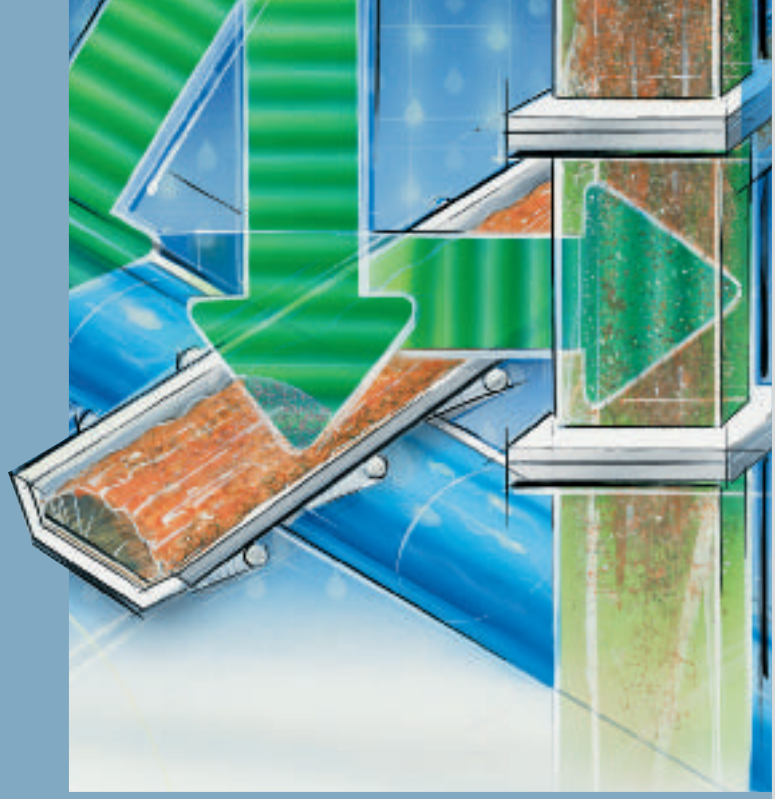


PROCESS CONTROL

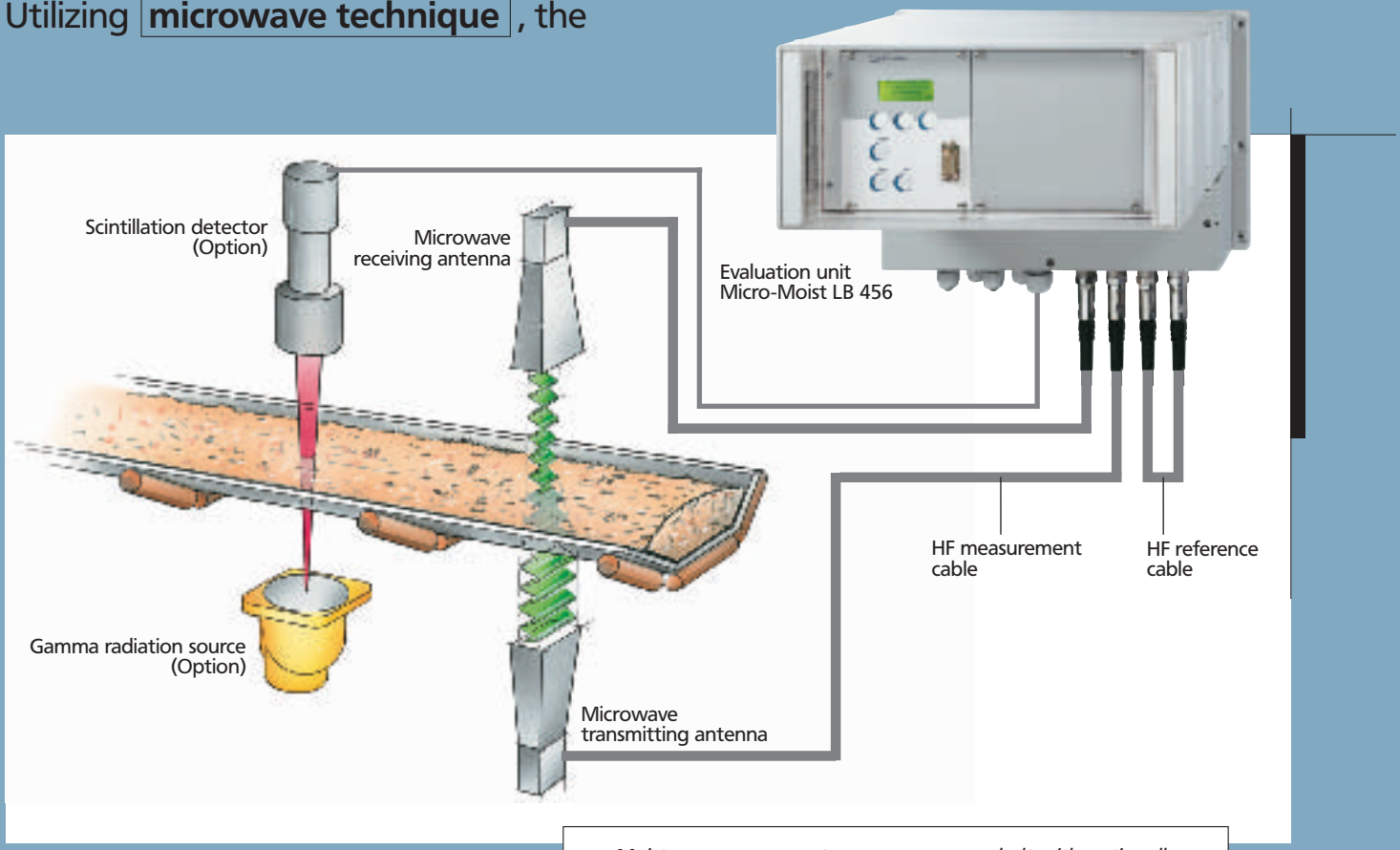
Contactless Measurement of Water Content and Moisture

