DASTEC
30 años de soluciones para la industria

Customized solutions for moisture measurement in bulk solids

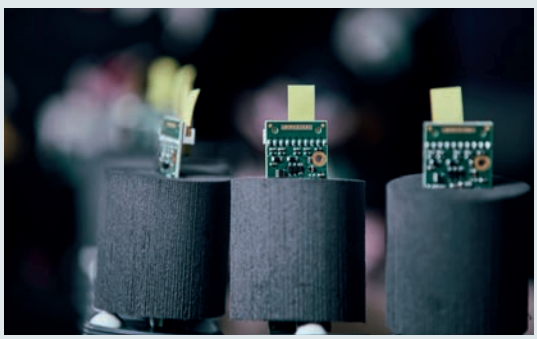
The right moisture sensor for every application

Moisture Sensor Experts

IMKO

History

- Founded in 1984 as an engineering company, IMKO GmbH has been working on moisture measurement for over 30 years now.
- Based on the unique TRIME-TDR technology, IMKO experts developed sensors for science and meteorology in the early 90s. A few years later, the product range was extended with solutions for measuring moisture in grain, primarily for applications in the agricultural sector.
- Since the introduction of the SONO series in 2010, IMKO GmbH now offers a product portfolio that enables moisture measurement in any material, even for detection of just a few drops of water in solids, for example.
- Today, we are an innovative and motivated team of around 20 employees and, since October 2017, we have been a subsidiary of the Endress+Hauser Group. IMKO GmbH continues to develop and produce products with the "Made in Germany" quality mark at its original location in Ettlingen.



IMKO – Application fields

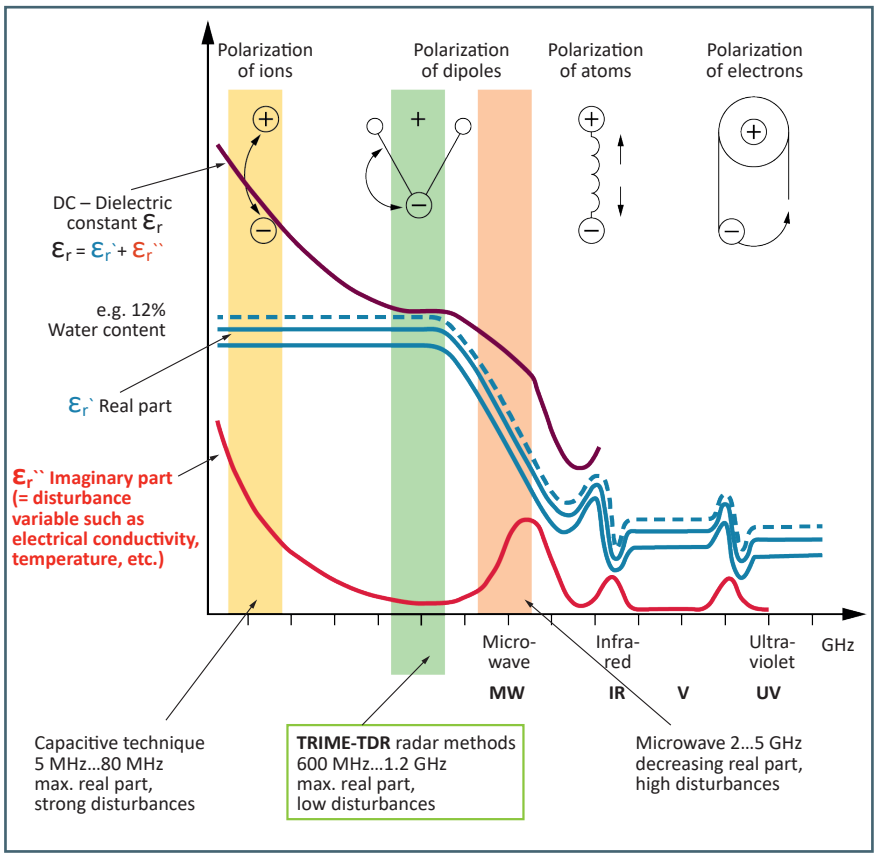
Bulk solids

Concrete

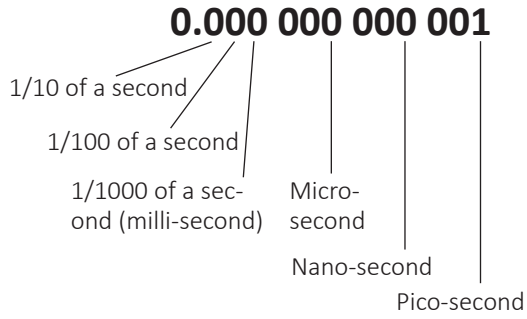
Soil

The IMKO TRIME-TDR measurement method

The sensors developed by IMKO are based on measurement with **Time Domain Reflectometry**, or TDR for short.
In principle, this measurement method is suitable for a range of applications, such as cable break detection or even measurement of fill levels.
When applied specifically for measuring moisture in bulk solids and liquids, the physical effect is used, which correlates the propagation speed of electromagnetic waves with the dielectric properties of the material to be measured.
Since water has a significantly higher dielectric constant than the materials to be measured, such as sand, grain or even oil, it is possible to determine the water content with a high degree of accuracy.



