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Density, Concentration and Solids Content

Non-contacting measurement

S Y S T E M O V E R V I E W



BERTHOLD
TECHNOLOGIES

Non-contacting measurement technology made by Berthold

Berthold density measurement systems are used for the continuous process control on pipelines and in vessels. Density, concentration and solids content are determined in a non-contacting manner, without affecting the flow properties of the measured material.

Successful applications can be found in a wide range of industries and in particular when facing extreme measurement conditions:

- Extreme temperatures
- High pressure
- Dust
- Corrosive or abrasive media

The measurement can be performed on liquids and mixtures of any type, including acids, bases, solutions, emulsions and suspensions. The bulk density of solid matters such as granulates or powders can also be determined.



Non-contacting perfection

- Easy to install, on the outside of the pipeline
- No contact with the material to be measured
- Free of wear and maintenance
- Subsequent installation on existing systems possible without process downtime
- High availability and therefore high operational safety
- Stable measurement without recalibration

certified

[SIL2] [SIL3] [EX]



Measuring principle and function

Gamma radiation is attenuated as it passes through a pipeline. This attenuation is measured by a detector. The extent to which the radiation is attenuated is dependent on the density of the medium in the pipeline. The higher the density, the less radiation reaches the detector. In this way, density, concentration and solids content can be determined reliably in a non-contacting manner – regardless of pressure, temperature, viscosity, conductivity and chemical properties.

This results in the high reliability and low maintenance requirements of the radiometric measuring systems, even under severe operating and environmental conditions.

Measuring configuration

Flexible adjustment to measurement geometry and task

Using different detectors and sources enables us to offer customized solutions that perfectly meet your requirements. Detectors and sources can be combined in various ways and may also be inserted in dip pipes.

Regardless of the measuring configuration and component aging, all systems can compensate for fluctuating temperatures, which guarantees the highest level of accuracy.

Which of the options shown on the right is selected depends on the:

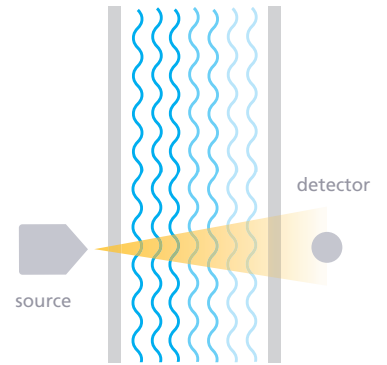
- Measurement geometry
- Accuracy requirements
- Economic aspects

Our experienced sales and application engineers will support you in finding the optimum system configuration.



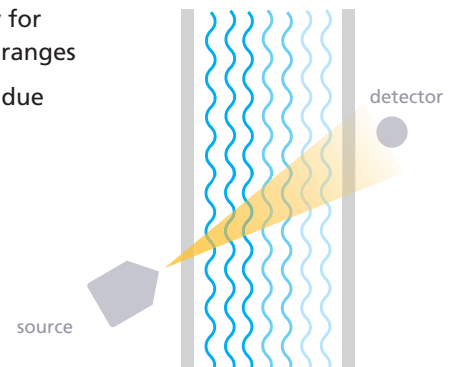
90° irradiation

- Standard solution
- Ideal for large pipe diameters and major density fluctuations
- Easy installation due to preassembled mounting device
- Lowest activities possible



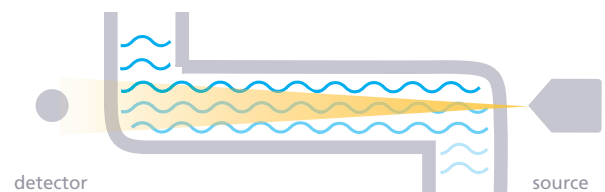
30° or 45° oblique irradiation

- Highest accuracy for small measuring ranges
- Easy installation due to preassembled mounting device



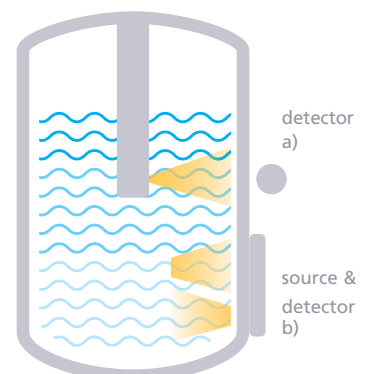
S- or U-shaped measuring path

- For the smallest pipe diameters
- For the slightest changes in density
- Optimal adjustment of the measuring path to the measurement task



Vessel measurement

- Transmission measurement with source in dip pipe (a) or backscatter measurement (b)
- Measurement of density profiles
- Optimal adjustment to the measurement task possible



Technologically always one step ahead!

Highest sensitivity

Berthold detectors are particularly sensitive to Gamma radiation. The advantages:

- Increased measurement accuracy and faster response times
- Significantly lower source activity
- Longer service life
- Use of smaller shieldings resulting in lower acquisition and transportation costs for source and shielding
- Low dose rate – less than 1 $\mu\text{Sv/h}$

Unparalleled long-term stability

A measurement that is stable and reliable over many years is an important quality criterion for the selection of radiometric systems. Accordingly, considerable effort was put into the development and optimization of this detector property. Today, we can proudly say that Berthold detectors provide the best long-term stability.

