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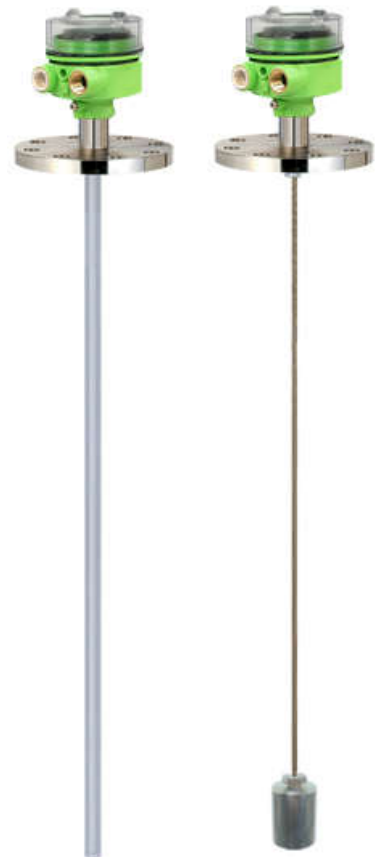
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# INSTRUCTION MANUAL

## CAPACITANCE TYPE LEVEL TRANSMITTER

### HT-100CT-2 Series

### HPC-100CT-2 Series





Doc. no : HT(HPC)100CT2\_IM\_Eng\_Rev.6.4


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 You should be well-informed of the contents where **WARNING** is marked before carrying out the work.

 You should be careful where **CAUTION** is marked to carry out the work.

 You should be aware of where **NOTICE** is marked to carry out the work.

**Overview** HT (HPC)-100CT-2 Series is a Capacitance Type Level Transmitter which continuously measures liquid levels using of liquid's dielectric constant. It can be easily installed and adjusted, and can be easily applied to corrosive liquids and widely used in general industries, chemical and oil plants.

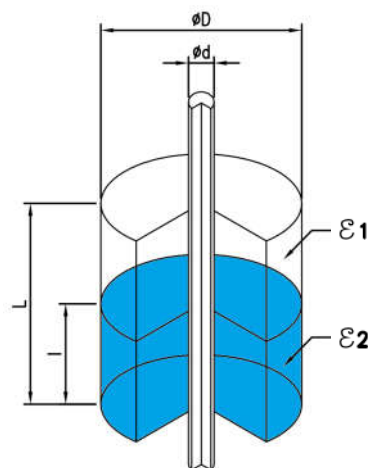
- Characteristics**
- Widely used to measure various liquid levels
  - Strong structure and semi-permanent life cycle due to move-less part
  - Various probe types for wide application
  - Easy installation of wire type. (HT-100CTW-2 Series)
  - Applicable to corrosive liquid
  - Interface measurement between water and oil is available
  - Applicable to explosive area (HPC-100CT-2 Series)
  - Have KC certificate and CE certificate

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

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

Since  $\frac{(\epsilon_2 - \epsilon_1)}{\log_{10} D/d}$  is a constant value as an initial condition, and get this value as K,  $\Delta C$  becomes a function of level of material only. Therefore, level can be obtained through the measurement of  $\Delta C$ .



- $\epsilon_1$  : Dielectric constant of air
- $\epsilon_2$  : Dielectric constant of medium (contents)
- L : Height of tank
- l : Level of medium (contents)
- D : Outer diameter of tank
- d : Outer diameter of sensing probe

**Specifications Weather-Proof Version**

Model	HT-100CT-2	HT-100CTH-2	HT-100CTW-2	HT-100CTWH-2
Probe Type	Rod		Wire	
Mounting	Screw or Flange			
Ambient Temperature	-20°C ~ +60°C			
Process Temperature	-40°C~+80°C	-40°C~+150°C	-40°C~+80°C	-40°C~+150°C
Process Pressure	Vacuum~ 20kg/cm2(300#)			
Power Source	DC 24V			
Output	DC 4~20mA(2-wire)			
Enclosure	Weather-Proof			
Wetted Parts Material	SUS 304, 316L with Teflon			
Process Connection	PT 1"(M) Screw		50A JIS 10K RF Flange	
Housing ; Cable Entry	PBT;PF1/2"(F),IP65	AL; PF 1/2"(F), IP66	PBT;PF1/2"(P),IP65	AL; PF 1/2"(F), IP66
	AL;PF1/2"(F),IP66		AL;PF1/2"(F),IP66	
Accuracy	Up to ±0.5% of F.S			

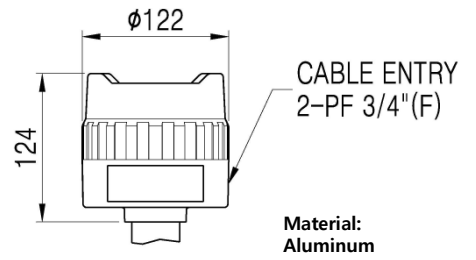
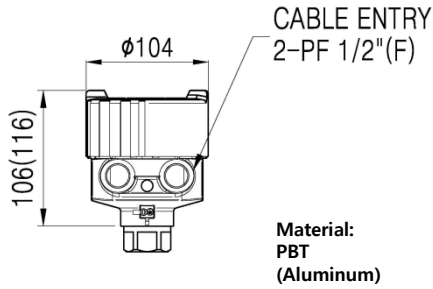
**Ex-Proof Version**