Time resolution of the IMKO sensor technology



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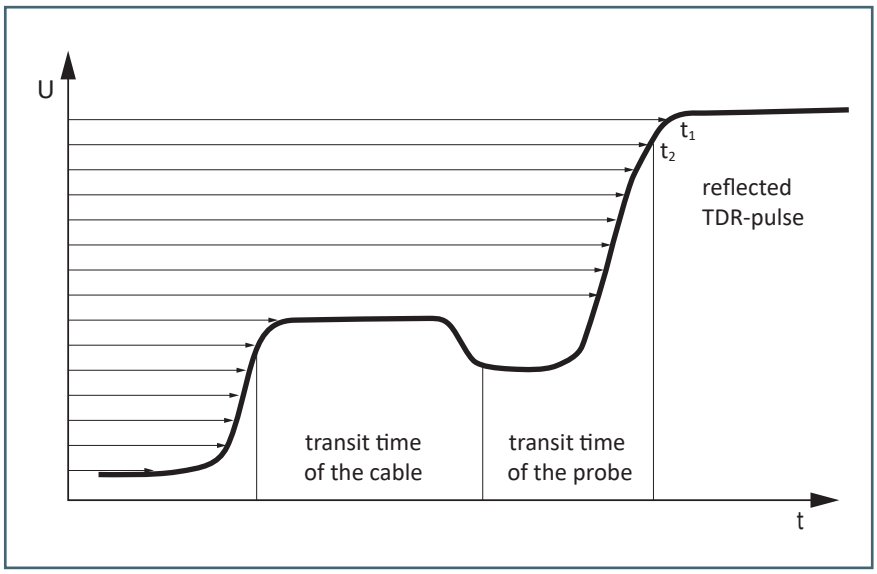
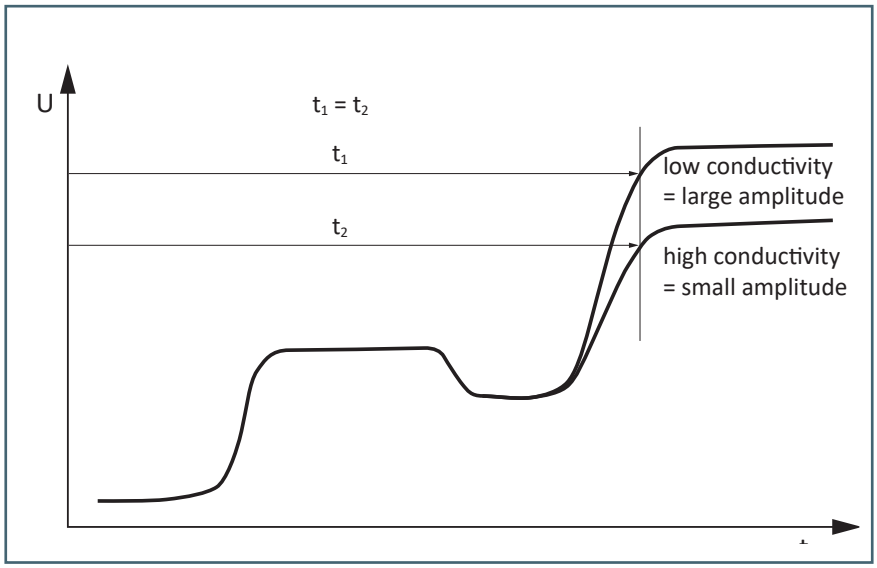
TDR measurement with the patented TRIME method

Implementing a TDR measurement is usually associated with significant technical effort. Very accurate pulses must be generated and the measurement requires the utmost in precision. Therefore, for a long time, TDR technology remained a laboratory measurement method kept back for science. Measuring devices based on TDR were not only very expensive, but also large and unsuitable for field use.
The TDR technology optimized by IMKO specifically for material moisture measurement, the **TRIME method** (**T**ime Domain **R**eflectometry with **I**ntelligent **M**icromodule **E**lements), is a robust measurement technology, which enables a compact and industry-compatible design with a very good price/performance ratio.



One of the biggest interference influences in all kinds of moisture measurement is the electrical conductivity of the medium to be measured. Electrical conductivity influences the measurement result. Even in tap water, the mineral content fluctuates over the year by up to 50% compared to the annual average. TDR technology is very robust as far as the electrical conductivity of the medium is concerned too. Intelligent signal analysis compensates for this disturbance variable and, if necessary, the analyzed signal can even be used to record the enrichment or discharge of minerals.



TRIME®-TDR – Winner of multiple awards
Innovation awards, such as the Bauma Innovation Award 2016 and DLG Approved certification from the German Agricultural Society (DLG – 2018), show how successful the high-tech potential of TRIME-TDR technology has proven in practice. Countless industrial and scientific projects have demonstrated the advantages of TRIME technology.

GEWINNER DES: bauma Innovationspreis 2016

ANERKANNT 2018 DLG WWW.DLG.ORG
IMKO TRIME GWS
✓ Messgenauigkeit Weizen
✓ Messgenauigkeit Gerste
✓ Messgenauigkeit Raps
DLG-Prüfbericht 6936

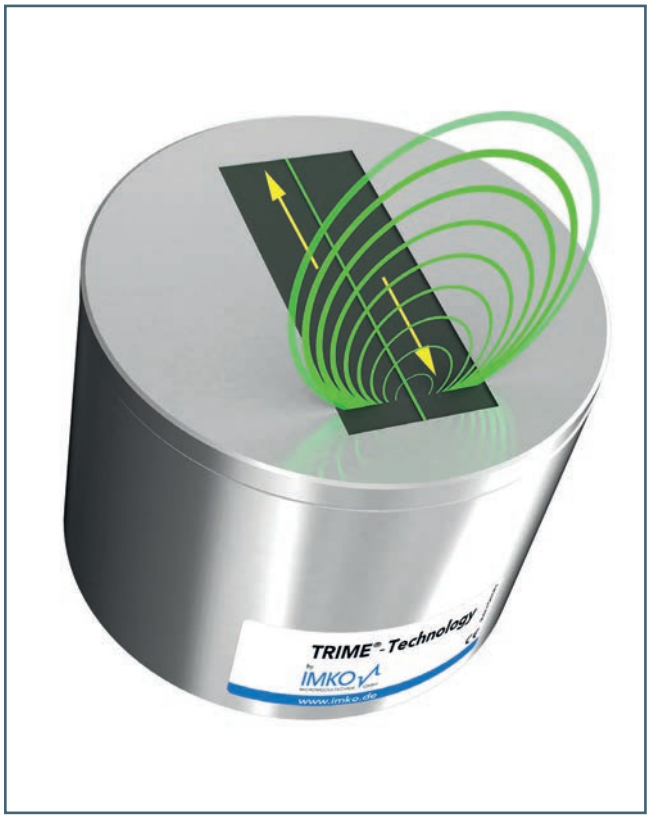
The SONO probe as a "moisture tomograph"

The guided radar wave (in green) propagates at approximately the speed of light. The sensor measures the material layer by layer discoidally and transverse to the sensor surface, as is familiar from a computer tomograph, for example.

