LT989W

Operation Manual

V1.0

Please fully read this operation manual before using the product.

1 Introduction

The LT989W level transmitter is a fully-sealed submersible instrument used for level measurement applications. The unit contains a highly stable and dependable sensor with a special transmitter PCB that is mounted in a stainless-steel housing. The integrated construction and the standard output signal support automated facility control and monitoring systems. The stainless-steel cap is designed to protect the steel diaphragm of the transducer, while still allowing the fluid being monitored with ample access to the transducer. The housing protection is IP68 rated, and the transmitter is suitable for long-term submerged operation.

The LT989W has many advantages, which include small size, light weight and long-term stability. This product is suitable for widely varying applications including petroleum and chemical industries, medical, metallurgy, power station, mining, city water supply, drainage and hydrology survey.

2 Specifications

Range（FS）: 5, 10, 15, 20, 30, 50, 100 mH_2O

Over pressure: 1.5 times FS

Accuracy Error: ±0.5%FS

Stability Error: Range ＞ 10mH_2O ±0.2％FS/year

Range ≤ 10mH_2O ±20mmH_2O/year

Temperature Drift: Zero Drift FS Drift

Range ＞ 10mH_2O ±0.02％FS/℃ ±0.05％FS/℃

Range ≤ 10mH_2O ±0.05％FS/℃ ±0.05％FS/℃

Operation Temperature: -10℃ to 70℃

Storage Temperature: - 20℃ to 85℃

Power Supply Voltage: 11V-28VDC

Note: It is recommended that the transmitter output signal be allowed 30 minutes to settle after it has been powered into operation for best precision.

Signal Output: 4mA-20mADC (2-wire) – Type E

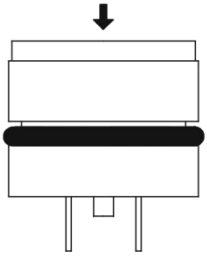
0.5VDC – 4.5VDC (3-wire) – Type K

Load Resistance (measurement Impedance): ≥10kΩ（3-wire）

Load(Ω): RL≤ (U-11)/0.02（U is power supply voltage in VDC, formula applies to 2-wire connection only

3 Operation Principle

The sensing element of the transmitter is a transducer which converts the variations in pressure into an electrical signal by using the piezo-resistive qualities of silicon materials. The pressure acts on a stainless-steel diaphragm and is then transferred onto the sensitive chip by silicon oil which fills the gap between the stainless-steel diaphragm and the chip (see Fig. 1). Pressure or level can be measured accurately due to the highly linear relationship between the electric signal from the Wheatstone bridge (see Fig. 2) and the pressure incident on the semiconductor.



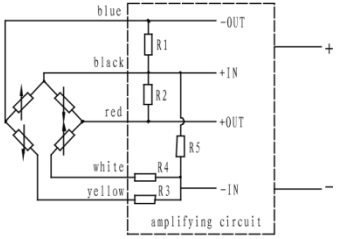


Fig. 1 **Fig. 2**

The basic principle of level measurement is that the static liquid pressure, which is proportioned to the depth of the liquid, is transferred into a current (or voltage) output signal. Once the linear relationship between the signal and pressure is established, the height of the liquid above the sensor can be calculated.

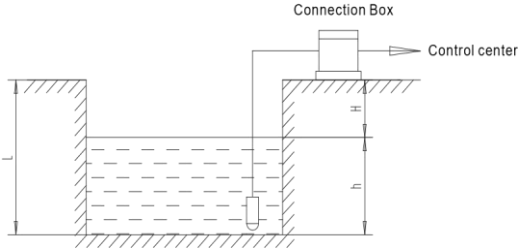


Fig. 3 $P = \gamma h$

As illustrated in Fig. 3, $P = \gamma h$ where P is the static pressure of the liquid at a depth of h and γ is the specific gravity of the liquid relative to water.

