IMKO
MICROMODULTECHNIK GMBH

Precise Measurement of the Moisture and the Composition of Materials with State-Of-the-Art TRIME® Radar Technology.

The new dimension to quality control – just as efficient as it is economic!

Measuring what others can‘t!

SONO Moisture Sensors for industrial Deployment

Increased safety and reduced damage-related costs due to novel evaluation methods at the quality control.

Since its foundation in 1984, IMKO has successfully established itself as a manufacturer of trendsetting high-tech products in the sector environmental sensor technology. IMKO develops, produces and distributes innovative measuring technology and sensors for the precise acquisition of various physical parameters in the sector environmental measuring technology as well as material moisture measurement for online and offline applications within process measuring technology.

With the novel SONO sensors, IMKO is presenting a new generation of moisture sensors. They were especially designed to meet the demands of the building and food industry but can also be deployed in other industries. The sensors' decisive lead is generated by the deployment of state-of-the-art TRIME radar technology.

SONO-MIX

SONO-VARIO

SONO-SILO

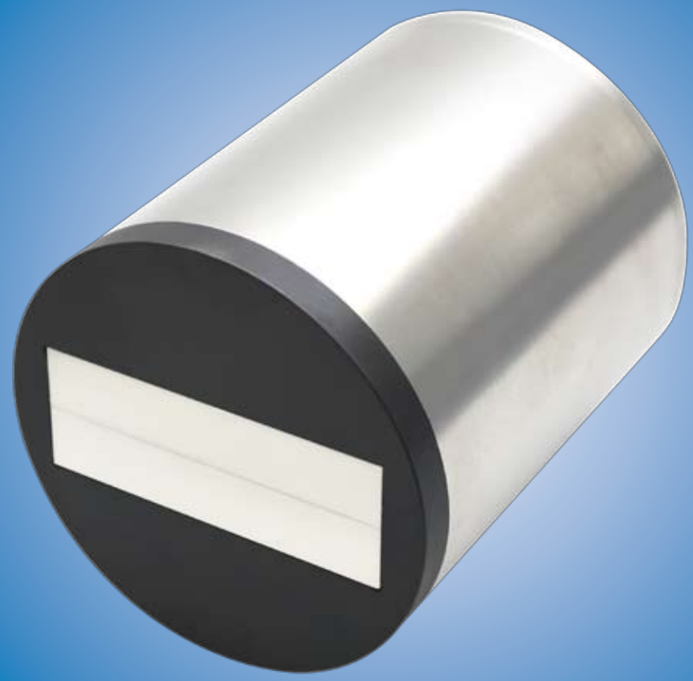
SONO-MOVE

The quality of fresh concrete is the decisive factor for the stability and durability of concrete constructions. Inferior concrete quality inflicts immense damage worldwide. Parameters, such as moisture, cement content, and slope are hereby the decisive factors. Only if they are controlled, can an ideal quality be warranted on a long term basis. The new SONO sensors make it easier than ever to warrant for high safety standards economically and without loss of time.

SONO sensors precisely measure the water content up to the point of material saturation and beyond via an electro-magnetic TDR pulse with 1-GHz-frequency. In addition, it is possible to establish valuable information regarding the mineral composition and consistence of the measured material.
It is possible to integrate SONO sensors into a wide array of various industrial plant types and to connect it to all existing control systems. One further advantage is that the novel sensor head is especially robust and wear-resistant. Should a replacement be necessary nevertheless, this can be conducted very easily.

Convincing Advantages for

- The building industry (e.g. for the precise determination of the quality of concrete directly in the mixer)
- The handling of bulk goods (e.g. for the consistent inline-measuring of the moisture content of wood chips, pellets, animal food etc.)
- The glass and ceramics industry (e.g. silica sand, moulding sand, ceramics mass etc)
- The chemical and pharmaceutical industry (e.g. powders, granulates etc.)



