

I N S T R U C T I O N M A N U A L

F O R

P R E S S U R E T R A N S M I T T E R



M O D E L : P K D



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Read and understand this manual for safe usage.

- This manual describes the product of standard specification. Read the other manual for the product of explosion-proof specification.
- This manual describes the handling, inspection and adjustment of the product whose model is mentioned on the cover page. Read and understand this manual before handling.
- Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent, even if the terms are mentioned in this manual.
- Save this manual in a proper place being available to refer to immediately.
- The specification of product mentioned in this manual may not be satisfied by the condition of environment and usage. Check and consider carefully before using.
- Contact to sales office at NOHKEN INC. for any question or comment about this manual and product.

The following are the description of the terms in this manual.

 WARNING	Indicates a potentially hazardous situation which, if not paid attention to, could result in death, serious injury or serious disaster.
 CAUTION	Indicates a hazardous situation which, if not paid attention to, may result in minor or moderate injury or damage to the device.

	Indicates a prohibited matter. The explanation with this mark shall be followed.
	Indicates an instructed matter. The explanation with this mark shall be followed.

⚠ WARNING

This product is not explosion-proof construction. Do not install this product to the place where the flammable gas or vapor occurs. If installed, the flammable gas or vapor may be ignited, and serious disaster may occur. Use the product of explosion-proof construction in this case.



Do not modify or disassemble the product. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or minor injury and electric shock may occur.
(Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent.)



Turn off the power, before wiring and inspection.
Otherwise, electric leakage, fire caused by short circuit, and electric shock may occur.



Ensure the wire is properly connected. The product and connected device may be malfunctioned, damaged, fired, or minor injury and electric shock may occur by improper wiring.



Turn off the power immediately, if the smoke, strange smell and sound occur. Do not use it until the problem is solved.



⚠ CAUTION

Avoid strong shock and rough handling to this product.
The product may be damaged by strong shock such as dropping, falling, throwing, knocking, lugging, etc.



Follow the specification of operating temperature, operating pressure, switch rating, etc. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or minor injury and electric shock may occur. Check the manual or specification sheet.



Operation test shall be done before practical usage. If the serious accident is expected to occur by malfunction of the product, the other operating principle of product shall be installed in parallel.



 CAUTION

Do not use the sensor or keep it in stock where the corrosive gas such as NH₃, SO₂, Cl₂, etc. is occurred.

The corrosive atmosphere can enter into the sensor inside through the vent on the housing.



Check and deeply consider the chemical compatibility for the material of product in advance.



Hold the stem very close to the mounting point, when carrying, installing, and removing. If held by the housing, it may be taken off from the flange, and the product may be damaged by dropping.



Earth terminal shall be grounded to JIS Class D ground (earth resistance less than 100Ω). If not grounded, electric shock may occur by any accident.



Provide arrester or surge absorber to avoid electrical impact such as lightning and static electricity. If not provided, the product and connected device may be malfunctioned, damaged, and fired, or minor injury and electric shock may occur.



INTRODUCTION

- A) This manual specifies the specification of a general product.
If you order a special product, some details of specification may be different with the manual.
- B) We are glad to suggest and advise for Model selection and chemical resistance of material, but final decision has to be made by the customer.
- C) This manual has been prepared with close attention. Ask sales office at NOHKEN INC. for any question or comment about the contents of this manual.
- D) For replacement parts
The quality of product has frequently improved, so same spare parts may not be supplied. In this case, replacement parts or products may be supplied. Ask sales office at NOHKEN INC. for details.
- E) The contents of this manual are subject to change any time without notice due to the improvement of the product.

WARRANTY & DISCLAIMER

- A) NOHKEN INC. warrants this product against defect in design, material and workmanship for a period of 1(one) year from the date of original factory shipment.
- B) The warranty only covers the damage of products. The secondary and third kind disasters are not covered by NOHKEN INC.
- C) NOHKEN INC. shall not be liable for the following.
 - C-a) Do not follow the description and direction in this manual.
 - C-b) Damage due to improper installation, wiring, usage, maintenance, inspection, storing, etc.
 - C-c) Repair and modification are done by the person who is not an employee of NOHKEN INC. and our distributor or agent.
 - C-d) Improper parts are used and replaced.
 - C-e) The damage is occurred by the device or machine except our products.
 - C-f) Improper usage. (See "Purpose of use" in chapter 1 in this manual)
 - C-g) Force Majeure including, but not limited to, fire, earthquake, tsunami, lightning, riots, revolution, war, radioactive pollution, acts of God, acts of government or governmental authorities, compliance with law, regulation, and order.

