

## General Information

# HPC-509N

Capacitance Type  
Level Limit Switch



**HITROL CO., LTD.**

## General

Capacitance level limit switch, HPC-509N is a multi-purpose level switch, which can detect the level of sediment in the liquid, interface between two different liquids as well as level of various materials from highly non-conductive powders and/or granules to conductive liquids with a high conductivity.

This unit is a level detection device with high performance developed by HITROL in order to detect levels of various

materials which requires a highly advanced technologies due to variety of materials to be measured and complexity of measurement conditions.

Level detection with a high stability and reliability are generally realized by long-time experiences, abundant past records, rigorously selected parts and components, and strict quality management.

## Operating Principle

The values of capacitance and conductance between probe and tank wall changes when the material to be measured is in contact with the probe.

The existence of material to be

measured is in contact with the probe.

The existence of material and/or interface are detected by converting this impedance change to electrical signal(or relay contact).

## Characteristics and Advantages

- \* Level switch for powders and/or granules(possible for liquids)
- \* Less effect by build-up
- \* Possible to use for low conductivity materials
- \* Instrument of a high sensitivity and stability
- \* Semi-permanent since it has no moving parts
- \* Easy to install and adjust
- \* On-site check is possible
- \* Possible to set up for time delay of relay contact output

## Specification

No.	Items	Specification
1	Power Supply	AC 110/220 V $\pm$ 10%, 60 Hz
2	Power Consumption	approx. 4 VA
3	Output Contact	relay output(1SPDT)
4	Contact Capacitance	max. AC 205 V, 10 A, DC 30 V, 5A
5	Life Time of Contact	approx. 500,000 times
6	Response Time	5 ms
7	Time Delay	0-10 sec. free setting
8	Display of Operation	red LED(highly illuminating red LED)
9	Operating Temp.	general : -20~+60 °C
		high temp. : -20~+250 °C
10	Operating Pressure	standard : 10 kfg/cm <sup>2</sup> , max. : 30 kfg/cm <sup>2</sup>
11	Mounting Regulation	1 "PT
12	Cable Gland	2-1/2 "PF
13	Length of Probe	300 mm
14	Range of Stable Detection	class 1 : 0.5~20 pF
		class 2 : 2.0~50 pF
		class 3 : 2.0~1000 pF
		class 4 : 2.0 pF~5 $\Omega$
15	Type	compact
16	Color	bright gray

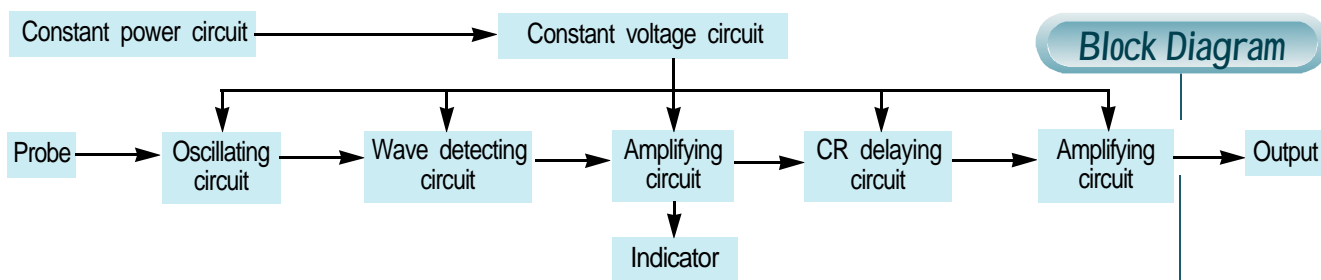


Fig. 1

Type	Sensitivity	Application
Class 1	0.5~20 pF	From low dielectric materials such as PVC powder, polyethylene pellet, instant coffee to insulation powders and granules, most of thin chips, flour, grains, and other processed grain powders and granules, solvent, cooking oil, kerosene, grease, and foamed surface, and etc.
class 2	2.0~50 pF	viscous liquids, adhesives, various foamed surface, water, interface, and etc.
class 3	2.0~1000 pF	acids, alkali, mixed waste water, conductive materials, interface, fertilizer, waster water from chemical industries
class 4	2.0 pF~5 Ω	carbon, sediment in a liquid

