Fluid Sensor Theory of Operation

Manning offers two different types of fluid sensors on its peristaltic samplers. The theory on how each type operates is presented here.

Continuity Fluid Sensor (Figure 1)

The continuity fluid sensor detects the presence of fluid by passing a small electric current between two probes in the sensor, using the fluid as a conducting medium. This fluid sensor consists of a PVC housing with two male quick-disconnect fittings. Two stainless steel ¼-20 screws act as probes. The probes are connected to a circuit on the sampler control board consisting of a resistor network and a logic inverter. When no fluid is in the sensor body, the voltage across the probes is approximately 3VDC, which is also present at the input of the inverter. The output of the inverter is then 0VDC (logic low), which the sampler controller interprets as no fluid being present.

When fluid passes through the fluid sensor body, it will cause the voltage across the probes to drop to less than 1.8VDC, causing the output of the inverter to go to logic high (+5VDC). The sampler controller interprets this as fluid being present.

The continuity fluid sensor works in a wide range of applications, as long as the fluid being sampled is sufficiently conductive enough. Also, if the fluid causes the inside of the sensor body to be coated, the sensor may not properly detect the presence of fluid.

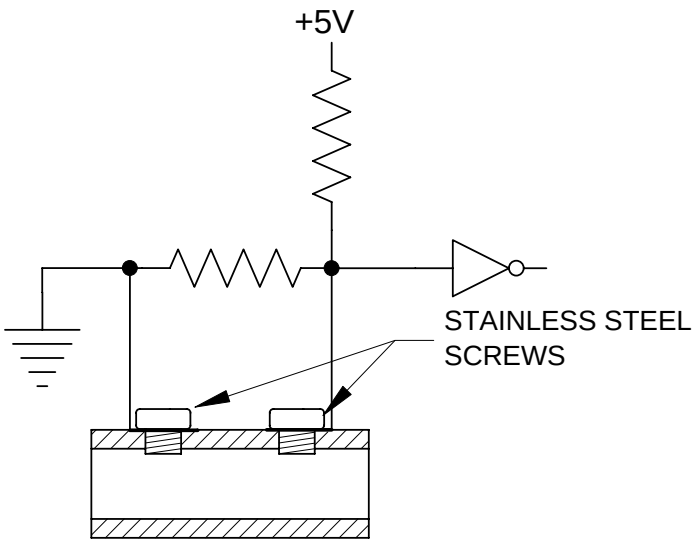

Figure 1- Continuity Fluid Sensor.

Ultrasonic Fluid Sensor (Figure 2)

The ultrasonic fluid sensor detects the presence of fluid by transmitting sound waves through the fluid. The sensor consists of a PVC body with two piezoelectric crystals, one on each side. The pump tubing is inserted into the sensor body and held in place with a lid. A circuit assembly inside of the sampler provides transmit and receive circuits for the sensor.

The transmit circuit provides an electric pulse to one of the crystals, causing it to oscillate. The sound wave created by the crystal's oscillation travels across the fluid sensor body through the pump tube to the crystal on the other side of the sensor body. The sound wave causes the other crystal to oscillate, producing an electrical signal which is sent to the receive circuit. Because sound travels better through a fluid than through air, the signal produced by the receive circuit when there is fluid in the tube is stronger than the one produced with air in the tube. The sampler controller uses this difference to sense the presence of fluid.

The ultrasonic fluid sensor works in most applications. It does not make physical contact with the fluid, and is not affected by the fluid's conductivity or temperature. Air bubbles in the fluid can cause the sensor to not detect fluid reliably, as they reduce how well sound travels through the fluid.

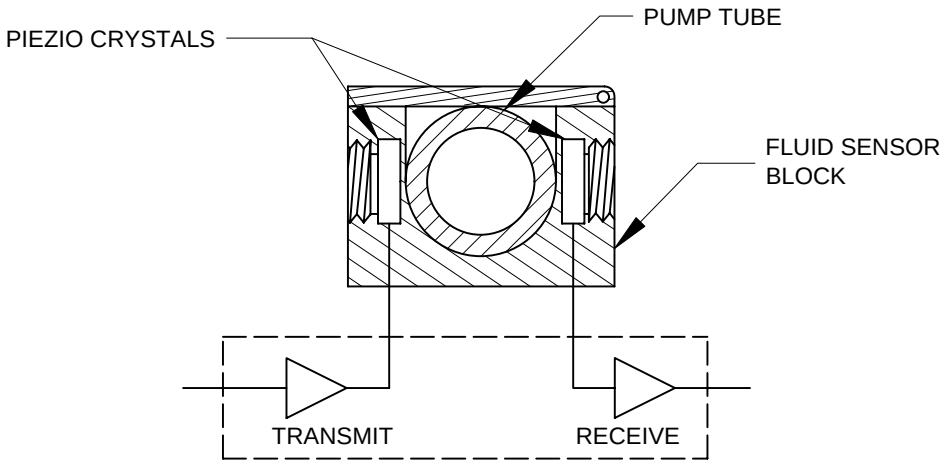

Figure 2- Ultrasonic Fluid Sensor.