

Glossary of feeding terms

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Feeders are involved in almost every kind of material processing. They move dry powder and bulk materials into conveyors, mixers, agglomerators, dryers, weighing equipment, and packaging equipment. This glossary defines common feeding terms, many of which are used differently by different industries and equipment suppliers. Sections define feeding methods, feeders and related components, feeder performance measurement terms, and general terms used in the feeder industry.

Feeding methods

Gain-in-weight feeding. Gravimetric method of controlling material flow by sensing weight gain to achieve a desired feedrate.

Gravimetric feeding. Feeding material by weight at some required rate.

Loss-in-weight feeding. Gravimetric method of controlling material flow by sensing weight loss to achieve a desired feedrate.

Volumetric feeding. Feeding material by volume at some required rate.

Feeders and related components

Auger. See *Screw*.

Batcher. Device that dispenses a pre-set amount of material either by volume, weight, or number; also can premix ingredients.

Belt feeder. Belt conveyor with tightly spaced idlers; can include a weighbridge beneath the belt for gravimetric operation. Often used volumetrically to feed from a supply hopper. See *Weighbelt feeder*.

Collector chute. Chute mounted under a weighbelt feeder to collect dust and other debris.

Combination feeder. Configuration mating a prefeeder to a weighbelt to control material flow onto the weighbelt.

Constant-speed belt feeder. Weighbelt feeder with constant belt speed; feedrate is controlled by varying inlet gate height or a prefeeder's feedrate.

Convertible feeder. Volumetric feeder whose metering can be changed to handle different materials with widely varying characteristics.

Conveyor assembly. Weighbelt feeder component that supports the weighbridge, belt tracker, and pulley drive system.

Center rod. Shaft that can be inserted into a screw to control a free-flowing material's flow or to stabilize a heavy material's flow.

Disk feeder. See *Rotary table feeder*.

Feeder. Device that controls material flowrate by volume, mass, or specific gravity. See *Gravimetric feeder* and *Volumetric feeder*.

Flexible connection. Pliable union or sleeve that joins gravimetric feeding equipment to supply hoppers, chutes, dust collectors, or other equipment to contain the material and isolate the feeding equipment's weighing components from vibration, stresses, and other external conditions. Sometimes called a *flex*.

Gain-in-weight batcher. Device that measures a preset amount of material by discharging the material into a container on a scale.

Gravimetric feeder. Device (commonly a weighbelt or loss-in-weight feeder) that controls material flow into a process by measuring the material weight and specifying the actual feedrate in weight per time units (for instance, pounds per hour). Can be used for batching or totalizing. Sometimes called a *weighfeeder*. See *Screw*.

Helix. See *Screw*.

Inlet gate. Weighbelt feeder's inlet opening (typically adjustable), which is positioned horizontally over the belt and shears the material bed to a roughly uniform level as material flows past the gate.

Inlet slide gate. Horizontal sliding gate, located at a supply hopper's bottom, that controls material flow to a weighbelt feeder's inlet.

Loss-in-weight batcher. Device used to measure a preset amount of material by discharging the material from a weighed container.

Loss-in-weight feeder. Unit includes a hopper (called a *weigh hopper*) filled with material, mounted on a scale, and linked to a feeder; the feeder discharges material from the weigh hopper at a rate that achieves a specified weight loss per unit time on the scale.

Master feeder. In ratio control, the feeder (or instrumentation) whose control value determines the setpoint of one or more other (slave) feeders.



Loss-in-weight feeder.

Master rate setter. Single-point flow controller and throughput totalizer that controls the setpoints of slave feeders to allow variation in the total production rate while keeping the correct proportion of ingredients.

Oscillating feeder. See *Vibrating feeder*.

Plow feeder. Either a rotary or fixed device: Rotary device has a rotary arm in a square or circular hopper that sweeps material to the central discharge; fixed device has a cone located above the central discharge that guides material down the cone's sides and beneath the cone through the discharge.

Prefeeder. Variable-speed, volumetric metering device such as a screw feeder, rotary valve, or vibrating tray; typically used on a weighbelt feeder to aid the flow of a floodable or hard-to-flow material from the feeder's inlet section onto the belt. Prefeeder's volumetric capacity is slaved to that of the weighbelt feeder.

Quick-clean feeder. Feeder used in applications requiring frequent and thorough cleaning (for instance, for product changeovers).

Ratio control. Feeder control configuration with the setpoint of one or more feeders (called *slave feeders*) directly proportional to the master feeder's setpoint.

Reciprocating feeder. Unit consisting of one or more flat steel plates that shake back and forth to propel material into a process; also called a *reciprocating-plate feeder*.

Rotary tables. Device with a power-driven circular plate (called a *table*) that rotates directly beneath a supply hopper's discharge; an adjustable feed collar controls material flow. Table's rotation evenly distributes material across the table (or into a groove in the table) so a hinged plow or other shear device can divert the material into the process. Also called a *disk feeder*.

