

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

F O R

CAPACITIVE LEVEL SENSOR



MODEL: C G — □ □ □ □ □ □ K



Issued 2014-06-02

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

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 or plug, and the product may be damaged by dropping.



The product is 50cm or longer

The product shall be kept horizontally. The product and other goods could be damaged, and minor injury may occur by falling.



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.



In case of connecting inductive or lamp load to the product.

Provide protective circuit to the load to avoid over voltage and over current. If not provided, the contact may be damaged.



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.

Table of Contents

1. PURPOSE OF USE	1
2. DESCRIPTION	1
2.1 Description	1
2.2 Principle of operation	1
3. SPECIFICATIONS	2
3.1 Part names and functions	2
3.2 Model numbering	3
3.3 Specification	4
4. HANDLING NOTES	5
5. INSTALLATION	6
5.1 Unpacking	6
5.2 Mounting	7
5.2.1 Mounting location	7
5.2.2 Mounting the sensor	10
5.2.3 Mounting orientation	10
5.3 Mutual interference	11
6. WIRING	12
6.1 Before wiring	12
6.2 Wiring	12
6.3 Cable inlet	13
6.4 Placing the cover	13
7. ADJUSTMENT	14
7.1 Before adjustment	14
7.2 Key operation during adjustment	16
7.3 Parameters	17
7.4 Sensitivity setting (Zero / Span setting)	19
7.5 Setting alarm	25
7.5.1 OFF-ON setting	25
7.5.2 OFF timer and ON timer setting	28
7.5.3 Setting relay	31
7.5.4 Display setting	33
7.5.5 Alarm check	35
7.6 Deactivating the warning	37
7.7 Parameter list	38
8. MAINTENANCE AND INSPECTION	39
8.1 Maintenance procedure	39
8.2 When to replace the sensor	39
9. STORING	40
10. TROUBLE SHOOTING	41
11. GLOSSARY	42

1. PURPOSE OF USE

Capacitive Level Sensor CG is a level instrument to detect presence of liquids or solids to send signals utilized to give an alarm output or control output for pump or other devices. Do not use for any other purpose.

2. DESCRIPTION

2.1 Description

CG sensor is mounted on a tank using the threaded connection(*) or flange(*). Its electrode inserted into a tank detects a level of liquids or solids. The electrode has no moving parts to achieve a long service life. The sensor incorporates a special circuit that can minimize buildup affection, semiconductor damage or faulty operation caused by high voltage static electricity in solids. Adjustment is easily made without need for a tester or other devices.

2.2 Principle of operation

The CG sensor, mounted on a tank, forms a capacitor(*) between its electrode and the tank wall. The capacitance(*) of this capacitor is proportional to the dielectric constant of the material inside the tank. The capacitor and the coil in the sensor circuit form a parallel circuit, which resonates at a frequency when an alternating signal is given. The resonance can be maintained by detecting the phase of the parallel circuit and then automatically adjusting the frequency to create the same phase. Thus the sensor utilizes change in frequency to determine material presence, enabling a wide range of sensitivity settings, from high to low values. Material resistance has no effect on the resonance frequency, so the buildup affection is minimized regardless of the sensitivity setting.

Dielectric constant

The dielectric constant(ϵ_s) is calculated as follows:

$$\epsilon_s = \frac{C_1}{C_0}$$

where,

C_0 = capacitance with no material in the tank.

C_1 = capacitance when material reaches the electrode.

Each material has a unique value for ϵ_s . Therefore, the sensitivity characteristics of the CG sensor is determined by the ϵ_s value of the measured material.

* Refer to 11. GLOSSARY.

3. SPECIFICATIONS

3.1 Part names and functions

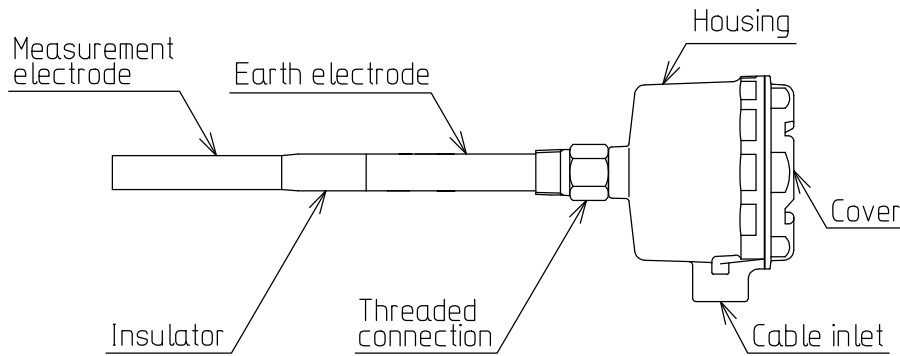


Fig. 3-1 Threaded connection type

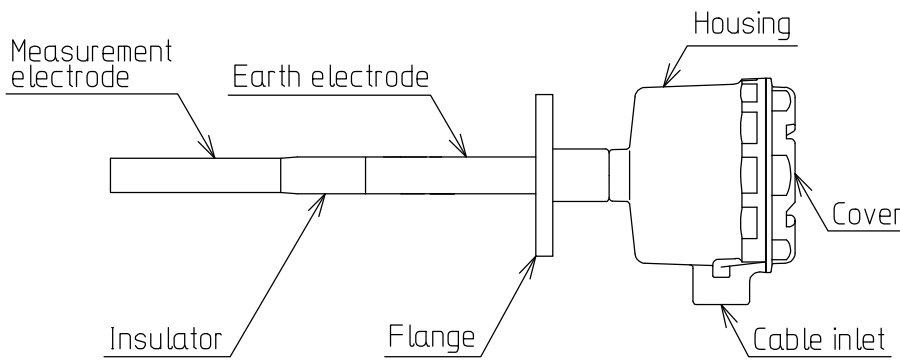


Fig. 3-2 Flange type

Cover: Used to cover the sensor

Cable inlet: For cable connection.

Housing: Incorporates a printed circuit board.

Threaded connection: Used to mount the sensor.

Flange: Used to mount the sensor.

Earth electrode: Metal rod to measure capacitance.

Insulator: Insulates the measurement electrode and the earth electrode.

Measurement electrode: Metal rod to measure capacitance.

3.2 Model numbering

CG-□□□□□□K

	Blank	: standard
	T	: with fin
	P	: with insulator pipe
	PT	: with insulator pipe and fin
	N	: threaded
	F	: flanged, sanitary mounting
	Z	: special mounting
1		: standard with ϕ 12 electrode, for liquids
2		: standard with ϕ 20 electrode, for liquids and solids
3		: pressure resistant
4		: pressure and heat resistant
5		: flat face
6		: wire version
7		: insulator pipe version
8		: anti-buildup version
9		: with special size electrode
25		: high sensitivity with ϕ 34
PLB		: pipeline, contact version
PLT		: pipeline, non-contact version

- Option T is not available with option 3. (Select 4 instead.)
- Option 4 does not require T at the end.
- "P" and "PT" are available only with flange mounting option.
(Types 2, 5, 9 and 25 only)
- Leave mounting option blank for option PLB and PLT, i. e. do not add F.

3.3 Specification

(1) Operating characteristics

Sensitivity: Dielectric constant 1.2 Min.
Capacitance between electrodes 1.0 pF Min.
Resistance between electrodes 10k Ω Min.
(L=250mm)

(2) Electrical characteristics

Power supply : 100 to 240V AC \pm 10%, 50/60Hz
Power consumption : approx. 6 VA
Alarm output : Dry contact relay (*) (SPDT)
Operation selectable
Relay ratings
Max. : 250V 3A AC (resistive load),
30V 3A DC (resistive load)
Min. : 5V 10mA DC (resistive load)
Insulation resistance:
100M Ω Min. 500V DC
between each terminal and housing (excl. E terminal)
Withstand voltage : 1500V AC for 1 minute
between each terminal and housing (excl. E terminal)

(3) Mechanical characteristics

Pressure (static pressure)
Type 1, 2, 5, 25: 1MPa Max. (excl. mounting)
Type 3, 4 : 3MPa Max. (excl. mounting)
Type 6 : 500kPa Max. (excl. mounting)
Other : electrode dependent.
Vibration : 10 to 150 Hz, 19.6 m/s² (L=250).
(in X, Y, Z direction, for two hours each)

(4) Environmental

Working temperature : Wetted parts -20 to +60 $^{\circ}$ C
with 1 fin : +120 $^{\circ}$ C Max.
with 3 fins: +180 $^{\circ}$ C Max.
Housing -25 to +65 $^{\circ}$ C*¹ (no dew condensation)
Humidity : 85%RH Max.

(5) Protection class

Wetted parts: IP68 or equivalent
Housing : IP65 or equivalent

(6) Others

Material
(a) Housing : Aluminum die casting (acrylic coated)
(b) Insulator: PE
(c) Electrode: 304 Stainless steel
(d) O-ring : FPM/FKM
Cable inlet : G 1/2 or equivalent

*1 Ambient temperature during adjustment: -10 to +55 $^{\circ}$ C
Display quality can be degraded in temperatures outside the above range.
(This does not affect sensor operation.)

* Refer to 11. GLOSSARY.

4. HANDLING NOTES

Observe instructions below when handling the sensor, or operation failure or user injury can result.



CAUTION

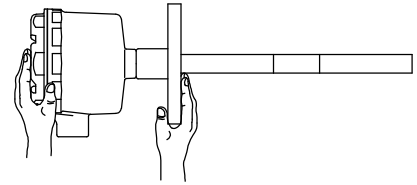
Never over-rotate the measurement electrode, or it will be damaged.

<p>4.1 Do not drop, throw, crush or give strong shock to the sensor to avoid damaging it.</p>	
<p>4.2 Do not place anything on the sensor, or excessive force can be applied to deform or damage the sensor.</p>	
<p>4.3 The nameplate contains maintenance and other important information. When painting the sensor, ensure such information is legible.</p>	
<p>4.4 Avoid using, or storing the sensor in corrosive atmosphere (NH_3, SO_2, Cl_2). Such atmosphere can ingress into the housing to corrode internal circuit.</p>	
<p>4.5 Avoid using or storing the sensor in a place where vibration is expected. If such location is inevitable, remove the source of vibration or protect the sensor from receiving the vibration.</p>	
<p>4.6 Avoid proximity to noise sources such as motors, pumps and invertors, or devices generating high frequency electric field such as ultrasonic cleaners and transceivers, to prevent operation failure.</p>	

5. INSTALLATION

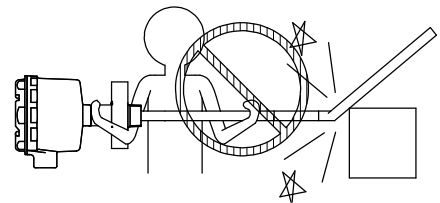
5.1 Unpacking

5.1.1 Open the package and take out the sensor.
Hold the sensor by the mounting component, and another component if necessary.

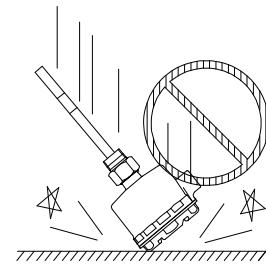


5.1.2 Completely remove packing material such as tape, vinyl and cardboard to prevent operation failure.

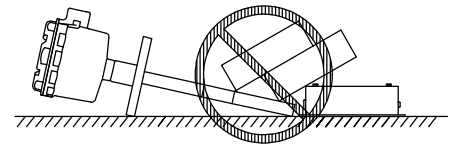
5.1.3 Sensors of 1500mm or longer have to be handled by more than one person, to prevent operation failure resulting from crushing or bent electrode.



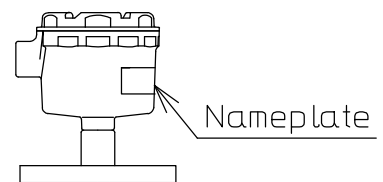
5.1.4 Do not drop, throw, crush or give a strong shock to the sensor to avoid damaging it.



