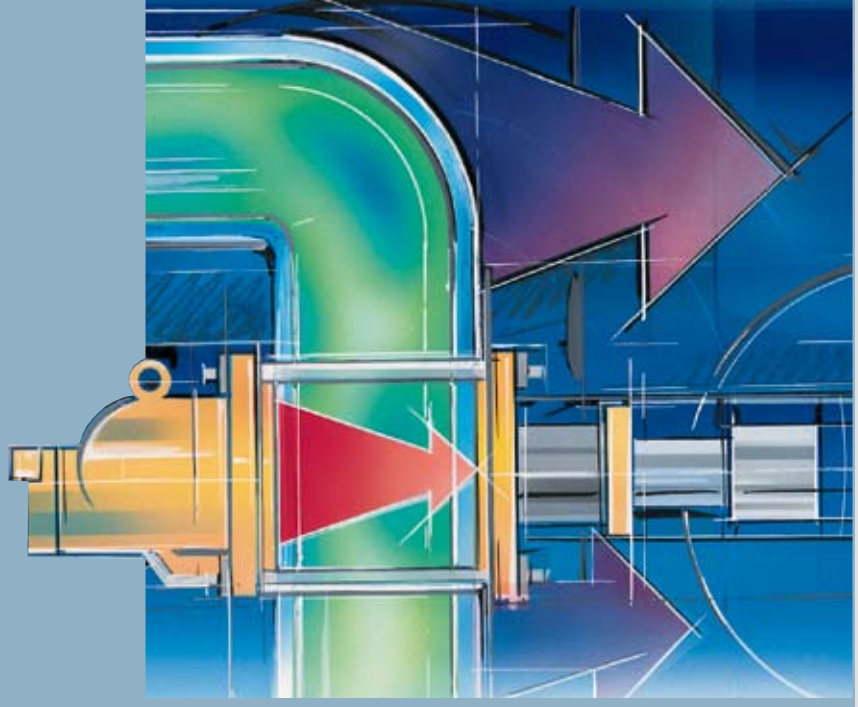


Uni-Probe LB 491

Determination of Density and Concentration

PROCESS CONTROL

BERTHOLD TECHNOLOGIES

Determining density and concentration using the

Uni-Probe LB 491

The measuring system LB 491 is used for contactless, continuous measurements of **liquids, slurries or bulk materials** in pipes and vessels.
It can easily be installed on existing pipelines without down time. It works reliably and is not affected by colour, temperature, pressure or chemical properties of the product to be measured.

Applications

■

Concentration measurements of acids, alkalis, saline solutions and suspensions.

■

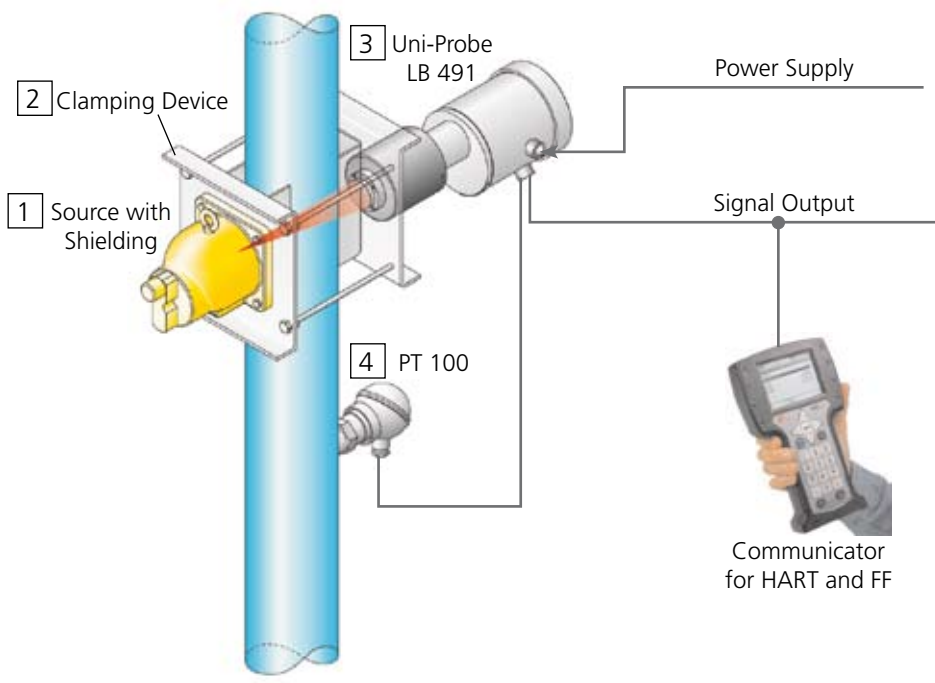
Crystallisation and polymerisation monitoring.

