ＩＮＳＴＲＵＣＴＩＯＮ　ＭＡＮＵＡＬ

ＦＯＲ

CAPACITIVE PHASE LEVEL MEASUREMENT

MODEL:ＣＧ３００

Revision　2012-08-09

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.

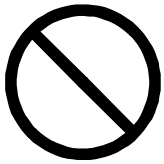
The following are the description of the terms in this manual.

⚠ 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.

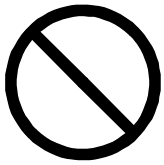
	Indicates a prohibited matter. The explanation with this mark shall be followed.
	Indicates an instructed matter. The explanation with this mark shall be followed.

⚠ WARNING

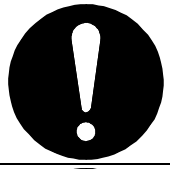
This product is not explosion-proof construction. Do not install this product to the place where the flammable gas or vapor occurs. If installed, the flammable gas or vapor may be ignited, and serious disaster may occur. Use the product of explosion-proof construction in this case.



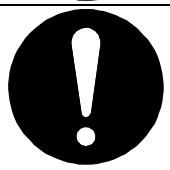
Do not modify or disassemble the product. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or minor injury and electric shock may occur.
(Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent.)



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



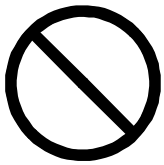
Ensure the wire is properly connected. The product and connected device may be malfunctioned, damaged, fired, or minor injury and electric shock may occur by improper wiring.



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.

<u>The product is 50cm or longer</u>
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.

<u>In case of connecting inductive or lamp load to the product.</u>
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

Capacitive Phase Level Sensor CG300 is a level instrument for continuous measurement of liquids with relatively high dielectric constant, such as water or chemical, to send signals utilized to give an alarm output or control output for pump or other devices. Do not use for any other purpose.

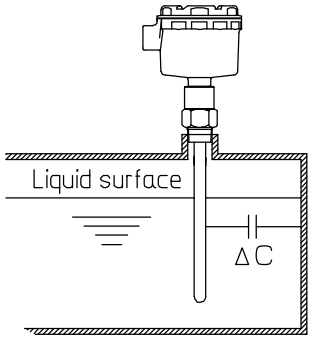
2. DESCRIPTION

2.1 Description

CG300 sensor measures capacitance (*) between the electrode and the tank wall which is electrically continued to the sensor mounting connection. The capacitance changes as the level changes, and the sensor sends signals corresponding to the capacitance value and thus proportional to the level.
The sensor is a compact level instrument, combining electrode and electronics in a single package.

2.2 Principle of Operation

CG300 sensor, mounted on a tank, forms a capacitor (*) between its detector and the tank wall.



ΔC: Increased capacitance due to liquid. Proportional to the immersed length of the detector.

The capacitance of this capacitor changes as the level rises and falls. The sensor electronics detects this capacitance change, to convert it to give a 4 to 20 mA DC output.

* Refer to 12. GLOSSARY.

3. SPECIFICATIONS

3.1 Model Numbering

Model code on the nameplate denotes as follows.

CG300□□

- Blank: without fin
- T : with 3 fins
- Z : special configuration

- F : flanged
- N : threaded
- Z : special mounting

3.2 Specifications

3.2.1 Operating characteristics

(1) Accuracy : ±0.5 % F.S.*1

(2) Sensitivity : 30 to 2000 pF

3.2.2 Electrical characteristics

(1) Power supply : 100 to 240V AC ±10%, 50/60Hz
(24V DC model also available.)

(2) Power consumption : approx. 7VA

(3) Output : 4 to 20mA DC (load 600Ω Max.)

(4) Insulation resistance
: 100MΩ Min., 500V DC
Between each terminal except E terminal and housing.
Between power terminal and signal terminal.

(5) Withstand voltage : 1500V AC, 1 minute
Between each terminal except E terminal and housing.
Between power terminal and signal terminal.

3.2.3 Mechanical characteristics

(1) Pressure (static pressure)
: 100kPa Max. (except mounting component)

3.2.4 Environmental

(1) Working temperature
: Housing -25 to +65℃ (no dew condensation)
Detector -10 to +60℃ ... normal (no freezing)
+60 to +130℃ ... for 30 minutes Max.
With 3 fins -10 to +130℃ (no freezing)

(2) Humidity : 85%RH Max.

3.2.5 Protection class

(1) Detector : IP68 or equivalent

(2) Housing : IP65 or equivalent

3.2.6 Others

(1) Material

(a) Housing : Aluminum die cast (acrylic coated)

(b) Electrode : 304 Stainless steel

(c) Insulator pipe : PFA

(d) O-ring : FPM/FKM

(2) Cable inlet : G 3/4 or equivalent

(3) L length : 4000mm Max.

(4) Cable : Power IV 2×2.0mm^2 (o.d. approx. φ3.5 ×2) or
CVV 2.0mm^2 × 2C (o.d. approx. φ10)
Signal CVV-S 1.25mm^2 × 2C (o.d. approx. φ10)

*1 For measurement range.
Reference conditions:
Environmental ... 25℃, 60%RH / Tap water
Application ... metallic tank of i.d. φ84.1mm, 1000m range

*2 Ambient temperature during adjustment: -15 to +55℃
Display quality can be degraded in temperatures outside the above range.
(This does not affect sensor operation.)

* Refer to 12. GLOSSARY.

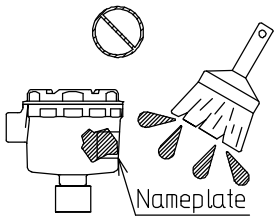
4. HANDLING NOTES

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

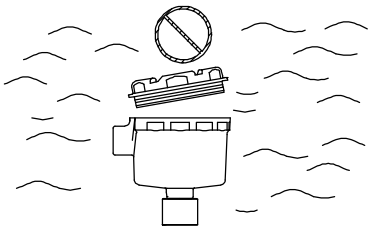
4.1 Do not drop, throw, crush or give a strong shock to the sensor to avoid damaging it.

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

4.3 The nameplate contains maintenance and other important information. When painting the sensor, ensure such information is legible.

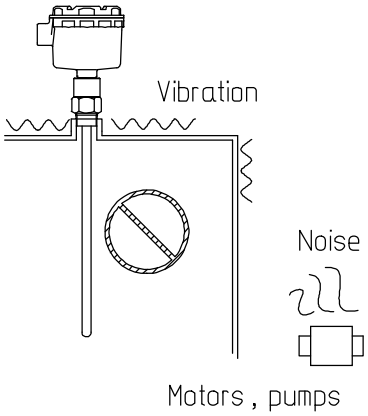


4.4 Avoid using, or storing the sensor in corrosive atmosphere (NH_3, SO_2, Cl_2). Such atmosphere can ingress into the housing to corrode internal circuit.



4.5 Avoid using or storing the sensor in a place where excessive vibration is expected. If such location is inevitable, remove the source of vibration or protect the sensor from receiving it.

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.



5. INSTALLATION

⚠ WARNING

CG300 sensor is not of the explosion proof model(*). Never use it in areas where flammable or explosive gases or vapors are generated.

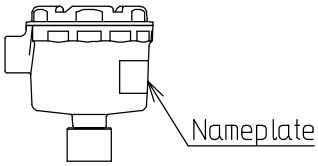
5.1 Unpacking

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

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

5.1.4 Check against nameplate that the sensor is as ordered. If not, please contact our sales office.



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

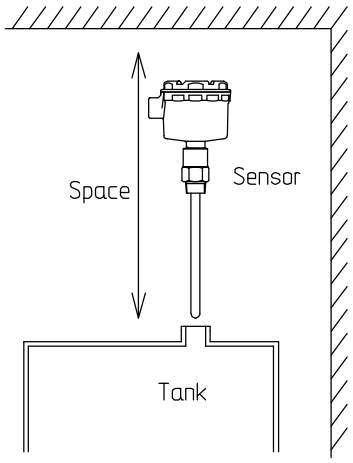
5.1.6 Completely remove packing material such as tape, vinyl and cardboard to prevent operation failure.

5.2 Mounting

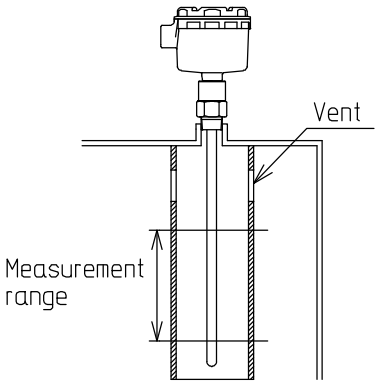
5.2.1 Mounting Location

Ensure ample space above and around the mounting point for easy handling and maintenance. Note that the space above tank must be large enough to contain overall length of the sensor. This must be ensured after mounting the sensor, for when maintenance is required.

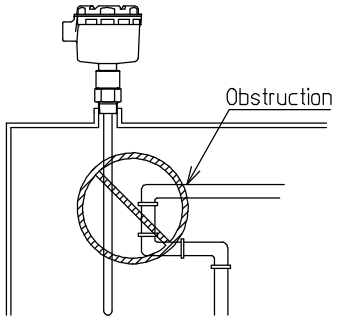
When mounting, observe the following instructions. Failure to do so can result in operation failure.



