smar

How does the DT300 Density Transmitter work?

Initial Note:

DT300 refers for the SMAR family of Density Transmitters that can be found with 3 available communication protocols. The DT301 is the HART model that also provides the 4-20 mA output, the DT302 for FOUNDATION Fieldbus, and the DT303 for Profibus PA.

1.Introduction

Many industrial processes need continuous density measurement to operate efficiently and guarantee quality and uniformity to the final product. This applies for sugar mills, beer plants, distilleries, dairy products, chemical and petrochemical industries, among others.

Several methods are used to measure the density of liquids, based on different technologies, such as: nuclear meters, refractometers, Coriolis principle, vibrant tuning fork, aerometers, laboratory analysis, etc.

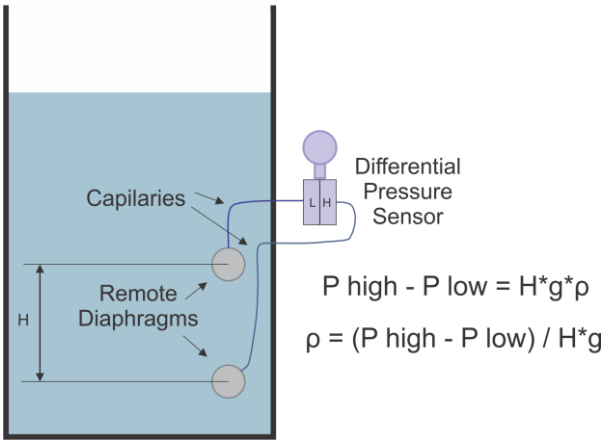
Following you can understand the DT300 density transmitter principle of operation and realize associated advantages of an online (continuous) density measurement.

2.1. How does it work?

The equipment uses a capacitive differential pressure sensor that communicates through capillaries to diaphragms immersed in the process fluid. These diaphragms are separated by a distance that must be known. (See figure below)

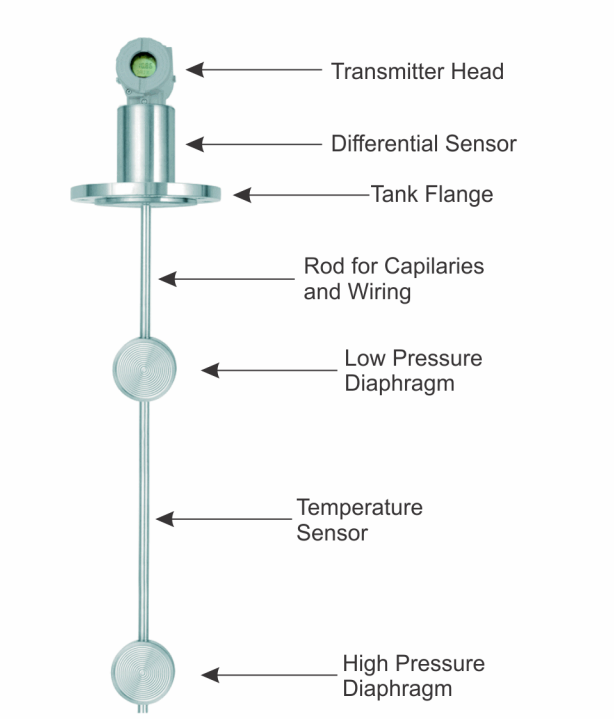
As we can see in the equation below, the differential pressure on the capacitive sensor will be directly proportional to the density of the liquid in the tank.

So, if we have the differential pressure (P high – P low), the vertical distance between diaphragms (H), and the gravity acceleration (g), we can determine the density of the fluid (ρ).



The DT300 anatomy

The DT300 density transmitter utilizes the presented method but there are other considerations. During its design implementation, it received a temperature sensor located between the diaphragms to compensate for the temperature effects on the device. (see figure below)



The distance between the diaphragms and the variation of the filling fluid in the capillaries that transmit the pressure from the diaphragms to the capacitive sensor must be considered.

The information generated by the sensor along with the collected process temperature, enable the electronic unit internal algorithm to determine the density or concentration values.

Furthermore, the DT300 density transmitter sends a digital signal through the line (also a 4-20 mA in case of the HART model) matching the unit selected by the user (ºBrix, ºPlato, ºBaume, g/cm3, among others).

Accuracy

The DT300 intelligent density transmitters offer an accuracy of ±0,0004 g/cm3 (± 0,1 ºBrix), and can be used on density measurements from 0.5 b/cm3 to 5 g/cm3.

Measuring ranges

The DT300 density transmitter is available in 3 measuring ranges to fit the application with the maximum accuracy

Range			Minimum Span
0.5	to	1.8 g/cm³	0.025 g/cm³
1.0	to	2.5 g/cm³	0.050 g/cm³
2.0	to	5.0 g/cm³	0.250 g/cm³

Open and closed thanks

This measuring method is immune to pressure variations on the recipient tank. It can also be used in open and pressurized tanks. However, it is a must that both diaphragms are completely immersed in the process fluid.

No moving part and no radiation

The fact that the DT300 density transmitter does not have moving parts makes it a robust device. Vibrations from the plant, unlike others density meters based on the oscillation, will have no effect on its measurements.