

Innovative Microwave Resonance Technology

Moisture and Bulk Density Measurement for the Food and Feed Industry



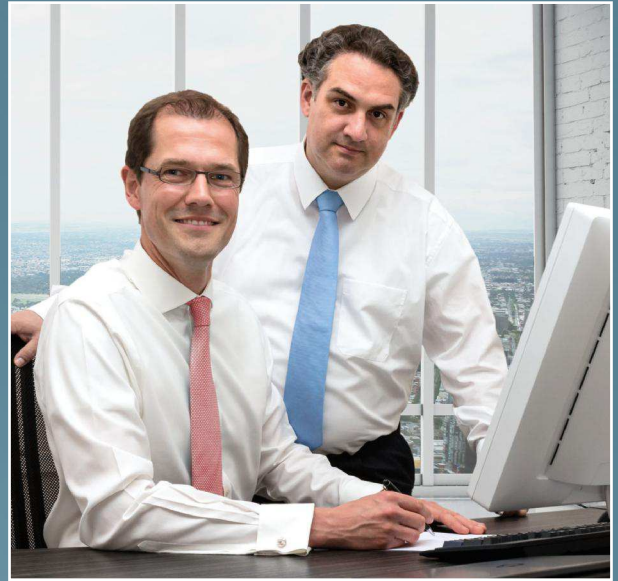
Production Optimisation and Cost Savings

- Improve yield and reduce waste
- Save energy through precise dryer control
- Enhance your productivity
- Increase your product quality
- Amortisation within less than one year



TEWS Elektronik Research, Development and Production





Dear Customer,

TEWS Elektronik GmbH & Co. KG was founded in 1970 in Hamburg, Germany as an owner-managed company. Since the late eighties it has focused its principal activities on developing, producing and selling its patented state-of-the-art microwave moisture and density measuring systems. The company is now headed by the second generation of the family, Mr. Andre Tews, accompanied by Dr. Tim Richter as CFO.

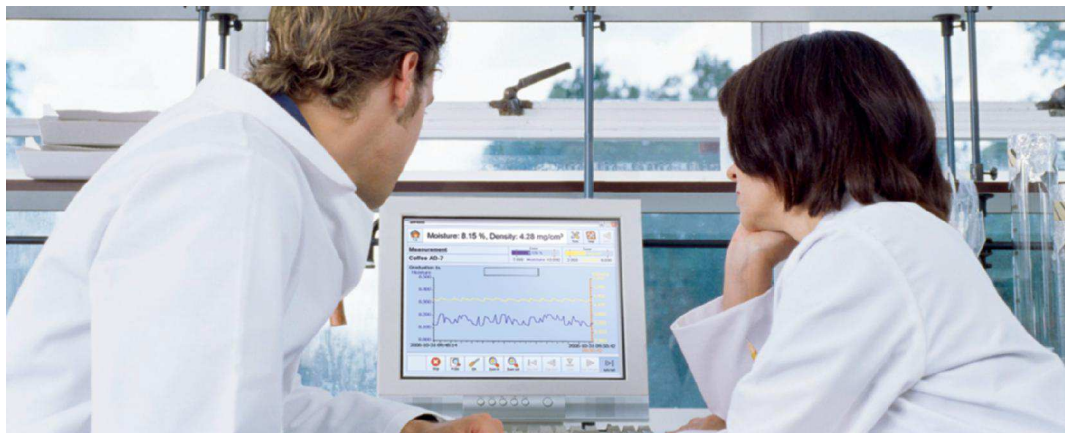
With around 50 employees in research, development and production, TEWS Elektronik provides customised online process systems and laboratory units for a large variety of applications in every corner of the world.

More than 6000 measuring systems are already in operation worldwide, and a truly global service team is available around the clock for application support and customer services.

Forward-looking TEWS Elektronik is prepared to respond to the most exacting requirements from its global customer-base.



