

# MULTIPHASE LEVEL & INTERFACE MEASUREMENT

Optimal monitoring of separation processes



**BERTHOLD**

# RADIOMETRIC SOLUTIONS FOR MULTIPHASE LEVEL AND INTERFACE MEASUREMENTS

Radiometric measurement systems from Berthold are used to monitor interfaces or multiple layers in process vessels. Not only the interfaces between two phases can be localized, but also the measurement of density profiles in more complex processes is possible. In this way, the heights of the different product layers inside the vessel can be mapped and so the characteristics of a transition phase, e.g. emulsion, can also be monitored.

Interface and multiphase level measurements are primarily applied in the oil and gas industry and in chemical plants, e.g. on separator vessels. Due to the harsh conditions prevailing there, such as high temperatures, pressures or geometrical issues, some measurement technologies are not able to provide reliable measurement results. Radiometric systems, on the other hand, can be used under such extreme conditions and provide accurate measurement results also when measuring corrosive liquids.

## Measurement technology

In simple terms, a radiometric measurement consists of a system of a source that emits radiation and a detector that can detect this radiation. Gamma radiation is attenuated when penetrating a vessel and its contents. Thereby, the attenuation by the heavier phase is much stronger due to its higher density than that by the lighter phase. Based on the measured intensity of the gamma radiation together with a corresponding calibration, the individual phases can thus be identified. The measurement is not affected by pressure, temperature, viscosity, colour and chemical properties of the measured material. Consequently this results in high reliability and low maintenance of radiometric measurement systems, even under harsh operating and environmental conditions.

## Advantages of radiometric technology

- No direct contact to the measured material
- Reliable under extreme conditions
- Wear-and maintenance-free
- Easy installation even on existing vessels
- Smooth handling and operation
- No re-calibration required

# INTERFACE MEASUREMENT OF TWO PHASES

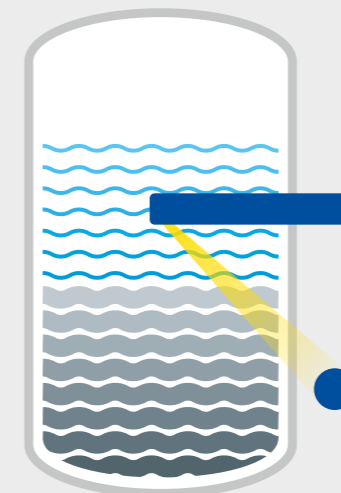
Radiometric measurement systems are used for localization of the interface layer between two phases. Clearly formed interfaces between two liquids or product layers can be measured by means of simple measuring arrangements. Factors like vessel geometry, accuracy requirements or economic aspects influence the selection of the most suitable arrangement.

Our highly experienced application experts are pleased to support you and help you find the best solution for your needs.

## Possible applications

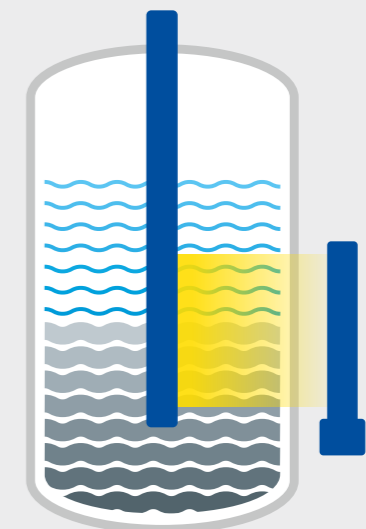
- Storage tanks
- Settling tanks
- Separators with clear interfaces

### Point source in dip pipe / point detector



- For small measuring ranges
- Perfect for horizontal cylindrical vessels
- Highly accurate, especially with small differences in density
- Very cost-efficient