Exact Moisture Values and Material Composition with RbC

In addition to the precise measurement of moisture, it is also possible to determine the radar-based conductivity (RbC – Radar based Conductance) with SONO sensors. RbC gives information to important parameters of the respective material composition, e.g. in respect to the cement content or the slope of fresh concrete. This represents a significant improvement of the quality control already directly in the process – even if the water and the sand are charged with conductive minerals.

Auto-Calibration after Abrasion

Due to the innovative sensor design, no recalibration is necessary in case of abrasion. This consequently positively affects the long-term reliability and reduces maintenance.

Integrated Evaluation and Highest Measuring Accuracy

SONO-sensors are equipped with intelligent microprocessors. The signal evaluation is already conducted in the sensor itself and consequently, in most cases, there is no longer the necessity for external evaluation devices. It is possible to store up to 15 calibration curves in the sensor. Adjustable mean value accumulation and filter algorithms ensure measurement accuracies of up to +-0.1%.

Simple Configuration and Interface for Network Operation

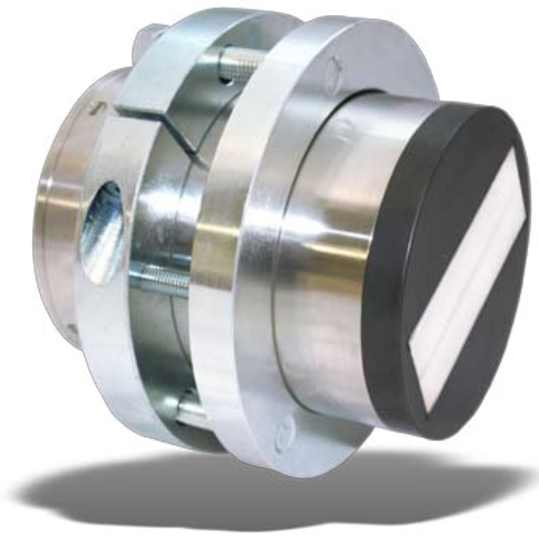
The software SONO-CONFIG enables the easy configuration of the sensor parameters such as the measurement range, smooth mean value accumulation, analogue output 0(4)..20 mA, calibration selection, and many other parameters. The RS485 interface enables network operation of SONO sensors. Upon request, SONO sensors which can be connected to industrial buses such as Profibus, Ethernet etc. via external modules are also available.

Competent Consultancy – Reliable Service

Reaching from the selection of the ideally suited sensor, over to the customisation to special applications, right up to the maintenance and service, IMKO or your IMKO partner will be there to assist you at all times. We are just as individual and flexible as our products.

SONO-MIX: The new Concrete Sensor – Measures directly in the Mixer

Highest accuracy at the measurement of moisture and material composition in fresh concrete – directly in the mixer using state-of-the-art RbC technology.



Exchangeable especially wear-resistant sensor head: hardened special steel with highly wear resistant ceramic window.

The accurate low-cost solution for:

- The Building Industry
- Bulk Material Handling

- **Higher safety at the production of fresh concrete** due to the precise measurement of the moisture as well as the radar-based conductance (RbC – Radar based Conductance) up to 50dS/m. RbC enables conclusions regarding further parameters of the material recipe such as the cement content and the slope of fresh concrete with the effect of a more reliable quality control and higher cost-effectiveness because recipe errors are prevented.
- **The novel and very robust sensor head** (15 mm thick) consists of wear-resistant hardened steel with a rectangular ceramic window. It is fastened with 4 screws and can easily be exchanged. In case of abrasion, a recalibration is not necessary.
- **The intelligent pre-processing of the measurement values** with smooth mean value accumulation, adjustable filters, and the storage of up to 15 calibration curves for the calibration which is already conducted in the sensor itself. Usually, external evaluation devices are not required.
- **Two variably adjustable analogue outputs** 0(4)...20mA enable the easy connection to any control system.
- **A RS485 interface** enables the network operation of the sensor. It already contains a data bus protocol for the connection of several SONO sensors. The connection of the sensor to industrial buses such as Profibus, Ethernet, etc. is possible via optional external modules (available upon request).

SONO-MIX moisture probe installed into a mixing pan bottom.

