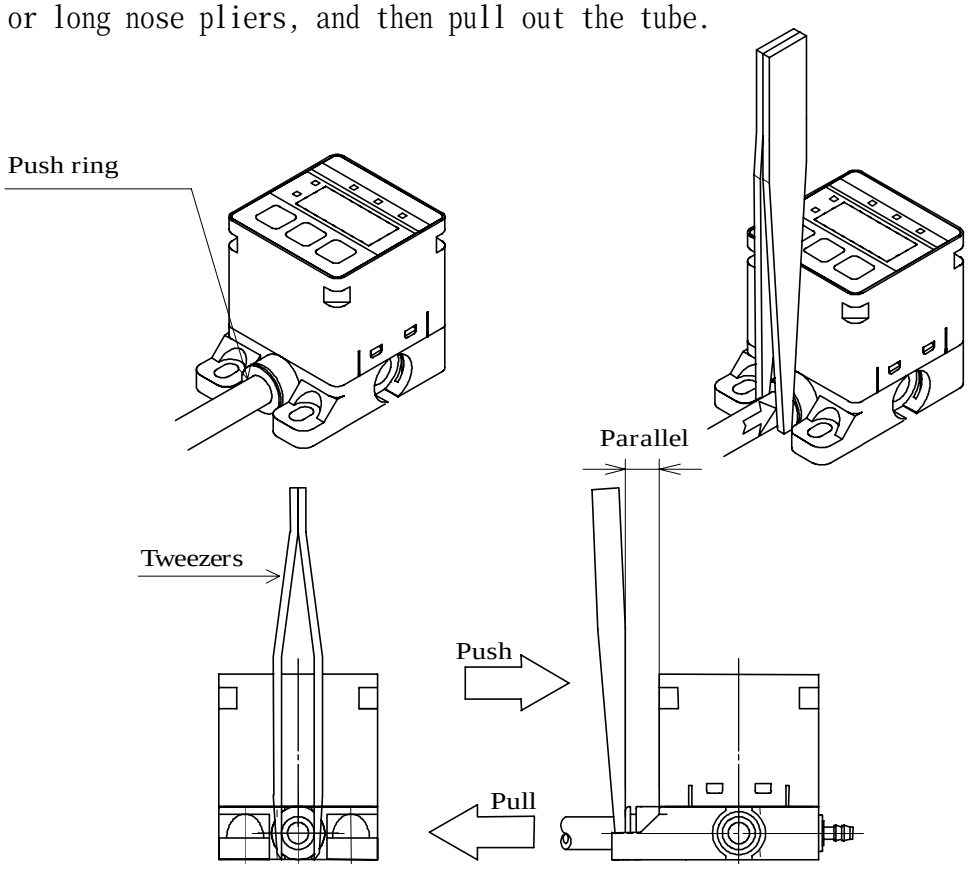
① For ports 6HD and 6HT, use CKD's soft nylon tube (F-1506).

② Before inserting the tube, cut out the tube straight using a sharp tube cutter. After checking that there are no dust, damages, and deformations at the top of the tube, insert the tube firmly. The claw inside the joint is then engaged with the tube to hold it. If the tube is connected and disconnected repeatedly, damage on the tube is expanded, causing leak or disconnection trouble. Every time the tube is connected, cut the tube to make new edge without damage, and then connect it to the joint.
After the tube has been connected, do not pull it strongly. The claw inside the joint is engaged with the tube excessively not to disconnect the tube against the tensile force. As a result, it may become difficult to disconnect the tube or the joint may break.



Cut the tube slantwise. Damage, contamination, and/or deformation Cut the tube straight.

③ To disconnect the tube, push the push ring parallel to the joint using tweezers or long nose pliers, and then pull out the tube.