Measuring Systems for Laboratory, At-line and Inline Applications

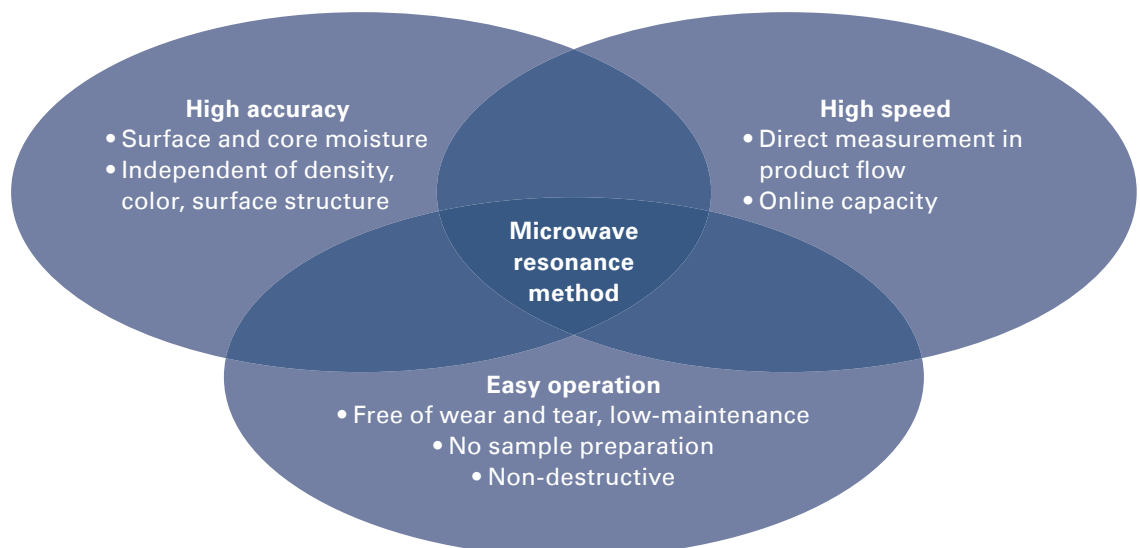


TEWS develops and manufactures microwave measuring systems specifically designed for the food and feed industry. It keeps close professional ties with leading small and large companies from the industry, including end customers and machinery makers. The products to be measured can take on a variety of shapes and sizes (e.g. powder, wafers, granules, pellets, etc.) that can all be covered with different types of sensors for installation in pipes and chutes, both at-line as well as in laboratories. As a matter of course, food safety requirements are also fully complied with.

Process Optimization – Higher Productivity and Profitability

Due to continuous monitoring during the production process, the moisture can be adjusted accordingly very quickly and always kept at an optimum level in order to assure highest product quality and avoid fungal infection. Thus, there is no need to wait for test results from a remote laboratory. Shorter drying times enable a higher throughput and avoid overdrying of the product and hence wasting energy. Furthermore, a higher degree of automation leads to lower personnel costs. Another important aspect is the fact that optimum product moisture leads to increased shelf life of the product.

Characteristics of Microwave Resonance Method



Applications



FOOD APPLICATIONS

TEWS Elektronik has vast experience in developing and manufacturing microwave measuring systems that are successfully used by various customers around the world for many different applications. Among others these include:

- Caramel paste
- Cereals
- Cocoa beans and nibs
- Dried herbs, fruits and spices
- Gelatine
- Green coffee beans, roasted and ground coffee
- Hop umbels
- Marzipan, almond paste
- Milk cream
- Nuts
- Oil seeds like soya, rapeseed, sunflower
- Pasta
- Potato chips and crisps
- Soft candy
- Soup powder
- Sugar
- Wafer, cracker and crisp bread



FEED AND SEED APPLICATIONS

TEWS sensors can be used at locations where competitive measuring technology like capacitive and optical methods may fail. We produce robust measuring systems that deliver accurate and stable measurements even under harsh environmental conditions in many different feed and seed applications, e.g.:

- Aqua feed
- Compound feed
- Feed pellets
- Grain
- Oil seeds, press cake, flakes and meal
- Pet food
- Pet treats & snacks
- Seeds

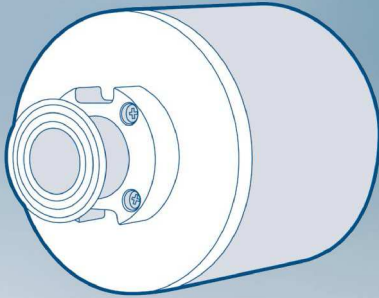




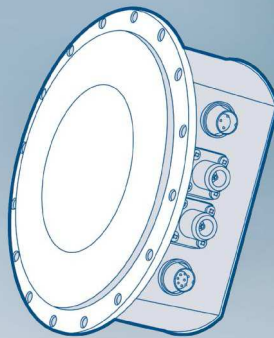
Moisture and Density Sensors



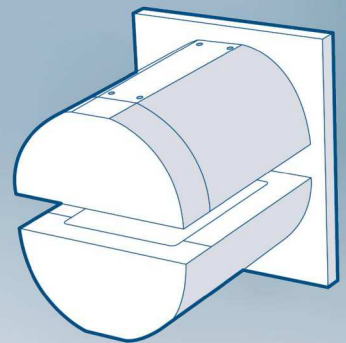
The food and feed industry faces many challenges in order to ensure consistent product quality and maximum production efficiency. TEWS's wide product range therefore includes a broad variety of sensors that can cope with many different applications in various industries. At the required point of measurement the product may be transferred from one conveyor belt to the next or flow inside a chute or into a silo. Ambient process conditions such as temperature and bulk density are likely to change as well. Specifically engineered and customized sensor solutions are available in order to cope with these often harsh conditions.