Model	HPC-100CT-2	HPC-100CTH-2	HPC-100CTW-2	HPC-100CTWH-2
Probe Type	Rod		Wire	
Mounting	Screw or Flange			
Ambient Temperature	-20°C ~ +60°C			
Process Temperature	-40°C~+80°C	-40°C~+150°C	-40°C~+80°C	-40°C~+150°C
Process Pressure	Vacuum~ 20kg/cm2(300#)			
Power Source	DC 24V			
Output	DC 4~20mA(2~wire)			
Enclosure	Ex-Proof (Ex d IIC T6, IP65)	Ex-Proof (Ex d IIC T4, IP65)	Ex-Proof (Ex d IIC T6, IP65)	Ex-Proof (Ex d IIC T4, IP65)
Wetted Parts Material	SUS 304, 316L with Teflon			
Process Connection	PT 1"(M) Screw		50A JIS 10K RF Flange	
Housing ; Cable Entry	AL ; PF 3/4"(F)			
Accuracy	Up to ±0.5% of F.S			

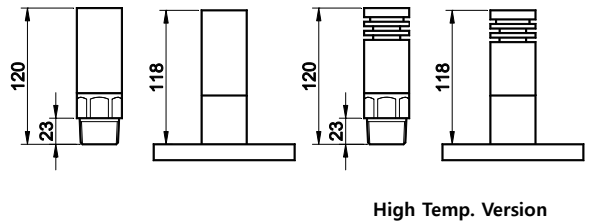
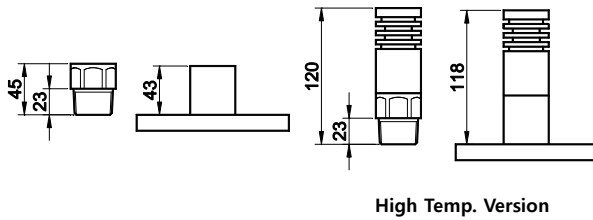
**Product Composition & Technical Data**

The dimensions on the following pages are indicated in mm

**[Housing]**



**[Connection]**



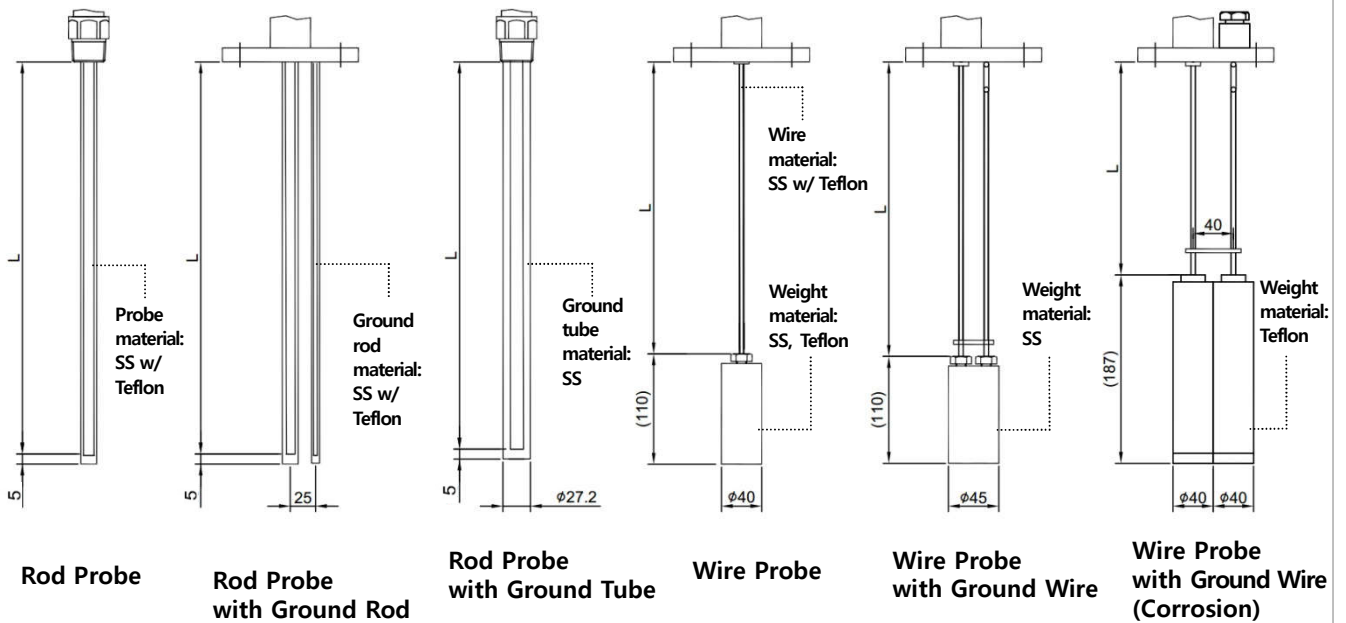
**Connection Type**

- Screw: PT 1" (Std.), NPT 1", PF 1", Others
- Flange: ANSI, JIS, DIN
- Tri-Clamp

