MassExact: Real-time and High Precision

Background

For some time, many industries have not been able to continuously measure the specific gravity of a slurry in real time. This problem has been compounded when abrasive media is involved. Many different meters cannot withstand abuse from abrasive slurries and are rendered unusable. It is also a challenge for many meters to measure the entire volume of a sample.

MassExact

The MassExact has multiple components that lead to a high repeatability, high accuracy, and long lifetime. One component is the abrasion resistant liner that allows it to be compatible with multiple carrier liquids and abrasive particulates. This liner extends the lifetime of the cartridge. Other components contribute to a high repeatability by allowing the cartridge to return to its original state with a high degree of precision. Other components allow the cartridge to maintain its shape. This allows a high repeatability without sacrificing any accuracy.

MassExact uses a flexible cartridge and a high precision displacement laser to measure the deflection. This deflection is translated into a weight. Since the volume of the cartridge is constant, the density of the media flowing through the cartridge is simply the weight divided by the volume inside the cartridge. Because the laser is capable of recording thousands of measurements per second, a continuous measurement can be achieved. This lowers the wait time from hours or days to milliseconds.

Quick Stats

The MassExact boasts an accuracy of greater than 99.5%. This is significantly better than most other continuous measurement techniques. The response time of the MassExact is also significantly better than other measurement devices. Samples can be taken every 45 milliseconds. The MassExact is also capable of being used on any pipe diameter and most specific gravity ranges. The MassExact is traceable to NIST, ASTM, and OIML standards.

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Temperature/Pressure Compensation

The effects of temperature and pressure have always had a large impact on the behavior of some density meters. The effects of temperature have a creeping effect on the system. As the temperature changes, the system begins to behave differently. The displacement reading starts to drift with changes in temperature. Temperature has a large effect on the properties of the cartridge. Instantaneous changes in pressure create a direct change on the system. To negate the disruptive effects of temperature and pressure, a predictive algorithm is implemented. This algorithm is used to remove the change in measurement caused by temperature creep and pressure. This leaves solely the effects of weight. This algorithm is stored on a purpose made PLC, easily customizable for each individual client.

Vibration

The slurry or sludge flowing through the system creates noise in the cartridge. Friction from the particulates in the media causes small amounts of vibration. This vibration is typically seen on the micron scale. This vibration coupled with other sources of vibration (i.e. pumps and ground vibration) can accumulate a lot of error. Because the MassExact has such a high sample rate, this vibration can be filtered out, and the accuracy can be preserved. Multiple samples can be averaged together to get a better fit for the system.

Installation & Calibration

Housing

An insulated housing is used to shield the flexible cartridge and measurement devices from ambient temperature and weather. The casing is designed to have a sleek curved top to prevent buildup. This allows the effects of rain, snow and wind to be mostly negligible compared to the effects of the media temperature. This casing also eliminates damage caused by weather.

Nema 4x

The NEMA 4x enclosure is used to prevent the detrimental effects of weather to interfere with the purpose made PLC and wiring of the measurement devices. Water, dust and heat can cause serious damage to the electronics.

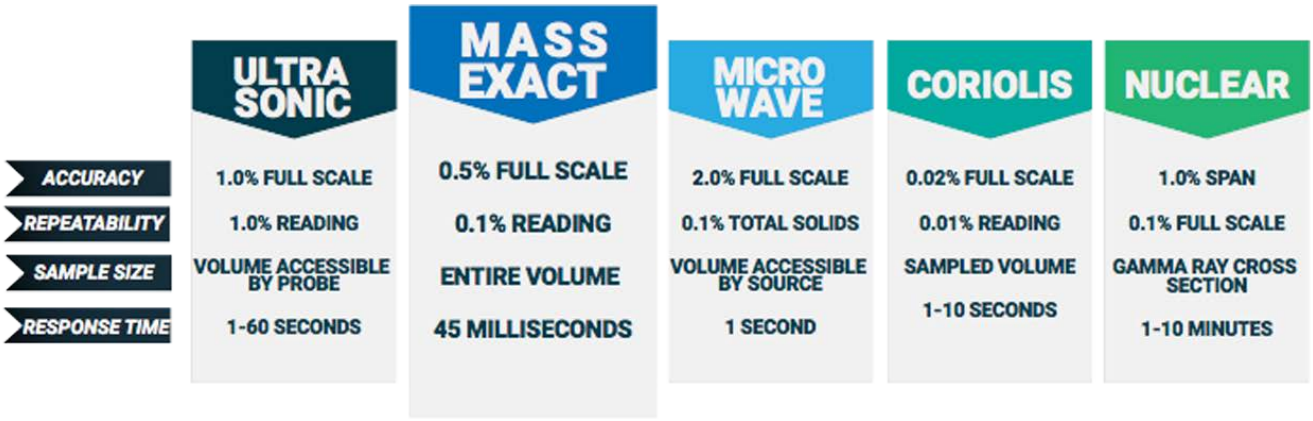
Ease of calibration

The MassExact has a simple one button calibration. This calibration can be used on any carrier liquid. The MassExact can also handle bidirectional flow.

Monitoring

MPV Tech also provides 24-hour coverage of the system. Real time monitoring can be accessed anywhere in the word through a wireless or Ethernet connection. This allows for easy maintenance on the system.

Other Density Meters



Coriolis

Coriolis density meters are attributed to high accuracy readings. These meters boast both high repeatability and a fast response time. However, these meters can only handle small pipe diameters or otherwise are limited to only taking a sample volume. The measuring portion of the pipe is also easily destroyed by abrasive media. These meters have an accuracy of 0.02% with a response time of 1-10 seconds.

Nuclear

Nuclear density meters are commonly used because of their high accuracy readings. However, they suffer due to their limited scope (only measure what is in the gamma ray cross section) and have stringent safety regulations. While these meters have an accuracy of 1% and a one minute response time, they are best used on homogenous slurries.

Microwave

Microwave density meters can only measure a small cross section of the sample at a time. These meters lose accuracy with increasing percent solids and increasing pipe diameters. Microwave meters are also limited to only media with a consistent electrical permittivity constant. Microwave meter probes also pose issues. The attached probe is exposed directly to the media. This exposure allows the probe to be easily damaged.

Ultrasound

Ultrasound meters tend to be used in non-flowing solutions and are therefore not used continuously. These meters also have a probe that is directly exposed to the media. Having to constantly replace probes can be costly and inefficient.

Auto-sampling/grab-sampling

Auto-sampling is the method of taking a small sample and measuring the density in a lab environment. This has an exceedingly long turnaround time. Because the sample has to be transported, there is also error due to evaporation. Auto-sampling is essentially a snapshot at a specific moment in time and not representative of the system as a whole. These tests take a while to perform. It takes even longer when composite sampling is performed.