Tubular sensors



Planar sensors



Fork sensors

Tubular sensors Bypass and laboratory use for

- Powder
- Granules
- Pellets

Planar sensors Inline use for

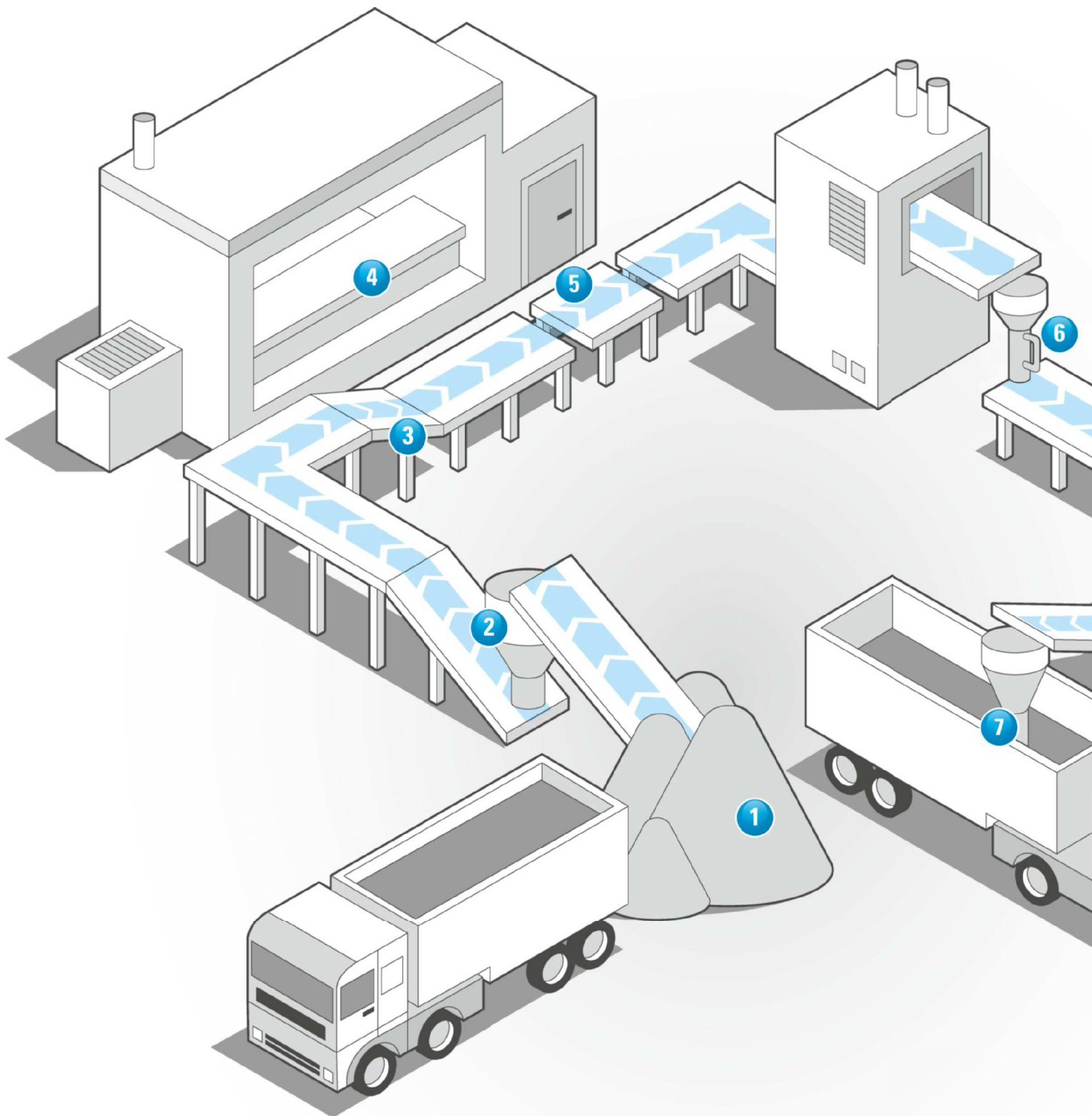
- Powder
- Granules
- Pellets

Fork sensors Inline and at-line use for

- Foils / Sheets
- Wafer
- Crisp bread

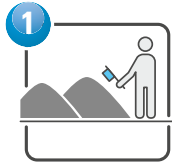


- Diverse sizes for use at specific locations in the production process
- Special sensors available for ATEX requirement and high temperature applications
- Moisture measurements down to 0.05% for very homogenous products
- Robust and durable design for industrial usage
- IP65 protection and partly CIP approved



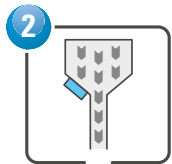
Typical Measuring Points

Moisture Measuring in Process Systems



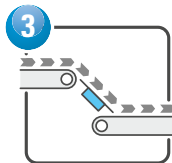
Hand-held for portable measurement

For quick moisture measurement during goods receipt inspection, or in storage.
MW 1100.



Sensor installation in the silo hopper

Online measurement:
Directly in the exhaust hopper.
MW 4200, MW 4260 or MW 4270 with planar sensor.



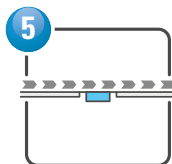
Sensor installation at ejection location

Sensor installation at the drop-off point at the end of a conveyor.
MW 4200, MW 4260 or MW 4270 with planar sensor.