This method results in a sensor with an exactly defined measurement field, which can measure without errors even in the event of fluctuating fines or varying grain size. By measuring transverse to the sensor surface, the mechanical condition of the sensor surface does not represent a disturbance variable, i.e. the recurring and unavoidable wear of the sensor surface does not falsify the measured value.

The defined measurement field also enables accurate measurement for applications in which the material coverage is too low or fluctuates. This results in a high degree of flexibility in terms of mechanical integration in the application.

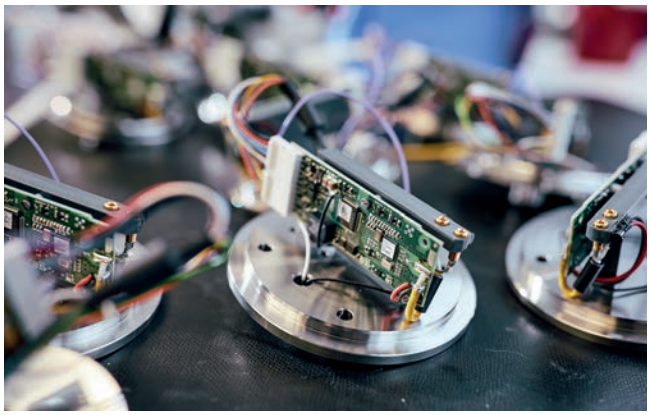
The IMKO sensor portfolio allows you to choose a suitable sensor design, enabling you to find the ideal solution for your application, always taking into account the framework conditions, such as moisture range, electrical conductivity, wear and mechanical installation.

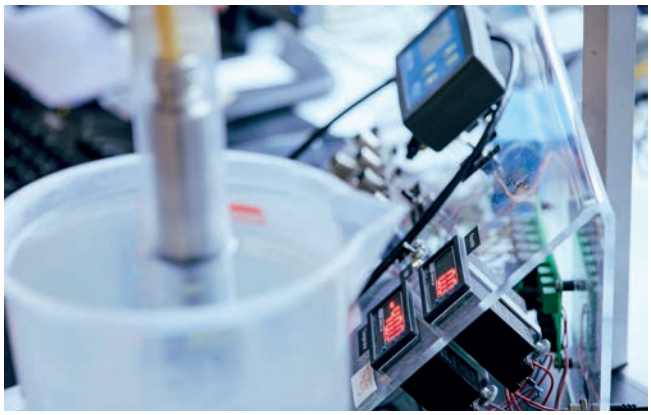


SONO process moisture probes for the bulk solids industry

Increase your plant safety and save time and resources through innovative sensor technologies

All foodstuffs and bulk solids contain a proportion of water. The moisture content not only determines the quality of products, but also their shelf life and due to the weight, their price. Legal requirements lay down the framework. With material moisture measurement, you can determine the water content in your foodstuffs and bulk solids. IMKO is presenting a new generation of moisture probes in the form of its SONO probes. These were specifically developed for applications in food manufacturing and the construction industry, as well as the chemical and pharmaceutical industries, but can be used in other industries too.

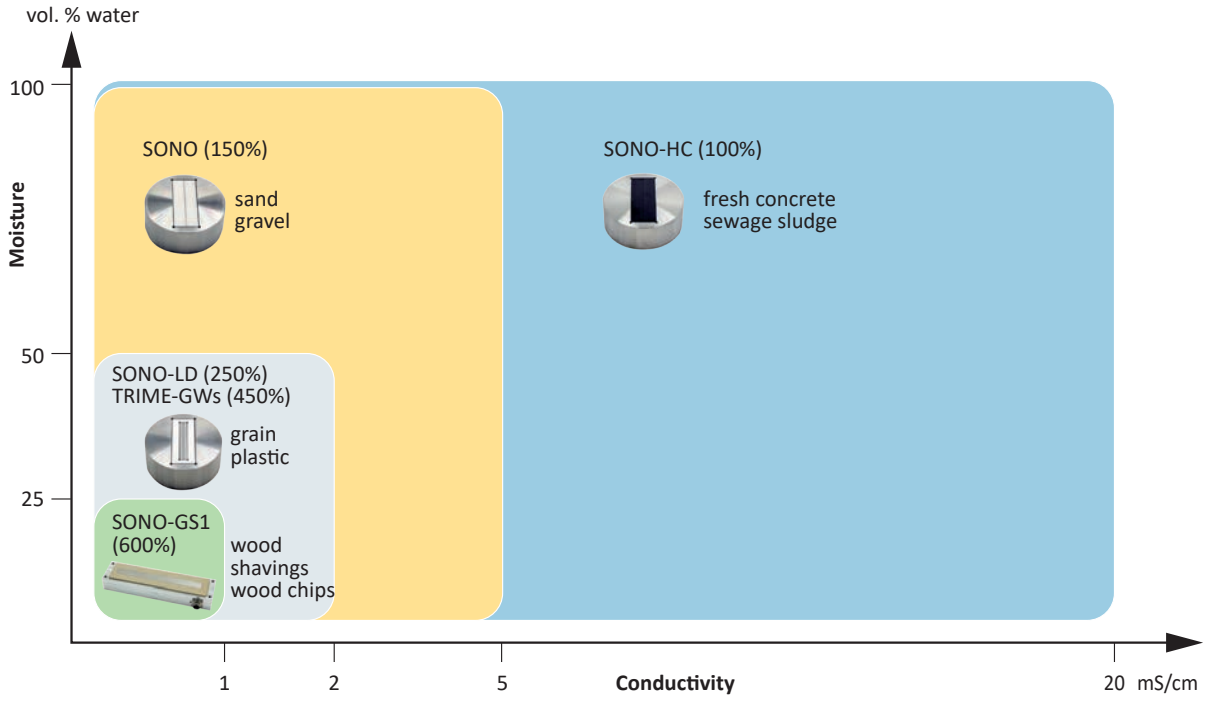




SONO sensor applications

Depending on the group, IMKO sensors differ in resolution and measuring range. The higher the conductivity range of a sensor, the lower the resolution or the performance characteristics.

