

## Level measurement

Product overview for applications in liquids and bulk solids





## Oil & Gas: Fuel for thought

We reduce complexities to help you perform, comply and thrive in the Oil & Gas sector

Although markets can be unpredictable, your operation cannot be. Whether upstream or downstream, you need a partner who understands that you must maintain and maximize plant availability – and do it with ever-tighter resources. From exploration to refinery, storage to distribution, and plant upgrades to new projects – we have the application expertise to help you succeed. At a time when the oil and gas industry faces skills shortages and regulations tightening, our organization is here across the full life cycle of your project always with your deadlines in mind. While complexity of facilities and processes are ever increasing, and downtime must be reduced, your competitiveness is enhanced with reliable, accurate and traceable asset information. In short, you need to do more with less, benefiting from a stable partner who is here for the long haul and ready across the globe, offering:

- Safety in plant operation
- Optimized production and return on investment (ROI)
- High plant availability

### ✓ Advantages at a glance

- Easy, safe and secure: Bluetooth connectivity for remote operation
- Guided setup sequences: Wizards for easy and intuitive step-by-step guidance via mobile device, Bluetooth or graphic display
- Globally unique Heartbeat Technology: for the highest level of system safety and measurement integrity. Mitigating risks by using state of the art technology meeting highest demands with regard to Functional Safety (IEC 61508) and mechanical integrity (e.g. gastight feedthrough)
- Minimizing operational costs through efficient proof testing concepts, predictive maintenance and innovative data management
- Meeting internationally recognized standards and recommendations such as: API, OIML, ASME, NORSOK, NACE etc.
- Increasing plant availability with innovative technologies particularly designed for oil and gas industry applications

## Product highlights



### Liquiphant FailSafe FTL81

**FailSafe overfill prevention for any liquids**  
Homogeneous redundancy in a device ensures maximum plant safety and allows the device to be used in safety systems with functional safety requirements up to SIL3.



### Micropilot FMR62B

**Radar instrument for highest demands in level measurement**  
Maximum reliability even under extreme process conditions like high temperatures or high pressure values. Guided commissioning and intuitive operation with the SmartBlue app.



### Gammapiilot FMG50

**Radiometric measuring device for challenging process conditions**  
The two-wire compact transmitter has been developed in accordance with IEC 61508 for SIL2/3 and offers maximum plant safety, efficiency and availability. Heartbeat Technology reduces testing effort and minimizes plant downtime.



### Levelflex FMP55

**The Multiparameter device is the innovation in interface measurement**  
Worldwide first combination of two different measuring principles in one device for reliable level and simultaneous interface layer measurement.



### Deltabar PMD78B

**Differential pressure transmitter with one/two diaphragm seals for differential pressure and level measurement**  
For measuring differential pressure, level and flow in liquids or gases, especially in applications involving high temperatures and tough conditions.



### Micropilot S and Proservo

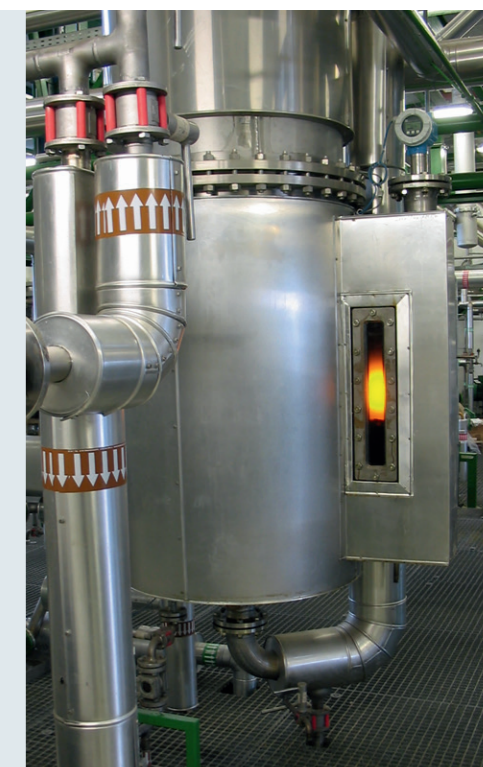
**High-precision measuring devices for custody transfer**  
With an accuracy better than 0.5mm, as confirmed by the NMI and PTB, these devices meet all relevant requirements of OIML R85 and API 3.1B. Using the measured data, the volume and mass of valuable liquids can be calculated with high precision, thereby saving costs.

### i Levelflex Multiparameter

Employing SensorFusion, Levelflex FMP55 offers you the first combination of the capacitance and guided radar measuring principles in one instrument worldwide. The combination guarantees safe measured value acquisition even in emulsion layers with the simultaneous output of level and interface signals. This makes Levelflex FMP55 Multiparameter the standard in interface measurement.

This solution guarantees the highest degree of safety, precision and efficiency:

- Redundant interface measurement guarantees safe processes
- New, dynamic algorithms for the highest degree of measuring safety and precise measurements
- Multi-Echo Tracking: Increased echo rate and analysis as well as automatic interference echo suppression already during commissioning
- Intuitive, menu-guided operating concept (on-site or via the control system) in the respective national language decreases costs for training, maintenance and operation
- HistoROM: Data storage for instrument settings and measured values, so that you always have your parameters available
- Exact instrument and process diagnosis for fast decision-making support with clear instructions concerning corrective measures





## Chemical: Competitive and safe

We help you boost your plant's safety and performance

You gain concrete benefits from a partner who has first-hand knowledge of your sector's issues around the globe: on increased safety, on environmental protection, on over-supply leading to cost pressure and on finding engineering support and service when required. You can rely on our help to become more competitive in your line of business.

With a long history of industry firsts we have grown with the sector by listening, acting and innovating to better serve you with:

- Safety, built in
- The technology to lead
- Best-fit project management

### ✔ Advantages at a glance

- Easy, safe and secure: Bluetooth connectivity for remote operation
- Guided setup sequences: Wizards for easy and intuitive step-by-step guidance via mobile device, Bluetooth or graphic display
- Globally unique Heartbeat Technology: for the highest level of system safety and measurement integrity. Meeting internationally recognized standards/recommendations: NAMUR, WHG, ASME, NACE, IEC 17025, MID, OIML
- Internationally accepted hazardous area approvals: ATEX, IECEx, FM/CSA, NEPSI, TIIS, INMETRO
- Use of state of the art technology – functional safety according to IEC 61508 (up to SIL3)
- Uniform operating safety by design concepts for simple and safe operations
- Optimized material availability and minimized stocks through inventory management solutions

## Product highlights



### Liquiphant FTL51B

**Universal point level switch for liquids with Heartbeat Technology**

Developed according to IEC 61508 for SIL2/3 applications. Verification via Bluetooth for Heartbeat Technology without process interruptions in assembled conditions.



### Micropilot FMR62B

**80GHz radar instrument for measurement in aggressive liquids**

Improved focusing and smaller beam angle. Perfectly suitable for tanks with many internal installations.



### Micropilot FMR51

**Radar instrument for highest demands in level measurement**

Maximum reliability under extreme process conditions and due to Multi-Echo Tracking.



### Micropilot FWR30

**The cloud-based level sensor for measuring in mobile and stationary applications**

Particularly suitable for non-invasive measurement of additives in mobile plastic tanks due to battery operation, absence of cables and easy commissioning with digital service.



### Levelflex FMP51

**The standard sensor for highest demands in level measurement**

For continuous level measurement of liquids, pastes and slurries but also for interface measurement.



### Deltabar FMD71/72

**Electronic differential pressure system utilizing one transmitter and two sensors**

Elimination of traditional mechanical issues resulting in greater process availability and reliability.



### Gammapiilot FMG50

**Radiometric measuring device for challenging process conditions**

The two-wire compact transmitter has been developed in accordance with IEC 61508 for SIL2/3 and offers maximum plant safety, efficiency and availability. Heartbeat Technology reduces testing effort and minimizes plant downtime.

### i Electronic differential pressure measurement

Differential pressure measurement is frequently used for level measurement in pressurized vessels or vacuum tanks. Conventional differential pressure systems with impulse lines often suffer from problems including blockage, freezing, leaks and condensation. Even differential pressure systems with oil-filled capillaries reach their limits in applications with fluctuating ambient temperatures.

Our electronic differential pressure system, consisting of a transmitter and two sensor modules, offers tried and tested pressure sensor technology in a new and innovative manner. The transmitter calculates the pressure difference from both sensors and forwards the level, the volume or mass by 4 to 20mA to the control system. This increases reliability as well as safety and reduces costs.

Advantages:

- Reliability: The new electronic differential pressure system eliminates the problems of conventional mechanical systems and leads to higher measuring precision, process availability and reliability.
- Safety: Safety risks are minimized due to the design architecture of the new electronic differential system.
- Cost efficiency: Low overall operating costs due to shorter installation times, lower maintenance, less downtimes and low spare part requirements.





## Mining, Minerals & Metals: Extracting more from less

In a world of lower grades, skills gaps and excavation challenges we can help you hit your targets

We've seen how lower grades are driving an acute need for ever-better automation and controls. You are also facing emerging skills gap, requiring better-informed industry partners.

At the same time, energy costs are only going one way, and the legislative environment is becoming increasingly stringent.

Tough challenges call for experienced heads who can:

- Reduce your metal and mineral production costs
- Keep your plant safe
- Boost compliance and responsibility

### ✓ Advantages at a glance

- Easy, safe and secure: Bluetooth connectivity for remote operation
- Guided setup sequences: Wizards for easy and intuitive step-by-step guidance via mobile device, Bluetooth or graphic display.
- Globally unique Heartbeat Technology: for the highest level of system safety and measurement integrity.
- Complete product basket for all applications, specifically in harsh environments
- Advanced diagnostic functionalities to make the process more safe and reliable
- Savings in raw material, water, energy and labor through accurate data of critical and quality relevant points in your process

### Product highlights



#### Micropilot FMR67B

**Level measurement with 80GHz technology for highest demands in bulk solids**  
Reduced tank wall reflections and less interferences through installations inside the tank. Large measuring range up to 12.5m (410ft) possible.



#### Micropilot FMR57

**For special demands in bulk solid level measurement**  
Highest reliability thanks to Multi-Echo Tracking. Advanced diagnostic functions for process optimization and automatization.



#### Micropilot FMR62B

**For level measurement in aggressive liquids with 80GHz technology**  
Offers extraordinary advantages in aggressive liquids with its completely PTFE-filled flush-mounted antenna.



#### Micropilot FWR30

**The cloud-based level sensor for measuring liquids in plastic tanks**  
Ideal for mobile and difficult-to-access applications with easy commissioning and digital service.



#### Levelflex FMP57

**For highest demands for continuous level measurement in bulk solids**  
Reliable measurement in narrow silos or bunkers. Unaffected by silo geometries, obstacles and the shape of angled surfaces.



#### Soliphant FTM51

**Universal point level switch for fine-grained bulk solids**  
Robust point level switch for use in silos containing fine-grained or powdery solids even with a low bulk density. For use in dust or gas incensive hazardous areas.



#### Gammapilot FMG50

**Radiometric measuring device for challenging process conditions**  
The innovative sensor technology means that the two-wire compact transmitter can be used without additional water cooling. Heartbeat Technology reduces testing effort and minimizes plant downtime.



#### Micropilot FMR10/FMR20

**Basic radar for level measurement in bulk solids**  
Level measurement, e.g. in smaller silos, vessels, bunkers, stockpiles up to a max. measuring range of 15m (49ft).

### i Radar measurement in bulk solids

Micropilot FMR57 is the sensor for the high demands in bulk solids, optimally suited to measurements in high silos, bunkers or on stockpiles. Particularly the parabolic antenna facilitates very small emitting angles and thus the measurement in slim silos with lateral baffles. FMR57 may be used in applications up to 400°C without any problems thus also solving sophisticated measuring tasks. The innovative signal analysis also uses historical silo data to strongly improve the reliability of the measurement. With the advanced diagnostic functionality in combination with the integrated air purge connection even strongly dust generating and build up producing media do not present any problems for the FMR57. Depending on the application the cost-effective FMR56 can be an attractive alternative.

Advantages:

- Optimum adaption to the surface of solids due to the sensor alignment
- Horn antenna or parabolic antenna to meet different emission angles
- Advanced Diagnostic to optimize and automatize the process, e.g. build-up detection





### Product highlights



**Liquiphant FTL33**

**Most universal point level switch for all kinds of pumpable liquids**  
Fully welded and independent from medium and mounting position.



**Liquipoint FTW33**

**Conductive point level detection**  
Perfect fit to the hygienic industry thanks to flush-mounted design and extended build-up compensation for reliable detection in sticky and pasty media.



**Deltapilot FMB70**

**Highest performance pressure sensor with the Contite measuring cell**  
Made for level measurement in liquid and past-like media in open or closed containers and unaffected by possible foam formation.



**Nivector FTI26**

**Cost-effective point level switch**  
Best buildup performance in its class and high sensitivity. All industry-relevant certificates available. Ready for Industry 4.0 thanks to IO-Link communication.



**Liquicap FMI51**

**Continuous level measurement with capacitance probes provides fastest response times**  
For water based media the devices are already pre-calibrated ex works. Used in conjunction with the Fieldgate FXA320, the ideal solution for inventory management and logistics optimization.



**Liquitrend QMW43**

**Detect media and blending homogeneity quickly**  
The Liquitrend QMW43 enables continuous measurement of medium buildup on the sensor and the actual level of conductivity present. This measurement can be used to adapt and optimize cleaning cycles as needed, recognize media and monitor mixing processes.



**Micropilot FMR63B**

**80GHz radar instrument for hygienic applications**  
3-A and EHEDG approvals. Improved focusing and smaller beam angle: particularly for small tanks and tanks with a lot of internal installations.

## Food & Beverage: Trust in quality

We help you to improve quality while reducing operational costs

From hygiene regulations and food safety to the basic demands of reliability and uptime, high quality food & beverage producers profit from our experience in more than 100 countries.