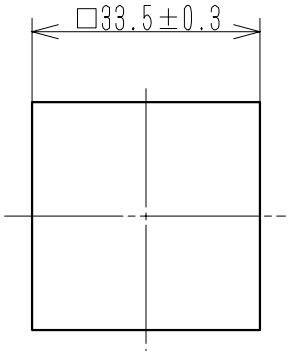


4.2 Mounting the PPD3-KHS (panel mounting)

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

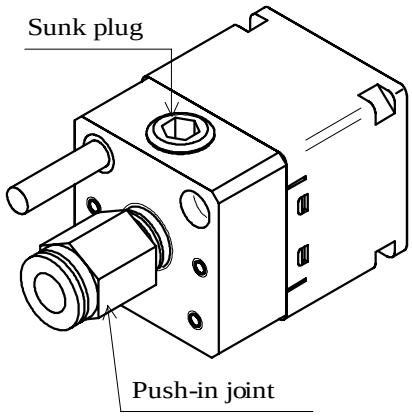
4.2.1 Mounting the PPD3-KHS (panel mounting)

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

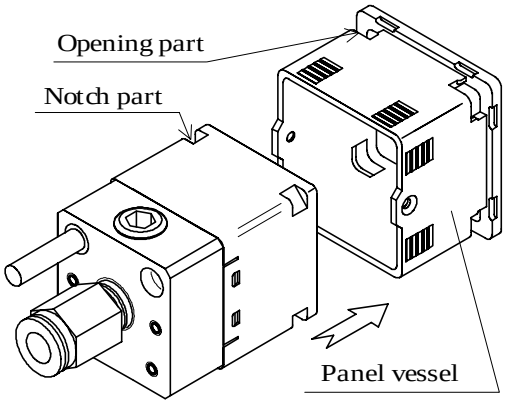


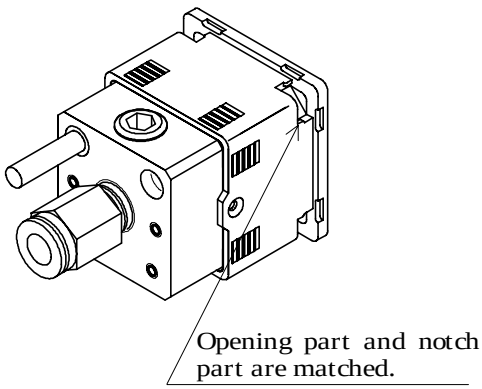
The following shows the mounting pitches when the panel holders are aligned in the same direction.
・Mounting pitch in the longitudinal direction: 53 or more
・Mounting pitch in the lateral direction: 40 or more
The mounting direction of the panel holder can be changed by 90°. Determine an appropriate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

② Attach the push-in joint (GWS6-6 or GZS6-6) supplied with the product to the bottom of the PPD3. Additionally, attach the sunk plug supplied with the PPD3 main body to the side surface. (If the protection performance is required, connect the atmospheric pressure introduction port. However, note that the part between the front of the panel and the inside of the panel is not water-proof.)

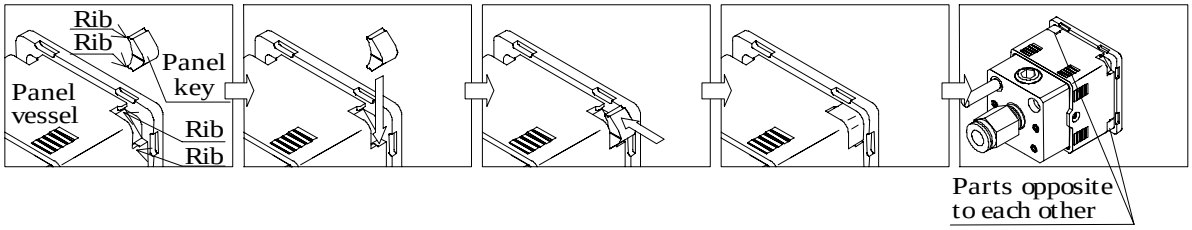


③ Insert the PPD3 main body into the panel vessel so that both front parts are aligned. At this time, the opening part at the side edge is matched with the notch on the PPD3 main body.