5.1.5 Do not place anything on the sensor, or excessive force can be applied to deform or damage the sensor.



5.1.6 Check against nameplate to ensure the sensor is as ordered. If not, please contact our sales office.

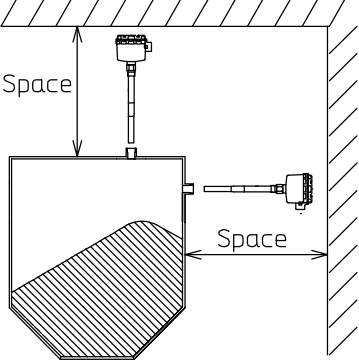
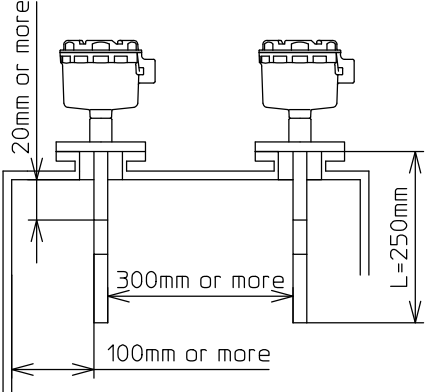
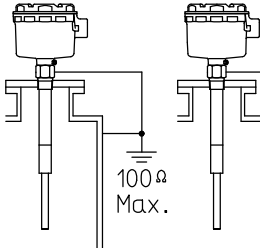
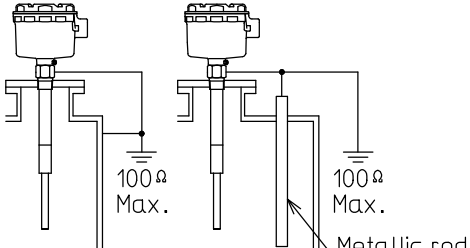
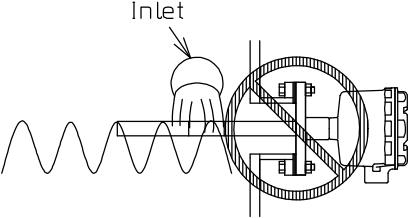


5.1.7 Check the sensor for visible damage. If any, it may have been caused during transportation. Please contact our sales office.

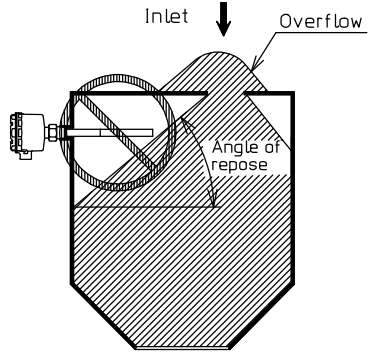
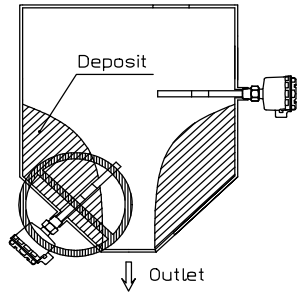
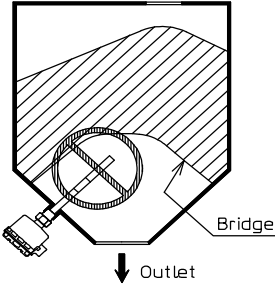
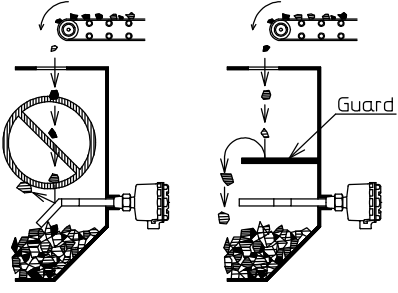
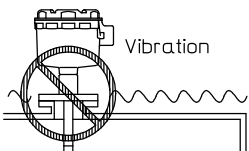
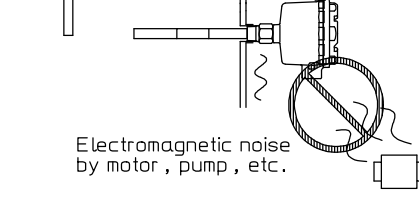
5.2 Mounting

5.2.1 Mounting location

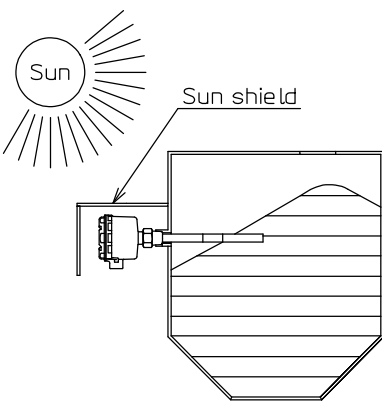
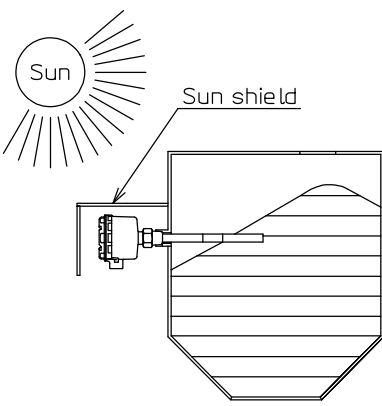
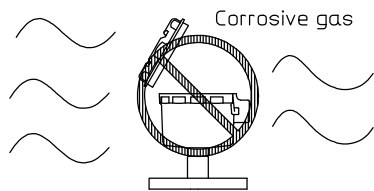
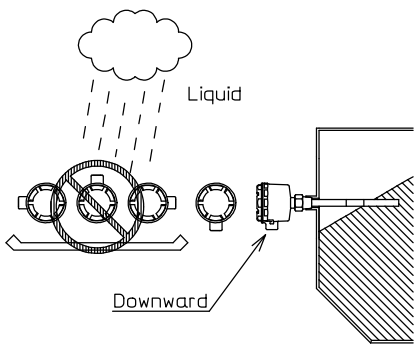
When mounting, observe the following instructions. Failure to do so can result in operation failure.

<p>(1) Ensure ample space above and around the mounting point for easy handling and maintenance. Note that the space must be large enough to contain overall length of the sensor. This must be ensured after mounting the sensor, for when maintenance is required.</p>	
<p>(2) When mounting the sensor on a nozzle, ensure the earth electrode projects into the tank for at least 20mm. Ensure at least 300mm between sensor electrodes (L=250mm), and 100mm between the electrode and the tank wall. Failure to do so can result in buildup, lowered measurement sensitivity, commissioning failure, or other operation failure. Contact our office for detail.</p>	
<p>(3) When mounting the sensor on a metallic tank, ensure electrical continuity between the mounting connection and the tank.</p>	
<p>(4) When mounting on a nonmetallic tank, provide a metallic rod longer than the sensor electrode in line with the electrode, to ensure electrical continuity between the mounting connection and the rod. Provide an earth cable to the threaded connection or flange to ground the device (100Ω Max.).</p>	 <p>Metallic tank Nonmetallic tank</p>
<p>(5) Avoid locations susceptible to turbulence. Such locations will cause unstable measurement. When not avoidable, use a stillpipe(*) or the timer. See section 7.5.2 for how to set the timer. Ensure at least 100mm between the stillpipe and the electrode.</p>	

* Refer to 11. Glossary.

<p>(6) Be aware of the angle of repose(*). Avoid locations where the material does not reach the sensor due to the angle of repose, to prevent operation failure.</p>	
<p>(7) Be aware of deposit(*). Avoid areas susceptible to deposit to prevent operation failure.</p>	
<p>(8) Avoid areas where the material does not reach the sensor due to bridge(*), to prevent operation failure and damaging the sensor when the bridge falls.</p>	
<p>(9) Avoid the path of falling material to prevent operation failure and damaging the sensor. Provide a guard(*) to protect the sensor, if necessary.</p>	
<p>(10) Avoid areas susceptible to vibration or shock. Proximity to a vibrator(*) or a knocker(*) can cause operation failure or sensor damage.</p>	
<p>(11) Avoid proximity to noise sources such as motors, pumps and invertors, or devices generating high frequency electric field such as ultrasonic cleaners and transceivers, to avoid operation failure.</p>	

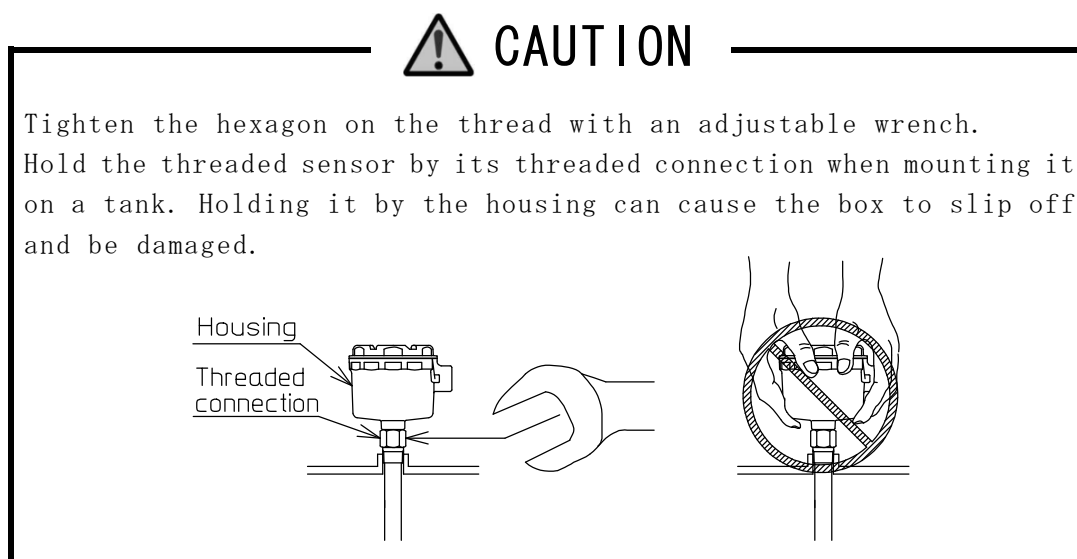
* Refer to 11. Glossary.

<p>(12) Avoid areas where extreme temperature rise is expected, or operation failure can result. The maximum working temperatures for the electrode is +60°C, and the housing +65°C.</p>	
<p>(13) Avoid exposure to direct sunlight. Especially in summer, the temperature inside the sensor can exceed the specified value due to direct sunlight, causing operation failure. Provide a sunshield(*) if necessary.</p>	
<p>(14) Avoid corrosive environment (NH₃, SO₂, Cl₂). Corrosive gases can ingress into the housing to corrode internal circuit.</p>	
<p>(15) When mounting the sensor in areas susceptible to rain, observe the following. Although the housing is designed not to have negative effect against water jet (IP65), improperly placed cover or inadequately treated cable inlet will cause water entry to result in operation failure. Ensure the cover is properly placed and the cable inlet is adequately treated. For horizontal mounting, ensure the cable inlet points downward.</p>	

* Refer to 11. Glossary.

5.2.2 Mounting the sensor

(1) Threaded model



When the sensor is used on a pressurized tank, provide sealing material on the thread to prevent leakage, ensuring electrical continuity between the threaded connection and the tank.

(2) Flanged model

Fit the sensor flange to the mating flange of the tank, and secure them using a proper tool and bolts according to the applicable standard. Mount the sensor vertically. When the sensor is used on a pressurized tank, use a gasket to prevent leakage, ensuring electrical continuity between the flange and the tank. Note that bolts and gaskets are optional parts.

5.2.3 Mounting orientation

The sensor is mainly mounted either horizontally or vertically.

(1) Horizontal mounting

The electrode in line with the material surface creates a large contact area. This makes the slight level change a large capacitor change, realizing high accuracy operation.

(2) Vertical mounting

The buildup is minimized and stable operation is expected. However, the contact area with the material being small, the user has to be aware that the measurement accuracy can become lower, and that a long electrode is required for low level detection.

Reference

Horizontal mounting can cause buildup of material with high viscosity(*), leading to unstable operation. To minimize buildup, it is recommended to mount the sensor at an angle in a way that the electrode points downward.

* Refer to 11. GLOSSARY.

5.3 Mutual interference

When multiple sensors with a long measurement electrode, such as cable suspended version (type 6), are mounted close to each other, interference may cause unstable operation.

The longer the dimension L, the larger the influenced area will be.

Provide an enough space between the sensors for stable operation.

Table 5-3 shows the recommended interval between sensors for different electrode lengths. Note that different values may be required since the influenced area varies with the earth electrode length and the mounting conditions.

