

# BULK FLOW MEASUREMENT

Reliable measurement on all kinds of conveying systems



# Bulk flow measurements from Berthold

Berthold's radiometric belt scales measure flow rates of bulk materials, throughput and mass flow. The non-contacting weighing systems are used in numerous industries, such as mining, building materials, power generating or pulp & paper industry. The measurement can be performed on all conveyor systems. Often, it is the only method to determine the flow rate reliably. Our measuring systems are particularly suitable for the monitoring of loading, dosing and mixing processes, as well as for production and output control.

## We measure

- current flow rate
- total solid mass (tonnage)
- batch processes

The belt scales can measure anything from granulates up to large pieces of rock, but also powders and liquids. The typical measuring range is between 100 kg/h and 1000 t/h.



## Non-contact – Perfect!

No drift, no recalibration – dirt or encrustations affect the measurement no more than wind, vibrations, dust, fluctuations in the belt tension and varying bulk densities. Subsequent installation on existing conveyor systems is another noteworthy advantage. Setting the system up is so easy and after commissioning, our systems work highly accurate and maintenance-free for years, with unmatched repeatability of  $\pm 1\%$ .

## A lot of benefits

- Online monitoring on all conveyor systems – even where conventional technologies cannot be employed
- Compliance with delivery/production schedule
- Optimal utilization of load capacities
- Optimum addition of raw materials in mixing processes
- Very reliable measurement
- No frequent recalibration and cleaning

## Extraordinary advantages for best solutions

With their unique and comprehensive range of “modular systems”, Berthold, like no other supplier, is able to design tailor-made systems that precisely match your measuring task. In addition, we offer benefits that go beyond your specification and make the difference.

- Best detector technology
- Accuracy 2-3% of measuring range
- Repeatability  $\pm 1\%$
- Highly sensitive detectors that allow minimal source activity
- Expertise and long-standing experience. For all applications, we adapt the measuring arrangement, the isotope and the source activity to the respective measuring task.
- On request, we can offer customer-specific turn-key solutions consisting of:
  - Measurement components
  - Mounting frame
  - Speed measurement
- Over 2000 systems successfully in operation worldwide

## The measuring principle

Material is transported through a field of gamma radiation, similar to a light curtain. The radiation is attenuated as it passed through the material. A scintillation detector now detects the attenuated radiation. The extent to which the radiation is attenuated depends on the mass per unit area (density x area). In combination with the conveying speed, the exact throughput in kg/h or t/h can be determined.



Bulk flow measurement on a screw conveyor

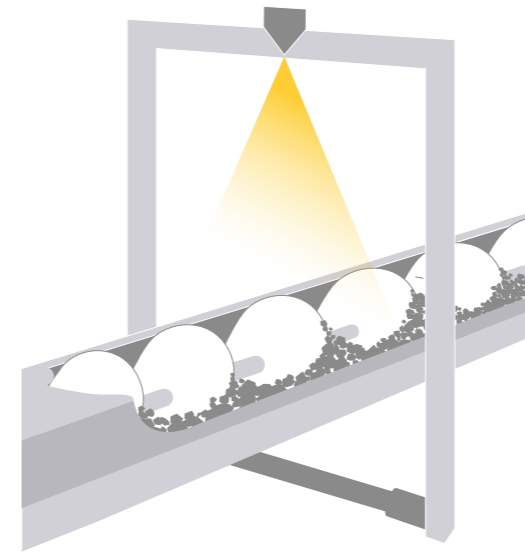


## Where we measure

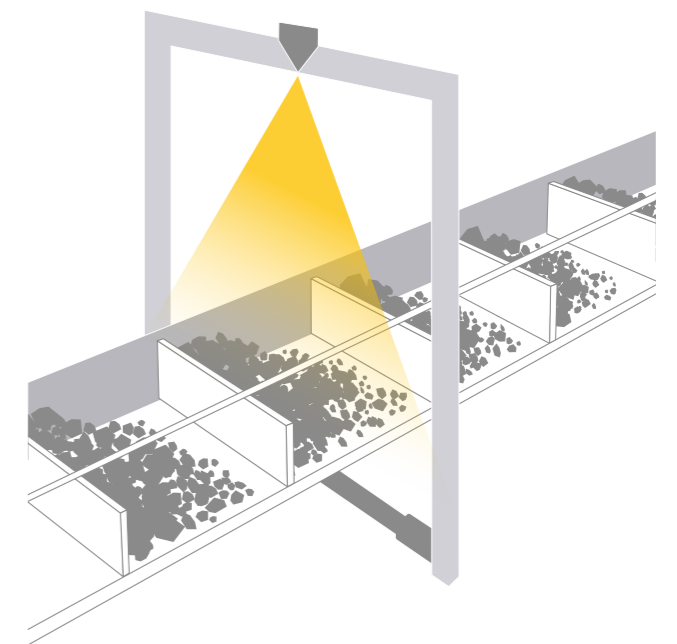
Since radiometric bulk flow and throughput measurements are contactless systems, they can be used on all kinds of conveyors. It is also possible to measure free-falling bulk materials and pneumatically conveyed materials.