The specific gravity γ = (Density of the liquid)/(Density of water), so for water the specific gravity is 1.

Calculating Pressure/Level as a Function of Signal Level – see Appendix 1

Example – Signal Level as a Function of Pressure

Use a level transmitter with range supporting 0m$H_2O$to 10mH_2O full scale, 2-wire, 4mA to 20mADC output to measure the level in a pool. Given specific gravity of water is 1.0, if the output is 10mA, what is the measured level?

Solution：$P = \gamma \cdot h$ …….. ①

$I = 4 + K \bullet P$ ……..②

where I is the output current value in mA, 4 is the zero output of the transmitter in mA and K is the transmitter sensitivity, or the ratio of transmitter FS output to the range. For this example, K=16mA/10mH_2O = 1.6 mA/mH_2O.

Substituting $P = \gamma \cdot h$ into formula ②:

$$I = 4 + K \cdot h \cdot \gamma \text{……③}$$

From formula ③, we get:

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

Put all the values into formula ④, we have $h = \frac{I-4}{K\cdot\gamma} = \frac{10-4}{1.6 \times 1} = \frac{6}{1.6} = 3.75(m)$

The measuring result is 3.75 meters.

4 Construction and Outline Dimension

4.1 Construction Material

Housing：Stainless Steel 1Cr18Ni9Ti

O -Ring：Fluorine-rubber

Rubber Bushing：Nitrile Butadiene Rubber

Cable：Diameter 7.3mm Polyethylene Special Cable

Diaphragm：Stainless Steel 316L

4.2 Construction

The transmitter construction to see Fig. 4:

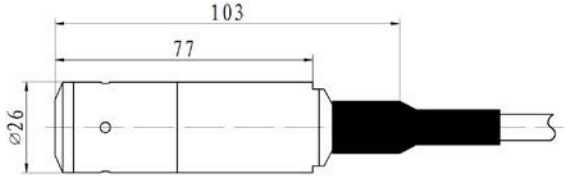
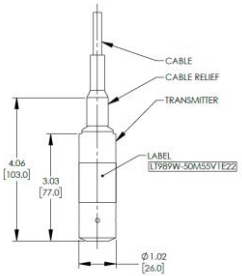


Fig. 4

4.3 Outline and Dimension

The transmitter outline drawing is shown in Fig. 5.



Typical Outline Drawing

Fig. 5

5 Unpacking, Storage and Shipment Enclosed

5.1 Unpacking

Attention:

a) Check the package for shipping damage.

b) When opening the box, please be careful to protect the housing and rubber casing of the transmitter cable from being damaged.

The contents of the package include:

- LT989W level transmitter
- Polyethylene Special Cable connected to the transmitter
- Product Operation Manual

5.2 Storage

The storage temperature range is -20℃ to 85℃, and relative humidity under 85%. The transmitter should not be stored in the presence of corrosive gases.

6 Installation

6.1 Check before Installation
Please check the following before transmitter installation:

a) Be sure the received product is what you ordered.

b) Check the product label and follow how the transmitter should be electrically connected to your system in the proper way.

c) The level of fluid measured should not exceed the level range specification of the level transmitter.

d) The measured liquid is compatible with the transmitter construction material.

e) The measuring fluid should not jam the holes on the protection cap.

6.2 Installation Methods
The transmitter can be mounted via several methods. It can be suspended from the electrical cable, it can be placed resting on the bottom of the tank or well in either horizontal or vertical orientation, or it can be attached to a pipe. For better accuracy, it is recommended that the units be mounted with the pressure connection downward. Under the moving water, the pressure connection side should be parallel to the direction of the water flow.

6.2.1 Level Transmitter Installation in Still Water

For installation in the water pond with a water pump, please see Fig. 6.

In the case where there is a water pump, the level transmitter should not be positioned too close to the pump inlet, in order to protect the transmitter from the impact of the pump when the pump is working. Alternatively, it is recommended to use the method shown in Figure 7 and protect the level transmitter with a steel pipe/tube.

