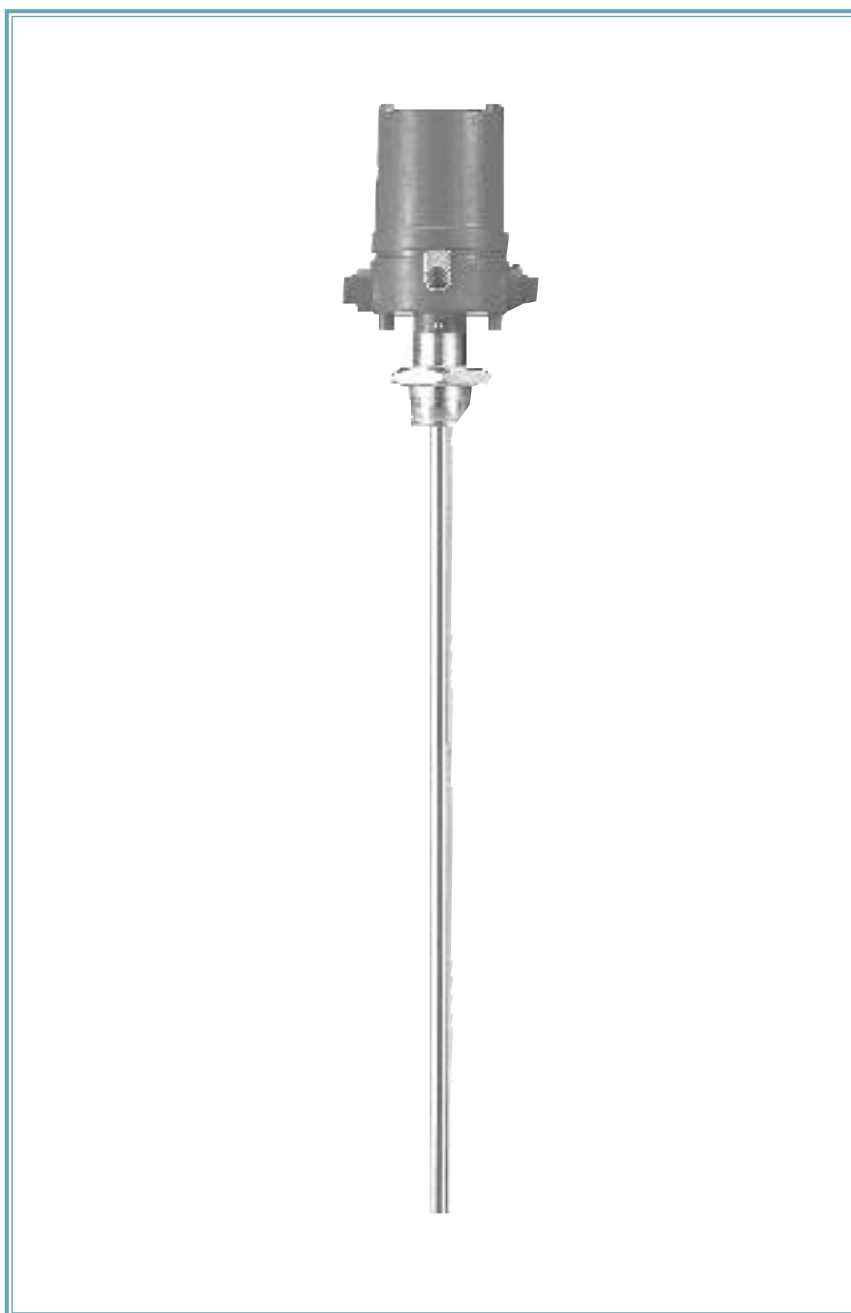


## General Information

# HPC-100C Series

Capacitance Type  
Level Transmitter



*General Information*



**HITROL CO., LTD.**

General

Capacitance type level transmitter is installed in the tanks or other vessels of explosion-proof area, can continuously measure the level of materials in the

vessel using dielectric constant( $\epsilon_s$ ) of the material(solid particles or liquid) in the vessel, and continuously convert it into the electric signal(4-20 mA DC).