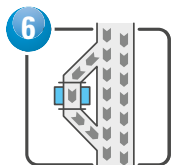
Laboratory sensors for measurement of samples

For quality control and for ensuring quality, for product development or goods receipt inspection.
MW 1150 for routine measurements, MW 4300 / MW 4310 for sophisticated laboratory applications.



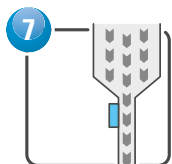
Vibrating conveyor system

Installation of the planar sensor directly in a vibrating conveyor.
MW 4260 or MW 4270 with planar sensor and special cable set.



Sensor installation in a bypass of main product flow

Installation of a tubular sensor in a tube for free-flowing and non-adhesive products for semi-automated inline measurement.
MW 4260 or MW 4270 with bypass sensor.



Sensor installation in the wall on the buffer silo

Online measurement:
Directly at the outlet of the buffer silo.
MW 4200, MW 4260 or MW 4270 with planar sensor.

Quality Assurance in the Laboratory

MW 4300 / MW 4310

Accurate, fast and easy to operate



The laboratory testers MW 4300 and MW 4310 stand for the high-quality laboratory measurement of moisture and/or bulk density. The MW 4300 features an integrated 10.4" touch TFT LCD that enables a vast range of configuration, calibration and data analysis options. It is mainly used as a replacement for time-consuming methods such as drying oven or KF. The MW 4310 requires a commercially available monitor and PC keyboard.

Key features

- Measuring results obtained within seconds to avoid process delays
- No preparation of samples (e.g.grinding or weighing) required
- Up to 200 product calibrations can be set up inside
- Measurements can be stored on external PC via network or USB
- Sensors for sample volumes of 1 ml – 2000 ml available
- MW 4310 as cost-efficient alternative requires external monitor, keyboard and mouse
- Up to 2 laboratory sensors can be connected

MW 1150

Ideal for Routine Measurement



The MW 1150 is designed as a compact laboratory instrument that can also easily be used at-line. The display is directly attached to the sensor for optimised space conditions. The MW 1150 is set up and calibrated via a PC connection. It enables frequent microwave moisture measurements at a reasonable cost.

Key features

- Configuration, calibration and data analysis related to applications
- Data transfer via industry standard 4-20mA interface
- Results are displayed on 5.7" LCD monitor in less than 1 second
- 250 readings can be stored internally for 25 different products
- Printer and USB port for PC connection available
- Equipment for sample volumes of 1 ml – 2000 ml available
- Convenient communication via TMV Lite software



Accurate Inline Measurement in Process Lines

MW 4260 / MW 4270 Moisture and Bulk Density



TEWS understands the specific requirements that customers have and provides a variety of process systems. The top range MW 4270 features an integrated touch TFT screen for highest convenience and ease of use. The MW 4260 has a single line analogue display. All versions can be connected to a PC and controlled using the TMV software.

Key features and options

- Measuring results within a fraction of a second with up to 3,500 measurements/s
- Long-term stability and low installation cost
- Easy integration into closed-loop control systems
- IP65 protection for industrial use
- ATEX protection possible

MW 4200 Compact Version – Higher Flexibility



The MW 4200 is the perfect alternative for specific purposes:

- Applications where the distance between the sensor and the display needs to be longer (up to 8 m)
- Applications where traversing is essential to get accurate results

Moisture and Density Sensors



Planar Sensors for Inline Moisture Measurement



Planar sensors can be installed along a conveyor belt, in a chute, a vibrating conveyor or a silo for the inline moisture measurement of bulk material. The product to be measured moves over the sensor with direct contact. Extra hard stainless steel and ceramics are used to make the sensors very robust and durable so they can be used for abrasive products and can withstand product temperatures of up to 120°C.



Tubular Sensors for Moisture & Bulk Density Measurement



Bypass sensors are automatically filled and emptied with the product to be measured in order to provide a semi-automated inline analysis. They can also be used for the measurement of bulk density.

