

I N S T R U C T I O N M A N U A L
F O R
H Y D R O S T A T I C L E V E L M E A S U R E M E N T

M O D E L : P L 8 2 0

M O D E L : P L 8 5 0 0

Issued

Feb. 24, 2003

NOHKEN INC.

IMPORTANT INFORMATION

- A. This manual describes the installation, operation, adjustment and maintenance of model PL hydrostatic level measurement. Read and understand this manual before installation. After reading, save to refer when you need.
- B. Specifications are subject to change without any obligation on the part of the manufacturer.
- C. This manual specifies standard specifications of this product. Some specifications may be different from your product if you order the custom-made product.
- D. If you have any questions or comments for the contents of this manual, ask Nohken's sales office.
- E. Nohken Inc. pursues a policy of continuing improvement in design and performance of this product. We will supply the alternative parts or complete new products required to repair or replacement.
- F. Signal words in this manual means as follows:

F-a  W A R N I N G

indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

F-b  C A U T I O N


indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

F-c  N O T E

indicates exceptional cases and attention for handling of products.

F-d R E F E R E N C E

indicates technical valuable suggestions which is unrelated to the hazard.

F-e  indicates prohibition.

4. SPECIFICATIONS

4.1 Model numbering

- (1) Sensor P L 8 2 0 - 1 □ Cable sheath
└───┬─── 0 : Chlorosulfonyl polyethylene (CSM)
 1 : Polyvinyl chloride (PVC)
 2 : Polyethylene (PE)
- (2) Converter Unit . . . PL8500

4.2 Standard specifications

4.2.1 Specifications of the sensor

Model	PL820-1□
Measuring Object	Water, Non-corrosive liquid
Operating Characteristics	
Measuring Range	0 to 4 m, 10 m, 16 m, 40 m, 100 m
Accuracy	±0.5% F.S. (includes hysteresis(*) and repeatability(*))
Temperature Characteristics	±0.03 % F.S./°C
Electrical Characteristics	
Power Supply	14 to 30 V DC
Output Signal	4 to 20 mA DC (two-wire system) (Above-mentioned measuring range) Inaccuracy(*) 4 ± 0.08mA DC (ZERO) (In the shipment) 20 ± 0.08mA DC (SPAN)
Mechanical Characteristics	
Withstand Pressure	Four times of Measuring Range
Tensile Strength of Cable	PE ; 700 N PVC, CSM; 1 kN
Working Temperature	0 to 50 °C
Construction	Wetted part equivalent IP68
Lightning Protection	12 kV (1.2/50 μs)
Physical	
Material of Housing	304 stainless steel
Diaphragm(*)	Hastelloy C-22
Dimension of Housing	φ 30 × 220
Cable	PE; 2 × 0.5 mm ² (Outside diameter φ 12 Max.)
(Built-in vent tube)	PVC; 4 × 0.3 mm ² (Outside diameter φ 12 Max.) CSM; 4 × 0.3 mm ² (Outside diameter φ 12 Max.)

* : See section 13, GLOSSARY, for the word explanation.

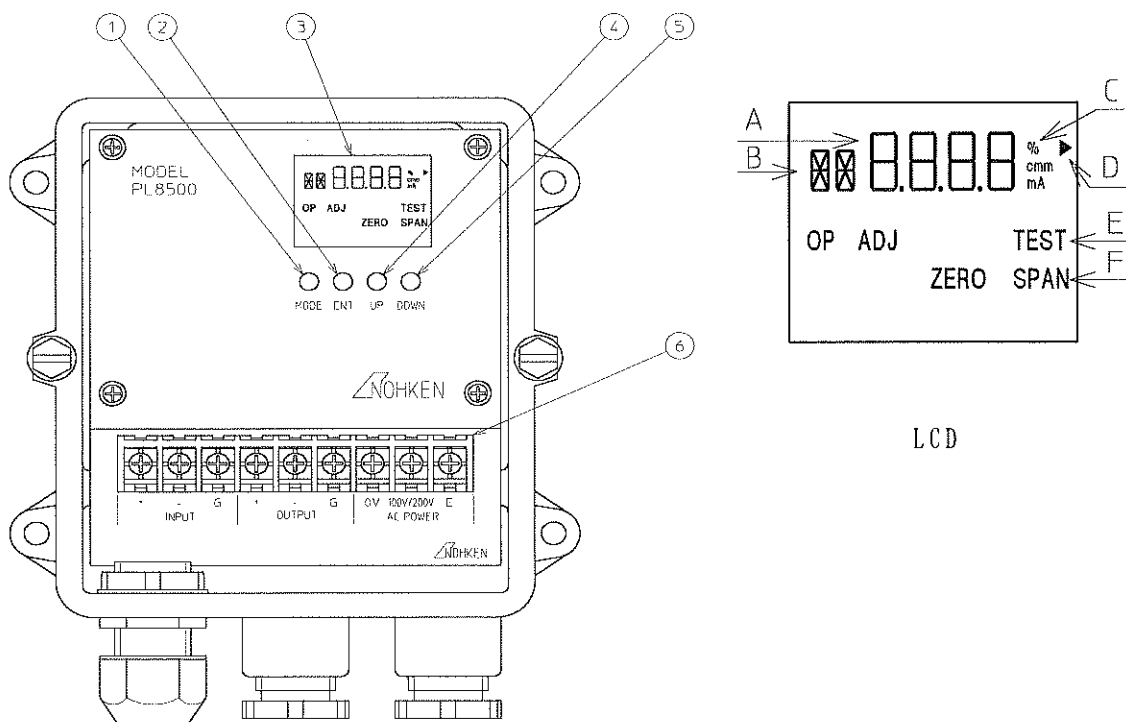
Mass of Housing	Approx. 700 g
Cable	Approx. 125 g/m(PE) , Approx. 150 g/m(PVC) Approx. 156 g/m(CSM)
Position of diaphragm (Zero point)	15 mm from tip of sensor
Surge arrester	Gas-filled surge arrester(*) Surge absorber(*)
Cable length	100 m Max.
Separated length	1 km Max.

