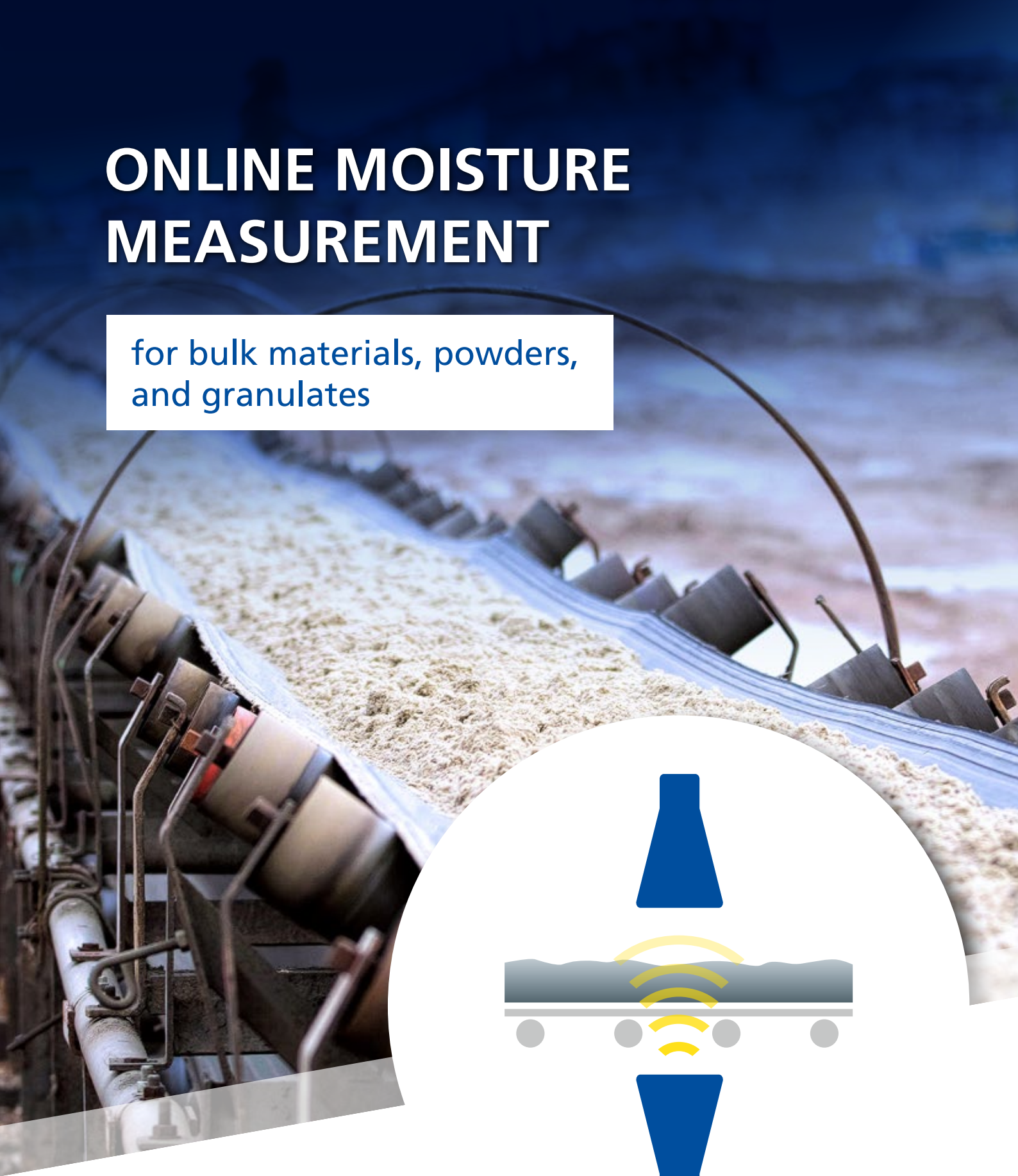
# ONLINE MOISTURE MEASUREMENT

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

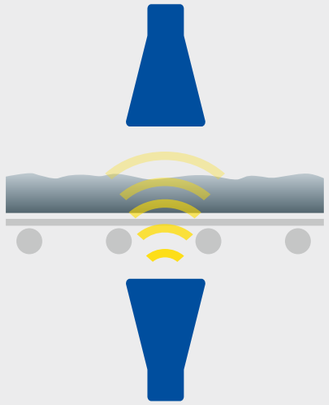
- Alumina / clay
- Silica sand
- Coal, coke
- Sugar beet pulp, sugar beet cubes
- Bagasse
- Foodstuffs e.g., cheese, cereals, pasta
- Wood fibre and chips
- Paper and cardboard
- Fertilisers (e.g. phosphate)
- Iron ore
- Sintered pellets
- Straw bales
- Tobacco
- Building material e.g., bricks, sand,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



