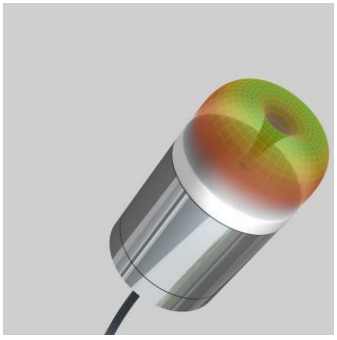
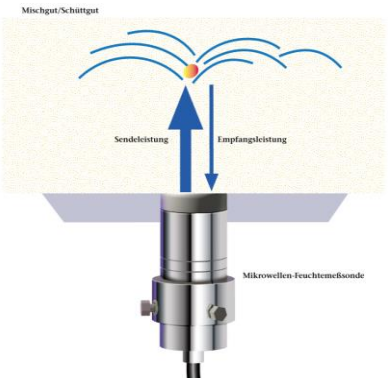
The Microwave Measuring Method
Functional Principle and Application Possibilities



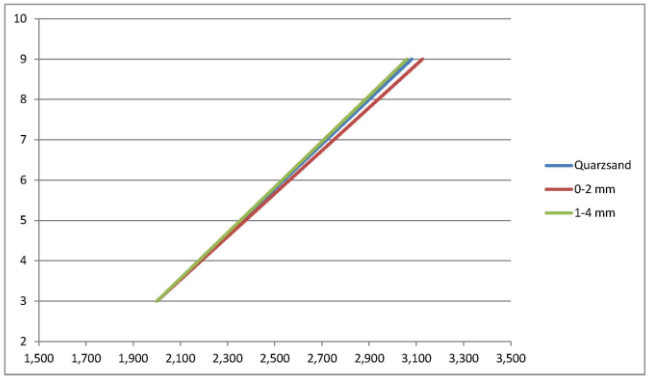
Virtual presentation of microwave radiation



Functional Principle

The microwave measurement method is in use for the aggregate measurement of the individual components as well as the mixer measurement for more than 20 years. The microwave measurement is linear in a wide moisture range, which guarantees accurate measuring results even with high material moistures.

The following example illustrates the high reproducibility of different aggregates:



Calibration curves of different sands

The probe's operating frequency of 433 MHz has proved to be advantageous. A penetration depth of the measurement signal of 50-100mm can be achieved which enables detection of a sufficient material cross section in order to evaluate a representative measurement result of the entire batch.
External influences on this measuring signal, such as material build-ups in the mixer or changing PH-values due to different types of cement usage, no longer impact the measurement when using microwave technology. Basically it has to be noted that in the microwave measurement method as with all other dielectric measuring methods steady density and pressure conditions are required for accurate measurement results.

Developing new probe generations make use of proven simulation programs from the satellite or Smart Phone technology. This enables to 'anticipate' the measuring behavior of the probes and to optimize the entire development process.

Microwave moisture measuring probe with exchangeable measuring head (version for use in mixers)

Microwave moisture measuring probe BASIC for moisture measuring in aggregates

Especially with the microwave sensors significant improvements could be made in recent years.
New electronics components have such stable temperature characteristics that high temperature variations of the medium to be measured or the ambient temperature have no influence on the measured signal. Due to the small size of these components, extremely compact sensors can be realized. The small dimensions of the probes - the diameter is only 75 mm, the smallest length 22,5 mm – allows to install the probe even with difficult installation situations.

These new components enable the development of very fast sensors. Shortest response times of less than one millisecond guarantee a very high-resolution measuring signal course and accurate measuring results.

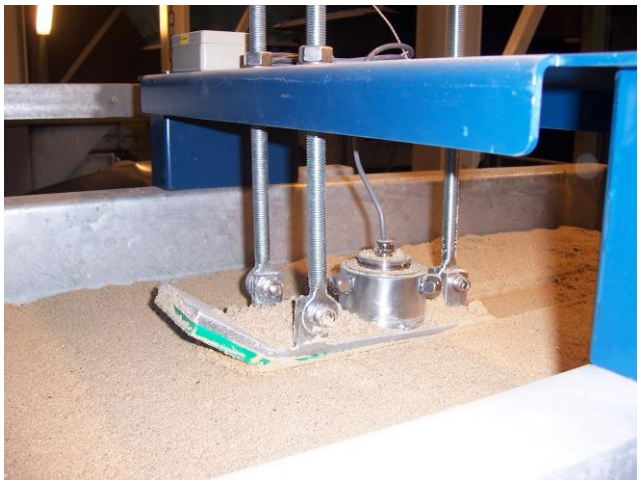
Probe installation below a silo outlet

Probe installation on a chute underneath the silo flap

Advantages:

- The probe is installed underneath the silo flap on a plate
- Total quantity which is dosed is measured by the probe
- Probe can always be monitored visually for material build-ups or damage
- Material flow is not harmed
- Only the measuring surface is in contact with the material.

Probe installation on dosing belts



Installation on a conveyor belt

Advantages:

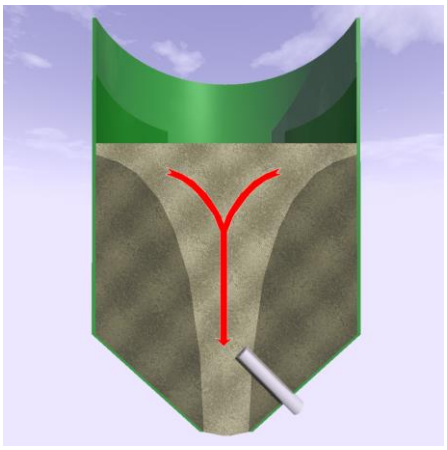
- The probe is installed on a conveyor belt using a slide
- This installation ensures very exact measuring accuracy, because the whole material can be measured even with slow dosing times
- The probe is steadily in touch with the material because of constant contact pressure
- Only the measuring surface is in contact with the material.