4.2.2 Specifications of the Converter Unit

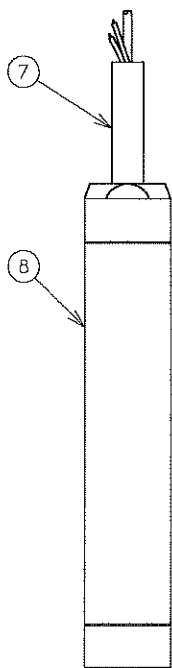
Model	PL8500
Operating Characteristics	
Accuracy	± 0.5% F.S. Combination accuracy with Level Sensor is $\pm \sqrt{\left(\frac{0.5 \times \text{Maximum measuring range (m)}}{\text{Measuring length (m)}}\right)^2 + (0.5)^2} [\%]$
Electrical Characteristics	
Power Supply	100 to 240 V AC ± 10%, 50 / 60 Hz
Power Consumption	Normally ; Approx. 5 VA At supplying power ; Approx. 40 VA
Input Signal	4 to 20 mA DC (Two-wire)
Output Signal	4 to 20 mA DC
Load resistance	600 Ω Max.
Working Temperature	0 to 50 °C
Working Humidity	5 to 95 % RH
Construction	Housing equivalent IP20
Lightning Protection	12 kV (1.2/50 μs)
Physical	
Material of Housing	Aluminium die-casting (ADC12) (silver hammer tone coating)
Dimension of Housing	(H179) × W150 × D70
Cable Inlet	1-Cable clamp (Cable diameter size φ 8.5 ~ φ 12.5) 2-JIS F 15a (G 1/2)
Mass	Approx. 1.3 kg

* : See section 13, GLOSSARY, for the word explanation.

5. NOMENCLATURE



Converter Unit : PL8500



Sensor : PL820

- ①MODE keypad ----- Used to change the operation mode.
- ②ENT keypad ----- Used to enter your desired value.
- ③LCD ----- Display the setting value of a water level.
 - A ; Display measuring value, parameter No. and setting value.
 - B ; Display 「M1~M2」, parameter No.
 - C ; Display the unit mark.
 - D ; Display when a measuring value become below zero.
 - E, F ; Display the present state.

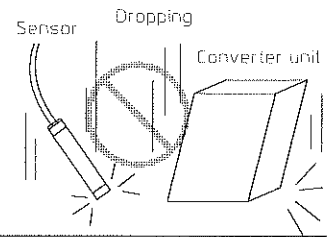
※ 「0. L.」 is displayed when the measuring value exceeds 「9999」.
 「0. L.」 is displayed, when it exceeds 「9999」, if the setting of decimal point was set up by 3 digits after the decimal point.

- ④UP keypad ----- Used change the data value.
- ⑤DOWN keypad ----- Used change the data value.
- ⑥Terminal board -- Terminal screw is M4.
- ⑦Cable ----- Built-in the vent tube.
- ⑧Housing ----- Built-in the semiconductor transducer.

6. HANDLING NOTES

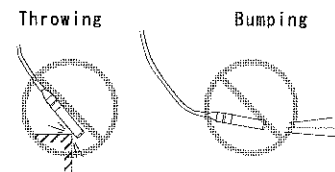
Cautions shall be taken as follows. If not, the sensor/converter unit may cause malfunction and/or injury could occur.

6.1 Avoid physical shock. Dropping, throwing or bumping shall damage the sensor/converter unit.

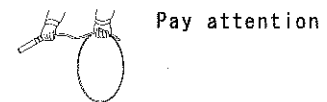


6.2 Pay attention not to exert a force on the cable when carrying.

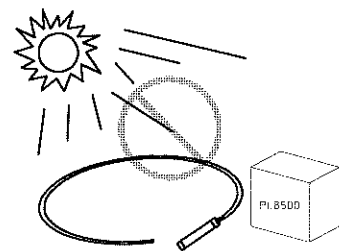
6.3 Do not store the sensor/converter unit where exposed to direct sunlight and/or where humidity is high.



