

Internal Piezoelectric Quartz Crystal Pressure Transducer

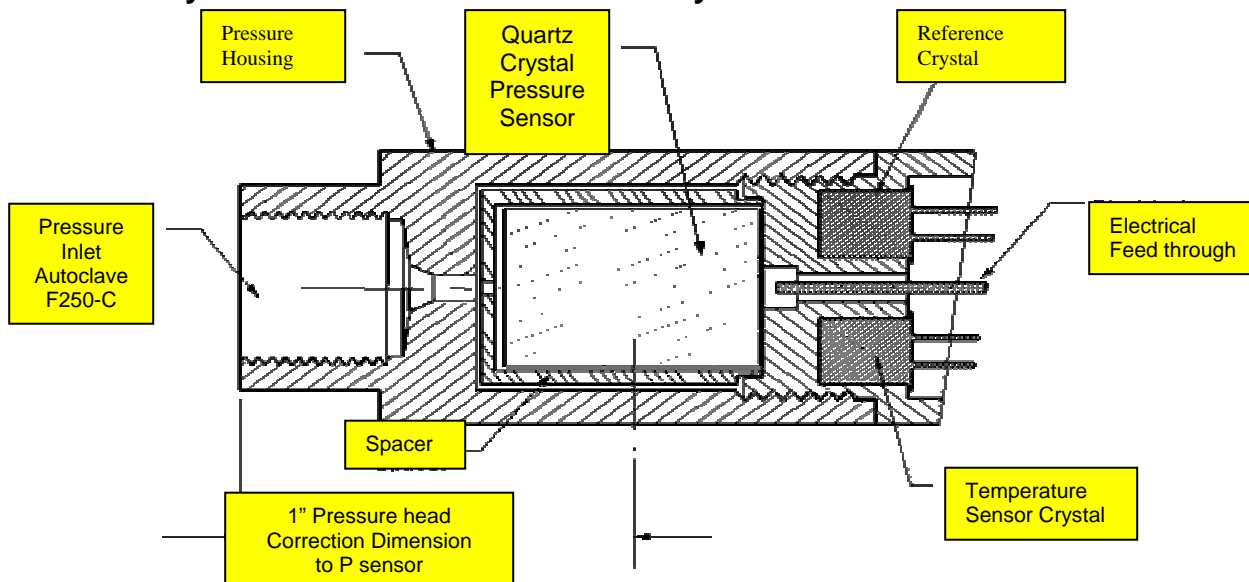
The EBOT utilizes a Piezoelectric Quartz Crystal sensor (pronounced "pea-a-zo".)

The most sensitive electrical devices ever invented to measure pressure. The accuracy of the EBOT is obtained from piezoelectric internal pressure transducer, a shear mode, quartz crystal resonator whose frequency changes with pressure. This transducer is durable, accurate and repeatable. The transducer utilizes a second quartz crystal for temperature compensation ensuring that the pressure data is unaffected by temperature changes in the well and surface surroundings. The surface transducer calibration and accuracy are verified before, during, and after each test.

Quartz Resonator Pressure Sensor

The sensor is made of crystalline quartz that is naturally piezoelectric. Quartz resonators use the inverse piezoelectric effect to induce the resonator to vibrate at its mechanical resonant frequency when electric fields are applied to its electrodes. An oscillator circuit supplies the power and allows the frequency to be measured. Because frequency (and its inverse, time) can be measured with greater precision, the sensor's frequency output provides high-resolution pressure measurement. The sensor changes frequency in response to pressure. The structure is a thick-walled hollow cylinder with closed ends. A thickness-shear-mode disc resonator divides the central portion of the hollow cylinder. Fluid pressure on the exterior hydrostatically compresses the quartz cylinder, producing internal compressive stress in the resonator. The vibrating frequency of the sensor changes in response to this stress. The quartz resonator has a high Q, which means that its vibration can be driven with very little electrical power. This provides long operating life in battery-powered applications.

Three-crystal Quartz Transducer Assembly



The "transducer" is the entire assembly required to produce the frequency or digital output signals. The transducer relies on three thickness-shear-mode quartz resonators: Pressure sensor, a temperature sensor, and a reference crystal.