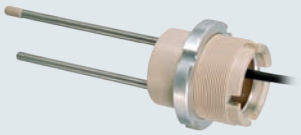
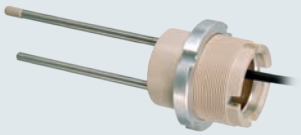
Use the following diagram to help you choose your IMKO sensor. The IMKO application team would also be pleased to provide assistance.

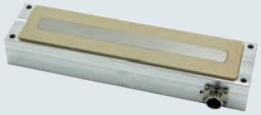


The sensitivity of the individual sensor series in comparison to SONO-HC is marked in brackets

State-of-the-art sensor technology for optimal measurement results

Process connection/sensor type		SONO-HC	SONO	SONO-LD
Applications		0 to 100% vol. water content No to high electrical conductivity (0 to 20 mS/cm) Bulk solids density of approx. 1.0 to 3.0 kg/dm³	0 to 100% vol. water content No to medium electrical conductivity (0 to 5 mS/cm) Bulk solids density of approx. 0.8 to 2.0 kg/dm³	0 to 50% vol. water content No to low electrical conductivity (0 to 2 mS/cm) Bulk solids density of approx. 0.3 to 1.0 kg/dm³
Probe geometry		**Probe name**	**Probe name**	**Probe name**
Round sensor, short		**SONO-VARIO HC**	**SONO-VARIO**	**SONO-VARIO LD**
Round sensor, medium		**SONO-VARIO Xtrem HC** → V4A option → Solid carbide option	**SONO-VARIO Xtrem** → V4A option → Solid carbide option	**SONO-VARIO Xtrem LD**
Round sensor, long		**SONO-MIX**	On request!	On request!
Rod sensor		**SONO-SILO Xtrem HC**	**SONO-SILO** → Xtrem option	On request!
Rectangular sensor		**SONO-MIXmini HC** → 3 mm remote ceramic option	**SONO-MIXmini**	**SONO-MIXmini LD**
High-temperature version (remote electronics)		On request!	**SONO-ES** → VARIO Xtrem → VARIO Xtrem V4A → VARIO Xtrem Solid carbide → MIX mini	**SONO-ES** → VARIO Xtrem LD → MIX mini LD
Accessories				
SONO-View, display and configuration unit	SM-USB, interface converter	Sensor cable available in 4 m/10 m/25 m	Universal holder with tilt mechanism	Sliding carriage incl. mounting material
				

	TRIME-GWs **Precise moisture measurement in heterogeneous bulk solids** with low mineral content and low to medium moisture **Moisture range: 0 to 50%** **Conductivity range: 0 to 2 mS/cm** **Bulk solids density: 0.3 to 1.0 kg/dm³**
	**TRIME-GWs transmitter** Transmitter for measuring moisture in a continuous material flow and at hard to reach places, such as in vertical dryers. Used in conjunction with GR, GRr or WS2 probe. **Temperature range: -10 to +70°C** **1x GR/GRr/WS2 probe can be connected**
	**GR probe SONO version** 2-rod probe, round with temperature sensor integrated in the rod with **PEEK protection cap**, for connection to the **TRIME GWs transmitter**. **Temperature range: 0 to +120°C (up to 150°C for a short time)** **Conductivity range: 0 to 1 mS/cm**
	**GR probe (for rice and other abrasive bulk solids)** 2-rod probe, round with temperature sensor integrated in the rod with **stainless steel protection cap**, for connection to the **TRIME GWs transmitter**. **Temperature range: 0 to +120°C (up to 150°C for a short time)** **Conductivity range: 0 to 1 mS/cm**
	**WS2 probe (for bulk solids with increased mineral content or steam applications)** 2-rod probe, rectangular with temperature sensor integrated in the rod with **PEEK protection cap**, for connection to the **TRIME GWs transmitter**. **Temperature range: 0 to +120°C (up to 150°C for a short time)**

	SONO-GS1 **Precise moisture measurement in low-density bulk solids** with low mineral content and low to medium moisture **Moisture range: 0 to 25%** **Conductivity range: 0 to 1 mS/cm** **Bulk solids density: 0.1 to 1.0 kg/dm³**
	**SONO GS1** Large rectangular sensor for high-precision applications and for installation in container walls, along screw conveyors and piping or similar **Sensor surface of stainless steel (V4A) and PEEK** **Temperature range: 0 to 70°C**
 	**SONO-ES GS1** Large rectangular sensor for high-precision applications and for installation in container walls, along screw conveyors and piping for applications with increased temperature >70°C **Sensor surface of stainless steel (V4A) and PEEK** **Temperature range: 0 to 120°C**

