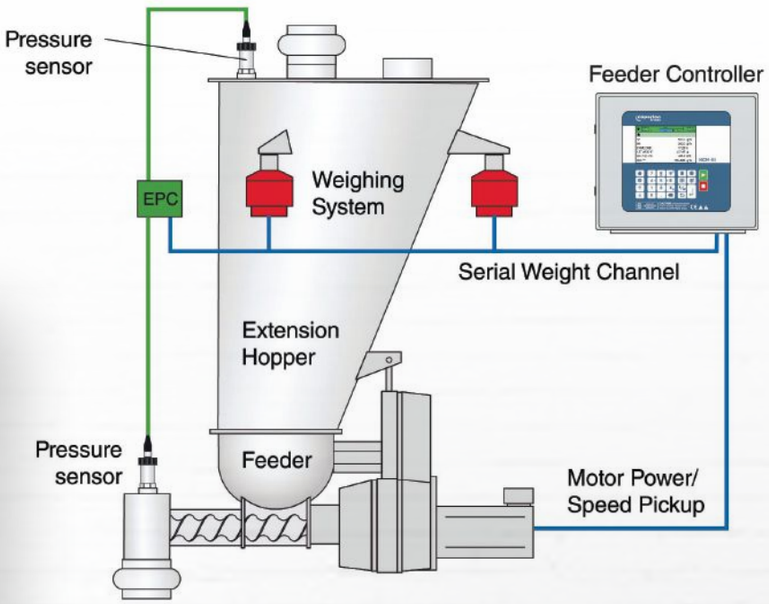
EFFICIENT PRESSURE COMPENSATION IMPROVES WEIGHING ACCURACY IN LOSS-IN-WEIGHT FEEDERS

Electronic pressure compensation systems are more effective and reliable than traditional mechanical systems. | **By Fabian Siffert,** Coperion K-Tron

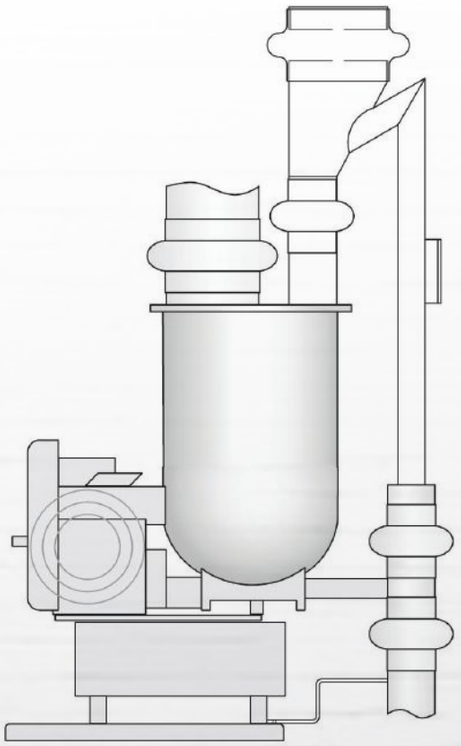
Loss-in-weight (LIW) feeder performance is dependent on accurate weighing, which can be affected by a variety of influences, both internal and external to the feeder and feeder process. Understanding the significance of these influences is critical for achieving optimal performance, since even slight changes in the mass flow accuracy of a feeder or multiple feeders can make a significant difference in both end-product quality and raw ingredient costs. A LIW feeder can be especially sensitive to ambient influences because it must accurately measure very small differences in the weight of a relatively large load — the feeding system itself.

Pressure variations within the system and at the process connections can affect weighing performance. For example, if the LIW feeder discharge to the system below is closed, then any pressure differential can cause a feed rate error. A higher pressure in the downstream system, such as back pressure from a mixer or extruder for example, exerts an upward force against the feeder outlet and, in turn, on the weight-sensing device, especially when the outlet is capped. In effect, this force slightly lifts the load on the scale so the controller reads a lower system weight than it should. The LIW controller would interpret the reduced weight signal to mean that mass flow is higher than expected and react by erroneously decreasing the feeder output.

Another area where a pressure differential can interfere with weighing accuracy is in the feeder's hopper. Potential sources of pressure variations include an increase in air pressure in the hopper due to the sudden inflow of material during refill, a clogged vent filter, a dust collection system connected to the hopper vent, or a nitrogen blanket applied to the hopper. Any positive air pressure acts equally towards all sides and so also pushes up on the hopper lid and the refill valve. Because the force in the inlet area is not applied to the hopper lid but to the refill valve above, pressure forces inside the hopper are not balanced. Due to the inlet opening, the forces acting upon the lid are lower than those acting oppositely on the floor of the hopper. These higher forces pressing down result in an increase in the weight signal. The LIW controller would interpret the increased weight signal to mean that mass flow is slowing and react by erroneously increasing the feeder output creating a mass-flow error.



▲ **Figure 2:** Electronic pressure compensation (EPC) is much easier to install and maintain than mechanical pressure compensation.



▶ **Figure 1:** Screw feeder with traditional mechanical pressure compensation on both the hopper inlet and feeder discharge.

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Traditionally, these troublesome pressure fluctuations have been compensated for by mechanical means, as shown in Figure 1. However, factors such as mechanical tolerances, the alignment and age of the flexible bellows, and others can impact the mechanical pressure compensation and prevent the pressure from fully compensating for the forces generated by changing pressures, often making this costly solution deficient.

An effective but simple alternative to mechanical pressure compensation is electronic pressure compensation (EPC). EPC can be used to automatically detect changes in pressure within a feeder and adjust the weight signal accordingly. As shown in Figure 2, electronic pressure compensation is based on a high-precision pressure sensor, which is mounted on the hopper lid and/or outlet tube and constantly measures the pressure. The signal from the sensor is transmitted via sensor board to the feeder control system, where it is used to dynamically compensate for pressure fluctuations and, thus, prevent weighing errors. It is also possible to use electronic pressure compensation for the hopper while utilizing traditional mechanical pressure compensation on the discharge.

When it comes to handling air pressure issues in loss-in-weight feeders, especially for pressure issues in the feeder's material hopper, EPC offers distinct advantages over traditional mechanical pressure compensation systems and can be less expensive in many cases. EPC has been shown to significantly improve the feeding accuracy of gravimetric feeders in closed systems. In addition, the electronic solution is more effective and reliable, maintenance free, and easy to retrofit on existing systems. PR

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