THE TERMS OF WARRANTY AND DISCLAIMER SHALL IN NO WAY LIMIT YOUR LEGAL RIGHTS.

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1. PURPOSE OF USE

PKD sensor is an instrument to measure a liquid pressure, which is proportional to a liquid level, and indicate a liquid level. Do not use it for any other purpose.

Do not use it to measure liquids that may corrode the wetted parts material.

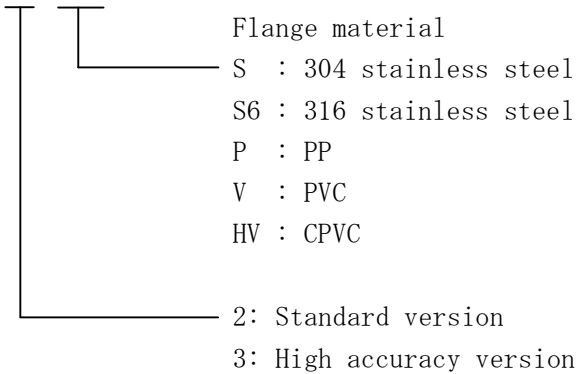
2. DESCRIPTION

PKD sensor detects liquid pressures to know liquid levels. The sensor continuously converts the data to digital signals to correct output and temperature effect, and then gives a current output (4 to 20mA DC). The housing has a vent to automatically correct measurement error due to change in atmospheric pressure.