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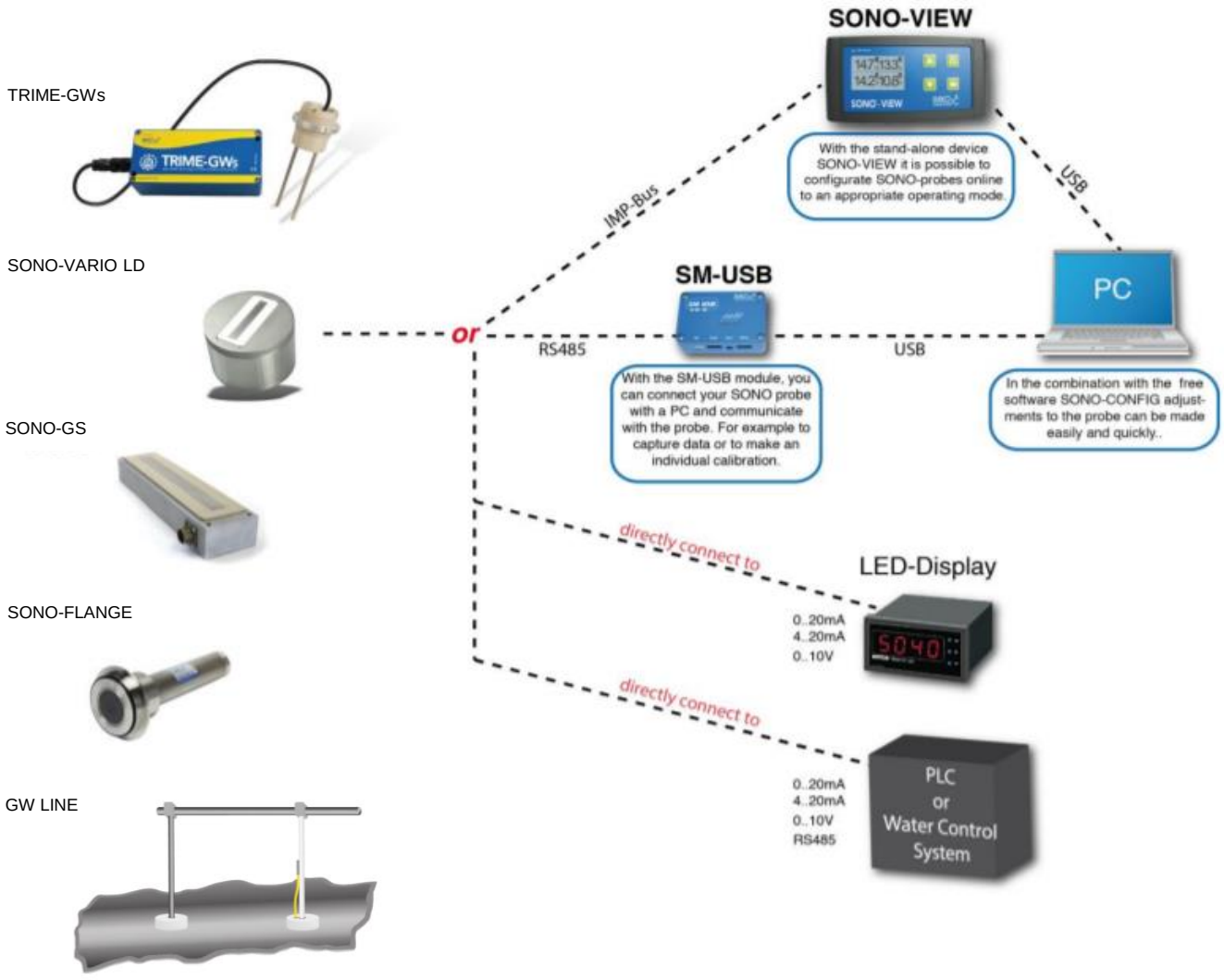
Predictive sensor networking through intelligent device communication

SONO probes enable easy and user-friendly sensor networking

Standard RS485 interfaces often pose significant challenges. They are not galvanically isolated and there is always the risk of ground loops or interference pulses, which can result in significant safety problems. For long cable lengths in particular, a shielded and twisted cable must be used. Depending on the wiring plan (topology), a 100 Ohm terminating resistor must be installed at sensitive locations in the RS485 network when there are individual spurs. In practice, this means significant effort for the plant operator. With SONO-VIEW, up to four SONO probes can be connected via the SONO-internal IMP bus. The robust IMP bus guarantees safety.

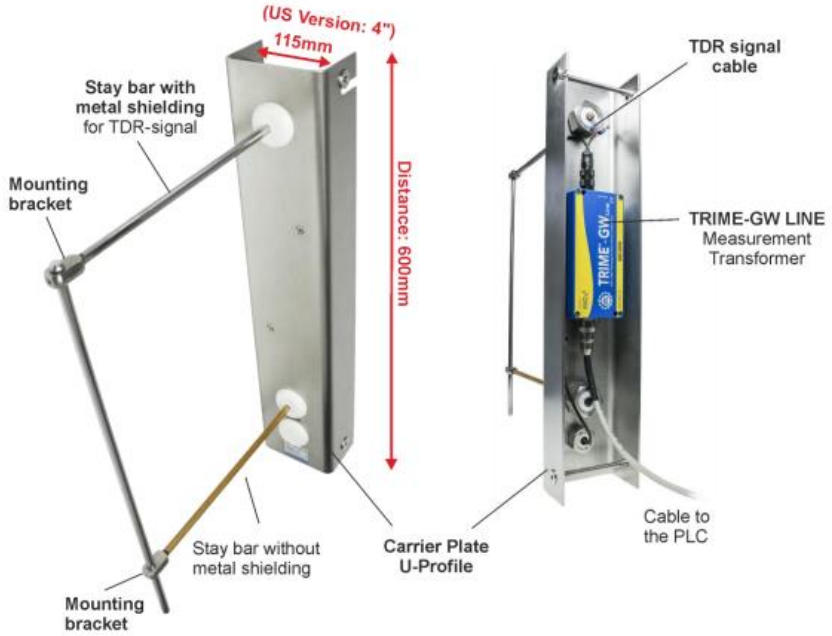


Predictive sensor networking through intelligent device communication ensures smooth processes in the application. The IMP bus does not transmit its data packets as voltage pulses, but as current pulses. Thus, the process works even with long cable lengths on existing and already laid lines. A shielded cable is not required and even spurs in wide-ranging network topologies are not a problem.

