Uni-Probe LB 490

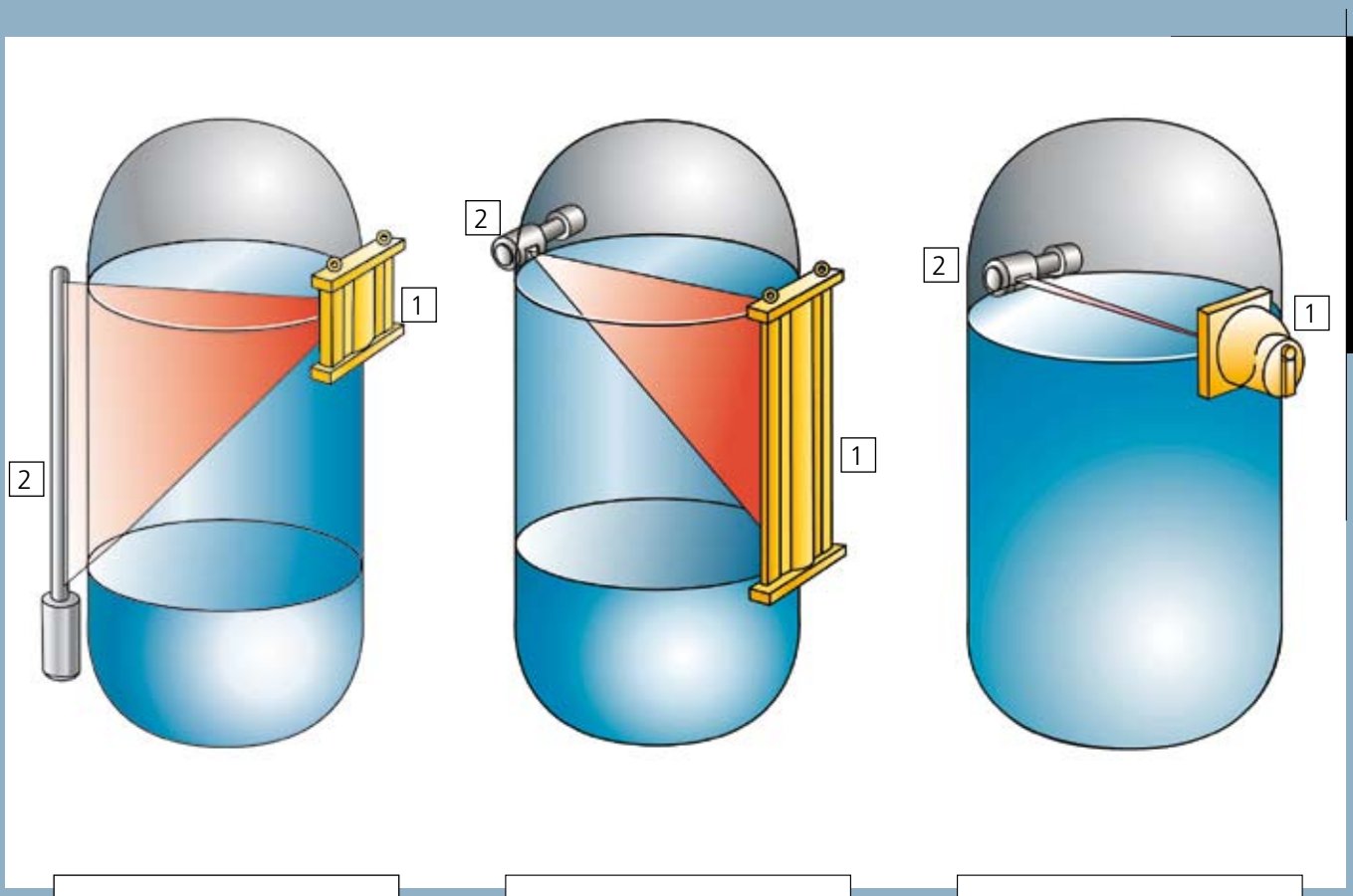
Non-Contact Level Measurement

PROCESS CONTROL

BERTHOLD TECHNOLOGIES

Level Gauge LB 490

The measuring system **LB 490** is used for the contactless continuous measurement of liquids and bulk materials in reactors, vessels and bunkers. The measurement is not affected by the chemical and physical properties of the product being measured. The level measurement is adapted to the specific geometry of the vessel.



