IN-LLT-C

Submersible Level Transmitter

1.1 Description.

The Intech IN-LLT-C hydrostatic level transmitter is a fully sealed submersible pressure instrument. It is designed for liquid level measurement. The sensor and electronics are housed within a stainless steel IP68 housing and provide end users with an Industrial 4~20mA loop powered signal.

The transducer diaphragm is mechanically protected by a steel cap that is designed to allow water / product free access to the diaphragm perform the measurement. Signal cable is sealed to the housing and contains the atmospheric pressure reference tube. IN-LLT-C units are designed for long term submersible operation.

The IN-LLT-C piezo-resistive level transmitter has advantages of small size, light weight and long-term stability; it can be applied to measure and control in the petrochemical, medical, metallurgy, power station, mines, city water supply, drainage and hydrology survey and various other industries.

2.1 Specifications.

Range (FS):	1 2 5 10 20 50 100 200 mH_2O		
Overpressure:	2 times FS		
Accuracy:	0.5% FS		
Stability:	range>20mH_2O, 0.2% FS		
	range≤20mH_2O, 20mmH_2O		
Temperature drift:		zero	FS
	range>10mH_2O	0.02% FS/°C	0.05% FS/°C
	range≤10mH_2O	0.05% FS/°C	0.05% FS/°C
Application temp. range:	-10~80°C		
Storage temp. range:	-40~100°C		
Power supply:	12~28VDC		
Output signal:	4~20mADC (2-wire)		
Load (Ω):	R_L ≤ (Uv-12)/0.02 (U is power supply voltage)		

3.1 Operation Principle.

The measuring element of transmitter is a piezoresistive sensor, which transfers the pressure into electric signal by semiconductor silicon material's piezo-resistive effect. The measured pressure acts on stainless steel diaphragm, and then be transferred onto sensitive chip by silicon oil which is filled between the stainless steel diaphragm and sensitive chip (see figure 1). The sensitive chip is connected with transmitter special amplifying circuit by wires (see figure 2). Due to the good linearity relationship between the electric signal of Wheatstone bridge on the sensitive chip and the measured pressure, the pressure can be measured accurately.

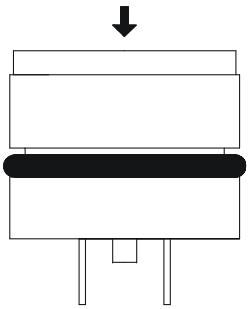


Figure 1

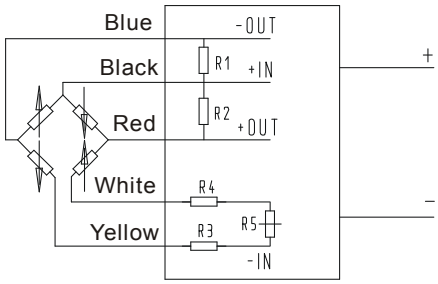


Figure 2

The basic principle of level measurement is that the liquid static pressure, proportioned with the liquid depth, is transferred into current (or voltage) signal output. The linearity corresponding relationship between electric signal output and the liquid depth is established to measure level or the liquid depth.

See figure 3 for the level measurement principle

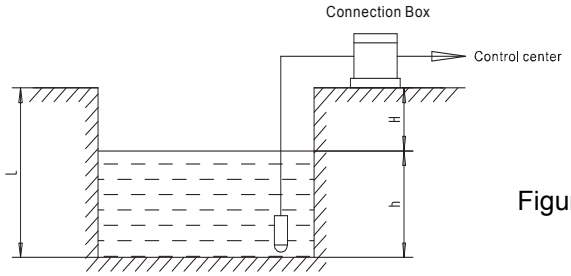


Figure 3

P = γ. h…….

P is the liquid static pressure at the measuring point;
γ is the liquid specific gravity;
h is the depth from the measuring point to the liquid surface, or level.

3.2 Calculation Examples.

Using a level transmitter with pressure range 10mH_2O, 2-wire, 4~20mADC output to measure the level of some pool, the water gravity is 1.0. If the output is 10mA, what is the measured level?

Solution : I = 4 + K•P ……..②

Put formula ① P = γ·h into formula ②:

I = 4 + K·h·γ……③

I is the output current value, the unit is mA;

4 is the zero output of transmitter, 4mA ;

K is the transmitter sensitivity, or the ratio of transmitter FS output (this example is 20-4 = 16mA) to range (this example is 10mH_2O. For this example, 16mA/10mH_2O = 1.6 (mA/mH_2O). This value has been given in product qualify certificate.

h is the level , the unit is m;

γ is the liquid gravity, this example is 1.0;

From formula ③, we get:

$$h = \frac{I - 4}{K \cdot \gamma} \quad \text{……..④}$$

Put all the values into formula ④, we have $h = \frac{I-4}{K\cdot\gamma} = \frac{12-4}{1.6 \times 1} = \frac{8}{1.6} = 5(m)$

The measuring result is five meters.