**Material**

- 304, 316L, Others

**[Probe]**



	Rod Probe	Rod Probe w/ Ground Rod	Rod Probe w/ Ground Tube	Wire Probe	Wire Probe w/ Ground Wire
Total length (L)	100~3,000	100~3,000	100~3,000	1,000~15,000	1,000~15,000
Probe dia.	Φ15	Φ15	Φ15	Φ4	Φ4
Ground dia.	-	Φ10	Φ27.2	-	Φ4
For acid liquids	○	○	-	○	○
For high-viscosity liquids	○	○	-	-	-
For non-metal tanks	-	○	○	-	○
For sphere tanks	-	○	○	-	○

#### Dielectric Constant Value

Fuel Oil (Gasoline, Diesel...)	2
Hydrogen chloride	4.6~12
Hexane, Liquid	6
Butanol	17~18
Ammonia	16~25
Alcohol	16~31
Acetone	20
Caustic soda	22~26
Ethanol	25
Methanol	32~33
Glycerin	47~68
Water	81
Sulfuric acid	84

The data of dielectric constant value can be downloaded from technical data by accessing our website [www.hitrol.com](http://www.hitrol.com).

**Installation**

The capacitance type level transmitter can be installed in screw (PT, NPT, PF) and flange (ANSI, JIS, DIN) as well as tri-clamp and other various locations.

It shall be used after setting the range at the site according to the site installation conditions and medium to be measured.

If setting with the other medium which is not actual medium to be measured the measure value may be not correct.

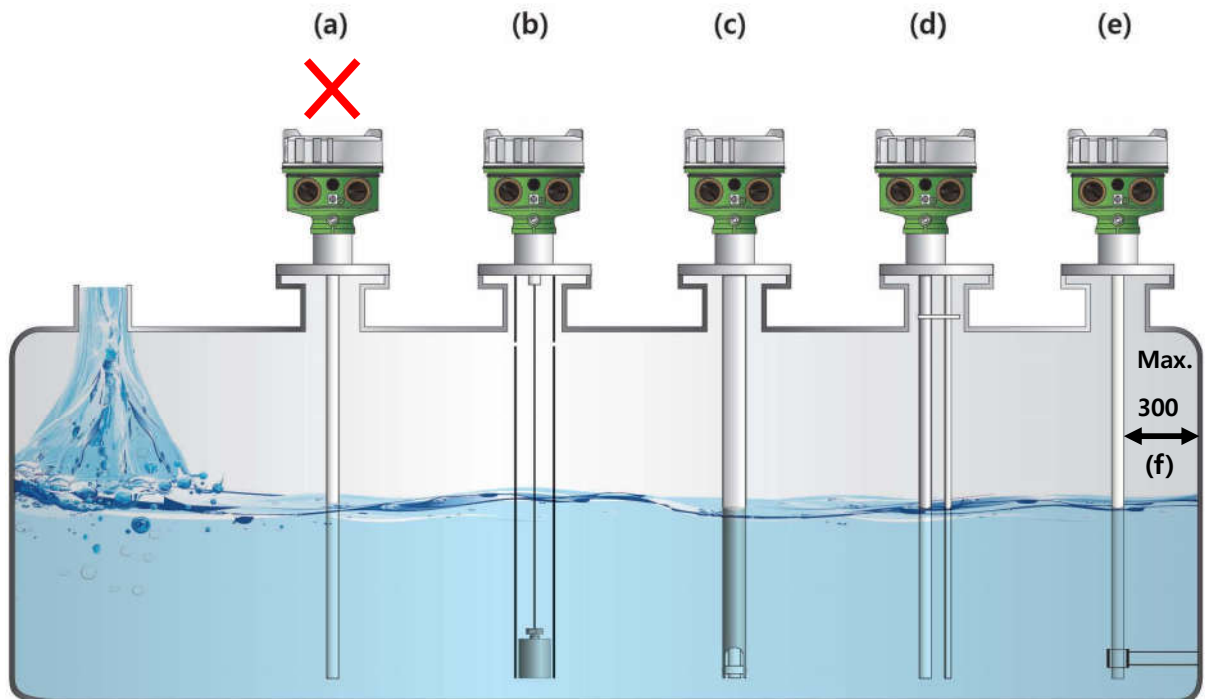
Pay attention to the following matters during installation.