Rotary valve. Fixed- or variable-speed metering device that prevents a fine powder from flooding or transfers material between areas of differing pressure by isolating one part of the process from other parts. Sometimes called a *rotary feeder*, *rotary feed valve*, or *rotary airlock*.

Sampling valve. Valve located at a weighbelt feeder's discharge to divert material flow for sampling and calibration.

Screw. Helical or closed-flight auger-like component used in a screw feeder to move material or control its flow. See *Screw feeder*.

Screw feeder. Screw in a trough or cylindrical tube or sleeve used to feed material from a supply hopper to process equipment; sometimes used to partially mix materials as they're transported. Twin-screw type uses two screws that may or may not be intermeshed. Screw design variations include constant, stepped, and variable pitch; variable diameter; variable shaft diameter; and variable pitch and shaft diameter.

Slave feeder. Feeder whose control value is received from a master feeder and is proportional to the master feeder's control value or a measured or set process variable. See *Master feeder* and *Ratio control*.

Strain gauge. Weight transducer (load cell) used in a gravimetric feeder for measuring deformations in the feeder's load-bearing element; device works by converting applied load or pressure to a voltage-based output by sensing a change in the electrical resistance of a fine wire network when the network is applied to the feeder's load-bearing element.

Surge hopper. Large-capacity carbon steel or stainless steel storage container, either located on top of a feeder or freestanding, that ensures an adequate supply of material to the feeder.

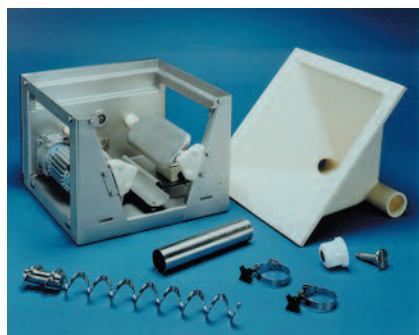
Vibrating feeder. Shallow flat-bottomed pan or trough vibrated in a sinusoidal fashion by an external drive to propel material forward, often onto a belt conveyor; also called a *vibrating tray feeder* or *oscillating feeder*.

Vibrating tray prefeeder. Shallow, flat-bottomed, vibrating tray or trough installed directly upstream from a weighbelt feeder that handles a fibrous or other difficult-to-handle material; the tray's sinusoidal vibration propels the material across and off the tray, controlling material flow to the feeder.

Volumetric feeder. Device that controls material flow into the process by setting the metering device's displacement or rotational speed; feedrate is expressed as volume per unit time rather than weight or number per unit time.

Weighbelt feeder. Short belt conveyor that controls belt speed and material flowrate either by weighing the entire weighbelt assembly or, with a larger feeder, by weighing a cross-section of material passing over the belt's weighbridge; the feeder's mass flow is determined by multiplying belt loading (pounds per foot) by belt speed (feet per minute). See *Weighbridge*.

Weighbelt meter. Weighbelt feeder that runs at a fixed speed or volumetric capacity and totalizes material throughput in a process; can also provide a mass-flow signal to another instrument in the process for ratioing additional ingredients with the major ingredient's uncontrollable flow.



Quick-disconnect volumetric feeder (disassembled).

Weighbridge. In a larger weighbelt feeder, the structure that supports the load-sensing device and provides the platform on which the weighbelt rests.

Weighfeeder. See *Gravimetric feeder*.

Feeder performance measurement terms

Accuracy. Feeder's degree of conformity to a process standard, usually expressed as a percentage of error at a specific statistical confidence level. See *Repeatability*, *Sigma*, and *Standard deviation*.

Calibration. To standardize flow or batch measurement by correcting for deviation from a standard. Also to determine, by measuring or comparing with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob.

Catch sampling. At specific intervals over a certain time period, collecting and weighing material discharged from a feeder to determine feeder accuracy.

Linearity. Measurement of how well or how poorly a gravimetric feeder delivers the desired feedrate over the feeder's full operating range.

Repeatability. Degree to which repeated measurements of a feeder's feedrate over short time periods at a given setpoint coincide, usually expressed in units of variation or, more precisely, as a percentage error at a specific statistical confidence level. Graphically repre-

sented as a distribution curve; a normal (Gaussian) distribution at 2 sigma is the industry standard defining feeder performance quality. See *Sigma* and *Standard deviation*.

Sigma. The true variation of a feeder's feedrate around its mean; a sigma's value closely approximates a standard deviation's value, but the term *sigma* isn't interchangeable with the term *standard deviation*. For a given feedrate, 1 sigma is the expressed percentage specifying the range in which 65 percent of all sample values will fall; 2 sigma (the industry standard) is the expressed percentage specifying the range in which 95 percent of all sample values will fall; and 3 sigma is the expressed percentage specifying the range in which 99 percent of all sample values will fall. See *Repeatability* and *Standard deviation*.