Operating Principle

When there are two conductors insulated each other, the value of capacitance formed between two conductors is a function of the sizes of two conductors, relative location of two conductors and the dielectric constant of material placed between two conductors.

Under the condition that air of dielectric constant  $\epsilon_1$  exists in the space between two concentric conductors, lower part of the space between two conductors is filled with material of dielectric constant  $\epsilon_2$  as shown below, the change of capacitance is expressed as follows.

$$C = \frac{(\epsilon_2 - \epsilon_1) \times L}{\log_{10} D/d} \text{ [pF]}$$

Since  $(\epsilon_2 - \epsilon_1)/\log(D/d)$  is a constant value as an initial condition, and set this value as K, C becomes a function of level of material only. Therefore, level can be obtained through the measurement of C.

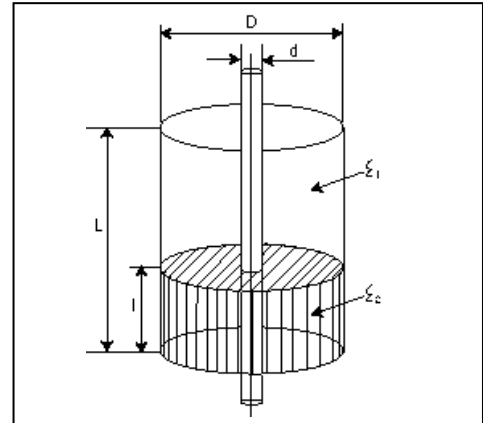


Fig. 1

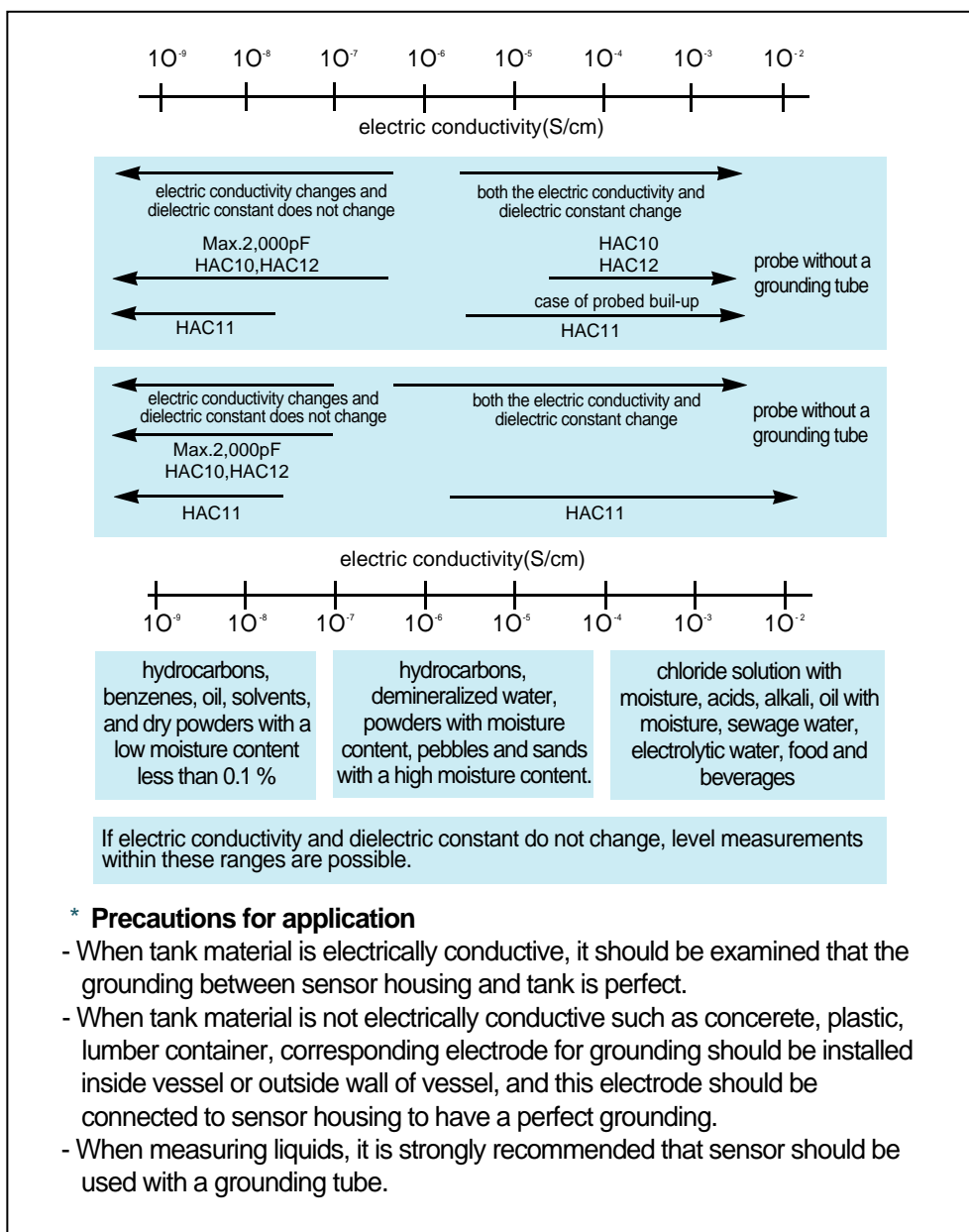
Specifications

Insert Amp	HAC 10	HAC 11	HAC 12
Power Supply	14-48 V DC	20 V DC	20 V DC
Power Consumption	Max. 20 mA	Max. 20 mA	Max. 20 mA
Output Signal	4-20 mA DC	0-4 mA DC	0-2 mA DC
Measuring Frequency	1 MHz	33 KHz	1 KHz
Measuring Range	20-2,000(pF)	40-4,000(pF)	20-2,000(pF)