### Sensitivity of Instrument

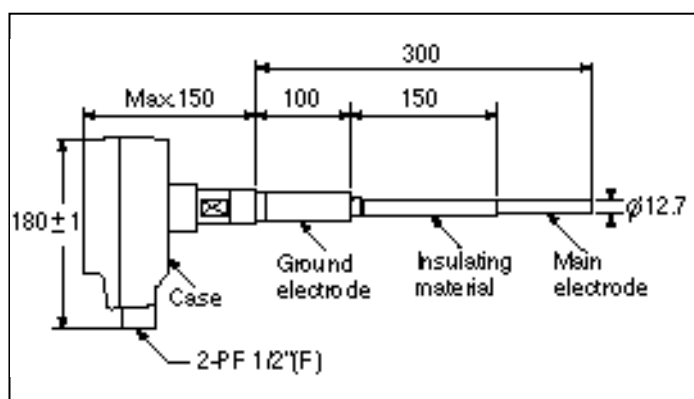


Fig. 2

### Outside Dimensions and Name of Components

No.	Name of components	Material	Quantity
1	case	ADC 12	1
2	ground electrode	SUS 304	1
3	insulating material	telfon	1
4	main electrode	SUS 304	1

- \* **Liquid** : various fuels, solvent, acids, alkali, liquefied gas, pure water, and etc.
- \* **Mixed liquid** : waste water from plants, sewage water, agricultural chemicals, various, processing materials, various solutions, and etc.
- \* **Interface** : crude oil and water, mercury and water, alcohol and acid, sediment in a liquid, liquid and foam, and etc.
- \* **Foam layer** : latex foam, beer foam, soap foam, and etc.
- \* **Viscous material** : clay, sludge, vaseline, paint, grease, adhesives, rock powder, paraffin, cheese, honey, and etc.
- \* **Powder** : plastic powder, carbon, chloric iron powder, mud and sand, sugar, flour, and etc.
- \* **Granule** : plastic pellet, metallic pellet, chemical fertilizer, medicine, grains, food, and etc.
- \* **Lump** : coal, lime stone, mining stone, and etc.

### Application

## Installation Method and Precautions

### Installation method

HPC-509N is installed at top or side of the vessel, and used for upper and lower level limits, and can be installed and used either metallic vessel or plastic vessel since it has no limitations on the vessel materials.

#### \* Installation at the side of vessel(horizontally)

Very sensitive detection is possible since level is detected using the whole electrode. However, since errors due to build-up can be occurred, it is recommended that the sensor should be installed so that the end of electrode should be directed downwards. Refer ① of Figure 3.

#### \* Installation at the top of vessel(vertically)

It is an installation method which has less effect of build-up, however, since the level is detected using only the bottom end of electrode, sensitivity is weak, and this installation method is not suitable for low conductivity material. Refer ② of Figure 3.

### Precaution on installation

When installing several HPC-509Ns on a single vessel, distance between electrodes should be separated as given below. Refer Figure 4.

#### \* Length of electrode is equal to or below 300 mm

: equal to or greater than 250 mm

#### \* Length of electrode is equal to or below 500 mm

: equal to or greater than 350~400 mm

When the gap between electrode is not long enough, error can be occurred, since interference between level switches can be generated, and operation can be unstable.

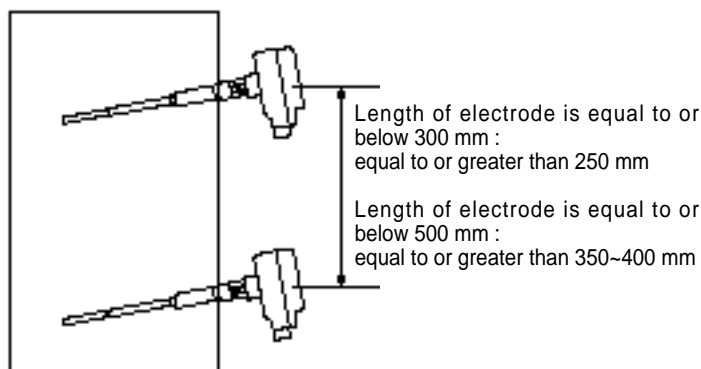


Fig. 4

Ground electrode should be inserted into the vessel equal to or over 50 mm. Refer ① of Figure 5.