Rod Detector and Point Source

Point Detector and Rod Source

Level Switch

Figures above show schematic layouts of typical measuring arrangements, comprising the source 1 mounted on the outside of the container, and the Uni-Probe 2. Source and Uni-Probe have to form a radiation field corresponding to the size of the measuring range. The Uni-Probe is available as a point detector or as a rod detector.

Continuous Level Measurement

There are three basic configurations with which a continuous level measurement can be performed:

1. Rod Detector and Point Source
2. Point Detector and Rod Source
3. Rod Detector and Rod Source

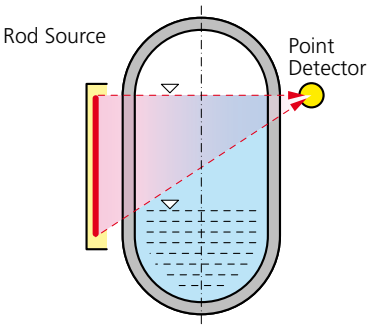
The selection of an option depends on:

- the measuring geometry
- the measuring task
- ambient factors
- considerations of space and money

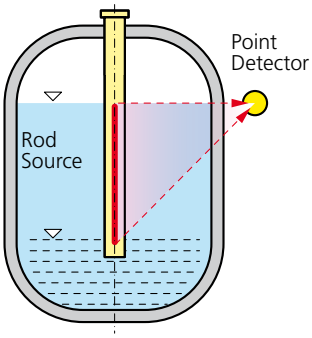
Measuring Method If the level rises in the range of the radiation field, the product being measured attenuates the radiation. The radiation intensity which is measured by the Uni-Probe is displayed as a level signal.

General Arrangements

Rod Source Arrangements

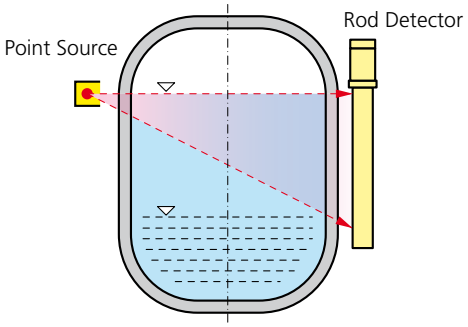


Standard



on thick-walled vessels, only one wall has to be irradiated

Rod Detector Arrangements



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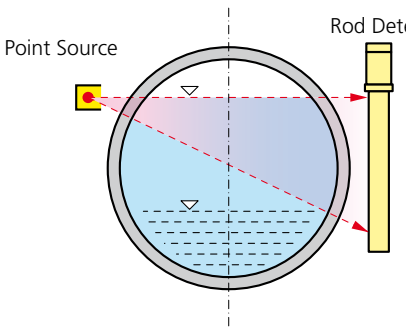
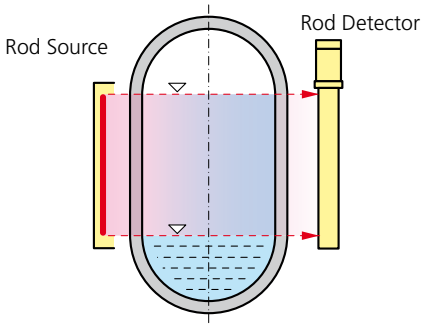
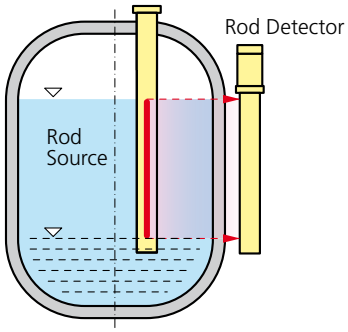


