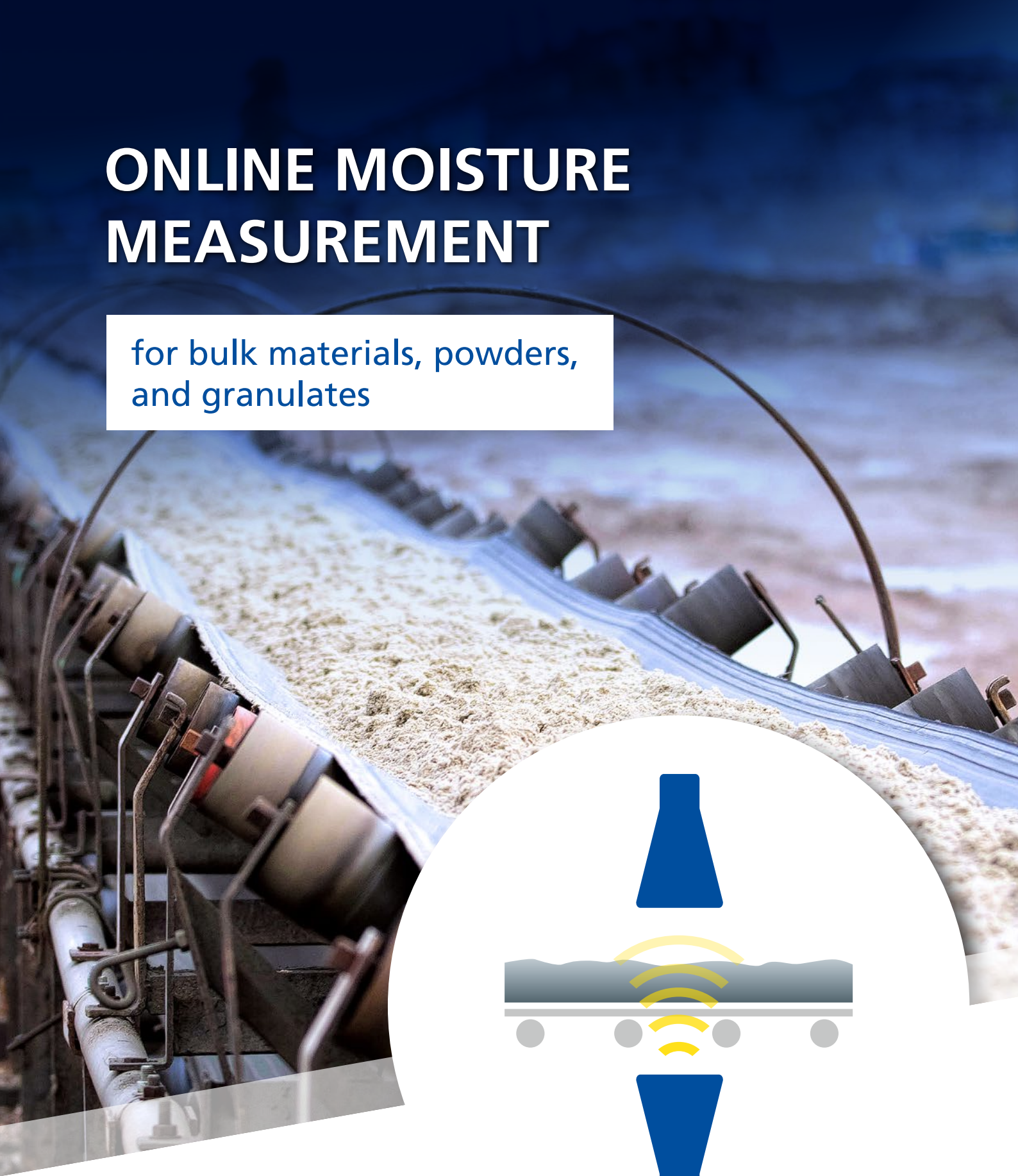
ONLINE MOISTURE MEASUREMENT

for bulk materials, powders, and granulates



QUALITY
MADE IN
GERMANY

BERTHOLD

ONLINE MOISTURE MEASUREMENT ON SILOS, SHAFTS OR CONVEYOR BELTS

Being a manufacturer of various moisture measurement systems in the field of process measurement technology, we can offer you the optimum solution for your applications. Berthold offers a variety of moisture measurement approaches and solutions for process control, supplying the optimal technology for your application.
The moisture content is an important and decisive quality parameter in many industrial production processes. Our online measurement enables optimal optimised process control, with cost-efficient energy use in firing or drying processes, and reduces waste by measuring in real time during production. Accurate monitoring of moisture during product loading ensures compliance with delivery specifications. Berthold's measurement systems are simple, robust and reliable, and work unaffected by dust, temperature or colour. From the food industry to power plants to the pharmaceutical industry - the areas of application for our measuring systems are limitless.

Advantages of moisture measurement

- Cost-optimized production through real-time measurement
- Easy installation, even on existing containers, conveyors, silos, tanks or measuring shafts
- Extremely representative, accurate and reliable measurement without recalibration
- Maintenance-free
- Measurement of the entire material cross section
- Superior measurement technology „Made in Germany"

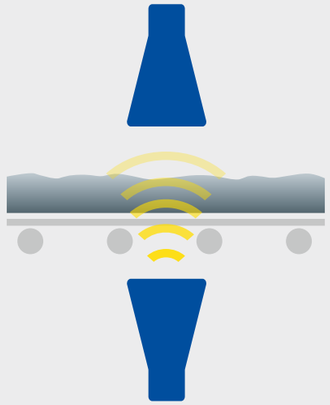
Successful applications

- Alumina / clay
- Silica sand
- Coal, coke
- Sugar beet pulp, sugar beet cubes
- Bagasse
- Foodstuffs e.g., cheese, butter, cereals
- Wood fibre and chips