Micro-Moist LB 456

BERTHOLD TECHNOLOGIES

Micro-Moist LB 456

Micro-Moist LB 456 has been designed for the **non-contact**, on-line measurement of the moisture of different kinds of products on a conveyor belt, in a chute, bunker or container. Utilizing **microwave technique**, the **entire material cross-section** in the range of transmission is covered, ensuring **representative on-line** measurements for **quality assurance** and **process optimization**.



Moisture measurement on an a conveyor belt with optionally available radiometric basis weight compensation

Measurement Arrangement on a Conveyor Belt

The antenna pair and the optionally available radiometric basis weight measurement are mounted on a frame. Both measuring paths transmit the material vertically. Oblique transmission may be recommended only in exceptional cases. Instead of the radiometric basis weight measurement, a height indicator may be employed to compensate for the layer thickness, provided the material density remains constant; another alternative is product smoothing.

The evaluation unit is installed in the direct vicinity of the antenna. The HF reference cable is a waveguide circulator serving as a reference for the measurement signal.

Moisture Measurement in a Chute

The moisture measurement of bulk goods in a chute offers a fixed geometry of the product being measured, and this has a positive effect on the measured data. In many cases, basis weight compensation is not required when performing moisture measurements in a chute. Plastic or ceramic chutes are available, depending on your application. Chutes are ideal for the measurement of all kinds of bulk goods up to a product temperature of 500°C.

A round measurement chute made of stainless steel can be supplied for special applications. This measuring cell is lined with PTFE and, typically, has a nominal width of 150 mm.