For installation in the deep water still well, please see Fig.7.

In a deep water still well, it is necessary to use a steel pipe as a protective device. The steel pipe should be of good straightness and its inner diameter must be larger than the outer diameter of the transmitter. To lift and drop the level sensor easily and for the ease of fluid running through the pipe, it is recommended that a couple holes be drilled on the pipe at different heights of the pipe. Additionally, to avoid the damage of the cable from pulling during the installation, users can attach the transmitter to the steel wire and lift the cable up and down using the steel wire.

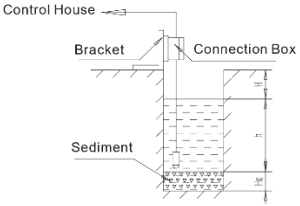


Fig. 6

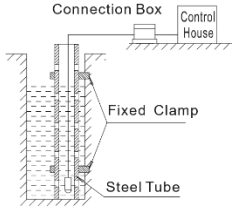


Fig. 7

6.2.2 Level Transmitter Installation in Flowing Water

For installation in Flowing Water（e.g. river channel, reservoir, etc.）, please refer to Fig.8.

In flowing water, the transmitter may be installed in a steel pipe, in order to prevent the transmitter from being knocked into a wall or a barrier.

For installation in the flowing water area with less turbulence and sediments, please refer to Fig.9. In this case, installation in a steel pipe is not required. Users need to gently lower the transmitter into the liquid slowly making sure that the cable does not drag over sharp edges and only to the depth necessary.

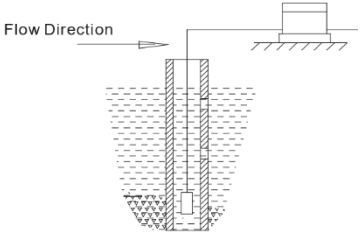


Fig. 8

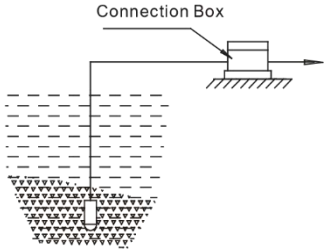
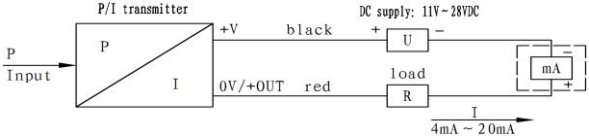


Fig. 9

6.3 Electrical Connection

After the successful installation of transmitters, customers can complete the electrical connection of the transmitters to their level controller or meters in accordance with the electrical connection instruction on the product label/nameplate and the following schematics:

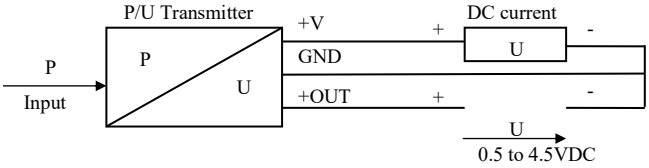
6.3.1 The electrical connection schematic of the 2-wire 4mA~20mA DC transmitter, please see Fig. 11. (cable connection)



Cable	2-wire
Black	+V
Red	+OUT
White	Null

Fig. 11

6.3.2 The electrical connection schematic of the 3-wire 0.5 to 4.5VDC transmitter, please see Fig. 12.(cable connection)



Cable	3-wire
Black	+V
Red	+OUT
White	GND

Fig. 12

6.4 Vent Tube Installation

The level transmitter cable normally includes a plastic vent tube which connects the back-pressure cavity of the gauge sensor to the atmosphere. In the process of installation and operation, care should be taken that the vent tube be well connected with the atmosphere. Always be careful that the vent tube is not jammed, and make sure no water or other liquid flows through the vent tube.