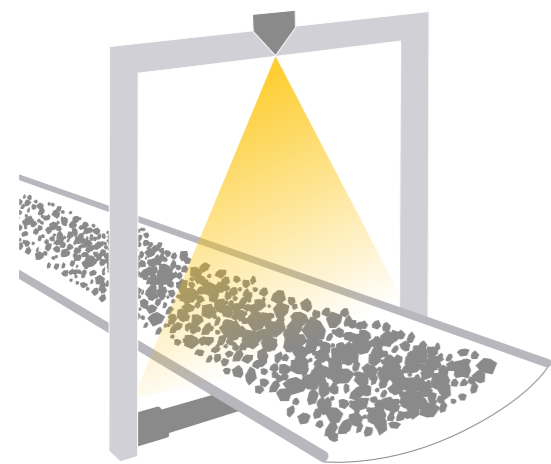
Screw conveyors



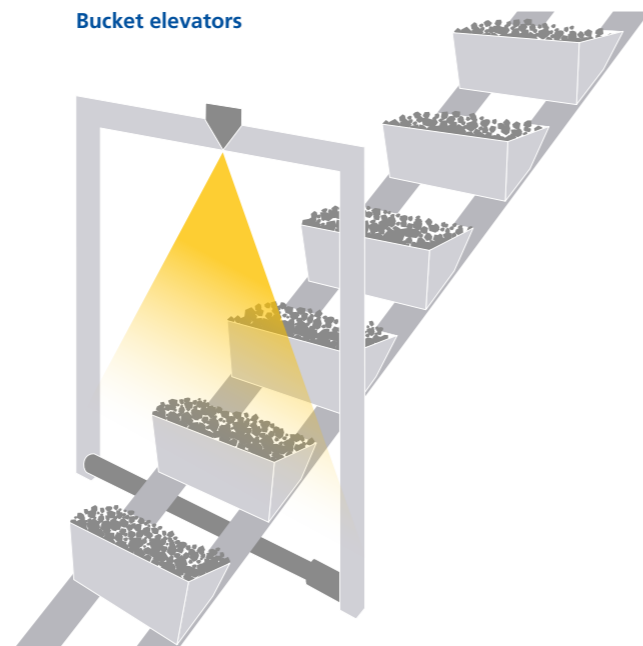
Drag chain conveyors



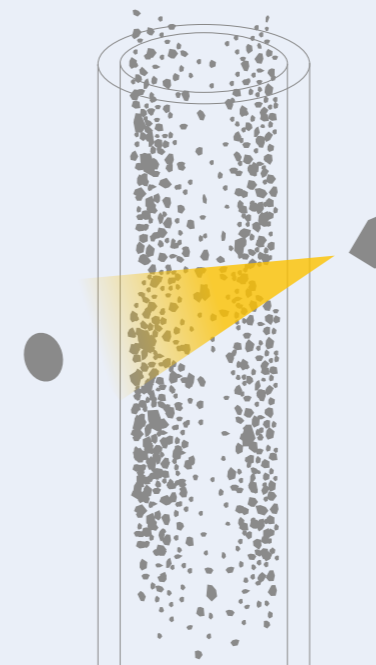
Conveyor belts



Bucket elevators



Pipeline



### Mass flow measurement

- Non-contacting mass flow measurement as a simple clamp-on solution.
- No installations in the pipe, no disturbance of the material flow.
- For liquids of all kinds, ideal for suspensions and slurries.
- Usually, the offsetting with the speed signal takes place in the transmitter.
- At customer's request, the solids concentration can be indicated on its own and the calculation of the mass flow takes place in the control room.