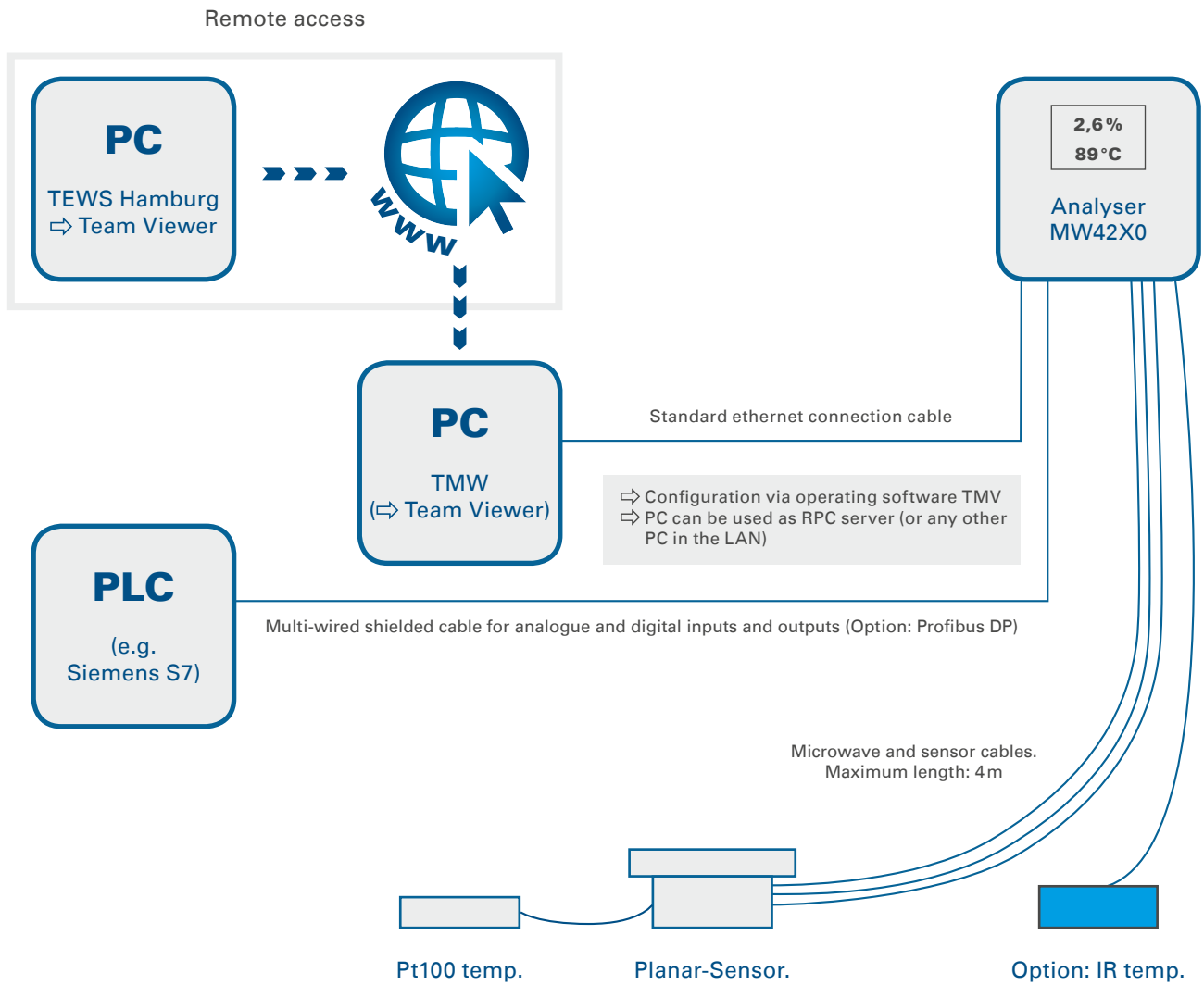


Fork Sensors for Measurement of Flat Products



This special type of sensor can be applied for the measurement of flat products including wafer or crisp bread. Fork sensors are made up of two semi-cylinders that generate the microwave field between them. The measurement is contactless and the product can flow freely through the sensor.

Standard Configuration of an MW 42x0 Process Unit



Complete set of standard interfaces

- Analogue output 4 -20mA
- Network connection (Modbus/TCP)
- Analogue & digital I/Os
- Profibus and other fieldbus on request (option)
- Remote support via TeamViewer

Selection Criteria of Planar Sensor Locations

Planar sensors are most often used for inline applications. They can be easily integrated into the process at various positions, which provides a very high degree of flexibility for the user. In order to find the optimum solution, a number of things have to be taken into account:

- The product has to be in direct contact to the sensor and is moving
- Varying coverage of the sensor or a discontinuous product flow is no problem as the measurement is independent of the bulk density resp. mass-flow
- It is essential to have access to the sensor for cleaning, servicing and sampling

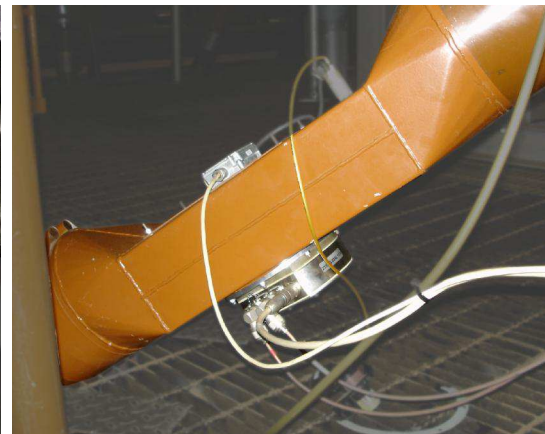
A few examples of planar sensor installation into the process