on cylindrical, horizontal vessels

Rod Source with Rod Detector Arrangement



for low source activities

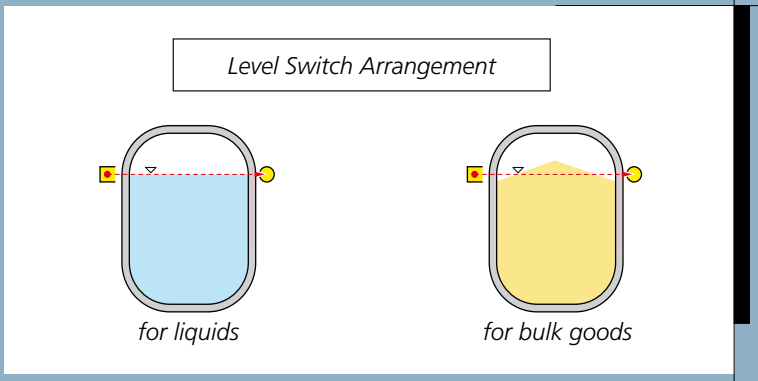


for thick-walled vessels and for interface measurements

Level Switch

The limit switch value can be measured using a point source and a point detector.

When measuring bulk goods, the switch point can be set to a defined material level.



Communication

The Uni-Probe can be equipped with the 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.

The following user interfaces are available for communication and parameter settings.

HART

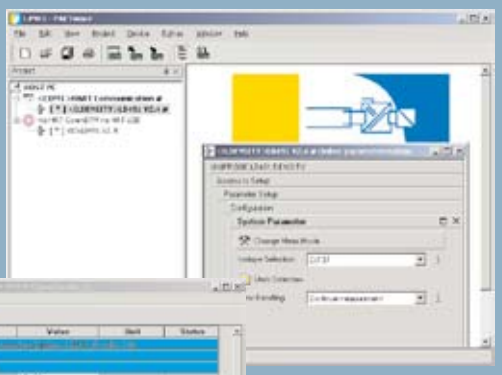
- Standard HART Communicator
- DTM for FDT
- Simatic PDM

Profibus PA

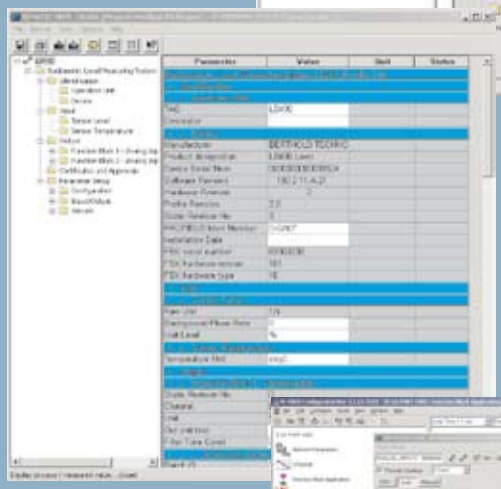
- Siemens Simatic PDM
- alternative also via HART

Foundation Fieldbus (FF)

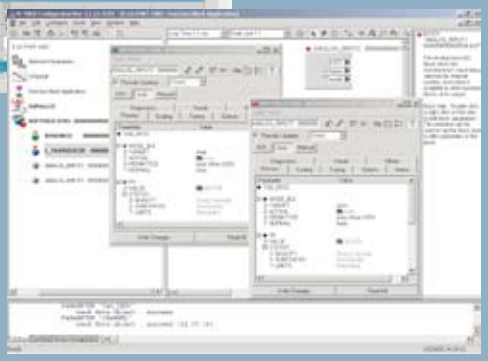
- Communicator 375 (Emerson Process)
- Process Control System
- alternative also via HART