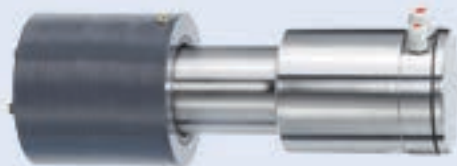
A patented procedure for automatic drift compensation compensates for temperature influence and ensures a high sensitivity and consistent measuring accuracy over the entire lifetime of the system and years of operation without the need for recalibration.

The stability of the CrystalSENS is $\leq 0.002\%$ per $^{\circ}\text{C}$, tested over a temperature range of $-40 \dots +60^{\circ}\text{C}$.



System Overview

Specialists in radiometric density measurements, Berthold supplies a broad range of system families. They differ in scope of service and range of price. Berthold is able to adapt their product range perfectly to the most varied of applications and requirements. This brochure provides information on each system family.



LB 444

- Genuine 2-wire system
- Separate evaluation unit
- Intrinsically safe power supply
- Extra: Inline measuring path for low-energy isotopes

SENSseries LB 480

- Compact field device
- SIL2 and SIL3
- HART interface
- Separate terminal compartment (Ex-e)



UniProbe LB 491

- Compact field device
- HART, Profibus and Fieldbus Foundation
- Extra: Mass flow measurement (e.g. in t/h)

SmartSeries LB 414

- Compact field device
- Local interface (display and operation)
- Perfect for density measurements in non-hazardous areas
- Impressively simple



LB 444

Proven in thousands of applications

[EX]

Using proven control room technology

- The most widely used radiometric detector worldwide
- Ideal for standard and special applications such as concentration measurement and product analysis
- Proven 2-wire system with separate transmitter and intrinsically safe power supply
- Very easy to use and handle
- Ideally suited for applications with limited space requirements due to its compact design
- Highest reliability

Lead collimator provides protection against unwanted background radiation and ensures high reliability and measurement accuracy

Full Ex-i
(intrinsically safe power supply)

Detector and terminal compartment offer increased safety

Slim and lightweight design, ideal for applications in the dip pipe

Stainless steel housing

A variety of scintillator crystals are available for optimum adjustment to the measurement task

Proven in thousands of applications – LB 444

The LB 444 offers proven 2-wire technology with a separate transmitter of the best quality. Over several decades of successful operation, the LB 444 has undergone a number of system optimizations. We have well over 15,000 systems in operation today that impressively

testify to its high industrial standard. Due to its proven technology, the LB 444 is also used successfully in SIL systems. The detector is slim, lightweight, easy to mount and can be used in dip pipes. It is a system that provides unique versatility and reliability.

Separate Transmitter with display



LB 379 Measuring unit for special applications

Due to the use of the low-energy isotope Am-241 or Cm-244, the LB 379 is able to detect elements depending on their atomic number. This way, the concentration can be determined even if the density of the mixture changes only slightly or not at all.

Application examples: %HCl, %H₂SO₄ and %Zn in aqueous solution.

LB 444

Evaluation unit	
Power supply	115/230 V _{AC} , ±10 %, 50 ... 60 Hz, 30 VA 24 V _{DC} (18 ... 32 V _{DC}), 30 W; 24 V _{AC} , +10 %/-15 %, 50 ... 60 Hz, 30 VA
Ambient temperature	Operation: 0 ... +50 °C (+32 ... +122 °F), no condensation Storage: 0 ... +70 °C (+32 ... +158 °F), no condensation
Design	19" module 3 HE, 21 TE, protection type IP20
Installation	19" rack (max. 4 modules), wall housing (max. 2 modules) or switch-board
Menu languages	English, German, French

Detector operating data	
Power supply	Supplied by transmitter via a 2-wire signal cable
Cable connections	1x M16 for cable 4 ... 9 mm 1x M12 for cable 3 ... 6 mm
Maximum cable length	for Berthold cable ID no. 32024, LiYCY-OZ 2 x 1 mm ² : 1000 m other cables: max. 40 Ω, for intrinsically safe installations: L & C to be considered according to certificate.
Wire cross section	0,5 ... 1,5 mm ²
Housing material	Stainless steel ISO 1.4301 / AISI 304
Water cooling	Option (can also be retrofitted), max. 6 bar

	Scintillator size Ø x length [mm]	Weight [kg]	Weight with cooling system [kg]	Collimator
CrystalSENS (Point detectors)	44 x 5 NaI(Tl)	6	8	N.A. (LB 379)
	25 x 25 NaI(Tl)	6	8	Option
	40 x 35 NaI(Tl)	6	8	Option
	50 x 50 NaI(Tl)	18	20	Standard
SuperSENS	150 x 150 polymer	45	54	Standard
Ambient temperature (Operation and storage)	-40 ... +60 °C (-40 ... +140 °F) for NaI(Tl) or -40 ... +55 °C (-40 ... +131 °F) for polymer Observe possible temperature restrictions for Ex- protection!			
Temperature stability	≤0,002 %/°C (-20 ... +50 °C) for NaI(Tl) or ≤0,01 %/°C (-20 ... +50 °C) for Polymer			