When installing at the side of vessel(horizontally), cable gland at the case should be directed downwards for waterproof. Refer ② of Figure 5.

When material to be measured is supplied at an inlet, measuring electrode should be installed apart from the inlet at least 200 mm. Refer ① of Figure 6.

Particularly, when installing at the lower limit, it should be installed considering the allowable load of electrode(3.1 kgf/m). It has protection effect from the impact of free fall of incoming material when a protection plate is installed above the level switch in the vessel as shown in ② of Figure 6. Refer ② of Figure 6.

Since build-up of powder or granules can be occurred on the inclined plate between vessel wall and bottom of vessel, level switch should not be installed at such places. Refer ③ of Figure 6.

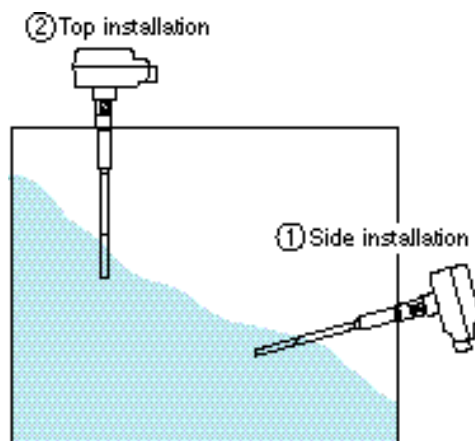


Fig. 3

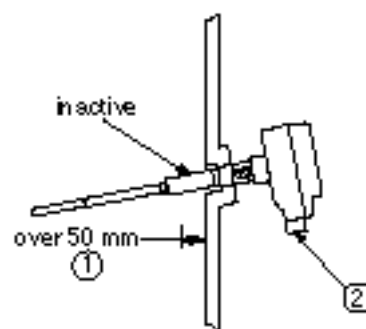


Fig. 5

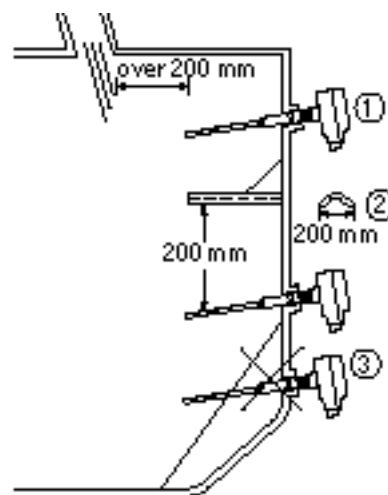


Fig. 6

When the material to be measured behaves such as a fluid, and/or in order to prevent fluctuation of output signals in case of measuring liquids, time delay function should be utilized properly.

When housing is exposed to direct sunlight and there would be possibility of temperature increase, a protection plate from direct sunlight should be installed.

Length of electrode is manufactured according to ordering specification, however, when it is needed to revise the length of electrode according to the change of on-site conditions, please follow the order given below in case of longer electrode.

(However, it is not possible to change the length of electrode on-site, when the whole electrode is covered by teflon.)

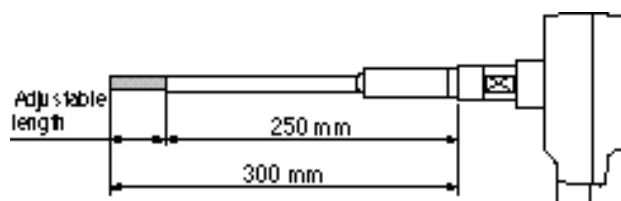


Fig. 7

Either AC 110 V  $\pm$  10 % or AC 220 V  $\pm$  10 % should be used only for power supply.

After wiring, cable gland should be completely plugged, Water and water droplet proof should be maintained by tightening the cover of housing using four(4) screws.

