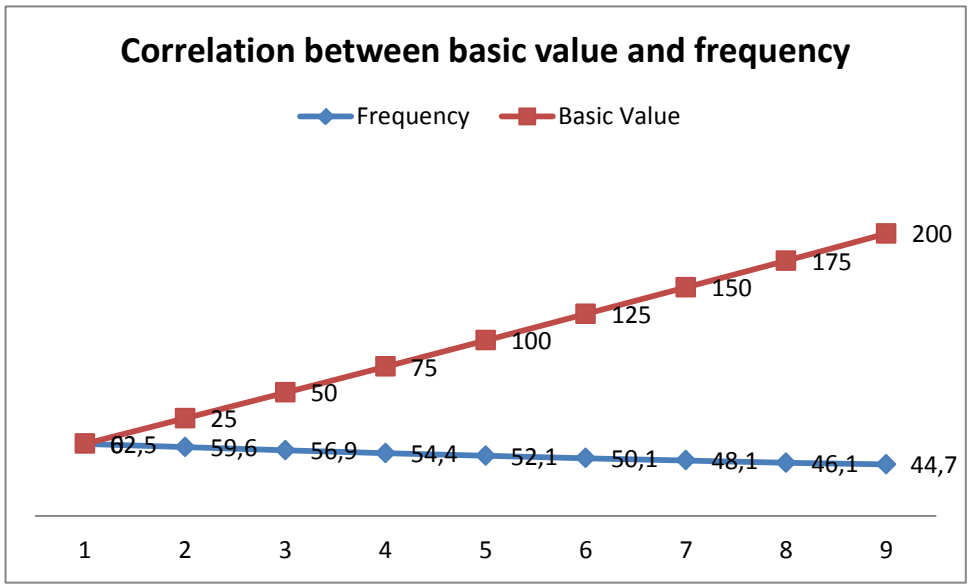
LABORETTE 24: Vibratory Feeder for feeding and dosing

The Vibratory Feeder LABORETTE 24 is suitable for automatic feeding of laboratory mills or sample dividers

For this Vibratory Feeder a new electronic control unit with digital display was now developed. The control unit is set ex-factory on the mechanic natural frequency (resonance frequency). This setting corresponds with the maximum material feed at 100 % intensity (= Amplitude). By reducing the amplitude of the vibration, the material feed decreases.
The new control unit even allows a change of the frequency in the setup mode. Thereby the maximum material feed can be reduced. A very fine control of the feed rate is obtained by adjusting both parameters the frequency and intensity.

ill. 1: Vibratory Feeder LABORETTE 24 with V- shaped channel

In the following, at first the characteristic of the new control unit shall be explained:
The vibrating system is prompted with a certain frequency. This frequency is between 45 and 63 Hz. On the digital display this frequency is not displayed in Hz though, in the setup the frequency is assigned a numerical value between 0 and 200.
In the following let's call this "basic value". Between the basic value and the frequency exists a linear correlation.



Is a certain basic value adjusted in the setup, the feed rate can be reduced from the 100 % default value by lowering the amplitude (intensity).

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Now with tests the following questions shall be answered:

- How does the flow rate change when the basic value is altered?
- How does the flow rate change, when at a constant basic value the amplitude is linearly reduced?
- With what reproducibility can material be conveyed?
- Which minimum and maximum amount can be set?
- How is the feed rate dependent on the material properties?

ill. 2: Control unit of the Vibratory Feeder Channel LABORETTE 24

The characteristic of the material conveyance with the LABORETTE 24 depends on various parameters:

- On the prompting frequency
- On the amplitude of vibration
- On the ambience temperature and the warming of the instrument during operation
- On the utilized channel shape
- On the fill height of the feed material on the feeder channel
- On the material properties of the feed material

General experimental procedure: Determination of the feed rate in dependence of the frequency with sand of medium and fine particles

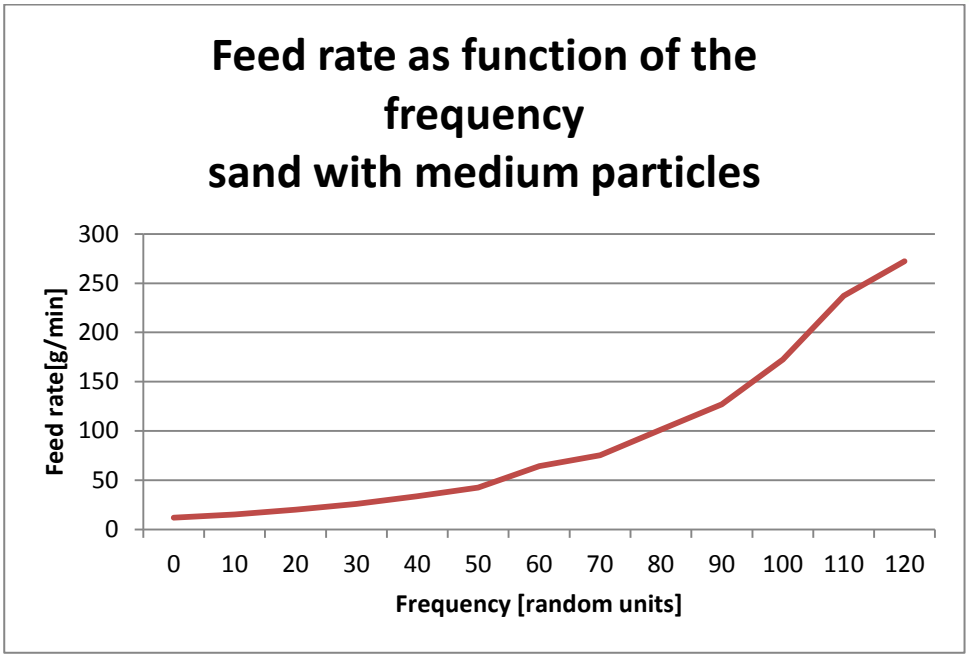
All tests were conducted with silica sand with different sized particles. The respective particle size was measured with the **Laser Particle Sizer ANALYSETTE 22**.
First, the maximum feed rate was determined. The utilized sand has a medium particle diameter of 0.5 mm.