Get it right the first time and make your safe choice:

- Constant food quality & compliance
- Resources savings
- An expert partner

**Advantages at a glance**

- Complete basket of 3-A, FDA and EHEDG approved level measurement solutions
- Food safety and reliability due to instruments designed and manufactured specifically for all requirements in food & beverage industry
- Savings in raw material, water, energy and labor through accurate data of critical and quality relevant points in your process
- Optimized material availability and minimized stocks through inventory management solutions

**i Exact knowledge of hygienic condition of plant opens up new possibilities**

Many food production processes take place within closed systems. While these systems are designed to prevent the ingress of unwanted contaminants from the environment, they also make it difficult to determine the effectiveness of cleaning processes. If a process is closed off from the outside, it is impossible to see from the outside how clean it is. This is where the new Liquitrend QMW43 technology from Endress+Hauser comes in. By means of capacitive and conductive measuring technology, the customer is able to gain direct insight into their plant. The stainless steel measuring head reflects the condition of the inside of pipes, for example, and continuously measures the thickness of any buildup that occurs during the production process or is still present following cleaning. In addition, the device continuously outputs information on the conductivity of the medium at the sensor. These two continuous measurements facilitate decision-making, verifiably reduce cleaning times and therefore also save resources.





## Life Sciences: The pulse of life sciences

Trust a reliable partner who helps you achieve operational excellence

It is a daily task to meet stringent GxP regulations and productivity goals throughout your product lifecycle. You can count on our world-class instruments, designed to ASME-BPE standards, but also our highly qualified engineering input and experienced service teams. We partner with you to generate process optimization, higher plant availability and continuous improvement.

Our experience, gained at the heart of the sector, will help you to:

- Get to market faster
- Boost productivity - manage risk

### ✓ Advantages at a glance

- Measurement instruments that fully comply with the numerous requirements, codes and standards, such as FDA, ISPE, GAMP, ASME-BPE, EU1935/2004, etc.
- Advanced diagnostics guarantees highest process safety and efficiency
- Products designed for high temperatures and pressures during CIP and SIP processes
- Delivery of products with all required approvals (material certificates for the process wetted parts, certificates of compliance, calibration certificates, surface roughness finish certificates, test reports, etc.)

## Product highlights



### Liquiphant FTL50H

**Compact, hygienic point level switch with stainless steel housing**

Used as overflow prevention system or for pump protection, ideally for storage tanks, mixing tanks and pipes.



### Levelflex FMP53

**Continuous level measurement for hygienically sensitive applications**

Meets all hygienic requirements according to ASME-BPE and USP Class VI. Unique in situ validation without dismantling from the process.



### Liquipoint FTW33

**Conductive point level detection**

Perfect fit to the hygienic industry thanks to flush-mounted design and extended build-up compensation for reliable detection in sticky and pasty media.



### Deltapilot FMB70

**Hydrostatic pressure sensor with the Contite cell for level measurement**

Condensate resistant Contite measuring cell and two-chamber housing. Unaffected by possible foam formation.



### Micropilot FMR63B

**80GHz radar instrument for hygienic applications**

Approved according to ASME-BPE and USP Class VI. Improved focussing and smaller beam angle: particularly for small tanks and tank with many internal installations.

### i Guided radar in bioprocesses

Level measurement in bioprocesses is quite demanding on the instrumentation. Changing densities, temperature shocks, hygiene requirements, continually moist surfaces and foam formation with different consistencies may not impair the instrument.

The constructive design of the Levelflex FMP53 instrument type has been particularly devised for the highest hygiene requirements in the life sciences industry. The instrument complies with the ASME-BPE recommendations.

The mode of operation is independent on density and thus the guided radar measurement is optimally suited to this application. The small vessels frequently found in bioprocesses prompted optimizing of the measuring method. Consequently, the level may now be safely acquired in a 10 liter vessel.

Employing Multi-Echo Tracking – for the reliable measurement even in sophisticated measuring tasks – as well as HistoROM for an easy exchange of electronics without any additional aids, Levelflex increases availability and reduces costs. The operator is pleased with the additional simplification of calibration due to the possibility of verification in assembled conditions. The availability of all hygiene process connections facilitates engineering and planning.





## Water & Wastewater: Water is our life

Increase your efficiency and ensure compliance with an experienced and trusted partner

As budgets shrink and legislative demands soar, we bring expertise for challenging needs. Safe potable water... discharges, environmental penalties... water infrastructure for developing countries... energy monitoring... the rising quantities of sludge from wastewater treatment and the opportunities they create for biogas. We make sense of it all, with experienced thinking supported by process technology solutions for your every need.

Through working with water in over 100 countries, Endress+Hauser offers a refreshing alternative.

- Improve plant safety and availability
- Optimize costs in your internal water processes
- Support your risk and failure management

### ✓ Advantages at a glance

- Easy, safe and secure: Bluetooth connectivity for remote operation
- Guided setup sequences: Wizards for easy and intuitive step-by-step guidance via mobile device, Bluetooth or graphic display.
- Globally unique Heartbeat Technology: for the highest level of system safety and measurement integrity.
- Cost-effective product and service portfolio for any applications, e.g. for drinking water, wastewater and sewage, desalination
- Meeting internationally recognized standards/ recommendations for drinking water applications
- Highest efficiency by easy commissioning, operation and maintenance of instruments

## Product highlights



### Prosonic FMU90/FDU90

#### Ultrasonic sensor for level and flow measurement

Measurement is unaffected by dielectric constant, density or humidity and also unaffected by build-up due to the self-cleaning effect of sensors.



### Micropilot FMR10/FMR20

#### Basic radar for liquid level applications

For non-contact level and flow measurement, e.g. basins, channels, river monitoring. With *Bluetooth*® commissioning, operation and maintenance app.



### Micropilot FMR60B

#### Radar instrument for liquid level applications with 80GHz technology

Used for continuous, non-contact level measurement of liquids, pastes and slurries. Not affected by changing media, temperature changes, gas blankets or vapors.



### Micropilot FWR30

#### The cloud-based level sensor for mobile and stationary applications

Suitable for non-invasive measurement of liquids in plastic tanks and in overflow basins and channels, due to battery operation, absence of cables and easy commissioning with digital service.



### Waterpilot FMX11

#### Straightforward and reliable level measuring probe for freshwater applications

Certified for drinking water applications and can be used in fountains, storage tanks, water towers, dams, gaging stations, lakes and rivers.



### Waterpilot FMX167

#### Reliable and robust level probe with ceramic measuring cell

Certified for drinking water with a robust ceramic sensor and integrated temperature measurement. Also for usage in wastewater and salt water applications.



### Liquicap FMI52

#### Continuous level and interface measurement

Reliable rope probe for continuous level monitoring in liquids, particularly in small tanks, build-up forming media and extremely high temperatures.



### Deltapilot FMB53

#### Hydrostatic pressure sensor with Contite measuring cell

Hermetically sealed Contite measuring cell with condensate-resistance, high reference accuracy and minimum temperature effects.

### i Radar measurement in water and wastewater applications

Radar technology is particularly suited to continuous measurement of levels in water and wastewater applications. Temperature fluctuations do not impair the measurement of the non-contact and free of maintenance devices.

Especially the new Micropilot FMR10 and FMR20 offering best application fit for level measurement in storage tanks, open basins, pump/lift stations or in the sewer management. Commissioning, operation and maintenance is possible via *Bluetooth*® wireless technology with the Endress+Hauser SmartBlue app or via HART. The most compact radar in class fits also in limited space applications due to its unique chip design.

#### Advantages:

- Long sensor lifetime thanks to full PVDF body
- Hermetically sealed wiring and fully potted electronics eliminating water ingress and allows operation under harsh environmental conditions
- Best price-performance-radar





## Power & Energy: Power up your plant

Power plants play a vital role. We help maximize uptime, while delivering safety and productivity.

Today's Power & Energy industry must strike a complex balance: meeting spiraling demand for affordable and reliable energy while increasing cleaner and renewable sources in the energy mix. As cost and regulatory pressures grow, modernization is essential for efficient, safe resource use. As renewables advance, so does the need for energy storage. With best-fit instrumentation, deep power application expertise, services and solutions, Endress+Hauser brings efficient, reliable productivity.

When you choose us, you:

- Boost the efficiency of your plant
- Improve safety
- Retain expertise

### ✓ Advantages at a glance

- Easy, safe and secure: Bluetooth connectivity for remote operation
- Guided setup sequences: Wizards for easy and intuitive step-by-step guidance via mobile device, Bluetooth or graphic display
- Globally unique Heartbeat Technology: for the highest level of system safety and measurement integrity
- Functional safety: IEC 61508 SIL2/3 certified
- EN12952-11 (water tube boiler), EN12953-09 (shell type boiler) for guided radar instruments and DP transmitter
- Intelligent instruments with continuous self-monitoring
- Pressure directives such as PED, AD2000, CRN, EN13480
- Minimized downtime and highest safety through modern instrumentation

## Product highlights



### Micropilot FMR67B

**For highest demands in bulk solids level measurement up to 450°C (842°F)**  
Thanks to 80GHz technology, reduced tank wall reflections and interferences through tank installations. Large measuring range up to 125m (410ft) possible.



### Solicap FTI77

**Point level detection for bulk solids, especially for high temperatures and strong mechanical loads**  
Sword/rope probe for point level detection up to 400°C (752°F) of fine-grained to coarse-grained bulk solids, such as fly ash.



### Levelflex FMP54

**Guided radar for high temperature and high pressure applications**  
Integrated ceramic-graphite seal safeguards reliable level measurement in steam boilers up to 450°C/400bar (842°F/5,800psi).



### Liquiphant FTL64

**Point level switch for liquids in high-temperature applications with Heartbeat Technology**  
Suitable for high-temperature applications up to 280°C (536°F). Developed according to IEC 61508 for SIL2/3 applications; second process seal (2<sup>nd</sup> line of defense) guarantees high degree of safety and availability. Verification via Bluetooth and Heartbeat Technology while installed and without interrupting the process.



### Cerabar PMP71B

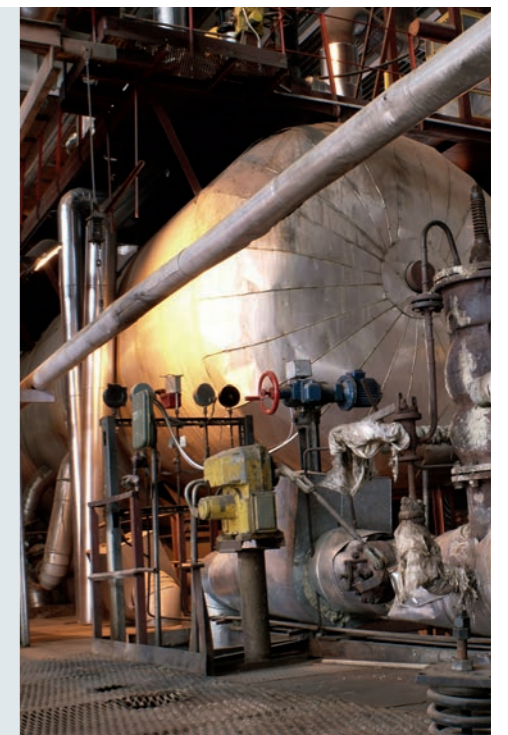
**Digital pressure transmitter with metallic measuring cell; optionally with fully welded diaphragm seal**  
For pressure, level, volume or mass measurement in liquids or gases. Designed for high pressure applications up to 700bar (10,500psi) and extreme temperature conditions.

### i Guided radar for extreme conditions

Levelflex FMP54 is predestined for level measurement in liquids under extreme conditions. The design of the process connection with a ceramic-graphite seal guarantees safe processes both in high temperatures and pressures as they occur in steam boilers and in toxic media, e.g. ammonia. The second gas-tight feedthrough guarantees additional safety. For steam boiler applications, Levelflex FMP54 offers the option of a gas phase compensation. This feature guarantees safe and precise level measurement even under the highest process pressures. In case of gas phases in a steam boiler, conventional guided radar devices determine measured values which are strongly deviating from the actual level. Only the gas phase compensation of Levelflex provides you with reliable and precise measuring results if gas and steam phases or high pressures occur.


