

DOSING NEGATIVE, LOSS-IN-WEIGHT PENKO ENGINEERING B.V.



INTRODUCTION

This White Paper discusses the challenges, options and solutions for process manufacturers when the dosing and/or the mass flow are/is controlled by means of Loss-in-Weight for the processing.

PURPOSE OF WHITE PAPER

... is to explain why it is important to dose the correct amount of material. By their very nature, Loss-in-Weight (LIW) systems can be non-automatic or automatic. When not used for the regulation of a material flow, the advantage of negative weighing is a reduction of the in-flight effect, see figure 1.

Whether a LIW system is of industrial proportions to create mixtures, or a simple, small, single flow system, similar challenges regarding accurate mass flow control apply which in turn have a direct effect on a process manufacturers cost and profit margins. Overflow and underflow both result in a reduced efficiency of the installation. Product quality fluctuations and even rejection of the finished product result in product wastage and profit loss.

BACKGROUND ON LOSS –IN-WEIGHT

By their nature Loss-in-Weight systems are used for internal weighing only. This means legal requirements do not exist. However, it has to meet a company's quality assuring system. Controllers for Loss-in-Weight processes are designed to ensure the control and optionally the regulation of the exact negatively dosed amount and/or the mass flow, including the totalization of the dosed product amount. For this purpose the loss in weight (Δm) is checked and, where necessary, the corresponding time (Δt) is determined. In the latter case, a simple calculation ($\Delta m : \Delta t$) provides the mass flow. During operation PENKO instruments offer a wealth of information, namely the:

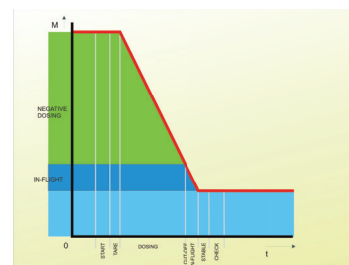


Figure 1. Mass-time graph of a negative dosing.



Photo 1. A weigh hopper for negative dosing.

DOSING NEGATIVE, LOSS-IN-WEIGHT PENKO ENGINEERING B.V.



- ▶ • weigher contents
- loss in weight
- dosed mass
- mass flow

In addition there is an option to switch the dosing on/off and/or to control the mass flow. This is done by means of a continuous comparison between the actual and the pre-set mass flow with, if necessary, the adjustment of the speed of the dosing conveyor. During the filling process of the weigher, in other words, when no loss in weight can be detected, the speed of the dosing conveyor is adjusted in several, empiric established, steps in accordance with the filling ratio.

Loss-in-Weight systems are popular in blending processes where a mixture is made out of several components. A typical configuration comprises of a weigher with one or more containers with each a supply and a dosing conveyor, a screw, or a proportional valve, see figure 2. The sequence starts with the weigher being filled. One or more than one recipe value(s) is/are set for the gross weight and a second value is set for the net to be dosed amount.

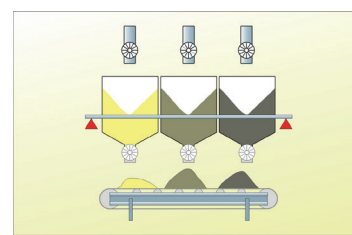


Figure 2. Negative dosing of three components out of a common weighing frame.

Typically, a PENKO controller for flow measurement and regulation is programmed with a set value for the mass flow and adjusts the speed of the output feeder in proportion to the measured flow, figure 3. A module calculates the output speed of the hopper and compares the pre-set desired mass flow with the actual mass flow. Whilst the hopper slowly empties, in succession the loss in weight and actual mass flow per unit of time is recalculated by the controller and subsequently the feeder output speed is adjusted when necessary. This sequence compensates differences in material flow characteristics due to the volume of material or changes in material density.

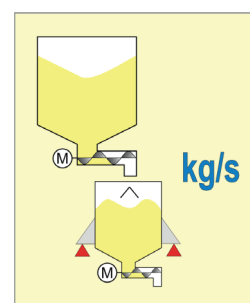


Figure 3. Measuring a mass flow.

A more extensive example shows figure 4. In this application a mixture is realized simultaneously by means of three LIW feeders in combination with a continuous mixer. This way an uninterrupted flow of mixed product is created. Optionally a “master/slave” regulation can be made. In such a case the measured mass flow of the main ingredient is used as a ratio for the calculation of the other ingredients. This guarantees the relation between the ingredients follows the most important one.

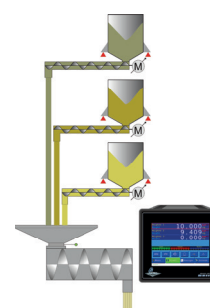


Figure 4. The continuous preparation based on weight of a mixture by means of three feeders.