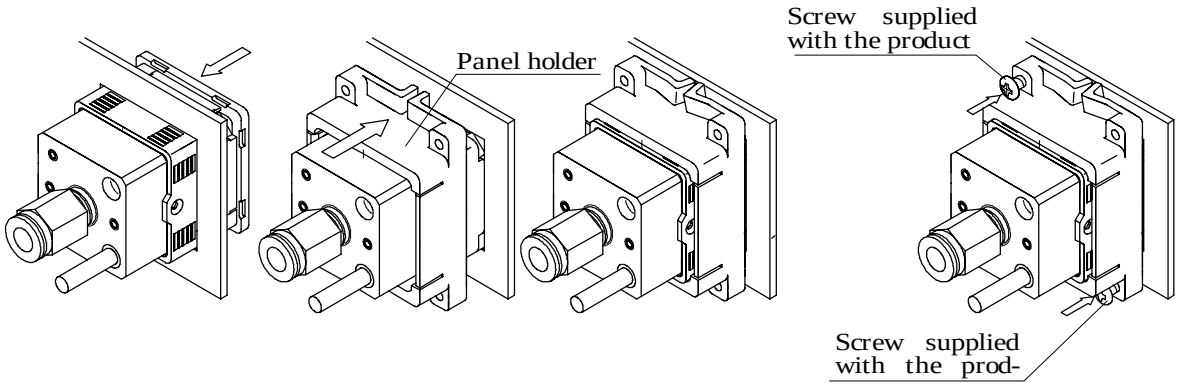
④ Attach the panel key to the notch part at the side edge. Four panel keys are supplied with the product. To keep the sufficient strength, it is necessary to attach the panel key to at least two positions opposite to each other. Other two keys are used as spare parts or attached to the remaining notch 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.



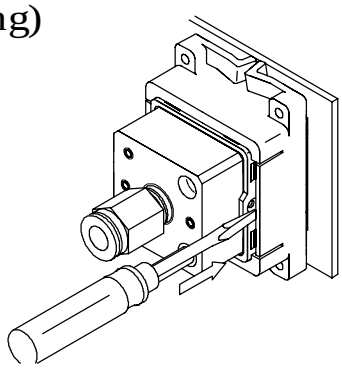
Four panel keys are put as they are connected to the runner. Cut the panel keys using diagonal cutters, and then attach them. Additionally, the runner is used as a handle and attach the panel key to the opening part. After that, cut the panel key or turn the runner part to twist and cut the panel key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

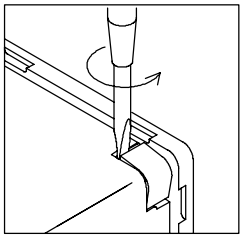
⑥ If the panel holder has a large play, screw-in the P-tight screws supplied with the product at the positions opposite to each other to push the rear of the panel by their ends.
(At this time, note that the rear surface of the panel is damaged.)



4.2.2 Removing the PPD3-KHS (panel mounting)



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.

4.2.3 Cautions for installation of the PPD3-KHS (panel mounting)

① For this mounting, use the PPD3 main body model with port type 6B (PPD3-□-6B, PPD3-S-□-6B).
If other port type is used, mounting may become very difficult or impossible, or abnormal mounting pitch is needed.

② For pipe connections, use push-in joints and resin tubes supplied with the product. If a metallic pipe is used, excessive stress is produced when the vibration or impact is applied, causing the mounting part, switch main body, or panel structure to be deformed or damaged.

Accordingly, do not apply any tensile force, vibration, and/or impact to the tube after mounted. Do not connect a long tube, which may be suspended. Doing so may cause unexpected stress by vibration or impact. When using a long tube, secure it to the frame around the switch and connect it to the product after it is connected using the relay connection joint.

③ Connections of the push-in joints and sunk plugs to the switch main body, and connections of the joint for the atmospheric pressure introduction port if the protection performance is required must be performed on sole PPD3 unit before mounting it on the panel. The pipe connection work with the product mounted on the panel may produce a stress, causing the mounting parts, switch main body, panel plate, and mounting structure to be deformed or broken.

④ The tube connection and wiring work to the switch main body must be carried out after the panel mounting has been completed. If the product is mounted on the panel after the tube and wiring connections have been made, this may cause the workability to lower.

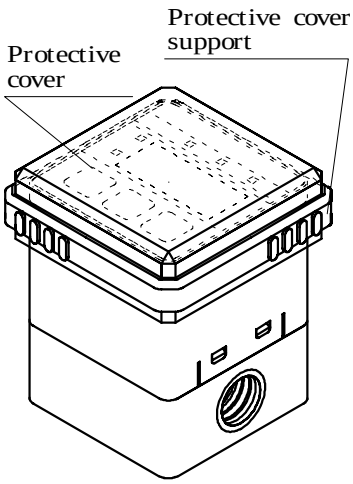
⑤ In this panel mounting, the seal structure between the front and rear of the panel cannot be kept. This mounting method cannot be used if the panel requires the protection structure.
(The PPD3 main body has the protection performance IP65.)