Corn cob drying application example (GW LINE)

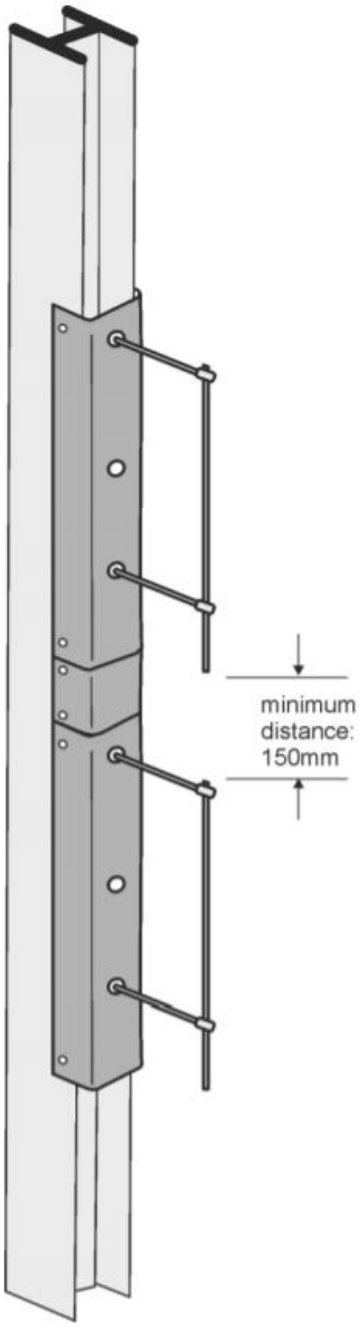
Using GW-Line enables:

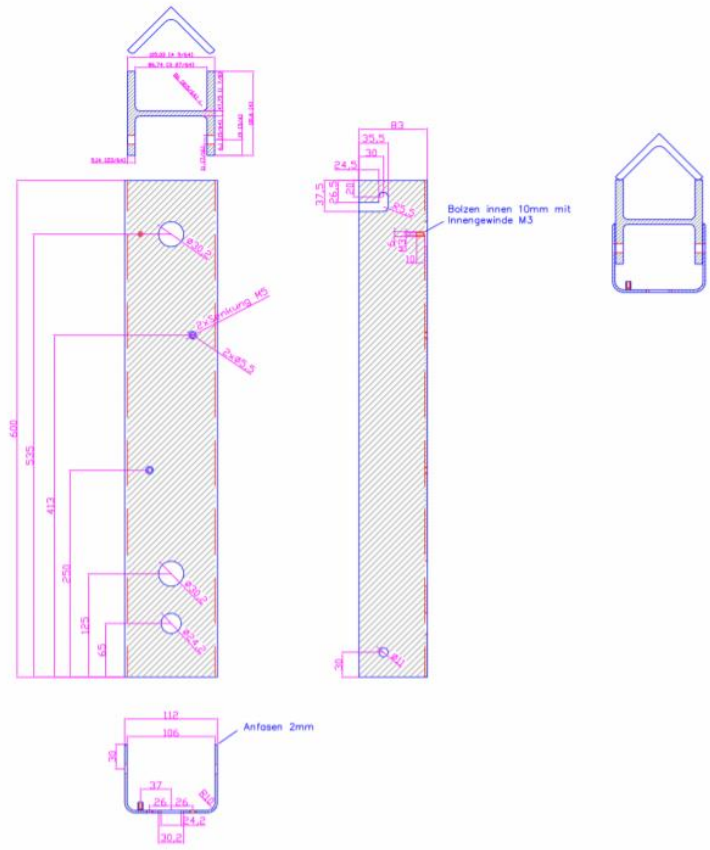
- Direct moisture measurement in the process
- With an extremely large measuring field to enable the moisture determination of enntire corn cobs
- Continuous monitoring of moisture content and temperature in situ
- Improved process stability and thus lower postharvest losses
- Improved process control through all steps in production
- Cost Saving
- Energy saving



- Largest measurement volume in commercialised TDR probes
- Highest accuracy
- ISO 9001 certified
- DLG certified

Installation guide for corn cob drying application example (GW LINE)





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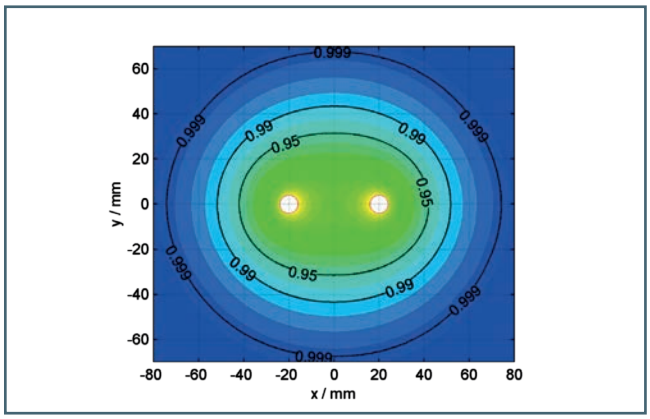
Grain drying application example (TRIME-GWs)

Using TRIME® GWs enables:

- Direct moisture measurement in the material, even at hard to reach places
- Continuous recording and monitoring of moisture content and temperature
- Improved and more accurate process control during all steps
- Improved process stability and thus lower product losses (overdrying/underdrying)
- Cost savings due to improved energy efficiency (due to less overdrying)