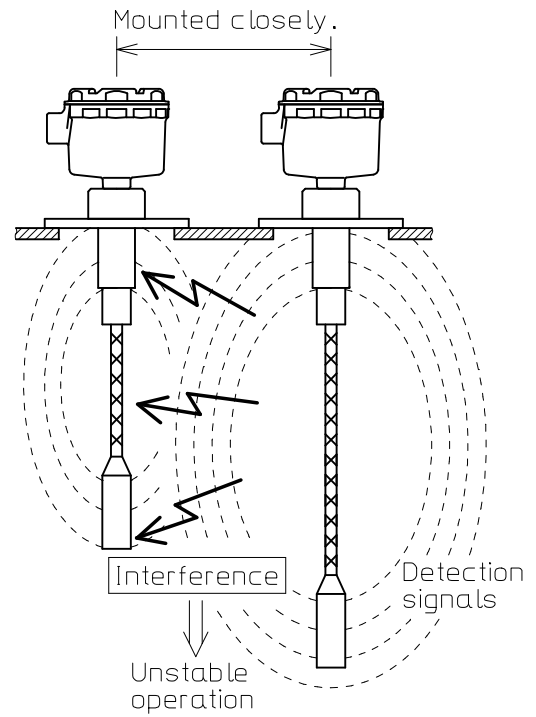


Table 5-3: Dimension L and sensor interval

Dimension L	Required interval
Up to 250mm	300mm Min.
Up to 500mm	300mm Min.
Up to 1000mm	400mm Min.
Up to 1500mm	500mm Min.
Up to 2000mm	600mm Min.
Up to 2500mm	700mm Min.
Up to 3000mm	800mm Min.
Up to 3500mm	900mm Min.
Up to 4000mm	1000mm Min.

Chart below is for when the earth electrode is 150mm and resonant frequency difference is 50kHz.

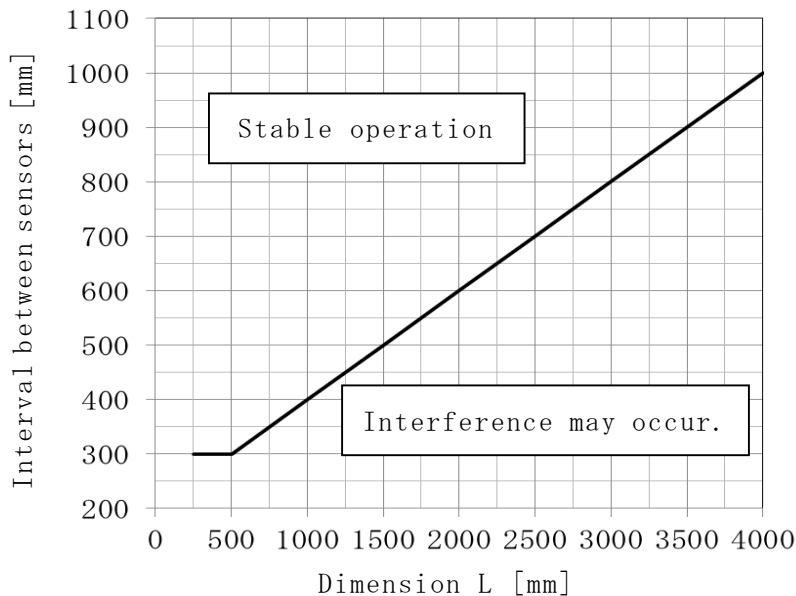


Fig. 5-3: Relation between dimension L and interval

6. WIRING

6.1 Before wiring

6.1.1 Disconnect power.



WARNING

Disconnect power before wiring, or electric shock, leakage, ignition or user injury due to short circuit can result.



CAUTION

Contact ratings are 250V, 3A AC (resistive load) or 30V, 3A DC (resistive load). Ensure the connected load is within these ratings, or the relay contacts can be damaged. If the load exceeds the ratings, use another relay or a device suitable for the load, between the load and the output terminal of the sensor.

6.1.2 Remove the cover of the housing.

6.2 Wiring

Connect cable to each terminal. Use a tool to tighten the screws. Terminal screws are of M4, so use a cable lug of R1.25-4 or an equivalent size.

6.2.1 The power rating of the sensor is 100 to 240V AC.

Connect power line on L and N terminals.

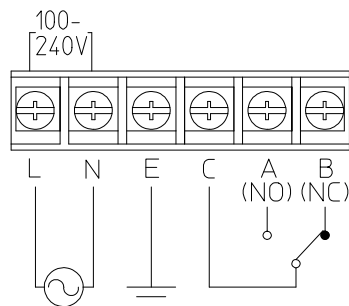


Fig. 6-2 Relay terminal



WARNING

Supplying power larger than 240V will result in overcurrent on the sensor to cause device damage or human injury.

6.2.2 When the material is detected, C-A (NO) closes and C-B (NC) opens.

When no material is detected, C-B (NC) closes and C-A (NO) opens.

Relay terminals C, A (NO), and B (NC) are dry contacts.

6.3 Cable inlet

Cable inlet is of G 1/2 or equivalent.

Cable can be fixed with a cable gland or by connecting a conduit to the housing. In both cases, lead the cable downward in front of the cable inlet to prevent water entry to the housing.

Secure the cable using sealing compound when a conduit is used and by tightening the gland with a proper tool when a cable gland is used, to prevent entry of dust, debris or rain water to the housing. If water or moisture can enter from inside the conduit, putty the inside.

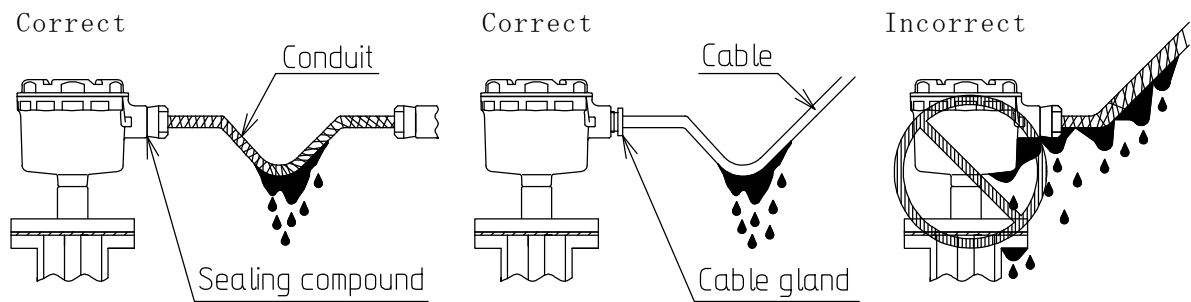


Fig. 6-3 Cable inlet type

6.4 Placing the cover

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

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

7. ADJUSTMENT

The sensor is factory calibrated to suit your application. However, operation can become unstable depending on conditions in the tank, or due to change of mounting or in material, and buildup affection. In these cases, make adjustment following steps in section 7.4 Sensitivity adjustment.

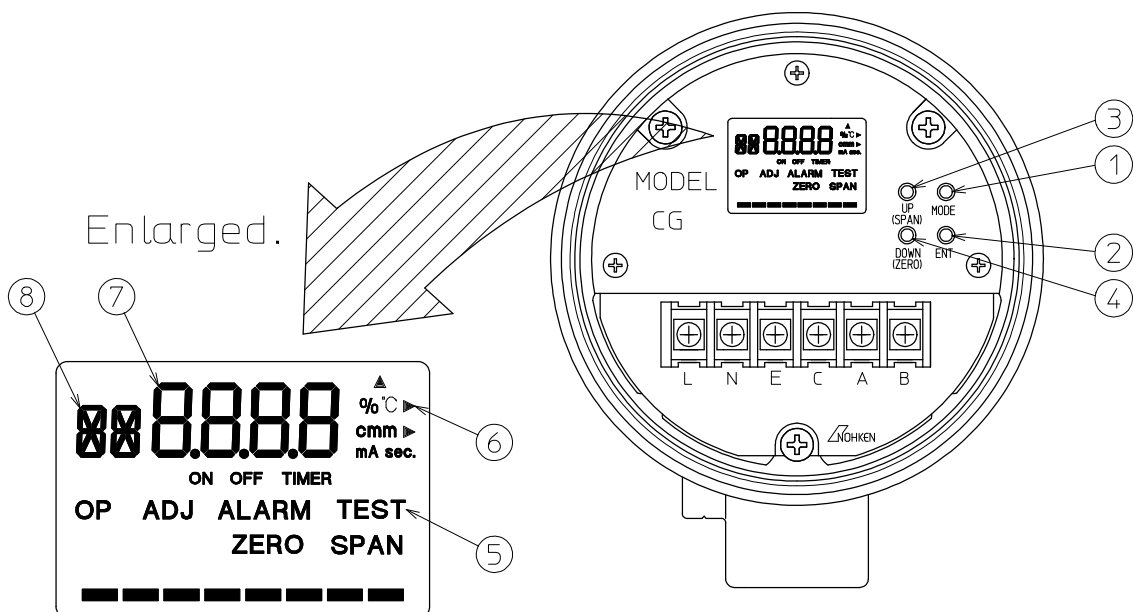
For other programming procedures, such as delay time and relay operation settings, see section 7.5.

If the sensor displays “ER”, then follow the steps in 7.6.

7.1 Before adjustment

7.1.1 Parts name

No.	Name	Function
1	Mode key (MODE)	Switches adjustment modes. Cancels entry.
2	Enter key (ENT)	Accepts or updates the setting. Opens parameter.
3	Up key (UP)	Scrolls modes, values, parameters
4	Down key (DOWN)	Scrolls modes, values, parameters
5	Mode area	Displays current mode.
6	Unit area	Displays unit.
7	Value area	Displays measured or set value or parameter
8	Maintenance mode area	Displays maintenance mode or parameter.



7.1.2 Supplying power

Supply power to the sensor.

The sensor will start operation and displays “current bar graph value” in the value area and “OP” in the mode area. The measurement will be unstable for 20 to 30 minutes after supplying power.

Wait for approximately 30 minutes before starting adjustment.



WARNING

During adjustment, the relay output can be switched, causing other devices to start or stop operation. Ensure controlled devices are not adversely affected, e.g. by disconnecting the relay output cable.



CAUTION

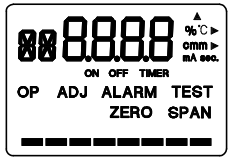
Pressing ENT while OP is flashing updates the new entries.
To cancel the entry, press MODE and DOWN for longer than 2 seconds while OP is flashing. Make adjustment again as necessary.

In the case of power interruption during adjustment, data that have not been updated will be lost. Make adjustment again after supplying power.

Mode M3 is a service mode for the maker.
When this Mode is opened, press MODE while OP is flashing to return to the measurement mode.