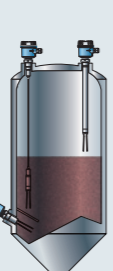

Advantages:

- SIL2 according to IEC 61508, SIL3 in case of homogeneous redundancy
- The easiest verification test for SIL and WHG worldwide
- High diffusion resistance due to ceramic coupling and graphite seal
- Resistant against steam
- Available with rod, rope and coax probe





# Overview of measuring principles

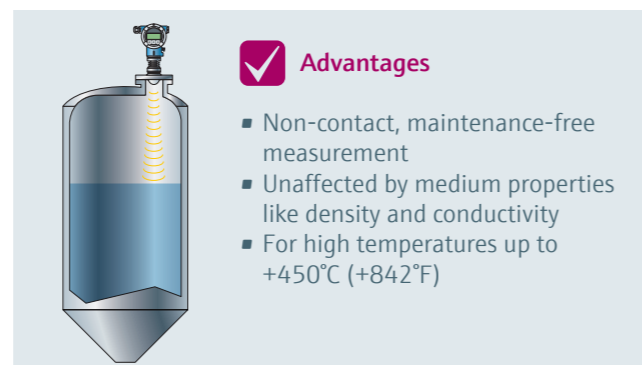
	Description	Measuring principle						
Continuous level measurement in liquids	<p>We offer a number of most varied measuring principles for continuous level measurement in liquids. You will find more information on our technologies from <a href="#">page 20</a>.</p>	<p><b>Radar</b> Measuring principle <a href="#">Page 20</a> Instruments <a href="#">Page 22</a> Custody transfer instruments <a href="#">Page 28</a></p> 	<p><b>Guided radar</b> Measuring principle <a href="#">Page 20</a> Instruments <a href="#">Page 23</a></p> 	<p><b>Ultrasonics</b> Measuring principle <a href="#">Page 20</a> Instruments <a href="#">Page 24</a></p> 	<p><b>Hydrostatics</b> Measuring principle <a href="#">Page 21</a> Instruments <a href="#">Page 25</a></p> 	<p><b>Capacitance</b> Measuring principle <a href="#">Page 21</a> Instruments <a href="#">Page 26</a></p> 	<p><b>Radiometry</b> Measuring principle <a href="#">Page 21</a> Instruments <a href="#">Page 27</a></p> 	<p><b>Servo</b> Measuring principle <a href="#">Page 21</a> Instruments <a href="#">Page 28</a></p> 
	Continuous level measurement in bulk solids	<p>We offer a number of most varied measuring principles for continuous level measurement in bulk solids. You will find more information on our technologies from <a href="#">page 30</a>.</p>	<p><b>Radar</b> Measuring principle <a href="#">Page 30</a> Instruments <a href="#">Page 32</a></p> 	<p><b>Guided radar</b> Measuring principle <a href="#">Page 30</a> Instruments <a href="#">Page 33</a></p> 	<p><b>Ultrasonics</b> Measuring principle <a href="#">Page 30</a> Instruments <a href="#">Page 34</a></p> 	<p><b>Electromechanical</b> Measuring principle <a href="#">Page 31</a> Instruments <a href="#">Page 35</a></p> 	<p><b>Radiometry</b> Measuring principle <a href="#">Page 31</a> Instruments <a href="#">Page 36</a></p> 	
Point level detection in liquids	<p>We offer a number of most varied measuring principles for point level detection in liquids. You will find more information on our technologies from <a href="#">page 38</a>.</p>	<p><b>Vibronic</b> Measuring principle <a href="#">Page 38</a> Instruments <a href="#">Page 40</a></p> 	<p><b>Capacitance</b> Measuring principle <a href="#">Page 38</a> Instruments <a href="#">Page 41</a></p> 	<p><b>Conductive</b> Measuring principle <a href="#">Page 38</a> Instruments <a href="#">Page 42</a></p> 	<p><b>Float switch</b> Measuring principle <a href="#">Page 39</a> Instruments <a href="#">Page 43</a></p> 	<p><b>Radiometry</b> Measuring principle <a href="#">Page 39</a> Instruments <a href="#">Page 44</a></p> 		
Point level detection in bulk solids	<p>We offer a number of most varied measuring principles for point level detection in bulk solids. You will find more information on our technologies from <a href="#">page 46</a>.</p>	<p><b>Vibronic</b> Measuring principle <a href="#">Page 46</a> Instruments <a href="#">Page 48</a></p> 	<p><b>Capacitance</b> Measuring principle <a href="#">Page 46</a> Instruments <a href="#">Page 49</a></p> 	<p><b>Paddle</b> Measuring principle <a href="#">Page 46</a> Instruments <a href="#">Page 50</a></p> 	<p><b>Microwave</b> Measuring principle <a href="#">Page 47</a> Instruments <a href="#">Page 51</a></p> 	<p><b>Radiometry</b> Measuring principle <a href="#">Page 47</a> Instruments <a href="#">Page 52</a></p> 		
Density and interface measurement	<p><b>Density measurement</b></p> <p>You have the choice to measure density or concentration in your process with different measuring principles. To learn more, see from <a href="#">page 54</a>.</p>					<p><b>Interface measurement</b></p> <p>You have the choice to measure interfaces in your process with different measuring principles. To learn more, see from <a href="#">page 56</a>.</p> 		

# Continuous level measurement in liquids

Choose the measuring principle which fits best for your application

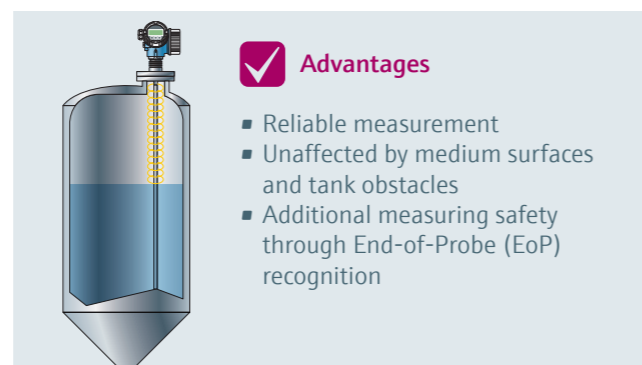
## Radar

Micropilot works with either pulses or with Frequency Modulated Continuous Wave (FMCW). Pulse: High-frequency radar pulses which are emitted by an antenna and reflected from the product surface. The time between pulse launching and receiving is measured and analyzed by the instrument and constitutes a direct measure for the distance between the antenna and the surface of the medium. FMCW: Works with an FMCW continuous electromagnetic wave which is emitted from an antenna and reflected by the product surface. The frequency change “ $\Delta f$ ” is measured and the time and distance are calculated.



## Guided radar

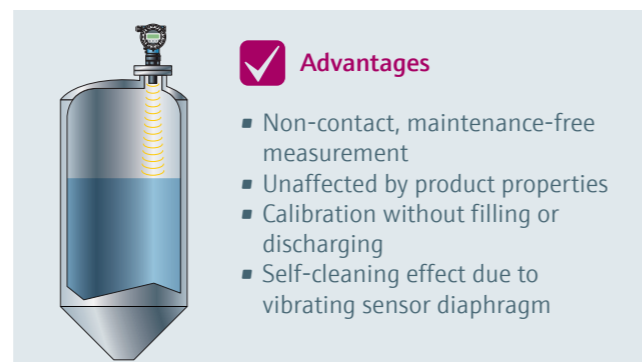
Levelflex works with high-frequency radar pulses which are guided along a probe. As the pulse impacts the medium surface, the characteristic impedance changes and part of the emitted pulse is reflected. The time between pulse launching and receiving is measured and analyzed by the instrument and constitutes a direct measure for the distance between the process connection and the product surface.



## Ultrasonics

Prosonic is based on the Time-of-Flight principle. A sensor emits ultrasonic pulses, the surface of the media reflects the signal and the sensor detects it again.

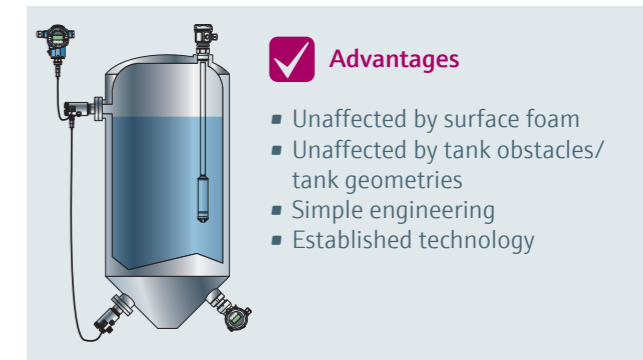
The Time-of-Flight of the reflected ultrasonic signal is directly proportional to the distance traveled. With the known tank geometry the level can be calculated.



## Hydrostatics

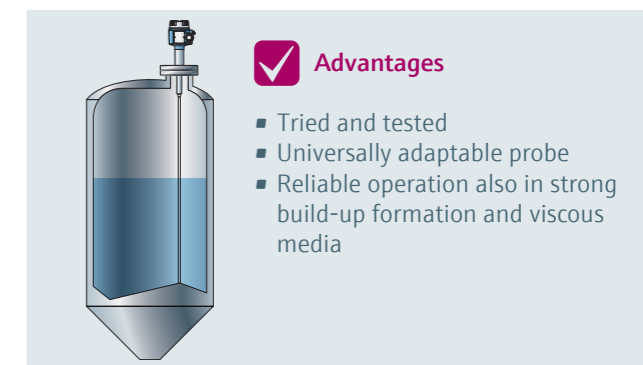
Hydrostatic level measurement in open tanks is based on the determination of the hydrostatic pressure which is generated by the height of the liquid column.

The obtained pressure is thus a direct measure for the level. In closed vessels with overpressure, the differential pressure measured is a direct indicator of the level.



## Capacitance

The principle of capacitive level measurement is based on the capacitance change of a capacitor. The probe and the tank wall form a capacitor whose capacitance is dependent on the amount of product in the tank: An empty tank has a lower, a filled tank a higher capacitance.



## Radiometry

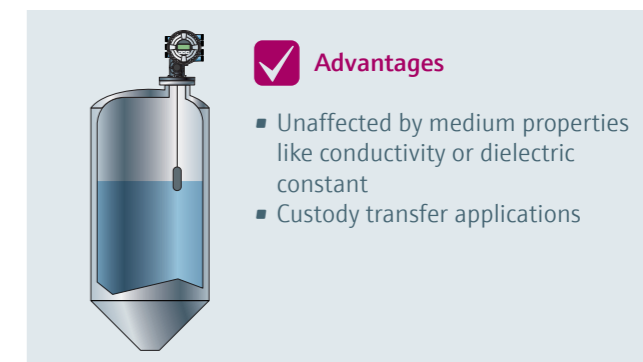
The radiometric measuring principle is based on the fact that gamma radiation is attenuated when it penetrates a medium. The radiation source is installed in a source container, which allows the radiation to be emitted only in the direction of the process vessel.

The detector is positioned on the opposite side of the process vessel. It converts the received radiation into an electrical signal and uses it to calculate the level.



## Servo

When the displacer is lowered and comes into contact with the liquid, the weight of the displacer is reduced by the buoyancy force of the liquid, which is measured by a temperature-compensated magnetic transmitter. This changes the torque in the magnetic connection, which is measured by six Hall sensors. A signal indicating the weight of the displacer is sent to the motor control circuitry. As soon as the liquid levels rise or fall, the drive motor adjusts the position of the displacer. The rotation of the measuring drum is analyzed continuously to determine the level value using a magnetic encoder.



## Radar – the Micropilot

Radar level measurement is a safe solution for liquids under extreme process conditions (pressure, temperature) and vapors. The Micropilot can also be used in hygienic applications for non-contact level measurement.



## Guided radar – the Levelflex

Guided radar pulse measurement is well suited to liquids. The surface condition of the medium is of minor importance due to the safe guidance of the reflected waves. Reliable measurement is also safeguarded in turbulent liquid surfaces or foam formation. Guided radar is also first choice for interface measurement.



### The Micropilot portfolio for applications in liquids



- 1**  
**Micropilot FMR10/FMR20**  
Basic model for level liquid applications
- Temperature: -40 to +80°C (-40 to +176°F)
  - Pressure: -1 to +3bar (-14.5 to +43psi)
  - Measuring range: up to 20m (66ft)
- 2**  
**Micropilot FWR30**  
The cloud-based level sensor for stationary and mobile applications
- Temperature: -20 to +60°C (-4 to +140°F)
  - Measuring range: up to 15m (49 ft)
- 3**  
**Micropilot FMR60B**  
For standard applications and applications with small process connections in level measurement with 80GHz technology
- Temperature: -40 to +200°C (-40 to +392°F)
  - Pressure: Vacuum to +16bar (vacuum to +232psi)
  - Measuring range: up to 50m (164ft)
- 4**  
**Micropilot FMR62B**  
For level measurement in aggressive liquids or applications with extremely high temperatures
- Temperature: -196 to +450°C (-321 to +842°F)
  - Pressure: Vacuum to +160bar (vacuum to +2,320psi)
  - Measuring range: up to 80m (262ft)
- 5**  
**Micropilot FMR63B**  
Non-contact level measurement with highest hygienic requirements in the food and life sciences industry
- Temperature: -40 to +200°C (-40 to +392°F)
  - Pressure: -1 to +25bar (-14.5 to +363psi)
  - Measuring range: up to 80m (262ft)
- 6**  
**Micropilot FMR51**  
The standard sensor for highest demands in liquid level measurement
- Temperature: -196 to +450°C (-321 to +842°F)
  - Pressure: -1 to +160bar (-14.5 to +2,320psi)
  - Measuring range: up to 40m (131ft), up to 70m (229ft) with advanced dynamics
- 7**  
**Micropilot FMR52**  
For level measurement in aggressive liquids or applications with hygiene requirements
- Temperature: -196 to +200°C (-321 to +392°F)
  - Pressure: -1 to +16bar (-14.5 to +232psi)
  - Measuring range: up to 40m (131ft), up to 60m (197ft) with advanced dynamics
- 8**  
**Micropilot FMR54**  
For level measurement in liquids where strong steam or ammonia can occur
- Temperature: -196 to +400°C (-321 to +752°F)
  - Pressure: -1 to +160bar (-14.5 to +2,320psi)
  - Measuring range: 20m (65ft)

#### Advantages at a glance

- Hardware and software developed according to IEC 61508 for SIL2 (Min./Max. range) respectively SIL3 (homogeneous redundancy)
- Highest process safety due to Multi-Echo Tracking evaluation
- Non-contact measurement, free of wear and tear, that can be used in extreme process conditions
- Heartbeat Technology for a cost-effective and safe plant operation during the entire life cycle
- Safe measurement in vessels with changing products
- Reliable measurement due to advanced dynamics signal strength

### The Levelflex portfolio for applications in liquids



- 1**  
**Levelflex FMP50**  
For all basic level applications in liquids
- Temperature: -20 to +80°C (-4 to +176°F)
  - Pressure: up to +6bar (up to +87psi)
  - Measuring range: rod up to 4m (13ft), rope up to 12m (40ft)
- 2**  
**Levelflex FMP51**  
The standard sensor for highest demands in liquid level measurement
- Temperature: -40 to +200°C (-40 to +392°F)
  - Pressure: up to +40bar (up to +580psi)
  - Measuring range: rod up to 10m (33ft), rope up to 45m (148ft), coax up to 6m (20ft)
- 3**  
**Levelflex FMP52**  
Coated probe for use in aggressive liquids
- Temperature: -50 to +200°C (-58 to +392°F)
  - Pressure: up to +40bar (up to +580psi)
  - Measuring range: rod up to 4m (13ft), rope up to 45m (148ft)
- 4**  
**Levelflex FMP53**  
For the highest hygiene requirements in the food and life sciences industry
- Temperature: -20 to +150°C (-4 to +302°F)
  - Pressure: up to +16bar (up to +232psi)
  - Measuring range: rod up to 6m (20ft)
- 5**  
**Levelflex FMP54**  
For high temperature and high pressure applications in the oil & gas, chemical and power industry
- Temperature: -196 to +450°C (-320 to +842°F)
  - Pressure: up to +400bar (up to +5,800psi)
  - Measuring range: rod up to 10m (33ft), rope up to 45m (148ft), coax up to 6m (20ft)
- 6**  
**Levelflex FMP55**  
The Multiparameter device is the innovation in interface measurement
- Temperature: -50 to +200°C (-58 to +392°F)
  - Pressure: up to +40bar (up to +580psi)
  - Measuring range: rod up to 4m (13ft), rope up to 10m (33ft), coax up to 6m (20ft)

#### Advantages at a glance

- Hard- and software developed according to IEC 61508 for SIL2 (Min./Max./range) respectively SIL3 (homogeneous redundancy)
- Highest process safety due to Multi-Echo Tracking evaluation
- Reliable measurement in liquids with turbulent surfaces and foam formation
- Simple commissioning due to precalibrated sensor
- Heartbeat Technology for a cost-effective and safe plant operation during the entire life cycle
- Ideally for the direct replacement of displacers in existing displacer chamber

## Ultrasonic – the Prosonic

The ultrasonic method is a tried and tested, as well as cost-effective solution for level measurement in liquids. Instruments are available as compact or separate versions. This measuring principle is characterized by easy planning and assembly, fast and safe commissioning, a long service life and reduced maintenance costs. Typical applications include abrasive and aggressive media, even in rough ambient conditions, but also tasks in water and wastewater engineering.