TECHNICAL DATA SONO-MIX

SENSOR DESIGN	MOUNTING
Casing: High Grade Steel V2A 1.4301 Exchangeable especially wear-resistant sensor head: hardened special steel with highly wear resistant ceramic window. ***Available upon request:*** Version for applications with most extreme abrasion.	Sensor Dimensions: 108 x 132mm (Diameter x Length) The mounting and fastening frame can be mounted to the rear side of the mixer base or the outer wall of the mixer. For this purpose, it is adjusted with the help of the additional welded on mounting frame. This enables the easy mounting and dismounting as well as the adjustment of the sensor position in case of wear at the mixer base.
MEASUREMENT RANGE MOISTURE	**MEASUREMENT RANGE CONDUCTIVITY**
The sensor measures from 0% up to the point of material saturation.	The sensor, as a material-specific characteristic value, delivers the radar-based conductance (RbC – Radar-based-Conductance) in a range of 0…50dS/m.
MEASUREMENT RANGE TEMPERATURE	**MEASUREMENT DATA-PREPROCESSING**
Measurement Range: 0°C ...70°C The temperature is measured at the sensor casing beneath the wear-resistant sensor head and can optionally be issued at the analogue output 2. The material temperature can be measured with an external calibration and compensation of the sensor intrinsic-heating.	*MEASUREMENT MODE S:* For fast measurement operations with up to 100 internal measurements per second and a cycle time of 200 milliseconds. *MEASUREMENT MODE F:* (Standard Setting) For measurement operations with the option of the smooth mean value accumulation including filtering with accuracies of up to 0.1%.
POWER SUPPLY	**AMBIENT CONDITIONS**
+7V to +30V DC, 1,5 W max.	0 - 70°C; A higher temperature range is available upon request!
SIGNAL OUTPUT	**CALIBRATION**
2 x Analogue Outputs 4(0)...20mA Output 1: Moisture in % (variably adjustable) Output 2: Conductivity (RbC) or optionally the temperature. In addition, there is the option to split the analogue output 2 into two ranges, into 4..11mA for the temperature and 12..20mA for the conductivity. The analogue output 2 hereby changes over in 5 second cycles between these two (current) measurement windows. The two analogue outputs can be variably aligned with the SONO-CONFIG software. For a 0-10V DC voltage output, a 500R resistor can be installed.	The sensor is provided with a universal calibration. A maximum of 15 different calibrations can be stored. For special materials, variable calibrations with polynomials up to the 5th order are possible and can be downloaded into the sensor with the SONO-CONFIG software (Download per Internet). A zero point correction can be performed easily with the SONO-CONFIG software.
COMMUNICATION	**CONNECTOR PLUG**
A RS485 interface enables network operation of the sensor, whereby a data bus protocol for the connection of several SONO sensors to the RS485 is implemented by default. The connection of the sensor to industrial buses such as Profibus, Ethernet, etc. is possible via optional external modules (available upon request).	The sensor is equipped with a robust 10-pole MIL flange connector. Ready made connection cables with MIL connectors are available in the lengths 4m, 10m, or 25 m.
MEASUREMENT FIELD EXPANSION	
Approximately 50 - 80 mm, depending on material and moisture.	

SONO-VARIO: The Universal Moisture Sensor featuring RbC

Precise moisture and temperature measuring for bulk materials – also suited for applications which conventional capacitive sensors can not handle. Ideal for the integration into containers, hoppers and silos.

The accurate low-cost solution for:

- The Building Industry
- Bulk Material Handling
- Food Industry
- Glass/Ceramics Industry
- Animal Food Industry
- Chemical/Pharmaceutics Industry

The electro-magnetic TRIME®-TDR pulse penetrates optimal into the material.