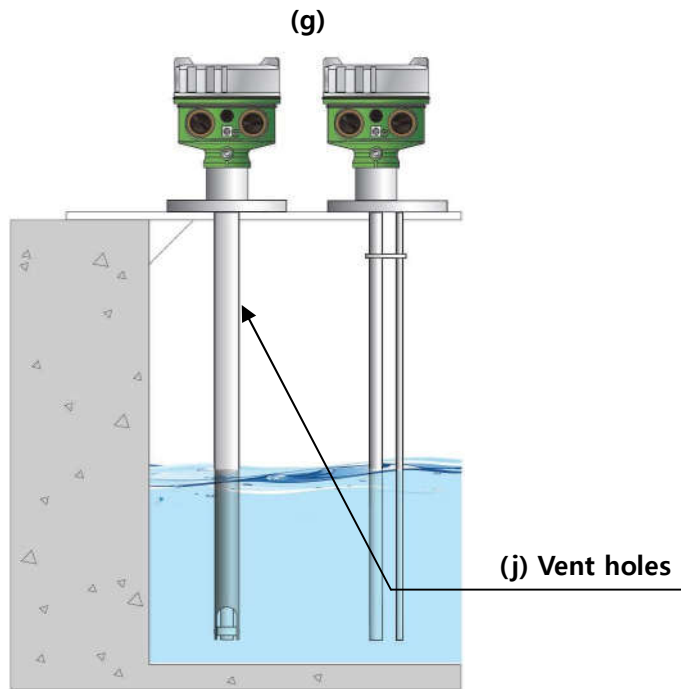
**Precautions for Installation**

- Product shall be installed at the place far from inlet in order to avoid the malfunction. (a)
- Protection tube must be installed on the wire probe if the contents are fluid or if there is an agitator nearby. (b)
- Probe shall be installed within Max. 300mm from the tank wall (f), and ground tube type shall be applied if the distance between the tank wall, agitator and sensing probe is far.
- If the tank material is non-conductive(ex. FRP), the rod probe with ground tube type shall be applied. (c)
- Ground rod type shall be used for corrosive liquid. (d)
- Bracket insulated to a sensing probe shall be installed at the bottom of probe in order to fix it if the probe length is long or there is slopping of medium in the tank. (e)

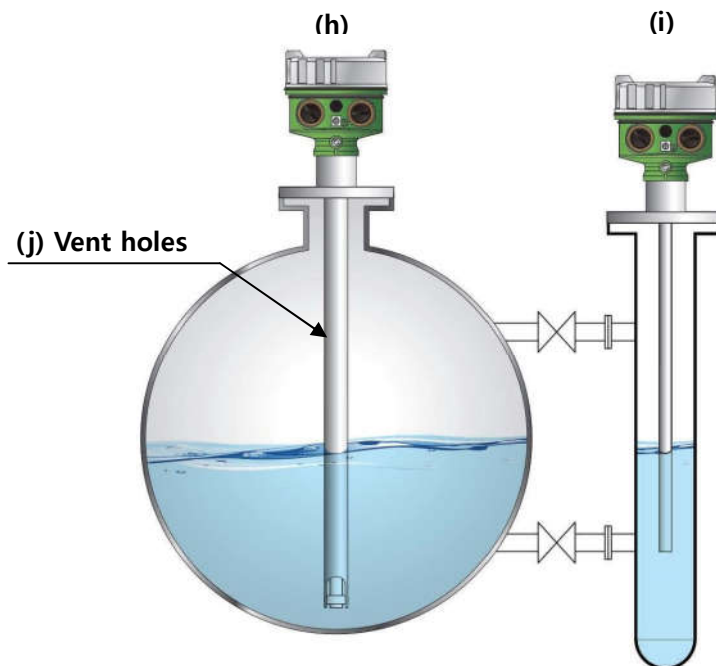


**When installing the product, verify the size of the product insert and the size of the nozzle in the tank before installing the product to the applicable standards. (ex. Ground tube, Ground Sensor, Weight, etc.)**





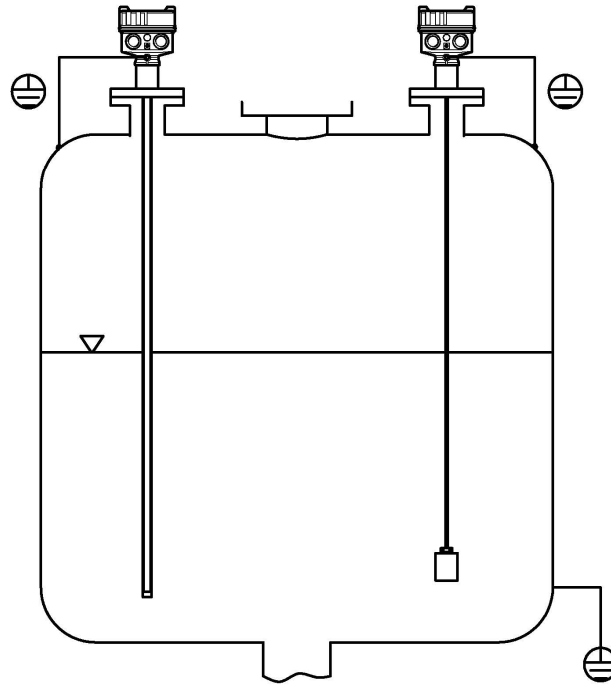
- Ground tube or ground rod type shall be applied for concrete or non-conductive tank as per above figure. (g)
- Ground tube type shall be applied for ball tank and external chamber shall be installed for side mounting of tank. (h)
- When side mounting, the chamber shall be installed. (i)
- The ground tube shall have vent holes in an appropriate location. (j)