# DIFFERENT MEASURING TECHNIQUES SUITABLE FOR YOUR MEASURING TASK

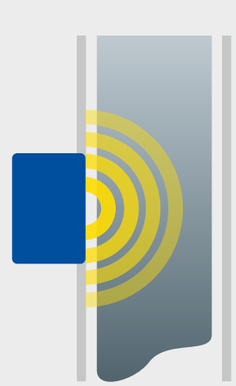
As the experts for moisture measurements, we provide various measurement techniques such as microwave transmission, microwave resonance, and radiometry, enabling us to realize most measurement tasks. Our measurement systems offer the highest accuracy for optimal production and operational reliability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

### Microwave transmission method



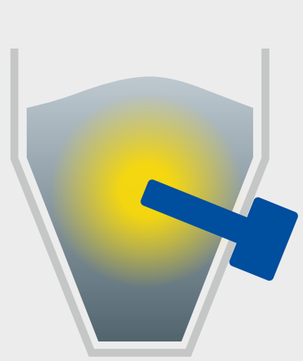
- Multifrequency technology for dynamic plausibility control of the raw signal
- Easy installation on existing conveyor belts or measuring shafts
- Signal quality management for the processing of measurement data
- Height and density compensation of non-homogeneous materials

### Microwave resonance method



- Measurement of material moisture in real time
- Installation on silo walls, conveyor belts, shafts or screw conveyors
- Savings in energy costs during drying processes
- Selection of calibration data for 4 different products possible

### 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<br>LB 56x ++: < 10 mW, coaxial output power |
| Housing | Stainless steel wall housing<br>LB 56x: H x W x D: 300 x 323 x 140 mm<br>LB 56x ++: H x W x D: 400 x 338 x 170 mm |
| Protection class | IP65 |
| Ambient temperature | In operation: LB 567: -20 … +50 °C (-4 ... +122 °F)<br>LB 567 ++, LB 568: -20 … +45 °C (-4 ... +113 °F)<br>In storage: All versions: -20 ... 60 °C (-4 ... 140 °F)<br>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<br>LB 56x: 24 V AC/DC<br>LB 56x ++: 24 V 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<br>1 x device ground e.g. temperature compensation |
| Current output | Current output 1: 4 ... 20 mA, max. impedance 800 Ω, isolated, for measured value<br>Current output 2: 0/4 ... 20 mA, max. impedance 800 Ω, isolated, for measured value<br>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<br>Functions: Measurement start/stop, measurement hold, product selection, sample recording |
| Relay outputs | 2 x relays, SPST, isolated<br>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

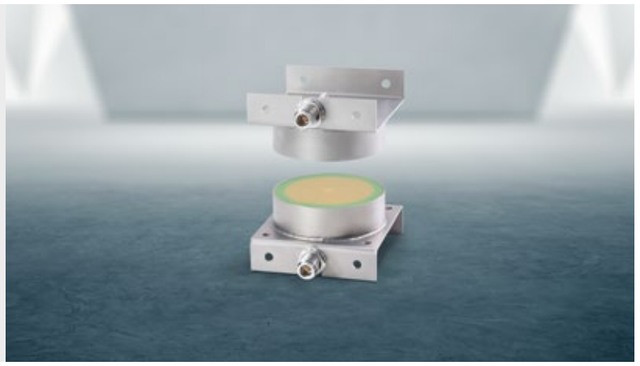
- Optimal focusing of the microwaves
- Non-contact sensor
- Maintenance-free
- High shock and vibration resistance
- Easy installation on existing lines, without process downtime

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

## Spiral antenna

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

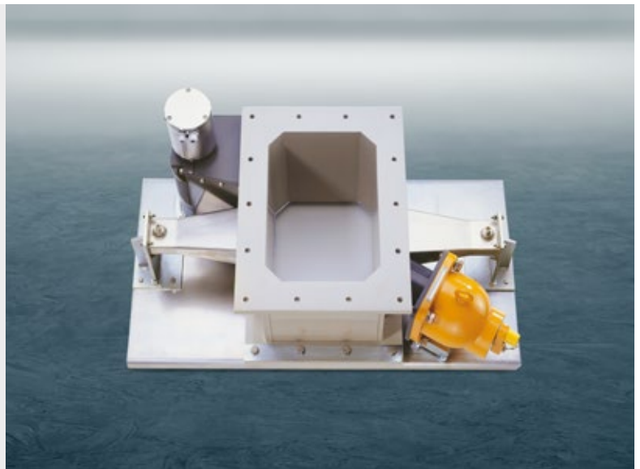
**Applications:** Perfect alternative for applications with limited space.