- **Higher reliability at the moisture measurement** in sand and other complex materials. The TRIME-technology guarantees precise measurements even under difficult conditions (e.g., if water and sand are charged with minerals with up to 12dS/m pore water conductivity). The additionally measured radar-based conductance (RbC – Radar based Conductance) enables conclusions regarding further parameters of the material recipe. For you, this has the following effect: improved quality control, more safety and less recipe errors.
- **In case of abrasion, a recalibration is not necessary.**
- **The intelligent pre-processing of the measurement values** featuring smooth mean value accumulation, adjustable filters, and up to 15 calibration curves for the calibration which is already conducted in the sensor itself. Usually, external evaluation devices are not required.
- **Two variably adjustable analogue outputs** 0(4)...20mA allow for the easy connection to any currently existing control system.
- **A RS485 interface** enables network operation of the sensor. It already contains a data bus protocol for the connection of several SONO sensors. The connection of the sensor to industrial buses such as Profibus, Ethernet, etc. is possible via optional external modules (available upon request).

TECHNICAL DATA SONO-VARIO

SENSOR DESIGN	MOUNTING
Casing: High Grade Steel V2A 1.4301 Abrasion Surface: Highly abrasion-resistant aluminium oxide ceramic. Other abrasion surfaces are available upon request! A high-temperature version is available upon request!	Sensor Dimensions: 108 x 44mm (Diameter x Length) The mounting frame can be screwed on to the rear side of any container, hopper, or silo.
MEASUREMENT RANGE MOISTURE	**MEASUREMENT RANGE CONDUCTIVITY**
The sensor measures from 0% up to the point of material saturation. In conductive materials, the moisture range is 0..15% moisture at up to 12dS/m pore water conductivity.	The sensor, as a material-specific characteristic value, delivers the radar-based conductance (RbC – Radar-based-Conductance) in a range of 0…12dS/m.
MEASUREMENT RANGE TEMPERATURE	**MEASUREMENT DATA-PREPROCESSING**
Measurement Range: 0°C ...70°C The temperature is measured at the ceramic disc inside the sensor casing and is issued at the analogue output 2. The material temperature can be measured with an external calibration and compensation of the sensor intrinsic-heating.	*MEASUREMENT MODE S:* For fast measurement operations with up to 100 internal measurements per second and a cycle time of 200 milliseconds. *MEASUREMENT MODE F:* For measurement operations with the option of the smooth mean value accumulation including filtering with accuracies of up to 0.1%.
POWER SUPPLY	**AMBIENT CONDITIONS**
+7V to +30V DC, 1,5 W max.	0 - 70°C; A higher temperature range is available upon request!
SIGNAL OUTPUT	**CALIBRATION**
2 x Analogue Outputs 4(0)...20mA Output 1: Moisture in % (variably adjustable) Output 2: Conductivity (RbC) or optionally the temperature. In addition, there is the option to split the analogue output 2 into two ranges: into 4..11mA for the temperature and 12..20mA for the conductivity. The analogue output 2 hereby changes over into an adjustable one-second cycle between these two (current) measurement windows. The two analogue outputs can be variably aligned with the SONO-CONFIG software. For a 0-10V DC voltage output, a 500R resistor can be installed.	The sensor is provided with a universal calibration. A maximum of 15 different calibrations can be stored. For special materials, variable calibrations with polynomials up to the 5th order are possible and can be downloaded into the sensor with the SONO-CONFIG software (Download per Internet). A zero point correction can be performed easily with the SONO-CONFIG software.
COMMUNICATION	**CONNECTOR PLUG**
A RS485 interface enables network operation of the sensor, whereby a data bus protocol for the connection of several SONO sensors to the RS485 is implemented by default. The connection of the sensor to industrial buses such as Profibus, Ethernet, etc. is possible via optional external modules (available upon request).	The sensor is equipped with a robust 10-pole MIL flange connector. Ready made connection cables with MIL connectors are available in the lengths 4m, 10m, or 25 m.
MEASUREMENT FIELD EXPANSION	
Approximately 50 - 80 mm, depending on material and moisture.	

SONO-SILO: The reliable Silo Sensor with RbC

The exact measurement of moisture even in bulk materials with higher mineral content which dispose of a pore water conductivity of up to 12dS/m - the quality guarantee where conventional capacitive sensors either fail or deliver unreliable values.