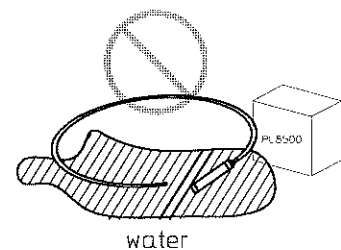
6.4 When putting the sensor/converter unit on the floor or ground, avoid wet locations. Otherwise, the insulation failure may occur.



6.5 Do not use or store in a corrosive atmosphere such as NH_3 , SO_2 , Cl_2 , etc. Otherwise, the corrosive gas may intrude inside the sensor from the vent tube.

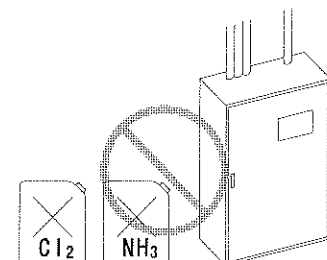


6.6 The cable gland of the converter unit is not fastened up before shipment. When storing, put the sensor/converter unit in the plastic bags to prevent from rain, splashing water. Also, when installing, locate the converter unit away from rain, splashing water. Install in the cover or provide the shield if necessary.



6.7 If the sensor/converter unit is stored for more than one year, ask Nohken for a check.

6.8 To prevent damage from electrical shock and/or the static electricity, the earth should be done JIS Class D ground.



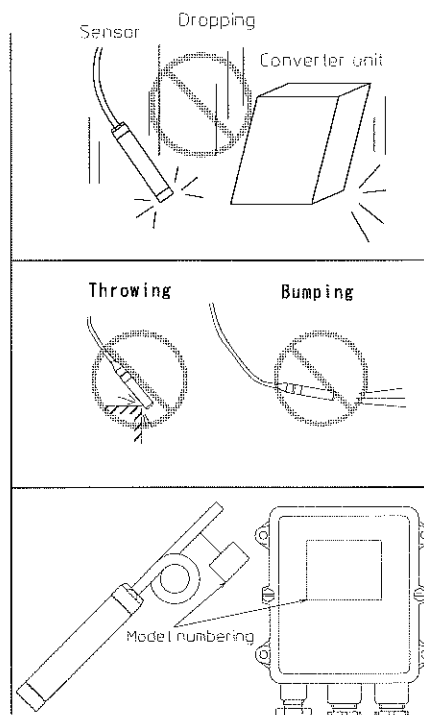
7. INSTALLATIONS

WARNING

The model PL is non-explosion-proof construction. DO NOT use where the existence of flammable gas, explosive fumes or vapor.

7.1 Unpacking

- 7.1.1 Take out the sensor/converter unit from the package carefully. Do not exert a force on the cable.
- 7.1.2 Avoid physical shock. Dropping, throwing or bumping shall damage the sensor/converter unit.
- 7.1.3 Model numbering of the sensor/converter unit is indicated on the nameplate. Check it to be sure as required.
- 7.1.4 Check the sensor/converter unit exterior for damage. If there is, contact Nohken.



7.2 Installation

- (1) Do not locate near liquid inlets/outlets. Otherwise the operation will be unstable.
- (2) The sensor must be submerged slowly into the liquid to prevent from hydraulic overloads and mechanical damage.
- (3) The vent tube is contained in the inside of a cable. Do not bend PE cable in diameter of 300 mm or less, and do not bend PVC cable and CSM cable to 100 mm or less.
- (4) Provide the stilling tube if there is turbulence or flow of the liquid over 5 cm.
- (5) When using weight, weight touches the bottom of a tank.
- (6) Use caution not to damage the cable.

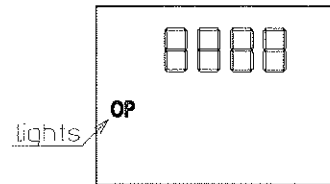
9. ADJUSTMENT

Check the following things before operation.

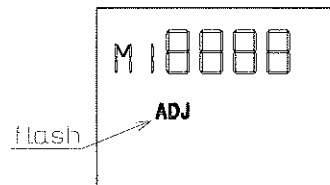
- (1) Check for miswiring, especially input, output and the power source.
- (2) Adjustment of the sensor and the converter unit has completed in before the shipment. Refer to 9.1, Zero and Span adjustment if necessary.

9.1 Zero and span adjustment

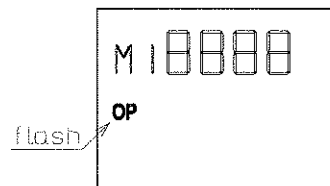
- (1) It begins at the measurement mode.
The measurement liquid in a tank is emptied or, pull up a sensor and leave it in the atmosphere.



