Definition of Accuracy

Weigh feeder accuracy is a measure of how closely a feeder discharges material at the desired flow rate. A complete expression of accuracy includes measurements of repeatability and linearity. Repeatability measures the extent of discharge variability at a given flow rate. Linearity gauges the deviation of average flow rate over the feeder's full operating range.

Measurements of both repeatability and linearity are made by independently weighing a series of timed catch samples obtained from the discharge stream. Sample weights are then used to compute repeatability and linearity statistics.

Repeatability:

ProRate PLUS loss-in-weight feeders have been designed to perform to the following repeatability standard:

> 0.5% of sample average at 1 sigma, based on a minimum of 30 consecutive samples of one-minute, 0.5 kg (~1.0 lb), 0.5% of gross scale capacity or 30 screw revolutions, whichever is greater, over a turndown of 20:1 from maximum design rate for free-flowing granular and powdered materials.

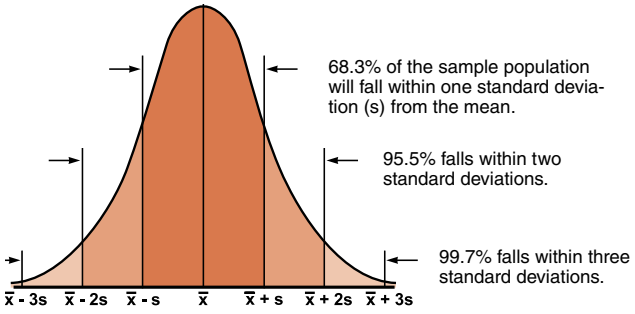
The diversity of materials and their associated handling characteristics require that repeatability performance for a particular combination of feeder and material be determined through laboratory testing.

To quantify the variability of the feeder's discharge stream, the concept of standard deviation is employed. Assuming a random distribution of sample weights around the mean sample weight, the weight of 68.3% of the samples will lie within 1 sigma (standard deviations) from the mean.

Standard deviation, s, is defined as...

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n - 1}}$$

where x_i is sample weight, $\bar{x}$ is average sample weight, and n is the number of samples.



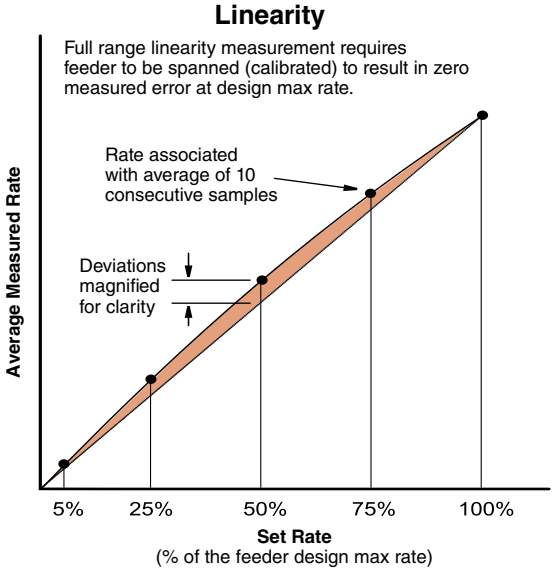
Linearity:

ProRate PLUS loss-in-weight feeders have been designed to perform to the following linearity standard:

> ±0.8% of set rate based on the mean value of a minimum of 10 consecutive samples of one-minute, 0.5 kg (~1.0 lb), 0.5% of gross scale capacity or 30 screw revolutions, whichever is greater, over a turndown of 20:1 from maximum design rate for free-flowing granular and powdered materials.

The diversity of materials and their associated handling characteristics require that linearity performance for a particular combination of feeder and material be determined through laboratory testing.