The accurate low-cost solution for:

- The Building Industry
- Bulk Material Handling
- Food Industry
- Glass/Ceramics Industry
- Animal Food Industry
- Chemical/Pharmaceutics Industry

- **The TRIME technology ensures safe measurements even under difficult conditions,** e.g. if the bulk material contains conductive elements with up to 12dS/m pore water conductivity. The radar-based evaluation of the conductance (RbC – Radar based Conductance) enables to establish the mineral content in the measured material and consequently ensures an improved quality control.
- **The sensor head and the electronics dispose of a modular construction.** In case of abrasion of the sensor head, the same can be exchanged easily. The existing SONO electronics remain unaffected hereof. In case of abrasion, a recalibration is not necessary.
- **The intelligent pre-processing of the measurement values** featuring smooth mean value accumulation, adjustable filters, and up to 15 calibration curves for the calibration which is already conducted in the sensor itself. Usually, external evaluation devices are not required.
- **Two variably adjustable analogue outputs** 0(4)...20mA allow for the easy connection to any currently existing control system.
- **A RS485 interface** enables network operation of the sensor. It already contains a data bus protocol for the connection of several SONO sensors. The connection of the sensor to industrial buses such as Profibus, Ethernet, etc. is possible via optional external modules (available upon request).

TECHNICAL DATA SONO-SILO

SENSOR DESIGN	MOUNTING
Casing: High Grade Steel V2A 1.4301 Abrasion Surface: Highly abrasion-resistant aluminium oxide ceramic.	Sensor Dimensions: 55 x 350mm (Diameter x Length) The sensor can be installed into silos with a tube extension with 55 mm diameter. A pivot-retainer for the installation into a silo is available.
MEASUREMENT RANGE MOISTURE	**MEASUREMENT RANGE CONDUCTIVITY**
The sensor measures from 0% up to the point of material saturation, even in very conductive materials with up to 12dS/m pore water conductivity.	The sensor, as a material-specific characteristic value, delivers the radar-based conductance (RbC – Radar-based-Conductance) in a range of 0…12dS/m.
MEASUREMENT FIELD EXPANSION	**MEASUREMENT DATA-PREPROCESSING**
Approximately 50 - 80 mm, depending on material and moisture.	*MEASUREMENT MODE S:* For fast measurement operations with up to 100 internal measurements per second and a cycle time of 200 milliseconds. *MEASUREMENT MODE F:* (Standard Setting) For measurement operations with the option of the smooth mean value accumulation including filtering with accuracies of up to 0.1%.
POWER SUPPLY	**AMBIENT CONDITIONS**
+7V to +30V DC, 1,5 W max.	0 - 70°C; A higher temperature range is available upon request!
SIGNAL OUTPUT	**CALIBRATION**
2 x Analogue Outputs 4(0)...20mA Output 1: Moisture in % (variably adjustable) Output 2: Conductivity (RbC) The two analogue outputs can be variably aligned with the SONO-CONFIG software. For a 0-10V DC voltage output, a 500R resistor can be installed.	The sensor is provided with a universal calibration. A maximum of 15 different calibrations can be stored. For special materials, variable calibrations with polynomials up to the 5th order are possible and can be downloaded into the sensor with the SONO-CONFIG software (Download per Internet). A zero point correction can be performed easily with the SONO-CONFIG software.
COMMUNICATION	**CONNECTOR PLUG**
A RS485 interface enables network operation of the sensor, whereby a data bus protocol for the connection of several SONO sensors to the RS485 is implemented by default. The connection of the sensor to industrial buses such as Profibus, Ethernet, etc. is possible via optional external modules (available upon request).	The sensor is equipped with a robust 10-pole MIL flange connector. Ready made connection cables with MIL connectors are available in the lengths 4m, 10m, or 25 m.

SONO-MOVE: The new Sensor for direct measurements in moved materials

Precise moisture measurements – directly on conveyors and in silos, containers and hoppers.