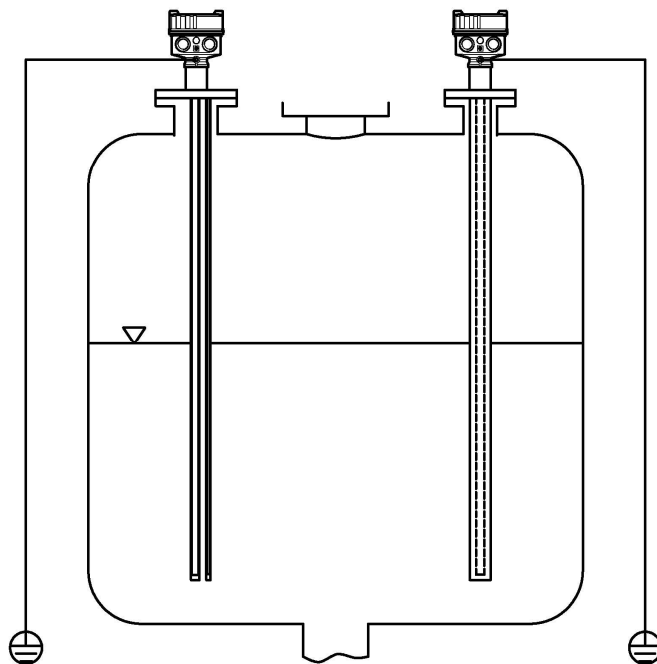


**■ Metal Tanks (Conductive tank)**

When installing on a conductive tank, the transmitter housing and tank shall be grounded as shown below.

**■ Non-metal tanks (Non-conductive tank)**

When installed on a non-conductive tank, use the ground tube (rod) or ground wire type. Also, the transmitter housing and tank shall be grounded as shown below.



**Wiring**

- Make sure to connect the power with correct polarity (+, -), and the power supply shall be between +17V ~ 40V.
- Do not connect the wire with the power connected.



**For Ex-proof product, the cover shall be locked and power shall be applied after wiring.**

**Failure Check & Maintenance****■ Maintenance**

The major parts of the HT(HPC)-100CT-2 Series level transmitters to be inspected are divided into the sensor element and the transmission element. The life spans of major parts vary with user environments and can be used in optimum conditions through periodic inspections. Therefore, the user shall maintain and repair the product through periodic inspections conducted at least once a year. In addition, check for the exterior of the product like visual damage. If the medium or foreign substance is attached to the probe, it will cause bad accuracy, so it shall be removed regularly. Be careful not to damage the Teflon part during removal.

**■ Failure Check**

The level of measured object changes, but the output does not change.

- ▶ Insufficient power supply
- ▶ Wrong adjustment of ZERO and SPAN

Only a slight change of output to the change of level of medium is present.

- ▶ Wrong adjustment of ZERO and SPAN
- ▶ A slight change of probe  $\Delta C$  value

No change of level, but output fluctuation is present.

- ▶ Wrong grounding
- ▶ Noise on the lines
- ▶ Extreme fluctuation of medium
- ▶ Bad insulation of probe

Output indicates full (20mA) of higher regardless of the change of level of the medium.

- ▶ Wrong adjustment of ZERO and SPAN

**Precautions  
For Removal**

- Check the level and presence of medium in the tank before removing it.
- Wear gloves when removing it, to prevent a burn.
- If there is explosive gas atmosphere, do not open the cover.
- Disassemble work shall be done with the power off.
- Make sure than any O-ring or gasket is not damaged while opening or closing the cover of product.

**Precautions  
for  
Transportation  
& Assembly**

- Pay special attention to prevent any impact on the device during transportation or assembly.
- Pay attention to prevent any damage to any packing when transporting or mounting the machine to the vessel.



**Please do not apply high impact to the product.**

**Precautions  
for  
Attachment**

- Use the same standard flange or screw.
- Make sure to insert washers between bolts and nuts to prevent loosening.
- Make sure to insert gaskets between flanges.  
(Select the gaskets in consideration of temperature of content and pressure of vessel.)
- Install an Ex-proof product only in an Ex-proof zone.
- After the installation is complete and the cover of the product is assembled, power it on.

**Precautions  
for  
Grounding  
(Ex-proof)**

- When connecting to an external ground, the ground wire shall be 4mm<sup>2</sup>(4mmSQ).



**Make sure to insert a washer if the terminal lug is removed from ground terminal and then re-connected. (Loosening prevention)**

**If the grounding part is painted or rusty, it may not be grounded.**



**HEAD (Weather-proof)**

**HEAD (Ex-proof)**

**Safety and  
Environment**

- Precautions for Use
  - Make sure to connect the product and vessel using required tools for sure.
  - Keep the lock key safe and make sure that it is locked.
  - Do not apply high impact to the product.
- Precautions for Wiring
  - Make sure to wire contacts correctly. (Refer to Wiring)
  - Wire and supply the power to the device after checking the specifications.
  - Pay attention to prevent electric shock.

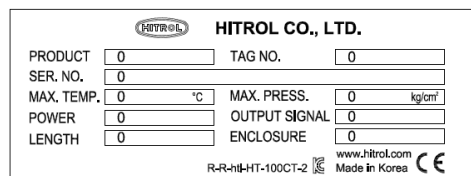
■ Disposal of Product

- Make sure to separate the amplifier and main unit from housing before disposing the products. Also, the amplifier shall be detached and discard the metal and non-metallic materials. No part (ex. Mercury switch) has influence on the environment, so no special attention is required.

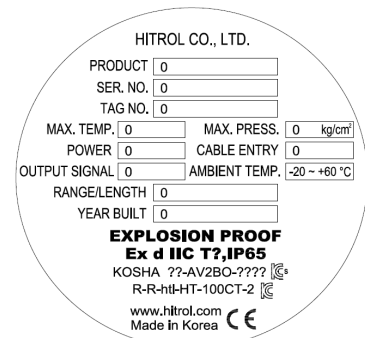
**Marking**

■ Product Identification

The product identification mark is attached onto the housing and shows the model name, serial number, working temperature, working pressure, and matters regarding output. The serial number is a unique manufacturing number for the identification of products.