4. Construction and Outline Dimension

4.1 Construction Material

Housing：Stainless Steel 1Cr18Ni9Ti

O -Ring：Fluorine-rubber

Rubber Bushing：Nitrile Butadiene Rubber

Cable：φ7.5mm Polyethylene Special Cable

Diaphragm：Stainless Steel 316L

Connection Box： Casting Aluminum (ZL102)

4.2 Construction

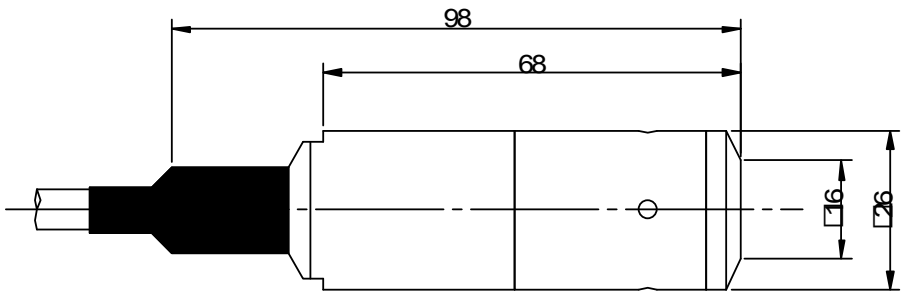


Figure 4

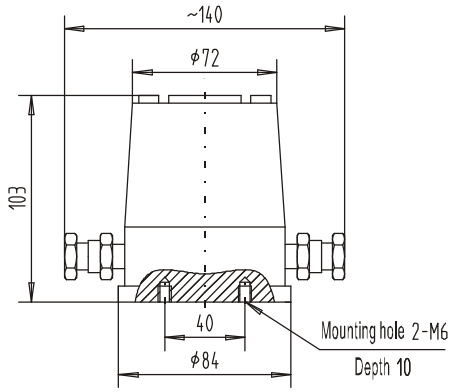
4.3 Outline and Dimension

See figure 4 for dimensions.

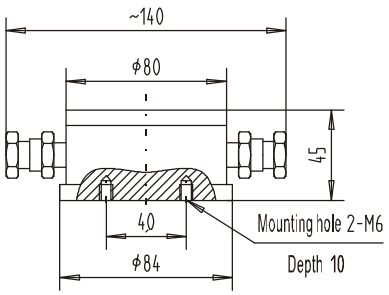
Cable Length: assembled according to customers' options; longest cable could be 500 meters.

Connection Box: Please specify if a connection box is to be connected to the IN-LLT-C when ordering.

Indicator: only for transmitter with 2-wire, 4~20mAdc output and connection box A, indicator could be provided according to the options.



Connection Box A



Connection Box B

Figure 5

5. Unpacking, Storage and Shipment Enclosed

5.1 Unpacking.

Attention:
1. Avoid knocking violently when opening to prevent damaging instruments or accessories. Please be careful to prevent the housing and rubber casing of transmitter cable from damage.

5.2 Enclosed

The transmitter includes:	
IN-LLT-C Piezoresistive level transmitter	1
Polyethylene Special Cable (connected with transmitter)	subject to ordered length
Connection Box (connected with cable)	subject to order
Indicator (in connection box A	subject to order
Product Operation Manual	1
Product Quality Certificate	1
Quality Tracking Card	1
Power Supply	subject to order
Digital Displaying Instrument	subject to order

5.3 Storage

The transmitter should be stored in dry and ventilative room with ambient temperature -40~120°C, relative humidity no more than 85% and the air in the room without corrosive gas.

6. Installation

6.1 Check before Installation

Attention before transmitter installation:
The static pressure produced by the liquid at installation place exceeds the transmitter FS or not.
The measuring liquid is compatible with the transmitter construction material or not.
The measuring liquid may stop up the holes on the protection cap or not.

6.2 Installation Methods

The transmitter should be installed vertically down.
In the flowing water, the acted surface should be parallel with the water flowing direction.

6.2.1 Installation in Static Water

For installation in static water see figure 6.
To prevent shaking or destroying the transmitter when pumping, the transmitter should be put away from the liquid resource. Otherwise it should be installed as per figure 7, protected by steel tube.