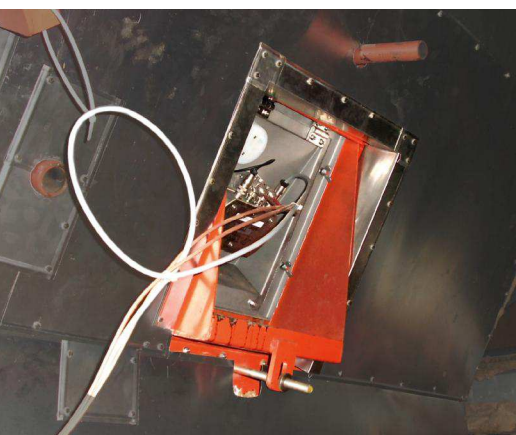
Drop-off point at the end of a conveyor belt



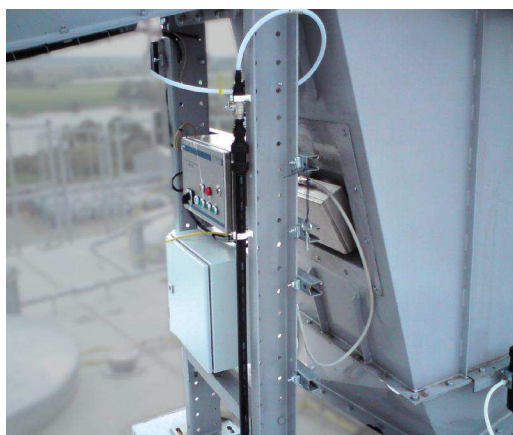
Plates to cover the sensor surface



Installation in a chute from round to square



Swing device for easy installation and maintenance



Outside installation in hopper



Sensor inside the wall of a buffer silo or a drop shaft

Microwave Transmission System



The transmission measuring system MW-T is designed for non-contact moisture measuring, specifically in large bales or boxes. The instrument is, for example, used for herbs, spices and tea.

The sensor field passes completely through the sample being analyzed so that moisture is measured right to the core. Moisture measuring using MW-T is carried out irrespective of the product density, meaning that densities or masses do not have to be determined separately.

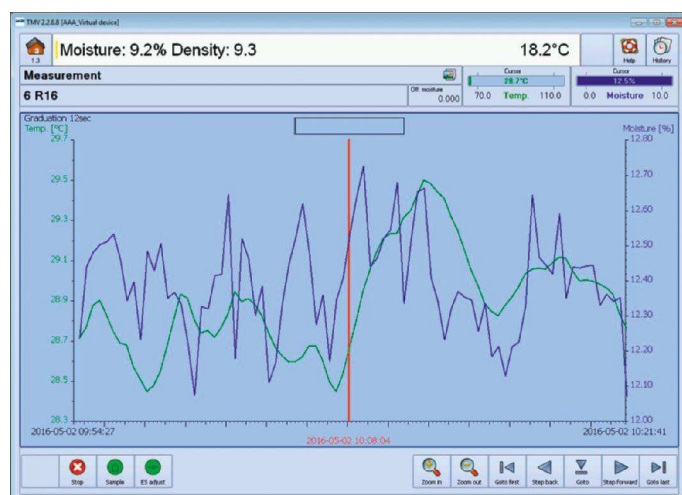
MW-T is a robust measuring unit: Results are neither influenced by the distance between sensors nor the exact adjustment of the sample.

Consulting & Services



- Support in selecting the optimum sensor location
- Commissioning of TEWS microwave moisture measuring systems
- Training of operators
- Regular maintenance visits
- Training courses at our headquarters in Germany or on site
- Remote support via TeamViewer
- Testing of samples and assisting in setting-up calibrations
- Development of customised sensors
- Service centres in Hamburg, USA, Thailand and China

Software TEWS MOISTURE VIEW®



No.	Name	Remark	MC	CC	Moisture	MC	MC	type	Off
1	K6		500	23	0.00			Phi	
2	G6		177	13	0.00			Phi	
3	G11		500	15	0.00			Phi	
4	G15		500	33	0.00			Phi	
5	G28		74	6	0.00			Phi	
6	R16		500	23	0.00			Phi	
7	R16 12%		500	25	0.00			Phi	
8	W8		500	19	0.00			Phi	
9	W16		500	26	0.00			Phi	
10	W16 12%		500	14	0.00			Phi	

The TEWS Moisture View software TMV is based on the experience of more than 20 years in the food and feed industry. It is particularly simple and straight forward to use in order to ensure easy operation. Furthermore, it comes free of charge with every measuring system and can be quickly installed on external PCs for remote data monitoring and configuration.

- Statistics and trend diagram functions for analysis and display
- User administration includes log-in function and log files
- Personal set-up and user profile memory
- Multiple language selection

Accessories

For laboratory use

- Thermo printer P 1150
- Pt100 temperature sensors
- Infrared temperature sensor
- Hoppers, brushes, dishes
- Spare beakers