3. SPECIFICATIONS

3.1 Model code

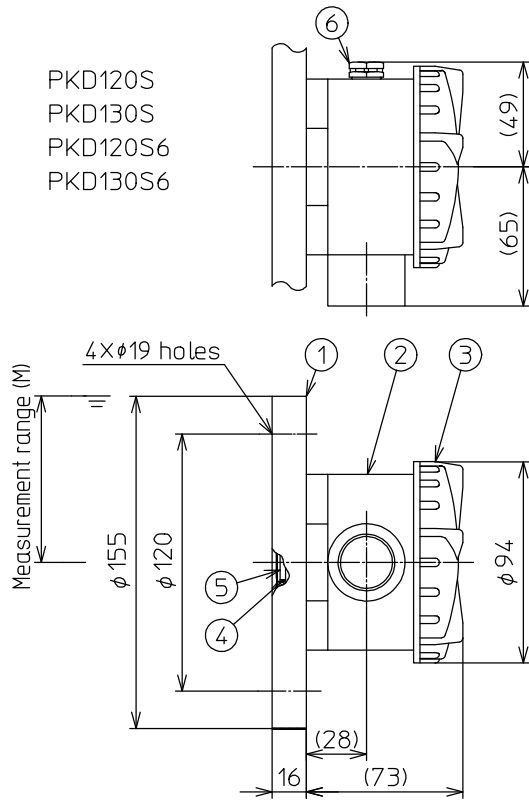
PKD1□0□□



3.2 Specifications

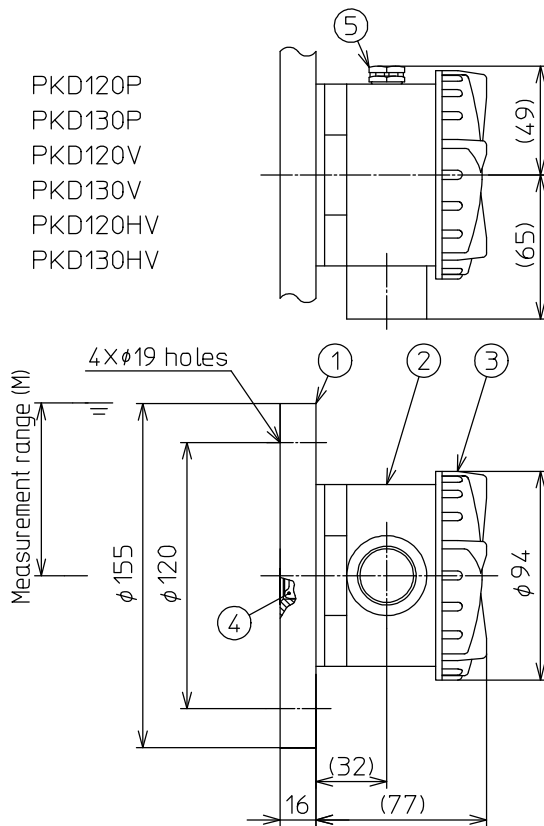
Model	PKD120□□	PKD130□□
Measured material	Water, wastewater, chemical	
Electric characteristics		
Power supply	24V DC $\pm 10\%$	
Output current	4 to 20mA DC, two-wire	
Resistive load		
Amplification	x 1 to x 6.25	
	Measurement range: 5m \rightarrow 0.8 to 5m 10m \rightarrow 1.6 to 10m 35m \rightarrow 5.6 to 35m	
Operating characteristics		
Measurement range	0 to 5m, 10m, 35m	0 to 5m, 10m
Accuracy	$\pm 0.2\%$ F.S. (hysteresis and repeatability included) $\pm \frac{0.2 \times \text{Maximum range(m)}}{\text{Set Span(m)}} (\%F.S.)$	$\pm 0.1\%$ F.S. B.S.L. $\pm \frac{0.1 \times \text{Maximum range(m)}}{\text{Set Span(m)}} (\%F.S. B.S.L.)$
Temperature characteristics	$\pm 0.015\%$ F.S./ $^{\circ}\text{C}$ (depends on maximum range)	
Mechanical characteristics		
Withstand pressure	2 x Measurement range	
Environmental		
Working temperature	Wetted parts	S, S6, P, HV: 0 to $+70^{\circ}\text{C}$ V: 0 to $+50^{\circ}\text{C}$
	Housing	0 to $+50^{\circ}\text{C}$
Storage temperature	-5 to $+50^{\circ}\text{C}$	
Humidity	95%RH Max.	
Protection class		
Wetted part	IP68 or equivalent	
Housing	IP65 or equivalent	
Material		
Wetted parts	S : 304 stainless steel, 316L stainless steel, FPM/FKM, CR S6 : 316 stainless steel, 316L stainless steel, FPM/FKM, CR P : PP, FPM/FKM V : PVC, FPM/FKM HV : CPVC, FPM/FKM	
Others	PVC, PBT	
Mounting	Flange (JIS 10K 50A / JIS 10K 50A or equivalent)	
Cable inlet	G 3/4 or equivalent	
Mass	S, S6 : approx. 2.7kg P, V, HV : approx. 0.8kg	

3.3 Outline drawing



6	Vent	1	PBT
5	Diaphragm	1	316L stainless steel
4	O-ring	1	FPM/FKM
3	Cover	1	PVC
2	Housing	1	PVC
1	Flange	1	304 stainless steel/ 316 stainless steel
P.No.	Name	Qty.	Material

Seal material: CR



5	Vent	1	PBT
4	Diaphragm	1	FPM/FKM
3	Cover	1	PVC
2	Housing	1	PVC
1	Flange	1	PP/PVC/CPVC
P.No.	Name	Qty.	Material

4. HANDLING NOTES

- (1) PKD sensor is a precision instrument. Do not give a strong shock or use it exceeding its ratings to avoid faulty operation. Handle the sensor with care.
- (2) Do not touch the diaphragm (pressure receiver).
- (3) Mount the sensor so that the diaphragm does not receive force.
- (4) Avoid mounting the sensor in proximity to the inlet/outlet or other locations where liquid pressure changes suddenly.
- (5) Do not remove or close the vent on the housing.
- (6) Make cabling as short as possible between the sensor and the power supply, and between the sensor and the load. Run the cable at least 50cm away from power lines, or use a conduit or duct to avoid electromagnetic induction.
- (7) Although the sensor incorporates a protection circuit, always use an arrestor to protect the circuit if the sensor is subjected to lightning affection, such as when mounted outdoors using long cable.
- (8) Secure the cover to avoid water, dust or metal debris entry.
- (9) Ground the sensor adequately to avoid injury due to electric shock or sensor damage due to electrostatic discharge. (Grounding resistance: 100 Ω Max.)
- (10) After mounting the sensor, place a cover on the housing to protect it from rain until wiring is complete.
- (11) Avoid storing the sensor in places that are wet, highly humid or exposed to direct sunlight. Ensure the sensor will not be damaged.
- (12) Avoid placing the sensor on a wet surface. Water may ingress into the housing and cause insulation failure.
- (13) Avoid mounting, or storing the sensor in corrosive atmosphere (NH_3 , SO_2 , Cl_2). Such atmosphere may enter from the vent on the housing and damage the inside.