### The Prosonic portfolio for applications in liquids



- 1**  
**Prosonic FMU30**  
Two-wire instrument for continuous non-contact level and flow measurement
- Temperature: -20 to +60°C (-4 to +140°F)
  - Pressure: +0.7 to +3bar (10 to +44psi)
  - Measuring range: Sensor 1½" up to 5m (16ft), Sensor 2" up to 8m (26ft)
- 2 3 4 5**  
**Prosonic FMU40/41/42/44**  
Two-wire or four-wire instrument for continuous non-contact level and flow measurement
- Temperature: -40 to +80°C (-40 to +176°F)
  - Pressure: +0.7 to +3bar (10 to +44psi)
  - Measuring range: up to 20m (16 to 66ft)
- 6 7 9**  
**Prosonic FDU90/91/92**  
Sensors for continuous, non-contact level measurement
- Temperature: -40 to +95°C (-40 to +203°F)
  - Pressure: +0.7 to +4bar (+10 to +58psi)
  - Measuring range: up to 25m (9.8 to 82ft)
- 8**  
**Prosonic FDU91F**  
Hygienic sensor for continuous, non-contact level measurement
- Temperature: -40 to +105°C (-40 to +221°F), CIP: 30 min. +135°C (+275°F)
  - Pressure: +0.7 to +4bar (+10 to +58psi)
  - Measuring range: up to 10m (33ft)
- 10**  
**Prosonic FMU90**  
Transmitter in housing for field or top hat rail mounting for up to 2 sensors
- Calculations: Average, difference, sum
  - Ambient temperature: -40 to +60°C (-40 to +140°F)
  - Accuracy: ±2mm (0.08") + 0.17% of the measured distance

#### Advantages at a glance

- Unaffected by product properties, e. g. dielectric constant or density
- Easy and fast commissioning due to preset application parameters
- Calibration without filling or discharging

## Hydrostatic – the Waterpilot, the Deltapilot, the Cerabar, the Deltabar

Hydrostatic pressure sensors for level measurement may be used in almost all liquid media, from water through to pastes and sludges. Even under difficult process conditions, these sensors may be adjusted to the application in an optimum fashion. Differential pressure transmitters are used for level measurement in pressurized tanks and also in abrasive and corrosive media.



### The Waterpilot, Deltapilot, Cerabar and Deltabar portfolio for applications in liquids



- 1 2**  
**Waterpilot FMX11/FMX21**  
Level probe for freshwater (FMX11/21), wastewater and salt water (FMX21)
- Temperature: -10 to +70°C (+14°F to +158°F)
  - Measuring range: 100mbar to 20bar (1.5 to 300 psi)
  - Accuracy: ±0.35% (FMX11); ±0.2%, optional ±0.1% (FMX21)
- 3 4 5 6**  
**Deltapilot FMB50/51/52/53**  
Pressure sensor with Contite cell for hydrostatic level measurement in liquid and paste-like media
- Temperature: -10 to +100°C (14 to 212°F)
  - Measuring range: +100mbar to +10bar (+1.5 to +150psi)
  - Accuracy: Standard ±0.2%, optional ±0.1%
- 7**  
**Deltapilot FMB70**  
Highest performance pressure sensor with Contite cell for hydrostatic level measurement in liquids
- Temperature: -10 to +100°C (-14 to +212°F) (+135°C (+275°F) for 30min. max)
  - Measuring range: +0.1 to +10bar (+1.5 to +150psi)
  - Accuracy: Standard ±0.1%, optional ±0.075%
- 8 9**  
**Deltabar PMD55B/PMD75B**  
Differential pressure transmitter with metal sensor for measurement of pressure differences
- Temperature: -40 to +85°C (-40 to +185°F)
  - Measuring range: +10mbar to +40bar (+0.15 to +600psi)
  - Accuracy: ±0.1%, "Platinum" ±0.075%
- 10**  
**Deltabar PMD78B**  
Differential pressure transmitter with metal sensor for measurement of pressure differences
- Temperature: -40 to +120°C (-40 to +248°F)
  - Measuring range: +10mbar to +40bar (+0.15 to +600psi)
  - Accuracy: Standard ±0.05%, "Platinum" ±0.035%
- 11**  
**Deltabar FMD71/72**  
Electronic differential pressure system utilizing two ceramic sensor modules and one transmitter
- Temperature: -40 to +150°C (-40 to +302°F)
  - Measuring range: +100mbar to +40bar (+1.5 to +600psi)
  - Accuracy: ±0.075% single sensor, "Platinum" ±0.05% single sensor
- 12 13**  
**Cerabar PMP51B/PMP71B**  
Digital pressure transmitter with metal sensor for level, absolute and gauge pressure measurement
- Temperature: -40 to +400°C (-40 to +752°F)
  - Measuring range: 400mbar to 700bar (1.5 to 10,500psi)
  - Accuracy: ±0.055% (PMP51B), ±0.025% (PMP71B)
- 14 15**  
**Cerabar PMC51B/PMC71B**  
Digital pressure transmitter with ceramic sensor for level, absolute and gauge pressure measurement
- Temperature: -40 to +150°C (-40 to +302°F)
  - Measuring range: 100mbar to 40bar (1.5 to 600psi)
  - Accuracy: ±0.055% (PMC51B), ±0.025% (PMC71B)

#### Advantages at a glance

- Established measuring principle for temperatures up to 400°C (752°F) and pressures up to 700bar (10,500psi)
- Easy engineering
- Unaffected measurement with tank baffles or surface foam
- Hygiene instrument designs

## Capacitance – the Liquicap

Capacitance level measurement covers a wide range of applications which are not limited to process engineering. Simple and cost-effective probes offer a wealth of possibilities for level monitoring in liquids, particularly in small tanks, build-up forming media and extremely high temperatures. Certain interface measurements can also be solved with capacitance probes. Capacitance probes can also be used in processes with fast changes in the tank level.



### The Liquicap portfolio for applications in liquids



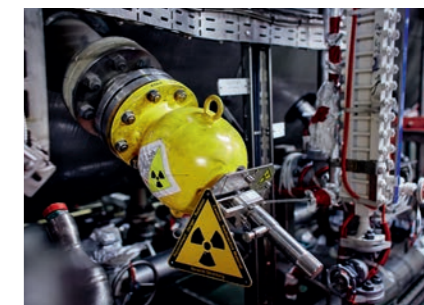
- 1**  
**Liquicap FMI21**  
For continuous level measurement in conductive liquids
- Temperature: -40 to +100°C (-40 to +212°F)
  - Pressure: Vacuum to +10bar (vacuum to +145psi)
  - Measuring range: up to 2.5m (8ft)
- 2**  
**Liquicap FMI51**  
For continuous level and interface measurement in liquids
- Temperature: -80 to +200°C (-112 to +392°F)
  - Pressure: Vacuum to +100bar (vacuum to +1,450psi)
  - Measuring range: 0.1 to 4.0m (0.3 to 13ft)
- 3**  
**Liquicap FMI52**  
For continuous level and interface measurement in liquids - for large measuring ranges
- Temperature: -80 to +200°C (-112 to +392°F)
  - Pressure: Vacuum to +100bar (vacuum to +1,450psi)
  - Measuring range: 0.42 to 10.0m (1.38 to 33ft)

#### ✓ Advantages at a glance

- Accurate measurement in small tanks
- Short response times
- Measurement from probe end to process connection, no blocking distance
- Technology proved in millions of applications
- Interface measurement independent of emulsion layers

## Radiometry – the Gammapiilot

Gamma instruments are used increasingly in applications where other measuring principles are no longer effective due to extreme process conditions or mechanical, geometric or structural conditions. Radiometric instruments work without contact with the process. They are installed externally on the tank or pipe and measure through the vessel wall. This measurement method is therefore suitable for use in a wide range of media, regardless of the medium properties.



### The Radiometry portfolio for applications in liquids



- 1**  
**Gammapiilot FMG50**  
The two-wire compact transmitter for point level detection, continuous level measurement, interface, density and concentration measurement
- Temperature: No limitation (non-invasive, extraneous)
  - Pressure: No limitation (non-invasive, extraneous)
- 2**  
**Gamma Modulator FHG65**  
Effective suppression of background and extraneous radiation
- Temperature: No limitation (non-invasive, extraneous)
  - Pressure: No limitation (non-invasive, extraneous)
- 3**  
**Source container FQG60**  
Radiation source container with radiation source insert with manual switch-on and switch-off
- Weight: 18kg
  - Pressure: No limitation (non-invasive, extraneous)
- 4 5**  
**Source container FQG61/62**  
Radiation source container with source holder for manual or pneumatic switch-on/switch-off
- Weight: 40kg (FQG61); 87kg (FQG62)
  - Pressure: No limitation (non-invasive, extraneous)
- 6**  
**Source container FQG63**  
Lightweight radiation source container with flexible extension element for source
- Temperature: -52 to +400°C (-62 to +752°F)
  - Weight: 87kg
  - Pressure: No limitation (non-invasive, extraneous)
- 7**  
**Source container FQG66**  
Radiation source container with source holder for manual or pneumatic switch-on/switch-off
- Weight: 435kg
  - Pressure: No limitation (non-invasive, extraneous)

#### ✓ Advantages at a glance

- Non-contact, external measurement for the highest degree of safety and reliability under the most extreme process conditions
- 2-wire loop-powered compact transmitter
- Functional safety up to SIL2/3 according to IEC 61508

## Servo and Radar for custody transfer

Our tank gauging instruments are used for custody transfer and inventory control applications with NMI- and PTB-approvals and meet the requirements according to OIML R85 and API 3.1B.



### The Proservo for applications in liquids



- |  |  |   |
|--|--|---|
| <p><b>1</b><br/><b>Micropilot NMR81</b><br/>Drip-off lens antenna with 80GHz transmitting frequency for free-space custody transfer applications with NMI and PTB approvals</p> <ul style="list-style-type: none"> <li>■ Temperature: -40 to +200°C (-40 to +392°F)</li> <li>■ Pressure: Vacuum to +16bar (vacuum to +232psi)</li> <li>■ Measuring range: up to 70m (230ft)</li> </ul> | <p><b>2</b><br/><b>Micropilot NMR84</b><br/>Drip-off planar antenna with 6GHz transmitting frequency for custody transfer stilling well applications with NMI and PTB approvals</p> <ul style="list-style-type: none"> <li>■ Temperature: -40 to +150°C (-40 to +302°F)</li> <li>■ Pressure: Vacuum to +25bar (vacuum to +362psi)</li> <li>■ Measuring range: up to 40m (131ft)</li> </ul> | <p><b>3</b><br/><b>Proservo NMS80/81</b><br/>High precision servo measurement for liquid level, interface and density profiling</p> <ul style="list-style-type: none"> <li>■ Temperature: -200 to +200°C (-328 to +392°F)</li> <li>■ Pressure: 0 to +6bar (0 to +87psi)/0 to +25bar (0 to +362psi)</li> <li>■ Measuring range: up to 55m (180ft)</li> </ul> |
| <p><b>4</b><br/><b>Micropilot FMR532</b><br/>6GHz high accuracy pulse radar for custody transfer applications in stilling wells with NMI and PTB approvals</p> <ul style="list-style-type: none"> <li>■ Temperature: -40 to +150°C (-40 to +302°F)</li> <li>■ Pressure: Vacuum to +25bar (vacuum to +362psi)</li> <li>■ Measuring range: up to 40m (131ft)</li> </ul>                  | <p><b>5</b><br/><b>Micropilot FMR540</b><br/>26GHz high accuracy pulse radar for custody transfer free-space applications with NMI and PTB approvals</p> <ul style="list-style-type: none"> <li>■ Temperature: -40 to +200°C (-40 to +392°F)</li> <li>■ Pressure: Vacuum to +16bar (vacuum to +232psi)</li> <li>■ Measuring range: up to 40m (131ft)</li> </ul>                            |   |

#### ✓ Advantages at a glance

- Hardware and software developed according to IEC 61508 up to SIL3 (in homogeneous redundancy) for high level of safety
- Maximum reliability through accuracy up to  $\pm 0.4\text{mm}$  ( $\pm 0.02\text{''}$ )
- Developed according to international metrology recommendations such as OIML R85 and API MPMS
- Local and country-specific certifications like NMI or PTB for custody transfer applications
- Simplified installation and trouble-free operations due to easy connection to major DCS systems via open protocols

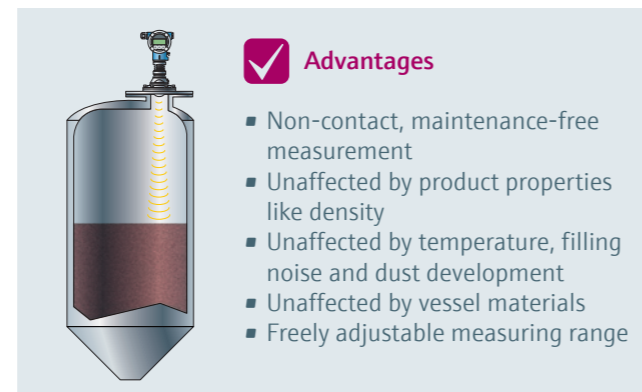


# Continuous level measurement in bulk solids

Choose the measuring principle which fits best for your application.