- Paper and cardboard
- Fertilisers (e.g. phosphate)
- Iron ore
- Sintered pellets
- Straw bales
- Tobacco
- Building material e.g., bricks, sand, fibreboards, nonwovens

DIFFERENT MEASURING TECHNIQUES SUITABLE FOR YOUR MEASURING TASK

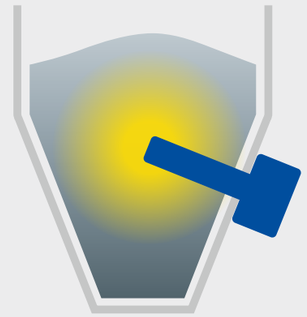
As the experts for moisture measurements, we provide various measurement techniques such as microwave transmission, microwave resonance, and radiometry, enabling us to realize most measurement tasks. Our measurement systems offer the highest accuracy for optimal production and operational reliability over many years of use.

Microwave transmission method



- Multifrequency technology for dynamic plausibility control of the raw signal
- Easy installation on existing conveyor belts or measuring shafts
- Signal quality management for the processing of measurement data
- Height and density compensation of non-homogeneous materials

Radiometric moisture measurement



- Representative measured values due to large measurement volume
- Not influenced by temperature, conductivity, pressure, pH value etc.
- Proven measurement technology with achievable accuracy of ±0.1 % moisture
- Various sensors for measurements in or through the vessel

MICROWAVE
TRANSMISSION METHOD

The microwave measurement system generates microwaves which interact with the water molecules due to the high dielectric constant. This interaction causes a decrease of the microwave energy, which can be detected as phase shift and attenuation.
Since the phase shift and attenuation changes are directly proportional to the water content in the product, the concentration or dry content in the medium can be determined with high accuracy. Berthold's superior multifrequency technology ensures stable and reliable measurements, unaffected by interfering reflections or resonances.