4.3 Using the PPD3-KC protective cover

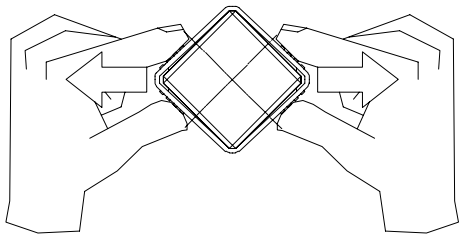
(This product is to be purchased separately by specifying the model.)

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

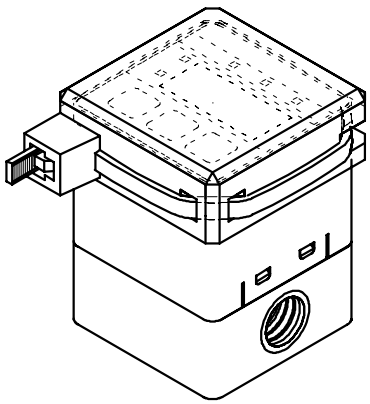


Pick and pull the projections on the both sides of the protective cover (approximately 2 mm) to mount or remove the cover.



<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.



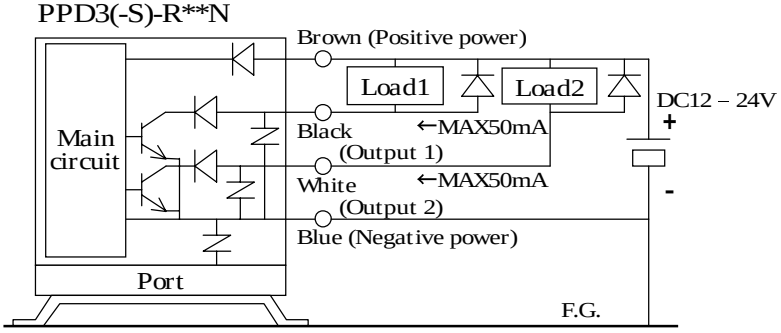
Use of binding bands makes it possible to perform the simple sealing.