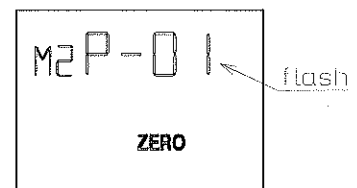
- (2) Depress MODE key for two seconds or longer.
ADJ is flashed.



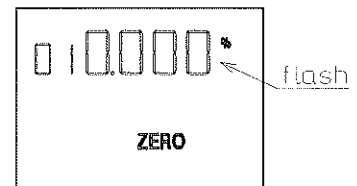
- (3) Increment or decrement the parameter until OP is displayed by up or down keypads.



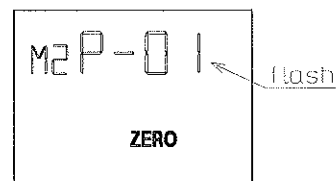
- (4) Depress MODE key for two seconds or longer.
P-01 is flashed. (Zero adjustment)



- (5) Depress ENT keypad.
0.000 is flashed.



(6) Depress ENT keypad.
P-01 is flashed.

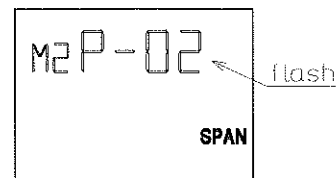


(7) Install a sensor, put measurement liquid into a tank, and measure the water level. Compute how many % of the measurement length it is equivalent to as the measured water level with reference to a right example.

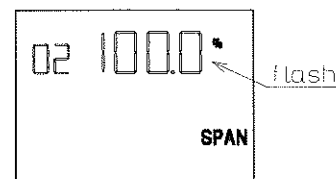
ex) When the measured water level is 2.5m by 0 to 4m measurement length.

$$2.5\text{m}/4\text{m} \times 100\% = \underline{62.5\%}$$

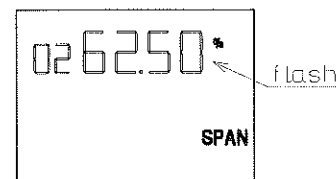
(8) Increment or decrement the parameter until P-02 is displayed by up or down keypads. (Span adjustment)



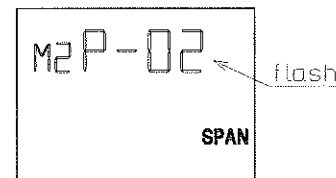
(9) Depress ENT keypad.
100.0 is flashed.



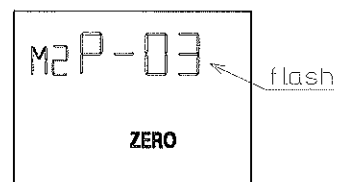
(10) Increment or decrement the parameter until the value which was computed in the procedure (7) is displayed by up or down keypads.



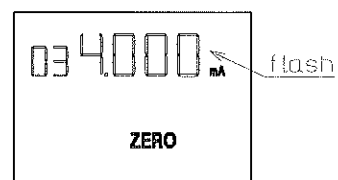
(11) Depress ENT keypad.
P-02 is flashed.



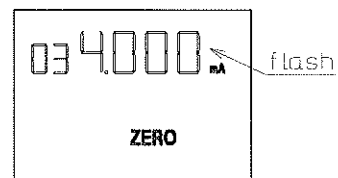
(12) Increment or decrement the parameter until P-03 is displayed by up or down keypads.
(Adjustment of the output current of zero)



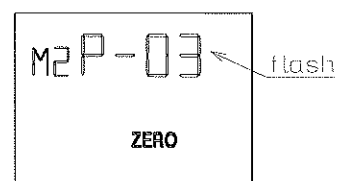
(13) Depress ENT keypad.
The present setting value flash.



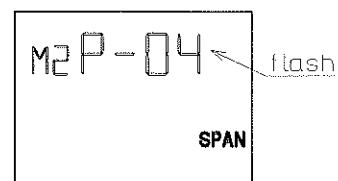
(14) Increment or decrement the parameter until the output current of zero is displayed by up or down keypads.



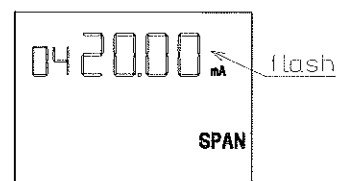
(15) Depress ENT keypad.
P-03 is flashed.



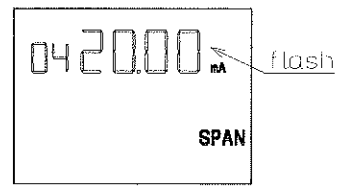
(16) Increment or decrement the parameter until P-04 is displayed by up or down keypads.
(Adjustment of the output current of span)



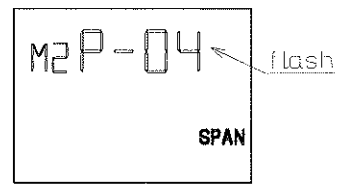
(17) Depress ENT keypad.
The present setting value flash.