7.2 Key operation during adjustment

LCD and Keys

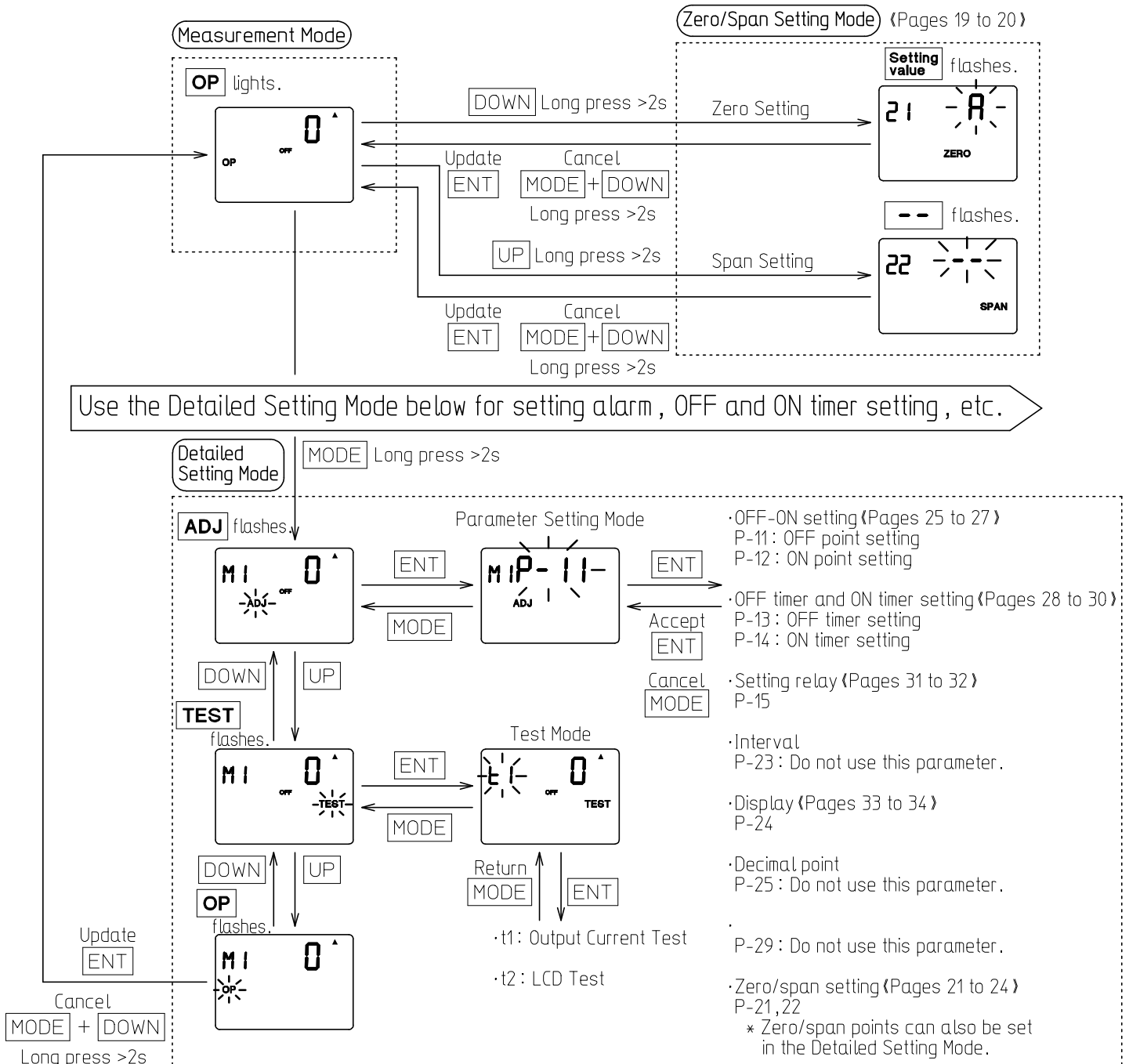


UP (SPAN) MODE
DOWN (ZERO) ENT

[Notes on units]
Unit in the Measurement mode is %. In the Zero/Span Setting Mode and Detailed Setting Mode, one of the following units, suitable for the set content, is displayed on the Unit area of LCD. (See 7.1.1 Parts Name)

% : Ratio of level to the measurement range
mA : Output current[mA DC]
mm : Level at the time of adjustment

[MODE] [ENT] [UP] [DOWN] mean keys to be pressed.



See pages 17 to 18 for parameter details.

If M3 is displayed, see page 15. If ER is displayed, see page 37.

7.3 Parameters

CG sensor has the following parameters.

(1) Parameter setting mode: ADJ parameter

P-11 OFF point (Default: 2) 《See pages 25 to 26》

Sets the point where the relay is de-energized. Select one out of the eight segments between zero and span points.

《Range: $1 \leq P-11 < \text{ON point}$ 》

P-12 ON point (Default: 7) 《See pages 26 to 27》

Sets the point where the relay is energized. Select one out of the eight segments between zero and span points.

《Range: $\text{OFF point} < P-12 \leq 8$ 》

P-13 OFF timer (Default: 1.0 sec.) 《See pages 28 to 29》

Sets the time until de-energizing the relay, after the material descends below the OFF point.

《Range: 0.0 to 25.5 sec.》

P-14 ON timer (Default: 1.0 sec.) 《See pages 29 to 30》

Sets the time until energizing the relay, after the material reaches the ON point.

《Range: 0.0 to 25.5 sec.》

P-15 Relay operation (Default: 0) 《See pages 31 to 32》

Sets the relay operation.

0 (ON) : energized when the sensor detects the material.

1 (OFF) : energized when the sensor does not detect the material.

P-21 Zero point (Default: 1.000) 《See pages 23 to 24》

Sets the zero point.

P-22 Span point (Default: 1.080) 《See pages 21 to 22》

Sets the span point.

P-23 Interval (Default: 0.3 sec.)

Sets the time interval between measurements (sampling interval).

* Usually not necessary to be changed.

- P-24 Display (Default: 1) 《See pages 33 to 34》
Sets the information to be displayed on the LCD.
- 1: Number of segment of the bar graph
 - 2: Dielectric constant
 - 3: Resonant frequency
- P-25 Decimal point (Default: FLOt) (floating decimal point)
Sets the number of digits after the decimal point when P-24 is set to “2 (Dielectric constant)”.
- * Usually not necessary to be changed.
- P-29 Auto sensitivity adjustment (Default: A)
Sets the dielectric constant value used for operation from the zero point (P-21) or the span point (P-22).
- * Usually not necessary to be changed.

(2) Test mode: TEST parameter

- t1 Alarm test
Tests the alarm operation. Change the bar graph for this purpose.
- t2 LCD test
Checks the LCD operation.
- Procedure:
1. In the Adjustment Mode, press UP or DOWN until the “TEST” flashes.
 2. Press ENT to enter the TEST Mode. Then press UP or DOWN until “t2” flashes.
 3. Press ENT. Each segment will light one after another.
 4. Press MODE to finish the test and return to the Adjustment Mode .
 5. Press UP or DOWN until “OP” flashes. Press ENT to return to the Measurement Mode.

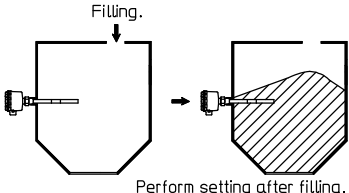
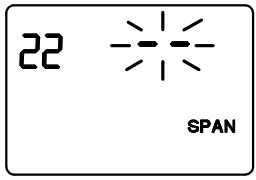
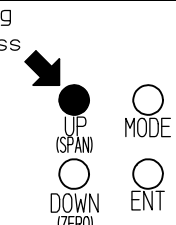
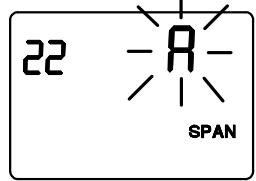
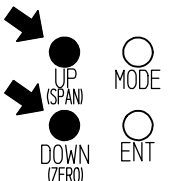
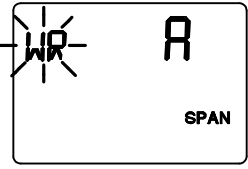
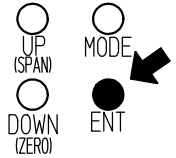
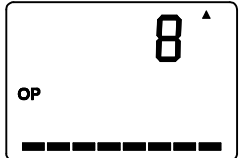
7.4 Sensitivity setting (Zero / Span setting)

Always perform the zero and span setting after mounting the sensor on a tank. Perform sensitivity setting when adjustment or re-calibration is needed due to change of tank inside conditions, mounting or measured material, or buildup affection.

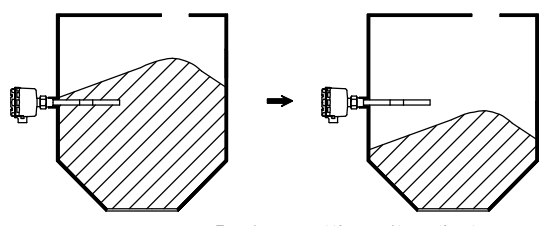
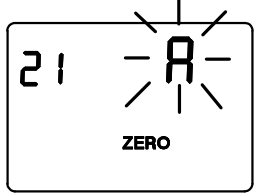
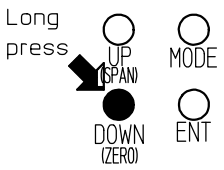
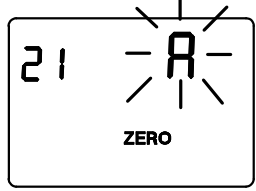
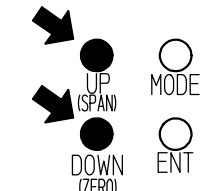
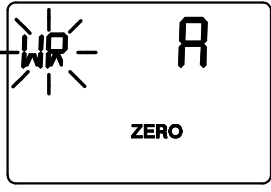
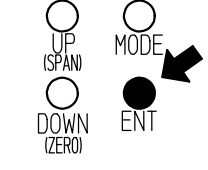

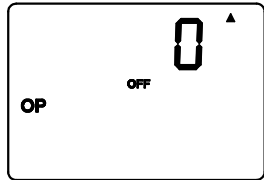
7.4.1 Easy sensitivity setting

Setting either zero or span point causes the other point to be automatically set. Saves the user from entering both values.

(A) Span setting

Procedure	LCD	Key																
<p>(1) Ensure the sensor is in operation. Fill the tank until the material covers the electrode. Use the tank and the material used for the actual application.</p>																		
<p>(2) Press UP for longer than 2 seconds. “22”, “SPAN” will light and “OP” will flash.</p>		<p>Long press</p> 																
<p>(3) Press UP or DOWN to select the desired sensitivity class. See the table below for reference.</p> <table border="1" data-bbox="199 1153 837 1500"> <thead> <tr> <th>Sensitivity class</th> <th>Capacity [pF Min.]</th> </tr> </thead> <tbody> <tr> <td>AA</td> <td>Do not select.</td> </tr> <tr> <td>A</td> <td>0.5 or equivalent</td> </tr> <tr> <td>B1</td> <td>2 or equivalent</td> </tr> <tr> <td>B2</td> <td>5 or equivalent</td> </tr> <tr> <td>C</td> <td>Do not select.</td> </tr> <tr> <td>D</td> <td>Do not select.</td> </tr> <tr> <td>--</td> <td>No setting</td> </tr> </tbody> </table>	Sensitivity class	Capacity [pF Min.]	AA	Do not select.	A	0.5 or equivalent	B1	2 or equivalent	B2	5 or equivalent	C	Do not select.	D	Do not select.	--	No setting		 <div data-bbox="909 1310 1452 1456" style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">CAUTION</p> <p>When the zero point has already been set, select “--”.</p> </div>
Sensitivity class	Capacity [pF Min.]																	
AA	Do not select.																	
A	0.5 or equivalent																	
B1	2 or equivalent																	
B2	5 or equivalent																	
C	Do not select.																	
D	Do not select.																	
--	No setting																	
<p>(4) Press ENT. “WR” lights for about 5 seconds. New entries have been saved, and the sensor will return to the measurement mode. * New entries are being saved in the microcomputer while WR is on.</p>	<p>For 5 seconds (setting being updated.)</p>   <p>New entries are saved and the sensor returns to the measurement mode.</p> 																	

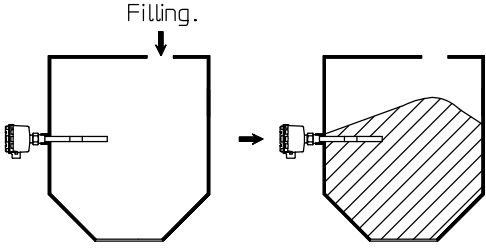
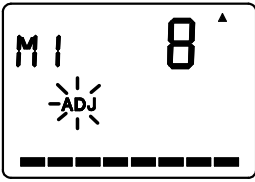
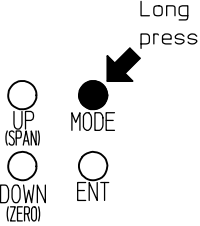
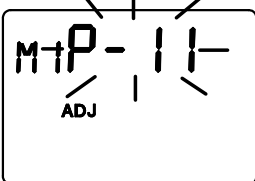
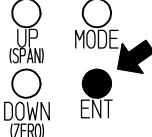
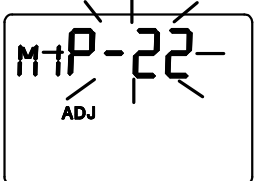
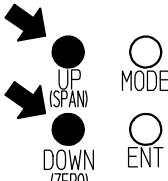
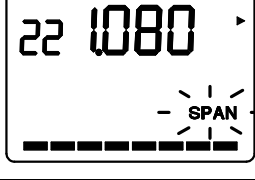
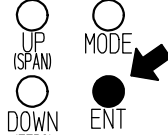
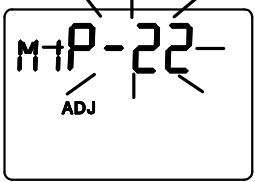
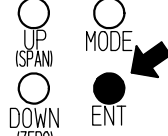
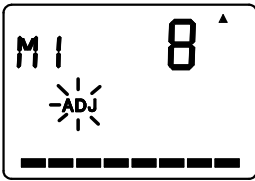
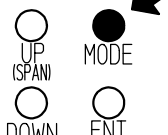
(B) Zero setting