Probe installation in silos

Installation option of the probe in silo outlet with a protective pipe

Advantages:

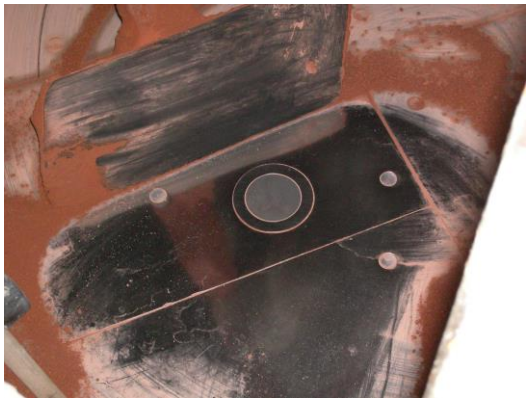
- In the silo, the probe can be situated exactly in the material flow with a lengthening pipe, which is protecting the probe.
- Only the measuring surface is in contact with the material.



Correct probe installation at the material flow

- With this installation, the probe cannot be monitored visually
- A false filling of the silo with stones ensures a risk of probe damage
- The probe can impede the dosing especially with small silo flaps

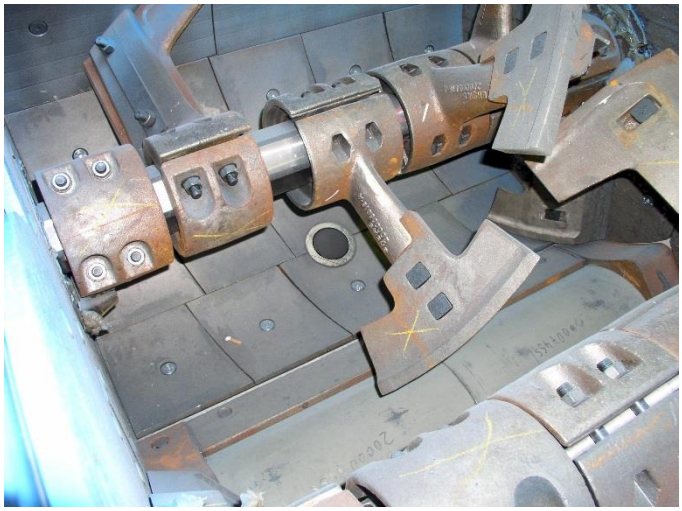
Probe installation in pan mixers



Installation of a mixer probe in the bottom of a pan mixer using a wear protection tile.

- For planetary mixers or pan mixers we recommend the installation in the mixer bottom. So even small batches can be detected with sufficient accuracy.
- It is important to ensure that the probe is not installed too close to the mixer wall and installed at a location of the mixer floor that is cleaned by at least one mixer blade. Material build-ups on the probe's measuring surface can be avoided.
- The probe should not be installed directly under material inlets (aggregates, cement, color, additives).

Probe installation in shaft mixers

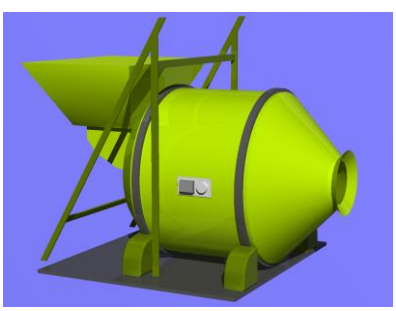


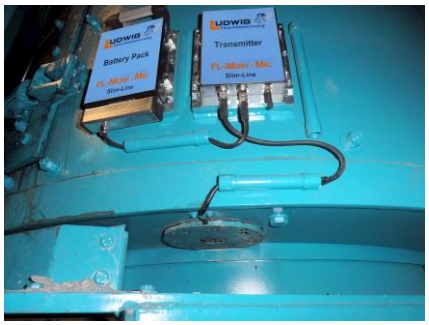
Probe installation in the cover of a double shaft mixer

- For double or single shaft mixers the probe installation at the mixer cover has proven advantageous. Here's to pay attention to a position in the lower part of the cover to get reliable measurement results even with smaller batches.
- With this mixer type, the probe is installed centrally over the mixer gate as the most optimal degree of the mix is ensured at this position.

Probe installation in mixers with rotating mix drum or moving containers for bulk materials

The newly developed microwave moisture measurement system **FL-MOBIMMIC-SlimLline** with WIRELESS data transfer enables probe installation in situations in which the application of wired sensors was not possible previously.





Installation of probe, transmitter and Akku pack at a mixer with rotating drum

Moisture and conistency measurement system FL-MOBIMIC-Inspector for use in ready mix trucks

Using the WIRELESS data transmission and a special arrangement of several measuring sensors, it is possible to determine the process parameters moisture, consistency, temperature, drum filling level, drum rotation direction and speed, as well as any existing residual flow.
The measured values can be queried from the dispatcher or the system control of the concrete manufacturer via the vehicle management system and a GPS data transfer at any time.

Moisture and consistency measurement system FL-MOBIMIC-Inspector installed in the hatch of a ready-mix concrete mix truck

Applications and Features

Our mobile measuring unit evaluates the temperature and moisture of bulk materials of all kinds. It is very user-friendly due to its ease of operation and the integration of wireless technology or USB connection to PC/Laptop. It has applications in almost every process situation. It allows convenient evaluation, quality control and monitoring during every phase of processing - from evaluating the condition of materials to be processed for evaluation of the finished product.

Application of FL-MOBIMIC- ProfiCheck