Measuring Solids in Process Can be Difficult. Measuring it Accurately Can Seem Nearly Impossible.

The trend to improve efficiency in today's industrial sector drives the need for accurate, dependable flow measurement throughout every step of an industrial process. Accurate flow measurement acts as a window into your process that will ultimately give you the information you need to take control of it. On the other hand, a flow measurement that is not repeatable, accurate, or representative of mass flow can destabilize your process, costing both time and money.

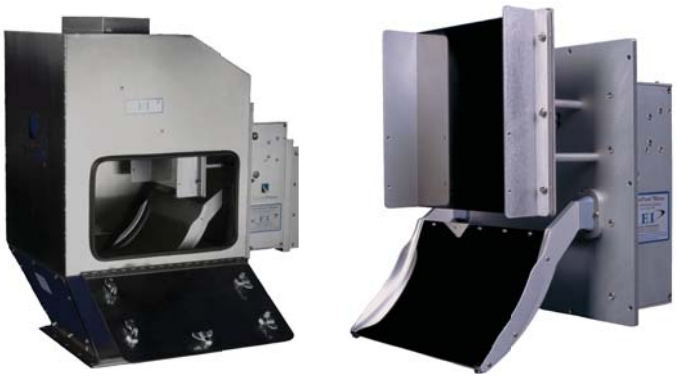
Some of the Primary Causes of Inaccurate Solids Flow Measurement

- Improper Selection of Measurement Technology
- Product Collecting, Building Up, or Sticking to the Measurement Element
- Highly Mechanical Components that Become Unreliable Due to Wear
- Measurement Assumptions of Certain Variables Rather Than Measuring Them
- Fluctuations or Pulsations in Flow That Cause Shifts in Meter Readings
- Inadequate Space for Installation

CentriFlow®

Choosing the Correct Measurement Technology

There are many ways of measuring solids flow while in process. The most accurate and most dependable is the gravimetric method of flow measurement, which allows for true measurement of flow rather than a calculation based on assumptions of key variables including density, shape and particle size. Typically, flow measurement using a gravimetric flow meter allows for a true dynamic



flow measurement while in process.

Ultrasonic flow meters, sometimes referred to as radar, doppler or nuclear flow meters are relatively inexpensive, yet they are notoriously inaccurate, especially when bulk density differs greatly across the product sample.

Static weigh scales can be accurate, however, they are limited in their scope and do not measure dynamic flows of product while in process. Using a hopper or silo on loadcells is one method of static weighment, but this type of measurement is very susceptible to external factors that can distort measurement accuracy. Some of these factors include temperature changes or even changes in weather if the application is outside. Another factor to consider is that loadcells are typically used in concert for product weighment. The inaccuracy of the system is compounded based on the number of loadcells being used.

Another alternative to gravimetric weighment is volumetric flow measurement, such as Loss-In-Weight devices. Loss-In-Weight measurement utilizes the volume of product in order to deduce mass flow. This type of measurement assumes a constant bulk density which may vary greatly during production. Moreover, volumetric measurement typically results in "blind spots" in measurement because the "loss" of weight within the hopper can not be calculated while the hopper is being filled. As a result, volumetric flow measurement tends to be more accurate for shorter runs where density can remain relatively constant and less accurate over longer, more continuous applications where density may vary.

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Finally, Coriolis based mass flow meters are typically fairly accurate, but the initial purchase tends to be costly and the maintenance costs can be even more expensive because of the abundance of highly mechanical components. These continuously moving, mechanical components tend to wear out and require continuous repair or replacement. For many Coriolis style meters, if the meter malfunctions and the inner drum no longer rotates, product can no longer flow through the meter. In such cases, the meter would need to be completely removed from service each time it malfunctions.

The CentriFlow® Meter Advantage: The CentriFlow® Meter from Eastern Instruments is a gravimetric measurement device that truly measures the flow of particles as they pass over the measurement pan. The flow measurement signal is independent of density or particle size and is extremely accurate, even when measuring products whose flow is not uniform. The dynamic flow measurement of the CentriFlow® Meter offers real-time measurement of both flow rate and total, and is perfect for any application from batching to continuous processes to blending.

Another feature of the CentriFlow® Meter is that the cost of maintenance and repair is very low, as there are virtually no moving parts on the meter. To remain accurate and dependable, the CentriFlow® Meter's measurement pan need only move 15 thousandths of an inch (the thickness of a business card). This means that the spare parts required for the meter are minimal and the need for constant re-calibration due to parts wearing or failing altogether, is nearly negligible.