(1) Avoid proximity to outlet, agitator or other locations susceptible to turbulence.
When such locations are not avoidable, use a metallic stillpipe(*). Mount the stillpipe so that it is electrically continued to the sensor mounting component and the tank.
Provide a vent on the upper portion of the pipe. With a vent in the measurement area or no vent, the sensor cannot operate.



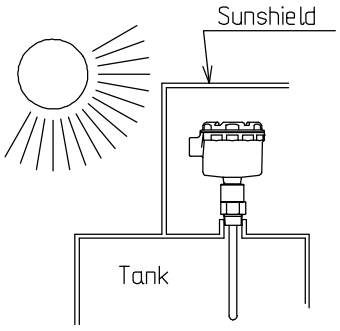
(2) Avoid areas that are close to obstruction such as piping. If such locations are not avoidable, use a metallic stillpipe.



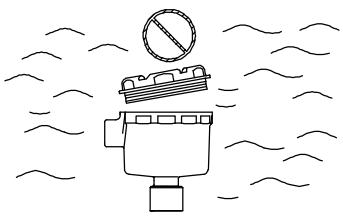
(3) Avoid areas where temperature can be high, or operation failure can result. The maximum temperature allowed for the housing is 65℃, and that for the detection component is as follows.

Model	Max. temperature allowed
CG300□	60℃ (130℃ within 30 minutes)
CG300□T	130℃

(4) Avoid exposure to direct sunlight. In summer, the temperature inside the sensor can exceed the rating due to direct sunlight, causing operation failure.
Provide a sunshield(*) if necessary.



(5) Avoid corrosive environment (NH_3, SO_2, Cl_2). Corrosive gases can ingress into the housing to corrode and damage internal circuit.



(6) 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 cause operation failure. Ensure the cover is properly placed and the cable inlet is adequately treated.

5.2.2 Mounting the Sensor

Threaded model

Tighten the hexagon on the thread with an adjustable wrench. Never rotate the housing itself. Secure the sensor to the mounting location using a proper tool. 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.

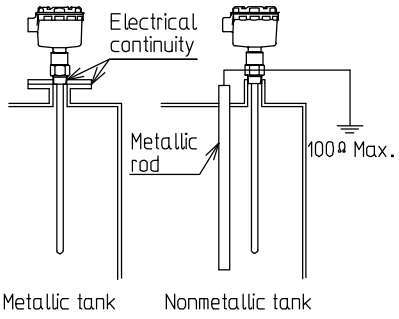
Flanged model

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.

(1) When mounting the sensor on a metallic tank, ensure electrical continuity between the mounting connection and the tank.

(2) When mounting on a nonmetallic tank, provide a metallic rod longer than the sensor electrode in the tank 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.).



* Refer to 12. GLOSSARY.

6. WIRING

6.1 Before Wiring

6.1.1 Disconnect power to the cable used for the sensor.

⚠ WARNING

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

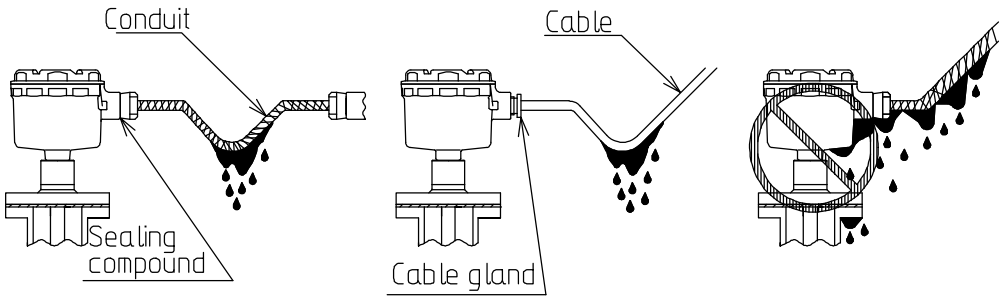
6.1.2 Remove the cover of the sensor housing.

6.2 Cable Inlet

Cable inlet is of G 3/4 or equivalent.

Cable can enter the housing through a cable gland or be routed through a conduit. 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.



6.3 Wiring

6.3.1 Use shielded cable for the sensor input and output. Do not run the cable in line with power line or wiring for magnetic switches. The cable inlet of the sensor is of G3/4 or equivalent.

Recommended cable:

100 to 240V AC ... Power: IV (2x2.0 mm^2) or CVVS (2 core, 2.0 mm^2)
Signal: CVV-S (2 core, 1.25 mm^2)

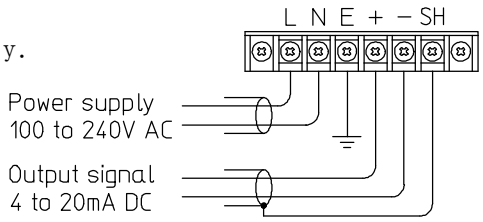
24 V DC .....CVV-S (4 core, 1.25 mm^2)

6.3.2 Ensure the supplied voltage is as specified. Voltages outside the rating can damage the sensor power component, and cause ignition.

6.3.3 Separation distance allowed is 200m in cable length for 2 core, 1.25mm^2 CVV-S cable.

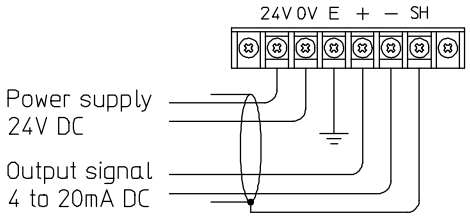
6.3.4 Ground the cable shield at the power supply.

6.3.5 Load resistance of the output signal (4 to 20mA) must be 600Ω or smaller. Large load resistance can cause incorrect output or other failures.



AC version (100 to 240V AC)

6.3.6 Connect cable to the sensor terminals. Always use a tool to tighten the terminal screws. The screws are of M3, so use a cable lug of R1.25-3 or an equivalent size.



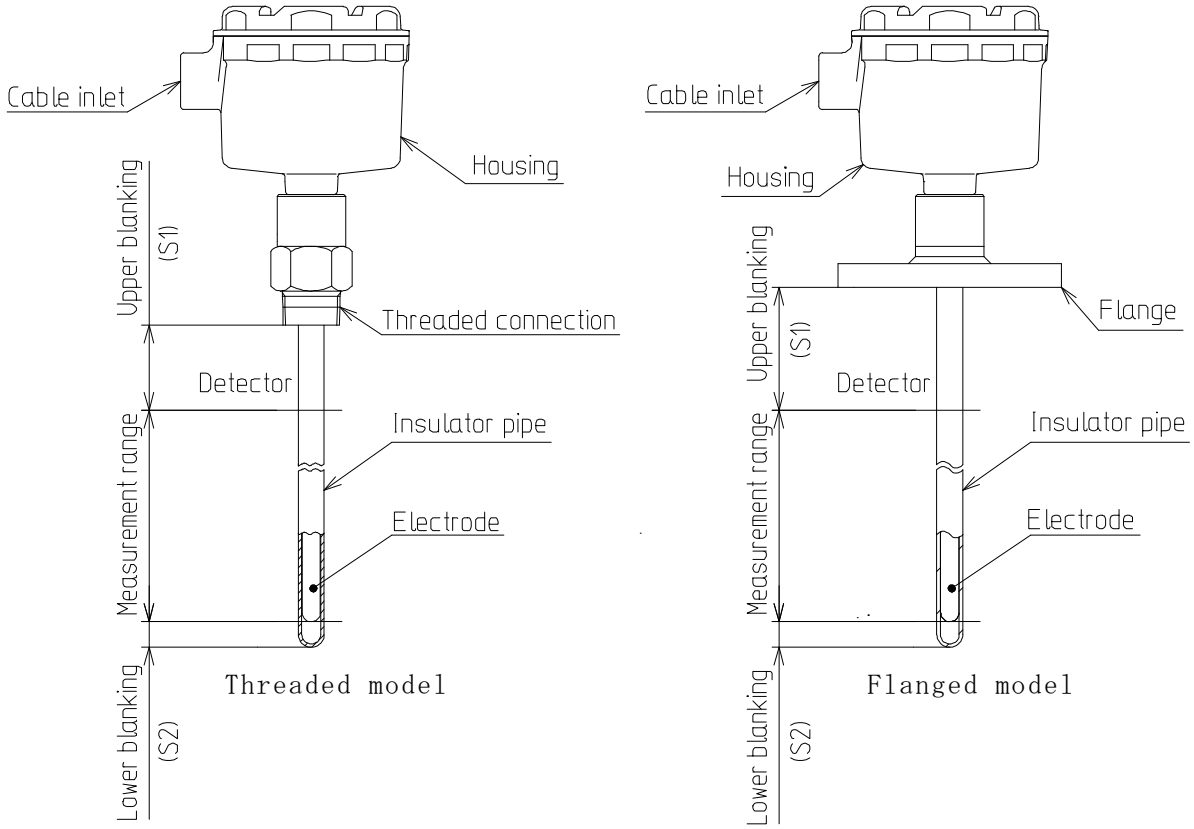
DC version (24V DC)

6.4 Placing the Cover

Remove dust or metal debris inside the housing, if any. After ensuring no foreign object inside the housing, place the cover.

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

7. PART NAMES AND FUNCTIONS



Cable inlet : For cable connection.

Housing : Incorporates a printed circuit board.

Threaded connection

: Used to mount the sensor.

Flange : Used to mount the sensor.

Electrode : Metal rod to measure capacitance.

