

DENSITY MEASUREMENT

Reliable measurement even under extreme conditions



BERTHOLD

RADIOMETRIC DENSITY MEASUREMENTS

Radiometric density measurements are used wherever conventional measurement techniques fail. Successful applications can be found in a wide variety of industries and especially where extreme process environments and thus difficult measuring conditions prevail, such as extreme temperatures, high pressure, dust or corrosive or abrasive media. Berthold's density measuring systems are used for continuous process monitoring on pipelines and in vessels. Density, concentration and solids content can thus be determined without contact and without changing or affecting the flow properties of the measured material.

The measurement can be performed on liquids and mixtures of any type, including acids, alkalis, solutions, emulsions and suspensions. It is also possible to determine the bulk density of solids, such as granulates or powders.

Measurement technology

In simple terms, a radiometric measurement is a system consisting of a source that emits radiation and a detector that can detect that radiation. Gamma radiation is attenuated when penetrating pipes and vessels. The amount of attenuation depends on the density of the product inside: the higher its density, the higher is the attenuation, and the less radiation reaches the detector.

The measurement is not influenced by pressure, temperature, viscosity, colour or chemical properties of the product to be measured. This results in a high level of reliability combined with freedom from maintenance, even under harsh operating and environmental conditions.

Advantages of radiometric technology

- High reliability under extreme process conditions
- Easy mounting, even on existing vessels and pipes
- No contact with the measured product
- No wear and maintenance

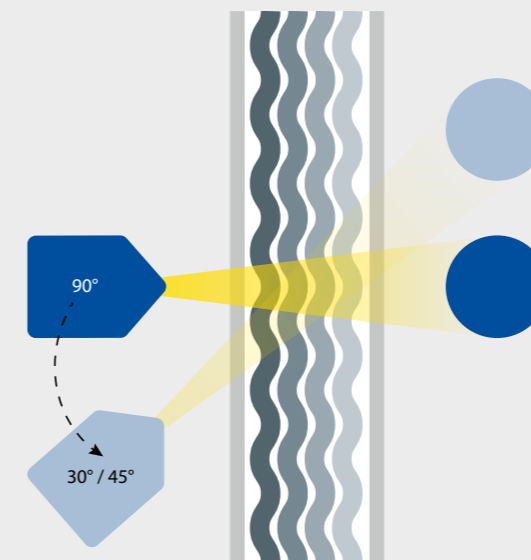
CUSTOMIZED ARRANGEMENTS FOR YOUR MEASUREMENT TASK

Customized solutions that ideally comply with the given requirements are achieved by using various detectors and sources. These can be combined in different ways and can also be used in dip pipes. Which one of these options is chosen depends on measurement geometry, accuracy requirements and economic aspects.

Possible applications

- Pipelines
- Process and storage vessels

Measurements on pipelines



Easy mounting due to preassembled mounting device

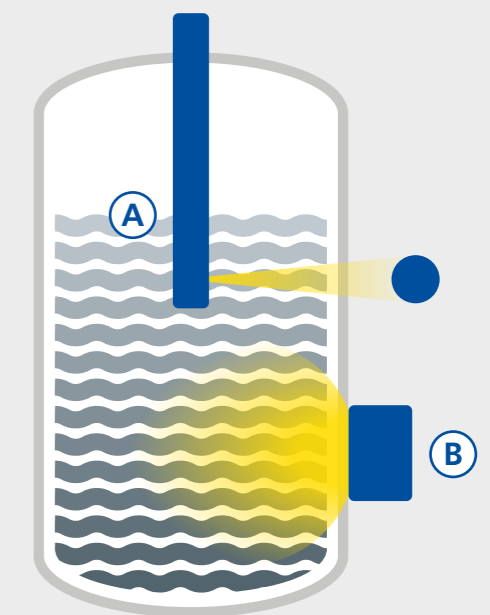
Standard solution

- 90° irradiation: ideal for large pipe diameters and major density fluctuations

Special solutions

- 30° or 45° irradiation: highest accuracy for small measuring ranges
- S- or U-shaped measuring paths: for smallest pipe diameters and slightest density changes

Measurements on vessels



- Transmission measurement with source in dip pipe **A** or backscatter measurement **B**
- Measurement of density profiles possible

DETECTOR SERIES

FOR DIFFERENT TECHNICAL REQUIREMENTS

As an expert for radiometric density measurements, Berthold offers a comprehensive range of system families. These differ both in their performance spectrum, such as interfaces or user interfaces, and approval types.