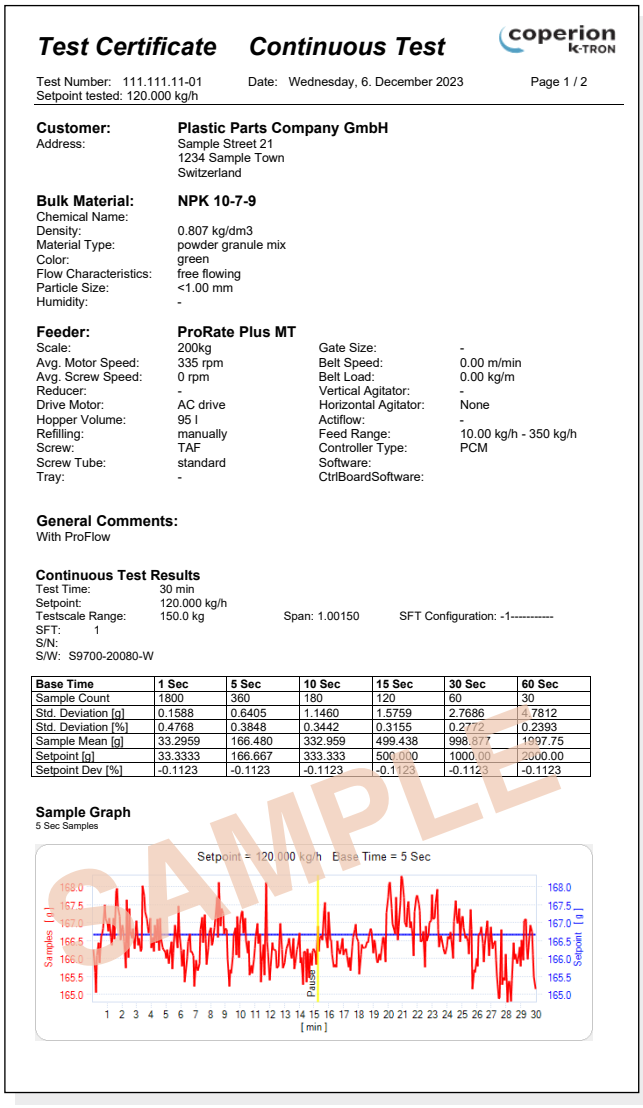
Note that the above definition quantifies linearity performance over the full operating range of the feeder. Many applications involve feeder operation at a constant rate or over a very limited range of rates. In these cases, it is normal practice to re-span (calibrate) the feeder to eliminate or minimize linearity error within the operating range.



Note: ProRate Plus feeders have a reduced precision towards the low end of the feeding rates, especially below 5% of drive command (percentage of max screw speed). Optimal performance is achieved when hopper fill is evenly maintained between 20% and 80% of hopper volume.

Sampling Procedure:

To most fairly and accurately report the performance of its feeders, ProRate PLUS employs a sampling procedure called differential dynamic sampling. In this approach, all samples are obtained consecutively and continuously. The feeder under test discharges directly to a sampling container on a high precision electronic scale. Scale readings are automatically communicated to a computer every five seconds (or every second if required by the application). Sample weights for each interval are determined, and all required statistical quantities are computed and presented in a comprehensive, formalized report.



Test Certificate ***Continuous Test***

coperion K-TRON

Test Number: 111.111.11-01 Date: Wednesday, 6. December 2023 Page 1 / 2
Setpoint tested: 120.000 kg/h

Customer: **Plastic Parts Company GmbH**
Address: Sample Street 21
1234 Sample Town
Switzerland

Bulk Material: **NPK 10-7-9**
Chemical Name:
Density: 0.807 kg/dm3
Material Type: powder granule mix
Color: green
Flow Characteristics: free flowing
Particle Size: <1.00 mm
Humidity: -

Feeder: **ProRate Plus MT**

Scale:	200kg	Gate Size:	-
Avg. Motor Speed:	335 rpm	Belt Speed:	0.00 m/min
Avg. Screw Speed:	0 rpm	Belt Load:	0.00 kg/m
Reducer:	-	Vertical Agitator:	-
Drive Motor:	AC drive	Horizontal Agitator:	None
Hopper Volume:	95 l	Actiflow:	-
Refilling:	manually	Feed Range:	10.00 kg/h - 350 kg/h
Screw:	TAF	Controller Type:	PCM
Screw Tube:	standard	Software:	
Tray:	-	CtrlBoardSoftware:	

General Comments:
With ProFlow

Continuous Test Results
Test Time: 30 min
Setpoint: 120.000 kg/h
Testscale Range: 150.0 kg Span: 1.00150 SFT Configuration: -1----------
SFT: 1
S/N:
S/W: S9700-20080-W

Base Time	1 Sec	5 Sec	10 Sec	15 Sec	30 Sec	60 Sec
Sample Count	1800	360	180	120	60	30
Std. Deviation [g]	0.1588	0.6405	1.1460	1.5759	2.7686	4.7812
Std. Deviation [%]	0.4768	0.3848	0.3442	0.3155	0.2772	0.2393
Sample Mean [g]	33.2959	166.480	332.959	499.438	998.877	1997.75
Setpoint [g]	33.3333	166.667	333.333	500.000	1000.00	2000.00
Setpoint Dev [%]	-0.1123	-0.1123	-0.1123	-0.1123	-0.1123	-0.1123

Sample Graph
5 Sec Samples

Sample Test Lab Report