Measuring unit LB 379	
material	Stainless steel 1.4571, 1.4401 or 1.4301 (for pipes with lining)
Measurement pipe	DN 65, 10 bar, optional soft rubber or PTFE lining Flange according to DIN 2576 or ASA, threaded connection SC 65 in accordance with DIN 11851
Product temperature	with PTFE coating/without lining: -190 ... +260°C (-310 ... +500°F) with soft rubber: -30 ... +80°C (-22 ... +176°F)

Detector certificates & tests	
IP protection	IP65
Explosion protection	ATEX: II 2 G EEx de IIC T6 -40 ... +73 °C
	II 2 D EEx de IIC T6 IP65 T80 -40 ... +73 °C
	II 2 G EEx ib IIC T6 -20 ... +60 °C
	FM: Class I Division 1 Group A, B, C, D -20 ... +50 °C
	FM: Class II Division 1 Group E, F, G -20 ... +50 °C
CSA: Class I Division 1 Group B, C, D -40 ... +50 °C	
Other certificates	CE, Nepsi, TIIS, Kosha, others on request

Inputs and outputs	
Signal output	0/4 ... 20 mA floating / max. impedance 500 Ω
Digital input	Hold input
Analog input	0/4 ... 20 mA for speed signal at mass flow measurement in the pipeline
Digital outputs	1 relay for collective fault message 2 relays for min. / max. alarm or detector temperature Permissible load at ohmic load: AC: max. 250 V, max. 1 A, max. 200 VA DC: max. 300 V, max. 1 A, max. 60 W
Interfaces	RS 232 for parameter export or PC operation using UNIBERT
Data backup	in non-volatile memory

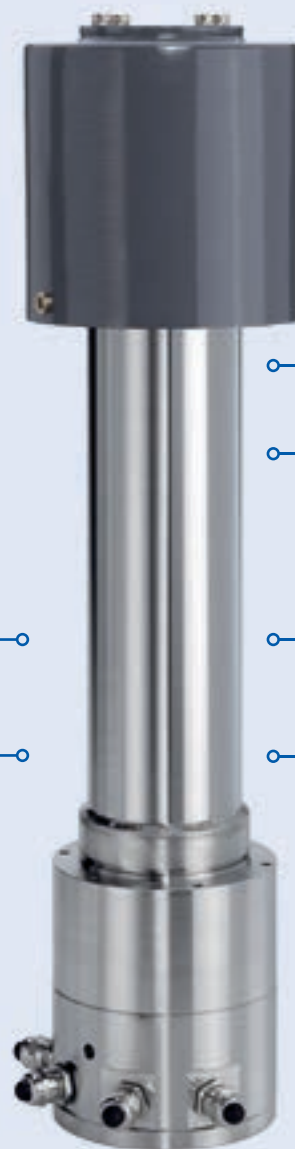
SENSseries LB 480

The best choice for highest demands

[SIL2] [SIL3] [EX]

The best choice for highest demands

- Compact field device with integrated transmitter
- SIL2 and SIL3 certified
- Process connection via HART
- Quick Start menu for effective and fast start-up
- Continuous self monitoring
- High interference immunity (SIL standard)



Monitoring of detector temperature with adjustable max./min. threshold for cooling control

Current output active or passive

Monitored current output

CPU monitoring through watchdog timer

Terminal compartment offering increased safety, easy and safe connection in the field for all four wires

Excellent IP protection: IP65, 66, 67, 68, 69K

Extremely robust design

Continuous water cooling for the entire detector (can also be retrofitted)

Stainless steel housing in 304 or 316L

High durability confirmed in various temperature, shock and vibration tests.



SENSseries LB 480 for critical processes

The SENSseries LB 480 measuring system is especially suited for challenging applications. This is the first radiometric density measuring system to be certified according to SIL2 and SIL3 and features a variety of maintenance-oriented diagnostic functions. For example, the measurement stability is continuously monitored by using the cosmic radiation as a reference measurement. Combined with the unparalleled long-term stability, the SENSseries LB 480 offers the highest level of occupational safety and process reliability. This detector is therefore the best choice especially in safety-critical processes, including oil platforms.

SpeedStar

SpeedStar is used when the speed of the measurement is a crucial issue. Due to the extremely short response time of 50ms, rapid changes such as slugs are detected early, before they reach the production processes downstream.

Quick Start – for a fast and easy start-up

The user-friendly Quick Start menu guides you to an effective start-up in only a few steps. Once the most important measurement parameters (isotope and one calibration point) have been entered, the measurement is available within a very short time. Special functions and supplementary parameters can be added later, if required.