### Rod source in dip pipe / rod detector



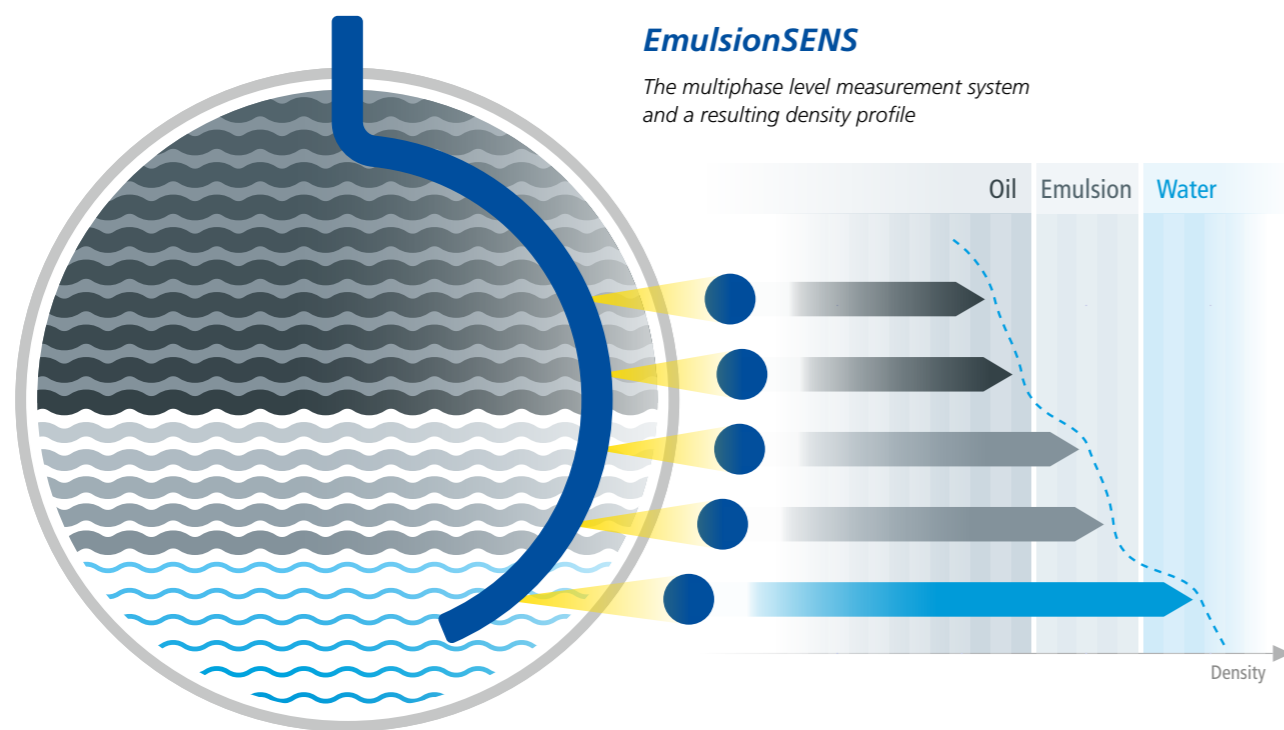
- For measuring ranges of any lengths
- Best accuracy along whole range
- Highest sensitivity and minimum source activity
- Unique rod source technology

# MULTIPHASE LEVEL MEASUREMENT MEASURING DIFFERENT LAYERS

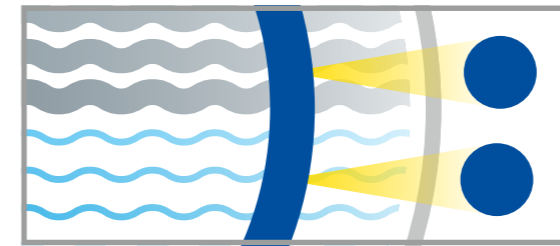
The measurement of more than two phases or of interfaces that are not clearly defined poses a number of challenges for the measurement technology. Depending on the process, an emulsion layer changing in height or only very small differences in density of the individual phases must be expected. Build-up on the vessel walls or installations inside the vessel are also not uncommon in separation processes. Because of these and other challenges, some measuring technologies fail, whereas radiation-based measuring systems, such as Berthold's EmulsionSENS, master them. The result of a reliable monitoring of the separation process could therefore be not only the optimization of the residence time but also the consumption of chemicals, such as anti-foaming agents, thus saving costs.

## EmulsionSENS

With Berthold's multiphase level measurement system EmulsionSENS separating layers are reliably monitored and the dependent process can thus be optimally controlled. Several density measurements are installed on different heights with detectors mounted on the vessel outside and sources inserted into a dip pipe to create a density profile of the vessel contents. If not only the density values of the vessel contents are of interest, but also the position and height of the individual phases, the level of the phases can also be output. Depending on requirements, EmulsionSENS is therefore available in two different arrangements (aligned and staggered).