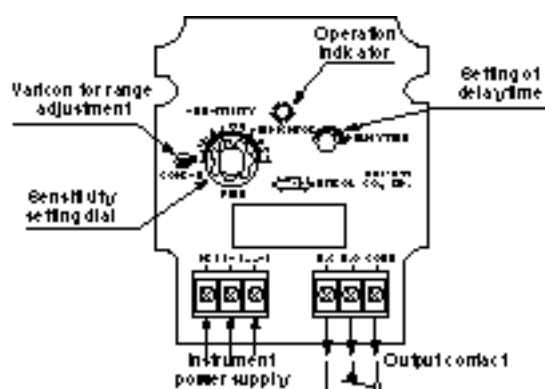


Fig. 8

It is recommended to properly adjust the sensitivity according to type of materials to be measured and installation status of level switches. It should be adjusted so that the sensitivity is insensitive under the low specific gravity or dry conditions.

Sensitivity setting dial has a range from L to H(0-100), L is the lowest sensitivity, and H is the highest sensitivity.

For the case of interface between two liquids, it should be adjusted according to the following method by contacting it towards the liquid having larger dielectric constant becomes ON between N.O. and COM, and liquid having lower dielectric constant becomes OFF.)

- (1) Tank should be empty.
- (2) Sensitivity setting dial should be turned from L to H position.
- (3) Position on the scale that the indicating lamp starts to emit should be recorded.

When the lamp does not turn on, adjustment of item (7) should be performed.

Lamp setting scale

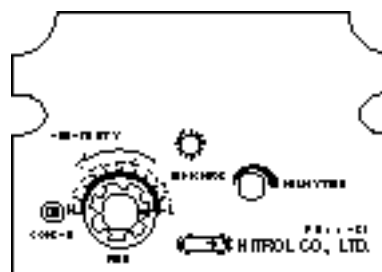


Fig. 9

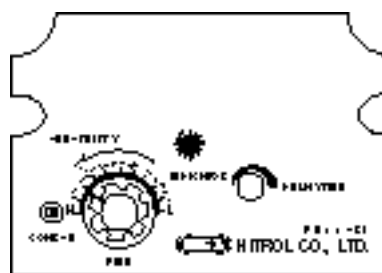
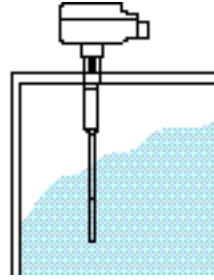
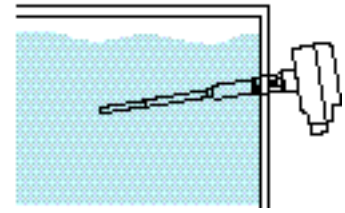


Fig. 10

- (4) Level switches should be completely covered by materials to be measured.



**Vertical installation at top of the vessel**  
Electrode is covered 100-150 mm from the bottom of measuring electrode.



**Horizontal installation at side of the vessel**  
Electrode is completely covered

Fig. 11

- (5) When sensitivity setting dial is turned towards L direction under the condition of (4), the indicating lamp changes from on state to off state. Position of sensitivity setting dial at this state should be recorded.

*Turn on=>Turn off at the position of sensitivity setting dial*

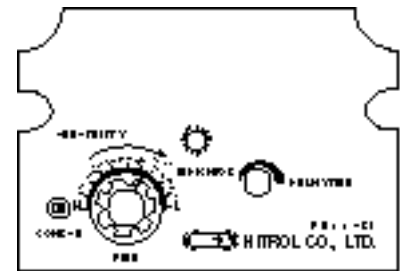


Fig. 12

- (6) Sensitivity setting dial should be adjusted at the middle point between the positions of (3) and (4).

(When the indicating lamp does not turn off even though the sensitivity setting dial is turned towards L direction, the sensitivity setting dial should be completely turned towards L direction.)

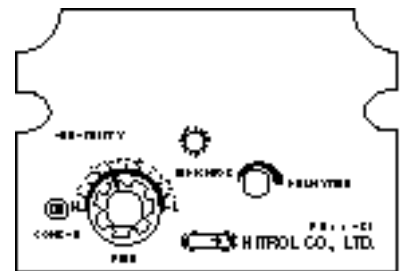


Fig. 13

- (7) When the indicating lamp does not turn on even though the sensitivity setting dial is turned from L to H direction under the condition that the probe is not in touch with material to be measured, the following adjustment should be performed.