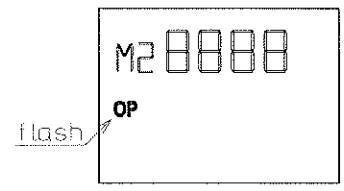
(18) Increment or decrement the parameter until the output current of span is displayed by up or down keypads.



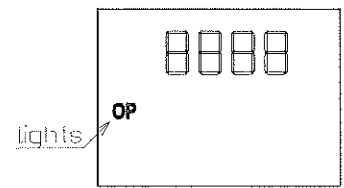
(19) Depress ENT keypad.
P-04 is flashed.



(20) Increment or decrement the parameter until OP is displayed by up or down keypads.

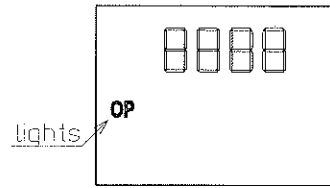


(21) Depress ENT keypad.
Adjustment of zero, span, output current of zero, output current of span is completed and it starts begins at the measurement mode.
Check that OP lights.

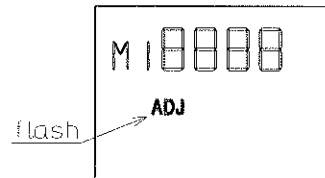


9.2 Adjustment of display value

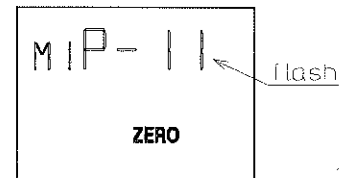
(1) It begins at the measurement mode.



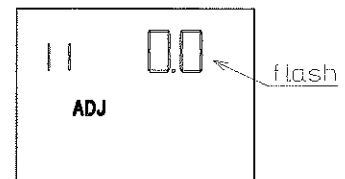
(2) Depress MODE key for two seconds or longer.
ADJ is flashed.



(3) Depress ENT keypad.
P-11 is flashed.
(Adjustment of the position of decimal point)



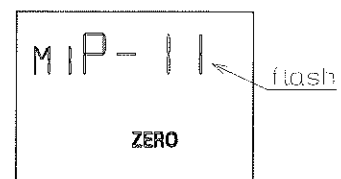
(4) Depress ENT keypad.
Present the position of the decimal point is flashing.

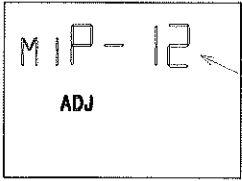
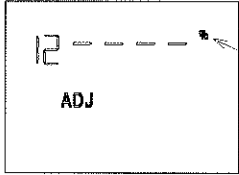
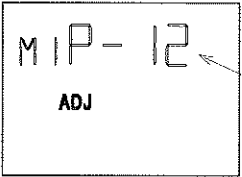
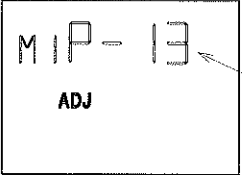
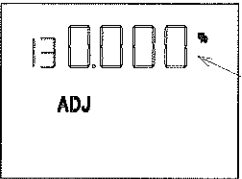


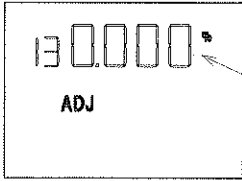
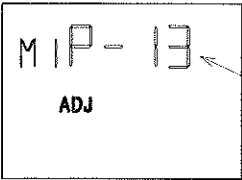
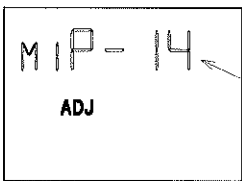
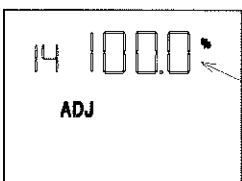
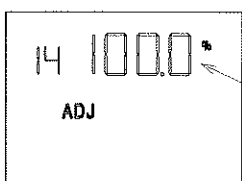
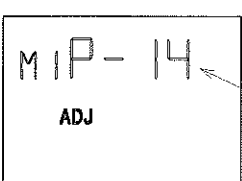
(5) Increment or decrement the parameter until the position of decimal point to hope for is displayed by up or down keypads.

- :no digits after the decimal point
- .□ :1 digits after the decimal point
- .□□ :2 digits after the decimal point
- .□□□ :3 digits after the decimal point
- .□.□.□ :floating point

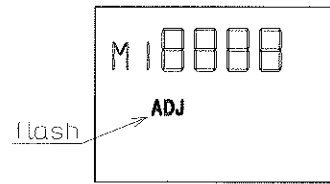
(6) Depress ENT keypad.
P-11 is flashed.



