Approach Truck Loading

Description to explain SWR's actual position for using the MaxxFlow in truck loading applications

Introduction

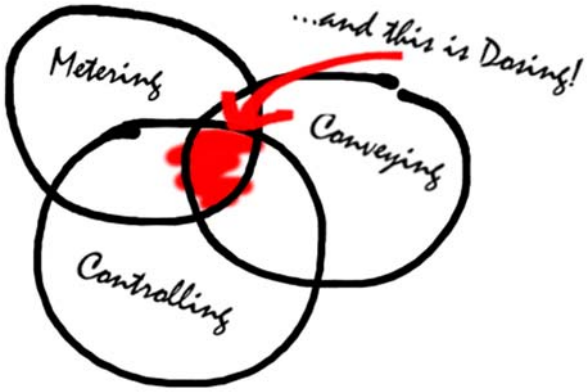
In the truck loading application, the task is to load a desired amount of material into a truck. This amount is normally been preselected by the truck-driver and in most applications is in in the range of 20 to 30 tons. The desired time for the loading in most cases is between 15 and 20 minutes. This leads to an average flow rate of around 100 t/h.

However, if the task is to load a desired amount of material into a truck in a desired time, than the whole application is not just a measuring application. In truth, it is a dosing application.

This fact has to be addressed when using the MaxxFlow system in a truck loading application.

The MaxxFlow sensor delivers only one part of a dosing system, namely the part of metering.

The dosing solution however consists out of three parts, which are: metering, conveying and controlling.



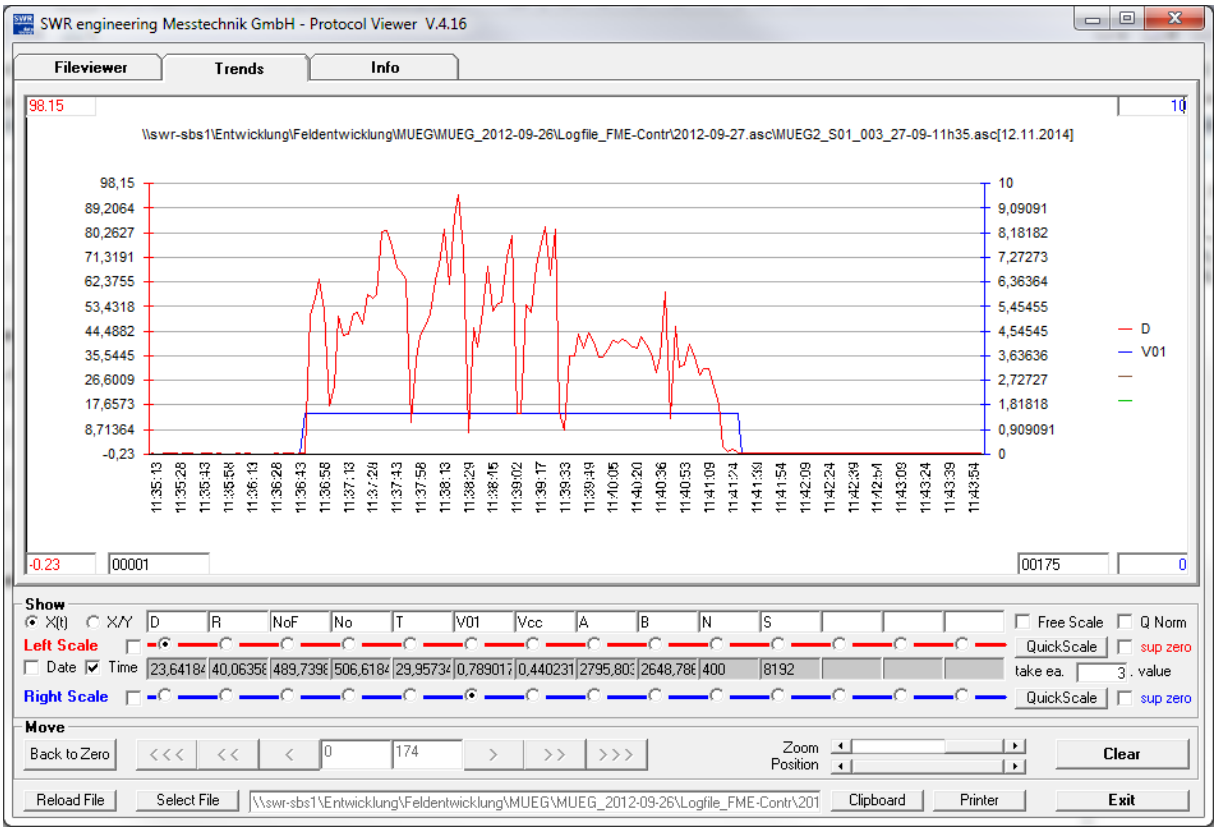
All three parts must match, in order to get a satisfying result in dosing or in short words:

If the truck driver wants to fill 25 tons the outlet-scale shall show at least an amount of 25tons +/-3%

Experience

In truck loading applications which we have experienced in the past, it was found that in most applications the part of conveying was not fulfilling the requirements for a good dosing result. Why?

Approach Truck Loading



The above reading shows a loading where it can be seen that the flow is pulsating very much during the time of loading. In some situations it comes nearly down to zero and in the next moment is goes up to full load again. This condition makes it nearly impossible to meet the desired pre-set value, because the pulsating flow makes it very difficult for the sensor to measure accurate as it has to follow the changes in flow rate very quickly and needs to be able to measure with the sufficient accuracy of the whole range of flow.

We can state today that under this condition the MaxxFlow can not solve a truck loading application!

Solution

The right approach to solve this application is to use the MaxxFlow in a closed loop. However, this is only possible when the conveying, respectively the feeding device, is designed in a way that it can work as an actuator. In particular, that means:

1. If the feeding device is a rotary valve, the chamber volume of a single chamber shall not be more than the volume of the the MaxxFlow sensor itself, e.g. not more than 9,7 liter.
2. If the feeding device is a screw feeder than there is no limitation as a screw feeder is creating a sufficiently constant flow.
3. If the feeding device is an air slide, a dosing valve at the inlet of the air slide is necessarily needed.
4. If the feeding device is a vibration feeder than there is no limitation as a vibration feeder is creating a very constant flow.

Whatever feeding device is used, the feeder needs to be equipped with a frequency converter to enable a control loop.

Approach Truck Loading

In addition please note, that even the best feeder cannot work if the material is not in flowable condition.

This means that in conjunction with a properly designed feeder, a sufficient concept of periodic fluidization might be needed to enable the feeder to really adjust the flow rate.

Or in short words: If there is no material coming out of the silo, the feeder can turn as much as it can but won't change the flow rate.

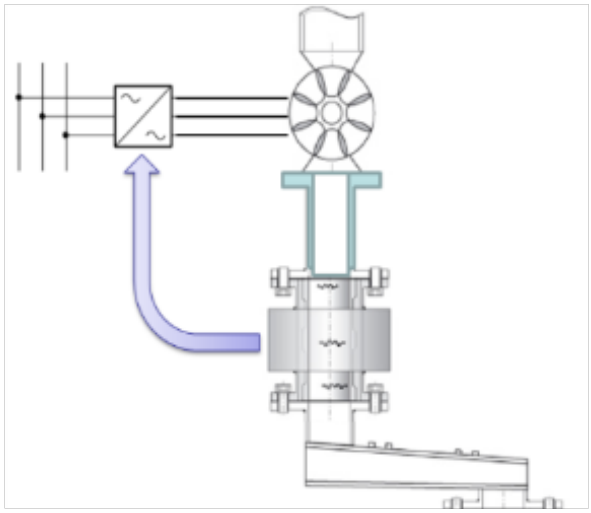
At the actual stage, SWR does not take responsibility for the control loop, as we are not that much experienced in here.