Product Buildup on Measurement Element

If not addressed, product buildup on key components can cause a variety of difficulties for flow measurement devices. Buildup on measurement surfaces can often cause zero shifts and will ultimately affect the accuracy of the measurement system if not properly attended to. Buildup can cause additional concerns as well, that could negatively affect the performance of the measurement device, not to mention the effectiveness of the process itself. If the product being measured is corrosive in nature, then continued contact with key components of the measurement device can cause undue wear or even equipment failure.

For applications in the food industry, where equipment is required to be "Food Grade", buildup could cause contamination or sanitation concerns. Buildup on measurement devices like Weigh Belts, is often a concern if the buildup is not easily cleaned or removed from the process. The clean-up of some measurement devices may take several hours, during which time production must be suspended. For such devices, the clean-up and maintenance required to maintain a clean and sanitary environment can often be both costly and time consuming.

The CentriFlow® Meter Advantage: The CentriFlow® Meter is affected by product buildup just as other gravimetric flow measurement devices, however, unlike other devices, the CentriFlow® Meter can be equipped with a variety of options that will minimize and in many cases eliminate the problem of buildup altogether. A variety of flow surface options are available, including PTFE liners and super slick coatings, that allow product to pass over the measurement pan, rather than collecting on it. For powdery or dusty materials, a VibraWeigh option is available which vibrates the measurement pan back and forth in order to facilitate the product's movement off of the measurement pan. For products with the most extreme buildup concerns, a Pulsed Blast option is available. The Pulsed Blast sends a blast of dry instrument air across the measurement pan at various intervals in order to remove particulate collecting there.

For installations in the food industry, a food grade model is also available. The Food Grade CentriFlow® Meter has a Stainless Steel construction (including all-welded Stainless Steel flow surfaces) as well as a NEMA 4X Rated Stainless Steel electronics enclosure for easy cleaning. Routine cleaning of the CentriFlow® Meter takes only a few minutes, and for most installations there are no parts that require removal or repositioning in order to initiate a cleaning cycle.

Wearing of Mechanical Components

Mechanical movement is one of the biggest contributors to the malfunction of a flow meter. Some metering devices utilize extensive mechanical designs with numerous components in order to measure the flow of product. With extended use, the mechanical components within these devices will begin to wear or to break entirely. Often, extensive wear in key components will cause a metering system to malfunction, resulting in inaccuracies in flow measurement if not corrected.

Moreover, the more moving mechanical components that a metering system utilizes, the more parts will ultimately need to be replaced. With highly mechanical devices, repair costs, not to mention the cost of spare parts, can be quite substantial. Weigh Belts are an example of highly mechanical devices that rely on a multitude of moving, mechanical components to measure the flow of product passing over it. These devices and their components are thus, very susceptible to mechanical wear. Worn components (including the belt itself which will begin to expand with time) can contribute to changes in the mechanical structure of the meter and can cause inaccuracies in the system.

The use of highly mechanical measurement devices can create larger issues if they malfunction, including the stoppage of entire lines of production. With some types of Coriolis style solids meters, if the rotation mechanism within them fails, the flow through the meter will stop. In such cases, flow through the meter would either need to be bypassed, or the operation of the production line would have to be suspended. Similarly with Weigh Belts, if the motor driving the rotation of the belt ceases to function, the Weigh Belt will cease to function, thus stopping the production line if not bypassed.

The CentriFlow® Meter Advantage: The CentriFlow® Meter has virtually no moving parts. With the exception of the measurement pan which is flexed downward a maximum of 0.015" as flow travels across it, the CentriFlow® Meter is a static device. Because the meter's range of motion is limited to such a small distance, the CentriFlow® Meter requires virtually no maintenance and very few spare parts. In the highly unlikely event that the CentriFlow® Meter does malfunction, the product flow will continue to pass through the meter unhindered, leaving production unaffected.

Assumption of Density or Other Variables

For many mass flow measurement devices, variables such as density, product size or even product temperature are assumed to be constant. Of course, these variables are rarely ever constant and can vary greatly, even in fairly consistent products like plastic pellets or rice. Some factors that can affect density are; changes in moisture content, environmental temperature, or changes in the process itself. Some processes may require a "warming up" and/or "cooling down" period where the equipment within the process will behave differently (resulting in different "grades" of product) during different phases of production. If the changes in product quality are great enough to affect the density, then the accuracy of any flow measurement which assumes density will be inaccurate. Some measurement devices that assume density include; Volumetric measurement devices, Doppler devices and Ultrasonic flow meters.