For installation in a deep well see figure 7.
A steel tube insertion method is usually used. The steel tube cannot be bent; the diameter of steel tube must be more than 30mm. Several holes should be made at different heights on the tube so as to easily raising and make water flow smoothly. If necessary, wrap steel wire around transmitter to prevent breaking the cable by lifting with the steel wire.

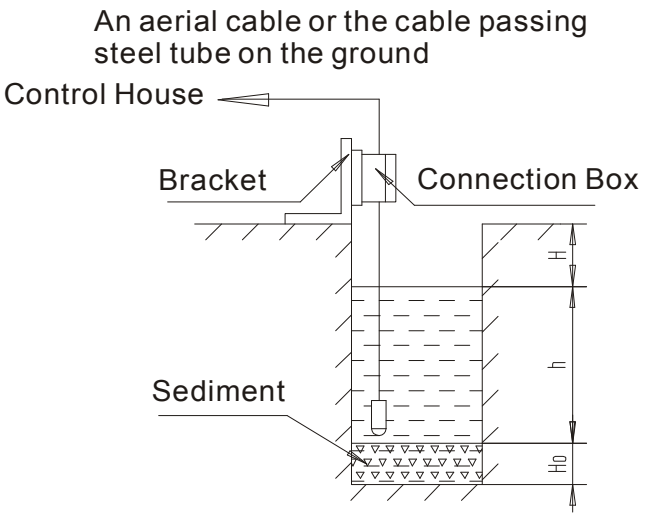


Figure 6

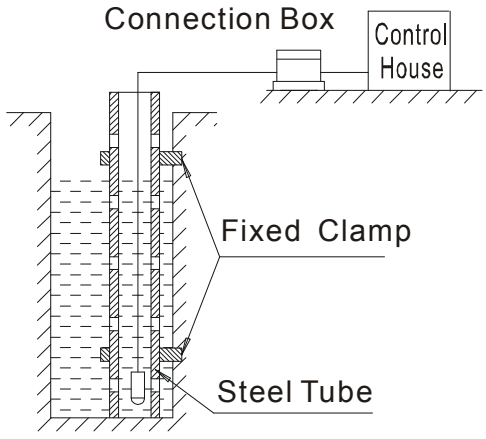


Figure 7

6.2.2 Installation in Flowing Water (e.g. river channel, reservoir area, etc)

Water-calming equipments are required.
Method one: Insert a steel tube in the water channel (see figure 8).
The steel tube wall should be thicker, and several holes should be made at different heights on the tube to damp waves and clear the water pressure influence.
Method two: Superficial burying is better in the sand and stone channel (see figure 9).

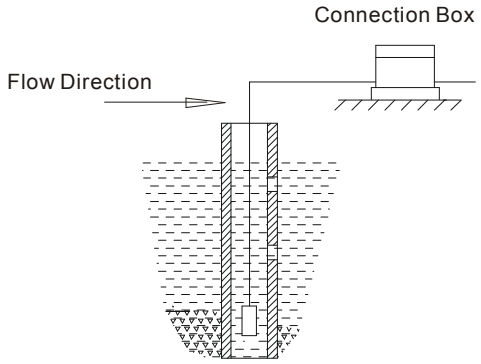


Figure 8

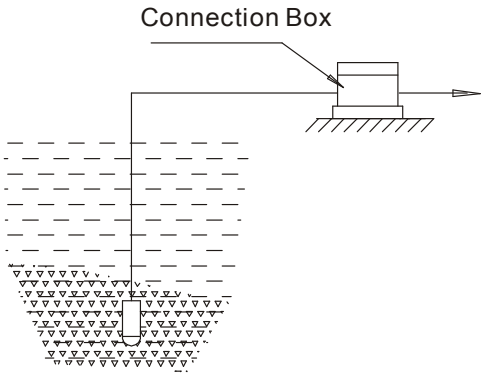


Figure 9

Method three: see figure 10.
This method can not only clear water flowing pressure and wave influence, but also filter the sand and mud.