LB 480

Detector operating data

Power supply	100 ... 240 V _{AC} , +/-10 %, 50 ... 60 Hz, 8 VA 24 V _{DC} (18 ... 32 V _{DC}), 8 W			
Cable connections	4 cable entries M20 sealed with dummy plugs Option: Cable glands M20			
Maximum cable length	3300 m (120 Ω), 1600 m (250 Ω), 800 m (500 Ω)			
Wire cross section	0.5 ... 1.5 mm ² (up to 2.5 mm ² without wire-end sleeves)			
Housing material	Stainless steel ISO 1.4301 / AISI 304 (Standard) Stainless steel ISO 1.4404 / AISI 316L option (others on request)			
Water cooling	Option (can also be retrofitted), max. 6 bar			
	Scintillator size Ø x length [mm]	Weight [kg]	Weight with cooling system [kg]	Collimator
CrystalSENS (Point detectors)	50 x 50 NaI(Tl) 40 x 35 NaI(Tl) 25 x 25 NaI(Tl)	11	14,5	Option
SuperSENS	150 x 150 (polymer)	53	63	Standard
Ambient temperature (Operation and storage)	-40 ... +60 °C (-40 ... +140 °F) for NaI(Tl) -40 ... +55 °C (-40 ... +131 °F) for polymer Observe possible temperature restrictions for Ex-protection!			
Temperature stability	≤0,002 %/°C (-40 ... +60 °C) for NaI(Tl)			

Detector certificates & tests

IP protection	IP65 / IP66 / IP67 / IP68 / IP69K			
Explosion protection acc. to ATEX	ATEX: II 2 G Ex db eb IIC T5 / Ex tb IIIC T95 °C -40 °C ... 80 °C II 2 G Ex db eb IIC T6 / Ex tb IIIC T80 °C -40 °C ... 65 °C II 2 G Ex db eb [ia] IIC T6 / Ex tb [ia] IIIC T80 °C -40 °C ... 50 °C			
Vibration / Shock	Vibration: 1.9 g / mech. shock: 30 g according to DIN EN 60068-6 and 60068-2-27			
Functional safety	SIL2 according to IEC 61508, 2-channel SIL3			
Other certificates	CE, IECEx			

Inputs and outputs

Signal output	HART 4 ... 20 mA floating, active or passive, acc. to Namur NE 43 max. impedance: 500 Ω (when active) Resolution better than 0.006 mA Stability +/-0.001 %/°C (-40 ... 60°C) Power supply: 12 V ... 24 V (passive) max. impedance at 12 V: 250 Ω (passive) max. impedance at 24 V: 500 Ω (passive)
Analog input	Pt100 for temperature compensation
Digital outputs	Open Collector optionally for: Max-Alarm, Min-Alarm, warning and error messages, hold signal, radiation interference detection, detector temperature Permissible load at ohmic load: max. 100 mA at 5 ... 36 V _{DC}
Interfaces	RS 485 for software update
Data backup	in non-volatile memory
User interface	Delta V AMS
HART communicator	Simatic PDM