The CentriFlow® Meter Advantage: The secret of the CentriFlow Meter's accuracy lies in the zero-friction design of the meter, which is based on the principle of Centripetal Force. The pivot point of the meter's measurement pan is specifically located so as to cancel the friction component of the product travelling through the meter. The centripetal force of the product travelling over the curved measurement pan deflects the pan and the meter measures this force, which is directly correlated to the products' mass flow. Because the measurement of the meter is a true force based measurement, it is NOT dependent on product density, particle size, product shape, or even particle elasticity and so changes in these parameters will have no effect on the measurement. Even as these variables change over time, the mass flow measurement from the CentriFlow® Meter will remain extremely accurate.

Inaccuracy due to Pulsations in Flow

Pulsations in flow rate can cause accuracy issues for some types of flow meters that are not equipped to accurately compensate for large fluxuations in flow rate. These fluxuations can occur due to system variations, or simply from the natural pulsations of a feed device, such as a screw conveyor or rotary valve. Impact Meters are very susceptible to changes in flow rate, as flow rate changes will affect how product is presented to the measurement plate. If flow rate drops too low, product can bounce around in the measurement area, or may not impact the measurement plate at all.

For devices such as Weigh Belts, which, by their nature, tend to "average" flow rate across a certain interval, instantaneous changes in flow will not even be registered. While the flow of the product may be quite low at any given instant, the averaged flow rate, as seen by the Weigh Belt, may be quite high. The result is that while the Weigh Belt may indicate a flow rate (an averaged flow rate), the actual flow across the belt could be nothing at all.

The CentriFlow® Meter Advantage: Pulsating flows caused by feed devices such as rotary valves and screw conveyors have little to no impact on the accuracy of the CentriFlow® Meter. In fact, for increased accuracy, it is recommended that the meter be installed directly after some sort of feed device, including rotary valves and screw conveyors. Even when pulses completely stop flow (the flow reaches zero) the CentriFlow® Meter remains extremely accurate. For certain installations, the CentriFlow® Meter's turndown ratio can be as high as 20 to 1.

Typically, the flow rate and totalization outputs of the CentriFlow® Meter are instantaneous outputs that offer real time flow data for your process. The instantaneous output ensures that every spike and stoppage in flow is reported by the CentriFlow® Meter. The flow rate and totalization signals are available as 4-20 mA outputs and are also available (along with a variety of other outputs) over Ethernet. While the CentriFlow® Meter's standard measurement signal is instantaneous, the signal can be filtered as well. While the flow signal will be filtered, the totolization will not be affected by the filter and will remain an extremely accurate totalization signal. The filter can be adjusted from 0.1 up to a 10 second moving average.

Inadequate space for installation

Space within today's modern industrial plant is often at a premium, and the space needed for the proper installation of a flow measurement device is, at times, simply non-existent. Impact meters have a small footprint, but to install them with the adequate strike zone, they often need at least 5 feet of drop into them in order to produce the correct "impact" against their measurement plate. Coriolis meters can take up a great deal of vertical space and can measure upwards of 5 feet or more in height. Weigh Belts, while they do not take up a great deal of vertical height, do take up extensive horizontal space. Often, rather than installing the proper flow meter (which may involve the extensive realignment of existing equipment and exhausting precious time and resources) many plants elect to use inadequate measurement devices, or worse, elect to forgo flow measurement all together.

The CentriFlow® Meter Advantage: The CentriFlow® Meter is the perfect fit for new construction, or for retrofit applications precisely because the vertical footprint needed for installation is so small. With a vertical footprint of under 3 feet for some applications, the CentriFlow® Meter will fit almost anywhere. Because no strike zone is required, the meter is typically mounted directly under existing feed devices. If transitions into or out of existing equipment are required, Eastern Instruments will gladly provide the required concept drawings, and can manufacture the needed transitions as well.

SUMMARY

The CentriFlow® Meter from Eastern Instruments is a Solid Particle Mass Flow Meter that is durable, accurate, maintenance-free, compact, and cost-effective. Its unique design, extreme accuracy and easy installation make it a perfect replacement for a variety of flow measurement devices, including weigh belts, impact meters, loss in weight meters, and static weigh scales.