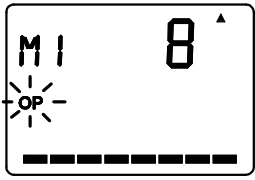
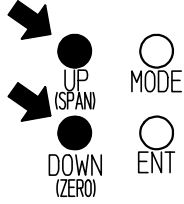
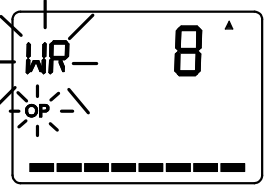

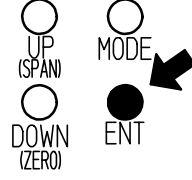
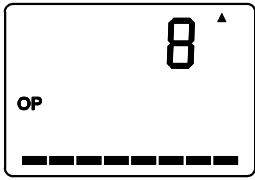
Procedure	LCD	Key																
<p>(1) Ensure the sensor is in operation. Discharge the material until the surface is at least 100mm below the electrode. Use the tank used for the actual application.</p>	 <p>Discharge. ↓ Perform setting after discharge.</p>																	
<p>(2) Press DOWN for longer than 3 seconds. "21", "ZERO" will light and the current sensitivity class value will flash.</p>		<p>Long press</p> 																
<p>(3) Press UP or DOWN to select the desired sensitivity class. See the table below for reference.</p> <table border="1" data-bbox="199 896 845 1232"> <thead> <tr> <th>Sensitivity class</th> <th>Capacity [pF Min.]</th> </tr> </thead> <tbody> <tr> <td>AA</td> <td>Do not select.</td> </tr> <tr> <td>A</td> <td>0.5 or equivalent</td> </tr> <tr> <td>B1</td> <td>2 or equivalent</td> </tr> <tr> <td>B2</td> <td>5 or equivalent</td> </tr> <tr> <td>C</td> <td>Do not select.</td> </tr> <tr> <td>D</td> <td>Do not select.</td> </tr> <tr> <td>--</td> <td>No setting</td> </tr> </tbody> </table>	Sensitivity class	Capacity [pF Min.]	AA	Do not select.	A	0.5 or equivalent	B1	2 or equivalent	B2	5 or equivalent	C	Do not select.	D	Do not select.	--	No setting		 <div data-bbox="917 1019 1452 1198" style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">⚠ CAUTION</p> <p>When the span point has already been set, or when "AA", "C" or "D" is displayed, select "--".</p> </div>
Sensitivity class	Capacity [pF Min.]																	
AA	Do not select.																	
A	0.5 or equivalent																	
B1	2 or equivalent																	
B2	5 or equivalent																	
C	Do not select.																	
D	Do not select.																	
--	No setting																	
<p>(4) Press ENT. "WR" lights for about 5 seconds. New entries have been saved, and the sensor will return to the measurement mode.</p> <p>* New entries are being saved in the microcomputer while WR is on.</p>	<p>For 5 seconds (setting being updated.)</p>    <p>New entries are saved and the sensor returns to the measurement mode.</p> 																	

7.4.2 Zero / Span Setting

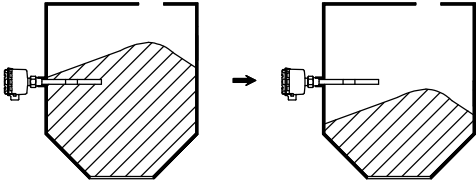
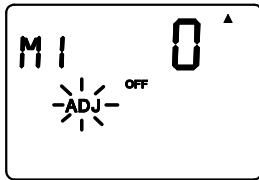
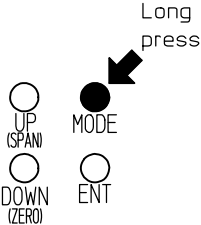
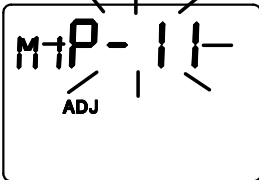
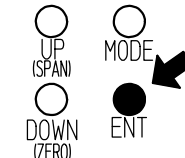
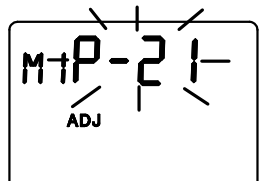
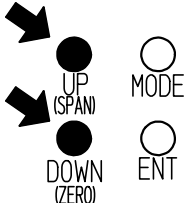
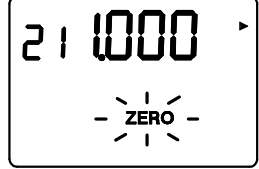
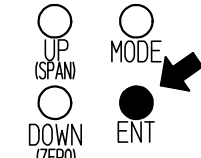
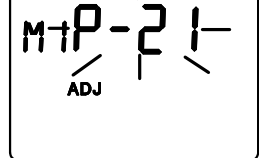
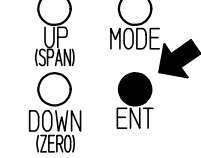
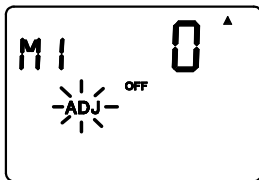
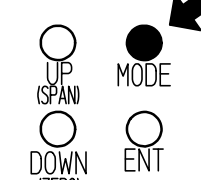
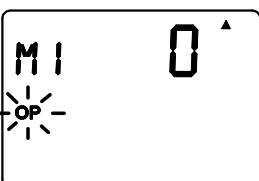
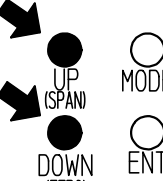
Perform the zero and span setting from the setting mode.

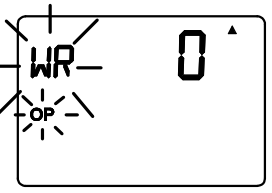

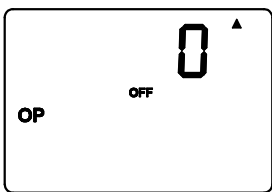
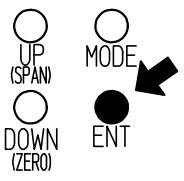
(A) Span setting

Procedure	LCD	Key
<p>(1) <> Ensure the sensor is in operation. Fill the tank until the material covers the electrode. Use the tank and the material used for the actual application.</p>	 <p style="text-align: center;">Filling.</p> <p style="text-align: center;">Perform setting after filling.</p>	
<p>(2) Press MODE for longer than 2 seconds. “M1” will light and “ADJ” will flash.</p>		 <p style="text-align: right;">Long press</p>
<p>(3) Press ENT. “P-11” will flash.</p>		
<p>(4) Press UP or DOWN until “P-22” flashes.</p>		
<p>(5) Press ENT. “22” will light and “SPAN” will flash. The current value will be displayed.</p>		
<p>(6) Press ENT to accept the new value. “M1” will light, “P-22” will flash, and the sensor will be in the state in step 4.</p>		
<p>(7) Press MODE. “ADJ” will flash, and the sensor will be in the state in step 2.</p>		

Procedure	LCD	Key
(8) Press UP or DOWN until "OP" flashes.		
<p>(9) Press ENT.</p> <p>"WR" lights for about 3 seconds. New entries have been saved, and the sensor will return to the measurement mode.</p> <p>* New entries are being saved in the microcomputer while WR is on.</p>	<p>For 3 seconds (setting being updated.)</p>    <p>New entries are saved and the sensor returns to the measurement mode.</p> 	

(B) Zero setting

Procedure	LCD	Key
<p>(1) <<Zero setting>> Ensure the sensor is in operation. Discharge the material until the surface is at least 100mm below the electrode. Use the tank used for the actual application.</p>		
<p>(2) Press MODE for longer than 2 seconds. "M1" will light and "ADJ" will flash.</p>		
<p>(3) Press ENT. "P-11" will flash.</p>		
<p>(4) Press UP or DOWN until "P-21" flashes.</p>		
<p>(5) Press ENT. "21" will light and "ZERO" will flash. The current value will be displayed.</p>		
<p>(6) Press ENT to accept the new value. "M1" will light, "P-21" will flash, and the sensor will be in the state in step 4.</p>		
<p>(7) Press MODE. "ADJ" will flash, and the sensor will be in the state in step 2.</p>		
<p>(8) Press UP or DOWN until "OP" flashes.</p>		

Procedure	LCD	Key
<p>(9) Press ENT. "WR" lights for about 3 seconds. New entries have been saved, and the sensor will return to the measurement mode. * New entries are being saved in the microcomputer while WR is on.</p>	<p>For 3 seconds (setting being updated.)</p>   <p>New entries are saved and the sensor returns to the measurement mode.</p> 	

REFERENCE

Zero and span points are factory set to 1.00 and 1.080 (sensitivity class A) respectively, unless the user has specified otherwise. Change the zero and span points to suit the application.

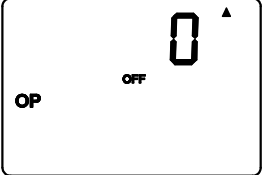
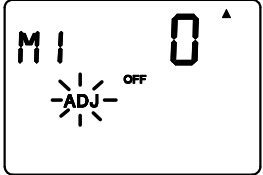
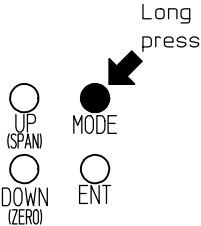
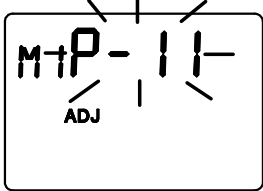
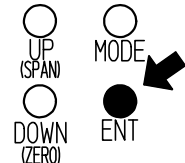
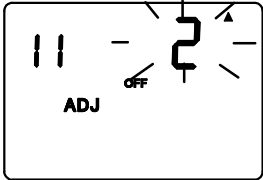
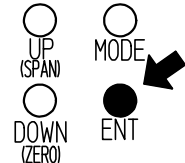
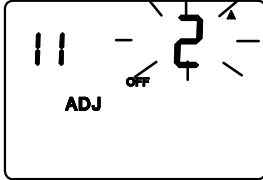
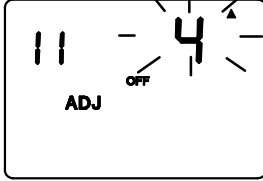
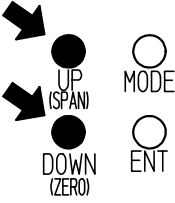
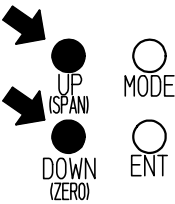
7.5 Setting alarm

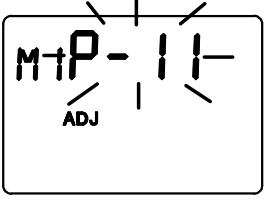
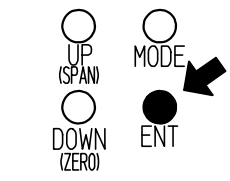
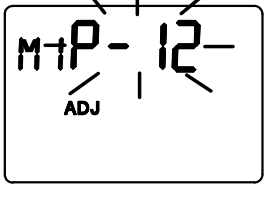
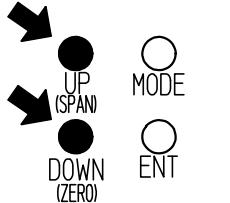
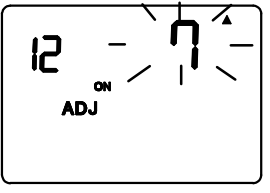
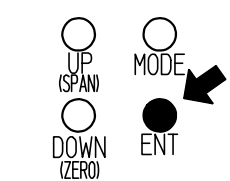
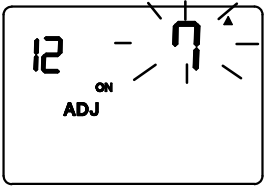
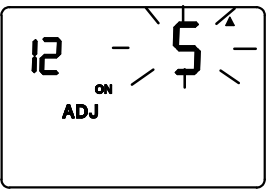
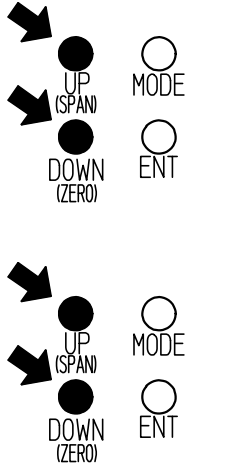
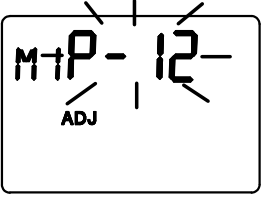
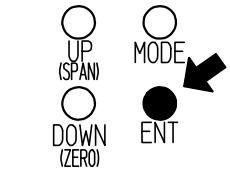
7.5.1 OFF-ON setting