■

Measurement of the solid matter content in slurry, in flue gas desulphurisation suspensions, in aluminium production and in mining.

■

Determination of the bulk density in washing powder and clinker.



Process Control System

typical arrangement of the measuring system

Measuring Principle The gamma radiation emitted by a source is attenuated when it passes through matter. The extent to which it is attenuated depends on the measuring path and on the density of the product. Given a constant distance in the measuring path, radiation absorption is a function of the density of the material being measured.

Measuring Arrangement The measuring system consists of the source with shielding [1], a clamping device [2] and the Uni-Probe LB 491 [3].

The Uni-Probe LB 491 contains a scintillation counter with NaI crystal and evaluation unit in one housing.

Installation Installation is carried out without pipeline modification or production downtime.

Both the shielding and the detector can be mounted on the outside of the pipe, using our clamping devices with 90°, 45°, 30° irradiation angles.

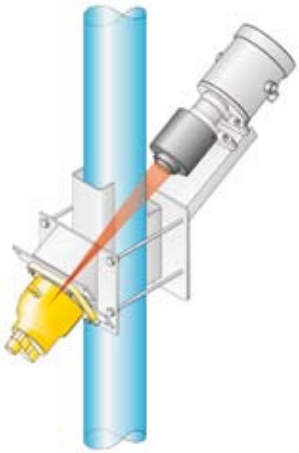
A S- or U-shaped measuring path is used for more precise measurements with small pipe diameters, .

Temperature variations in the product can be compensated by a RTD Pt 100 [4] or a 4-20 mA temperature signal.

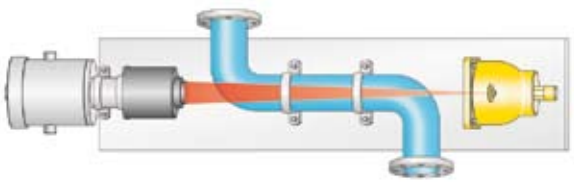
Applications

- Chemical Industry
- Mining
- Food Industry
- Dredgers

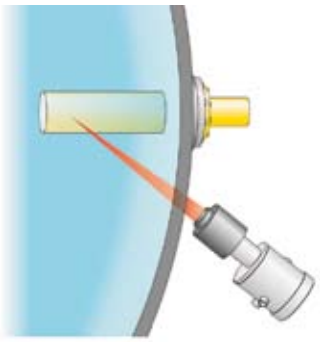
General Arrangements



45° or 30° arrangement



S- or U- shaped measuring pipe

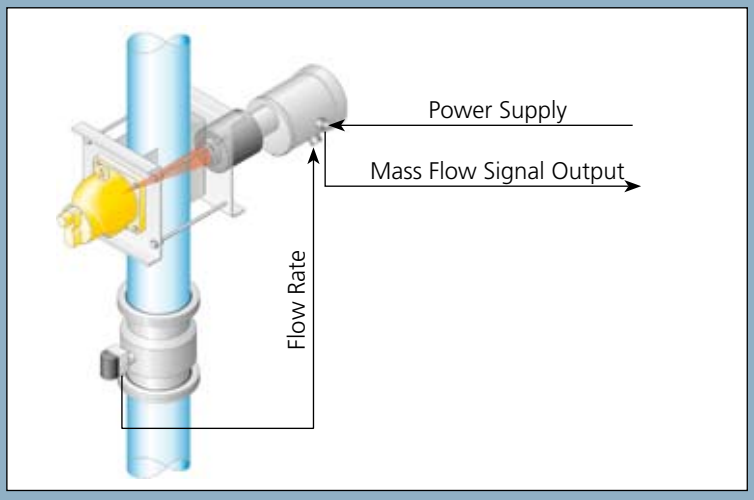


measurement in a vessel

Mass Flow Measurement

The mass flow measurement (t/h) requires the information about the product flow rate in the pipe, as well as the density value. For liquids a volume flow meter can be used. The 4-20 mA flow rate signal can directly transferred to the Uni-Probe LB 491.