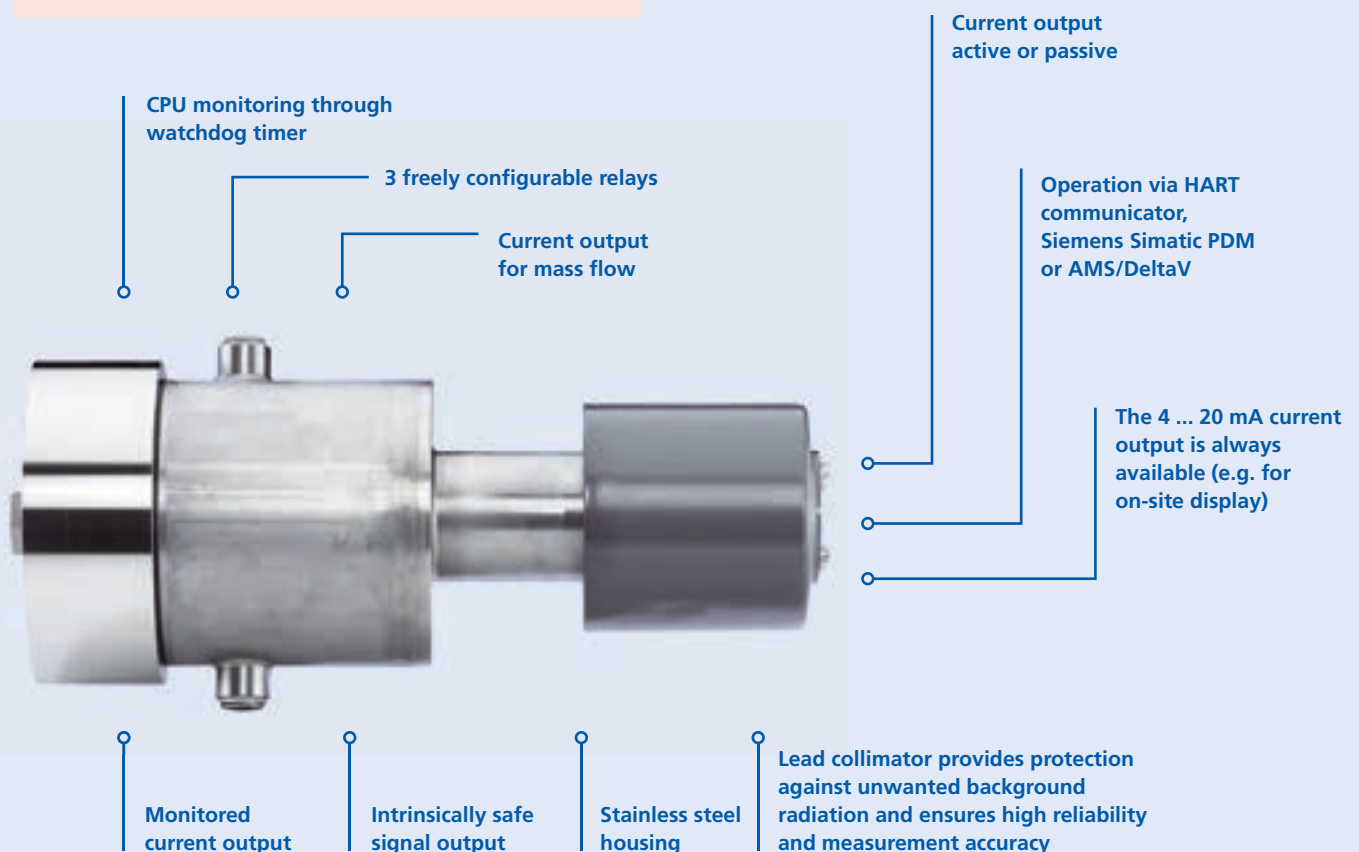
Uni-Probe LB 491

A universal field device for a variety of applications

[EX]

A versatile compact device

- Versatile detector for various applications
- Compact field device with integrated transmitter
- Communication via HART, Foundation Fieldbus or Profibus PA
- Communication can be switched from Bus to HART at any time
- Solid system for standard applications
- Can also be used for mass flow measurements



Robust compact device for high demands

The Uni-Probe LB 491 density measurement system is a proven compact device fitted with a robust stainless steel housing. It is inexpensive, reliable, precise and requires

very little source activity. It features all common communication possibilities such as HART, Profibus PA and Foundation Fieldbus.



Monitored current output

A monitored current output provides you with a high level of safety. It ensures that the correct measured values are displayed. The device constantly compares the actual flowing current with the target value. A failure current is generated if any deviations are detected. A watchdog timer monitors the functionality of the CPU at the same time.

Mass flow

In combination with a flow rate measurement, the Uni-Probe LB 491 can also be used to determine the mass flow rate (t/h). The flow rate signal is directly transferred to the Uni-Probe as a 4-20 mA current signal before being internally offset against the density. The result is a reliable and precise mass flow measurement that combines all the benefits of the non-contacting measurement technology.

LB 491

Detector operating data

Power supply	100 ... 240 V _{AC} ±10 %, 50 ... 60 Hz, 15 VA 24 V _{DC} (18 ... 32 V _{DC}), 15 W; 24 V _{AC} +10 %/-15 %, 50 ... 60 Hz, 15 VA
Cable connections	4 cable entries 3/4" inch, NPT, sealed with dummy plugs Option: metric adapters and cable glands on request
Maximum cable length	3300 m (120 Ω), 1600 m (250 Ω), 800 m (500 Ω)
Wire cross section	0,5 ... 1,5 mm ²
Housing material	Stainless steel ISO 1.4301 / AISI 304
Water cooling	Option, max. 6 bar

	Scintillator size Ø x length [mm]	Weight [kg]	Weight with cooling system [kg]	Collimator
CrystalsENS (Point detectors)	50 x 50 NaI(Tl)	22,5	24	Standard
SuperSENS	150 x 150 polymer	52	62	Standard
Ambient temperature (Operation and storage)	-40 ... +60 °C (-40 ... +140 °F) for NaI(Tl) bzw. -40 ... +55 °C (-40 ... +131 °F) for polymer Observe possible temperature restrictions for Ex-protection! For 100 ... 240 V _{AC} version, operation only up to max. 50 °C			
Temperature stability	≤0,002 %/°C (-40 ... +50 °C) for NaI(Tl) bzw. ≤0,01 %/°C (-40 ... +50 °C) for polymer			

Detector certificates & tests

protection	IP65 / IP66 + Nema 4X		
Explosion protection	ATEX:	II 2 GD EEx d IIB T5 IP66 T100 °C II 2 GD EEx d IIC T6 IP66 T80 °C (... +50 °C with LB 490 TowerSENS and SuperSENS) II 2 GD EEx d [ia] IIC T6 IP66 T80 °C	-40 ... +80 °C -40 ... +60 °C -20 ... +50 °C
	FM/CSA:	Class I Division 1 Group A, B, C, D Class II Division 1, Group E, F, G	-40 ... +50 °C
Other certificates	CE, IECEx, Nepsi, Kosha, CCOE, others on request		