Insulator pipe

: Pipe working as an insulator to measure conductive liquids.

Detector : Wetted parts from the thread end or flange lower face to the end of the insulator pipe.

Range : From the electrode end to the thread end, or 10mm below the flange lower face.

* L = 4000mm Max.

Upper blanking (S1)

: Zone near the mounting connection within which measurement is not possible.

Lower blanking (S2)

: Zone near the electrode end within which measurement is not possible.

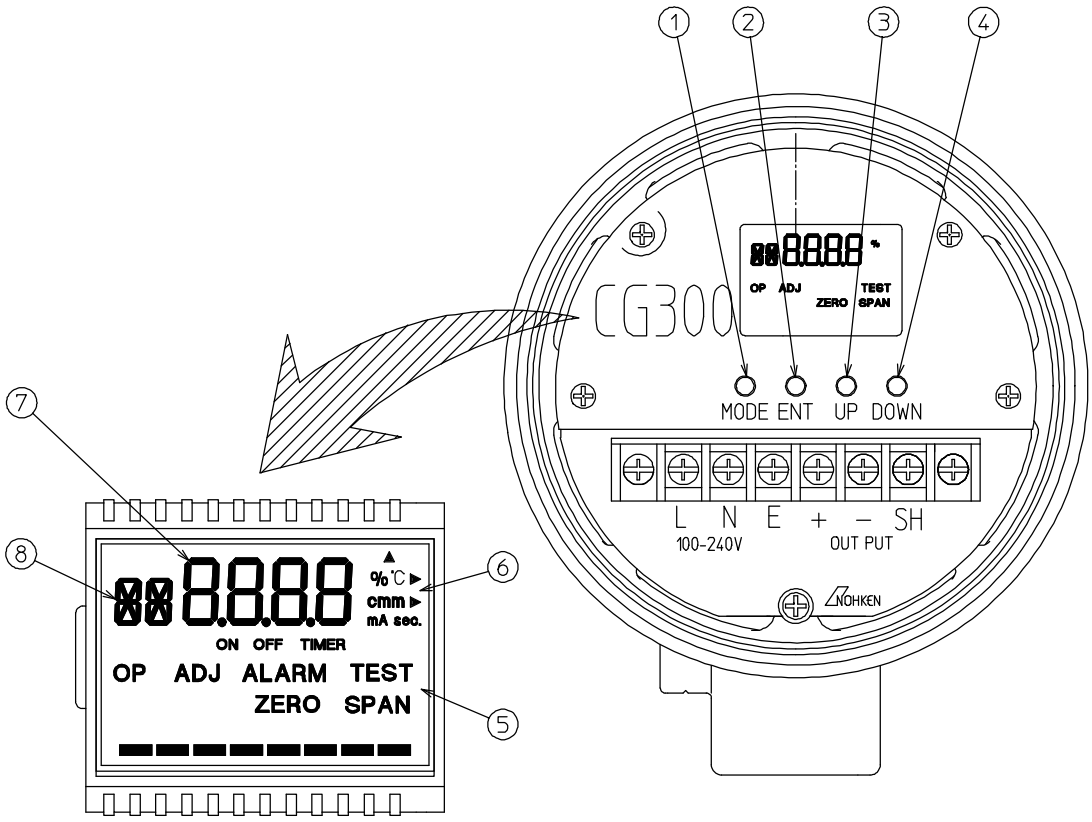
8. ADJUSTMENT

The sensor is programmed using simulation signals before shipment. The zero and span points have to be adjusted after installation to suit your application. Read 8.4 Setting Zero/Span Points before making adjustment.

8.1 Before Adjustment

8.1.1 Parts Name

No.	Name	Function
1	Mode key (MODE)	Switches adjustment modes. Cancels entry.
2	Enter key (ENT)	Accepts or saves entry.
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. (See page 13 for detail.)
7	Value area	Displays measured or set value or parameter
8	Maintenance mode area	Displays maintenance mode or parameter.



8.1.2 Supplying Power

Supply power to the sensor.

The sensor will start operation and displays “##%” 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

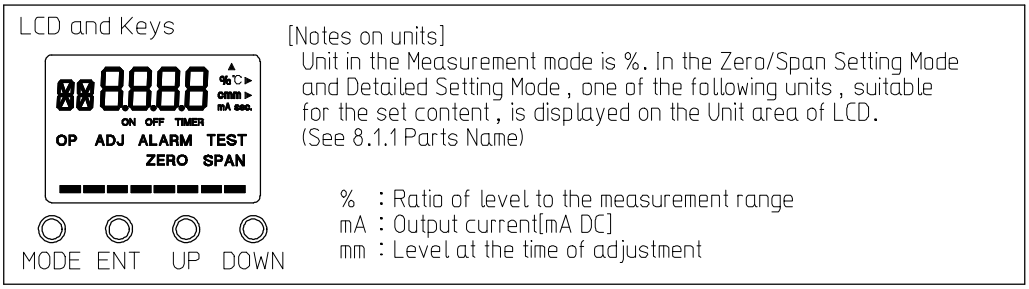
Pressing ENT while OP is flashing updates the new entries.
To cancel the entry, press MODE and DOWN for longer than 3 seconds while OP is flashing. Make adjustment again as necessary.

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

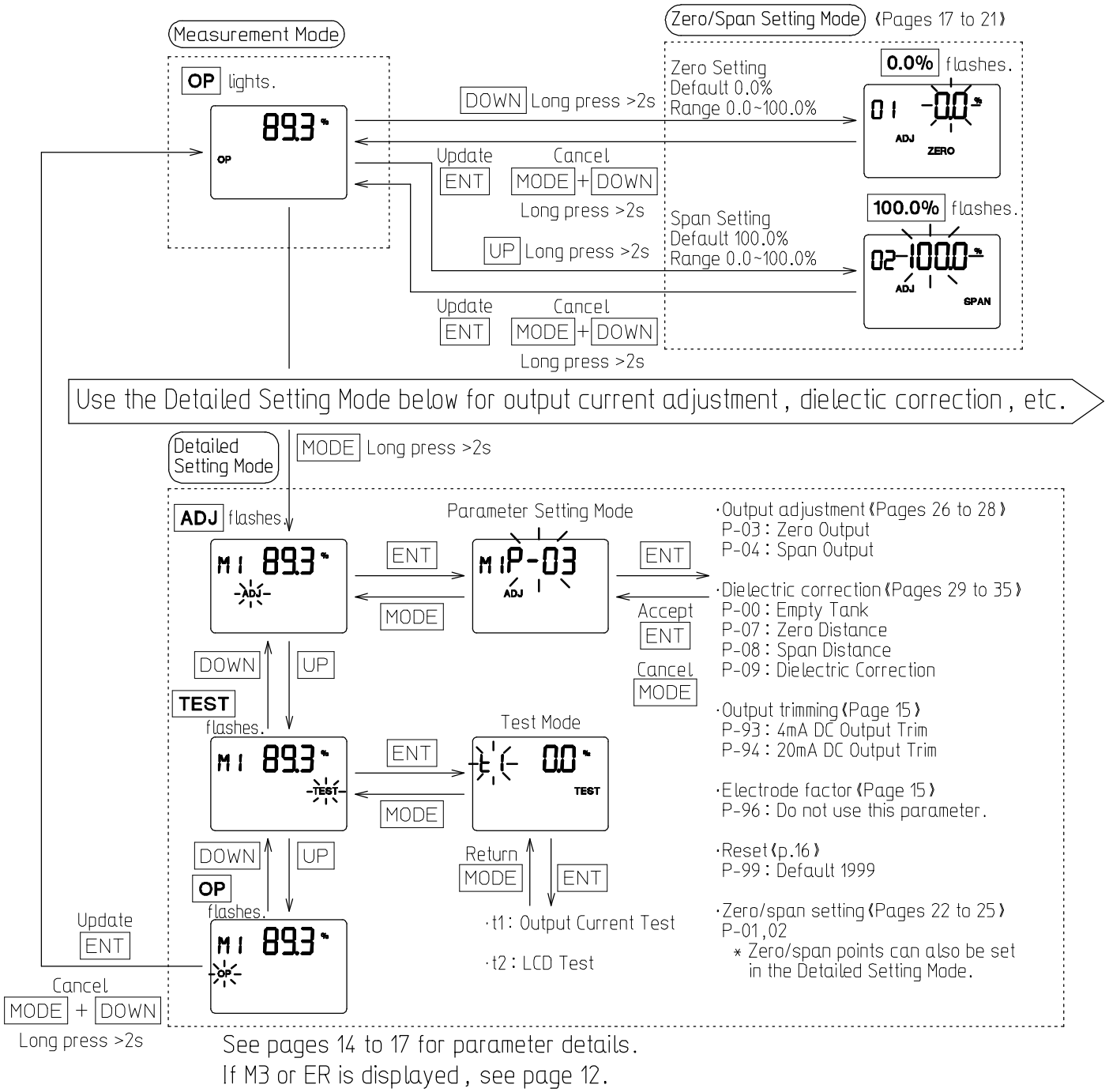
If error occurs when accepting an entry, ER will light in the parameter area. Make adjustment again, and cycle power after that.
If ER persists after cycling power, contact our sales office.

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.

8.2 Key Operation during Adjustment



MODE ENT UP DOWN mean keys to be pressed.



See pages 14 to 17 for parameter details.
If M3 or ER is displayed, see page 12.

8.3 Parameters

CG300 sensor has the following parameters.