4.4 Wiring

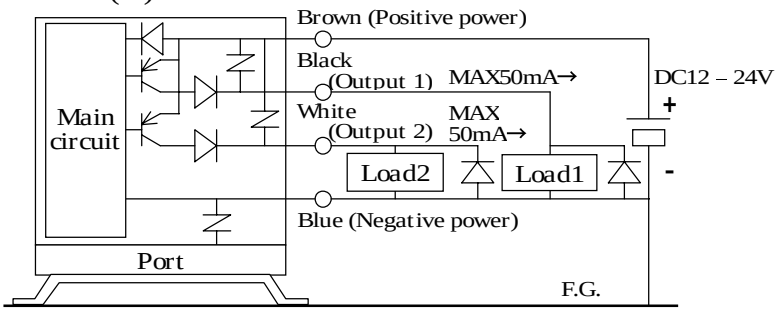
4.4.1 Circuit and connections

<Circuit connection examples>

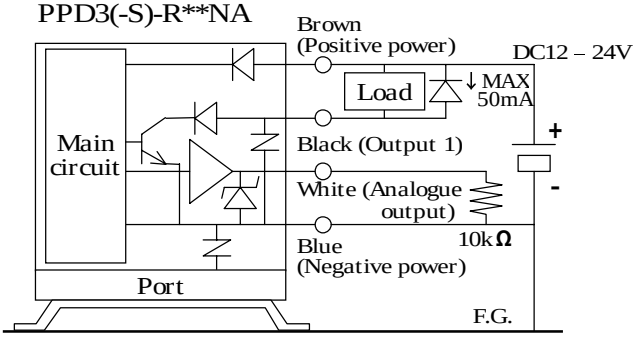
PPD3(-S)-R**N



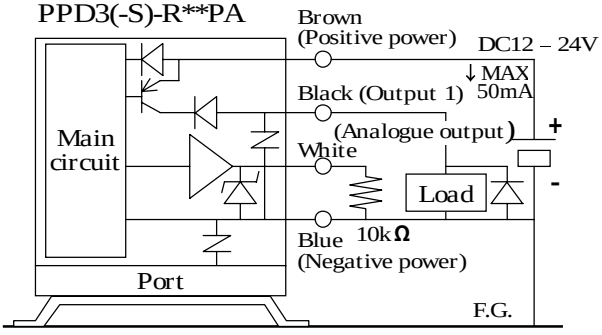
PPD3(-S)-R**P



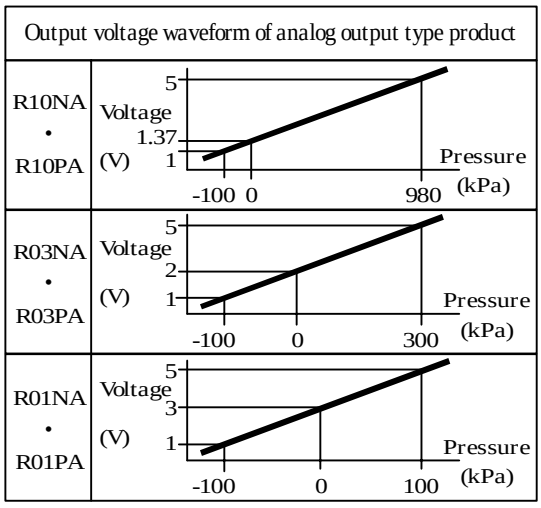
PPD3(-S)-R**NA



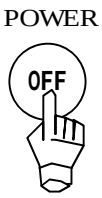
PPD3(-S)-R**PA



Output voltage waveform of analog output type product

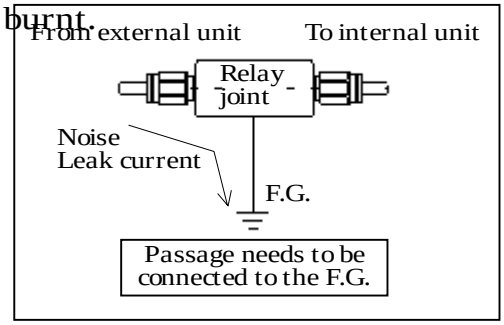


4.4.2 Cautions for wiring



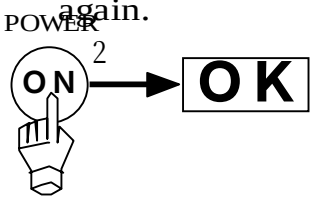
① Before starting the wiring work, shut-down the power completely. Additionally, discharge the static electricity from your body, tool, and unit. Do not apply an excessive force, repetition deformation, or tensile force to the lead wire of the product. For moving parts, use wire materials with elasticity, such as those for robots.

② In this product, to prevent the insulation of the sensor from being broken by the static electricity, the port and the negative power line are connected with the varistor. Therefore, when several ten voltage is applied to the product, it is turned ON. (The product is not turned ON at a rated voltage of 24V.) In the machine using this product, the negative or positive line of the DC power to be supplied to this product is connected to the FG line, such as machine frame, and this product is also installed on the frame having the same electrical potential (electrically connected).
Therefore, the insulation resistance test and dielectric strength test shall not be made on this product. Additionally, the electrical welding is not made on the machine frame after the product has been installed. If the electrical welding is performed, the welding current flows though the FG line, causing this product and/or power supply unit to be burnt.



Particularly, if the PPD3-S is used to detect the pressure of the fluid coming from the external unit and the conductive material, such as water content in the fluid may enter the PPD3-S, it is necessary that the electrical potential of the fluid is grounded by the relay joint connected to the frame (FG) before connecting the product.
If a large electrical potential may be produced between the DC power supply unit and fluid when the power supply unit is not connected to the F.G., a current flows though the conductive material in the fluid. This may cause the fluid to be decomposed electrically, corrosive electrolytic material to be produced, corrosion of the sensor to be developed significantly by the electrical reaction, resulting in breakage in a short time. Additionally, this may also cause an electrical shock hazard.

③ 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.



This product does not detect the pressure immediately after the power is turned ON. The control circuit is so designed that the signal is ignored for approximately 2 sec. after the power is turned ON.

Note) A DC power supply unit, in which the AC power is lowered by the auto transformer, and rectified and smoothed, is not insulated from the AC primary side. If such power supply unit is used, this may cause the product or power supply unit to break, resulting in an electrical shock hazard. Never use such power supply unit.