Drying of bulk solids in vertical dryers

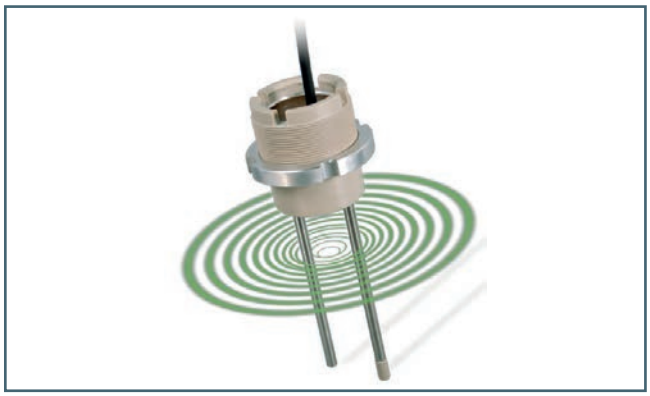
When grain is harvested, it usually contains excess water. If the grain is stored in a silo, this excess water would cause mold to form immediately, resulting in the total loss of the product. Therefore, all common grain types are dried before being stored in a silo, usually using a vertical dryer with product passing through it once (continuous dryer). The input moisture is measured to determine the water quantity to be removed, and the dwell time or throughput rate is controlled based on the known dryer performance. This not only ensures that the product does not go moldy later in the silo, but also that you are not wasting energy unnecessarily by overdrying the product.



The figure shows the measurement field of the standard GR probe. The broad distribution of the measurement field up to 95% (green area) ensures optimal measurement results.

Overdrying or underdrying costs financial resources

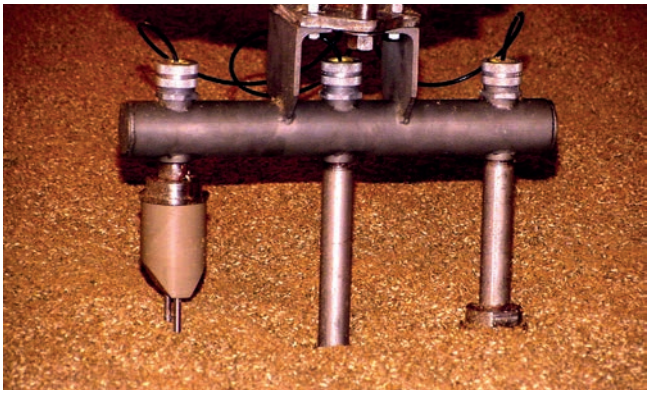
Manually controlled dryers are hard to monitor. They can achieve inaccurate results, which mean financial losses due to time-consuming sampling, excessively moist or dry product or cost-intensive follow-up treatment. For the first time, the innovative TRIME® TDR method enables accurate, continuous measurements directly in the drying process at temperatures of up to 120°C (248°F) and regardless of the type and composition of the product to be dried, such as corn, cereals, oil seeds, animal food and other granules.



TRIME GR probe with electromagnetic field

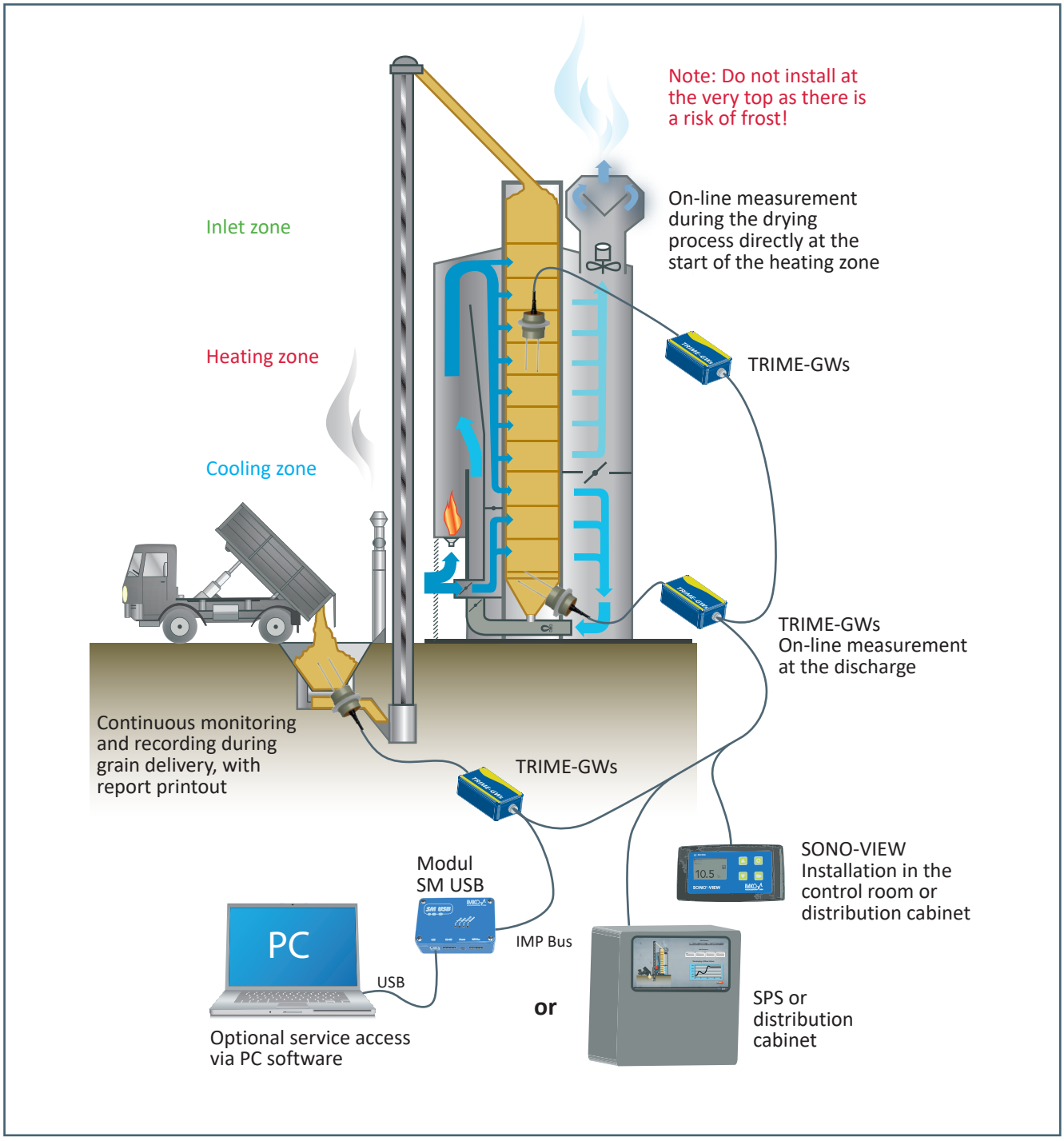
TRIME® GWs – monitors water content and optimizes your process control