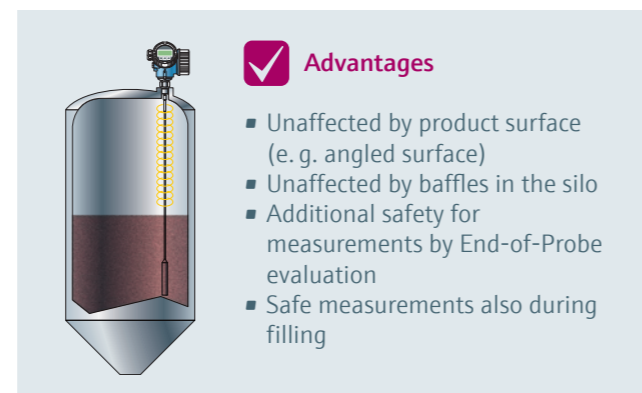
## Radar

Micropilot works with either pulses or with Frequency Modulated Continuous Wave (FMCW). Pulse: High-frequency radar pulses which are emitted by an antenna and reflected from the product surface. The time between pulse launching and receiving is measured and analyzed by the instrument and constitutes a direct measure for the distance between the antenna and the surface of the medium. FMCW: Works with an FMCW continuous electromagnetic wave which is emitted from an antenna and reflected by the product surface. The frequency change “ $\Delta f$ ” is measured and the time and distance are calculated.



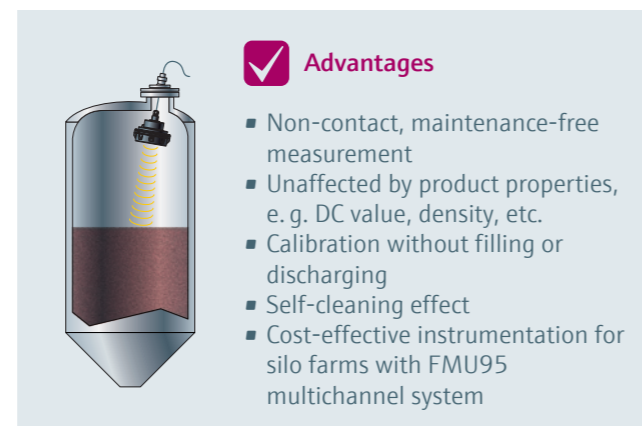
## Guided radar

Levelflex works with radar pulses guided along a probe. As the pulses meet the medium surface, part of the emitted pulse is reflected due to a change of the DC value between the air and the medium. The time between pulse launching and receiving is measured and analyzed by the instrument and constitutes a direct measure for the distance between the process connection and the product surface.



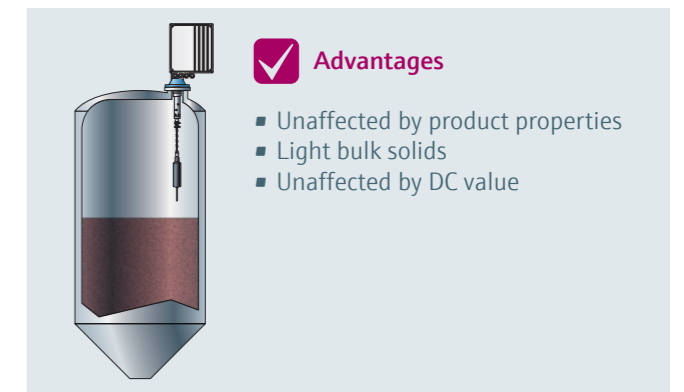
## Ultrasonics

Prosonic works with ultrasonic pulses which are emitted by a sensor, reflected by the surface of the medium due to a change of the density between the air and the medium and again acquired by the sensor. The required Time-of-Flight is a measure for the distance travelled in the empty part of the silo. This value is deducted from the overall height of the silo to yield the level.



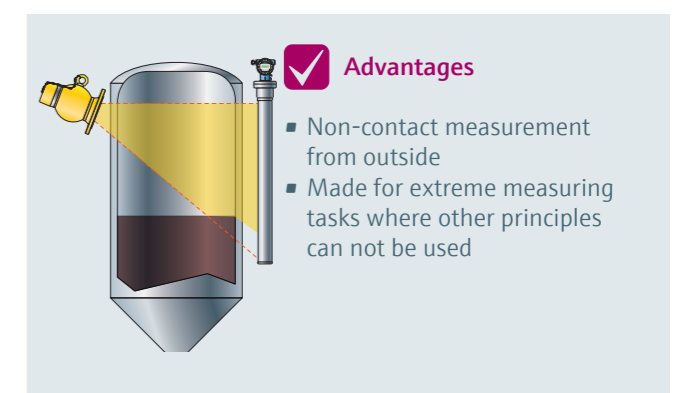
## Electromechanical level system

A weight is lowered on a measuring tape. As it meets the surface of the bulk solids, the tensile force of the weight is reduced. This change is recognized, the instrument reverses the sense of rotation of the motor and rewinds the tape. A pulse generator counts the rotations in a non-contact manner as the weight is lowered. Each counted pulse corresponds to an exactly defined distance. If this distance is deducted from the overall distance (height of the vessel), the level results.



## Radiometry

The radiometric measuring principle is based on the fact that gamma radiation is attenuated when it penetrates a medium. The radiation source is installed in a source container, which allows the radiation to be emitted only in the direction of the process vessel. The detector is positioned on the opposite side of the process vessel. It converts the received radiation into an electrical signal and uses it to calculate the level.



## Radar – the Micropilot

Radar level measurement is a safe solution under extreme process conditions and vapors. The development of this measuring principle led to its use in bulk solid applications, since it is unaffected by dust and noise.



### The Micropilot portfolio for applications in bulk solids



1

#### Micropilot FMR10/FMR20

Basic model for level measurement in bulk solids

- Temperature: -40 to +80°C (-40 to +176°F)
- Pressure: -1 to +3bar (-14.5 to +43psi)
- Measuring range: up to 15m (49 ft)

2

#### Micropilot FWR30

The cloud-based level sensor for stationary and mobile applications

- Temperature: -20 to +60°C (-4 to +140°F)
- Measuring range: up to 15m (49 ft)

3

#### Micropilot FMR66B

Basic model for level measurement in solids

- Temperature: -40 to +200°C (-40 to +392°F)
- Pressure: up to +3bar (up to +43.5psi)
- Measuring range: up to 50m (164ft)

4

#### Micropilot FMR57

The sensor for high demands in bulk solids level measurement

- Temperature: -40 to +400°C (-40 to 752°F)
- Pressure: up to +16bar (up to +232psi)
- Measuring range: up to 70m (230ft)

5

#### Micropilot FMR67B

For highest demands in bulk solids. Level measurement with 80GHz technology

- Temperature: -40 to +450°C (-40 to 842°F)
- Pressure: Vacuum to +160bar (vacuum to +2,320psi)
- Measuring range: up to 125m (410ft)

### Advantages at a glance

- Hard- and software developed according to IEC 61508 for SIL2 (Min./Max. range) respectively SIL3 (homogeneous redundancy)
- Highest process safety due to Multi-Echo Tracking evaluation
- Non-contact measurement, free of wear and tear, that can be used in extreme process conditions
- Vapors or dusts do not affect the measurement
- Safe measurement in silos with changing product
- Reliable measurement due to advanced dynamics signal strength
- Heartbeat Technology for a cost-effective and safe plant operation during the entire life cycle

## Guided radar – the Levelflex

Guided radar pulse measurement is well suited to bulk solids. The surface condition of the medium is of minor importance due to the safe guidance of the reflected waves. Different angled surfaces or outflow funnels, as they occur in bulk solids, do not influence measurement.



### The Levelflex portfolio for applications in bulk solids



1

#### Levelflex FMP56

Economically efficient basis model for all level applications in bulk solids

- Temperature: -40 to +120°C (-40 to +248°F)
- Pressure: up to +16bar (up to +232psi)
- Measuring range: up to 12m (39ft)

2

#### Levelflex FMP57

The sensor for highest demands for level measurement in bulk solids

- Temperature: -40 to +185°C (-40 to +365°F)
- Pressure: up to +16bar (up to +232psi)
- Measuring range: rod up to 4m (13ft), rope up to 45m (148ft)

### Advantages at a glance

- Hard- and software developed according to IEC 61508 for SIL2 (Min./Max./range) respectively SIL3 (homogeneous redundancy)
- Highest process safety due to Multi-Echo Tracking evaluation
- Safe measurement in bulk solids and in applications with strong dust formation
- Simple commissioning due to precalibrated sensor
- Heartbeat Technology for a cost-effective and safe plant operation during the entire life cycle



## Ultrasonic – the Prosonic

The ultrasonic method is a proved, as well as cost-effective, solution for level measurement bulk solids. Instruments are available as compact or separate versions. This measuring principle is characterized by easy planning and assembly, fast and safe commissioning, a long service life and reduced maintenance costs. Typical applications include abrasive and aggressive media, even in rough environments.



### The Prosonic portfolio for applications in bulk solids



- 1**  
**Prosonic FMU30**  
Cost effective all-round instrument for level applications in bulk solids
- Temperature: -40 to +60°C (-40 to +140°F)
  - Pressure: +0.7 to +3bar (+10 to +44psi)
  - Measuring range: Sensor 1½" up to 2m (6.6ft), sensor 2" up to 3.5m (11ft)
- 2 3 4 5**  
**Prosonic FMU40/41/42/44**  
Cost effective device for sophisticated level measurement in bulk solids
- Temperature: -40 to +80°C (-40 to +176°F)
  - Pressure: +0.7 to +3bar (+10 to +44psi)
  - Measuring range: up to 10m (33ft)
- 6 7 8 10 11**  
**Prosonic FDU90/91/92/93/95**  
Ultrasonic sensor for level and flow measurement for connection to FMU9x
- Temperature: -40 to +150°C (-40 to +302°F)
  - Pressure: +0.7 to +4bar (+10 to +58psi)
  - Measuring range: up to 45m (148ft)
- 9**  
**Prosonic FDU91F**  
Hygienic sensor for level measurement for connection to FMU9x
- Temperature: -40 to +105°C (-40 to +221°F), 30min., +135°C (+275°F)
  - Pressure: +0.7 to +4bar (+10 to +58psi)
  - Measuring range: up to 5m (16ft)
- 12 13**  
**Prosonic FMU90/95**  
Transmitter in housing for field or top hat rail mounting for up to 10 sensors
- Calculations: Average, difference, sum
  - Ambient temperature: -40 to +60°C (-40 to +140°F)
  - Accuracy: ±2mm + 0.17% of the adjusted measuring range

#### Advantages at a glance

- Unaffected by product properties, e. g. density or moisture
- Easy and fast commissioning due to preset application parameters
- Calibration without filling or discharging

## Electromechanical level measurement – the Silopilot

Old seafarers used a weight on a rope to test the depth to the bottom of the sea. In industrial level measurement, the basic idea of sounding is still utilized in the electromechanical level system. Where other measurement methods are limited, applications involving bulk solids predominantly use electromechanical level measurements.



### The Silopilot portfolio for applications in bulk solids



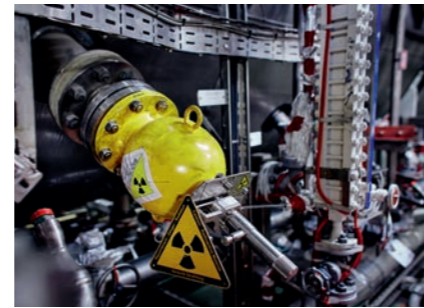
- 1**  
**Silopilot FMM20**  
Basic model for continuous level measurement in light bulk solids
- Temperature: -20 to +150°C (-4 to +302°F)
  - Pressure: +0.8 to +1.1bar (+11.6 to +15.95psi)
  - Measuring range: up to 32m (105ft)
- 2**  
**Silopilot FMM50**  
For continuous level measurement even in high bulk solids silos or bins
- Temperature: -20 to +230°C (-4 to +446°F)
  - Pressure: +0.8 to +3bar (+11.6 to +43.5psi)
  - Measuring range: up to 90m (295ft)

#### Advantages at a glance

- Proved, reliable measurement up to 90m (295ft)
- Safe measurement in extremely dusty environments
- Robust system with high tensile force prevents breakdown due to an immersed weight
- Compact instrument with 4 to 20mA current output as well as additional freely programmable signal outputs (e. g. counting pulses, relays)

## Radiometry – the Gammapiilot

Gamma instruments are used increasingly in applications where other measuring principles are no longer effective due to extreme process conditions or mechanical, geometric or structural conditions. Radiometric instruments work without contact with the process. They are installed externally on the tank or pipe and measure through the vessel wall. This measurement method is therefore suitable for use in a wide range of media, regardless of the medium properties.