The result:

- With increasing frequency the conveyed amount of material increases
- The connection between basic value and material amount is not linear
- The maximum feed rate for this material is about 1 kg per minute

Test: Sand with medium particles

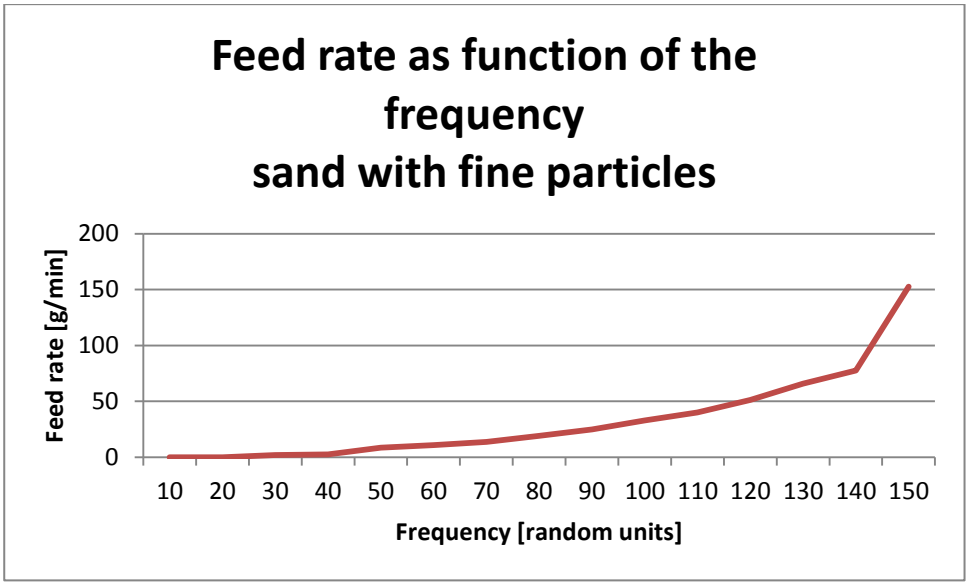
In the next test the feed rate in dependence of the frequency shall be determined. The fill height on the Vibratory Feeder was selected as low as possible and is only a few millimetres. The in the setup adjustable basic value was increased linearly starting at 0 and the conveyed amount of silica sand per minute determined at intensity 100 % **.** For this, from 5 measurements a mean value was determined.



An additional increase of the basic value was not possible. Individual coarse sand particles were expelled at the funnel out of the V-channel.

Test: Sand with fine particles

Now, in the next test, sand with very fine particles (d_{50} = 10 µm) was utilized. Again, in the setup the basic value was increased in linear steps. With a value of 0 and up to 40 there is no continuous conveyance. The material flow on the Vibratory Feeder stalls again and again.



The tests showed

- Sand with a medium particle size of 0.5 mm and maximum fill height on the Vibratory Feeder can be conveyed with a feed rate of 1.2 kg per minute. As a minimum rate for this setting 120 g/min were determined
- Sand with a medium particle size of 0.3 mm and a low fill height on the Vibratory Feeder can be conveyed at a rate of 12 to 270 g/min by altering the basic value
- Sand with very fine particles can be conveyed at the same fill height with a feed rate of 2.5 to 153 g/min in dependence of the basic value

In the next tests it will be examined:

- How does the feed rate change at a constant basic value setup by changing the intensity
- What is the correlation between intensity and the conveyed amount of material
- Which minimum amounts can be conveyed reproducibly

At first, the fill height of the Vibratory Feeder was a bit increased. Now in the setup a basic value was sought after at which approximately 250 g/min of the sand with a particle diameter of 0.3 mm could be conveyed. This setup setting was saved and utilized for all further tests.

Amplitude[%]	**100**	**90**	**80**	**70**	**60**	**50**	**40**	**30**	**20**	**10**
Feed rate [g/min]	242	178	119	78	56	35	25	15	9	7

As a final test, the reproducibility of the conveyance in dependence of the amplitude is tested. For this at varying intensities, the conveyed amount was determined 10 times and from these measuring values was the median value of the feed rate determined.

Amplitude [%]	**Feed rate [g/min]**	**Standard deviation [%]**
10	7 +- 0,3	4,1
40	25,2 +- 0,7	2,8
60	55,8 +- 1,5	2,7
80	122,6 +- 1,8	1,5

Summary:

The new control unit of the Vibratory Feeder **LABORETTE 24** allows the change of the maximum feed rate by adjusting the vibration frequency in the setup of the instrument.
The feed rate depends on the shape of the feeder channel (U-shaped or V-shaped), on the set fill height, on the particle size of the material, as well on additional specific properties of the material, like for example the pourability. By varying both the frequency and the amplitude in many areas the feed rate can be altered.

ill. 3: V-shaped and U-shaped channel are easy to interchange

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