Control units

The heart of the measuring systems are the control units. Many years of experience and extensive research have gone into the development and production of these units. We offer transmitting units in three versions, which differ in frequency bandwidth and measurement dynamics. This allows us to use the ideal technology depending on the application and measurement requirements. Our experienced sales engineers are available to advise you on the selection of the right system for your application.

MicroPolar LB 567

- For inhomogeneous materials and with constant bulk density
- Product height compensation
- Also available with amplifier for more demanding measuring tasks (LB 567)

MicroPolar LB 568

- For materials with fluctuating bulk density
- Density compensation

Technical data

Method	Microwave transmission measurement
Transmitting power	LB 56x: < 0.1 mW, coaxial output power (Performance depends on country)
Housing	Stainless steel wall housing LB 56x: H x W x D: 300 x 323 x 140 mm
Protection class	IP65
Ambient temperature	In operation: LB 567: -20 … +50 °C (–4 ... +122 °F) LB 567 ++, LB 568: -20 … +45 °C (-4 ... +113 °F) In storage: All versions: –20 ... 60 °C (–4 ... 140 °F) Operation and storage without condensation
Achievable accuracy	≤ 0.2 wt.% (standard deviation), depending on product and calibration
Power supply	100 … 240 V AC, 50/60 Hz LB 56x: 24 V AC/DC
Sensor connection	Inputs and outputs for HF cable (measuring and reference channel), 50 Ω N socket
Current input	2 x current input 0/4 ... 20 mA: Impedance 50 Ω,1x isolated 1 x device ground e.g. temperature compensation
Current output	Current output 1: 4 ... 20 mA, max. impedance 800 Ω, isolated, for measured value Current output 2: 0/4 ... 20 mA, max. impedance 800 Ω, isolated, for measured value e.g., for temperature, conductivity etc.
Pt100 connection	Measuring range: –50 … +200 °C (–58 … +392 °F) for temperature compensation
Digital input	3 x digital inputs Functions: Measurement start/stop, measurement hold, product selection, sample recording
Relay outputs	2 x relays, SPST, isolated Functions: Collective malfunction signal, measurement stop, limit value (min. and max.)

Measuring sensors

Berthold's microwave antennas can be integrated on all types of conveyor belts or retrofitted on all measuring shafts without process downtime. Since microwave transmitters and receivers are mounted on opposite sides, the entire material cross-section is recorded. A high degree of representativeness is therefore guaranteed.

Horn antennas

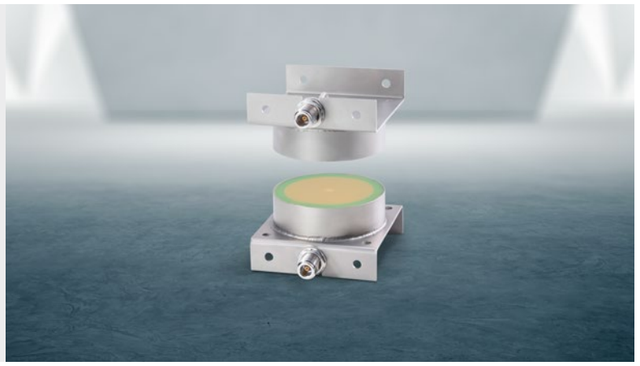
- Optimal focusing of the microwaves
- Non-contact sensor
- Maintenance-free
- High shock and vibration resistance
- Easy installation on existing lines, without process downtime

Applications: Suitable for all installations on conveyor systems, chutes, bunkers and measuring shaft.