Inputs and outputs

Signal output	HART 4 ... 20 mA floating, active or passive, to Namur NE 43 max. impedance: 500 Ω (when active) Power supply: 12 V ... 24 V (passive) max. impedance at 12 V: 250 Ω or 24 V: 500 Ω (passive) Option: intrinsically safe HART current output 4 ... 20 mA, floating, passive Power supply: 12 ... 30 V, voltage drop <3.5 V, 20 m signal cable (blue), pre-assembled Exi IIB: Lo=14,78 mH; Co=679 nF / Exi IIC: Lo=2,18 mH; Co=84 nF
Bus output - option	Bus interface: Profibus PA or Foundation Fieldbus Bus powered, typically 13 mA with 2xAI function blocks Option: intrinsically safe bus interface, 20 m signal cable (blue) pre-assembled, Approval according to ATEX and FISCO
Digital inputs	Dig In 1: Hold input, Dig In 2: Empty adjustment
Analog input	Pt100 for temperature compensation 0/4 ... 20 mA for speed signal at mass flow measurement in the pipeline
Digital outputs	1 relay (SPDT) for collective fault message 3 relays (SPDT) either for: Hold signal, min./max. alarm, detector temperature, radiation interference detection Permissible load at ohmic load: max. 5 A at 250 V _{AC} or 30 V _{DC}
Interfaces	RS 232 for software update
Data backup	in non-volatile memory
User interface HART Communicator	Delta V AMS Simatic PDM FDT / DTM

SmartSeries LB 414

Smart detector for non-hazardous areas

Simply smart!

- Compact field device with integrated transmitter
- Perfect for density measurements in non-hazardous areas
- Simple and straightforward local display operation
- Process connection via 4-20mA/HART
- No recalibration required
- Impressively simple

Self-diagnosis according to
Namur standard NE 107

Display and control panel
on the detector

Robust design with
stainless steel housing

Guided Quick
Start menu

Modem for
PC connection



Polymer lid with window or stainless
steel lid for extremely hot working
environments

Status LED
according to
NE 107

Process connection via 475 HART
Communicator, Simatic PDM or
AMS/DeltaV



A smart solution for standard tasks

The SmartSeries detectors are the smart solution for density and concentration measurements in non-hazardous areas. Hard and robust – proven by stress tests carried out by the Fraunhofer Institute – this detector is suitable for the toughest work environments, such as in mining, cement production and in the paper industry.

Integrated evaluation and control unit

The system can be operated either through the HART interface or via the device's user interface. All parameters can be entered directly via the local user interface. The operation is simple and intuitive and is effected either via the control elements on the device itself or with the aid of an infrared remote control. Of course, all settings can be performed via a PC. This PC is simply connected through our detector service modem.

LB 414

Detector operating data

Power supply	100 ... 240 V _{AC} ±10 %, 50 ... 60 Hz max. 10 VA 24 V _{DC} , 18 ... 32 V _{DC} max. 8 W
Cable connections	3 cable entries, 1x M20, 2x M16
Maximum cable length	3300 m (120 Ω), 1600 m (250 Ω), 800 m (500 Ω)
Wire cross section	0.5 ... 1.5 mm ² (up to 2.5 mm ² without wire-end sleeves)
Housing material	Stainless steel ISO 1.4301 / AISI 304 (others on request)
Water cooling	Option (can also be retrofitted), max. 6 bar

	Scintillator size Ø x length [mm]	Weight [kg]	Weight with cooling system [kg]	Collimator
CrystalSENS (Point detectors)	50 x 60 polymer 40 x 35 NaI(Tl)	10 10	13,5 13,5	Option Option
Ambient temperature (Operation and storage)	-20 ... +60 °C (-4 ... +140 °F)			
Temperature stability	≤ 0.002 %/°C (-20 ... +50 °C)			

Detector certificates & tests

Environmental tests	IP protection: IP66 / IP67 IEC 60068-2-27 Mechanical shock (30 g) IEC 60068-2-6 Vibration (1.9 g at resonance frequency) IEC 60068-2-38 Temperature and humidity (-10 ... 65°C; >90 %) IEC 60068-2-14 Temperature shock (-45°C ... 65°C in 10 s)
Other certificates	CSA _{US} general area

Inputs and outputs

Signal output	HART 4 ... 20 mA potential-free, active or passive max. impedance: 500 Ω (active) Power supply: 12 V ... 24 V (passive) max. impedance at 12 V: 250 Ω (passive) max. impedance at 24 V: 500 Ω (passive)
Digital output	Relay (SPDT) optionally for: Status indicators, min./max. alarm, Detector temperature Permissible load at ohmic load: max. 5 A or 30 V _{DC}

Software

Measurement application	Density/Concentration: g/cm ³ , kg/m ³ , g/l, SGU, lb/gal, lb/ft ³ , Solids content: % (wt/wt)
User Interfaces	Local User Interface, HART, PC Interface
Data backup	in non-volatile memory

Options and accessories

PC software for parameter setting	
Accessory kit for expanded temperature range	Stainless steel lid and cable glands -40 ... +60 °C (-40 ... +140 °F), with water cooling: -40 ... +100 °C (-40 ... +212 °F)
Accessory kit External communication	M20 adapter and cable for detector service modem or 475 HART Communicator
IR remote control	Infrared remote control for local user interface
Locking	Protects polymer lid from unintended removal

Tough performers noted for their precision



CrystalSENS

Small, compact scintillation detector with particularly high sensitivity and stability despite its small size. Available in various scintillator materials, sodium iodide or polymer, as well as various scintillator sizes. This diversity allows for optimal adjustment of the detector properties to the measurement task, especially in terms of sensitivity, speed, mechanical stability, etc.