5. INSTALLATION

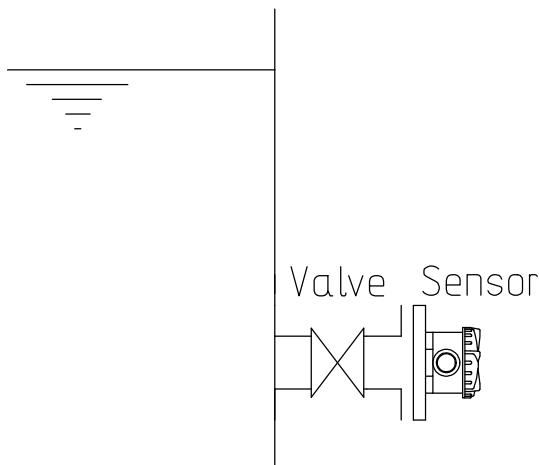


Fig. 5-1

- (1) Mount the sensor as close to the tank bottom as possible. The sensor reports "0m" when the liquid level is below the pressure receiver.
- (2) Do not close the vent to avoid measurement error.
- (3) Provide a valve near the sensor mounting position. Without one, the sensor cannot be removed for maintenance when the measured material is in the tank.
- (4) Do not use the sensor in corrosive atmosphere.

6. WIRING

6.1 Before wiring

6.1.1 Disconnect power to cabling to be wired.



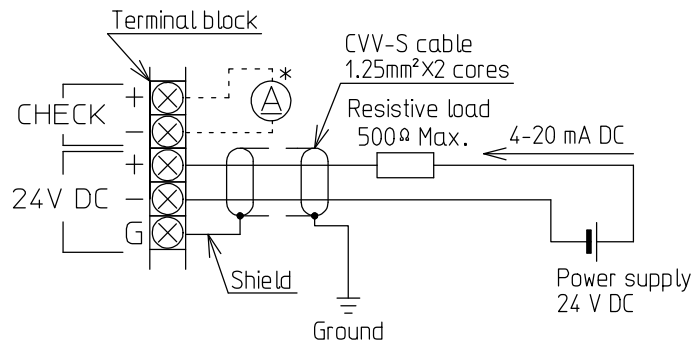
WARNING

Disconnect power before wiring, or electric shock, leakage, ignition or short circuit due to energized parts contacting each other may result.

6.1.2 Open the sensor cover.

6.2 Wiring

Connect cables as shown below. Always use a tool to tighten the screws. The screws are of M3.5. Use cable lugs of R1.25-3.5 or an equivalent size.



Connect shield to G terminal, and ground the shield at power supply. Only when checking output signals, connect the ammeter to the CHECK terminals(*), otherwise leave them open (unused).



CAUTION

Use shielded cable for signal lines. Do not run the cable in line with power lines or magnetic switches.

6.3 Cable inlet

Cable inlet is of G 3/4 or an equivalent size.

Fix the cable using a cable gland, or use a conduit and connect it to the housing. In both cases, lead the cable or the conduit downward in front of the cable inlet to prevent water entry to the housing.

Use sealing compound for a conduit, or tighten and secure the cable gland with a proper tool, to prevent entry of dust, debris or rain water to the housing. If water or moisture can enter the housing from inside the conduit, putty the conduit inside.

6.4 Placing the cover

Remove dust or debris inside the housing, if any. Metal debris inside the housing may cause short circuit.

Ensure the cover is tightened until it comes to a stop. If the cover is loose, rain water or dust may enter the housing to cause corrosion or short circuit, resulting in faulty operation.

7. PART NAMES AND FUNCTIONS

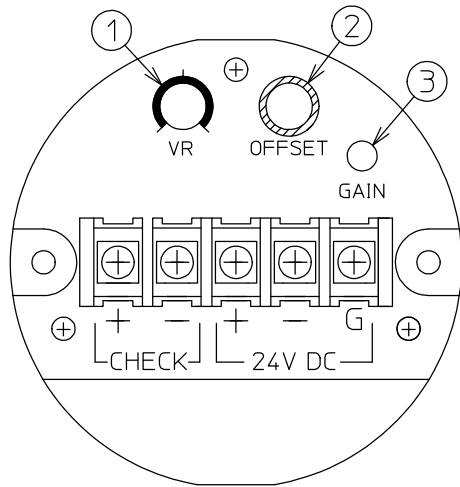
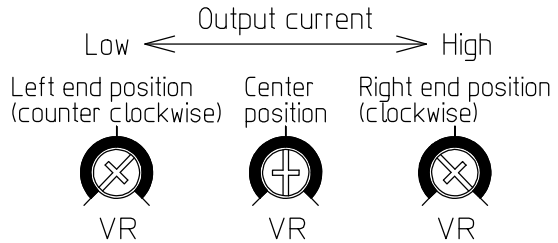


Fig. 7-1

① Trimmer

Used with the OFFSET or GAIN button pressed.
Increases output current when turned clockwise, and decreases when turned counterclockwise.