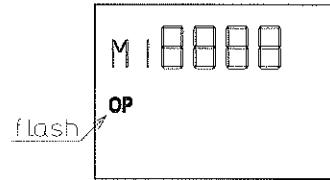
<p>(7) Increment or decrement the parameter until P-12 is displayed by up or down keypads. (Adjustment of unit mark)</p>	
<p>(8) Depress ENT keypad. Present unit mark is flashing.</p>	
<p>(9) Increment or decrement the parameter until unit mark is displayed by up or down keypads.</p>	<p>% m c m m m m A (blank)</p>
<p>(10) Depress ENT keypad. P-12 is flashed.</p>	
<p>(11) Increment or decrement the parameter until P-13 is displayed by up or down keypads. (Adjustment of display of zero)</p>	
<p>(12) Depress ENT keypad. The present setting value is flashed.</p>	

<p>(13) Increment or decrement the parameter until value of zero is displayed by up or down keypads.</p>	
<p>(14) Depress ENT keypad. P-13 is flashed.</p>	
<p>(15) Increment or decrement the parameter until P-14 is displayed by up or down keypads. (Adjustment of display of span)</p>	
<p>(16) Depress ENT keypad. The present setting value is flashed.</p>	
<p>(17) Increment or decrement the parameter until value of span is displayed by up or down keypads.</p>	
<p>(18) Depress ENT keypad. P-14 is flashed.</p>	

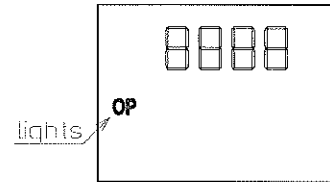
(19) Depress MODE keypad.
ADJ is flashed.



(20) Increment or decrement the parameter until
OP is displayed by up or down keypads.

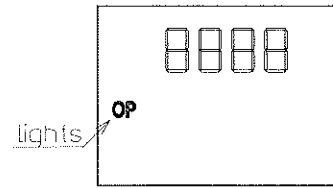


(21) Depress ENT keypad.
Adjustment of the position of decimal point,
unit mark, display of zero, display of span
is completed and it starts begins at the
measurement mode.
Check that OP lights.

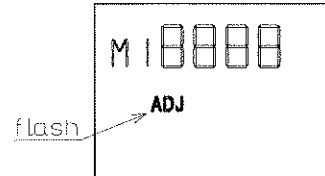


9.3 Adjustment of test signal

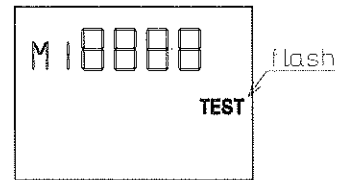
(1) It begins at the measurement mode.



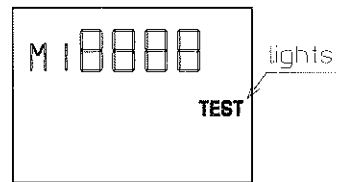
(2) Depress MODE key for two seconds or longer.
ADJ is flashed.



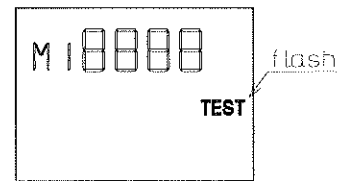
(3) Increment or decrement the parameter until
TEST is displayed by up or down keypads.



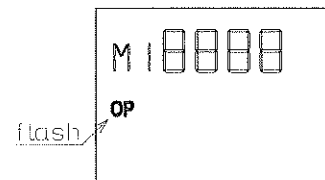
(4) Depress ENT keypad.
TEST lights.



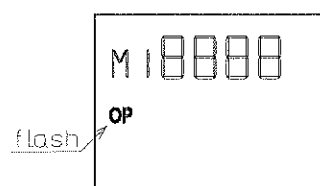
(5) The test signal can be changed by up or down
keypads.



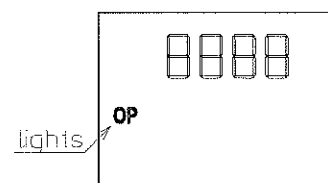
(6) Depress MODE keypad.
TEST is flashed.



(7) Increment or decrement the parameter until
OP is displayed by up or down keypads.

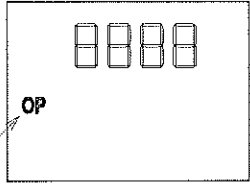
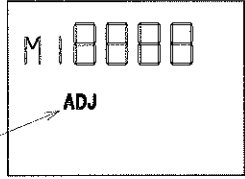
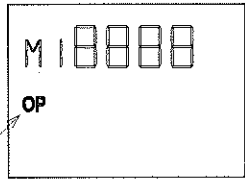
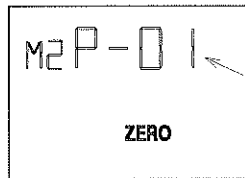
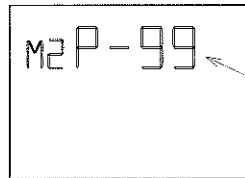
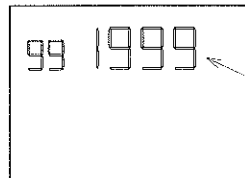


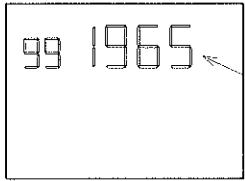
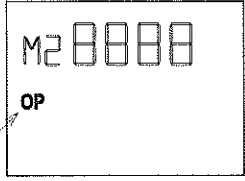
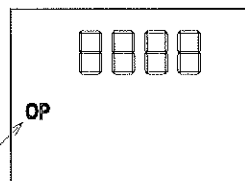
(8) Depress ENT keypad.
It starts begins at the measurement mode.
Check that OP lights.