(1) Adjustment Mode: ADJ parameters

P-00 Empty Tank 《See pages 30 to 31.》
Sets the dielectric constant when the tank is empty.
* Used when Dielectric Correction feature is used.
No need to be set if measured material is not changed.

P-01 Zero Point (Default: 0.0%) 《See pages 22 to 23.》
Sets the level in % for the zero point.
Enter a desired value.

《Range: 0.0 to 100.0%》

P-02 Span Point (Default: 100.0%) 《See pages 23 to 25.》
Sets the level in % for the span point.
Enter a desired value.

《Range: 0.0 to 100.0%》

P-03 Zero Output (Default: 4.00mA) 《See pages 26 to 27.》
Sets the output current for the zero point.

《Range: 3.00 to 21.00mA》

P-04 Span Output (Default: 20.00mA) 《See pages 27 to 28.》
Sets the output current for the span point.

《Range: 3.00 to 21.00mA》

P-07 Zero Distance (Default: 0mm) 《See page 31.》
Sets the zero point in mm (Lower blanking distance S2).
* Used when Dielectric Correction feature is used.
No need to be set if measured material is not changed.

《Range: 0 to 4000mm》

P-08 Span Distance (Default: 1000mm) 《See pages 31 to 33.》

Sets the span point in mm (Lower blanking distance S2 + Measurement range M).

* Used when Dielectric Correction feature is used.
  No need to be set if measured material is not changed.

《Range: 0 to 4000mm》

P-09 Dielectric Correction (Default: 0mm) 《See pages 33 to 35.》

Sets the point used for adjustment when measured material is changed for example, from water to kerosene. Enter an available level point (except the zero point). After the adjustment, the sensor automatically calculates the zero and span points for the new material and gives a current output.

* Dielectric Correction requires parameters P-00, P-07 and P-08 to be set. Measure and enter a level (except the zero point) after changing the material. If the material is not changed, this parameter needs not to be changed.

《Range: P-07 Zero Distance to P-08 Distance 》

P-93 4mA DC Output Trim

Adjusts the current output for the zero point.

* Output is factory adjusted, so this parameter usually needs not to be set. If it does, contact our sales office.

P-94 20mA DC Output Trim

Adjusts the current output for the span point.

* Output is factory adjusted, so this parameter usually needs not to be set. If it does, contact our sales office.

P-96 Electrode Factor (Default: 1.000)

* No need to use this parameter. Do not change the value.

P-99 Reset (Default: 1999)

Resets the entries to factory defaults.

Enter “1965” in this parameter and press ENT to perform a reset.

⚠ WARNING

P-99 Reset

- When parameter settings are not specified at the time of order:
  Reset clears the adjustment made for P-01 Zero Point and P-02 Span point. Always perform Zero/Span Setting after a reset.
- When parameters are specified at the time of order:
  The sensor is pre-set to values different from those indicated as Default in this manual, and they will be lost after a reset. Before performing a reset, note the entries on the parameter list on page 36.

(2) Test Mode: TEST parameters

t1. Output current test

Output current can be changed regardless of the level.

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 “t1” flashes.
3. Press ENT. The current measured value “##%” will flash and an output current corresponding to the level will be given.
4. Press UP or DOWN to change the output.
   《Range: Output current values corresponding to -5.0 to 105.0% 》
   * Output current is given according to the settings in P-93 4mA DC Output Trim and P-94 20mA DC Output Trim. For example, when the zero point is set to give 4mA DC, and the span point 20mA DC, the output current will range between 3.2mA DC and 20.8mA DC (for -5.0% and 105.0%)
5. Press MODE to finish the test and return to the Adjustment Mode.
6. Press UP or DOWN until “OP” flashes. Press ENT to return to the Measurement Mode.

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 UP or DOWN while “t2” flashes. All LCD segments will light.

4. Press ENT. Each segment will light one after another.

5. Press MODE to finish the test and return to the Adjustment Mode.

6. Press UP or DOWN until “OP” flashes. Press ENT to return to the Measurement Mode.

8.4 Setting Zero / Span Points

Zero and span points can be set by just pressing the push button.
Zero / Span Setting does not require the level to be at the zero or span point; it can be performed by entering the values for two available levels.
For example, if the level can only be changed between 20 and 80% of range, then enter “20.0%” for zero point when the level is at the 20% point, and “80%” for span point when the level is at the 80% point. Then the integrated microcomputer will automatically calculate the zero and span points to give a current output for the measured level.

- Zero point
  1) Fill the tank to the zero or an available point.
  2) Follow the steps in Quick Zero Setting (page 19) to enter 0.0% or the available level in %.
     (This can also be done using P-01)
  3) Setting is complete.

- Span point

1) Fill the tank to the span or an available point.
2) Follow the steps in Quick Span Setting (page 20) to enter 100.0% or the available level in %.
   (This can also be done using P-02)
3) Setting is complete.

⚠ CAUTION

Do not enter the same value for the zero and span points. This will cause output fluctuation and thus operation failure.

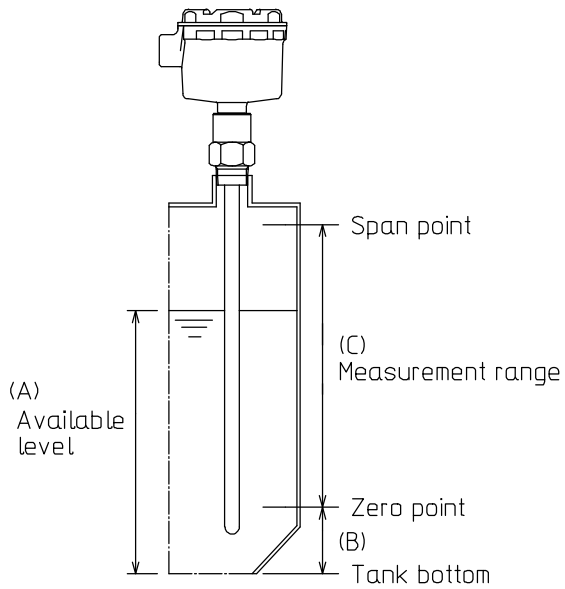
* The % value of the available level is calculated using this formula:

Value for a level [%] = (A − B) / C x 100

where
A = Available level [m]
B = Distance between tank bottom and zero point [m]
C = Measurement range [m]

For example,
when the available level is 2m, the distance between tank bottom and zero point is 1m, and the measurement range is 2m:

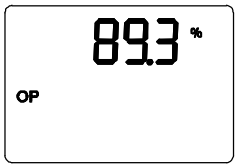
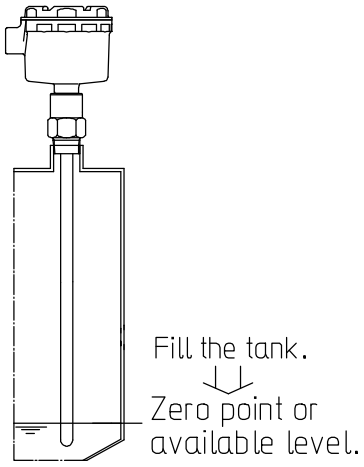
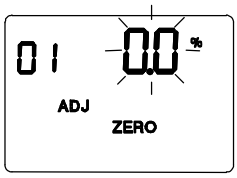
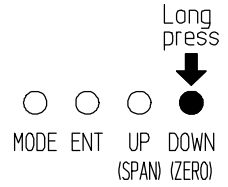
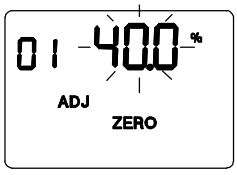
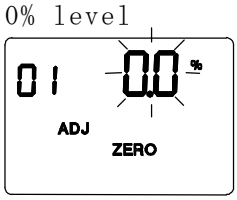
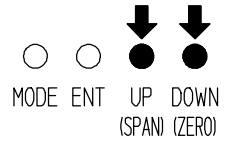
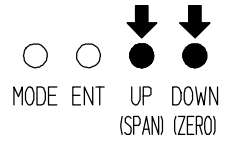
Value for a level [%] = (2[m] − 1[m]) / 2[m] x 100% = 50%

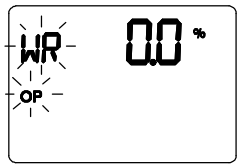
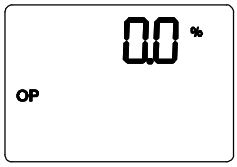


8.4.1 Quick Zero / Span Setting

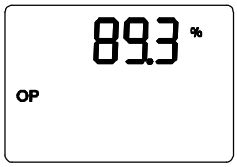
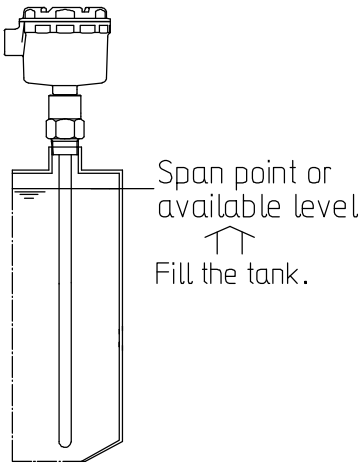
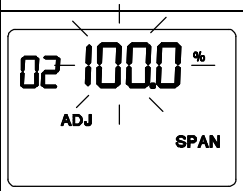
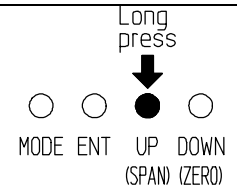
Always perform the zero and span setting after mounting the sensor on a tank.