② OFFSET button

Used to set the offset value of the output signal to make fine adjustment for the current level.

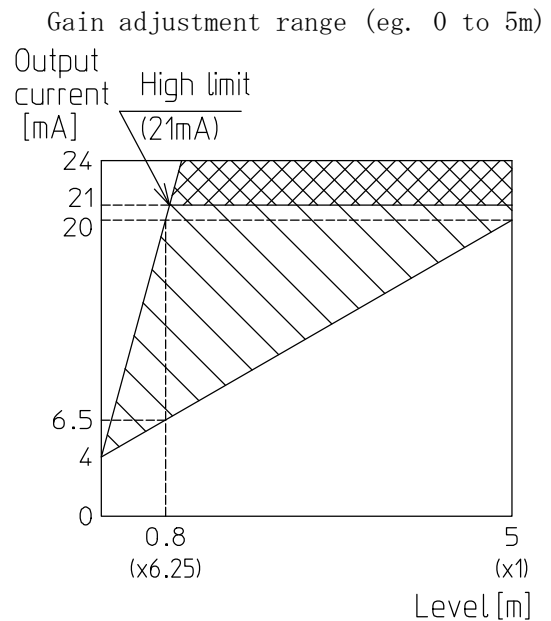
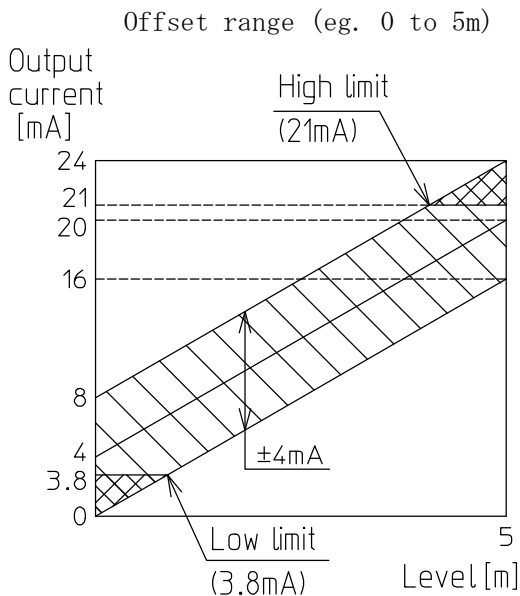
③ GAIN button

Adjusts gain for the output signal.
Sets the desired output for a level.

Offset adjustment : within $\pm 4\text{mA}$

Gain adjustment : x1 to x6.25.

Minimum range is 0.8m (when the measurement range is 5m.)



8. OPERATION

8.1 Before operation

- (1) Before supplying power, ensure wiring is correct.
Be especially careful about polarity and the power supply voltage.
- (2) The sensor is factory configured. It can start measurement right after the zero and span points are checked. If fine adjustment is required, follow instructions in sections 8.2 Offset adjustment and 8.3 Gain adjustment.
- (3) Allow a warm up period of about 10 minutes before starting adjustment.
- (4) Do not disconnect cabling but connect a dc ammeter to the CHECK terminal as shown in Fig. 8-1.