Weather-proof



Ex-proof

**User Training**

The fluid temperature of the container shall be up to 80°C for Weather-proof type. For high temperature, the fluid temperature shall not exceed 150°C. In addition, make sure that the ambient temperature of housing is kept at -20°C ~ +60°C.

An Ex-proof product is pressure-resistant and Ex-proof type, so never open the cover during operation.



**Do not apply the Weather-proof (non-Ex-proof) product in an Ex-proof zone.**

**Warranty and Contact**

■ Warranty and Service

This product is subject to the warranty for 2 years of shipment and unpaid service will be provided for any damage found under normal operating conditions. If it is not about the failure of product, the service charge will be payable.

You can request A/S at our website or by contacting our headquarters.

■ Headquarters . Factory . Laboratory Contact Number

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# M-100CT2

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## User Manual

### Capacitance Type Level Transmitter



Doc. no. : Rev1.6

Issued Date : 2023.07.04

# 1. Configuration of Module (M-100CT2)



No	Configuration	Function
1	S Key	<ul style="list-style-type: none"> <li>■ Function setting</li> <li>■ Save the setting</li> </ul>
2	M Key	<ul style="list-style-type: none"> <li>■ Mode Change</li> <li>■ Cancellation</li> </ul>
3	▲ Key	<ul style="list-style-type: none"> <li>■ Span Set</li> <li>■ Setting the value left / up</li> </ul>
4	▼ Key	<ul style="list-style-type: none"> <li>■ Zero Set</li> <li>■ Setting the value right / down</li> </ul>
5	LCD	<ul style="list-style-type: none"> <li>■ Display of operating and setting status</li> </ul>
6	LED	<ul style="list-style-type: none"> <li>■ Display of power and status</li> </ul>
7	UART	<ul style="list-style-type: none"> <li>■ Communication port of M-100CT2 setup and operation status</li> </ul>
8	N/A	<ul style="list-style-type: none"> <li>■ Not used</li> </ul>
9	PWR	<ul style="list-style-type: none"> <li>■ For supply power and current output</li> <li>■ Check for output current</li> </ul>

## 2. Specification

Category	M-100CT2	
Enclosure	Weather Proof	
Material	PBT / ALC	
Mounting	Integral	
Microprocessor	16Bit Microprocessor	
Current Loop Interface	2-Wire Loop Current	
Supply Voltage	DC+17V ~ +40V @ Typ.+24V	
Measurement Accuracy	±1mm	
Output Current Accuracy	3.8mA ~ 20.5mA @ ±0.5% F.S	
Output Current Range	■ 3.8mA ~ 20.5mA @ Alarm 3.6mA, 21mA [NAMUR NE43]	
	■ 4.0mA ~ 20.0mA @ NAMUR NE43 Holding	
Frame Ground	FG	
Damping Time	■ Default 0.5 sec	
	■ Range : 0 sec ~ 10 sec @ 0.5 sec Step ADJ.	
Self-Diagnosis	■ When the sensor is not wiring	3.6mA Current Output
	■ Lower than Zero	3.6mA Current Output [NAMUR NE43]
	■ Higher than Span	21mA Current Output [NAMUR NE43]
Simulation Current Out	■ 4mA @ 5 sec	
	■ 12mA @ 5 sec	
	■ 20mA @ 5 sec	
Status Indicator	■ Tri-Color LED [Green]	Normal Operation
	■ Tri-Color LED [Red]	Abnormal Operation
	■ Tri-Color LED [Orange]	Zero, Span Not Set
Setting Method	Quick Setting / Setting Menu	
Display	mA, %, m, ft, Level, Distance, Rotation	
Ambient Temperature	-20°C ~ +60°C	