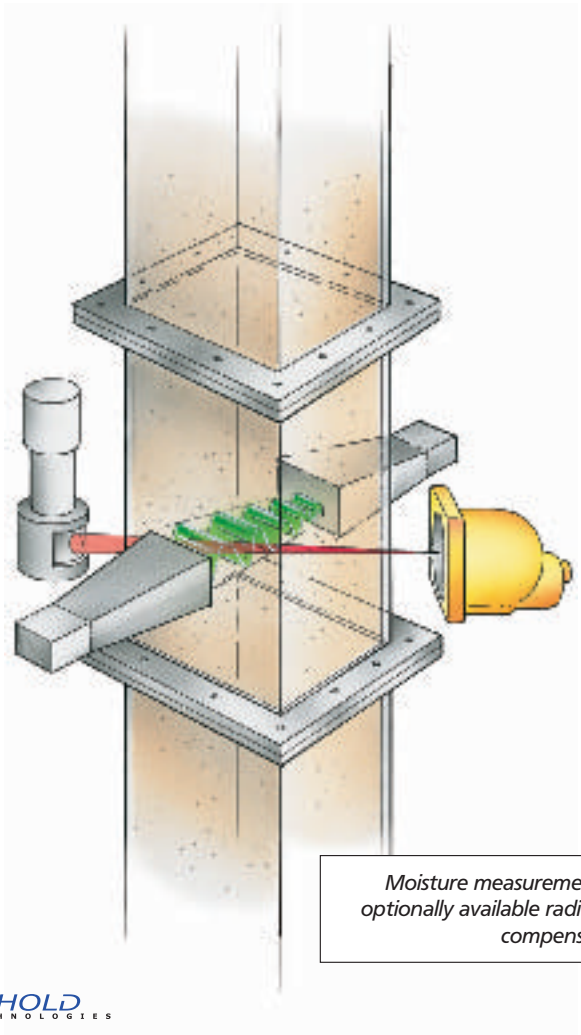
Fields of Application

The moisture measuring system Micro-Moist LB 456 measures the water contents in solid matter and bulk goods which are not conductive, or only to a minor degree.

Typical fields of application are in the primary industry, chemical-, building material-, wood-, paper- and food-industry.

Examples of successful Micro-Moist applications

- Bauxite
- Bentonite
- Brown coal
- Fertilizer
- Fodder
- Grain
- Foundry molding sand
- Gypsum
- Wood chips
- Wood fibers
- Limestone production
- Potatoe chips
- Almonds
- Methyl cellulose
- Mineral fiber plates
- Salt
- Rice
- Sand
- Chipboard chips
- Hard coal
- Starch pellets/Starch
- Clay mass
- Sugar beet chips



Moisture measurement in a chute with optionally available radiometric basis weight compensation

Chute Measurement Arrangement

The measurement chute is either installed directly in the product stream or a bypass. Constant and slow product flow through the chute during measurement has to be ensured. The sensors are installed on the measurement chute.

System Configuration

Micro-Moist LB 456 consists of the evaluation unit and a microwave measuring path.

The microwave measuring path consists of either

- Transmitting and receiving antenna
- Measuring cell
- Chute

each including high frequency measurement and reference cables.

Option: Basis weight compensation

The radiometric measuring path consists of a low-activity Gamma radiation source in a shielding container and a highly sensitive scintillation detector.

Micro-Moist LB 456 evaluation unit, optionally available in stainless steel housing

Engineering Data

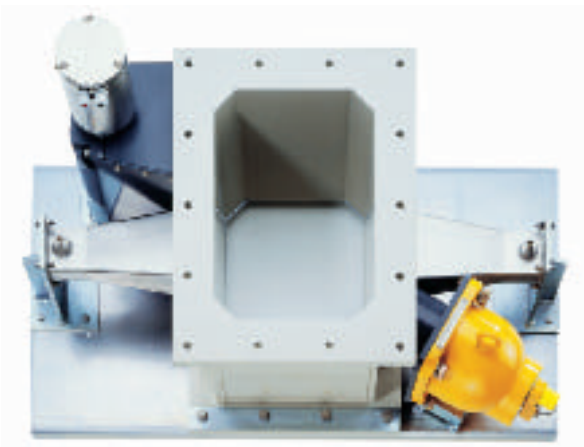
The following engineering data is required to select the microwave sensors and to submit a quotation:

- **Type and profile of conveyor system**
- **Conveyed product, grain size**
- **Product temperature**
- **Measuring range**
- **Typical loading height**
- **Product speed**
- **Required accuracy**

Microwave horn antenna

Microwave spiral antenna

Microwave measuring cell nominal width 150 mm



Installation of horn antenna and radiometric measuring path on a plastic measurement chute

Principle of Measurement

The material layer to be measured is transmitted by microwaves. The free water molecules rotate in the electromagnetic field. As a result, the propagation velocity of the microwaves is slowed down (phase shift) and their intensity is weakened (attenuation). Both effects are measured by Micro-Moist and used as a direct indication of the moisture contents.

Micro-Moist utilizes a **wide frequency band**. In each measurement cycle, phase shift and attenuation are measured at a variety of individual frequencies and a plausibility analysis is performed.

This, in particular, is the **benefit of the wide-band technique**: interfering resonance and reflection effects which occur with demanding measurement geometries can be reliably suppressed.

In general, only non-conductive material (product, walls, conveyor systems) can be transmitted. Steel-reinforced conveyer belts may be transmitted only under certain circumstances.

Option: basis weight compensation

The radiometric measuring path consists of a Gamma radiation source in a shielding container and a highly sensitive scintillation detector. If the layer thickness and density of the material being measured varies significantly, an additional radiometric irradiation measurement may compensate for this influence.