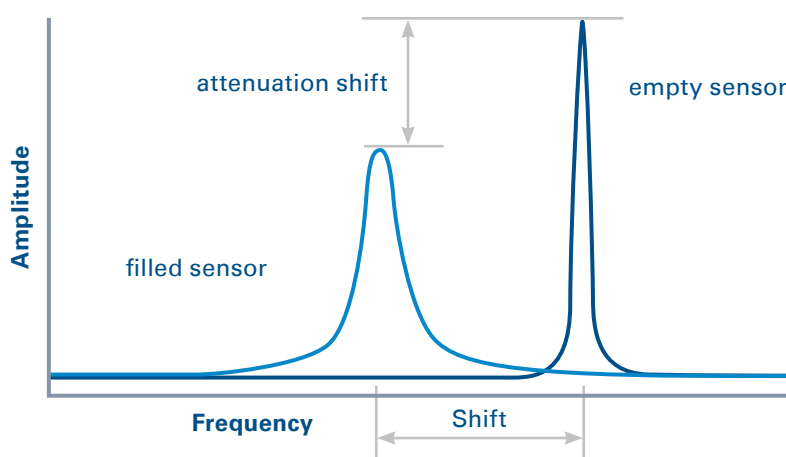
For process systems

- Infrared temperature sensors
- Analogue remote display
- Welding flanges
- Mounting plates and swing devices
- Profibus and other field bus interfaces



Advantages of TEWS's dual Parameter Microwave Measurement

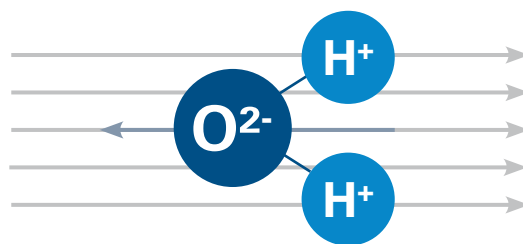
- Non-destructive measurement in original product shape
- Independent of color, surface structure and density
- Very fast and user-friendly as no sample preparation necessary
- Reference samples can be reused
- Measurement takes place right into the sample core
- Very high measuring rate for accurate laboratory and inline use
- Calibrations can easily be set-up by user and transferred to new instrument



Water molecules are one of the smallest molecules that have a positive and a negative side. The moisture sensor generates a low-energy electro-magnetic field, which interacts with these water molecules inside the product sample. Since the microwave field penetrates a number of centimeters into the sample, water is not only detected at the surface but also in the product's core.

The product sample reduces the propagation speed of the microwave field, and the water molecules in the sample perpetually align to the electromagnetic field, thus depriving it of energy. The moisture meter continuously measures these two effects which are referred to as the dual parameter method.

A moisture value is calculated on the basis of the resonance parameters. This is independent of the sample's bulk density or the thickness of the product layer on top of the sensor. For every product the moisture meter is calibrated with the aid of a laboratory method (e.g. LOD method or Karl Fischer Titration), so that the product's moisture content is displayed, stored or processed as a percentage value.



In some cases the microwave resonance method can also be used to measure bulk density, sample mass or a sample's weight per area.

Comparison of Inline Moisture Measuring Methods

MEASURING METHOD			
Property	Near Infrared (NIR)	Capacitive	TEWS-Microwave Resonance
Mode of operation	Analysis of optical spectral lines	Measurement of permittivity	Measurement of resonance shift and attenuation
What can be measured	Moisture, fat, protein, sugar etc.	Moisture	Moisture
Contact with product	Non-touching	Touching	Touching
Depth of penetration	Surface only	Core	Core
Calibration	Complex (modelling)	Simple	Simple
Moisture range	Limited, depending on product	Limited, depending on product	Limited, depending on product
INTERFERING FACTORS			
Contactless measurement	✓	⚠	⚠
Varying sensor filling level	✓	⚠	✓
Independent of salt content of product	✓	⚠	✓
Varying product density	✓	⚠	✓
Independent of small changes in composition and natural changes	⚠	⚠	✓
Varying product color	⚠	✓	✓
Varying product surface structure	⚠	✓	✓
Varying temperature	⚠	*	✓
Dust / dirty atmosphere	⚠	✓	✓
Black product (light absorbing)	⚠	✓	✓
Ambient light	⚠	✓	✓

✓ Not affected ⚠ Potentially problematic * Compensation possible

Other Industry Applications



Wood and Paper Industry

TEWS systems measure the moisture of wood chips and pellets, fibres and boards, paper sheets, webs and rolls and even the bulk density of wood pellets. The measuring results are unaffected by varying colors, densities or board and paper thicknesses.

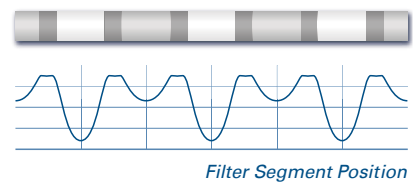
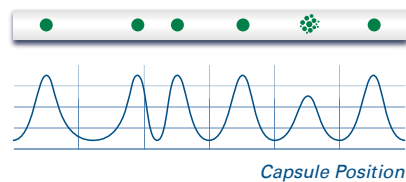
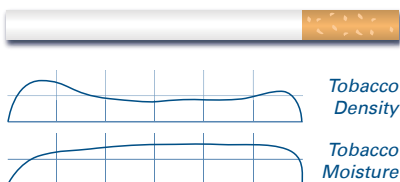
Pharmaceutical and Chemical Industry

Microwave measuring instruments measure the mass, density and moisture in production processes as well as in the laboratory. Application areas include gelatine capsules and tablets, powders and granules, fertilizer and washing powder.