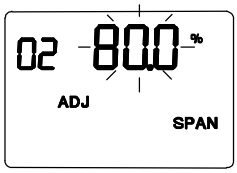
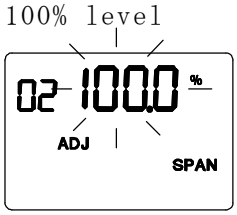
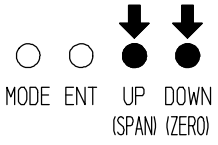
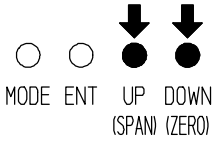
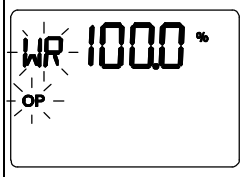
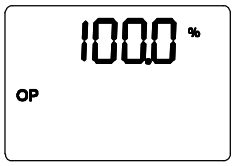
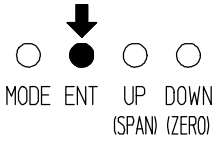
A. Quick Zero Setting

Procedure	LCD	Key
(1) ≪Zero setting≫ Verify that the LCD displays "##%" and "OP", and the sensor is in the Measurement Mode.		
(2) Fill the tank to the zero point, or any level except that set in Step 2 of B. Quick Span Setting. **⚠ CAUTION** Use a level away from the span point, or the level set in Step 2 of B. Quick Span Setting. If too close, accuracy may decrease.		
(3) Press DOWN for longer than 2 seconds. "ZERO" will light and "0.0" will flash.		
(4) Press UP or DOWN until the value corresponds to the current level. (0.0% when the level is at the zero point.) ＊See 8.4 Setting Zero / Span Points for calculation formula of level in %. ≪Range: 0.0 to 100.0 %≫	40% level  0% level 	 

Procedure	LCD	Key
(5) After confirming the correct entry, press ENT. "・・・" and "WR" will flash alternately for about 5 seconds, and then "OP" and the current level in % will be displayed. The sensor is now in the Measurement Mode. ＊The settings are being updated while "WR" is flashing.	For 5 seconds (setting being updated.)   The settings are updated, and the current level is displayed. 	

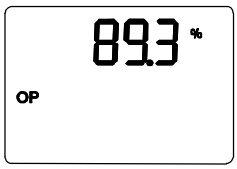
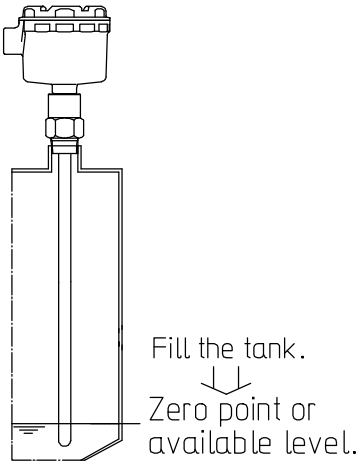
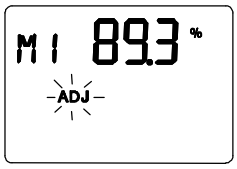
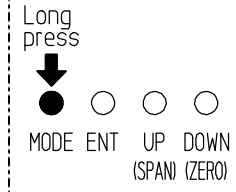
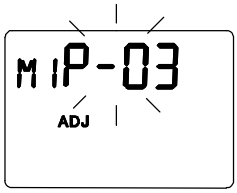
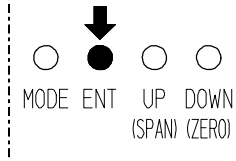
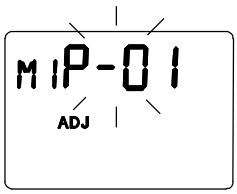
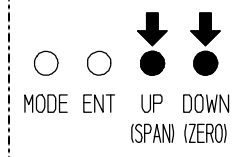
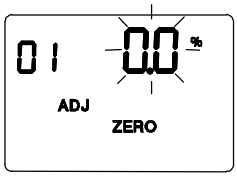
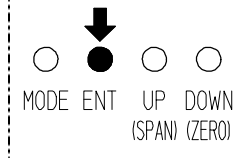
B. Quick Span Setting

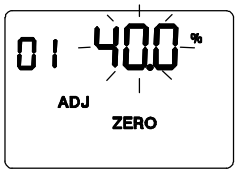
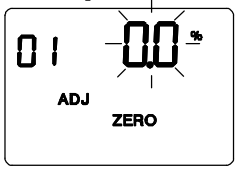
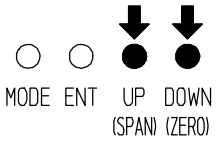
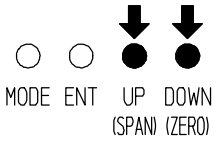
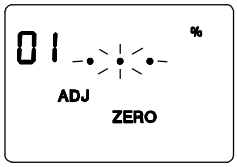
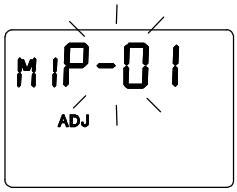
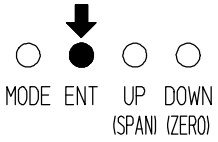
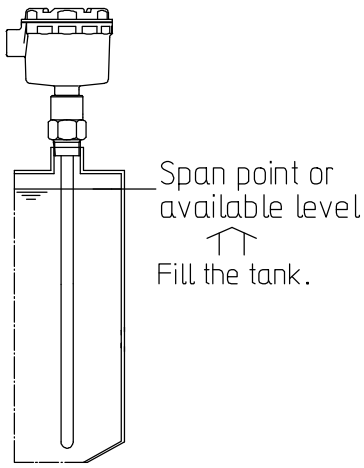
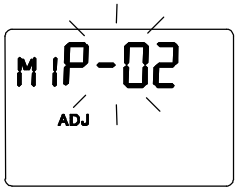
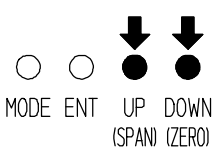
Procedure	LCD	Key
(1) ≪Span setting≫ Verify that the LCD displays "##%" and "OP", and the sensor is in the Measurement Mode.		
(2) Fill the tank to the span point, or any level except that set in Step 2 of A. Quick Zero Setting. **⚠ CAUTION** Use a level away from the zero point, or the level set in step 2 of A. Quick Zero setting. If too close, accuracy may decrease.		
(3) Press UP for longer than 2 seconds. "SPAN" will light and "100.0" will flash.		

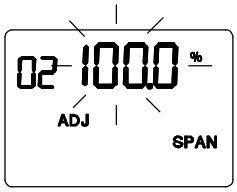
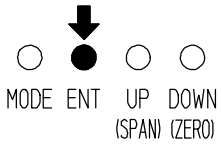
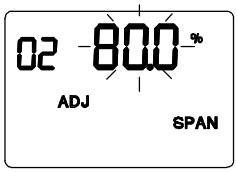
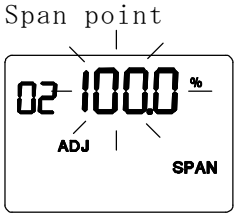
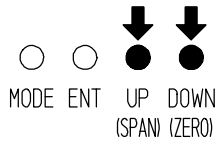
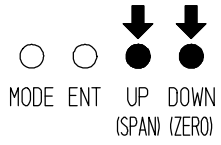
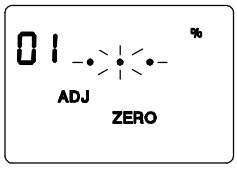
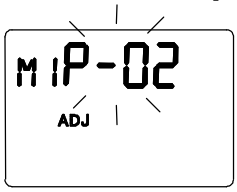
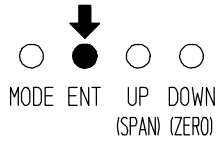
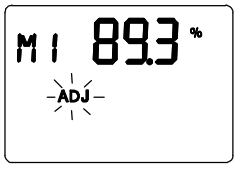
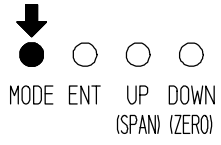
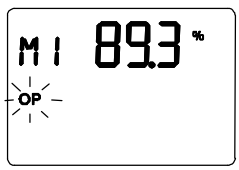
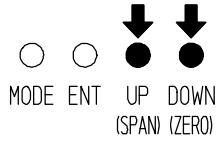
Procedure	LCD	Key
(4) Press UP or DOWN until the value corresponds to the current level. (100.0% when the level is at the span point.) ＊See 8.4 Zero / Span Setting for calculation formula of level in %. ≪Range: 0.0 to 100.0 %≫	80% level  100% level 	 
(5) After confirming the correct entry, press ENT. “・・・” and “WR” will flash alternately for about 5 seconds, and then “OP” and the current level in % will be displayed. The sensor is now in the Measurement Mode. ＊The settings are being updated while “WR” is flashing.	For 5 seconds (setting being updated.)  The settings are updated, and the current level is displayed. 	

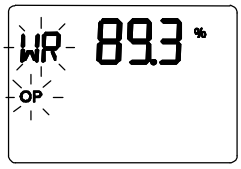
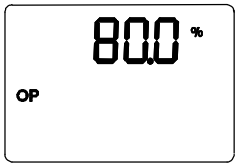
8.4.2 Zero / Span Setting

Always perform the zero and span settings after mounting the sensor on the tank.