- The sensitivity setting dial should be adjusted to 90.
- The varicon for coarse adjustment located left side of sensitivity setting dial should be adjusted so that the indicating lamp changes from turn-off to turn-on using a small driver.
- The varicon for coarse adjustment turns any direction, that is, left or right, however, it is not needed to turn more than 360 degree, since turning 360 degree will return the original position.
- Return to procedure (2) after completing the above mentioned adjustment.

*Varicon for range adjustment*

*It should be adjusted so that LED changes from turn-on to turn-off using a small driver. Return back to the procedure (2).*

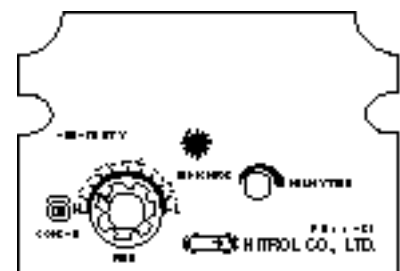


Fig. 14

Operation of output relay can be continuously delayed at the maximum of 10 seconds from the detection of material to be measured.

Delay time should be set up using semi-fixed volume for delay time adjustment when it is necessary.

However, output relay does not operate when the time duration for which the electrode is in touch with the material to be measured is shorter than the setting delay time.

### Adjustment of Delay Time

The followings should be examined when it does not properly operate.

- \* Whether the wiring is properly connected.
- \* Voltage of power supply is suitable.

### Trouble Shooting

Probe is not in touch with the material to be measured.

Operation status	Possible cause	Solution
Relay operates.  LED turns on.	Sensitivity is not properly adjusted.	Sensitivity adjustment is performed one more time according to the "sensitivity adjustment"
	There is a lot of material to be measured between tank wall and probe	Build-up should be removed by disassembling the device from the vessel Sensitivity adjustment is performed one more time according to the "sensitivity adjustment" using initial setting values of capacitance.
	Lead wire from probe becomes short circuit with case.	Causes of short circuit are removed by disassembling the amplifier from the case.

Whole probe is completely covered by material to be measured.

Operation status	Possible cause	Solution
Relay does not operate.  LED does not turn on.	Power is not supplied. Power has a lower voltage than required.	Power supply is examined one more time.
	Sensitivity adjustment is not properly performed.	Sensitivity adjustment is performed one more time according to the "sensitivity adjustment"
	Value of dielectric constant is low.	Sensitivity adjustment is performed one more time according to the "sensitivity adjustment" The structure of probe should be changed.

Build-up attached to the probe should be removed simultaneously when cleaning the vessel.

When flowing velocity is fast or there is a stirrer inside the vessel, mechanical damage and destruction of insulation of probe should be carefully examined.

### Maintenance

## ORDER CODES

- \* Wet Part Material
  - S1 : SUS 304 (ROD + Partial teflon insulation)
  - S2 : SUS 316 (ROD + Partial teflon insulation)
  - S3 : ROD + Teflon + Coating
  - S4 : ROD + Teflon + Coating (For corrosion liquid)
- \* Enclosure
  - 0 : Weather-Proof
  - E : Ex-Proof (d2G4 & Ex d IIC T4 IP65)
- \* Pressure Temperature
  - 0 : ATM. 80 °C
  - 1 : 100~180 °C
  - S : Special Version
- \* Mounting Size & Material
  - 1 : Screw size PT 1 " & SUS 304
  - 2 : Screw size PT 1 " & SUS 316
  - 3 : Flange size JIS 25A 10K RF & SUS 304
  - 4 : Flange size JIS 50A 10K RF & SUS 304
  - 5 : Special version
- \* Head Material
  - A : ADC 12
  - S : Special version
- \* Measuring Length
  - 1 : ROD Type Per Additional 100 mm
  - S : Special version
- \* Output Signal
  - A : 1-SPDT
  - B : Special version
- \* Conduit Conn.
  - 1 : PF 1/2 "
  - 2 : PF 3/4 "
  - S : Special version

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