In a similar way you also can measure the density and the mass flow of pneumatic conveyed bulk materials.



Communication

The Uni-Probe can be equipped with following interfaces:

- HART (standard)
- Profibus PA (option)
- Foundation Fieldbus (option)

Systems with Profibus or Foundation Fieldbus can alternatively be switched to HART communication. The 4-20 mA current output signal is always available.

For communication and parameter setting the following user interfaces are available.

HART

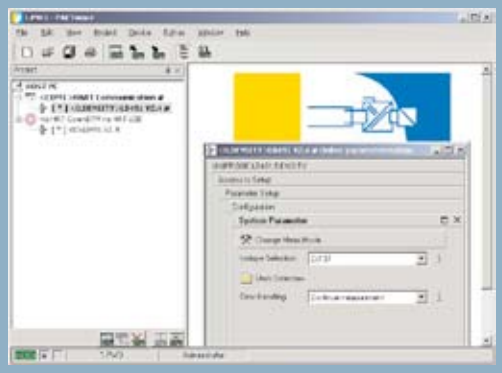
- Commercial HART Communicator
- DTM for FDT
- Siemens Simatic PDM

Profibus PA

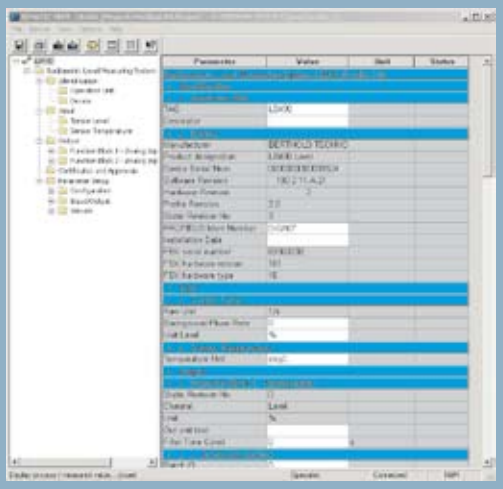
- Siemens Simatic PDM
- Alternative also via HART

Foundation Fieldbus (FF)

- Communicator 375 (Emerson Process)
- DCS
- Alternative also via HART



DTM for HART



Siemens Simatic PDM for HART and Profibus

Foundation Fieldbus

Measurement-Components

Uni-Probe The Uni-Probe LB 491 is a scintillation counter with NaI crystal. Photo flashes are produced in the crystal by gamma radiation. The number of flashes is proportional to the intensity of the radiation field. The crystal is optically linked to a photo multiplier which, together with the electronics, converts the photo-flashes into electrical impulses. In comparison with other detector technologies (such as ionisation chambers), the advantages are:

- high sensitivity to gamma radiation
- therefore lower source activity
- higher temperature stability
- longer service life

The higher temperature stability is additionally optimised by a electronic control loop. This control loop provides an excellent drift stability even for small measuring ranges. Any possible long-term drift by aging is also compensated by this control loop.

The compact shape of the sensitive part of the detector - the crystal - combined with a lead shielding reduces measurement errors caused by fluctuations of background radiation.

Source with Shielding All radioactive sources in industrial application are tightly encapsulated in stainless steel , keeping the radioactive substance separate and isolated from the material being measured. In most cases, a Cs-137 radiation source is used, although Co-60 and Am-241 sources can be used in special applications.

The sources are built into sturdy shieldings which possess a lockable shutter for the active beam that is directed toward the detector. The shielding is adapted to the required activity so that operation personnel are never exposed to any excessive radiation levels. An activation of the product being measured is impossible.

Many other types of shieldings are available from BERTHOLD TECHNOLOGIES for measurements in tanks or vessels and for most industrial processes.

Project Engineering In order to realize the full benefits offered by radiometric measurements the particular conditions of the production process must be taken into account. This ensures optimum operational safety and the lowest source activity consistent with accuracy.