Procedure	LCD	Key
(1) Verify that the LCD displays "##%" and "OP", and that the sensor is in the Measurement Mode.		
(2) Fill the tank to the zero point, or any level except that set in Step 9 (P-02). **⚠ CAUTION** Use a level away from the span point, or P-02 set point. If too close, accuracy may decrease.		
(3) Press MODE for longer than two seconds. "M1" will light and "ADJ" will flash. The sensor is now in the Adjustment Mode.		
(4) Press ENT. "ADJ" and "M1" will light, and "P-03" will flash. The sensor is now in the Parameter Setting Mode.		
(5) ≪Zero setting≫ Press UP or DOWN until "P-01" flashes.		
(6) Press ENT. "ZERO" will light, and "0.0" will flash.		

Procedure	LCD	Key
(7) Press UP or DOWN until the value corresponds to the current level. (0.0% when the level is at the zero point.) ＊See 8.4 Setting Zero / Span Points for calculation formula of level in %. ≪Range: 0.0 to 100.0 %≫	40% level  Zero point 	 
(8) After confirming the correct entry, press ENT. "・・・" will flash for about 3 seconds, and then "P-01" will flash, meaning the new entry has been saved.	For 3 seconds.  Display after zero point value has been accepted. 	
(9) Fill the tank to the span point, or any level except that set in Step 2 (P-01). **⚠ CAUTION** Use a level away from the zero point, or P-01 set point. If too close, accuracy may decrease.		
(10) ≪Span setting≫ Press UP or DOWN until "P-02" flashes.		

Procedure	LCD	Key
(11) Press ENT. "SAPN" will light, and "100.0" will flash.		
(12) Press UP or DOWN until the value corresponds to the current level. (100.0% when the level is at the span point.) ＊See 8.4 Setting Zero / Span Points for calculation formula of level in % ≪Range: 0.0 to 100.0 %≫	80% level  Span point 	 
(13) After confirming the correct entry, press ENT. "・・・" will flash for about 3 seconds, and then "P-02" will flash, meaning the new entry has been saved.	For 3 seconds.  Display after zero point value has been accepted. 	
(14) Press MODE. "M1" will light and "ADJ" will flash. The sensor is now in the Adjustment Mode.		
(15) Press UP or DOWN until "OP" flahes.		

Procedure	LCD	Key
(16) Press ENT. “WR” will light for about 5 seconds, and “OP” and the current level in % will be displayed. The sensor is now in the Measurmement Mode. ＊The settings are being updated while “WR” is flashing.	For 5 seconds (setting being updated.)   The settings are updated, and the current level is displayed. 	

8.5 Adjusting Output Current

Output current for zero and span points can be adjusted.

Default values are 4mA DC for the zero point and 20mA for the span point.

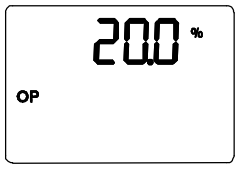
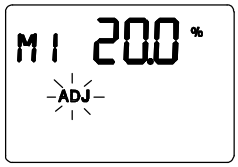
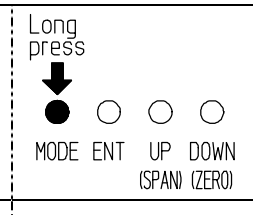
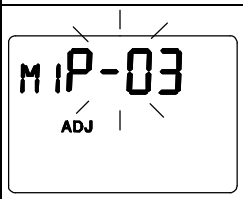
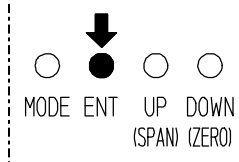
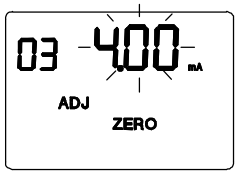
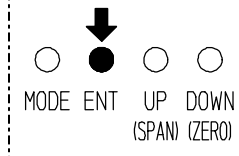
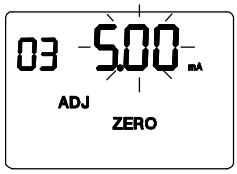
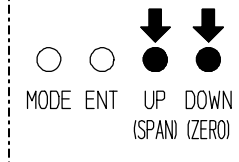
Output current is adjusted before shipment. The user does not usually have to adjust it. Adjust it if necessary.

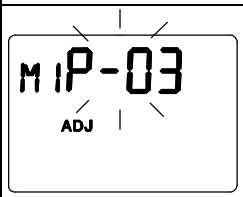
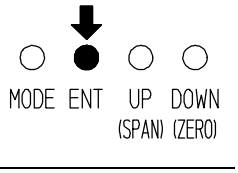
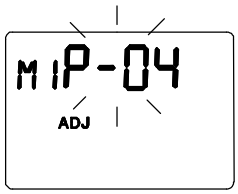
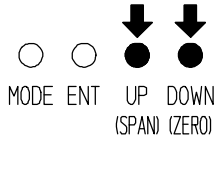
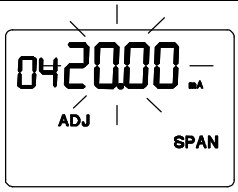
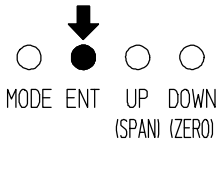
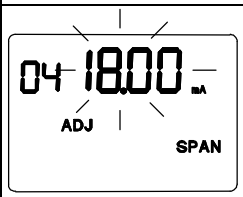
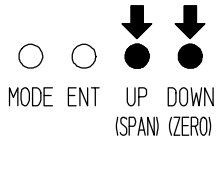
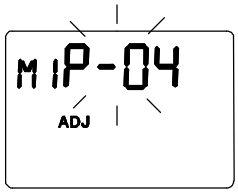
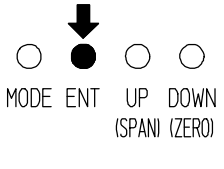
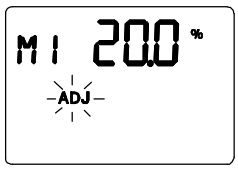
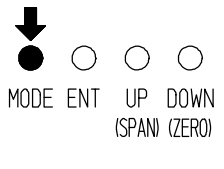
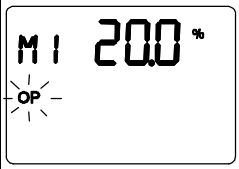
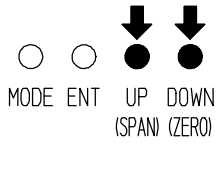
Range: 3.00 to 21.00mA DC

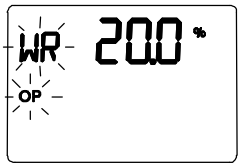
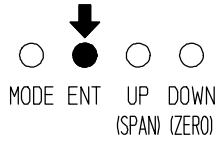
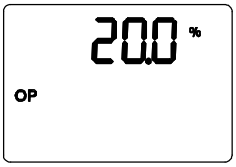
⚠ CAUTION

Do not set the same value for the zero and span points. Output current will be fixed, and the sensor will not operate.

8.5.1 Output Adjustment

Procedure	LCD	Key
(1) Verify that the LCD displays "##%" and "OP", and the sensor is in the Measurement Mode.		
(2) Press MODE for longer than 2 seconds. "M1" will light, and "ADJ" will flash. The sensor is now in the Adjustment Mode.		
(3) Press ENT. "ADJ" and "M1" will light, and "P-03" will flash. The sensor is now in the Parameter Setting Mode.		
(4) ≪Zero output adjustment≫ Press ENT. "ZERO" will light and "4.00" will flash.		
(5) Press UP or DOWN until the desired mA value is displayed. ≪Range: 3.00 to 21.00mA≫		

Procedure	LCD	Key
(6) Press ENT. "P-03" will flash, meaning the output for zero point has been accepted.		
(7) ≪Span output adjustment≫ Press UP or DOWN until "P-04" flashes.		
(8) Press ENT. "SPAN" will light and "20.00" will flash.		
(9) Press UP or DOWN until the desired mA value is displayed. ≪Range: 3.00 to 21.00mA≫		
(10) Press ENT. "P-04" will flash, meaning the output for span point has been accepted.		
(11) Press MODE. "M1" will light and "ADJ" will flash. The sensor is now in the Adjustment Mode.		
(12) Press UP or DOWN until "OP" flashes.		

Procedure	LCD	Key
(13) Press ENT. “WR” will light for about 3 seconds, and “OP” and the current level in % will be displayed. The sensor is now in the Measurmement Mode.	For 3 seconds. 	
＊The settings are being updated while “WR” is flashing.	The settings are updated, and the current level is displayed. 	
→ After setting is complete, the sensor gives an output according to the new setting.		

8.6 Adjusting Dielectric Constant

CG300 sensor has the dielectric constant correction parameters for when the measured material is changed, for example, from water to kerosene. When the material is changed, adjustment at one available point will enable the sensor to calculate the zero and span points and give a current output.
With this feature, the material level does not have to be changed to perfrom zero/span settings, realizing easy adjustment.

Before performing Dielectric Correction, P-00 Empty Tank, P-07 Zero Distance and P-08 Span Distance have to be set with empty tank.
For this correction feature, use an available level (except for zero point)of the new material.
See 8.6.1 Dielectric Correction for detail.

⚠ CAUTION

After performing Dielectric Correction, accuracy of output current may not meet the specification.

