One-Chip Water Depth Sensor Composed of Pressure, Salinity, Temperature sensor

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The pressure sensor is a device, which can be used to measure static pressure, or a pressure in moving fluids. The piezoresistive silicon pressure sensor was one of the first micromachined products manufactured in production quantities. A typical piezoresistive pressure sensor consists of two componets : a diaphragm and resistors. Silicon is used for pressure sensors, because it combines well-established electronic properties with excellent with excellent mechanical properties. Other advantages of silicon include drastically reduced dimensions and mass, batch fabrication and easy interfacing or even interfacing with electronic circuits and microprocessors.[1,2]

Conductivity-temperature-depth (CTD) instrumentation is currently being fitted with more and more accurate pressure sensors. These sensors are conventionally used to infer depth below the water surface. The relationship between pressure and water depth, however, is complex and widely misunderstood. To investigate the most important factors affect the calculation of water depth from measured pressure. There are latitude, temperature, salinity, and atmospheric pressure. The sea-water density is also dependant on salinity, with high salinity water being about 3 % denser than fresh water. This too affects the change of the pressure/depth relationship.[3]

In this paper, we will fabricate water depth one-chip sensor to improve accuracy under various environment. There are temperature, piezoresistive type pressure, and electrode type salinity sensor in the proposed one-chip sensor. This sensor is able to operate in the range of 0 ~ 20 m for water depth, -10 ~ 50 ^{o}C for temperature, 0 ~ 5 % for salinity, respectively.

Figure. 1. shows the design schematic of a proposed one-chip water depth sensor that is able to measure pressure, salinity, and temperature.

The amplification circuit of a pressure sensor connected in the Wheatstone bridge configuration is shown in Fig. 2.

Since the change of pressure in water depends on the various factors, such as salinity, latitude, temperature, and atmospheric pressure, it is need to be compensated. The salinity of these factors is dominant. Therefore we tried to compensate the salinity dependence for the pressure in water. We measured depth both in pure water and in water including 5 % salt. Figure. 3. shows the output voltage of pressure sensor versus water depth. It is means that water depth must be compensated salt density in the water.

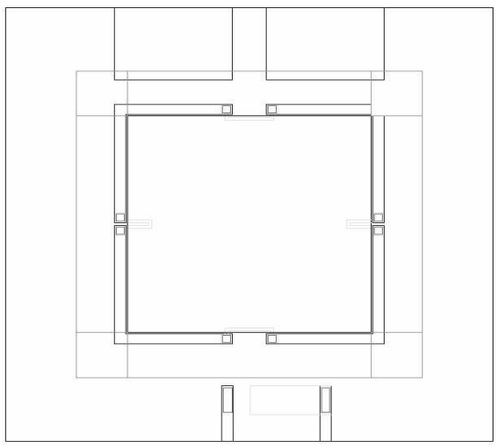

Fig. 1. Design schematic of a proposed one-chip depth sensor composed of pressure, salinity, and temperature sensor.

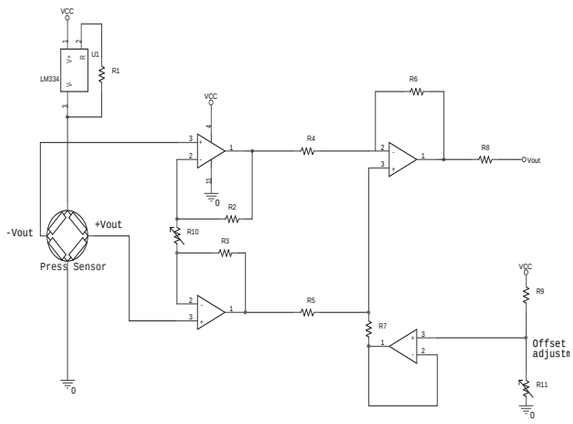

Fig. 2. Amplification circuit of a pressure sensor.

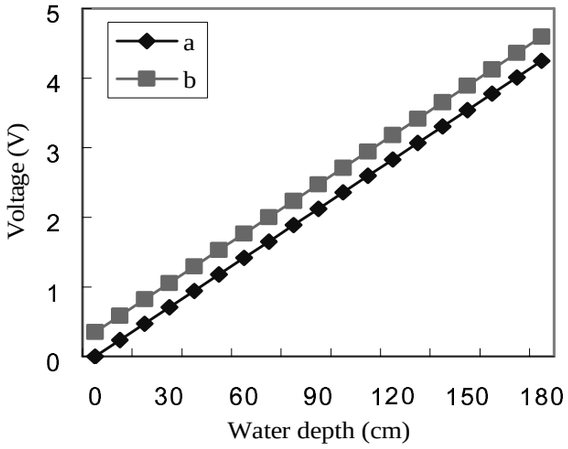

Fig. 3. Output voltage of (a) Pure water and (b) water including 5 % salt pressure sensor versus water depth.

References

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