Stability. Measurement of a gravimetric feeder's ability to operate within tolerance over time.

Standard deviation. Measurement of the dispersion of sample weights about their mean; when the standard deviation is small, most of the sample values are near the mean. See *Repeatability* and *Sigma*.

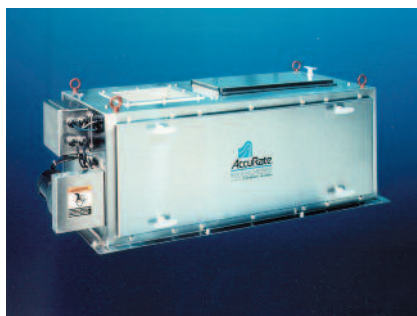
General terms

Belt loading. Measurement of material weight per conveyor belt unit length; used to determine a weighbelt feeder's actual feedrate or material throughput.

Cascading. When a slave feeder's feedrate changes in direct proportion to a change in the master feeder's feedrate.

Cycle time. (1) Total elapsed time between identical points in two successive and identical batching operations. (2) In continuous loss-in-weight feeding, the sum of the times required to empty and refill the weigh hopper.

Deflection. In gravimetric feeding, the total measured displacement from a zero condition to full scale at the load-sensing point.



Weighbelt feeder.

Dribble feeding. In batching and packaging, reducing the feedrate or material flowrate near batch completion or when the package is nearly filled to avoid overshooting the desired batch or weight or volume.

Feedrate. Actual amount of material (expressed in appropriate weight or volume units) discharged per unit of time; for instance, pounds per hour or cubic feet per hour.

Flooding. Extreme, liquid-like, rapid material flow usually caused by aeration. See **Wild flow**.

Formula control. See **Recipe control**.

Headload. Force or pressure exerted on a feeder or process equipment by material weight in a supply hopper.

Heel. Portion of material occupying the inlet area in a feeder or process equipment.

Local control. Directly registering the desired feedrate setpoint on the feeder controller. See **Ratio control**.

Metering. Typically with a weighbelt feeder, measuring (rather than controlling) an intermittent or uncontrollable material flow's total weight; used for monitoring material inventory or slaving other process equipment.

Minor ingredient. Material forming a small part of the total formula, often requiring a highly accurate feedrate or portion control due to the material's expense or effect.

Overload. In loss-in-weight feeding, a condition where too much material in the weigh hopper causes the weight to exceed the feeder's weigh scale range.

Overrange. In gravimetric feeding, a condition where the desired feedrate exceeds the feeder's capacity.

Pitch. Distance from any screw flight to the corresponding point on an adja-

cent flight, measured parallel to the screw axis.

Proportioning. In continuous feeding, controlling an ingredient's flowrate in proportion to the flowrate of one or more other ingredient; one ingredient's flowrate is described as a percent of another's flowrate. Sometimes called *ratioing*.

Ratioing. See **Proportioning**.

Recipe control. Controlling the formula of all ingredients in a particular mixture by specifying the total flowrate and the percentages (for a total 100 percent) for each ingredient. Sometimes called *formula control*.

Refill. Period during a loss-in-weight feeding cycle when the weigh hopper is refilled with material.

Response time. Time a feeder requires to readjust from one set of defined conditions to another set.

Sequencing. Incorporating time delays in feeder starting and stopping to coordinate processing operations so they'll meet material transport or residence time requirements.

Setpoint. Feedrate the feeder is trying to achieve or the actual feedrate; a perfectly tuned feeder's actual feedrate is equal to the feeder's setpoint.

Tare. In gravimetric feeding, an empty container's weight; deducted from the gross weight of a material and its container to determine net weight.

Tolerance. Feeder's specified performance limits.

Totalizing. In gravimetric feeding, counting and indicating (or printing) the sum of material throughput weights.

True rate. In gravimetric feeding, a flow-control method that multiplies

weight and metering speed measurements to determine actual mass flow and varies the metering device's speed to control flowrate.

Turndown. Measurement of the range over which a feeder can operate within specified performance limits (tolerance); expressed in relation to either full-scale or setpoint values.

Underrange. In gravimetric feeding, a condition where the desired feedrate falls below the feeding equipment's operating range.

Wild flow. Uncontrollable flow of material. See **Flooding**.

Zero condition. When a weight-sensing device indicates zero when no load is applied. Sometimes called *zero-load balance* or *empty balance*.

Zeroing. In gravimetric feeding, a method of adjusting the weight- or mass-sensing device to indicate zero when no load is applied. Sometimes called *zero adjustment*. **PBE**

For further reading

Find more information on feeders and feeding in articles listed under "Feeders" in *Powder and Bulk Engineering's* comprehensive "Index to articles" (later in this issue and at www.powderbulk.com).

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