Otherwise, failure to protect the vent tube could result in premature failure of the transmitter.

7 Operation, Maintenance and Fault Diagnosis

7.1 Operation

The customer can operate the transmitter without adjustment.

Please be sure that the installation and electrical connection are correct before operation.

Connect the (power) excitation and operate.

It is recommended that the transmitter output signal be allowed 30 minutes to settle after it has been powered into operation.

7.2 Maintenance

LT989W level transmitter does not require regular maintenance but following these steps can lead to more reliable operation.

a) Check the cable for excessive bends or breaks.

b) Carefully clean the protection cap and diaphragm cavity periodically.

c) Do not pull cables strenuously or poke the diaphragm with metal or other sharp, hard objects.

7.3 Fault Diagnosis

LT989W level transmitter is a fully integrated, sealed component with no movable internal parts, providing greater long-term stability and reliability.

If there is an apparent failure on the LT989W, such as no output signal, or the output signal is too big or too small, then turn off the power supplied to the transmitter. Then check that the installation and wire connection conform with the operation manual, that the excitation is correct and that the reference tube is unobstructed.

8 Warranty

Products manufactured and/or branded by seller are warranted for a period of one year from time of delivery against defects in workmanship or materials or failure to operate as described in product data sheets under normal use. In some cases, the warranty period may exceed one year where a written warranty description specific to a certain product is stated in a contract or posted on a company website, product catalog or user's manual. Accessories and consumable goods such as batteries, chargers and accessory cables are warrantied for four months.

Appendix 1- Pressure as a Function of Sensor Signal Level:

Users have a wide spectrum of experience and background, so it is helpful to review some basic relationships that are at the center of pressure and level sensors. It was emphasized earlier that the relationship between the pressure and the output signal was highly linear. In this context this means that the desired number (pressure or level) is a linear function of the signal from the sensor (current or voltage) and follows the algebraic form P(S)=MS+B. P, the result (Pressure or

Level) is a function of S, the measured signal (current or voltage). The value M is a constant known as the slope, and B is a constant known as the y-intercept.

For most pressure sensors the minimum pressure, Pmin, is 0 (mH_2O, kPa, Atm, …) and the "Zero Point" of the output signal corresponds to Pmin. When the sensor measures its maximum pressure, Pmax, it outputs the "Full Scale" signal level. The slope, M, is the change in pressure divided by the change in the signal level.

Example: Consider a level transmitter that measures from $0mH_2O$ (Pmin) to $10mH_2O$ (Pmax) while the signal goes from a "Zero Point" of 4mA to 20mA "Full Scale". This means that when the sensor provides 4mA of current the level is zero meters of H_2O, and when the sensor provides 20mA of current the level is 10 meters of H_2O.

The slope, m, is the change in the output divided by the change in the input.

M=(Pmax-Pmin)/(Signal_FullScale-Signal_ZeroPoint).

In this example $M=(10mH_2O-0mH_2O)/(20mA-4mA) =0.625mH_2O/mA$.

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About L-com

50 High Street, West Mill, 3rd Floor, Suite #30, North Andover, MA 01845, USA

L-com, a leading manufacturer of wired and wireless connectivity products, offers a wide range of solutions and unrivaled customer service for the electronics and data communications industries. The company's product portfolio includes cable assemblies, connectors, adapters, antennas, enclosures, surge protectors and more. L-com is headquartered in North Andover, Mass., is ISO 9001: 2015 certified and many of its products are UL® recognized. L-com is an Infinite Electronics brand.

Company Information

- GSA Contract # GS-35F-0174S
- UL File #s: E203961, E203962, E137614
- ISO Cert. #10009277 QM08
- CAGE CODE # 45321
- DUNS # 04-019-9572
- NAICS 335931, 335932, 334419 SICs 3678, 3679, 3644, 5065
- CCR Established
- Military Packaging Capable
- GSI Capabilities with a Government Representative Itinerant