# DuoSeries Transmitter LB 472

The specialist for bulk flow measurements



## A powerful tool

- Easy handling thanks to advanced touch panel
- Simplified calibration
- Proven 2-wire technology, no additional power cable required in the field
- Valuable diagnostic functions and self-monitoring (SIL standard)

Stainless steel housing

Input for speed signal

Monitored current output for maximum reliability

Display options:  
Current flow rate  
Total solid mass (tonnage)  
Batch process



Terminal compartment with increased safety (Ex-e)

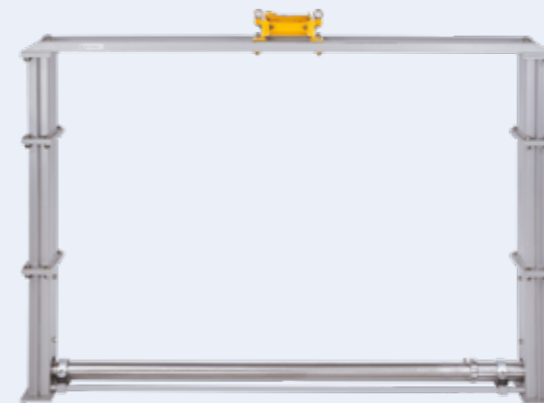
3.5" TFT touch panel for simplest operation

## Intuitive operation

The transmitter provides a local display of measurement values as well as on-site operation via the integrated touch panel. Valuable diagnostic functions and self-monitoring ensure increased reliability and availability of the measurement. Users also benefit from new service features (e.g. data log), which can be accessed remotely, via Ethernet or USB interface.

## Customized

On request, we supply the components together with a special mounting frame for installation of the detector and shield. The robust steel frame is optimized in terms of radiation protection and stability and ensures a reliable measurement.



## LB 472

Transmitter	
Power supply	100 ... 240 V <sub>AC</sub> ±10%, 50 ... 60 Hz, 22 VA (Master) or 6 VA (Slave) 24 V <sub>DC</sub> (18 ... 32 V <sub>DC</sub> ), 15 W (Master) or 5 W (Slave)
Ambient temperature	Operation: -20 ... +50 °C (-4 ... +122 °F), cabinet max. 40 °C Storage: -20 ... +85 °C (-4 ... +185 °F) No condensation for operation and storage
Design	19" module 3 HE, 21 TE, protection type IP 20
Installation	In wall-mounted cabinet or 19" rack

Detector operating data	
Power supply	Supplied by transmitter via 2-wire signal cable
Cable connections	1x M16 for cable 4 ... 9 mm 1x M12 for cable 3 ... 6 mm
Maximum cable length	with Berthold cable ID no. 32024, LiYCY-OZ 2x1 mm <sup>2</sup> : 1000 m Other cables: max. 40 Ω, For intrinsically safe installations: L & C according to certificate.
Wire cross section	0.75 ... 2.5 mm <sup>2</sup>
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 50 NaI(Tl)	9	12	Option
	50 x 60 Polymer	9	12	Option
UniSENS (Rod detectors)	50 x 500 Polymer	13	19	Option
	50 x 1000 Polymer	17	27	Option
	50 x 1500 Polymer	23	36	Option
	50 x 2000 Polymer	27	43	Option
Ambient temperature (operation and storage)	-40 ... +60 °C (-40 ... +140 °F) Observe possible temperature restrictions for explosion protection!			
Temperature stability	≤0,002%/°C (-40 ... +60 °C) with CrystalSENS or ≤0,01%/°C (-40 ... +60 °C) with UniSENS			

Detector approvals & tests	
IP protection	IP 66 / IP 67
Explosion protection	ATEX / IECEx: II 2 G Ex db eb IIC T1-T5 (T6) -40 ... +80 °C (+75 °C) II 2 G Ex db [ib] IIC T1-T5 (T6) -40 ... +80 °C (+75 °C) II 2 D Ex tb IIIC T85°C -40 ... +80 °C II 2 D Ex tb [ib] IIIC T85°C -40 ... +80 °C
Other certificates	US / Canada: according to Class Division (CSA) and Zones

Inputs and outputs	
Signal output	0/4 ... 20 mA potential-free / max. impedance 500 Ω
Digital input	2 inputs, configurable for hold, external tare and product changeover
Analog input	Pulse input or 0/4 ... 20 mA for speed signal
Digital outputs	1 relay (SPDT) for failure event 2 relays for mass counter, tare, hold, and other alarm functions Load resistance at ohmic load: max. 30 VAC, 46 VDC, max. 1 A
Data backup	in non-volatile memory
Menu languages	English, German, French, Spanish, Italian, Portuguese, Russian, Chinese, Korean, Finnish, Romanian, Serbian, Bulgarian others on request