Within each detector series it can be chosen between several detector types of different scintillator size and material.

DuoSeries LB 4700

Used where maintenance and control technology is implemented

- Proven 2-wire system
- Separate transmitter (LB 474)
- All contemporary Ex-approvals
- Several measuring modes such as density, concentration, solids content and potassium content
- Implemented min./max. alarm
- Easy, intuitive touch screen operation
- Important maintenance-oriented diagnostic functions and self-monitoring
- Mass Flow evaluation by using separate flow meter

SENSSeries LB 480

Robust and compact field device

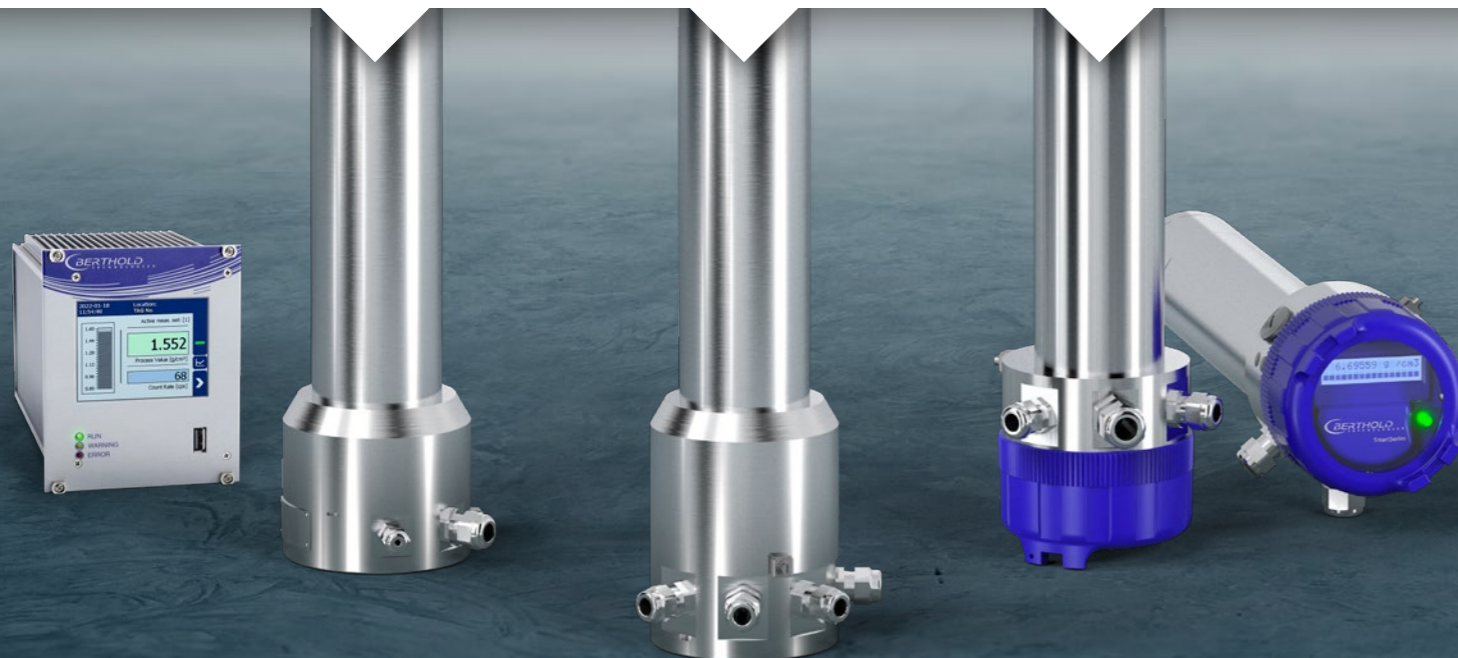
- Process connection via HART
- All contemporary Ex-approvals
- SIL 2, SIL 3 with homogeneous redundancy
- High interference immunity (SIL standard)
- Quick Start menu for effective and fast start-up
- Daily functional check and continuous self-monitoring
- Very short response times (50 ms)