Spiral antenna

- Small compact design
- Broadly aligned microwave field
- Robust design

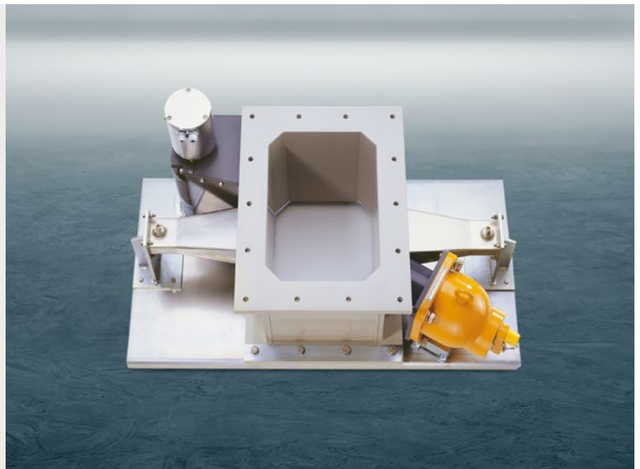
Applications: Perfect alternative for applications with limited space.



Measuring chute

- Complete measuring shaft unit (radiometric compensation optional)
- Easy to integrate into the process
- Stable construction
- For product temperatures up to 140 °C

Applications: For low-volume product flows, as the material can be collected in the chute until sufficient process material is available.



Technical data

Horn antennas

Material	Stainless steel, microwave window made of polycarbonate
Ambient temperature	–20 … 60 °C (-4 … +140 °F) operation and storage
Connection	1 x HF-connector, max. cable length: 4 m

Spiral antenna

Material	Stainless steel, plastic
Ambient temperature	–20 ... 60 °C (-4 … +140 °F) operation and storage
Connection	1 x HF-connector, max. cable length: 4 m

Measuring chute

Chute materials	1. Polypropylene homopolymer (PP-H) 2. Polyvinylidene fluoride (PVDF)
Components	- Chute - Mounting plate for horn antennas - 2 Brackets (4 with radiometric weight per unit area measurement) - 2 HF Angle connectors - General mounting material

MOISTURE MEASUREMENT WITH AREA WEIGHT COMPENSATION

Fluctuations in bulk density on conveyor belts can present major challenges for moisture measurements as they have an unfavorable effect on the accuracy of the measured value. This effect arises from the inconsistent product and particle size distribution, which in turn directly affects the measurement accuracy as changes in the product weight influence the measurement signal. To counteract this challenge as effectively as possible, radiometric area weight compensation is used. This compensation measurement consists of two components, a shield with a Cs-137 source and a detector (scintillation counter).

The measuring principle

In straightforward terms, a radiometric measurement system comprises a radiation-emitting source and a detector capable of detecting this radiation. Gamma radiation gets weaker as it moves through pipes and containers. The amount of weakening depends on how dense the product inside is. The denser the product, the more the radiation weakens, leading to less radiation reaching the detector. This measurement remains unaffected by factors like pressure, temperature, viscosity, colour, or chemical properties of the product. This means that even in challenging operational and environmental conditions, radiometric measuring systems maintain a high level of reliability without requiring regular maintenance.

Technical data

Detector scintillation counter

Variants	1. with axial collimator, for frontal irradiation 2. with radial collimator, for lateral irradiation
Crystal	CsJ 40 x 50
Material	Stainless steel Collimator: lead, painted steel
Protection class	IP67
Weight	With axial collimator: approx. 10.6 kg With radial collimator: approx. 10 kg
Power supply	12 … 24 V DC, ca. 1.2 W
Ambient temperature	Betrieb: –20 … +50 °C (253 … 323 K) Lagerung: –20 … +60 °C (253 … 333 K)
Connection cable	3 m long, 7-core, shielded (7 x 0,5 mm^2), Cable connection angled 90°, Temperature range: -40 … 70 °C (233 … 343 K)

Area weight per unit compensation

Measuring system	Evaluation unit LB 568 and detector LB 6739
Source	Cs-137
Backscatter chamber	Lockable shield with stainless steel housing
Wall thickness	Max. 10 mm steel or equivalent

RADIOMETRIC
MOISTURE MEASUREMENT

The radiometric method of moisture measurement is based on the deceleration of fast neutrons by hydrogen atoms. The fast neutrons are essentially unaffected by other elements. To measure the moisture content, a source is used which emits fast neutrons. Due to the interaction with hydrogen atoms in the water molecules in the measured material, a cloud of slow neutrons is formed in the vicinity of the source. The number of slow neutrons is proportional to the hydrogen content, which is why the moisture can be determined very precisely. The use of neutrons for moisture measurement is extremely reliable. This technology is independent of temperature, pressure, conductivity, or fluctuating particle sizes – even frozen water can be detected with this method.