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The CentriFlow® Meter Versus Alternative Technologies

Comparative Attributes of Various Types of Flow Meters

Flow Meter Type	Gravimetric	Volumetric	Ultrasonic	Static	Coriolis
Comparable Attributes:					
Measures Mass	YES	NO	NO	YES	NO
Measures Flow In-Process	YES	NO	YES	NO	YES
Easy To Install	YES	YES	YES	YES	NO
Accurate Measurement	YES	NO	NO	YES	YES
Affected by Variations in Shape, Density and Size	NO	YES	NO	NO	YES
Flow Continues Even If Meter Requires Repair	YES	NO	YES	YES	NO

Comparative Attributes of Various Types of Gravimetric Style Flow Meters

Gravimetric Flow Meter Style	CentriFlow®®	Impact	Curved Pan Impact Meter	Weigh Belt	Belt Scale
Comparable Attributes:					
Typical Stated Accuracy	0.25%	2.00%	0.50%	2.00%	2.00%
Affected by Product Buildup	YES	YES	YES	YES	YES
Simple to Operate	YES	YES	NO	YES	YES
Low Maintenance	YES	YES	NO	NO	NO
Easy To Clean	YES	YES	NO	NO	NO
Unaffected by Changes in Density, Shape or Size	YES	NO	NO	NO	NO
Wear Concerns Due to Moving Parts	NO	NO	NO	NO	NO

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Digital Electronics Package for the CentriFlow® Meter

Eastern Instruments' Digital CentriFlow® Electronics Package comes standard with the purchase of any CentriFlow® Meter. In conjunction with our CentriFlow® Meter, the Digital Electronics package offers an extremely high degree of accuracy, outputs of both flow rate and totalization, and a high degree of connectivity to onsite PLCs and other digitally controlled devices, all within a single, intuitive, multi-functioning control package.

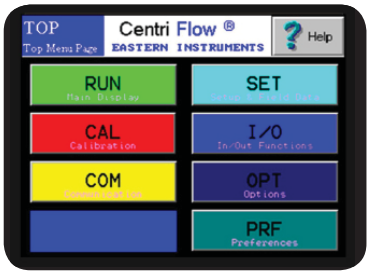
FASTER. EASIER. BETTER.

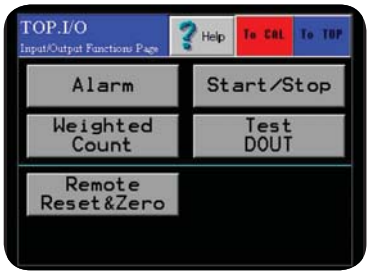
Digital Electronics Package

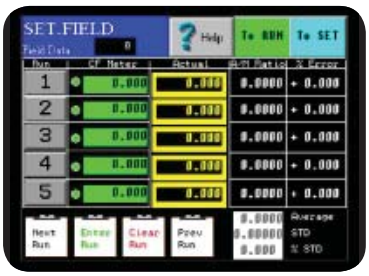
- White Painted Carbon Steel Enclosure (12" x 14" x 8") SS NEMA 4X is also available
- Digital CentriFlow®® Electronics Module (DCE)
- Flow Rate and Totalization Outputs:
  - 4-20 mA Output - Flow Rate Proportional (Current Sourced-Fully Isolated) Accuracy: 0.10% Typical*
  - Frequency Output - Flow Rate Proportional (0-500 Htz) Accuracy: 0.05% Typical*
- Remote Reset Capabilities
- Flow Rate or Totalization Alarm/Preset Capabilities
- Large, convenient, color, touch screen HMI with Flow Rate and Totalization displayed simultaneously on main screen
- Universal Power Supply (85-264 VAC)
- 2 Gigabyte, Compact, Flash Card that records data every second for up to 1 year
- User-friendly Calibration, including:
  - Zero Adjustment
  - Static Calibration
  - Dynamic Calibration/Field Calibrations
- HMI Onscreen Plotting/Trending
- Ask us about additional options!

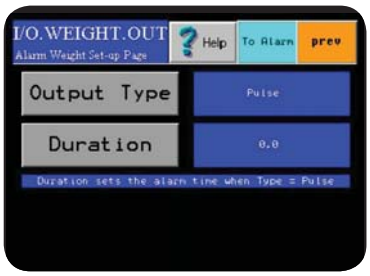
* Accuracy statement based on the DCE only and does not reflect the accuracy of the CentriFlow® Meter

SCREEN SHOTS









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