SmartSeries LB 414

Ideal for non-hazardous areas

- Compact field device with integrated transmitter
- Process connection via 4–20mA/HART
- Perfect for density measurements in non-hazardous areas
- Simple and straightforward operation via local display



DETECTOR TYPES

TAILORED FOR YOUR MEASUREMENT TASK

Scintillators are a major component of our detectors. Within a scintillator incident gamma radiation is converted into light flashes, which are further converted into electrons by the photocathode of the subsequent photomultiplier. In the next step the electrons are multiplied, and as a measurable pulse obtained at the anode. Therefore, the scintillator is crucial regarding the sensitivity of the measurement.

In Berthold detectors, scintillators of best quality materials are implemented to achieve optimal results for your measurement task.



CrystalSENS

Point detector with high-quality scintillation crystal made of e.g., sodium iodide which achieves a particularly high sensitivity despite its small volume. Due to its compact design, CrystalSENS is ideally suited for applications with limited space requirements.

SuperSENS

Point detector with an extreme large scintillation volume, which results in extraordinarily high sensitivity and accuracy. It is perfect for thick-walled pipes or big vessels because using smallest source activities is sufficient. By using SuperSENS, an imminent source replacement can be delayed by several years.

InlineSENS

The measuring cell InlineSENS combines radiation source and detector in one unit. Its use of low-energy isotopes like Am-241 provides best accuracy for measurements that involve only minor changes in density.

SOURCES AND SHIELDS SUITABLE FOR YOUR SPECIFICATIONS

As the only radiometry supplier worldwide, Berthold has its own source production and thus offers the highest flexibility. Best measurement results and cost-optimal solutions can be achieved by a broad spectrum: Point sources, different isotopes (e.g. Co-60, Cs-137, Am-241) and shields of specialized materials (e.g. lead, tungsten, stainless steel).

Maximum safety is ensured by the use of so-called SSC source capsules with up to threefold encapsulation. These are tested according to ISO 2919, exceed the highest classification C66646 and are extremely robust and temperature resistant up to 1200 °C.

For each measurement, our project engineers recalculate the necessary source activity, strictly according to the ALARA principle (as low as reasonably achievable). Accordingly, sources are designed in such a way that only as much activity as absolutely necessary is used. The table below shows some typical radiation exposures compared to a radiometric measurement.