### 3. Configuration of Setting Menu

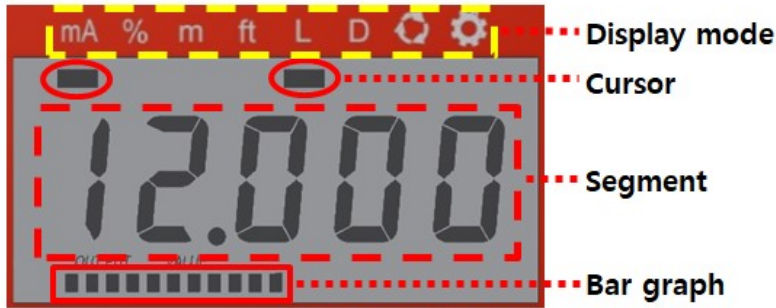
No.	Contents	Description	
[00]	mA / % Unit Set	▲ : mA ▼ : percent(※ [02], [03] setting unit)	
[01]	Level / Distance set	▲ : Level ▼ : Distance	Quick Menu
[02]	Zero Point Set	0.0 ~ 95.0% or 4.000 ~ 19.200 mA setting	Quick Menu
[03]	Span Point Set	5.0 ~ 100.0% or 4.800 ~ 20.000 mA setting	Quick Menu
[04]	Zero Height Set	Level setting criteria ※ -9.999~99.999m (User setting)	
[05]	Span Height Set		
[06]	Tank Height Set		
[07]	NAMUR NE43 Set	NAMUR NE43 function setting and Holding	
[10]	Damping Time Set	0 ~ 10 sec. (Default 0.5 sec @ 0.5 sec Step ADJ.)	
[11]	Zero Capacity fine Adjustment	Find adjustment from settled capacitance value. (0.1%, 1%, 10%)	
[12]	Span Capacity fine Adjustment		
[20]	Zero Output Current Adjustment	-0.100~ 0.100 mA (0.001mA Step ADJ.) ※ When the output current is adjusted offset	
[21]	Span Output Current Adjustment		
[30]	Rotation Time	0.5 ~ 10 sec. (Default 1 sec @ 0.5 sec Step ADJ.)	
[31]	'mA' Display On/Off	Rotation 'mA' select display	
[32]	'%' Display On/Off	Rotation '%' select display	
[33]	'Meter' Display On/Off	Rotation 'Meter' select display	
[34]	'Feet' Display On/Off	Rotation 'Feet' select display	
[40]	4mA Output	Output "4mA" for 5 sec	Quick Menu
	12mA Output	Output "12mA" for 5 sec	
	20mA Output	Output "20mA" for 5 sec	
[90]	Error Number Output	Display of error number according to malfunction	
[91]	Capacity value Output	Display Zero, Span, and current measured value	
[100]	Reset	Reset the all setting	

[Table 2] Setting Menu List



# 4. Setting and Operating

## ■ LCD Configuration



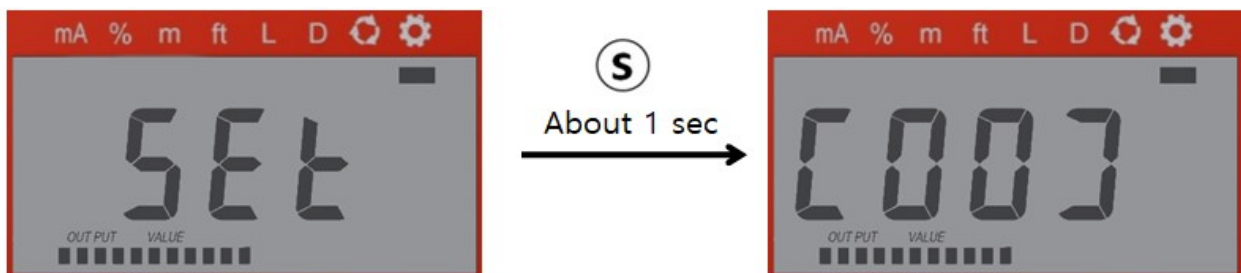
DISPLAY MODE	
mA	mA Mode
%	Percent Mode
m	Meter Mode
ft	Feet Mode
L	Level Mode (User setting)
D	Distance Mode (User setting)
⌚	Rotation Mode
⚙️	Setting Mode

The cursor moves sequentially whenever the (M) button is pressed.

The order of movement is as follows.

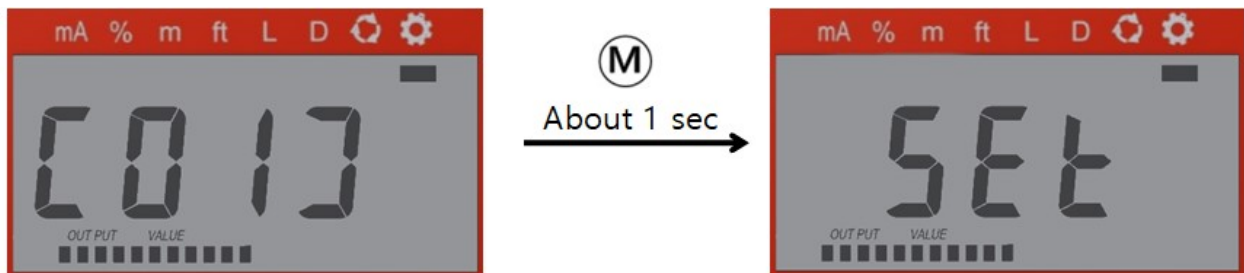
mA → % → m → ft → ⌚ → ⚙️ → mA → % → ...

## ■ Into the Setting Menu



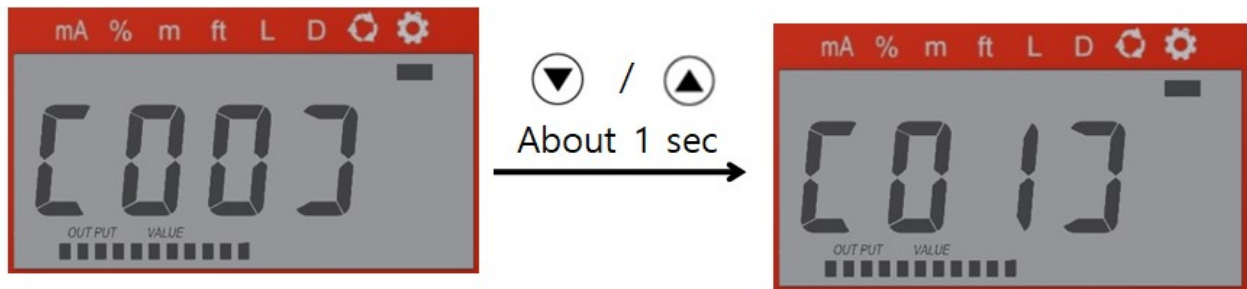
- In the Setting Mode, press (S) button for 1 second then the green LED will be Flickering and you can go into the Setting Menu.