Relevant engineering data should therefore be provided, as follows.

Engineering Data

- **density range**
- **product temperature range**
- **external diameter of the pipe, wall and material thickness, lining (if any)**
- **required accuracy**
- **for suspensions: solid matter density liquid density, min./max. density,**
- **for liquids: measuring range in g/cm³, min./max. concentration, chemical formula (if possible)**
- **reference to possible gas inclusions at the measuring point**
- **ambient temperature at the detector**

Technical Data LB 491

Operating Data	
Power Supply	95 … 250 VAC, 50 … 60 Hz, 15 VA alternative: 18 … 32 VDC / 24 VAC +10 % / –15 %, 15 W
Storage Temperature	–40 … +60 °C (–40 … +140 °F)
Operating Temperature	–40 … +50 °C (–40 … +122 °F)

Electronic	
CPU	– data storage in EEPROM or FRAM – self monitoring by watchdog timer – continuous hardware monitoring

Signal Output (HART, Field- or Profibus)	
HART	HART current output 0/4 … 20 mA, isolated alternative: active or passive max. impedance: 500 Ohm (at active) 12 V … 24 V (at passive) max. impedance at 12 V: 250 Ohm (at passive) max. impedance at 24 V: 500 Ohm (at passive) cont. monitored current output (patent pending)
Option:	second current output for e.g. mass flow signal 0/4 … 20 mA, isolated
Option:	intrinsically safe HART current output 0/4 … 20 mA, isolated, passive power supply: 12 … 30 V, voltage drop < 3.5 V, 20 m signal cable (blue), pre-assembled, Ci 3.36 nF, Li 13.65 H
Profibus PA	interface for Profibus PA Bus powered, typical 13 mA with 5xAI and 2xAO function blocks 0/4 ... 20 mA analogue output useable in parallel, e.g. for field indicator communication selectable between Profibus PA and HART
Option:	intrinsically safe Profibus PA interface, 20 m signal cable (blue), pre-assembled approvals according ATEX, and FISCO
Foundation Fieldbus	interface for Foundation Fieldbus Bus powered, typical 13 mA with 5xAI and 2xAO function blocks 0/4 ... 20 mA analogue output useable in parallel, e.g. for field indicator communication selectable between Foundation Fieldbus and HART
Option:	intrinsically safe Foundation Fieldbus Interface, 20 m signal cable (blue), pre-assembled approvals according ATEX, and FISCO

More In- and Outputs	
1 Digital Input	Hold Signal
1 Relay Contact SPDT	Error Signal max. 5 A at 250 VAC or 30 VDC
3 Relay Contacts SPDT	alternatively for: – Hold Signal – Max. Alarm – Min. Alarm – Detector Temperature – Radiation Interference max. 5 A at 250 VAC or 30 VDC
Pt 100	for temperature compensation, isolated
Analogue Input (Option)	4 … 20 mA, for flow rate (mass flow measurement), or for temperature compensation, isolated
RS232	for software update

Cable Connections	
Fittings	4, each ¾ inch NPT
Option	Adapter ¾ inch NPT to metric M20 other adaptors on request
Wire Cross Section	max. 1.5 mm²
Cable Glands	on request

Point Detectors	
Scintillator	50/50 NaI crystal
Housing	stainless steel 1.4301 / 304
Weight	22.5 kg (23 kg with water cooling)
Temp. Stability	± 0.1 %
Water Cooling	Option
Typical Dose Rate	0.5 µSv/h (0.05 mrem/h) for 300 cps

Certificates

Explosion Protection		
Class		Operating Temp.
ATEX	II 2 GD EEx d IIB/IIC T6 IP 66 T80°C	–40 … +50 °C (–40 … +122 °F)
FM/CSA	Class I, Division 1, Group A, B, C, D Class II, Division 1, Group E, F, G Nema 4X	
Optional:	intrinsically safe signal output ATEX II 2(1) GD EEx d [ia] IIB/IIC T6 IP 66 T80°C	–20 … +50 °C (–4 … +122 °F)
NEPSI	Ex d IIC T6 DIP A21 T_A, T6	–40 … +50 °C (–40 … +122 °F)

Sources and shieldings see separate leaflet.
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