Signal Transmission	Analogue 2-wire	Analogue 3-wire	Analogue 3-wire
Version	Compact	Saparated	Saparated
Separate Length		Bellow 35 Ohm per core	Bellow 35 Ohm per core
Connection to	Transmitter power supply	HLC-100C-P	HLC-100C-P
Operating Temp.	Standard : -20~+60 High temp. : upto 250		
Operating Pressure	Standard : 10 kgf/cm <sup>2</sup> Max. : 200 kgf/cm <sup>2</sup>		
Explosion Proof	Ex d llc T4 IP 65		
Connection	Standard 1 "PT		
Cable gland	2-PF 3/4 "PT		

Application

Selection of measuring frequency and insert amplifier is determined according to the following factors(Refer Table 1 and Table 2).

- \* How about the sensor structure and vessel wall 's material?
- \* What are the values of electric conductivity and dielectric constant of the material to be measured? (Tdale 3 given below shows the recommended applicable ranges of various materials and corresponding insert amplifiers.)
- \* Is build-up formed due to surrounding condition?



Block Diagram

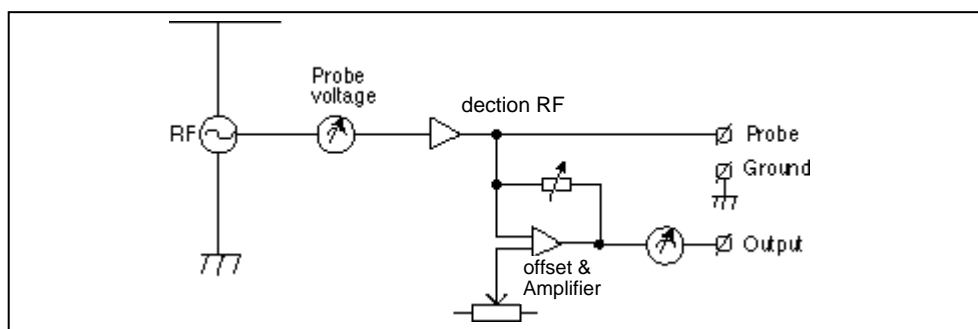


Fig. 2

## Installation and Cautions for Installation

Capacitance level transmitter can be used to continuously measure the level variations by installing it top of the tank. However, following precautions are required for installation