### The Radiometry portfolio for applications in bulk solids



- 1**  
**Gammapiilot FMG50**  
The two-wire compact transmitter for point level detection, continuous level measurement, interface, density and concentration measurement
- Temperature: No limitation (non-invasive, extraneous)
  - Pressure: No limitation (non-invasive, extraneous)
- 2**  
**Gamma Modulator FHG65**  
Effective suppression of background and extraneous radiation
- Temperature: No limitation (non-invasive, extraneous)
  - Pressure: No limitation (non-invasive, extraneous)
- 3**  
**Source container FQG60**  
Radiation source container with radiation source insert with manual switch-on and switch-off
- Weight: 18kg
  - Pressure: No limitation (non-invasive, extraneous)
- 4 5**  
**Source container FQG61/62**  
Radiation source container with source holder for manual or pneumatic switch-on/switch-off
- Weight: 40kg (FQG61); 87kg (FQG62)
  - Pressure: No limitation (non-invasive, extraneous)
- 6**  
**Source container FQG63**  
Lightweight radiation source container with flexible extension element for source
- Temperature: -52 to +400°C (-62 to +752°F)
  - Weight: 87kg
  - Pressure: No limitation (non-invasive, extraneous)
- 7**  
**Source container FQG66**  
Radiation source container with source holder for manual or pneumatic switch-on/switch-off
- Weight: 435kg
  - Pressure: No limitation (non-invasive, extraneous)

#### Advantages at a glance

- Non-contact, external measurement for the highest degree of safety and reliability under the most extreme process conditions
- 2-wire loop-powered compact transmitter
- Functional safety up to SIL2/3 according to IEC 61508

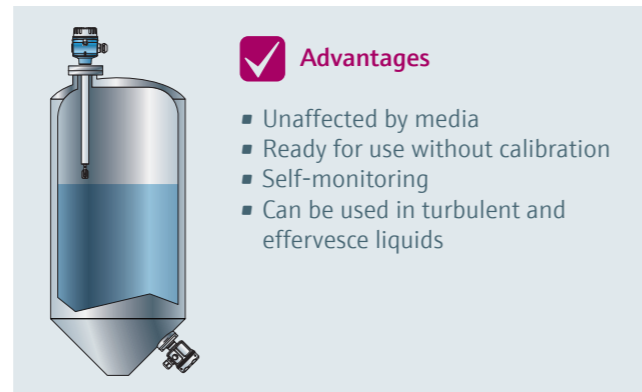


# Point level detection in liquids

Choose the measuring principle which fits best for your application.

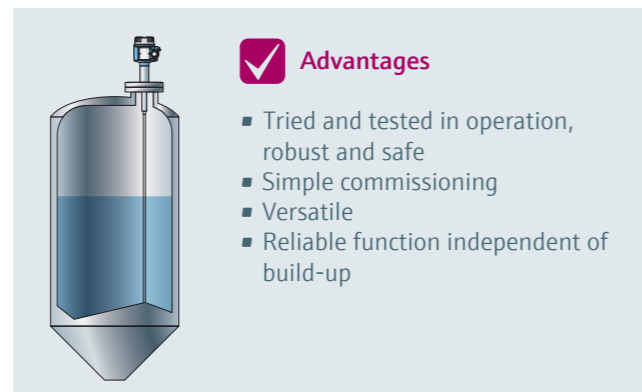
## Vibronic

A sensor in form of a tuning fork is excited at its resonant frequency. The drive works piezoelectrically. The oscillating frequency changes as the fork enters the medium. The change is analyzed and translated into a switching signal.



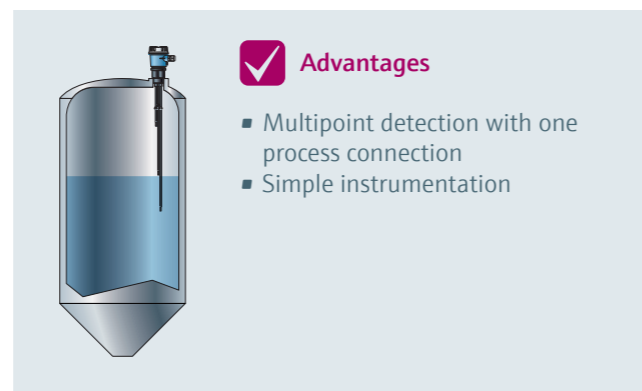
## Capacitance

A capacitance probe may be compared to an electric capacitor. As the tank is filled, the probe capacity increases. This change is electrically analyzed.



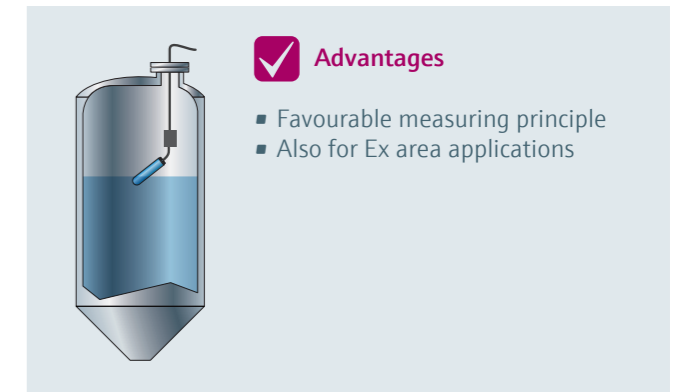
## Conductive

The resistance between two measuring electrodes changes by the presence or absence of a medium. In single-rod probes, the electrically conductive tank wall serves as a counter electrode.



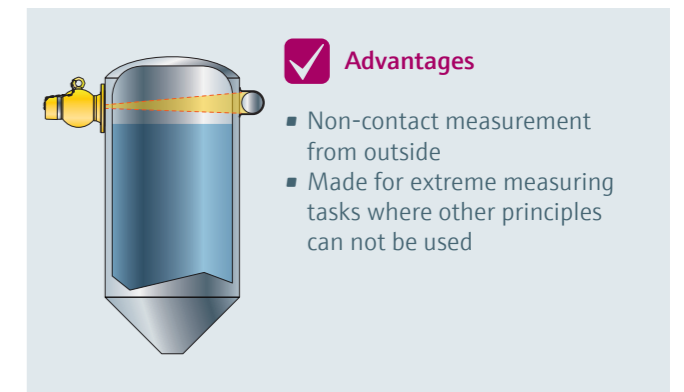
## Float switch

As the switch floats up and down on the surface of a liquid, an installed sensor detects its position and triggers the switching operation.



## Radiometry

The radiometric measuring principle is based on the fact that gamma radiation is attenuated when it penetrates a medium. The radiation source is installed in a source container, which allows the radiation to be emitted only in the direction of the process vessel. The detector is positioned on the opposite side of the process vessel. It converts the received radiation into an electrical signal and uses it to calculate the level.



## Vibronic – the Liquiphant

The instruments of the Liquiphant family reliably monitor the point level of all pumpable liquids in tanks and pipes. There are numerous applications from simple operational point level detection (minimum and maximum control), certified leakage monitoring and overfill prevention through to protective equipment in plant parts subject to Safety Integrity Levels (SIL2/3).



### The Liquiphant portfolio for applications in liquids



1

**Liquiphant FTL31**  
Point level switch in compact design with stainless steel housing

- Temperature: -40 to +150°C (-40 to +302°F)
- Pressure: -1 to +40bar (-14.5 to +580psi)
- Surface roughness: 3.2µm

2

**Liquiphant FTL33**  
Point level switch in compact hygienic design with stainless steel housing for the food industry

- Temperature: -40 to +150°C (-40 to +302°F)
- Pressure: -1 to +40bar (-14.5 to +580psi)
- Surface roughness: 0.76µm or 1.5µm

3

**Liquiphant FTL41**  
Point level switch for liquids in utilities across all industries

- Temperature: -40 to +150°C (-40 to +302°F)
- Pressure: -1 to +40bar (-14.5 to +580psi)

4

**Liquiphant FTL51B**  
Point level switch for liquids in the process industry

- Temperature: -50 to +150°C (-58 to +302°F)
- Pressure: -1 to +100bar (-14.5 to +1,450psi)

5

**Liquiphant FTL62**  
Point level switch for liquids with highly corrosion-resistant coating

- Temperature: -50 to +150°C (-58 to +302°F)
- Pressure: -1 to +40 bar (-14.5 to +580psi)

6 7

**Liquiphant FTL50H/51H**  
Point level switch for liquids especially in the food and life sciences industry

- Temperature: -50 to +150°C (-58 to +302°F)
- Pressure: -1 to +64bar (-14.5 to +928psi)

8

**Liquiphant FTL64**  
Point level switch for liquids in high-temperature applications

- Temperature: -60 to +280°C (-76 to +540°F); 300°C (572°F), 50 h on cumulative basis
- Pressure: -1 bis +100 bar (-14.5 to +1,450psi)

9 10 11

**Liquiphant FTL80/81/85**  
Point level switch for liquids for FailSafe overfill prevention

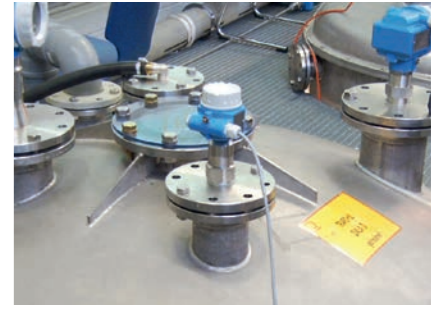
- Temperature: -60 to +280°C (-76 to +540°F)
- Pressure: -1 to +100bar (-14.5 to +1,450psi)

#### Advantages at a glance

- Universal use – unaffected by medium properties such as conductivity, dielectric constant, viscosity, pressure and temperature
- Free of calibration and maintenance
- Functional safety SIL2/3
- Accurate switch-point
- Highest reliability due to self-monitoring

## Capacitance – the Liquicap, the Liquipoint

Capacitance level measurement covers a wide range of applications. Simple and cost-effective probes offer many possibilities for point level detection in liquids. This measuring principle is particularly suited to applications involving aggressive media and heavy build-up.



### The Liquicap and Liquipoint portfolio for applications in liquids



1

**Liquicap FTI51**  
For liquids that are highly viscous and tend to form build-up

- Temperature: -80 to +200°C (-112 to +392°F)
- Pressure: Vacuum to +100bar (vacuum to +1,450psi)
- Sensor length: up to 6m (20ft)

2

**Liquicap FTI52**  
For liquids that are highly viscous and tend to form build-up – for large measuring ranges

- Temperature: -80 to +200°C (-112 to +392°F)
- Pressure: Vacuum to +100bar (vacuum to +1,450psi)
- Sensor length: up to 12m (39ft)

3

**Liquipoint FTW23**  
Compact probe for operation in water base media

- Temperature: -20 to +100°C (-4 to +212°F), CIP/SIP to +135°C (+275°F) for 1h
- Pressure: -1 to +16bar (-14.5 to +232psi)

4

**Liquipoint FTW33**  
Compact, flush-mounted probe

- Temperature: -20 to +100°C (-4 to +212°F), CIP/SIP to +150°C (+302°F) for 1h
- Pressure: -1 to 25 bar (-14.5 to 362.5psi)
- Sensor length: Flush-mounted

#### Advantages at a glance

- Proved technology
- Universally adaptable probes
- Reliable performance also in viscous media or heavy build-up

## Conductive – the Liquipoint

The conductive measuring principle offers the possibility for simple, safe detection of a point level in conductive liquids. The measuring principle performs well for a wide range of applications, from secure inventories (minimum quantity) and the avoidance of tank overflow through to two-point and multi-point control (pump control).



## Float switch – the Liquifloat

This measuring principle is a simple and cost-effective procedure for point level detection in liquids. It is predominantly used as a level alarm in open basins, e. g. in sewerage treatment plants.



### The Liquipoint portfolio for applications in liquids



- 1**  
**Liquipoint FTW31**  
Rod probe for multi-point detection up to 5 switch points
- Temperature: -40 to +100°C (-40 to +212°F)
  - Pressure: -1 to +10bar (-14.5 to +145psi)
  - Sensor length: +0.1 to +4m (+3.9 to +157")
- 2**  
**Liquipoint FTW32**  
Rope probe for multi-point detection up to 5 switch points
- Temperature: -40 to +70°C (-40 to +158°F)
  - Pressure: -1 to +10bar (-14.5 to +145psi)
  - Sensor length: +0.25 to +15m (+10 to +590")
- 3**  
**Liquipoint FTW33**  
Very compact flush-mounted probe
- Temperature: -20 to +100°C (-4 to +212°F), CIP/SIP to +150°C (+302°F) for 1h
  - Pressure: -1 to +25bar (-14.5 to +362.5psi)

### The Liquifloat for applications in liquids



- 1**  
**Liquifloat FTS20**  
For point level detection in liquids
- Temperature: -20 to +85°C (-4 to +185°F)
  - Pressure: up to +3bar (up to +43.5psi)

#### ✓ Advantages at a glance

- Simple measuring principle
- Multi-point detection with one process connection

#### ✓ Advantages at a glance

- Simple measuring principle
- Also for Ex area applications

## Radiometry – the Gammapilot

Gamma instruments are used increasingly in applications where other measuring principles are no longer effective due to extreme process conditions or mechanical, geometric or structural conditions. Radiometric instruments work without contact with the process. They are installed externally on the tank or pipe and measure through the vessel wall. This measurement method is therefore suitable for use in a wide range of media, regardless of the medium properties.