LB 350 Online moisture measuring system

The LB 350 is a measuring system for real-time determination of moisture content. Neutron moisture measurement is a very robust and proven technology with a long track record for moisture measurement on bulk materials and construction materials. It works when most other moisture measurement techniques fail for various reasons. The large measurement volume of up to one meter in diameter ensures a representative reading. Once installed and calibrated, the system provides highly reliable and maintenance-free moisture monitoring of bulk materials for several years. The LB 350 can additionally be equipped with a bulk density compensation, which increases the accuracy of the moisture measurement in case of strongly fluctuating product bulk densities.

Technical data

Analyser LB 350	
Method	Neutron moisture measurement
Construction	LB 350-1: Aluminium wall-mounted housing IP54, LB 350-2: 19“ subrack 3HE to accommodate 2 measuring channels
Power supply	DC voltage: 24 V DC (18 ... 36 V DC)
Power consumption	max. 25 VA
Ambient temperature	in operation: 0 ... +50 °C (+32 ... +122 °F) in storage: -40 ... +70 °C (-40 ... +158 °F)
Analog output	Moisture signal 0/4 - 20 mA, potential-free, load: max. 500 Ohm
Digital input	Measured value „stop“ by external contact closure
Digital outputs	3 relay contacts for: Collective fault signal, limit value max, limit value min. Load capacity: max. 250 V AC / 2 A induction-free
Directives	RoHS: 2011/65/EG EMV-directive 2014/30/EG: EN61326-1

Detectors: general data	
Counting tube	He-3 Counting tube, automatic drift stabilisation
Ambient temperature	in operation: -20 ... +50 °C (-4 ... +122 °F) in storage: -40 ... +70 °C (-40 ... +158 °F)
Housing	Stainless steel
Cable	7 x 1.5 mm^2, shielded maximum cable length: 1,400 m

Moisture bunker probe LB 6666	
Types	Counter tube and preamplifier in the probe
Protection class	IP65

Moisture bunker probe LB 6669	
Types	Counter tube and preamplifier separate
Protection class	IP65

Surface moisture probe LB 7410	
LB 7410-13	Lockable surface neutron shield with 2 counting tubes
Options	- with pneumatic shutter - fireproof version

Density compensation for transmission	
Measuring system	Transmitter unit LB 474 and detector LB 4700
Source	Source Cs-137 or Co-60
Shield	LB 7440 or LB 7442

Density compensation for backscattering	
Measuring system	Transmitter unit LB 474 and detector LB 4700
Source	Cs-137
Backscatter chamber	Lockable shielding with stainless steel housing
Wall thickness	max. 10 mm steel or equivalent

THE EXPERTS
IN MEASUREMENT TECHNOLOGY

Berthold Technologies stands for excellent know-how, high quality and reliability. The customer is always the focus of our solution. We know our business!
Using our varied product portfolio, our enormous specialized knowledge and extensive experience, we develop suitable solutions together with our customers for new, individual measurement tasks in a wide variety of industries and applications.

We are here for you – worldwide!
The engineers and service technicians from Berthold Technologies are wherever you need them. Our global network assures you fast and above all competent and skilled assistance in case when needed. No matter where you are, our highly qualified experts and specialists are ready and waiting and will be with you in no time at all with the ideal solution for even the most difficult measurement task.

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