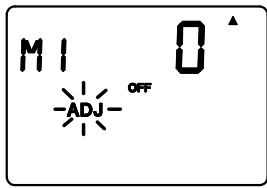
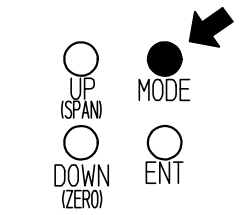
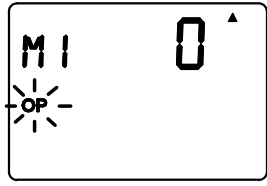
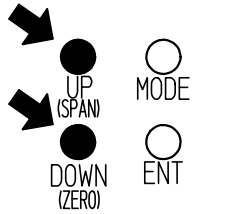
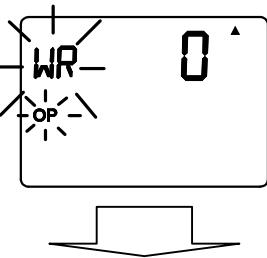
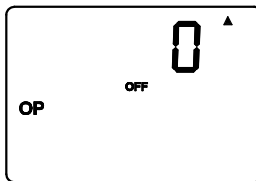
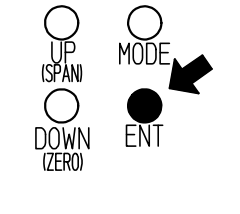
Alarm points (OFF, ON) can be set to any of the eight segments between zero and span points where sensitivity adjustment is made.

OFF point can be set between 1 and ON point. ($1 \leq \text{OFF point} < \text{ON point}$)

ON point can be set between OFF point and 8. ($\text{OFF point} < \text{ON point} \leq 8$)

Procedure	LCD	Key
(1) Ensure the sensor is in operation.		
(2) Press MODE for longer than 2 seconds. "M1" will light and "ADJ" will flash.		
(3) Press ENT. "ADJ" will light, and "P-11" will flash. * Proceed to step 7 <<ON point setting>> when setting the ON point only.		
(4) <<OFF point setting>> Press ENT. "11" will light, and the current value for OFF point will flash. (Reference: 2)		
(5) Press UP or DOWN to select a desired value. Note that the OFF point must not be higher than the ON point.	<p data-bbox="951 1480 1155 1509">If set to 2.</p>  <p data-bbox="951 1749 1155 1778">If set to 4.</p> 	 

Procedure	LCD	Key
<p>(6) Press ENT to accept the new value. “M1” will light, “11” will flash, and the display will return to that in step 3. * Proceed to step 11 <<Saving new values>> when the ON point is not to be set.</p>		
<p>(7) <<ON point setting>> Press UP or DOWN until “P-12” flashes.</p>		
<p>(8) Press ENT. “12” will light, and the current value for ON point will flash. (Reference: 7)</p>		
<p>(9) Press UP or DOWN to select a desired value. Note that the ON point must not be lower than the OFF point.</p>	<p>If set to 7.</p>  <p>If set to 5.</p> 	
<p>(10) Press ENT to accept the new value. “M1” will light, “P-12” will flash, and the display will return to that in step 7.</p>		

Procedure	LCD	Key
<p>(11) <<Saving new values>> Press MODE. "ADJ" will flash, and the sensor will be in the state in step 2.</p>		
<p>(12) Press UP or DOWN until "OP" flashes.</p>		
<p>(13) Press ENT. "WR" lights for about 3 seconds, "OP" flashes. New entries have been saved, and the sensor will return to the measurement mode. * New entries are being saved in the microcomputer while WR is on.</p>	<p>For 3 seconds (setting being updated.)</p>   <p>New entries are saved and the sensor returns to the measurement mode.</p>	

REFERENCE

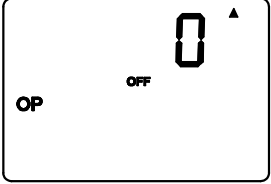
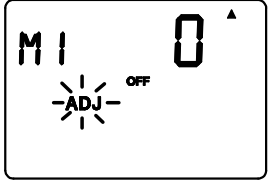
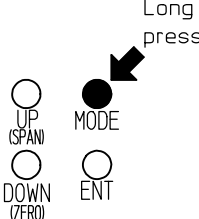
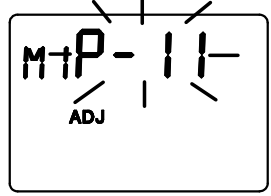
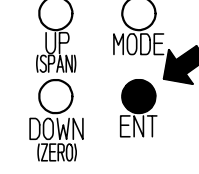
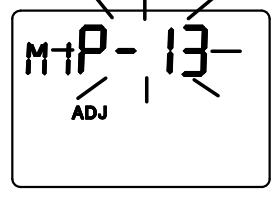
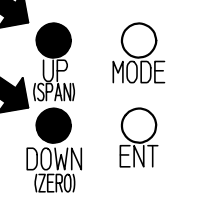
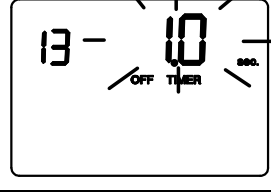
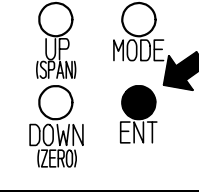
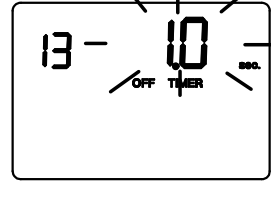
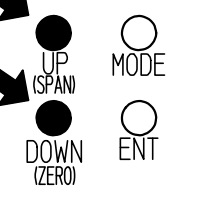
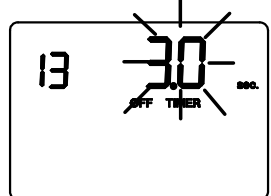
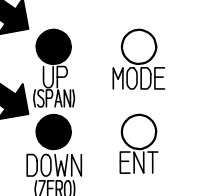
OFF and ON points are factory set to 2 and 7 respectively.

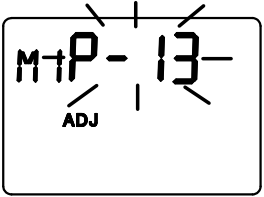
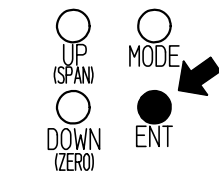
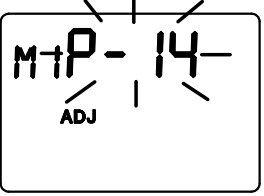
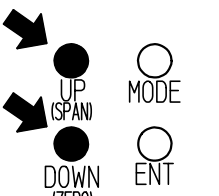
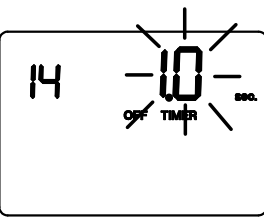
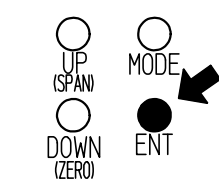
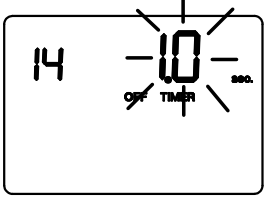
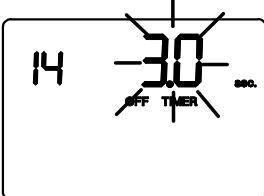
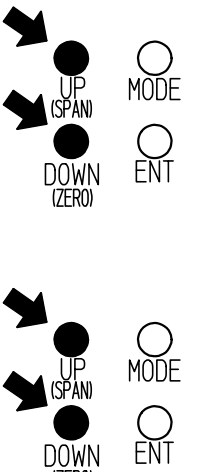
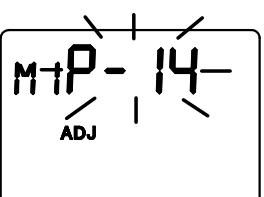
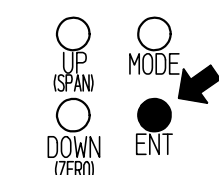
Change the settings to suit your application, by e.g. reducing hysteresis, or setting the OFF/ON points close to the zero or span.

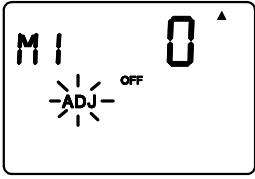
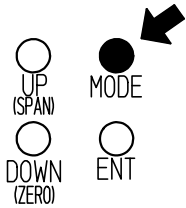
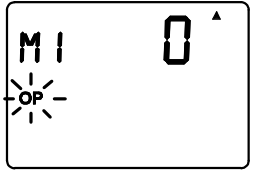
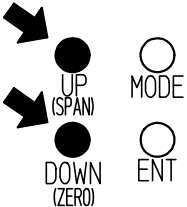
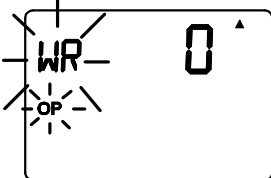

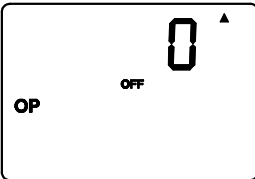
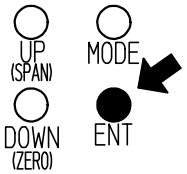
7.5.2 OFF timer and ON timer setting

For OFF timer, set the time before de-energizing the relay after the sensor switches to a non-detection state (reading below the OFF point). The range is 0.0 to 25.5 seconds.

For ON timer, set the time before energizing the relay after the sensor detects the material (reading over ON point). The range is 0.0 to 25.5 seconds.

Procedure	LCD	Key
(1) Ensure the sensor is in operation.		
(2) Press MODE for longer than 2 seconds. "M1" will light and "ADJ" will flash.		
(3) Press ENT. "ADJ" will light, and "P-11" will flash. * Proceed to step 8 <<ON timer setting>> when setting the ON timer only.		
(4) <<OFF timer setting>> Press UP or DOWN until "P-13" flashes.		
(5) Press ENT. "13" will light and the displayed value will flash.		
(6) Press UP or DOWN to change the value. Set range: 0.0 to 25.5 seconds (factory set: 1.0 seconds)	<p>If set to 1.0.</p> 	
	<p>If set to 3.0.</p> 	

Procedure	LCD	Key
<p>(7) Press ENT to accept the new value. “M1” will light, “P-13” will flash, and the display will return to that in step 4. * Proceed to step 12 <<Saving new values>> when the ON timer is not to be set.</p>		
<p>(8) <<ON timer setting>> Press UP or DOWN until “P-14” flashes.</p>		
<p>(9) Press ENT. “14” will light and the displayed value will flash.</p>		
<p>(10) Press UP or DOWN to change the value. Set range: 0.0 to 25.5 seconds (factory set: 1.0 seconds)</p>	<p>If set to 1.0.</p>  <p>If set to 3.0.</p> 	
<p>(11) Press ENT to accept the new value. “M1” will light, “P-14” will flash, and the display will return to that in step 8.</p>		