## ■ Return to Setting Mode



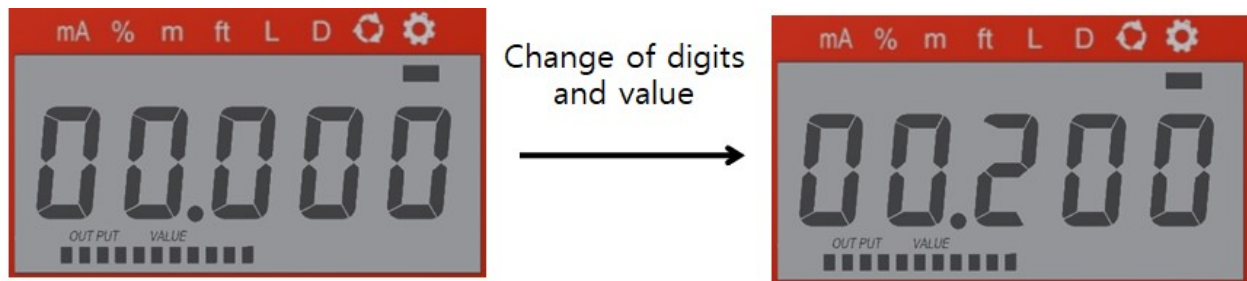
- In the Setting Menu, press (M) button for 1 second then the green LED will be flickering and you can go back to the Setting Mode.

## ■ Select the Setting Menu



- In the Setting Menu, use / buttons to select the user setting function.
- Pressing button for 1 second will enter the function.

## ■ Change the User Setting

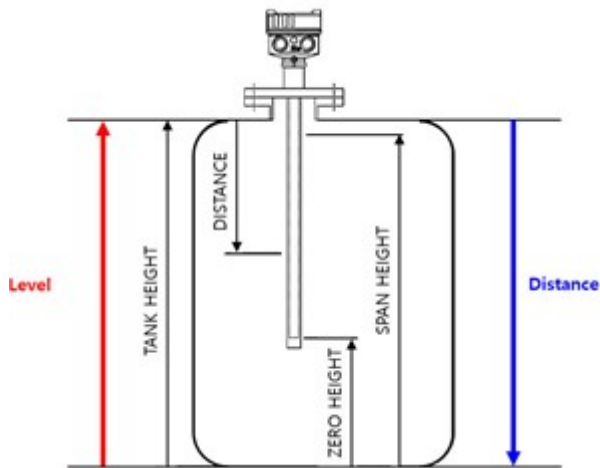


- If just 1 digit is flickering, it can be moved between the digits.
- If full digits are flickering, it can only be set up to the specified number.

Key Button	Function
Press more than 1 sec	Increasing of digits(Left)
Press more than 1 sec	Decreasing of digits(Right)
Press shortly	Increasing of the numerical value
Press shortly	Decreasing of the numerical value
Press more than 1 sec	Save and Leave
Press more than 1 sec	Leave without Save

[Table 3] Key Button Guidance

## ■ Height Setting



### ■ Level

This refers to the direction in which the medium is raised based on the bottom of the tank.

### ■ Zero Height

The distance from the bottom of the tank to the zero point is called "Zero Height".

### ■ Span Height

The distance from the bottom of the tank to the span point is called "Span Height".

### ■ Tank Height

The distance from the bottom of the tank to the top of the tank is called "Tank Height".

### ■ Distance

This refers to the direction of the downing of the medium from the top of the tank.

## ■ Zero, Span Quick Setting

### Setting by unit screen



[mA] Unit Setting



[%] Unit Setting

※ Factory shipping is set as "[%] uniy setting".

### Zero Setting

No.	Content	Quick Menu Setting
[02]	Zero Setting	▼ Press for 1 sec. → Input the value → S Press for 1 sec.

### Span Setting

No.	Content	Quick Menu Setting
[03]	Span Setting	▼ Press for 1 sec. → Input the value → S Press for 1 sec.

## ■ Zero, Span Capacity fine Adjustment

### Zero Setting

No.	Contents	Description
[12]	Span Capacity fine Adjustment	0.1% Up / Down : ▲/▼ Press shortly 1% UP / Down : ▲ / ▼ Press for 1 sec 10% UP / Down : (S) + ▲/▼ Pressing the button for 1 second changes the value. Press S button to save the value.

### Span Setting

No.	Contents	Description
[11]	Zero Capacity fine Adjustment	0.1% Up / Down : ▲/▼ Press shortly 1% UP / Down : ▲ / ▼ Press for 1 sec 10% UP / Down : (S) + ▲/▼ Pressing the button for 1 second changes the value. Press S button to save the value.

### Other

- ▷ Zero / Span can be set regardless of Display Mode status.
- ▷ It can set, save, or cancel the values. (Refer to *Table 3. Key Button Guidance*)
- ▷ The level of medium state shall be maintained when setting zero / span.