④ A reverse connection protective circuit and an over-current protective circuit are built into the switch output of this product. These circuits are effective only for specific faulty connections and short-circuited loads, and cannot protect the product from all kinds of faulty connections. Additionally, the circuits cannot protect the product from over-voltage and connection to the AC power supply unit. The circuits cannot also protect the analog output. Faulty connections may cause a fatal trouble in this product, as well as peripheral units. Always carefully perform the wiring and connection work.

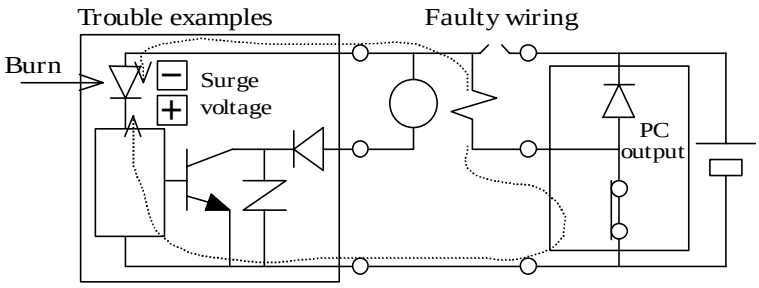
⑤ If the over-current protection of the switch output of this product detects an over-current, it turns OFF the output once. After that, the over-current protection turns ON the output repeatedly at short intervals to check whether or not the over-current status is reset. This may cause the power voltage to fluctuate and may affect the peripheral units. If the capacity of the power supply unit is insufficient, the voltage may drop before detecting the over-current, causing the power voltage to oscillate and the voltage of the over-current detection function to drop, resulting in malfunction or damage to the PPD3 output element.
In such case, check the circuit while carefully checking the short-circuit of the load.
For units producing the rush current, such as timer relay, the rush current is detected as over-current and the power supply is stopped. As a result, the unit cannot be driven. Always select units while carefully checking the normal drive cur-

rent and transient current capacity.

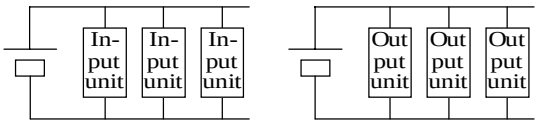
⑥ Do not operate the control and machine units immediately after the wiring to this product has been completed.
Unintended unit or incorrect set value may cause unexpected signal to output. First, perform the energized test with the control and machine units stopped to set desired switch data and unit. If possible, have the product detect the actual pressure and check that the product functions correctly and that the signal is transmitted to the control unit correctly before starting operation of the machine. Even though the product is only used for display, check the unit setup (if the unit switch function is valid).

⑦ Do not connect any induction load, such as solenoid valve, relay, and solenoid to the same DC power supply to be connected to this product.
As a rule, use a separate DC power supply unit for the drive system and sensor system. If the power is turned OFF or faulty wiring occurs, a surge voltage may cause the product to break.
If it cannot be avoided to use such power supply, surge prevention measures with diodes are taken on induction loads even in circuits other than this product.
Most of DC output unit of the personal computer include diodes. However, this does not function depending on the faulty wiring location. If possible, connect individual diodes directly to a part close to the induction load.
When taking the surge prevention measures with CR circuits and varistors, a reverse voltage equivalent to the limit voltage (several ten V) may be applied to the power line, causing the product or other units to break.

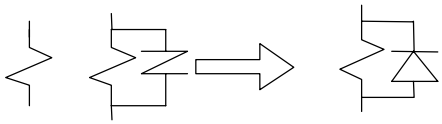
CAUTION



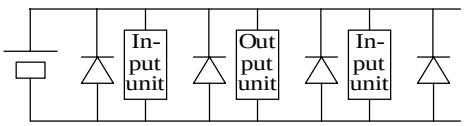
<Remedy 1> Separate the input system from the output system.



<Remedy 2> Attach diodes to all inductance loads directly.



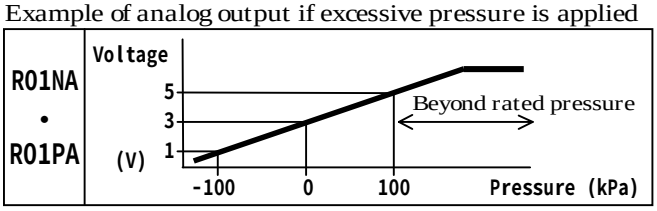
<Remedy 3> Install reverse voltage absorbing diodes at appropriate positions among power lines.