- \* Probe should not be installed at incoming path of material to be measured. Fig. 3-(a)
- \* When a long probe is used, a mounting bracket completely insulated with the sensing probe is installed at the bottom of probe. Fig. 3-(b)
- \* When the material inside the tank is fluid-like, or tank material is concrete, a probe with a grounding tube (guide tube) should be used. Fig. 3-(c)
- \* When tank material is not electrically conductive, and material to be measured is chemical, a double-layer probe should be used. Fig. 3-(d)

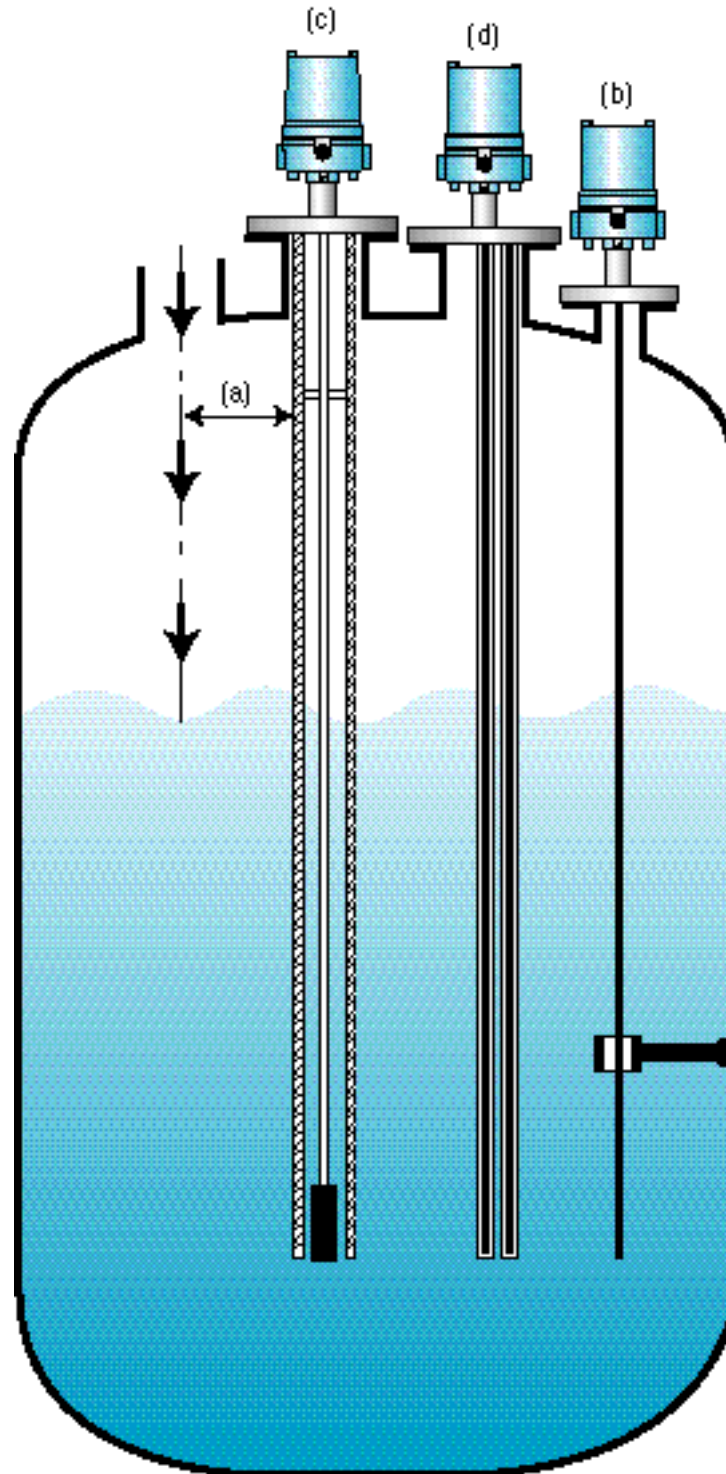


Fig. 3

Followings should be examined before zero and span adjustments.