9.4 Initialization

A parameter is returned to a setup of factory shipment.

<p>(1) It begins at the measurement mode.</p>	 <p>The LCD display shows four '8' digits. Below the digits, the letters 'OP' are displayed. An arrow labeled 'lights' points to the 'OP' indicator.</p>
<p>(2) Depress MODE key for two seconds or longer. ADJ is flashed.</p>	 <p>The LCD display shows 'M18888'. Below the digits, the letters 'ADJ' are displayed. An arrow labeled 'flash' points to the 'ADJ' indicator.</p>
<p>(3) Increment or decrement the parameter until OP is displayed by up or down keypads.</p>	 <p>The LCD display shows 'M18888'. Below the digits, the letters 'OP' are displayed. An arrow labeled 'flash' points to the 'OP' indicator.</p>
<p>(4) Depress MODE key for two seconds or longer. P-01 is flashed.</p>	 <p>The LCD display shows 'M2P-01'. Below the digits, the word 'ZERO' is displayed. An arrow labeled 'flash' points to the '01' part of the display.</p>
<p>(5) Increment or decrement the parameter until P-99 is displayed by up or down keypads. (Initialization)</p>	 <p>The LCD display shows 'M2P-99'. An arrow labeled 'flash' points to the '99' part of the display.</p>
<p>(6) Depress ENT keypad. 1999 is flashed.</p>	 <p>The LCD display shows '99 1999'. An arrow labeled 'flash' points to the '1999' part of the display.</p>

<p>(7) Increment or decrement the parameter until 1965 is displayed by up or down keypads.</p>	
<p>(8) Depress ENT keypad. OP is flashed. All parameter is returned to a setup of factory shipment. When values except 1965 are being displayed in the procedure (7), it is not initialized but returns to the state of a procedure (5).</p>	
<p>(9) Depress ENT keypad. It starts begins at the measurement mode. Check that OP lights.</p>	

10. MAINTENANCE & INSPECTION

Pull up the sensor slowly before maintenance. See section 6, HANDLING NOTES. Keep the ample space for maintenance.

10.1 Preparation

▲ CAUTIONS

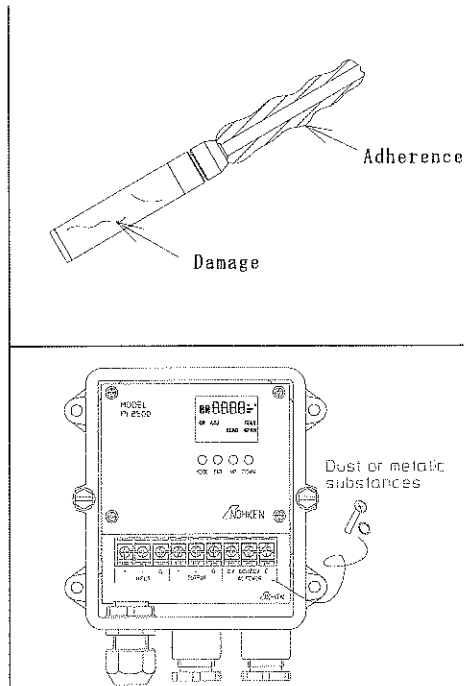
- When remove the cover of a converter unit, please make a cover not fall suddenly by holding it. There is a possibility that an injury of a worker and machine will be damaged.
- Pull up the sensor slowly and carefully not to contact with the wall.
- After pulling up the sensor, use caution not to damage the cable.

- 10.1.1 Pull up the sensor from the liquid and put it on an ample space.
- 10.1.2 The cover of a converter unit is removed. The cover of a converter unit is fixing the housing using the bolt of M6.

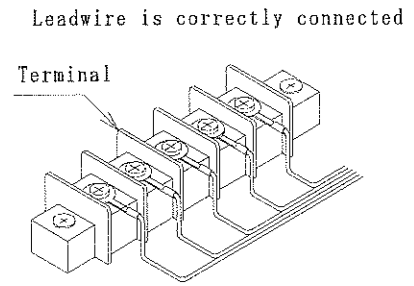
10.2 Maintenance & Inspection

Inspect the sensor semi-annually or annually. Since inspection intervals varies with applications and process conditions such as detecting materials, temperature and so on, we recommend you to inspect periodically. Turn on the power when maintenance.

- 10.2.1 Check exterior for damage. Repair or replace the parts if necessary.
- 10.2.2 Remove build-up on the cable and/or the sensor.
- 10.2.3 Clean dirt, dust and moisture and material from converter unit.
- 10.2.4 Check the terminal and the lead wire is correctly connected. Tighten the screw if necessary.