DOSING NEGATIVE, LOSS-IN-WEIGHT PENKO ENGINEERING B.V.



▶ BACKGROUND ON LOSS –IN-WEIGHT

Functions:

- Suppress dynamic effects
- Pre-set flow of mass, content of the weigher, loss in weight and total dosed mass
- Switching filling and dosing on/off
- Mass flow control (option)
- Mass flow control within pre-set tolerances
- Time controlled automatic refill
- On/off switch for a dosed pre-set total
- User friendly touch screen panel allows for ease of operation
- Simultaneous display of:
 - mass flow
 - contents of the weigher
 - dosed mass
 - loss in weight
- Stock control above the weigher by means of an input, including an alarm function
- Volumetric or gravimetric dosing

Optional extra's on the FLEX range (free programmable):

- Pre-set the mass flow by means of an analogous input (ideal for master/slave configurations)
- Actual mass flow report via an analogous output
- Create master/slave controls with a multi-channel instrument or several instruments



Photo 2. The continuous preparation of a mixture out of three weighing tanks.



Photo 3. The realization of a continuous flow out of two weighers.

DOSING NEGATIVE, LOSS-IN-WEIGHT PENKO ENGINEERING B.V.



COMPETITIVE ADVANTAGE

A high resolution filtering system combined with high speed – high accuracy measuring, offers smart weighing results for any operation environment.

All instruments are designed and manufactured for a 10.000 d accuracy. The combination of measuring at high speed (1600 conversions/s) with a high internal resolution (16.777.216), smart filters and sufficient computing capacity, make the FLEX range suitable for any Loss-in-Weight application. The high resolution and conversion speed guarantee the best possible flow control accuracy, even when conveying at high speeds, thus preventing wastage caused by wrong mixtures or disturbance of the process.

Model FLEX 2100:

This three-in-one device combines a stunningly-simple touchscreen interface, a core of sophisticated hardware and a clever calibration system. It offers 8 inputs/8 outputs, an integrated plc, communication via an Ethernet (TCP) portal with the protocols Modbus, FINS, Ethernet-IP and ASCII, portals RS232 and RS422/RS485 with the protocols Modbus and ASCII. Protocols for printers, webbrowsers and configuration software between PENKO-instruments are available on Ethernet (TCP), CAN, RS232/422 and USB. Additional options are an analogue output and a portal Profibus with protocol Profibus-DP.

Model FLEX

This most versatile apparatus is an all-in-one compact, reliable and user friendly indicator/controller, suitable for automatic and non-automatic weighing. The FLEX has an integrated PLC, offers an expandable number of inputs/outputs including remote I/O's; its communication portals include an Ethernet (TCP) portal with the protocols Modbus, FINS, Ethernet-IP and ASCII, portals RS232 and RS422/RS485 with the protocols Modbus and ASCII, as well as optionally a portal Profibus with protocol Profibus-DP. Protocols for printers, webbrowsers and configuration software between PENKO-instruments are available on Ethernet (TCP), CAN, RS232/422, and USB, making it highly suitable for complex weighing applications. Digital and analogue inputs/outputs are optional. The FLEX range has all the features of model FLEX-2100.

Model FLEX multi-channel

This most versatile apparatus possesses all the features of the models FLEX and FLEX-2100 with additionally the capacity to control up to four weighing systems in one instrument simultaneously and, where necessary, cross linked.



Engineering White Paper

DOSING NEGATIVE, LOSS-IN-WEIGHT PENKO ENGINEERING B.V.



▶ CONCLUSION

PENKO instruments control the Loss-in-Weight system as well as the stock control all in one. All PENKO systems are “Slave” systems.

Mass flow control, including preparing mixtures made up out of several components within strict accuracy requirements, in the shortest time possible and in the most effective way remains a challenge throughout the processing industry and will vary from one manufacturer to another. Consideration not only needs to be given to over/under flow challenges, but each product – particularly natural products – has its own intrinsic weight and volume that influence the conveying process.

To engineer the most efficient way per industry - per product - per manufacturer, there is no “one-size-fits-all” solution. Engineers at PENKO work out the best and most effective way this can be done.

“Following White Papers will discuss Loadcells, Installation of Loadcells, Non Automatic Weighing Systems, Check Weighing Systems, Filling Systems, continuous totalizing with Belt Weighing, discontinuous totalizing with Hopper Weighers, Grading Systems by means of Weight and Batch Control on Weight for Mixing Plants.

For more information: www.penko.com