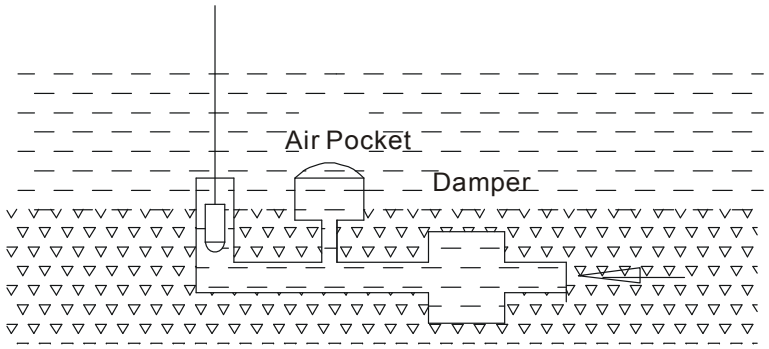


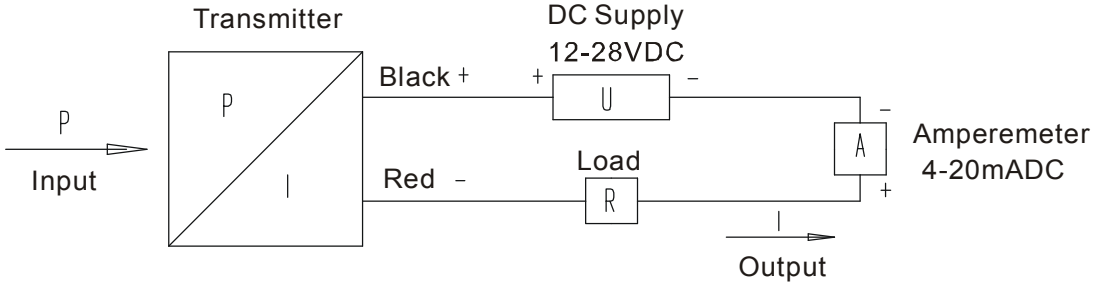
Figure 10

6.3 Electrical Connection

Wires should be connected based on terminal definitions on production quality certificate. See the following steps for the specific method.

6.3.1 Electrical Connection method with Two-wire 4~20mADC output

See figure 11 (Cable connection). Figure 11



6.3.2 Electrical connection method of transmitter with connection box

There is a terminal connection board in transmitter connection box, and the terminal definitions are indicated in figure 12.

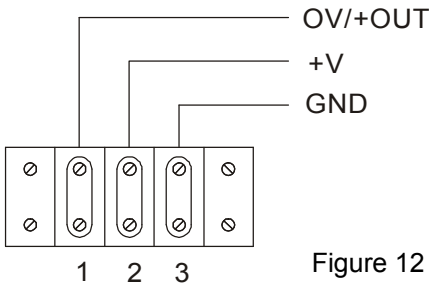


Figure 12

6.4 Reference Tube Installation

There is a plastic tube in the transmitter special cable; the back pressure cavity of gauge sensor is connected to atmosphere by this tube. In the process of installation and operation, be sure to keep the reference tube be well connected with the atmosphere. Mud or sand should not be jammed into the reference tube.
Prevent water or other liquid going through the reference tube to destroy the transmitter.

7. Operation, Maintenance and Fault Diagnosis

7.1 Operation

The customer could operate the transmitter without adjustment.
Please be sure that the installation and electrical connection are correct or not before operation.
Connect the excitation and operate.
The transmitter could work at once as soon as it is connected with excitation, but the output signal could be more reliable after 30 minutes.

7.2 Maintenance

The IN-LLT-C level transmitter does not need to be maintained regularly, but please pay attention to items as follow for better operating effect and reliability.
Check wire connection is reliable or not, and the cable is broken and old or not.

Clean the protection cap and diaphragm cavity periodically (take care!)

Don't violently pull cables or poke the diaphragm with metal or other hard objects.

7.3 Fault Diagnosis

The IN-LLT-C level transmitter is an integrative full-sealed construction without movable parts inside, owning advantage of long-term stability and reliability.
If some failures occur, such as no output, output too big or too small and unreliable, please turn off the excitation firstly, then check the installation and wire connection conform with the operation manual or not, the excitation is correct or not and the reference tube is unobstructed or not.
If unsuccessful, the transmitter may be damaged; please contact Intech Instruments.

Notes:

1. In the event that IN-LLT-C units are being used with media other than water please ensure that the seals and cable will not be compromised.
2. Two kinds of cable are available; Polyethylene (PE) & Polyurethane (PUR). Polyethylene cable is the stock standard.
3. If the IN-LLT-C is prone to lightning strikes, we strongly recommend the use of the optional LPN-OVP to protect the device.
4. At standard conditions: (@4°C, g=9.80665 m/s^2)
   1mH_2O = 0.1kgf/cm^2 = 9.80665kPa
5. For special requirements, please feel free to contact us.

Intech INSTRUMENTS LTD
www.intech.co.nz
Christchurch Ph: +64 3 343 0646
Auckland Ph: 09 827 1930
Email: sales@intech.co.nz