10.2.5 Make sure the terminal and the lead wire is not corroded. Replace it if necessary.



10.3 Replacement cycle

Inspect the sensor/converter unit semi-annually or annually. We recommend you to inspect periodically by sending them back to our factory. Replacement of internal parts may be necessary such as deteriorated surge absorber.

11. STORING

The sensor/converter unit shall be stored under the following conditions when it is not used for a long time.

11.1 Environmental conditions are as follows:

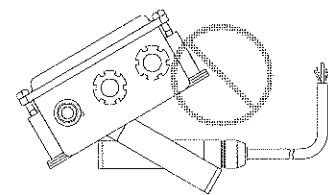
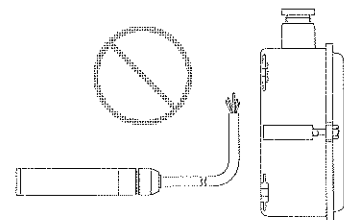
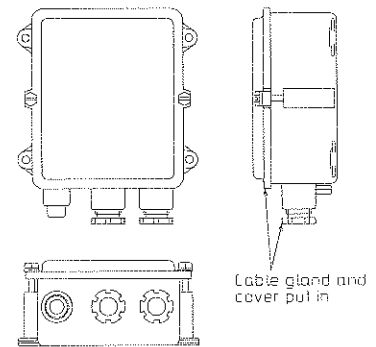
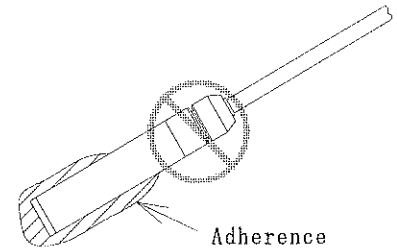
- No corrosive gases
(such as NH_3 , SO_4 , Cl_2 , etc.).
- Vibration is low.

11.2 Clean adherence. Otherwise, the sensor operation will be affected after solidifying.

11.3 The cover and cable gland of a converter unit should put in all parts. When keeping in the condition of these to have missed from, dust and moisture and so on are included in a converter unit.

11.4 Keep the sensor/converter unit away from rain and/or the splashing water. To prevent sensor/converter from rain and/or splashing water, the tip of the sensor cable shall not left upward.

11.5 Do not put things on the sensor. It shall deform and damage the sensor.



REFERENCE

Keep the sensor in sealed plastic bags with desiccant or other moisture-proof packing.

12. PARAMETER LIST

P-No.	Contents of a setting, and a function	Reference
P-01	<p>Zero adjustment</p> <p>It does zero adjustment in the condition to have inputted zero signal to.</p> <p>When zero signal cannot be inputted but the signal higher than zero is inputted, it inputs a percent value to the measurement length of the input signal and it does zero adjustment.</p>	<p>9. 1</p> <p>P. 11~14</p>
P-02	<p>Span adjustment</p> <p>It does span adjustment in the condition to have inputted span signal to.</p> <p>When span signal cannot be inputted but the signal lower than span is inputted, it inputs a percent value to the measurement length of the input signal and it does span adjustment.</p>	<p>9. 1</p> <p>P. 11~14</p>
P-03	<p>Adjustment of output current of zero</p> <p>The output current value in a zero position is set up.</p>	<p>9. 1</p> <p>P. 11~14</p>
P-04	<p>Adjustment of output current of span</p> <p>The output current value in a span position is set up.</p>	<p>9. 1</p> <p>P. 11~14</p>
P-11	<p>Adjustment of the position of decimal point</p> <p>The position of the decimal point in measurement mode is set up.</p>	<p>9. 2</p> <p>P. 15~18</p>
P-12	<p>Adjustment of unit mark</p> <p>The unit mark in measurement mode is set up.</p>	<p>9. 2</p> <p>P. 15~18</p>
P-13	<p>Adjustment of display of zero</p> <p>The display in a zero position is set up.</p>	<p>9. 2</p> <p>P. 15~18</p>
P-14	<p>Adjustment of display of span</p> <p>The display in a span position is set up.</p>	<p>9. 2</p> <p>P. 15~18</p>
P-99	<p>Initialization</p> <p>A parameter is returned to a setup of factory shipment.</p>	<p>9. 4</p> <p>P. 21~22</p>

13. GLOSSARY

- Semiconductor transducer : The piezo-resistive sensor which changes electric resistance in proportional to hydrostatic pressure head.
- Hysteresis : Output difference between the rising level and the falling level at the same position under the same operating conditions.
- Repeatability : Output difference among a number of consecutive measurements at the same liquid level approaching from the same direction, for full-range traverses.
- Inaccuracy : Output difference by zero point and span point.
- Diaphragm : The hastelloy thin membrane to sense and transmit the liquid head pressure.
- Gas-filled surge arrester : The discharge element which slips electron by the electric field effect.
- Surge absorber : The circuit protection element which suppresses the excessive voltage.

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