- \* Are installation and wiring correct?
- \* Is the power supply correct?
- \* Is the tank empty?
- \* Is the grounding between tank and transmitter housing perfect?

### **Insert amplifier (HAC 10)**

1. Zero and span adjustment for the processes filling the material in the tank up to 100 % very easily.

#### **1-1. Zero adjustment(4 mA adjustment)**

Following procedures should be performed according to order.

At first, make the tank completely empty.

Set the digital multimeter(or digital tester) to mV.

Contact (+) probe of multimeter to TP terminal of amplifier, (-) probe of multimeter to (-) terminal of power supply.

Set the display of multimeter to vicinity of 40 mV by turning the zero coarse switch from 1.

Exactly adjust the display of multimeter to 40 mV by turning the zero fine variable resistor(increase for clockwise, decrease counterclockwise).

Procedures from to are performed, zero adjustment(0 % . 4 mA DC) is completed.

#### **1-2. Span adjustment(20 mA adjustment)**

When zero adjustment is completed, span adjustment should be performed according to the following procedures.

At first, fill the tank with the material to the desired level.

Set the digital multimeter(or digital tester) to mV.

Contact (+) probe of multimeter to TP terminal of amplifier, (-) probe of multimeter to (-) terminal of power supply.

Set the display of multimeter to vicinity of 200 mV by turning the span coarse switch from 1.

Exactly adjust the display of multimeter to 200 mV by turning the span fine variable resistor(increase for clockwise, decrease counterclockwise).

Procedures from to are performed, zero adjustment(0 %, 4 mA DC) is completed.

2. Zero and span adjustment for the processes difficult to fill the material in the tank up to 100 %

#### **2-1. Adjust it as the same as 1-1.**

#### **2-2. Span adjustment(20 mA adjustment)**

When zero adjustment is completed, span adjustment should be performed according to the following procedures.

When the material is filled up to an arbitrary level in the tank, output signal proportional to the level can be calculated using the equation (1.1) given below.

$$I(mA) = \frac{\% \times 16}{100} + 4 \dots\dots\dots 1-1$$

Where  $I$  : output signal proportional to level

% : percentage corresponding to the current level

For an example, when the material is filled up to 80 % for the current measuring range in the tank, output signal becomes as follows according to equation(1.1)

$$I(mA) = \frac{80 \times 16}{100} + 4 = 16.8 \text{ mA}$$

Therefore, output current should be adjusted to 16.8 mA using the span coarse switch and fine variable resistor.

However, it should be noted that this span adjustment procedure can be applied only when the material should be filled over 50 % of the measuring range.