The accurate low-cost solution for:

- The Building Industry
- Bulk Material Handling
- Food Industry
- Glass/Ceramics Industry
- Animal Food Industry
- Chemical/Pharmaceutics Industry

- **The novel probe head consists of Wolfram-Carbide and a very wear-resistant ceramic in order to warrant for a long life-span of the probe. Thanks to the Wedge-shaped structure and at only 12mm thickness of the probe** the flow of the material on the conveyor belt is only slightly affected.
- **In case of abrasion, a recalibration is not necessary.**
- **The TRIME technology ensures safe measurements even under difficult conditions,** e.g. if the bulk material contains conductive elements with up to 12dS/m pore water conductivity. The radar-based evaluation of the conductance (RbC – Radar based Conductance) enables to establish the mineral content in the measured material and consequently ensures an improved quality control.
- **The intelligent pre-processing of the measurement values** featuring smooth mean value accumulation, adjustable filters, and up to 15 calibration curves for the calibration which is already conducted in the sensor itself. Usually, external evaluation devices are not required.
- **A RS485 interface** enables network operation of the sensor. It already contains a data bus protocol for the connection of several SONO sensors. The connection of the sensor to industrial buses such as Profibus, Ethernet, etc. is possible via optional external modules (available upon request).

TECHNICAL DATA SONO-MOVE

SENSOR DESIGN	MOUNTING
Casing Electronic Head: High Grade Steel V2A 1.4301 Casing Probe: Wolfram Carbide Abrasion Surface: Highly abrasion-resistant aluminium oxide ceramic.	Probe head dimensions: 140 x 110 x 12mm (length x height x width). Holder with electronics: 60 x 300mm (diameter x height). The probe can be fixed with a bracket on a conveyor belt.
MEASUREMENT RANGE MOISTURE	**MEASUREMENT RANGE CONDUCTIVITY**
The sensor measures from 0% up to the point of material saturation. In conductive materials, the moisture range is 0..15% moisture at up to 12dS/m pore water conductivity.	The sensor, as a material-specific characteristic value, delivers the radar-based conductance (RbC – Radar-based-Conductance) in a range of 0…12dS/m.
MEASUREMENT FIELD EXPANSION	**MEASUREMENT DATA-PREPROCESSING**
Approximately 50 - 80 mm, depending on material and moisture.	*MEASUREMENT MODE S:* For fast measurement operations with up to 100 internal measurements per second and a cycle time of 200 milliseconds. *MEASUREMENT MODE F:* (Standard Setting) For measurement operations with the option of the smooth mean value accumulation including filtering with accuracies of up to 0.1%.
POWER SUPPLY	**AMBIENT CONDITIONS**
+7V to +30V DC, 1,5 W max.	0 - 70°C; A higher temperature range is available upon request!
SIGNAL OUTPUT	**CALIBRATION**
2 x Analogue Outputs 4(0)…20mA Output 1: Moisture in % (0..20%, variably adjustable) Output 2: Conductivity (RbC) 0..20dS/m The two analogue outputs can be variably aligned with the SONO-CONFIG software. For a 0-10V DC voltage output, a 500R resistor can be installed.	The sensor is provided with a universal calibration. A maximum of 15 different calibrations can be stored. For special materials, variable calibrations with polynomials up to the 5th order are possible and can be downloaded into the sensor with the SONO-CONFIG software (Download per Internet). A zero point correction can be performed easily with the SONO-CONFIG software.
COMMUNICATION	**CONNECTOR PLUG**
A RS485 interface enables network operation of the sensor, whereby a data bus protocol for the connection of several SONO sensors to the RS485 is implemented by default. The connection of the sensor to industrial buses such as Profibus, Ethernet, etc. is possible via optional external modules (available upon request).	The sensor is equipped with a robust 10-pole MIL flange connector. Ready made connection cables with MIL connectors are available in the lengths 4m, 10m, or 25 m.

The new SONO-Sensors – Your Advantages at one Glance

Improved Quality Controls – More Safety– Improved Cost-Effectiveness

The novel and innovative TRIME® measuring method at the SONO sensors, in addition to the moisture value, also delivers a radar-based conductance value (RbC – Radar based Conductance). This enables important conclusions regarding further parameters of a material recipe such as the cement content and the slump of fresh concrete with the effect that cost-intensive quality faults are avoided.