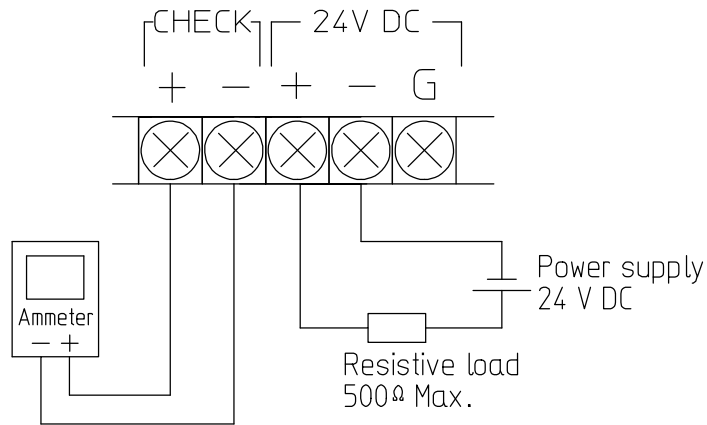
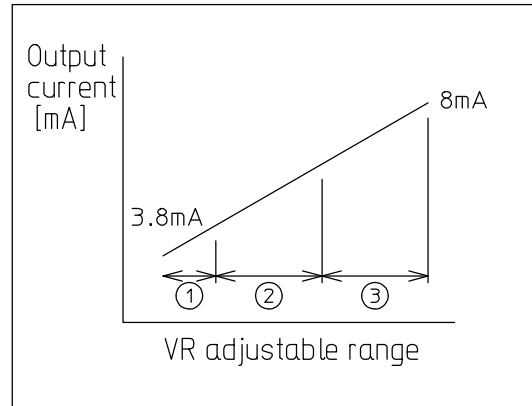


Fig. 8-1

Adjustment

The wide offset and span adjustable ranges are divided into 3 ranges for easy adjustment. The VR trimmer is turned for each range.

* See the chart on the right. The first turn of the VR changes the current in the range ①, the second in the range ②, and the third in the range ③. Release the OFFSET or GAIN button and set the VR to the center position before proceeding to the next range.






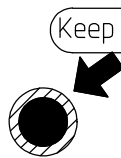

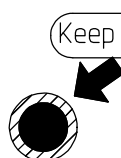




Offset range

8.2 Offset adjustment

Adjust offset while the pressure exerted on the diaphragm is atmospheric, or with the sensor removed from the tank.




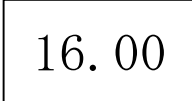



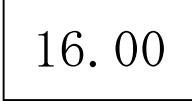






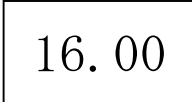
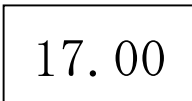



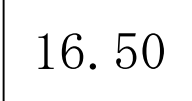
* The following instructions show how to increase the current value. To decrease the value, turn the VR counterclockwise.

	Description	Trimmer and button	Display (example)
①	Set the VR to the center position.	<p>Center</p>  <p>VR</p>  <p>OFFSET</p>	<div style="border: 1px solid black; padding: 10px; width: 60px; margin: 0 auto; text-align: center;">4.00</div>
②	Long press the OFFSET button for longer than 1 second.	<p>Center</p>  <p>VR</p>  <p>OFFSET</p>	<div style="border: 1px solid black; padding: 10px; width: 60px; margin: 0 auto; text-align: center;">4.00</div>
③	Turn the VR clockwise with the OFFSET button pressed. The current value will increase.	<p>Turn.</p>  <p>VR</p>  <p>OFFSET</p>	<div style="border: 1px solid black; padding: 10px; width: 60px; margin: 0 auto; text-align: center;">4.00</div> <p style="text-align: center;">Current value ↓ increases.</p>
	Turn the VR clockwise further with the OFFSET button pressed to further increase the value.	<p>Turn.</p>  <p>VR</p>  <p>OFFSET</p>	<div style="border: 1px solid black; padding: 10px; width: 60px; margin: 0 auto; text-align: center;">5.00</div>
④	Release the OFFSET button when the desired value is reached. * If the current value does not increase with the VR fully turned clockwise, release the OFFSET button once and start again from step 1.	 <p>VR</p>  <p>OFFSET</p>	<div style="border: 1px solid black; padding: 10px; width: 60px; margin: 0 auto; text-align: center;">4.50</div> <p style="text-align: center;">Current value decided.</p>

8.3 Gain adjustment

Adjust gain while the maximum process pressure is exerted on the sensor, or applying an equivalent pressure to the sensor.

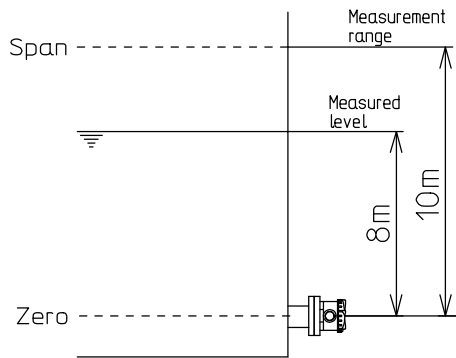
* The following instructions show how to increase the current value. To decrease the value, turn the VR counterclockwise.