### The Radiometry portfolio for applications in liquids



- |   |  |   |
|---|--|---|
| <p><b>1</b><br/><b>Gammapilot FMG50</b><br/>The 2-wire compact transmitter for point level detection, continuous level, interface and density measurement</p> <ul style="list-style-type: none"> <li>■ Temperature: No limitation (non-invasive, extraneous)</li> <li>■ Pressure: No limitation (non-invasive, extraneous)</li> </ul> | <p><b>2</b><br/><b>Gamma Modulator FHG65</b><br/>Effective suppression of background and extraneous radiation at the Gammapilot FMG60</p> <ul style="list-style-type: none"> <li>■ Temperature: No limitation (non-invasive, extraneous)</li> <li>■ Pressure: No limitation (non-invasive, extraneous)</li> </ul>    | <p><b>3</b><br/><b>Source container FQG60</b><br/>Radiation source container with radiation source insert with manual switch-on and switch-off</p> <ul style="list-style-type: none"> <li>■ Weight: 18kg</li> <li>■ Pressure: No limitation (non-invasive, extraneous)</li> </ul> |
| <p><b>4 5</b><br/><b>Source container FQG61/62</b><br/>Radiation source container with source holder for manual or pneumatic switch-on/switch-off</p> <ul style="list-style-type: none"> <li>■ Weight: 40kg (FQG61); 87kg (FQG62)</li> <li>■ Pressure: No limitation (non-invasive, extraneous)</li> </ul>                            | <p><b>6</b><br/><b>Source container FQG63</b><br/>Radiation source container with flexible extension element for radiator</p> <ul style="list-style-type: none"> <li>■ Temperature: -52 to +400 °C (-62 to +752 °F)</li> <li>■ Weight: 87kg</li> <li>■ Pressure: No limitation (non-invasive, extraneous)</li> </ul> | <p><b>7</b><br/><b>Source container FQG66</b><br/>Radiation source container with source holder for manual or pneumatic switch-on/switch-off</p> <ul style="list-style-type: none"> <li>■ Weight: 435kg</li> <li>■ Pressure: No limitation (non-invasive, extraneous)</li> </ul>  |

#### ✓ Advantages at a glance

- Non-contact, external measurement for the highest degree of safety and reliability under the most extreme process conditions
- 2-wire loop-powered compact transmitter
- Functional safety up to SIL2/3 according to IEC 61508

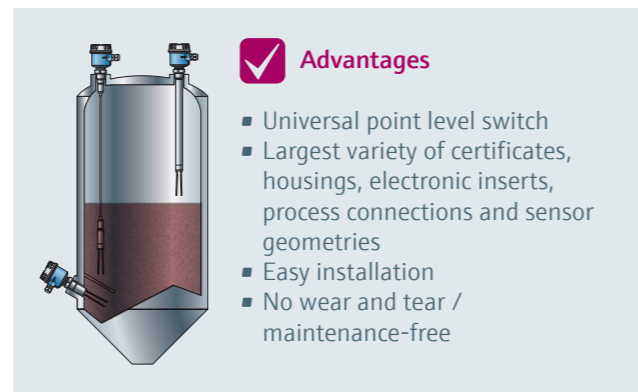


# Point level detection in bulk solids

Choose the measuring principle which fits best for your application.

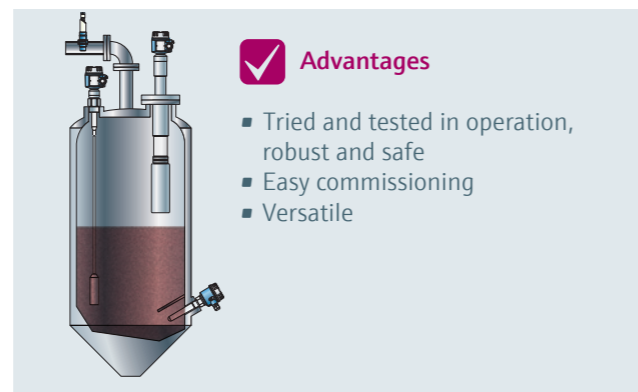
## Vibronic

A one-rod sensor or a tuning fork is excited at its resonant frequency. The drive works piezoelectrically. The amplitude changes as the fork enters the medium. The change is analyzed and translated into a switching signal.



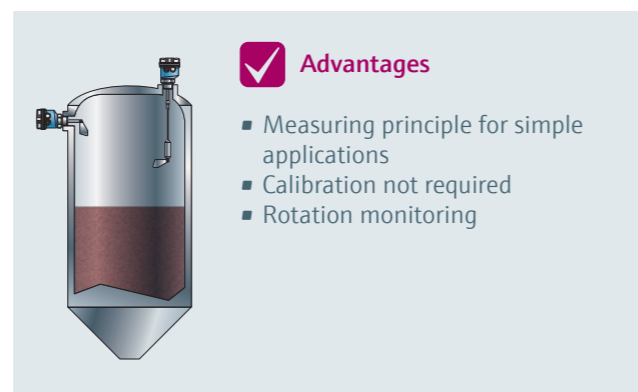
## Capacitance

A capacitance probe may be compared to an electric capacitor. As the tank is filled, the probe capacity increases. This change is electrically analyzed.



## Paddle

The rotation of the paddle is stopped as it is covered by solids. This actuates a relay.

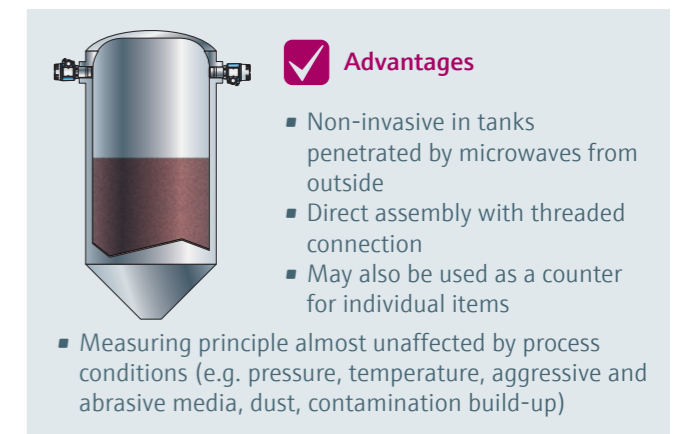


## Microwave barrier

**Microwave barrier:**  
Detection of all kinds of bulk solids is based on microwaves (transmitter-receiver principle).

**Bulk solids movement sensor:**  
Detection of bulk solids movement (present / not present) is based on microwaves (Doppler effect).

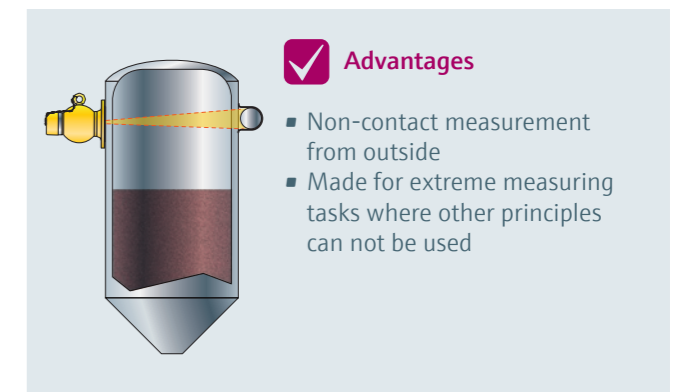
Inspection glasses have to be installed in case of metallic container walls. Installation in contact with the process is also possible.



## Radiometry

The radiometric measuring principle is based on the fact that gamma radiation is attenuated when it penetrates a medium. The radiation source is installed in a source container, which allows the radiation to be emitted only in the direction of the process vessel.

The detector is positioned on the opposite side of the process vessel. It converts the received radiation into an electrical signal and uses it to calculate the level.



## Vibronic – the Soliphant

The Soliphant offers robust point level switches for applications in powdery, fine-grained and lumpy bulk solids and solids with low density, e. g. caused by fluidizing. The different designs allow application diversity – Soliphant can even be used in hazardous areas. Typical examples are found in primaries (cement, plaster), the chemical industry (plastic granules, detergents), the food industry (flour, sugar) and animal feed production (wheat, corn).



### The Soliphant portfolio for applications in bulk solids



- 1 Soliphant FTM20**  
Compact vibration point level switch for bulk solids
- Temperature: -40 to +150°C (-40 to +302°F)
  - Pressure: -1 to +40bar (-14.5 to +580psi)
  - Sensor length: up to 225mm (9")
- 2 Soliphant FTM21**  
Vibration point level switch for bulk solids
- Temperature: -40 to +150°C (-40 to +300°F)
  - Pressure: -1 to +25bar (-14.5 to +360psi)
  - Sensor length: 500mm (20"), 1,000mm (40"), 1,500mm (60")
- 3 4 5 6 Soliphant FTM50**  
Universal point level switch for fine-grained bulk solids also for explosion-hazardous areas
- Temperature: -50 to +280°C (-60 to +540°F)
  - Pressure: -1 to +25bar (-14.5 to +360psi)
  - Sensor length: 145mm (5.7"), 200mm (8")
- 7 Soliphant FTM51**  
Universal point level switch for fine-grained bulk solids also for explosion-hazardous areas
- Temperature: -50 to +280°C (-60 to +540°F)
  - Pressure: Vacuum to 25bar (vacuum to 360psi)
  - Sensor length: 300 to 4,000mm (12 to 155"), 6,000mm (230") on request
- 8 Soliphant FTM52**  
Universal point level switch for fine-grained bulk solids also for explosion-hazardous areas
- Temperature: -40 to +80°C (-40 to +170°F)
  - Pressure: -1 to +2bar (-14.5 to +30psi), +6bar (+80psi) for EExd/EEExde
  - Sensor length: 750 to 20,000mm (30 to 800")

#### Advantages at a glance

- Universal use – independent of the medium
- Easy, fast commissioning (no calibration required)
- Permanent self-monitoring
- Build-up and abrasion monitoring

## Capacitance – the Nivector, the Minicap, the Solicap

Capacitance level measurement covers a wide range of applications which are not limited to process engineering. Simple and cost-effective probes offer many possibilities for point level detection in liquids and bulk solids. This measuring principle is particularly suited to applications involving aggressive media and heavy build-up.



### The Nivector, Minicap and Solicap portfolio for applications in bulk solids



- 1 Nivector FTI26**  
For all types of powdered and fine-grained solids
- Temperature: -20 to +80°C (-4 to +176°F)
  - Pressure: -1 to +6bar (-14.5 to +90psi)
- 2 Minicap FTC260**  
Point level switch for light bulk solids
- Temperature: -40 to +130°C (-40 to +266°F)
  - Pressure: Vacuum to +25bar (vacuum to +360psi)
  - Sensor length: 140mm (5.51")
- 3 Minicap FTC262**  
Designed for light bulk solids
- Temperature: -40 to +80°C (-40 to +176°F)
  - Pressure: -1 to +6bar (-14.5 to +90psi)
  - Sensor length: 500 to 6,000mm (20 to 236")
- 4 Solicap FTI55**  
For point level detection for fine-grained to coarse-grained bulk solids
- Temperature: -50 to +180°C (-58 to +356°F)
  - Pressure: -1 to +25bar (-14.5 to +363psi)
  - Measuring range: 200 to 4,000mm (4 to 157")
- 5 Solicap FTI56**  
Point level detection for fine-grained to coarse-grained bulk solids
- Temperature: -50 to +180°C (-58 to +356°F)
  - Pressure: -1 to +25bar (-14.5 to +363psi)
  - Measuring range: 500 to 22,000mm (20 to 866")
- 6 7 Solicap FTI77**  
Point level detection for bulk solids, especially for high temperatures and strong mechanical loads
- Temperature: -50 to +400°C (-58 to +752°F)
  - Pressure: -1 to +10bar (-14.5 to +145psi)
  - Measuring range: 200 to 20,000mm (20 to 787")

#### Advantages at a glance

- Proved technology
- Universally adaptable probes
- Reliable performance also in viscous media or heavy build-up



## Paddle switch – the Soliswitch

The universally usable paddle point level switch is employed as a full, empty and requirement alarm in silos with bulk solids. It is ideal for flowing bulk solids up to a grain size of 50mm (2").



### The Soliswitch portfolio for applications in bulk solids



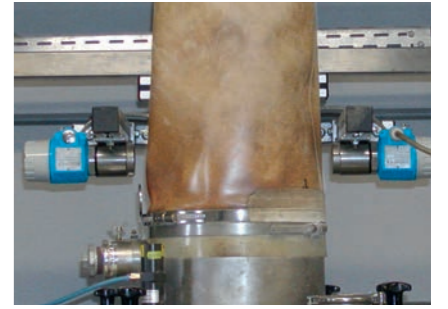
- 1 Soliswitch FTE20**  
Simple mechanical mechanism, extremely robust and cost-effective point level switch for bulk solids
- Temperature: -20 to +80°C (-4 to +170°F)
  - Pressure: +0.5 to +1.8bar (+7 to +25psi)
  - Sensor length: Different standard lengths between 75mm (3") and 300mm (12"), rope length of 2,000mm (80") (can be shortened)
- 2 Soliswitch FTE30**  
Simple mechanical mechanism, extremely robust and cost-effective point level switch for bulk solids
- Temperature: -20 to +80°C (-4 to +170°F)
  - Pressure: +0.5 to +1.8bar (+7 to +25psi)
  - Sensor length: Different standard lengths between 100mm (4") and 800mm (32"), rope length of 2,000mm (80") (can be shortened)
- 3 Soliswitch FTE31**  
Simple mechanical mechanism, extremely robust and cost-effective point level switch for bulk solids
- Temperature: -20 bis +80°C (-4 to 170°F)
  - Pressure: +0.5 to +1.8bar (+7 to +25psi)
  - Sensor length: Different standard lengths between 100mm (4") and 600mm (24"), rope length of 2,000mm (80") (can be shortened)

#### ✓ Advantages at a glance

- Easy installation
- Recognition of failures without dismantling the instrument
- Robust plastic housing with transparent cover
- Cover securing device
- Density setting without any tools
- Automatic rotation monitoring (optional)

## Microwave barrier – the Soliwave

In many cases where contact methods are limited, microwave barriers are the appropriate solution. They avoid jamming, indicate point levels, solve positioning and counting tasks, provide non-contact measurement and are thus, free of wear and tear. Typical products to be measured are wood chips, paper and carton chips, lime, pebbles, sand or even bags and complete boxes.