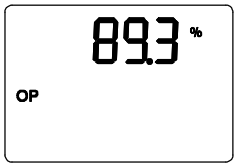
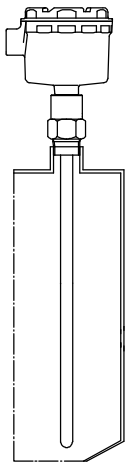
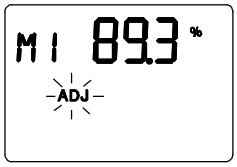
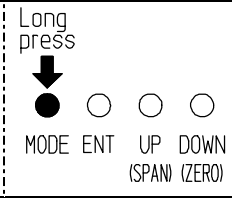
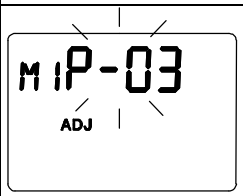
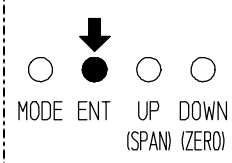
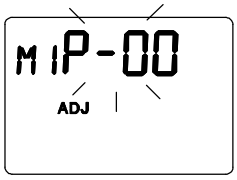
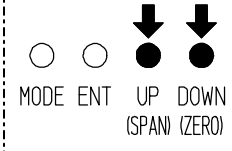
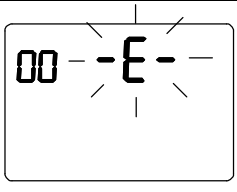
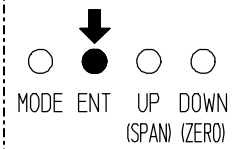
Using the zero point for P-09 Dielectric Correction will cause “Err” display, and the sensor will not operate. Use a level different from the zero point.

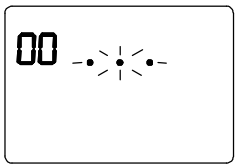
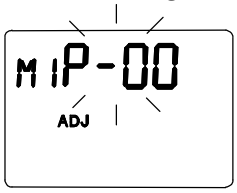
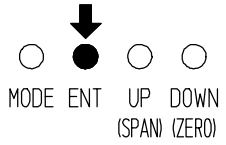
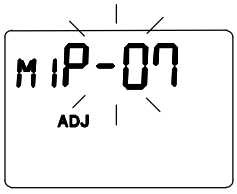
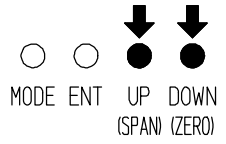
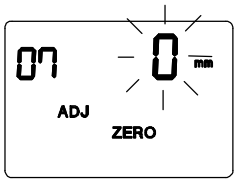
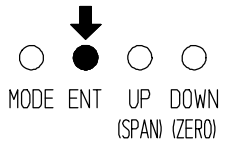
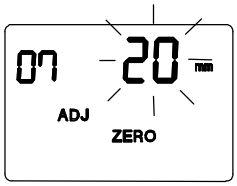
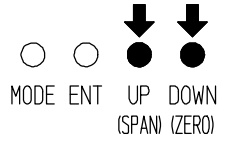
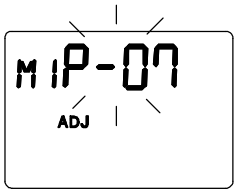
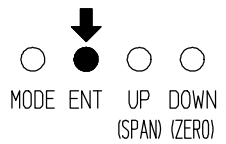
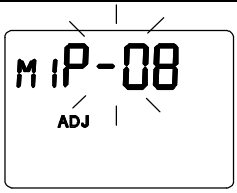
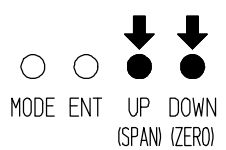
REFERENCE

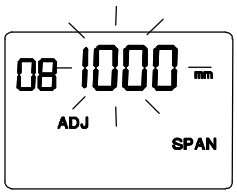
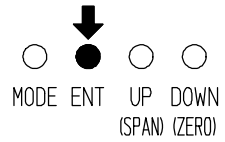
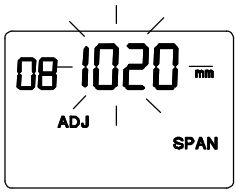
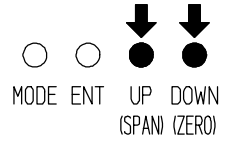
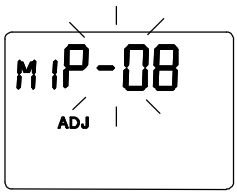
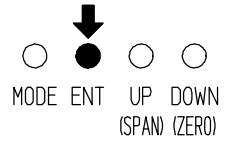
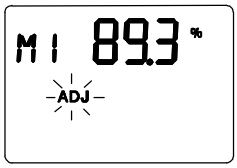
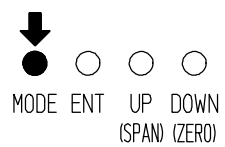
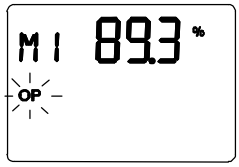
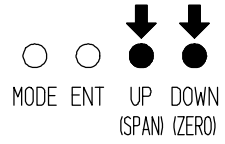
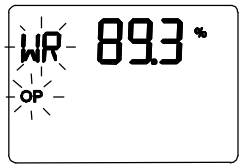
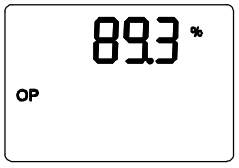
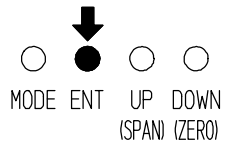
Using a 50% level for correction will minimize accuracy decrease.

8.6.1 Dielectric Correction

1) Before changing the material

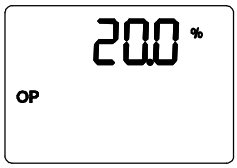
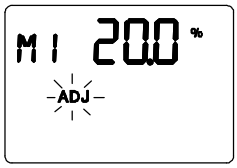
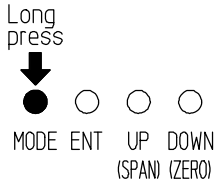
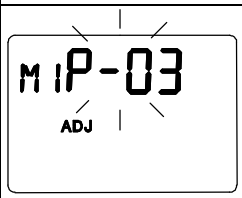
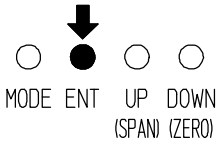
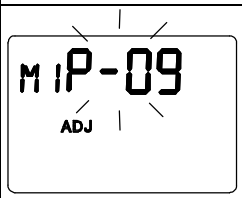
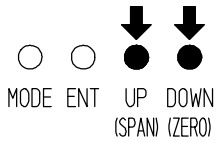
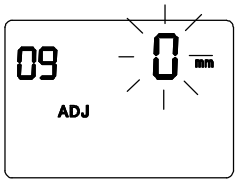
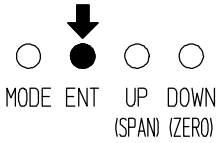
Procedure	LCD	Key
(1) Verify that the LCD displays “##%” and “OP”, and the sensor is in the Measurement Mode.		
(2) Empty the tank.		
(3) Press MODE for longer than 2 seconds. “M1” will light, and “ADJ” will flash. The sensor is not in the Adjustment Mode.		
(4) Press ENT. “ADJ” and “M1” will light, and “P-03” will flash. The sensor is now in the Parameter Setting Mode.		
(5) ≪Empty Tank≫ Press UP or DOWN until “P-00” flashes.		
(6) Press ENT. “00” will light, and “-E-“ will flash.		

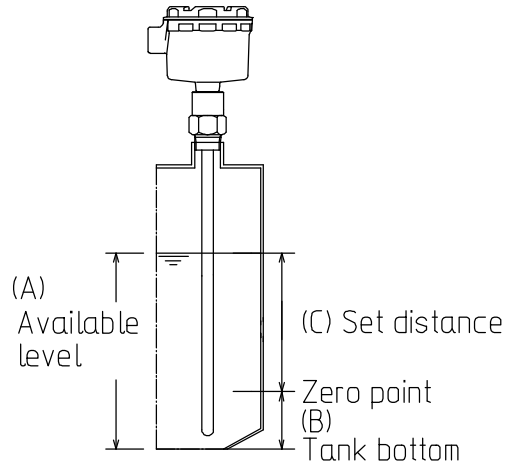
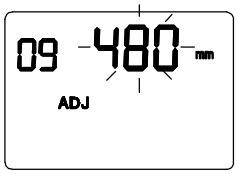
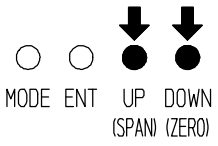
Procedure	LCD	Key
(7) Ensure the tank is empty, and press ENT. "・・・" will flash for about 3 seconds, and then "P-00" will flash, meaning the setting has been accepted.	For 3 seconds.   The setting accepted.  	
(8) ≪Zero Distance≫ Press UP or DOWN until "P-07" flashes.	 	
(9) Press ENT. "ZERO" will light, and "0" will flash. Default: 0mm	 	
(10) Press UP or DOWN to enter the distance suitable for your sensor (Lower blanking, S2). Eg.) When Range M is 1000mm, and Lower blanking S2 is 20mm, enter "20". ≪Range: 0 to 4000mm≫	 	
(11) Press ENT. "P-07" will flash, meaning the entry has been accepted.	 	
(12) ≪Span Distance≫ Press UP or DOWN until "P-08" flashes.	 	