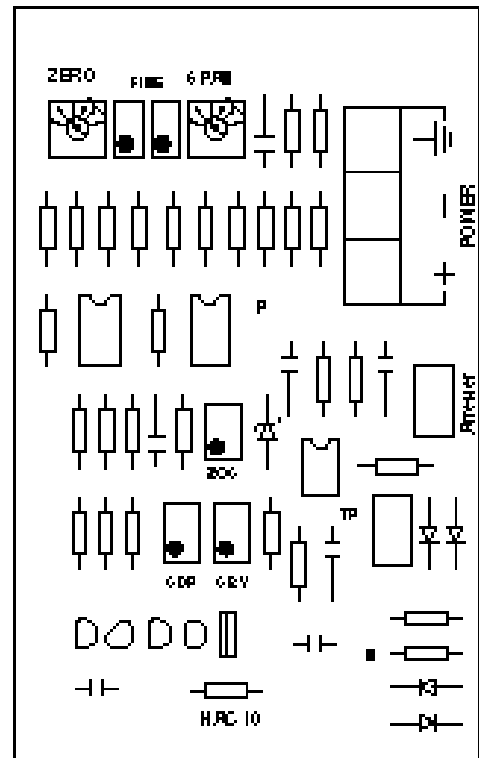


Fig. 4

**HAC 11, 12 Amp.:** Refer to HLC-100C-P operating manual

Wiring Diagram

**HAC 10 Amp.**

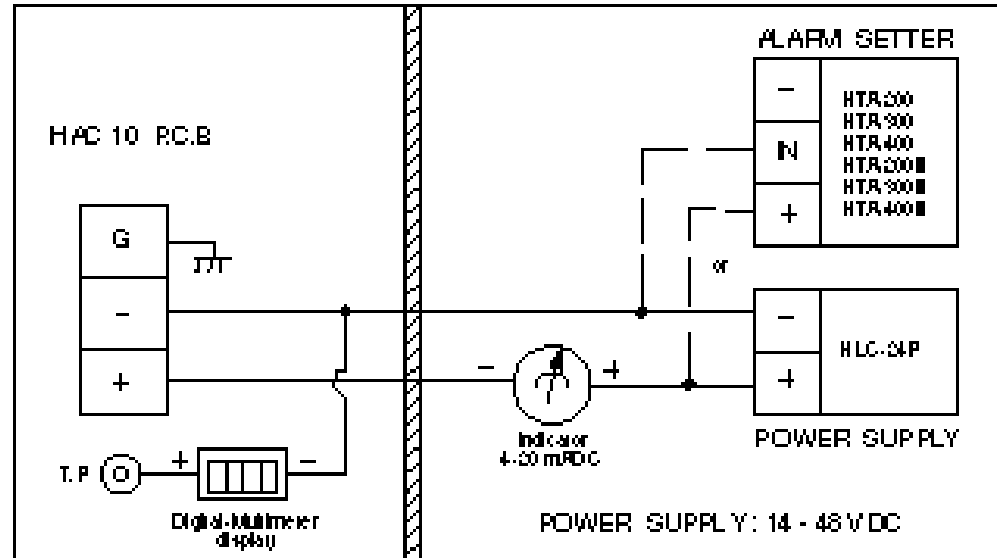


Fig. 5

### HAC 11, 12 Amp.

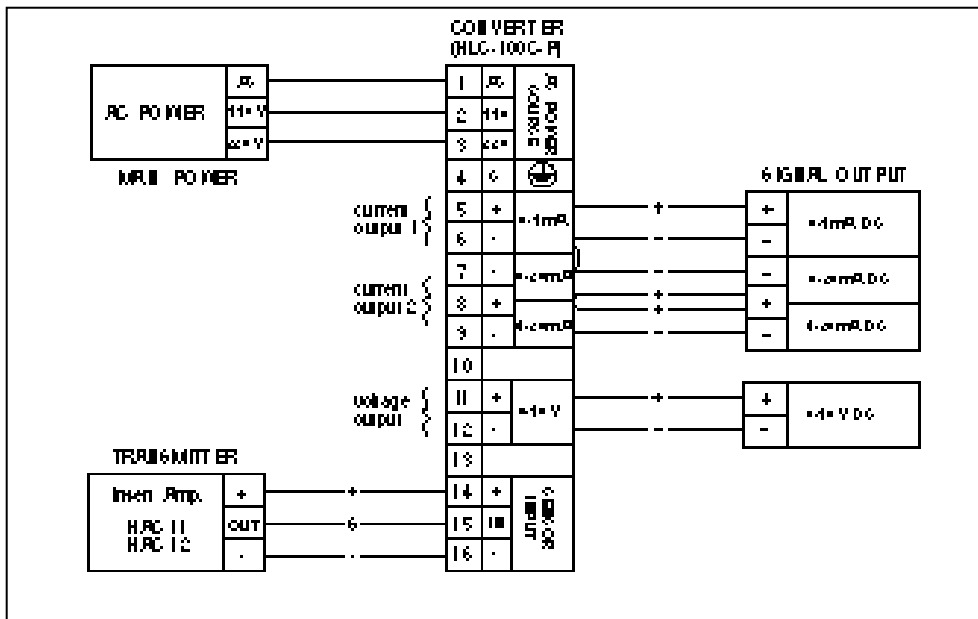
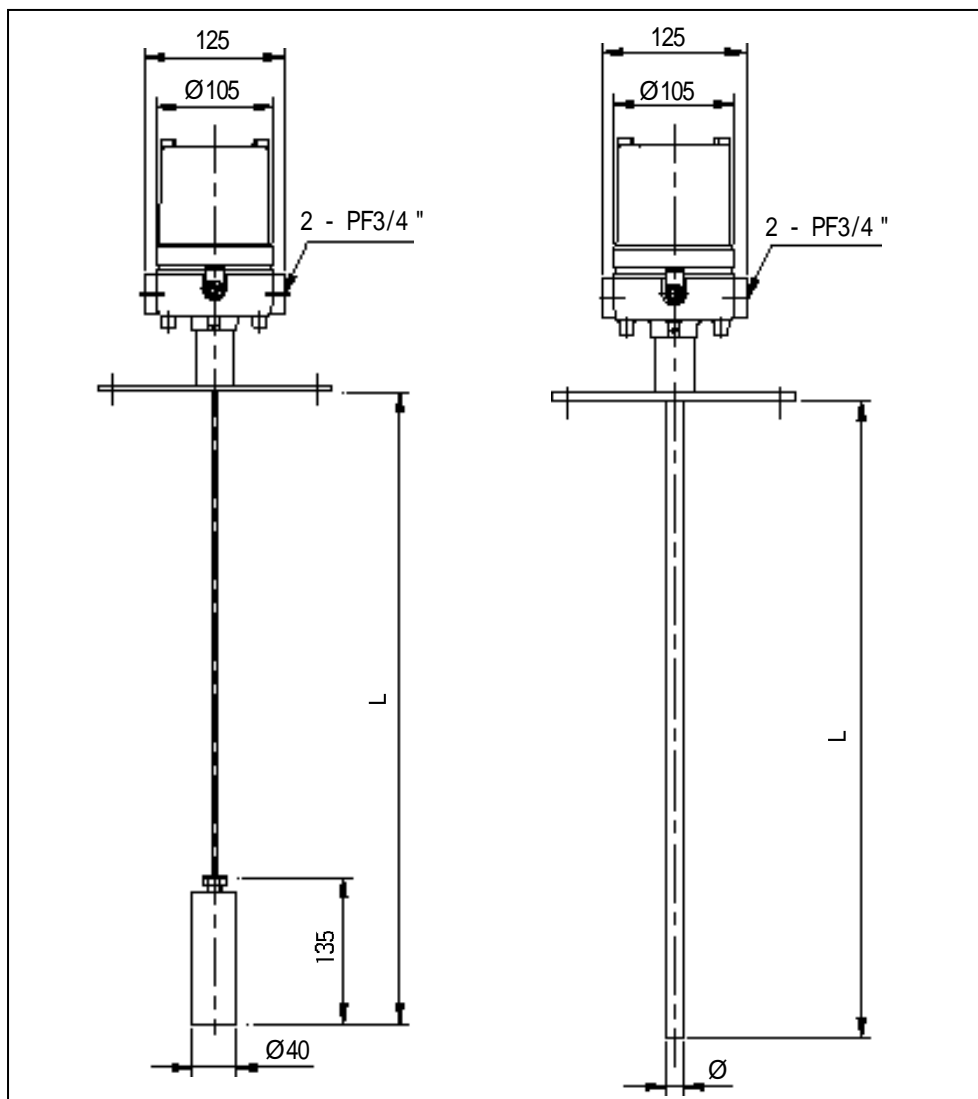


Fig. 6



Dimension

## Trouble Shooting and Maintenance

- \* Level changes, however, output does not change.
  - It is short of power supplied.
  - Amplifier is out of order.
- \* Output changes a little compared to the change of level.
  - Zero and span adjustment are not performed properly.
  - The value of C for probe is small.
- \* Output is fluctuating even though there is no changes in the level.
  - It is not properly grounded.
  - There are some noises in the wire.
  - There are severe oscillations in the material.
  - Insulation of probe becomes bad.
- \* Output indicates full(over 20 mA) regardless of level change.
  - Insulation of probe becomes bad.
  - Amplifier is out of order.
  - Zero and span adjustment are not performed properly.
- \* If build-up fo material is easily formed on the probe, remove the build-up periodically, especially when removing, it is carefully removed not to give damages of the probe 's coating.



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