SuperSENS

Point detector with extraordinarily high sensitivity and measuring accuracy. Ideally suited for applications that in the past required very high source activities. Perfect for thick-walled pipes and vessels or for large vessel diameters. The extremely large scintillation volume is many times greater than that of conventional detectors resulting in a threefold to fourfold increase of the sensitivity. By using the SuperSENS, the service life of existing sources can be extended for several years.



Inline density meter LB 379

The measuring unit LB 379 combines the radioactive source and the detector in one unit. Its compelling advantage is the use of low-energy isotopes such as Am-241. The LB 379 provides the best accuracy for measurements that involve only minor changes in density.

Due to the low energy (comparable to that of X-rays), the measuring unit can be operated on a licence-free basis in several countries. The system is flanged to the pipeline and is completely made of stainless steel.

Application examples

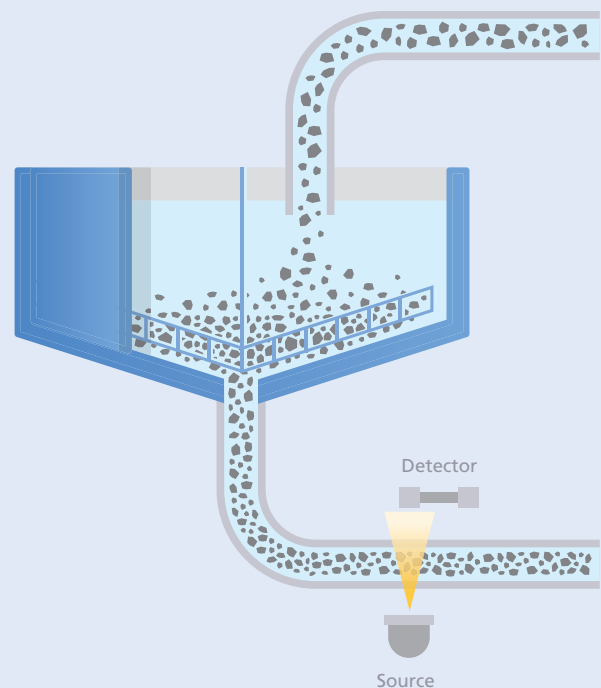
Solids content measurement in the thickener

Mining

Large volume thickening tanks are used in mining to concentrate the ore or minerals contained in sludge. Solids settle on the bottom of the thickener and from there they will be removed from the vessel via an underflow outlet. The sludge leaving the thickener should have a fairly high solids content. However, pumps and pipes can become clogged if too many solids are withdrawn at once.

Solution: Solids content measurement with SmartSeries LB 414

The solids content in the underflow is monitored continuously by the radiometric density measurement SmartSeries LB 414. The robust stainless steel device provides reliable measurements with excellent accuracy and reproducibility over many years. The integrated control panel allows for easy and quick start-up. Measured values are displayed on-site.



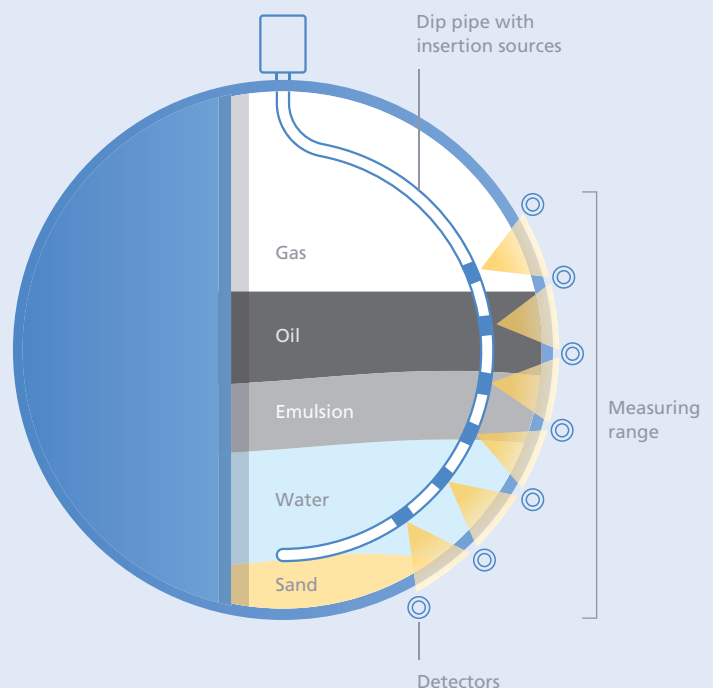
Multiphase level measurement in the separator

Oil and gas production

Due to the density difference, different product layers form in the separator – from bottom to top: Sand, water, emulsion, oil, foam and gas. The density profile is measured via the height of the separator to determine the thickness of the individual product layers.

Solution: Density measurement with SENSseries LB 480

Several density detectors are installed outside the vessel to determine the density distribution over the entire measurement range. The detectors are approved in accordance with SIL2 or SIL3 and operate very stable and safe over the entire operating time. Due to the precise mapping of the separation process, the addition of emulsion breakers can be optimized. In addition, the separation of oil and gas is optimized.



Sources and shieldings

Making special solutions the new standard

Berthold Technologies is a company rich in tradition and the only provider of radiometric measurement technology worldwide with an in-house source production. This opens up unique opportunities for our customers. The sources are manufactured to customer specifications and can be adapted perfectly to the respective application requirements.