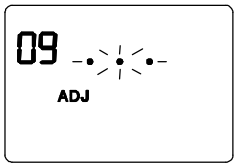
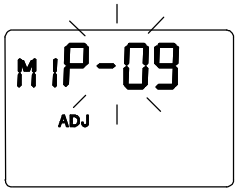
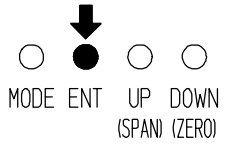
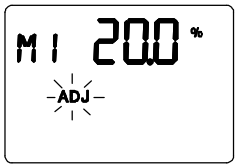
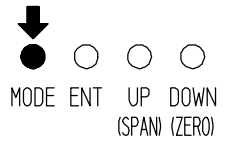
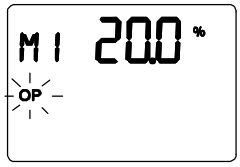
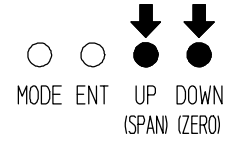
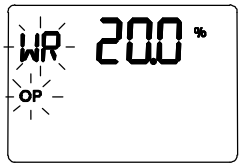
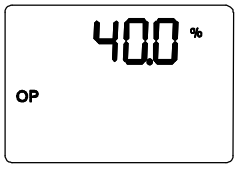
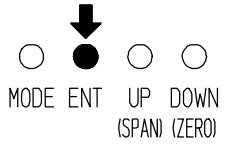
Procedure	LCD	Key
(13) Press ENT. "SPAN" will light, and "1000" will flash. Default: 1000mm		
(14) Press UP or DOWN to enter the distance suitable for your sensor (S2 + measurement range). Eg.) When Measurement range M is 1000mm, and Lower blanking S2 is 20mm, enter "1020" (1000+20). ≪Range: 0 to 4000mm≫		
(15) Press ENT. "P-08" will flash, meaning the entry has been accepted.		
(16) Press MODE. "M1" will light, and "ADJ" will flash. The sensor is now in the Adjustment mode.		
(17) Press UP or DOWN until "OP flashes".		
(18) Press ENT. "WR" will light for about 3 seconds. Then "OP" and the current level in % will be displayed, and the current output given. The sesnor is now in the Measurement Mode. ＊The settings are being updated while "WR" is flashing.	For 3 seconds   The settings are updated, and the current level is displayed. 	

Procedure	LCD	Key
(19) Fill the tank with the measured material, and perform 8.4.1 Quick Zero/Span Setting, or 8.4.2 Zero/Span Setting.		

2) Dielectric Correction

Procedure	LCD	Key
(1) Verify that the LCD displays “##%” and “OP”, and the sensor is in the Measurement mode.		
(2) Press MODE for longer than 3 seconds. “M1” will light, and “ADJ” will flash. The sensor is now in the Adjustment Mode.		
(3) Press ENT. “ADJ” and “M1” will light, and “P-03” will flash. The sensor is now in the Parameter Setting Mode.		
(4) ≪Dielectric Correction≫ Press UP or DOWN until “P-09” flashes.		
(5) Press ENT. “09” will light, and “0” will flash.		

Procedure	LCD	Key
(6) Press UP or DOWN to enter the level (C) of the new material. [Calculation of C] C = A − B where, C: Level of new material (entered distance) [mm] A: Available level [mm] B: Distance between tank bottom and zero point. (Lower blanking S2 + Tank bottom to Electrode end) Eg.) When Lower blanking S2 is 20mm, Tank bottom to electrode end is 40mm, and Material level 540mm, enter 480 (540 − (20+40)). **⚠ CAUTION** Dielectric Correction cannot be performed using the zero point. ≪Range: P-7 Zero Distance to P-08 Span Distance ≫	 	

Procedure	LCD	Key
(7) Press ENT. "・・・" will flash for about 3 seconds, and then "P-09" will flash, meaning the setting has been accepted.	For 3 seconds.   Display after the setting is accepted. 	
(8) Press MODE. "M1" will light, and "ADJ" will flash. The sensor is now in the Adjustment Mode.		
(9) Press UP or DOWN until "OP" flashes.		
(10) Press ENT. "WR" will light for about 3 seconds. Then "OP" and the current level in % will be displayed, and the current output given. The sesnor is now in the Measurement Mode. ＊The settings are being updated while "WR" is flashing.	For 3 seconds.   The settings are updated, and the current level is displayed. 	

8.7 Parameter List

Utilize the following list in setting the parameters.

P-No.	Parameter	【 Default 】	Range	Setting
P-00	Empty Tank			
P-01	Zero Point	【 0.0% 】	0.0 to 100.0%	
P-02	Span Point	【 100.0% 】	0.0 to 100.0%	
P-03	Zero Output	【 4.00mA 】	3.00 to 21.00 mA	
P-04	Span Output	【 20.00mA 】	3.00 to 21.00mA	
P-07	Zero Distance	【 0mm 】	0 to 4000mm	
P-08	Span Distance	【 1000mm 】	0 to 4000mm	
P-09	Dielectric Correction	【 0mm 】	P-07 to P-08	
P-93	4mA DC Output Trim		0.0 to 100.0%	
P-94	20mA DC Output Trim		0.0 to 100.0%	
P-96	Electrode Factor	【 1.000 】	0.0 to 100.0%	
P-99	Reset	【 1999 】	0.0 to 100.0%	
t1	Output Current Test		Current corresponding to -5.0 to 105.0%	
t2	LCD Test			

9. MAINTENANCE AND INSPECTION

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

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

9.1 Removing the Sensor

9.1.1 Disconnect power to the sensor.

⚠ WARNING

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

9.1.2 Remove the housing cover, and then the cables connected to the housing.

Disconnect the conduit, if used, from the housing.

9.1.3 For threaded sensors, turn the hexagonal component counterclockwise using a proper tool to remove the sensor from the tank.

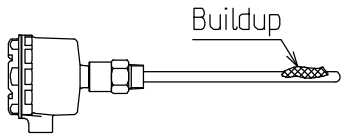
For flanged sensors, loosen bolts and nuts using a proper tool to remove the sensor from the tank.

9.1.4 Place the sensor on a flat surface.

9.2 Maintenance procedure

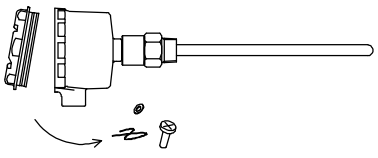
Perform maintenance and inspection once or twice a year. More frequent maintenance will be required depending on operating conditions such as frequency of use, material type, temperature and pressure.

9.2.1 Check for visible damage which may impair performance. Repair or replace if any.



9.2.2 Check for buildup on electrode and clean it if any.

9.2.3 Check housing inside for condensation, dust or metal debris, and remove if any.



9.3 Mounting the Sensor

See 5.2 Mounting.

9.4 Wiring

See 6. Wiring.

9.5 When to Replace

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

9.6 Component List

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

9.7 Adjustment

See 8. Adjustment.

10. 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.

10.1 Store the sensor indoors in the following conditions.

- Temperature: -10 to +60℃
- Humidity: 85%RH Max.
- Atmosphere: not corrosive (without NH_3, SO_2, or Cl_2)
- No excessive vibration

10.2 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.

10.3 Remove buildup. Buildup can harden and adversely affect operation when the sensor is used the next time.

10.4 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.

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

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.

11. 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
Output is fixed while the level changes.	Loose or incorrect wiring.	Wire correctly.	6. Wiring
	Liquid entered inside the insulator pipe due to pinhole caused by corrosion.	Material of construction not suitable for the measured liquid. Re-select the sensor.	9. Maintenance
	Threaded connection or flange not electrically continued to metallic tank, stillpipe, metallic rod (for a non-metallic tank), etc.	Provide electrical continuity.	5.2.2 Mounting the Sensor
Unstable output.	Same level is set to the zero and span points.	Perform zero/span setting again.	8.4.1 Quick Zero/Span Setting
Output exceeds the maximum value.	Loose or incorrect wiring.	Wire correctly.	6. Wiring
	Liquid entered inside the insulator pipe due to pinhole caused by corrosion.	Material of construction not suitable for the measured liquid. Re-select the sensor.	9. Maintenance
Output and level not proportional	Measured material is changed.	Perform zero/span setting using the new material.	8.4.1 Quick Zero/Span Setting

Trouble	Possible cause	Corrective action	Reference
Output changing regardless of level.	Buildup on the insulator pipe.	Clean the pipe. Prevent buildup.	9. Maintenance
	Threaded connection or flange not electrically continued to metallic tank, stillpipe, metallic rod (for a non-metallic tank), etc.	Provide electrical continuity.	5.2.2 Mounting the Sensor
Adjustment cannot be made.	Loose or incorrect wiring.	Wire correctly.	6. Wiring
	Liquid entered inside the insulator pipe due to pinhole caused by corrosion.	Material of construction not suitable for the measured liquid. Re-select the sensor.	9. Maintenance

12. 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.

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
Capacitor	Electrical component that has two electrodes and stores capacitance.
Explosion proof model	Electrical device designed not to ignite explosive gases or vapors in the surrounding. (This manual is not for explosion proof models.)
Stillpipe	Pipe to protect the sensor from excessive turbulence or flow to prevent faulty operation.

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