## 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)<br>2. Polyvinylidene fluoride (PVDF) |
| Components | - Chute<br>- Mounting plate for horn antennas<br>- 2 Brackets (4 with radiometric weight per unit area measurement)<br>- 2 HF Angle connectors<br>- General mounting material |

# MICROWAVE
# RESONANCE METHOD

The measuring system generates an electromagnetic microwave field which interacts with water molecules due to their high dielectric constant. This interaction causes a weakening or change of the field, which can be detected as frequency shift and attenuation. Since the changes are directly proportional to the water content, the moisture or dry content of the product can be determined with high accuracy.

## LB 571 Microwave resonator

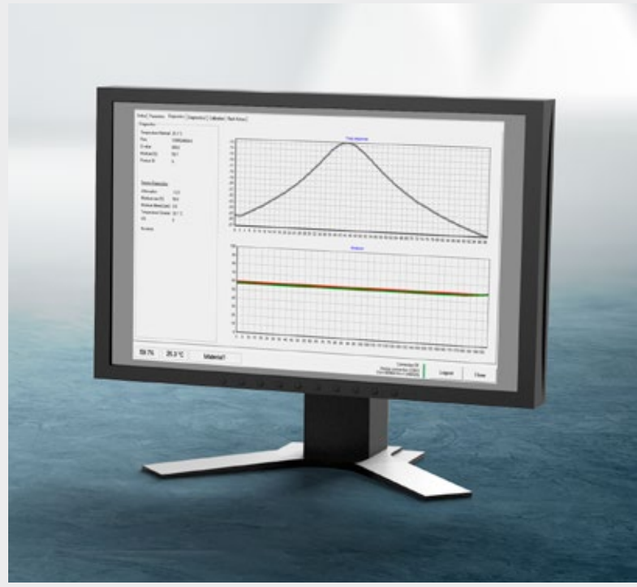
The sensor with its integrated signal processing can be used on a wide variety of bulk solids in a moisture range between 0 and 30 %. The robust design and the use of high-quality and wear-resistant materials ensure high operational reliability. The parts in contact with the medium are made of ceramic or stainless steel, the rest is made of corrosion-resistant aluminium. The LB 571 is therefore also suitable for use in the food industry. Calibration is performed directly on site, conveniently and quickly using the PC software supplied. Due to the real-time determination of the moisture during the ongoing process, continuous quality monitoring can save production costs, by reducing energy consumption in drying processes, for example or by reducing the amount of waste. For flexible and fast product changeover, up to four calibration curves can be stored and switched via process control digital input.

- Stand-alone, integrated control unit
- Convenient commissioning and calibration via PC software
- Selection of calibration data for 4 different products possible
- Continuous monitoring and logging

**Applications:** Bulk materials, nonwovens, fibreboard, film webs, pasta, paper and cardboard packaging

## Software

A software package is supplied to perform commissioning of various products. The software is used to fully configure the system and calibrate. Data points for samples can be produced via the software. These are calibrated based on laboratory analysis. During normal operation, there is no need for a computer to be connected to the instrument. Process and configuration data can be transferred for offline analysis or to other instruments via SD card. By means of a computer connected to the instrument, signals and measurement quality can be analysed and monitored online or offline via a separate diagnostics menu.



## Technical data

| | |
|---|---|
| Method | Microwave resonance measurement |
| Material | Stainless steel, ceramic |
| Ambient temperature | 0 ... +65 °C (+32 ... +149 °F) operation and storage |
| Dimensions | Ø 149 mm, height 100.5 mm |
| Cable gland<br>Connection | 2 x M20,<br>1 x M8 |
| Power supply | 18 ... 30 V DC / 2 A max. inrush current 10 A |
| Interfaces | 2 x analogue outputs (4 ... 20 mA) for humidity and material temperature signals (galvanically isolated, load >0 Ohm but <800 Ohm @24 V DC, passive)<br>3x digital input (24 V DC, 2x inputs reserved for product selection (max. 4 products),<br>2x digital output (alarm output, 1 replacement output load max. 50 mA @24 V DC) |
| Interface to PC | RS422/USB |
| Directives | RoHS: 2011/65/ EG<br>EMV-directive 2014/30/EG: EN61326-1 |

# **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,<br>LB 350-2: 19“ subrack 3HE<br>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)<br>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.<br>Load capacity: max. 250 V AC / 2 A induction-free |
| Directives | RoHS: 2011/65/EG<br>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)<br>in storage: -40 ... +70 °C (-40 ... +158 °F) |
| Housing | Stainless steel |
| Cable | 7 x 1.5 $mm^2$, shielded<br>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<br>- 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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