With TRIME® GWs, you can monitor the product moisture directly, even during the drying process, without taking samples. There is therefore no longer any need for indirect measuring methods, such as via the exhaust air humidity or the temperature. TRIME® GWs directly measures the water content of the product to be dried regardless of the type, temperature or mineral content of the medium. This means you can continuously monitor the water content of the product to be dried, and optimize your process control.



Use of TRIME® probes in malt

Installation example for a continuous dryer



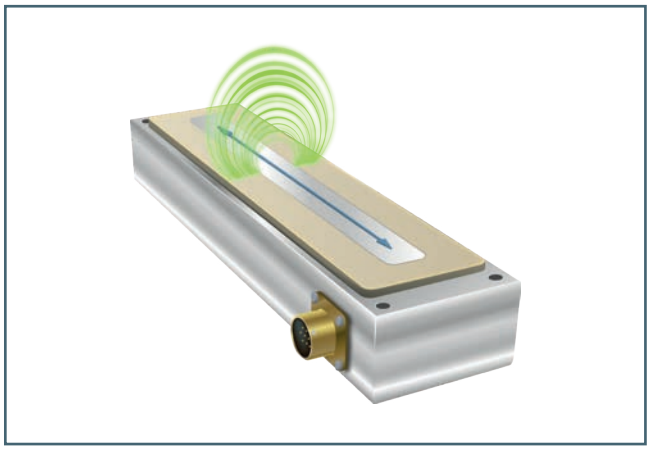
Application example in sawdust and wood chips/wood pellets (SONO-GS1)

Using SONO-GS1 enables:

- Direct moisture measurement in the material, even at hard to reach places
- Continuous recording and monitoring of moisture content and temperature
- Improved and more accurate process control during all work processes
- Increased process stability and thus lower scrap rates
- Cost savings due to increased energy efficiency (due to less overdrying)

Drying bulk solids in belt dryers

When drying bulk solids with belt dryers, an air-permeable belt is filled with the product to be dried. The height of the bulk solids on the belt and the dwell time in the dryer are defined based on the product type and properties, and the water volume to be removed. By adjusting the dwell time to the mean value, it is possible to compensate for a varying moisture content. This is necessary in the production of wood pellets, for example, because the quality is no longer guaranteed if the material is excessively dry, and operating times are put at risk if the material is too moist, provided the compactor closes.



Overdrying or underdrying costs financial resources

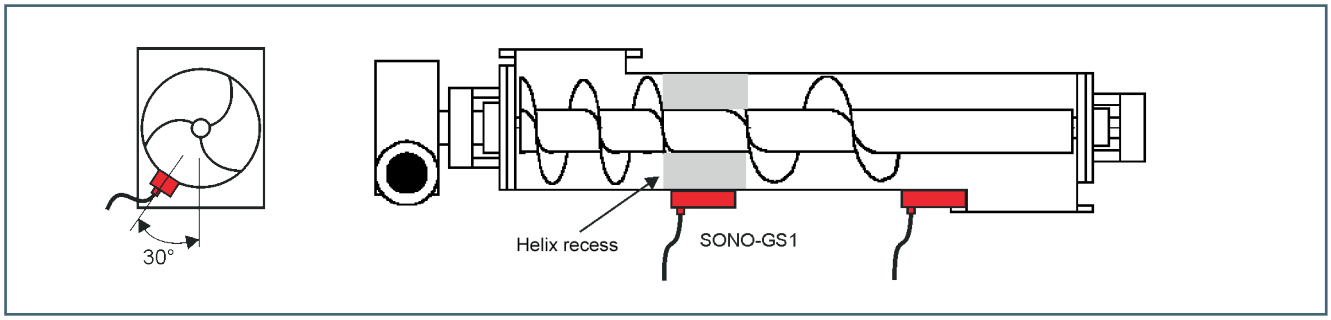
In the past, belt dryers were often controlled manually, or by means of laborious offline sampling. This is not only time-consuming, but also results in a significant lack of process precision, as it is not possible to compensate for any inhomogeneity. In addition, the sampling is implemented as a snapshot, which in practice can result in significant inaccuracies if, for example, a sample is drawn from a non-representative state (wet-pocket). Due to a lack of alternatives, a wide range of control versions have been developed over the years, either based on thermal balance or air humidity, but these methods are all indirect and depend both on the local climate and on the current weather.

SONO-GS1 – monitors the water content and optimizes your process control.

With the SONO-GS1 probe, you can measure the product moisture directly in the material flow and the measurement is ideal for determining the input moisture in the inlet to the dryer or the output moisture at the dryer discharge. Measurement in the dryer or on the belt is not recommended, as the material does not dry homogeneously during the drying process and since this inhomogeneity varies over the dwell time, this would falsify a measurement. Therefore, measurement should be taken at the discharge point, after mixing the product, e.g. at the end of the discharge screw.

Installation of the SONO-GS1 in a screw conveyor

If the SONO-GS1 probe is installed along the screw conveyor at the discharge, it is recommended that an installation angle of 30° (see diagram) in the direction of rotation of the screw be used, as this is where the optimal material flow is found. As an option, the screw can be (partially) recessed, so that a backlog forms, which can also compensate for an uneven material flow.



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