TRIME®-TDR – Recipient of many Awards

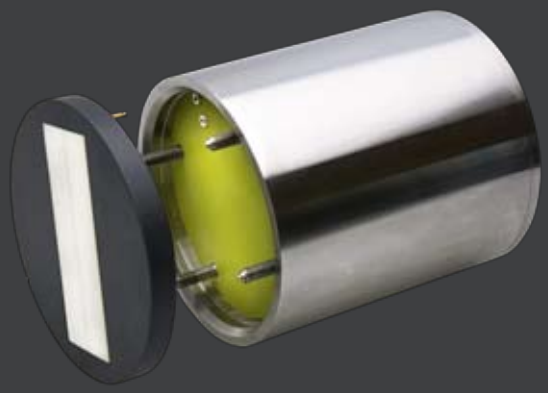
Innovation prizes such as the Eberle-Prize of the Federal State of Baden-Württemberg (1993) and the Silver Medal of the German Agricultural Society (DLG – 1999) give evidence on how successfully the high-tech potential of the TRIME®-TDR-technology has distinguished itself in practice. Numerous industrial and scientific projects confirm the advantages of the TRIME®-technology which by now has excellently performed under difficult conditions for 10 years at temperatures of up to 150°C and in application scenarios where other measuring systems failed to perform. You can find further information regarding the benefits of the TRIME®-TDR, in comparison to moisture measurements conducted on the basis of conventional capacitive methods or microwave technology, on our homepage www.imko.de under the topic „About TRIME-TDR“.

Silver Medal Innovation Award
1999 of the DLG
(German Agricultural Society)

Innovation Award of the State
of Baden-Württemberg

DLG ANERKANNT

certified by the DLG
(German Agricultural Society)

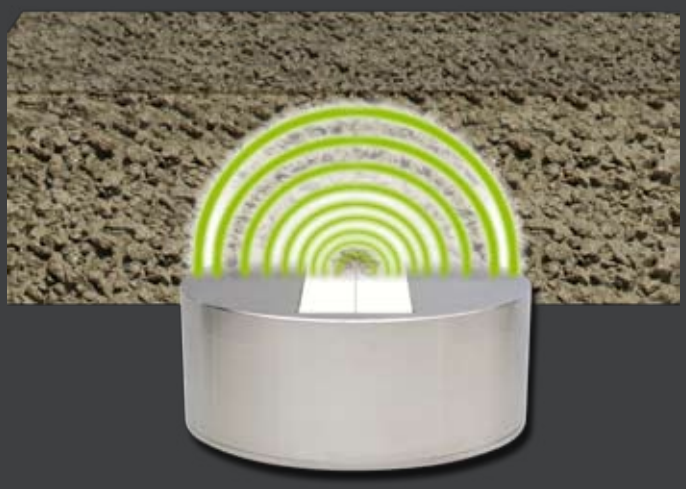


Highest Reliability due to Auto-Calibration

Conventional sensors deliver falsified measurement values, if the ceramic plate is exposed to wear and a cyclic recalibration is not conducted. SONO sensors are able to maintain their high accuracy over a long period of time. This is ensured by state-of-the-art sensors, the innovative construction of which does not require recalibration in case of abrasion.

Intelligent Sensors for Maximum Flexibility

A high-capacity microprocessor already performs the signal evaluation in the sensor itself. For most applications, external evaluation devices are consequently no longer necessary. In case of fast material flow, SONO sensors internally measure at a rate of 100 measurements per second and at an output cycle of 200ms. At the deployment in mixers, a sophisticated filter algorithm, as well as a smooth mean value accumulation, ensure precise measurement values with an accuracy of up to 0,1%. SONO sensors are able to detect faulty measurement values caused by rotating mixer blades and directly filter out the same. Every sensor is able to store up to 15 calibration curves with polynomials up to the 5th order. If required, the sensors can be easily and comfortably aligned to handle a wide array of tasks with the SONO-CONFIG software.



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