	Description	Trimmer and button	Display (example)
①	Set the VR to the center position.	Center  VR  OFFSET  GAIN	
②	Long press the GAIN button for longer than 1 second.	Center  VR  OFFSET  GAIN (Long press.)	
③	Turn the VR clockwise with the GAIN button pressed. The current value will increase. Turn the VR clockwise further with the OFFSET button pressed to further increase the value.	Turn.  VR  OFFSET  GAIN (Keep pressing.) Turn.  VR  OFFSET  GAIN (Keep pressing.)	 Current value ↓ increases. 
④	Release the GAIN button when the desired value is reached. * If the current value does not increase with the VR fully turned clockwise, release the GAIN button once and start again from step 1.	 VR  OFFSET  GAIN	 Current value decided.

Examples:

(1) When the measured liquid is not at the highest level.

Measure the level. Apply the measured level to the formula below, and set the output to the resulting value.



$$\frac{(\text{Measured level})}{(\text{Measurement range})} \times 16 + 4 = \text{Output current (mA DC)} \dots \text{Formula 1}$$

When

Measurement range = 10m (98.07kPa)

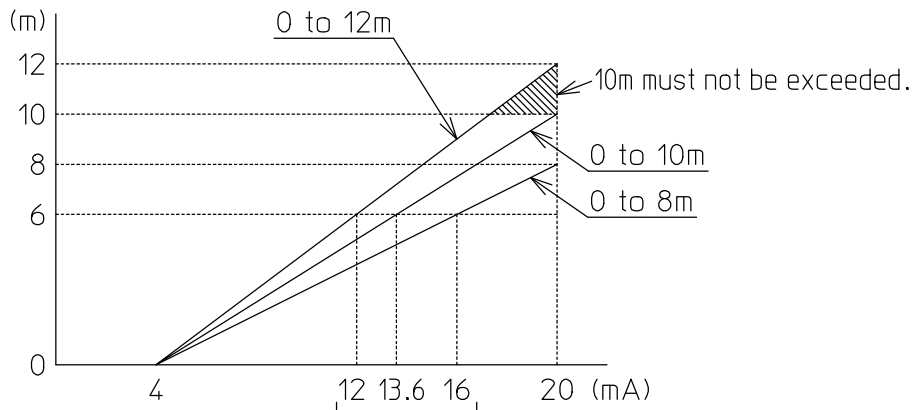
Measured level = 8m (78.45kPa),

the output current is calculated as follows:

$$\frac{8\text{m}(78.45\text{kPa})}{10\text{m}(98.07\text{kPa})} \times 16 + 4 = 16.8(\text{mA DC})$$

Note: Ensure the measurement range does not exceed the maximum range (5m, 10m or 35m).

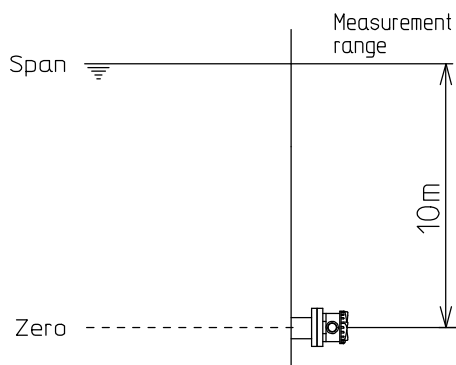
When the maximum range is 10m:



Span adjustable range when
Specific gravity = 1.0,
Measured level = 6m.

(2) When the specific gravity of the measured liquid is 1.2:

Use the formula below and set a value not exceeding the maximum range.



$$\text{Measurement range (m)} \times 9.80665 \times \text{Specific gravity} = \text{Pressure (kPa)} \dots \text{Formula 2}$$

When measurement range is 10m,
pressure exerted on the sensor is
 $10 \times 9.80665 \times 1.2 = 117.7\text{kPa}$

117.7kPa exceeds the maximum range of 10m,
so the sensor cannot measure it.

Longest possible measurement range for a liquid of
specific gravity 1.2 is calculated as follows,
based on Formula 2:
 $100 \div 9.81 \div 1.2 = 8.49\text{m}$

Note: Be careful about the calculation when a simulation pressure is applied.