Our standard range includes:

- Point and rod sources
- Dip pipe sources for installation in a vessel
- Various isotopes such as Cs-137, Am-241, Co-60 or Cm-244
- Various, often customized shieldings, from materials such as lead, tungsten or stainless steel

This diversity enables us to always choose isotopes and shieldings that represent the most cost-efficient solution for the respective application while ensuring the best measurement result at minimum radiation exposure. We will be happy to design special solutions for your special applications. **Please contact us.**



Maximum safety

The SSC source capsules made by Berthold have been tested according to ISO 2919 and exceed even the highest classification C66646. They are extremely robust and withstand temperatures up to 1200°C. The triple encapsulation of the isotope ensures maximum safety even in extreme measurement environments.

Radioactive isotopes

Isotope	Energy	Half-life	Application
Cs-137	660 keV	~ 30 years	Industry standard
Co-60	1200 keV	~ 5 years	Ideal when thick steel walls or large distances have to be irradiated
Am-241	60 keV	~ 430 years	Measures low differences in density or even individual elements in the mixtures of substances

Tailor-made – the best solution for your needs

Sources and shieldings are individually designed by our project engineers for each application. The measurement is designed in such a way that only the source activity that is actually needed will be used and, at the same time, a long service life of the source is guaranteed. For example, Co-60 can be used for more than 10 years without having to replace the source. Thanks to the high sensitivity of our detectors, the source activity in Berthold systems is significantly lower than that of other systems available on the market. A dose rate of less than 1 µSv/h is typically sufficient to perform reliable density measurements.

Levels of radiation?

Radiation	
Flight Frankfurt – New York	60 µSv
Chest X-ray	100 µSv
Living at 1600 m above sea level	1200 µSv/a
Berthold measurement (pipe is empty)	1 µSv/h

Competence in radiation protection

Every company working with radiometric measurements is automatically faced with the issue of radiation protection. Therefore, it is good to have a team of in-house experts on this matter. Our experts in the Radiation Protection division deal with the tasks related to dose rate measurement. The transfer of knowledge is direct and synergies are to your benefit. We at Berthold take special responsibility when it comes to training our customers. We offer training and workshops for Radiation Safety Officers.

Project-specific calculation of the source activity according to the ALARA principle

Small in size and with best shielding effect

Use of various isotopes:
Cs-137, Am-241, Co-60,
Cm-244

Various options available

Maximum safety due to the use of extremely temperature and corrosion resistant source capsules

Use of various shielding materials such as lead, tungsten or stainless steel



In-house production facility for sources allows customer-specific manufacturing and individual designs

Custom-made solutions based on diversity and experience



- Unique and comprehensive range of „modular systems“
- Wide range of proven components
- Optimum system configuration by using different isotopes
- Highly sensitive detectors for lowest source activities
- Huge variety of communication standards and certificates
- More than 800 man-years of development experience
- Well over 20,000 Berthold systems operating worldwide

Berthold is unparalleled when it comes to developing custom-made solutions that exactly meet the requirements of your measurement task. Moreover, we offer even further benefits that are not listed in your specifications.

Highest measuring accuracy combined with lowest source activities and a great variety of communication standards make our measurement systems unique. In addition, our „Berthold modular system“ includes both control room devices and compact devices.

Whatever measurement task you are facing – we can offer you the best solution.

	LB 444	SENSseries LB 480	Uni-Probe LB 491	SmartSeries LB 414
Communication standards				
4-20mA	•	•	•	•
HART		•	•	•
Foundation Fieldbus			•	
Profibus PA			•	
Explosion protection				
ATEX	•	•	•	
Intrinsically safe signal output	•	•	•	
Intrinsically safe power supply	•			
FM/CSA	•	•	•	
IECEX		•	•	
Functional safety				
SIL2/3		•		
Detector versions				
CrystalSENS NaI	•	•	•	•
CrystalSENS Polymer				•
SuperSENS	•	•	•	
Measuring unit LB 379	•			
Features				
Quick Start		•		•
Mass flow measurement			•	
Monitored current output		•	•	
Compensation of product temperature	•	•	•	
Operation and parameter settings				
Separate transmitter	•			
Local interface	•			•
PC software	•	•		•



We are there for you! Worldwide.

Our sales engineers are looking forward to your request. Regardless of what you want to measure or where the measurement is taking place, we will provide you with the right system for each measurement task and we know how to configure it so that it perfectly suits your needs. From a wide variety of possible options, our application engineers will choose the right one for you.

With over 60 years of experience, a team of 350 employees worldwide and product innovations that set technical standards, we see ourselves as the experts for radiometric measurement solutions.

All our products are designed and manufactured in Germany. At Berthold, you will always get quality products „made in Germany“.

BERTHOLD TECHNOLOGIES' PERFECT SOLUTIONS FROM A SINGLE SOURCE.

Berthold Technologies' engineers and service technicians are always there when you need them. Our global network of offices ensures fast and above all very competent assistance in case you need any. No matter where your production site is located, our qualified personnel will be with you in no time at all.

You can take our word for it.

DASTEC S.R.L.

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