This situation may occur on conveyor belts with varying loading or in chutes with varying bulk weights of the product being measured.

The starting point of this kind of measurement is the basis weight dependent attenuation of Gamma rays passing through the medium being measured.

Benefits of this Technology

- High selective sensitivity to free water molecules.
- A transmission measurement covers the entire material cross-section in the range of radiation; thus, representative measurement is possible even in case of inhomogeneous moisture distribution.
- Contactless transmission measurement, without any influence on the product or wear of the measuring system.
- Measurement of both microwave parameters phase shift and attenuation: variations of grain size, product temperature and composition may cause errors in pure attenuation measurements. These errors are minimized when running a phase measurement or a combined phase and attenuation measurement.
- Wide-band technique: interfering reflections and resonances often occur in mono-frequency measuring systems. Such interferences are suppressed by Micro-Moist's wide-band technique.

Your Benefit

- **High selective sensitivity to water:** High accuracy and long-term stability even with difficult products
- **On-line measurement:** Expensive mechanical sample separators and sampling devices are not required
- **Transmission measurement:** Representative measurement even on inhomogeneous products due to measuring large material quantities
- **Compensation of material variations:** Layer thickness and density variations are corrected through radiometric basis weight compensation
- **Contactless measurement:** No caking or abrasion on probes, no influence on product being measured by the microwaves
- **Simple installation:** Directly on existing conveyor belts, chutes, bunkers, containers, etc.

High operating safety and system availability

Technical Data LB 456

Evaluation unit LB 456

Assembly	1. wall housing made from ABS, protection type IP65 H = 237, W = 355, D = 267 mm Weight: approx. 8.0 kg 2. wall housing made of stainless steel, protection type IP66 H = 310, W = 400, D = 280 mm Weight: approx. 13.5 kg
Auxiliary energy	115/230 V AC +10 %,-15%; 47-65 Hz
Power consumption	17 VA (AC), max. 30 VA (AC)
Transmitting power	max. 0.005 mW
Temperature range	Operating temperature: 0 ... +50°C (273 ... 323 K), no condensation Storage temperature: –20 ... +80°C (253 ... 353 K), no condensation
Display	LCD display with 4 x 20 characters, illuminated. Data input via foil keypad. Dialog guidance with softkeys. Dialog: several languages. Data protection through freely selectable password.

Inputs

Analog input	0/4 -20 mA, load 50 Ω, e.g. for temperature compensation
Digital inputs	DI1: Stop measurement DI2: Start / Stop measurement DI3: Product 1 / Product 2
PT-100 connection	Measuring range –50 ... +200°C (223 ...473 K), Measurement tolerance < 0.4°C

Outputs

Analog output	0/4 -20 mA, load max. 500 Ω.
Digital outputs	DO1: relay for collective failure message DO2: relay for measurement stop DO3: relay for min./max. limit value Loading capacity: AC: max. 400 VA DC: max. 90 W AC/DC: max. 250 V or max. 2 A, non-inductive ≥ 150 V: Voltage must be grounded
24 V output	24 V DC, ≤ 100 mA, short circuit-proof
Interfaces	RS 232 and RS 485 for data output

HF-connections

N-sockets	Signal in/out for 50 Ω HF-cable
N-sockets	Reference in/out for 50 Ω HF-cable

HF-cable

Measuring cable	50 Ω, N-connectors on both sides, length: 1.5 m; 2 m (max. 4 m)
Reference cable	50 Ω, N-connectors on both sides, length from 1.5 m up to sum of both measuring cables

Sensors

Microwave Antenna	1. horn antenna (Transmitter and receiver) 2. spiral antenna (Transmitter and receiver)
Measurement chute	Internal dimensions: H = 360, W = 360, D = 250 mm 1. plastic PP-H, max. temperature 100°C 2. ceramics, max. temperature 500°C
Measuring cell	Nominal diameter 150 mm, stainless steel

Basis weight measurement (OPTION)

Detector	Scintillation counter with NaI (Tl) crystal Long-term stability ± 0.1% Stainless steel housing Cable entry: M12 and M16 Weight: approx. 18 kg

Type	Crystal	Irradiation	Prot. class
LB 5441-02	40/35	front-side	IP 65
LB 5441-03	50/50	front-side	IP 65
LB 5401-03	50/50	lateral	IP 65

Source	Nuclide ^{137}Cs, typical activity 370 MBq (10 mCi)
Shielding	Shielding container LB 7440

Design modifications may occur without notice.

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