Tobacco Processing Industry

TEWS Elektronik offers a wide range of instruments for quality control of the entire production process: from incoming bales to outgoing cigarettes. Sensors and analyzers are available for inline, at-line and laboratory measurement of green leaf and cut tobacco, cigarettes/cigars and filter rods.





Overview of Instruments and Sensors

FOR LABORATORY AND AT-LINE				FOR PROCESS INSTALLATION			
Model	Display	Density display	Size	Model	Display	Density display	Size
MW 1150	5.7"	No	240x70x170*	MW 4200	Numerical	No	370x250x160
MW 4300	10.4"	Yes	350x220x435*	MW 4260	5.7"	Yes	415x530x240
MW 4310	No	Yes	350x220x435*	MW 4270	10.4"	Yes	415x530x240

* plus sensors

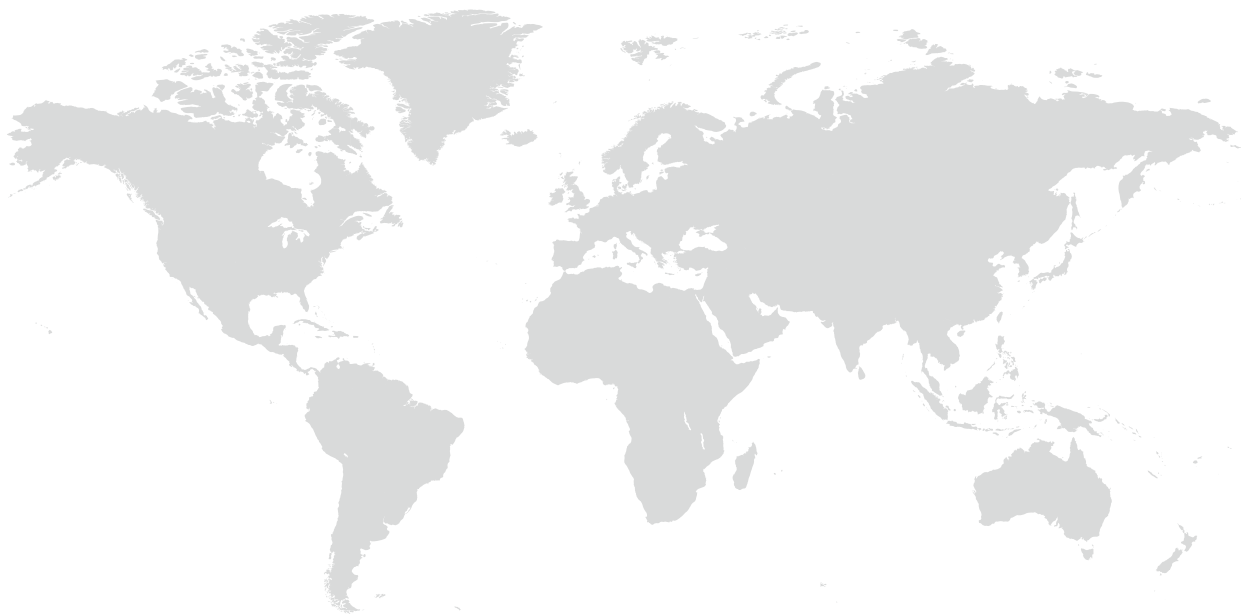
OVERVIEW OF SENSORS				
	Model	Typical product	Volume (ml)	Size* WxHxD (mm)
Laboratory sensors	SLE-10	Powder	9	255x265x280
	SLE-10B	Powder, granules	5	255x105x270
	SLE-16	Powder, granules	22	255x265x280
	SLE-20B	Powder, granules	14/18/22	255x150x280
	SLE-26	Powder, granules	80	255x305x280
	SLE-40B	Paste like, bulk material	60/160	365x205x275
	SLE-46	Beans, bulk material	350	365x390x280
	SLE-50B	Paste like, bulk material	90	365x205x275
	SLE-75B	Beans, bulk material	375	365x390x410
	SLE-96	Beans, bulk material	1600	365x390x410
	Model	Typical product	Volume (ml)	Form factor
Process sensors	SPP-080-0xx	Pet food, gelatine, oil seeds	–	Small planar
	SPP-160-xxx	All kinds of food and feed	–	Planar
	SPP-4200-xxx	All kinds of food and feed	–	Planar
	SPE-20/26	Powder	50/80	Bypass
	SPH-46	Granules, beans, bulk material	500	Bypass
	SPH-96	Beans, bulk material	2000	Bypass
	SPF-60-16	Wafer, crisp bread, flat material	–	Fork

For additional technical information regarding installation, calibration, network connections and closed-loop control please consult the respective manuals.



Innovative Microwave Resonance Technology

Food and Feed Industry



TEWS Elektronik is an international company with a large number of sales partners all over the world.
For an up-to-date list of agencies visit our website: www.tews-elektronik.com

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