8.4 Other adjustment

The following setting/adjustment is also available:

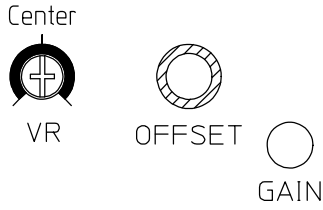
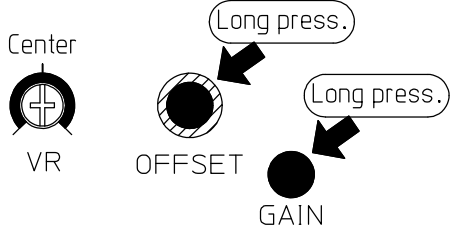
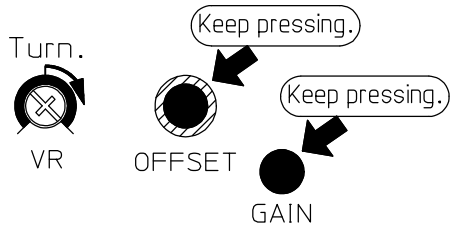
Output simulation, specific gravity entry, simulated zero/span points.

These operations require configuration using a PC. Please contact our sales office.

8.5 Master reset

Offset and span output settings can be reset to the factory defaults.

Note that reset will be complete when setting the VR to the right end position while pressing the OFFSET and SPAN buttons, and not just by pressing the two buttons.

	Description	Trimmer and button
①	Set the VR to the center position.	 <p>Center VR OFFSET GAIN</p>
②	Press both the OFFSET and GAIN buttons for longer than 10 seconds.	 <p>Center VR OFFSET GAIN</p> <p>Long press. Long press.</p>
③	While pressing both buttons, turn the VR clockwise until it comes to a stop.	 <p>Turn. VR OFFSET GAIN</p> <p>Keep pressing. Keep pressing.</p>
④	The output changes immediately after the reset is complete. Release the OFFSET and GAIN buttons.	

9. MAINTENANCE AND INSPECTION

- (1) Inspect the sensor every half a year.
Perform inspection while the sensor is powered up.
- (2) Remove the sensor from the tank or empty the tank, and check if the sensor gives a 4mA DC output.
Mount the sensor on the tank, and check if the sensor gives an output corresponding to the liquid level. (See formula ① on page 10.)
Follow instructions in sections 8.2 Offset adjustment (page 8) and 8.3 Gain adjustment (page 9) if fine adjustment is required.

10. TROUBLESHOOTING



CAUTION

In the event of trouble, perform the following and nothing else. If you have any question, please contact our sales office.

Trouble	Possible cause	Corrective action	Reference
No output is given.	Loose terminal screws.	Tighten the screws.	6. WIRING (p. 5)
	Power not supplied.	Supply power.	6. WIRING (p. 5)
	Wrong polarity when 24V DC is supplied.	Correct wiring.	6. WIRING (p. 5)
Incorrect measurement.	Wrong setting.	Make adjustment.	8. OPERATION (p. 7)
	Wrong mounting position.	Remove source of problem or relocate.	4. HANDLING NOTES – (4) (p. 4)
	Changed specific gravity.	Contact our sales office.	p. 10
	Clogged vent.	Remove source of problem.	p. 4
Measurement fluctuates.	Loose terminal screws.	Tighten the screws.	p. 5
	Noise problem.	Move cabling at least 50cm away from the power lines.	p. 4
Measured value exceeded the maximum value.	Removed cable has caused shortcircuit on the other terminal.	Remove source of problem.	p. 4
	Foreign object has caused shortcircuit.	Remove the foreign object.	p. 4

NOHKEN INC.

HEAD OFFICE : 15-29, Hiroshiba-cho, Suita-city, Osaka 564-0052, Japan.
TEL:06-6386-8141 FAX:06-6386-8140

TOKYO BRANCH OFFICE : 67, Kandasakumagashi, Chiyoda-ku, Tokyo 101-0026, Japan.
TEL:03-5835-3311 FAX:03-5835-3316

NAGOYA OFFICE : 3-10-17, Uchiyama, Chikusa-ku, Nagoya-city, Aichi 464-0075, Japan.
TEL:052-731-5751 FAX:052-731-5780

KYUSHU OFFICE : 14-1, 2-chome, Asano, Kokurakita-ku, Kitakyushu-city, Fukuoka 802-0001, Japan.
TEL:093-521-9830 FAX:093-521-9834