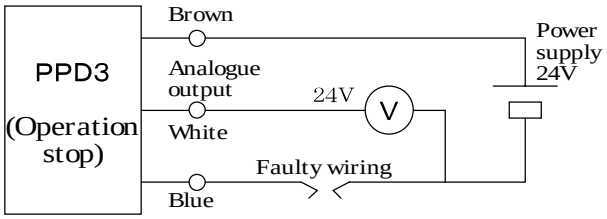
⑧ The analog output outputs 1 – 5V corresponding to the rated pressure range. However, a voltage exceeding this level may occur (be produced) in the following two cases.
Therefore, it is necessary to check that the circuit of the connected unit withstands this over-voltage. If necessary, take protective measures against the over-voltage to design an input circuit, which is not broken.

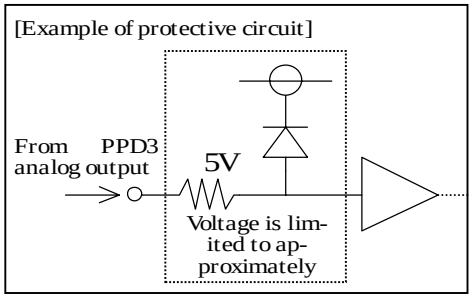
<Voltage beyond rated voltage occurrence case 1>
If a pressure exceeding the rating is applied, an analog voltage exceeding 5V (Max. 6 – 8V) is output.
(The pressure to be applied must not exceed the proof pressure.)

Example of analog output if excessive pressure is applied



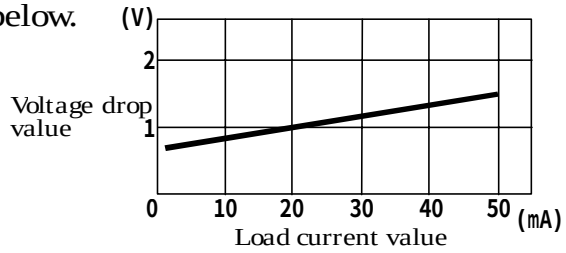
<Voltage beyond rated voltage occurrence case 2>
If the negative power line (blue line) of the PPD3 wiring is not connected or faulty, the positive power voltage occurs in the analog output (24V is output when using 24V power supply unit).
Particularly, if the connector is connected and disconnected with the power supplied when there are several connector connection parts in the wiring, this may produce the same state instantaneously.





Note : Normally, the analog input system is constructed by power voltage of up to 15V. If an analog power voltage of 24V is applied to an electronics part, such as operational amplifier IC, a trouble called "latch up" may occur in the worst case, causing a large current to flow, resulting in burning of IC and power supply circuit.
To prevent latch up troubles, it is necessary to install a protective circuit that limits the voltage in a safe range.

⑨ 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.



Note: As a protective circuit is added, the voltage drop may become approximately 1V higher than that of the conventional model. However, this may not affect the PLC input.
For safe operation, always check the specifications for the input unit.

5. MAINTENANCE

5.1 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.

6. HOWTO ORDER

PPD3－R03 NA－6HT
a _ b c _ d

a	
Mark	Sensor type
PPD3	Diffused type semi-conductor pressure sensor
PPD3-S	Stainless diaphragm sensor

b	
Mark	Pressure range
R10	For achievement pressure, -100 – 980kPa 用
R03	For achievement pressure, -100 – 300kPa 用
R01	For achievement pressure, -100 – 100 kPa

c	
Mark	Output formality
N	NPN transistor output, 2 points
P	PNP transistor output, 2 points
NA	NPN transistor output, 1 point and analog output, 1 point
PA	PNP transistor output, 1 point and analog output, 1 point

d	
Mark	Port type
6B	Rc1/8, 2-way port　Rear downward take-out
6T	Rc1/8, through-port　Horizontal both side take-out
6HD	With 6 mm push-in joint Lightweight port (downward)
6HT	With two 6 mm push-in joints Lightweight through-port (both horizontal sides)

Metal brackets and kits

Model	Contents
PPD3-KL	One-side mounting foot (L-shape mounting)
PPD3-KD	Both-side mounting foot (parallel mounting)
PPD3-KHS	Set of panel mounting metal brackets, cover is provided.
PPD3-KC	Operation protective cover