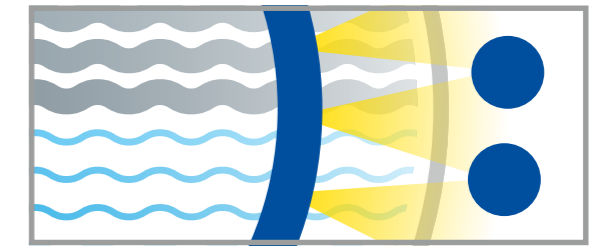


### Aligned arrangement



- Sources and detectors at same height
- Output: Density values of each detector
- Very precise point information
- Density accuracy approx. 0.002 g/cm<sup>3</sup>
- Cost effective

### Staggered arrangement



- Sources between detectors
- Outputs: Density values of each detector and level of each layer
- Precise information also between detectors
- Reproducibility of the measured level values with accuracy of  $\pm 25$  mm
- Configuration and visualization via transmitter unit

To obtain the best possible measurement, it is necessary to design the measurement system individually and adapt it to the respective process and requirements. Our experienced application specialists will be pleased to design EmulsionSENS to your requirements.

### Possible applications

- Desalter
- Hydrocracker
- FWKO
- Treaters
- Alkylation units
- Separators
- Storage tanks

### Customer benefit

- Non-contacting: detectors and electronics mounted outside the vessel, sources inserted into a closed dip pipe
- Unaffected: scaling or use of different opportunity crudes has no influence
- Fail-safe: multiple independent detectors and redundant signal transmission
- Representative: combination of high-energy gamma sources and long measurement paths provides reliable results



# EmulsionSENS

## A COMBINATION OF SELECTED COMPONENTS

### SENSseries LB 480

#### High sensitive scintillation detectors

The SENSseries LB 480 density meter is a compact field device that combines top of the class measuring technology with maximum manufacturing quality and innovative features - the best system for challenging measuring tasks.

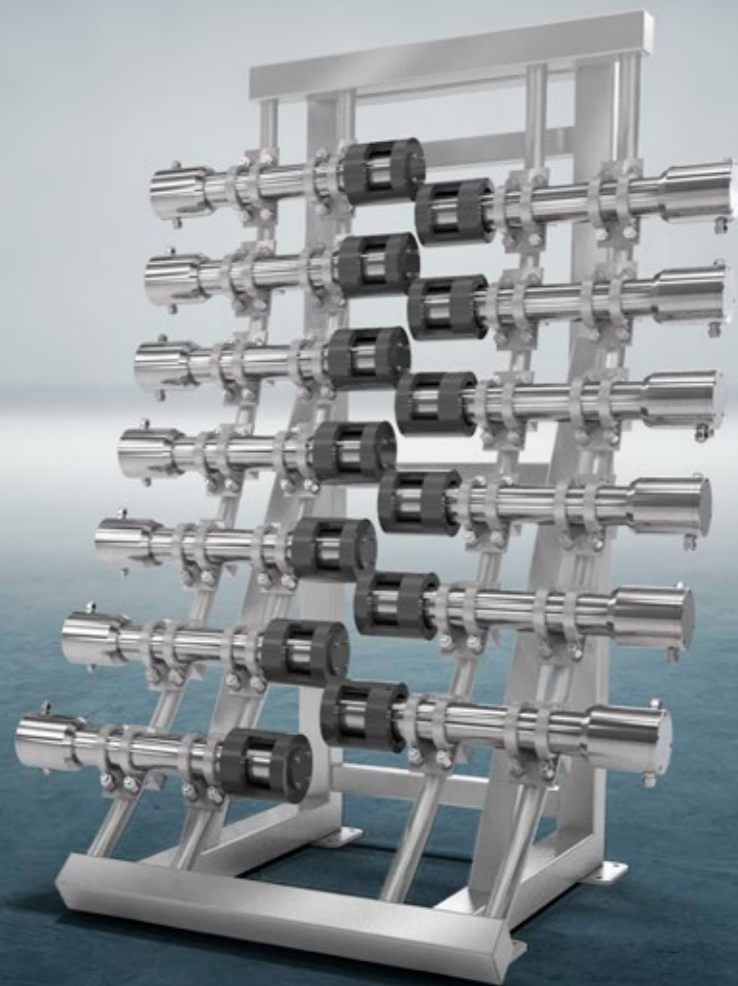
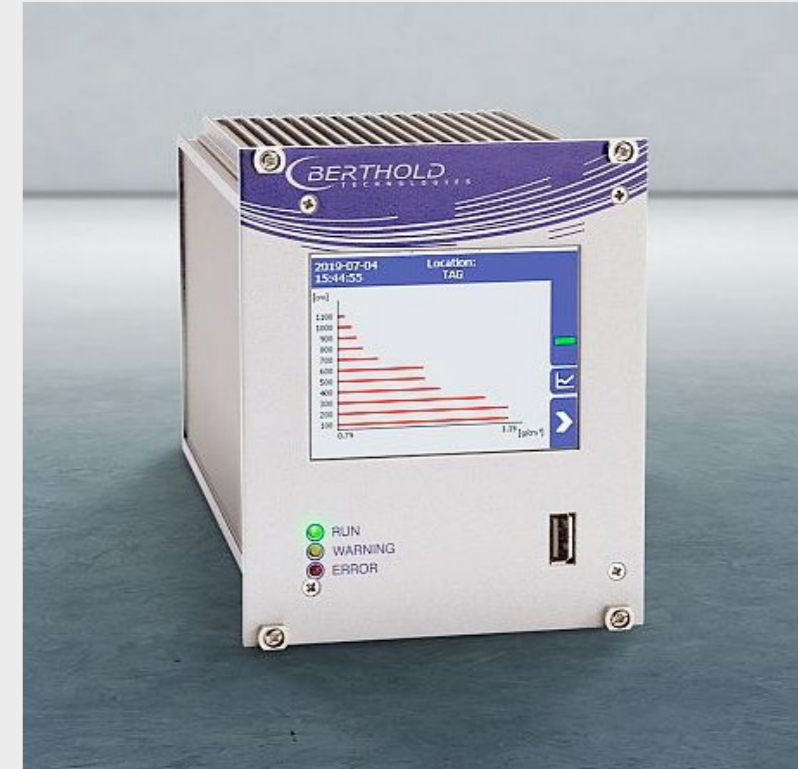
- Very robust: stainless steel or 316 L, SIL2/3 certification
- High sensitive: 2" scintillator
- Best stability:  $\leq 0.002\%$  per °C (-40°C...+60°C)
- Proven radiation interference detection: XIP
- Individual: number depends on measuring range and resolution requirements
- Easy access and not affected by process temperatures: correct positioning via extremely robust and tailor-made mounting structure on vessel outer wall
- Signal output to DCS: density values via 4...20 mA (HART)