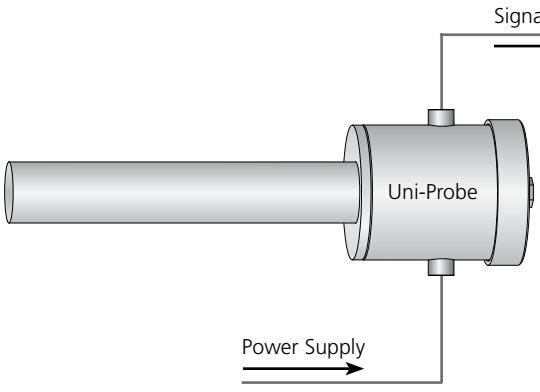
DTM for HART



Siemens Simatic PDF for HART and Profibus



Foundation Fieldbus

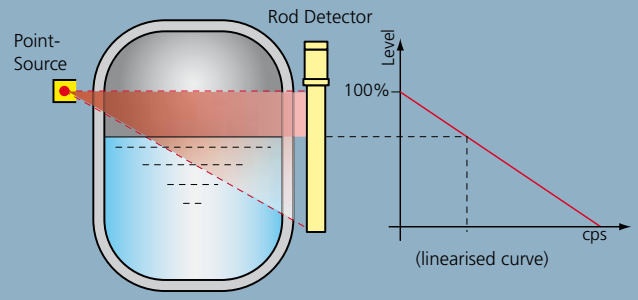


Communicator for HART and FF

Process-Control System

Non-Contact Measurement Technique

Measuring Principle The Level Gauge LB 490 operates according to radiometric principle; applying the physical law that gamma radiation is attenuated as it passes through matter. According to this principle, the measurement is affected only by the product being measured, since source type, wall thickness and absorption path are constant. Physical properties, such as pressure, temperature, viscosity and colour, as well as all chemical properties have no influence on the measuring effect. As a consequence the radiometric measuring method features a very high level of operation safety and requires practically no maintenance even under difficult operation and ambient conditions. The use of scintillation counters as radiation detectors and carefully planned project engineering ensure that the radiation exposure of the operating staff will stay clearly below the extremely low values permitted by law, which are as high as natural environmental radiation. All radiometric measuring systems have to comply with the applicable radiation protection regulations. According to these regulations, the handling of radioactive substances is subject to official approval and the user has to submit an application to the official authorities. If requested, we will provide the required technical data and documentation as required.



Source with Shielding All radioactive sources used for industrial applications are encapsulated in stainless steel, keeping the radioactive substance separate and isolated from the material being measured. Depending on the measurement task, either Co-60 or Cs-137 sources can be applied. The sources are built into sturdy shieldings which include a lockable radiation exit slit that is directed toward the detector. The shielding is adapted to the required activity so that operating personnel are never exposed to any excessive radiation levels. An activation of the product being measured is impossible.

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 together with dimensional drawings should therefore be provided, as follows.

Engineering Data

- **type and dimensions of the vessel**
- **wall thickness and wall material**
- **thickness and density of any insulation**
- **size and position of the required measuring range**
- **density and any special properties of the medium in vessel**
- **gas density under operating conditions in high pressure systems**
- **maximum speed of level variations**
- **ambient temperature at the detector**
- **agitators or other vessel internals, if any**

Technical Data LB 490

Operating Data

Power Supply	95 ... 250 VAC, 50 ... 60 Hz, 15 VA alternative: 18 ... 32 VDC / 24 VAC +10 % / –15 %, 15 W
Storage Temperature	Rod Detectors –40 ... +55 °C (–40 ...+131 °F) Point Detectors –40 ... +60 °C (–40 ...+140 °F)
Operating Temperature	–40 ... +50 °C (–40 ...+122 °F)

Electronic

CPU	– data storage in EEPROM or FRAM – self control by watch-dog-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 (for active) 12 V ... 24 V (for 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:	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 2xAI 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 2xAI 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
RS232	for software update
RS485	for multi detector applications for up to 8 detectors

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

Rod Detectors

Scintillator	plastic scintillator, 5 cm diameter, with automatic drift compensation
Housing	stainless steel 1.4301 / 304
Water Cooling	option
Temperature Stability	± 0.5 %

sensitive detector length (mm)	typical dose rate for 1000 cps (µSv/h)	weight (kg)	weight with water cooling (kg)
500	0.17	14	18.5
1000	0.09	17	25
1500	0.06	19	30.5
2000	0.04	21	36

Point Detector

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 for 300 cps

Certificates

FMEDA	hardware assessment according IEC 61508

Explosion Protection		
Class		Operating Temp.
ATEX	II 2 GD EEx d IIB/IIC T6 IP 66 T 80°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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