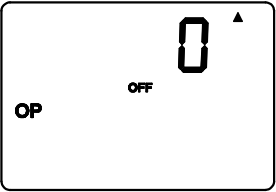
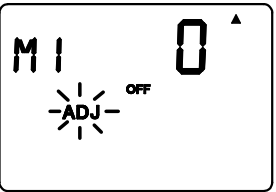
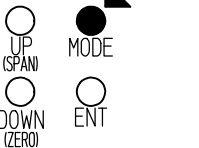
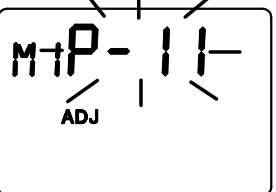
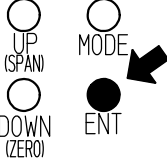
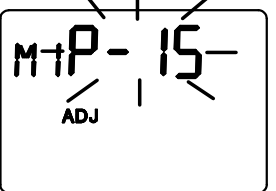
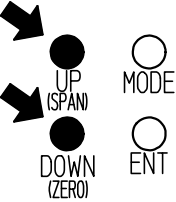
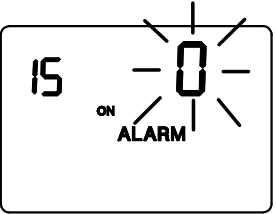
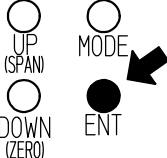
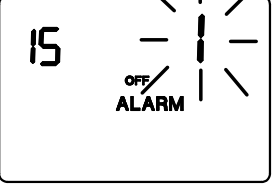
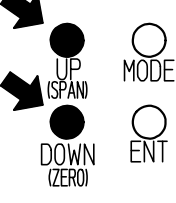
Procedure	LCD	Key
<p>(12) <<Saving new values>> Press MODE. "ADJ" will flash, and the sensor will be in the state in step 2.</p>		
<p>(13) Press UP or DOWN until "OP" flashes.</p>		
<p>(14) Press ENT. "WR" lights for about 3 seconds, "OP" flashes. New entries have been saved, and the sensor will return to the measurement mode. * New entries are being saved in the microcomputer while WR is on.</p>	<p>For 3 seconds (setting being updated.)</p>   	 <p>New entries are saved and the sensor returns to the measurement mode.</p>

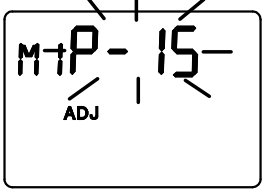
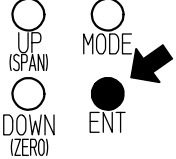
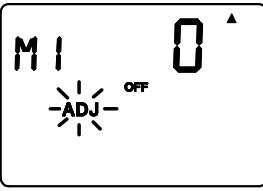
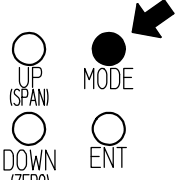
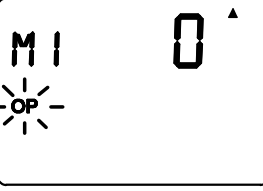
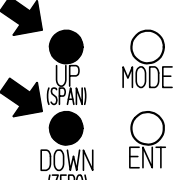
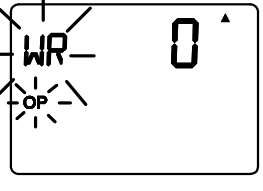

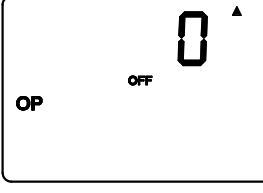
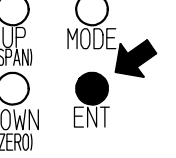
REFERENCE

Both the ON and OFF timers are factory set to 1.0 second.
 Change the settings to suit your application.

7.5.3 Setting relay

Follow the steps below to set relay operation.

Procedure	LCD	Key
(1) Ensure the sensor is in operation.		
(2) Press MODE for longer than 2 seconds. "M1" will light and "ADJ" will flash.		<p>Long press</p> 
(3) Press ENT. "M1" will light, and "P-11" will flash.		
(4) Press UP or DOWN until "P-15" flashes.		
(5) Press ENT. "15" will light and the displayed value will flash.		
(6) Press UP or DOWN to change the value. - "0" (ON) energizes relay when material is detected. - "1" (OFF) energizes relay when material is not detected.		

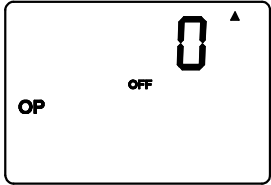
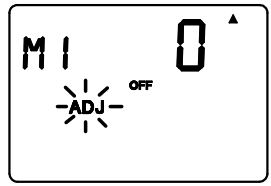
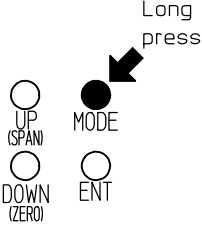
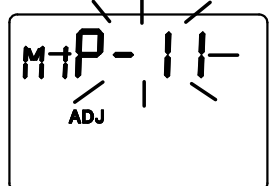
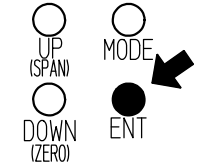
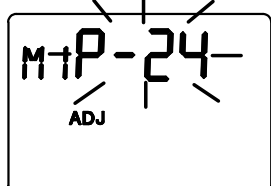
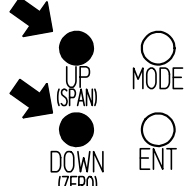
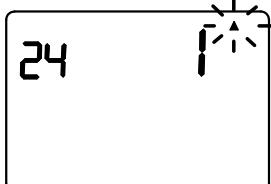
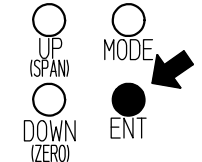
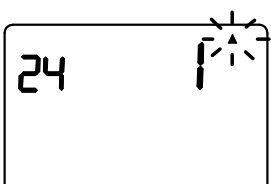
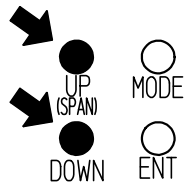
Procedure	LCD	Key
<p>(7) Press ENT to accept the new value. The display will return to that in step 4.</p>		
<p>(8) Press MODE. "ADJ" will flash, and the sensor will be in the state in step 2.</p>		
<p>(9) Press UP or DOWN until "OP" flashes.</p>		
<p>(10) Press ENT. "WR" lights for about 3 seconds, "OP" flashes. New entries have been saved, and the sensor will return to the measurement mode. * New entries are being saved in the microcomputer while WR is on.</p>	<p>For 3 seconds (setting being updated.)</p>    <p>New entries are saved and the sensor returns to the measurement mode.</p>	

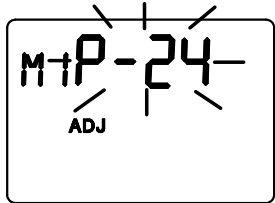
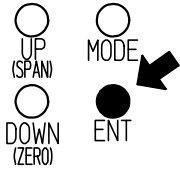
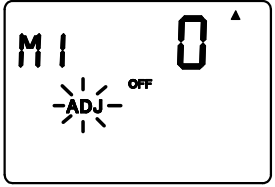
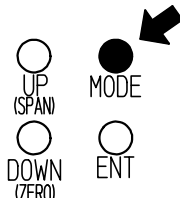
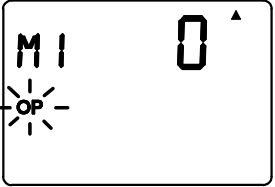
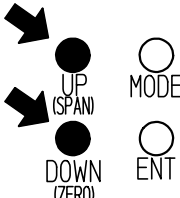
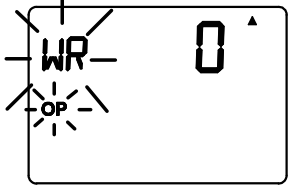

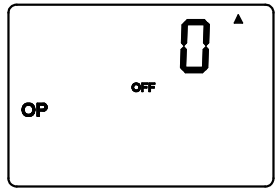
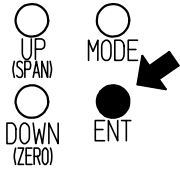
REFERENCE

Relay operation is factory set to be energized when the material is detected ("0" (ON)). Change the setting as required.

7.5.4 Display setting

Data to display during operation is selected.

Procedure	LCD	Key
(1) Ensure the sensor is in operation.		
(2) Press MODE for longer than 2 seconds. "M1" will light and "ADJ" will flash.		
(3) Press ENT. "M1" will light, and "P-11" will flash.		
(4) Press UP or DOWN until "P-24" flashes.		
(5) Press ENT. "24" will light and unit area will flash. The current value will be displayed.		
(6) Press UP or DOWN to select the desired data display. 1: Number of segment of the bar graph 2: Dielectric constant 3: Resonant frequency		

Procedure	LCD	Key
<p>(7) Press ENT to accept the new value. The display will return to that in step 4.</p>		
<p>(8) Press MODE. "ADJ" will flash, and the sensor will be in the state in step 2.</p>		
<p>(9) Press UP or DOWN until "OP" flashes.</p>		
<p>(10) Press ENT. "WR" lights for about 3 seconds, "OP" flashes. New entries have been saved, and the sensor will return to the measurement mode. * New entries are being saved in the microcomputer while WR is on.</p>	<p>For 3 seconds (setting being updated.)</p>   <p>New entries are saved and the sensor returns to the measurement mode.</p> 	

REFERENCE

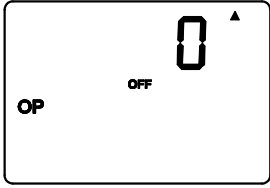
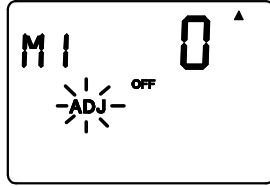
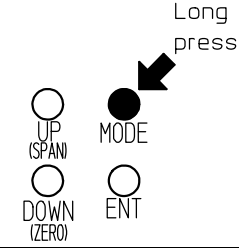
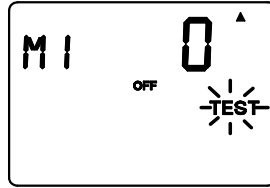
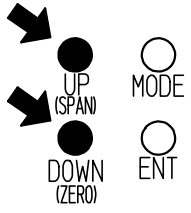
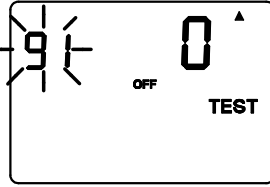
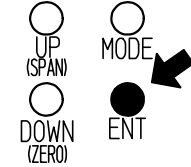
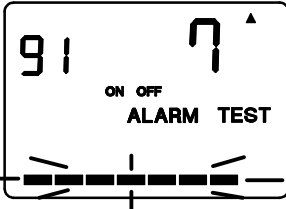
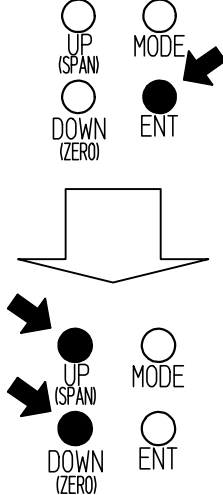
Data display is factory set to "1: bar graph". Change it as required.

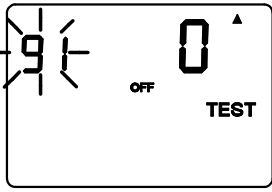
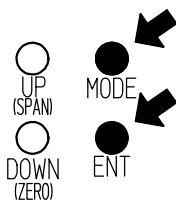
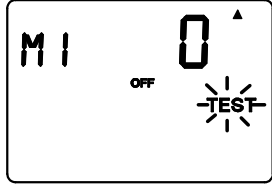
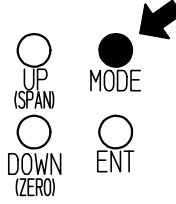
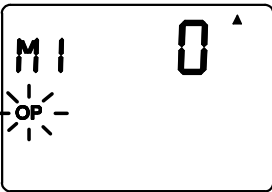
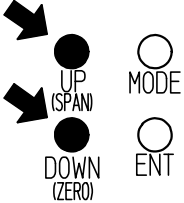
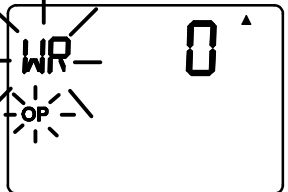

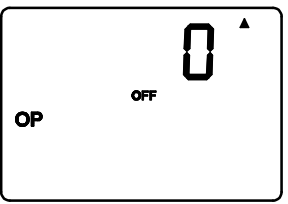
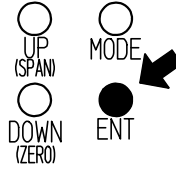
7.5.5 Alarm check

Alarm output can be checked without filling or discharging.

