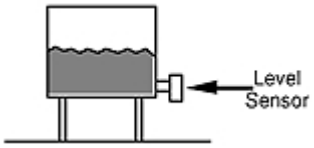
Liquid Level

The pressure measured at the bottom of a liquid filled tank is proportional to both the height (head) and density of the liquid. For best results the pressure should be sensed by a pressure transmitter mounted at the lowest point possible on the tank, as shown in Figure 1.

Figure 1:



Example #1: You want to monitor liquid level in a 30 foot high vertical water tank. A full tank would generate a maximum head pressure of 30 feet of water. Since one foot of water is equivalent to .4335 pounds per square inch (psi), the maximum pressure in psi is 13 psig. Per Table I below, a pressure transmitter with a range of 0-15 psig will accurately measure the liquid level within ±.46 inches of water.

Table 1:

Tank Level using a high accuracy (<±0.11% FS)
Pressure Transmitter

Full Scale Pressure Range	Tank Level (Water)	Accuracy of Level Reading
0-15 psig	0-34.6 ft. of water	±0.46 in. water
0-25 psig	0-57.7 ft. of water	±0.76 in. water
0-50 psig	0-115.3 ft. of water	±1.52 in. water
0-100 psig	0-230.7 ft. of water	±3.04 in. water

For liquids with densities different than water (1g/cm^3), pressure can be determined from liquid density (p), gravitational force (g) and liquid column height (h) with the formula:

$$P = \frac{\rho g h}{68947.6}$$

P = pressure in pounds per square inch (PSI)
p = liquid density in grams per cubic centimeters (g/cm^3)
(See Table II)

g = gravitational force (constant) = $= 980 \frac{cm}{sec2}$
h = liquid column height in centimeters (cm) (Note: 1 inch = 2.54 cm)

For liquid column height (h) in feet the formula simplifies to:

Formula 1: P = p h (.4335)

Example #2: You want to monitor liquid level in a 50 foot high vertical tank filled with Carbon Tetrachloride. Table II lists the density of Carbon Tetrachloride at 1.595 g/cm3 and we know that the maximum liquid height is 50 feet.

Using formula 1 the maximum pressure generated is:

P = p h (.4335) = (1.595) (50) (.4335) = 34.57 psig

Thus, a pressure transmitter with a range of 0-50 psig would be sufficient for monitoring levels in this tank.

Pressurized Vessels

A differential pressure transmitter is necessary for determining level in a pressurized vessel. Here the high side pressure port is connected to the lowest point possible on the tank and the low side pressure port is connected to the top of the tank. P in the formula would be the differential pressure measured.

Table II:

Density of various liquids*

Liquid	Density (g/cm^3)	Temp. °C
Acetone	.792	20
Alcohol, Ethyl	.791	20
Alcohol, Methyl	.810	0
Benzene	.899	0
Brine, 10% CaCi	1.091	0
Brine, 10% NaCi	1.078	0
Bunkers C Fuel Max.	1.014	15
Carbolic Acid	.950-.965	15
Carbon Disulfide	1.293	0

Carbon Tetrachloride	1.595	20
Chloroform	1.489	20
Distillate	.850	15
Ether	.736	0
Fuel 3 Max.	.898	15
Fuel 5 Min.	.966	15
Fuel 5 Max.	.993	15
Fuel 6 Min.	.993	15
Gasoline	.66-.69	
Glycerin	1.260	0
Kerosene	.82	
Mercury	13.60	
Milk	1.028-1.035	
Naptha, Wood	.848-.810	
Pentane	.624	15
SAE 10 Lube	.876	15
SAE 30 Lube	.898	15
SAE 70 Lube	.916	15
Salt Lake Crude	.843	15
32.6° API Crude	.862	15
35.6° API Crude	.847	15
40° API Crude	.825	15
48° API Crude	.788	15
Sea Water	1.025	15
Turpentine	.87	
Water	1.00	4

Note: See Corrosion Resistance Table for media compatibility with 17-4 pH stainless steel.