### Transmitter LB 478

Transforming density profile into level outputs

- Intelligent: calculation of levels of the individual layers based on the measured density profile
- Simple and intuitive: operation via 3.5" TFT touch-panel, different languages
- Visualization: measured values, trend chart, density profile
- Reliable: important maintenance-oriented diagnostic functions and self-monitoring
- Everything in place: necessary transmitters and other complex electronics can be located in a control cabinet
- Signal output to DCS: level values via 4...20 mA (HART)



### Multipart sources

High quality – made by Berthold

- Flexible: multiple point sources installed in flexible rods
- High-energy gamma point sources: Cs-137
- Most secure: safely sealed in absolutely tight and durable capsules made of stainless steel
- Leak-tested: according to ISO 9978 and DIN 25426
- Individual: number of sources or flexible rods depends on measuring range and chosen arrangement (aligned or staggered)
- ALARA: individual project engineering to ensure the principle „as low as reasonably achievable“ and aim to keep the source size to a minimum

### Flange shields

Best for radiation protection

- Safe place: keep flexible rods including sources during maintenance or storage, whereby shield remains mounted on the vessel
- Optimum shielding effect: stainless steel design
- Very compact: dimensions are adapted to required source activities, keeping height and weight as low as possible
- Even safer: pressure proof design available

### Dip pipe

Individual positioning of sources

- Uniform measuring paths: geometry depends on vessel orientation (vertical vessels - straight pipe / horizontal vessels - curved pipe)
- Tailor-made: adapted to the corresponding vessel dimensions
- Adapted to the environment: almost all common materials available





## 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. Berthold Technologies is specialised in radiometric process measurements for 70 years. This is our core competence with state-of-the-art and cutting edge products and solutions covering a vast range 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 of need. 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.

**Berthold Technologies GmbH & Co. KG**

Calmbacher Straße 22 · 75323 Bad Wildbad · Germany  
+49 7081 1770 · [industry@berthold.com](mailto:industry@berthold.com) · [www.berthold.com](http://www.berthold.com)