However, we will only enter into a truck loading application if the customer understands and accepts the need of:

- Suitable feeding device for conveying
- Frequency converter at feeding device
- Controller

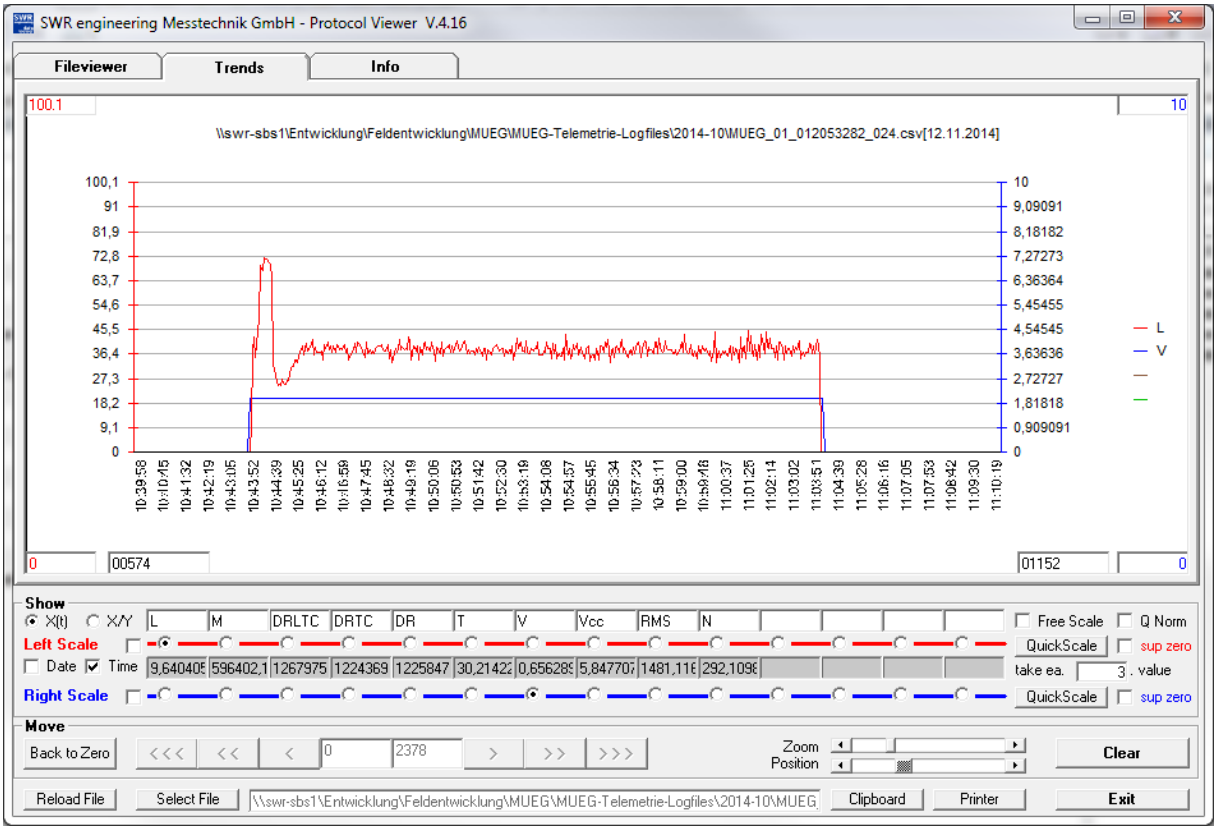
Note: All three items will not be in the scope of SWR.

By building up a control loop with the MaxxFlow sensor as feedback device, as shown in the below figure, the truck loading application can be solved.



The below reading shows the flow behavior during the loading time under ideal conditions.

Approach Truck Loading



After starting the loading the controller adjusts the flowrate by getting the feedback from the MaxxFlow sensor. The flowrate overshoots and undershoots only one time until loading is performing with constant (controlled) flow rate. After the integator has reached the desired preset-value the conveying stops.

Expectations

From a real application for a loading of flyash the below table shows the quality of results which can be expected if the approach as described above will be followed.

Approach Truck Loading

Load No.	MaxxFlow in tons	Scale in tons	Deviation in %
1	26,872	27,080	-0,768
2	27,943	27,720	0,805
3	27,145	27,380	-0,859
4	27,777	27,920	-0,513
5	24,438	23,760	2,852
6	28,482	27,060	5,254
7	27,950	27,880	0,250
8	27,896	27,880	0,059
9	26,799	27,780	-3,531
10	27,504	26,820	2,550
11	27,983	27,260	2,652
12	26,546	27,120	-2,116
13	26,513	26,860	-1,292
14	26,706	26,880	-0,648
15	25,249	26,260	-3,849

Based on that results the standard deviation is as much as 2.5%. In general we we can state that a maximum standard deviation of 5% can be granted.