Accessories	
Set of cable glands exp. temperature range	Cable glands made of metal -40 ... +60 °C (-40 ... +140 °F) With water cooling: -40 ... +100 °C (-40 ... +212 °F)
Detector Service Modem	For operation via PC

# Sources and shields

Where custom solutions become the new standard



- Project-specific calculation of the source activity according to the ALARA principle
- Customized manufacturing and individual designs
- Different exit angles for the radiation
- Extremely heat-resistant

Berthold is the only radiometry provider in the world with their own source production. This opens up unique opportunities for us and our customers. The sources are manufactured customer-specific and can therefore be optimally adapted to the respective application requirements. The result is cost-optimized solutions that achieve the best measurement performance at minimum radiation exposure.

- Small in size and with best shielding effect
- Version as point source or rod source
- Use of various isotopes: Cs-137, Co-60, Am-241

## 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 measuring environments. Our shields comply with the international standards:

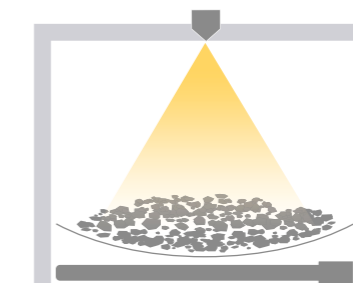
- ANSI 43.8
- ISO 7205
- IEC 62598

## 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 readily available in-house experts. 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.

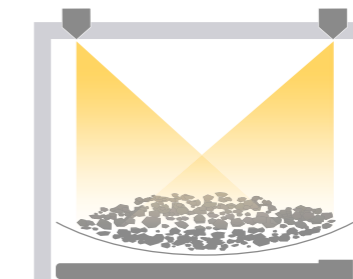


Customized solutions, which perfectly meet the given requirements; realized by the use of various detectors, sources and mounting solutions.



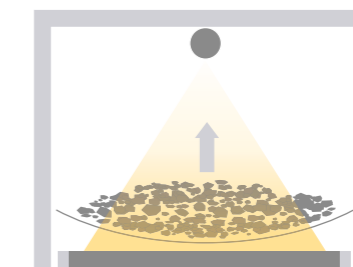
### Cs-137 point source with rod detector

- Standard solution
- For small loads
- Low transport costs
- Economical



### Two Cs-137 point sources with rod detector

- Ideal for very wide conveying systems
- Closely collimated beam
- Highest detector sensitivity
- Low source activity



### Co-60 rod source with point detector

- Ideal for large loading heights or very high bulk density
- Low source activity
- Best accuracy and measurement stability

## Small input, big impact

## Processes safely under control – some examples



Mass flow measurement on a pipeline, installed on a dredger

### Calibration

By entering theoretical values, an initial and quick calibration can be carried out. Maximum accuracy is achieved when comparative values from a reference scale are entered into the system, e.g. a truck weighing machine.

### Easy commissioning

First step is a tare calibration, followed by the measurement of sample batches with a calibrated weighing system. Based on the obtained data pairs, the transmitter calculates the calibration coefficients automatically. The achievable accuracy depends on the averaging time and the accuracy of the reference method. The stability of the measurement can be checked by means of a reference body put in front of the detector.

### Measuring mass flow in coal gasification processes

Synthetic gas is generated from coal in a gasification reactor. Strict monitoring of coal feed is of particular importance since overdosing can be a major safety risk. Berthold's radiometric mass flow measurement monitors the pneumatically conveyed quantity of fluidized coal at the reactor inlet pipes. The high repeatability and long-term stability of the measurement thus guarantees a safe process.

### Non-contact flow rate measurement on:

- Ash
- Biomass
- Clinker
- Coal
- Grain
- Limestone
- Logs
- Mud
- Ore
- Plastic granulate
- Recycled Paper
- Salt
- Sand
- Sugar beets
- Urea granulates
- Wood chips / pellets
- Wood panels



### Monitoring truck loading

The subsequent installation of a radiometric bulk flow measurement enabled one of our customers from the building materials industry to load trucks more efficiently. In the past, the trucks were only 90% loaded, not to risk exceeding the permissible total weight. Thanks to our radiometric measurement, about 10 truckloads a month can be avoided – a tremendous result in terms of cost reduction and environmental protection.



## 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)

