# COMPRESSION MODE VS. SHEAR MODE SENSOR DESIGNS

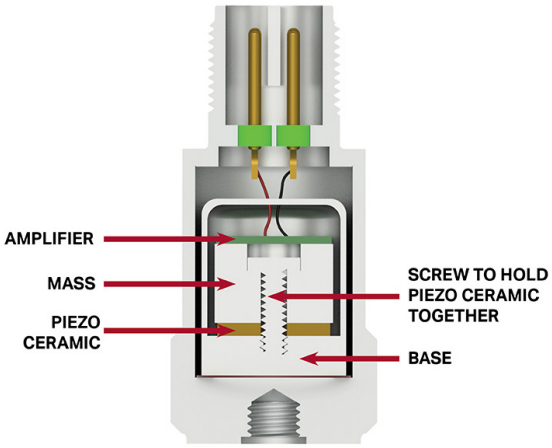
WHEN RELIABILITY MATTERS
CONNECT TO CONFIDENCE

The two primary sensor designs for dynamic vibration measurements are compression mode and shear mode. Below is an analysis of the primary benefits and tradeoffs between the two designs.

| | **Compression Mode** | **Shear Mode** |
|---|---|---|
| ***Sensing Element Construction*** | Mass, ceramic, conductive material and base held together by a screw | Mass, ceramic, conductive material and base held together by epoxy (or similar substance) |
| | **Compression Mode** | **Shear Mode** |
| ***Cost*** | Lower cost | Higher cost |

As CTC is committed to offering the most durable and reliable sensors on the market, all of our sensors feature the shear mode design.

**COMPRESSION MODE DESIGN**




The main flaw with this historical design is the stud holding the design together. This stud will expand and contract due to temperature changes. This change can be induced by a machine going from stopped to running, running to stopped, or other operational equipment nearby giving off additional heat or ambient temperatures such as weather in non-temperature controlled environments. A familiar, real-world example of this concept is how pavement will expand and contract due to weather (and eventually crack). The more extreme the temperature changes are, the more impact the screw (and sensing element) may experience over time.

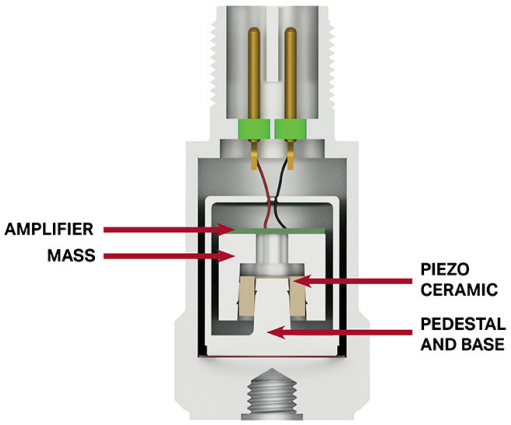
Compression mode sensors will perform well, especially in a lab setting and after the installation. The primary difference is that the shear mode design is less likely to fail over extended periods.

The main advantage of a compression design is the upfront cost. These sensors are much cheaper to build; hence the cost per sensor is typically less than a shear mode sensor. However, additional costs may appear down the line due to decreased reliability.

Compression designs were previously utilized because they had a higher mounted resonant

frequency than shear mode designs at one time. As the shear mode technique has been perfected over many years, this advantage has been far removed.

**SHEAR MODE DESIGN**




In a shear mode design, no stud holds the internal components together. Most designs use a form of epoxy cured under heat to maintain structure. The base and the mass have no contact, so there is no metal-to-metal contact within the sensing element, which significantly reduces the impacts of thermal transients.

These sensors are great for longevity and deliver a quality signal, typically between 0.1 kHz to about 30 kHz, with a linear frequency response given a tolerance of ±3 dB.

The downside is shear mode sensors can cost more upfront than compression mode sensors. However, shear mode sensors will last longer, saving time and cost in the future.

The shear mode design is known to have a lower base strain sensitivity than the frequency at which a running machine will experience strain, which is another advantage of this design. It prevents these sensors from transmitting unwanted data in applications affected by strain.