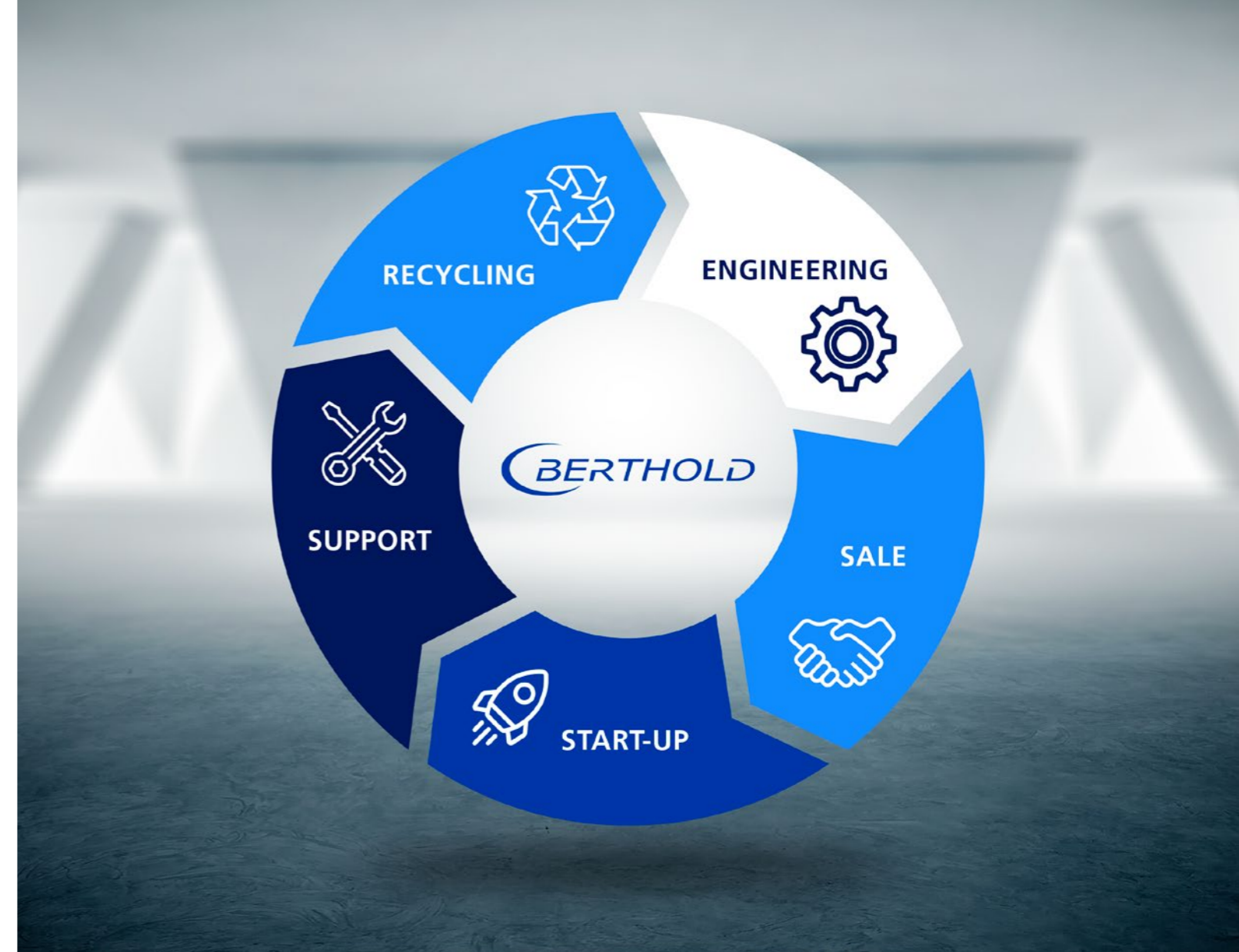
Typical radiation exposures

Whole body computer tomography	10–20 mSv
Transatlantic flight	Up to 0.1 mSv
Annual natural exposure	2.1 mSv/a
Radiometric measurement (with empty vessel)	0.001 mSv/h

Safety – Made by Berthold

With our unique selection of shields and customized solutions, we offer you the optimal solution for your measurement task.

International standards such as ANSI 43.8, ISO 7205 and IEC 62598 are a matter of course!



BERTHOLD – YOUR PARTNER SUPPORT OVER THE COMPLETE LIFE CYCLE

Berthold acts responsibly throughout the life cycle of a radiometric measurement. We take care of your radiometric measurement from design to final disposal. This includes shipping, import, commissioning and support. Berthold is committed to take back all delivered radiation sources - without further ado and at any time.

Our global network of experts is always available to provide you with fast and competent support and to find the ideal solution for you.

TECHNICAL DATA & FACTS

DENSITY MEASUREMENT SYSTEMS

DuoSeries LB 4700

SENSseries LB 480

SmartSeries LB 414

Process connection

4–20mA	•	•	•
HART		•	•

Certificates

ATEX / IECEx	•	•	
Intrinsically safe signal output	•	•	
Intrinsically safe power supply	•		
US / Canada (FM / CSA)	•	•	
SIL 2/3		•	

Versions

CrystalSENS	•	•	•
SuperSENS	•	•	
InlineSENS	•		

Features

Monitored current output	•	•	
X-Ray Interference Protection (XIP)	•	•	
Radiation Interference Discrimination (RID)	•		
Gas property compensation (GPC)	•	•	
Compensation of natural product radioactivity (PRC)		•	
Speedstar (50 ms response time)		•	

Operation and parameter settings

Separate transmitter	•		
HART communicator		•	•
AMS / PDM / FDT / DTM		•	•
Ethernet	•		

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!

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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