⚠ WARNING

During this check, the relay output can be switched to start or stop other devices, causing problem.
 Disconnect relay output cable or ensure controlled devices are not adversely affected beforehand.

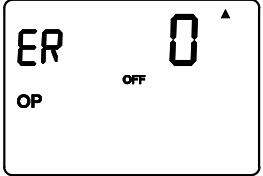
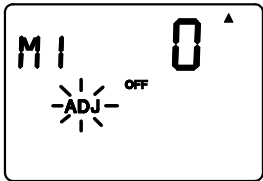
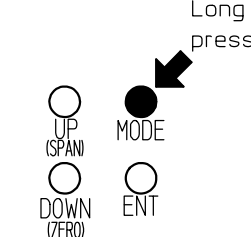
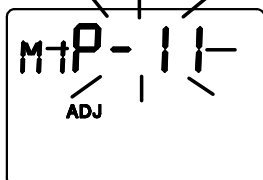
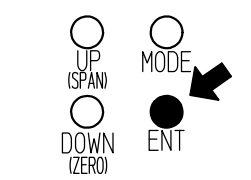
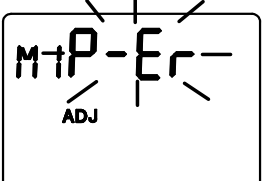
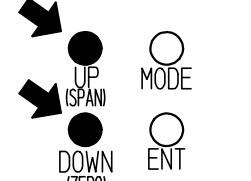
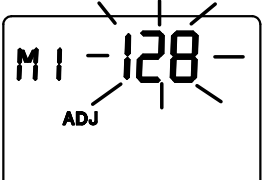
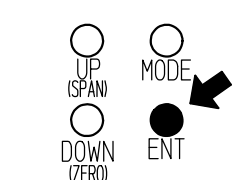
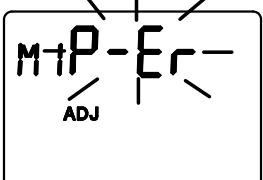
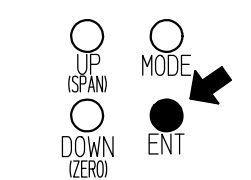
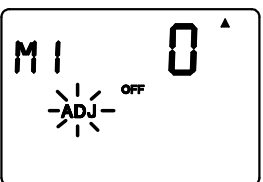
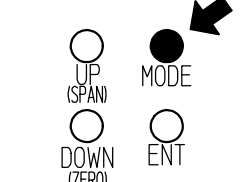
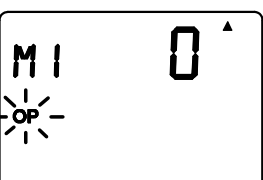
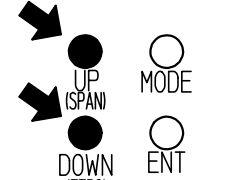
Procedure	LCD	Key
(1) Ensure the sensor is in operation.		
(2) Press MODE for longer than 2 seconds. "M1" will light and "OP" will flash.		
(3) Press UP or DOWN until "91" flashes.		
(4) Press ENT. "TEST" will light and "91" will flash.		
(5) Press ENT. Press UP or DOWN to change the displayed value and the bar graph. Ensure the alarm output corresponding to the value is given.		

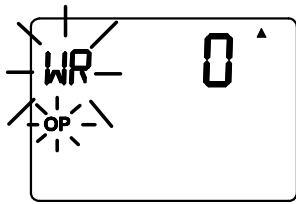
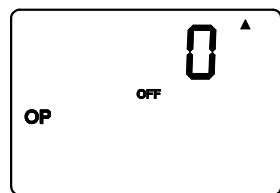
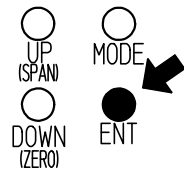
Procedure	LCD	Key
<p>(6) Press ENT or MODE. “91” will flash, and the current reading and corresponding bar graph will be displayed.</p>		
<p>(7) Press MODE. “M1” will light and “TEST” will flash.</p>		
<p>(8) Press UP or DOWN until “OP” flashes.</p>		
<p>(9) Press ENT. “WR” lights for about 3 seconds, “OP” flashes. The sensor will return to the measurement mode.</p>	<p>For 3 seconds</p>   <p>The sensor returns to the measurement mode.</p> 	

7.6 Deactivating the warning

If ER is displayed during operation, follow the steps below to cancel the display and deactivate the warning.

ER display does not affect operation.

Procedure	LCD	Key
(1) Ensure the sensor is in operation.		
(2) Press "MODE" for longer than 2 seconds. "M1" will light and "OP" will flash.		
(3) Press ENT. "M1" will light and "P-11" will flash.		
(4) Press UP or DOWN until "P-Er" flashes.		
(5) Press ENT. "128" will light.		
(6) Press ENT. "P-Er" will flash, and warning will be deactivated.		
(7) Press MODE. "ADJ" will flash, and the sensor will be in the state in step 2.		
(8) Press UP or DOWN until "OP" flashes.		

Procedure	LCD	Key
<p>(9) Press ENT. “WR” lights for about 3 seconds, “OP” flashes. New entries have been saved, and the sensor will return to the measurement mode. * Warning is being cleared while WR is displayed.</p>	<p>For 3 seconds (setting being updated.)</p>  <p>New entries are saved and the sensor returns to the measurement mode.</p> 	

REFERENCE

Warning indicator “ER” is displayed when the reading is outside the range, and remains displayed until the warning is deactivated. The sensor operates normally even with this indication.

7.7 Parameter list

Utilize the following list in setting the parameters.

P-No.	Parameter	【Default】	Range	Setting
P-11	OFF point	【2】	$1 \leq P-11 < \text{ON point}$	
P-12	ON point	【7】	$\text{OFF point} < P-12 \leq 8$	
P-13	OFF timer	【1.0sec】	0.0~25.5sec	
P-14	ON timer	【1.0sec】	0.0~25.5sec	
P-15	Relay operation	【0】	0 (ON): energized when the sensor detects the material. 1(OFF): energized when the sensor does not detect the material.	
P-21	Zero point	【1.000】		
P-22	Span point	【1.080】		
P-23	Interval	【0.3sec】	0.1~25.5sec	
P-24	Display	【1】	1: Number of segment of the bar graph 2: Dielectric constant 3: Resonant frequency	
P-25	Decimal point	【FL0t】	Sets the number of significant figures to display.	
P-29	Auto sensitivity adjustment	【A】		
t1	Alarm test			
t2	LCD test			

8. MAINTENANCE AND INSPECTION

The sensor has to be removed from the tank for maintenance.

Read section 4. Handling Notes beforehand and ensure ample space for maintenance.

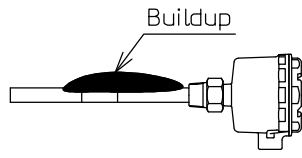
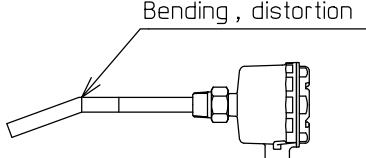
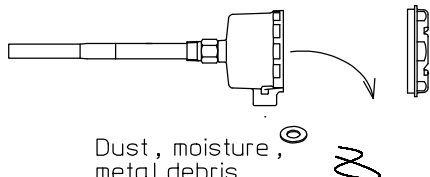
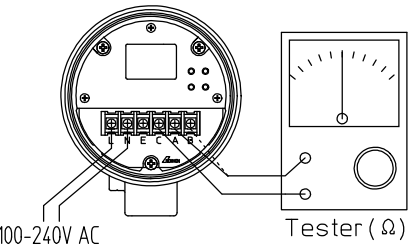


WARNING

Disconnect power before maintenance, or electric shock, leakage, or ignition or user injury due to short circuit can result.

8.1 Maintenance procedure

Perform maintenance and inspection once or twice a year. More frequent maintenance will be required depending on operating conditions such as frequency of use, material type, temperature and pressure.

<p>8.1.1 Check for buildup on electrode and clean it if any.</p>	
<p>8.1.2 Check for visible damage which may impair performance. Repair or replace (*1) if any.</p>	
<p>8.1.3 Check housing inside for condensation, dust or metal debris, and remove if any.</p>	
<p>8.1.4 Supply power to the sensor. Connect lead wire between the measurement electrode and the earth electrode to create short circuit, and check if the relay operates correctly. Check it using a tester or a buzzer. If the relay operates incorrectly, it needs to be repaired.</p>	

Contact our sales office in the event of fault.

*1 Contact our sales office for repair or replacement.

8.2 When to replace the sensor

Replace components when they show symptoms described in the table below. All new components must be of the same specification and provided by Nohken. Be careful since some components look the same but are of different specifications.

Component	When to replace
Housing	Fault due to corrosion or other causes that may impair insulation is observed.
Circuit board	Corrosion or damage that may impair performance is observed.
Electrode	Corrosion or damage that may impair performance is observed.

9. STORING

Observe instructions below when storing the sensor after delivery before use, or after removing from the tank. Failure to do so can result in operation failure.

9.1 Store the sensor indoors in the following conditions.

- Temperature: -10 to +60°C
- Humidity: 85%RH Max.
- Atmosphere: (1) not corrosive (without NH₃, SO₂, or Cl₂)
(2) without excessive dust
- No excessive vibration or shock

<p>9.2 Place the cover on the housing, and a protective board at the cable inlet. Without them, dust will enter the housing. Place the sensor such that the cable inlet points downward.</p>	
<p>9.3 Remove buildup. Buildup on the electrode can harden and adversely affect operation the next time used.</p>	
<p>9.4 Place wood piece or other support to prevent the detector from rolling or being bent, or insulator pipe from damage. For a sensor with a detector of 2000mm or longer, provide a support every 1000mm to prevent it from sagging.</p>	
<p>9.5 Do not place anything on the sensor, or excessive force can be applied to deform or damage the sensor.</p>	

REFERENCE

Wrap the sensor with polyethylene sheet and seal it to protect from moisture and dust. If the sensor is stored where temperature change is enormous, enclose desiccant such as silica gel in the polyethylene sheet.

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 alarm given with material exceeding the detection point. (Overfill resulted.)	Sensitivity too low.	Adjust sensitivity.	7.4
	Angle of repose affection.	Relocate the sensor.	5.2.1 (6)
	Bridge affection.	Relocate the sensor.	5.2.1 (8)
	Incorrect wiring.	Wire correctly.	6
	Sensor (circuit and electrode) damaged.	Replace damaged components. (*1)	
Alarm given without level reaching the detection point. (Relay gives output regardless of level change.)	Sensitivity too high.	Adjust sensitivity.	7.4
	Deposit affection.	Relocate the sensor.	5.2.1 (7)
	Insulation failure of the electrode.	Remove cause and make adjustment again.	
	Incorrect wiring.	Wire correctly.	6
	Sensor (circuit and electrode) damaged.	Replace damaged components. (*1)	

The causes shown above are for when the relay is set to energize when the sensor detects the material.

*1 Contact our sales office in the event of repair or replacement.

11. GLOSSARY

Terms used in this manual are defined in the chart below. This chart excludes the terms which have already been defined earlier in this manual.

Threaded connection	Threaded component to mount the sensor on a tank.
Flange	Component to mount the sensor on a tank using bolts and nuts.
Capacitor	Electrical component that has two electrodes and stores capacitance.
Capacitance	Value (C) gained when electric charge is applied between two electrodes, calculated using the following formula. $C = Q / V$, where Q = load given between two electrodes V = potential between the electrodes
Relay	Component whose contacts opens or closes when coil is energized. Closes its contacts to give an alarm output when material touches or covers the electrode.
Stillpipe	Pipe to protect the sensor from excessive turbulence or flow to prevent faulty operation.
Angle of repose	Angle between the horizontal surface and the surface of pile formed by granular substance poured on a horizontal surface.
Deposit	Solid remaining inside the cone of the tank. The amount depends on the angle of the cone.
Bridge	Material forming itself into the shape of a bridge in the tank.
Guard	Plate or pipe to protect the sensor against being deformed by force due to falling or flowing material.
Vibrator	Device that vibrates the tank from outside to remove buildup or deposit on the tank wall.
Knocker	Device that gives shocks to the tank from outside to remove buildup or deposit on the tank wall.
Sunshield	Component to be placed over the housing to protect it from direct sunlight.
Viscosity	Measure of resistance of a fluid.

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