### The Soliwave portfolio for applications in bulk solids



- 1 Soliwave FQR57**  
Transmitter for non-contact point level detection in bulk solids
- Temperature: -40 to +70°C (-40 to +158°F); optional +450°C (+842°F)
  - Pressure: +0.5 to +6.8bar abs (+7.3 to +98.6psi); optional +21bar abs (+304.6psi)
  - Measuring range: up to 100m (328ft)
- 2 Soliwave FDR57**  
Transceiver for non-contact point level detection in bulk solids
- Temperature: -40 to +70°C (-40 to +158°F); optional +450°C (+842°F)
  - Pressure: +0.5 to +6.8bar abs (+7.3 to +98.6psi); optional +21bar abs (+304.6psi)
  - Measuring range: up to 100m (328ft)
- 3 Soliwave FQR56**  
Transmitter for non-contact point level detection in bulk solids
- Temperature: -40 to +70°C (-40 to +158°F); optional +450°C (+842°F)
  - Pressure: +0.5 to +6.8bar abs (+7.3 to +98.6psi); optional +21bar abs (+304.6psi)
  - Measuring range: up to 100m (328ft)
- 4 Soliwave FDR56**  
Transceiver for non-contact point level detection in bulk solids
- Temperature: -40 to +70°C (-40 to +158°F); optional +450°C (+842°F)
  - Pressure: +0.5 to +6.8bar abs (+7.3 to +98.6psi); optional +21bar abs (+304.6psi)
  - Measuring range: up to 100m (328ft)
- 5 Soliwave FQR16**  
Transceiver for non-contact point level detection in bulk solids
- Temperature: -20 to +60 °C (-4 to +140°F); optional +450°C (+842°F)
  - Pressure: 0.5 to 6.8bar abs (7.3 to 98.6psi); optional +21bar abs (+304.6psi)
  - Measuring range: up to 20m (66ft)
- 6 Soliwave FDR16**  
Transceiver for non-contact point level detection in bulk solids
- Temperature: -20 to +60 °C (-4 to +140°F); optional +450°C (+842°F)
  - Pressure: 0.5 to 6.8bar abs (7.3 to 98.6psi); optional +21bar abs (+304.6psi)
  - Measuring range: up to 20m (66ft)

#### ✓ Advantages at a glance

- Adjustable sensitivity
- Non-contact measurement
- No wear and tear or maintenance with long service life
- Easy installation and commissioning
- Indication of the signal strength
- Automatical adjustment function
- On-site display and simulation

## Radiometry – the Gammapilot

Gamma instruments are used increasingly in applications where other measuring principles are no longer effective due to extreme process conditions or mechanical, geometric or structural conditions. Radiometric instruments work without contact with the process. They are installed externally on the tank or pipe and measure through the vessel wall. This measurement method is therefore suitable for use in a wide range of media, regardless of the medium properties.



### The Radiometry portfolio for applications in bulk solids



- 1**  
**Gammapilot FMG50**  
The 2-wire compact transmitter for point level detection, continuous level, interface and density measurement
- Temperature: No limitation (non-invasive, extraneous)
  - Pressure: No limitation (non-invasive, extraneous)
- 2**  
**Gamma Modulator FHG65**  
Effective suppression of background and extraneous radiation at the Gammapilot FMG60
- Temperature: No limitation (non-invasive, extraneous)
  - Pressure: No limitation (non-invasive, extraneous)
- 3**  
**Source container FQG60**  
Radiation source container with radiation source insert with manual switch-on and switch-off
- Weight: 18kg
  - Pressure: No limitation (non-invasive, extraneous)
- 4 5**  
**Source container FQG61/62**  
Radiation source container with source holder for manual or pneumatic switch-on/switch-off
- Weight: 40kg (FQG61); 87kg (FQG62)
  - Pressure: No limitation (non-invasive, extraneous)
- 6**  
**Source container FQG63**  
Radiation source container with flexible extension element for radiator
- Temperature: -52 to +400°C (-62 to +752°F)
  - Weight: 87kg
  - Pressure: No limitation (non-invasive, extraneous)
- 7**  
**Source container FQG66**  
Radiation source container with source holder for manual or pneumatic switch-on/switch-off
- Weight: 435kg
  - Pressure: No limitation (non-invasive, extraneous)

#### ✓ Advantages at a glance





- Non-contact, external measurement for the highest degree of safety and reliability under the most extreme process conditions
- 2-wire loop-powered compact transmitter
- Functional safety up to SIL2/3 according to IEC 61508



# Density / Concentration

Density measurement for quality monitoring and process control

## Vibronic – Liquiphant Density

	 Vibronic – Liquiphant	 Coriolis – Promass	 Radiometry – Gammapiilot	 Servo Technology – Proservo
<b>Advantages</b>	<ul style="list-style-type: none"> <li>Large number of process connection to choose from: universal usage</li> <li>Useable in hygienic applications</li> <li>Calculation of customer specific units e.g °Brix, °Plato, °Baumé etc. possible</li> <li>Up to 5 Liquiphant Density sensors can be connect to the density computer FML621</li> </ul>	<ul style="list-style-type: none"> <li>Maximum process dependability, because density, temperature and mass flow are all measured directly</li> <li>Approval for custody transfer applications</li> <li>No maintenance necessary</li> </ul>	<ul style="list-style-type: none"> <li>External, contact-free measurement without interrupting the process</li> <li>Suitable for abrasive and aggressive media and for liquids containing solids</li> </ul>	<ul style="list-style-type: none"> <li>Level and density measurement with just one device</li> <li>Approval for custody transfer</li> <li>Creation of density profiles over the entire tank height</li> </ul>
<b>Installation options</b>	Direct measurement in tanks and pipes	Direct measurement in the pipe	From outside through the pipe, in the bypass or tank	Direct measurement in tanks
<b>Process temperature</b>	0 to +80°C/+32 to +176°F	-50 to +200°C/-58 to +392°F (-200 to +350°C/-328 to +662°F optional)	Independent	-200 to +200°C/-328 to +392°F
<b>Process pressure</b>	up to 25bar/363psi	up to 400bar/5,800psi	Independent	up to 25bar/363psi
<b>Accuracy</b>	0.002g/cm <sup>3</sup>	0.0005g/cm <sup>3</sup>	±0.001g/cm <sup>3</sup>	0,003g/cm <sup>3</sup>
<b>Reproducibility</b>	0.0007g/cm <sup>3</sup>	0.00025g/cm <sup>3</sup>	±0.0005g/cm <sup>3</sup>	
<b>Units of density</b>	Norm density, °Brix, °Baumé, °Plato, % volume, concentration etc. with 2D and 3D tables. Formula editor to calculate customer specific units	Standard density, standard volume flow and totalizing, % mass, % volume, alcohol tables (for mass and volume), target flow and carrier flow, °Brix, °Plato, °Baumé, °API, etc.	g/cm <sup>3</sup> , g/l, lb/gal, concentration	g/m <sup>3</sup> , g/ml, g/l, kg/l, kg/dm <sup>3</sup> , kg/m <sup>3</sup> , lb/ft <sup>3</sup> , lb/gal (us), lb/in <sup>3</sup> , STon/yd <sup>3</sup> , °API, SGU
<b>Output/ communication</b>	4 to 20mA, relay, Ethernet, PROFIBUS Profinet	4 to 20mA, HART, PROFIBUS PA/ DP, FOUNDATION fieldbus, MODBUS	4 to 20mA HART	Modbus RS485, V1, WM550, 4 to 20mA, HART (via Gauge Emulator: BPM and TRL/2)
<b>Approvals</b>	ATEX, FM, CSA, IECEx, TIIS, NEPSI, 3-A, EHEDG, CRN, FDA	ATEX, FM, CSA, TIIS, SIL2, 3-A, EHEDG, IECEx	ATEX, FM, CSA, IECEx, NEPSI, SIL, WHG	ATEX, FM, CSA, IECEx, NEPSI, SIL, WHG, TIIS For custody transfer applications: NMi, PTB, METAS, BEV...
<b>Additional information</b>	Connect of temperature- and pressure transmitter for compensation	Approvals for applications in custody transfer (PTB, NMi, EAM/METAS, BEV)	Additional volume flow measurement enables mass flow calculation	-
<b>Application limits</b>	<ul style="list-style-type: none"> <li>Gas bubbles or build-up at the sensor fork</li> <li>Fluid velocity &gt;2m/s in pipes</li> <li>Liquids with high viscosity &gt;350mPa·s</li> </ul>	<ul style="list-style-type: none"> <li>Not for non-homogeneous mediums</li> <li>Only for pipe diameters up to DN 250</li> </ul>	<ul style="list-style-type: none"> <li>Not with degasification in the medium</li> </ul>	<ul style="list-style-type: none"> <li>Highly variable levels (e.g. due to agitators)</li> <li>Density range: 0.430 to 2.000g/cm<sup>3</sup></li> </ul>

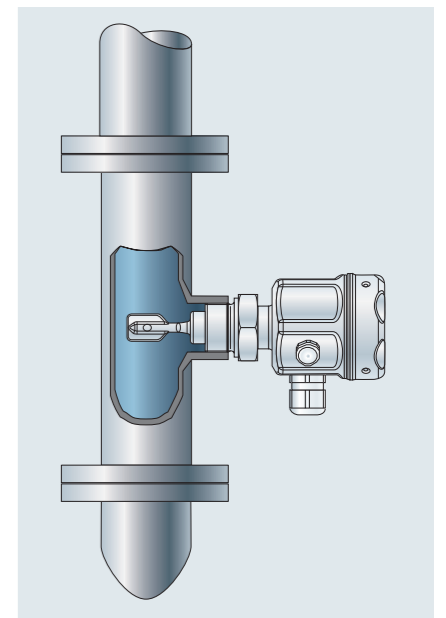
**Quality measurement in liquids**  
 With an individual developed electronic, the process approved vibronic principle is usable for density measurement. Overdosing preliminary, interim and final products, determining the exact density or concentration, monitoring quality and controlling process – all these activities constitute a reason for the density measurement of the medium. Using the vibronic principle, we offer you the possibility of determining density and concentration in a simple and fast manner across industries.



**Advantages at a glance**

- Costly laboratory avoid
- Process monitoring and controlling in situ and online
- Complying with tolerances is to increase quality
- Industry independent
- Any unit you require (°Plato, °Brix, °Baumé,...)

**Functional principle**  
 A sensor in form of a tuning fork is excited on its resonance frequency. The drive works piezoelectrically. The oscillating frequency changes in liquids.  
 Different media has different density/ concentration, therefore, we have different oscillating frequencies. Those signals will be evaluated and converted into quality information by Liquiphant Density.



# Interface measurement

Separate the best from the rest

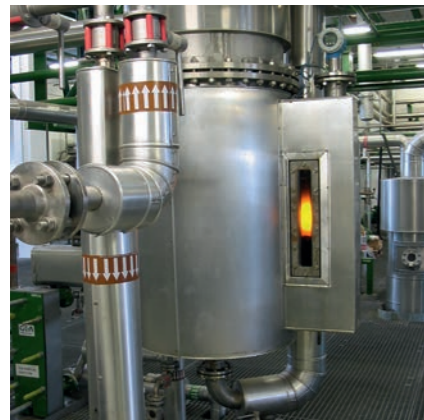
## Interface measurement for any application

Your application is of prime significance because the instrument serves the application and is only selected once the general setting is known. You get the optimum interface measurement solution in relation to your process requirements from us.

Precise interface measurement is important in continuous and dynamic processes. Is the overall level constant or variable, and if so, in which range? Should the overall level be available as a measured value in addition to the interface measurement. Does emulsion occur during measurement?

The answers to such questions have a strong influence on the correct selection of instrumentation. We offer you transparency in relation to options, application limits and commissioning of the individual measuring principles. Guided radar, multiparameter, capacitance instrumentation or radiometry – we support you in your application..

## Functional principles



### Guided radar

As the pulses impact the medium surface, only part of the sending pulse is reflected. Especially in media with a low dielectric constant (DC), the other part penetrates the medium. As the signal enters the lower medium with a higher dielectric constant it is reflected once more. Taking the delayed Time-of-Flight of the pulse through the upper medium into consideration the distance to the interface is determined in addition.



### Multiparameter

The name of the innovation in interface measurement is FMP55 Multiparameter. This instrument combines the advantages of the capacitance and guided radar measuring principles. Emulsion layers may cause signal losses in interface detection in guided radar measurements. Only Levelflex FMP55 Multiparameter can guarantee safe measured values for both the interface and the overall level with this unique, redundant measuring system.



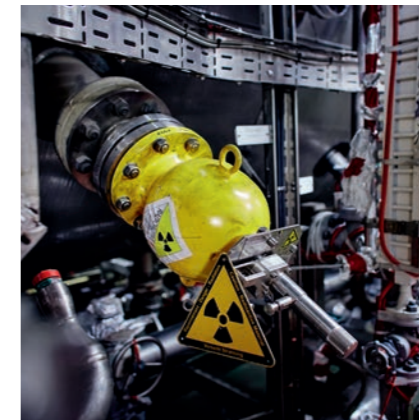
### Servo technology

The density of the medium can be determined by immersing the displacer in the product. Jumps of  $0.1\text{g/cm}^3$  in the density measurement are interpreted by the sensor as the interface. The sensor can determine up to three interfaces within the tank. This enables it to reliably measure the water level within an oil tank at any time and thus calculate the actual quantity of usable product in the tank.



### Capacitance

Media with a small dielectric constant (DC) cause very small changes of the capacitance value while media with a high DC produce respectively large capacitance changes in level measurement. In many interface applications, the medium with the smaller DC value is on top, e.g. in hydrocarbon on water. The upper medium merely provides a minimum contribution to the overall capacitance value – the issued level thus only refers to the water level (the interface).



### Radiometry

The measurement effect is based on the fact that the different interfaces absorb radiation differently. Once the transmitter is calibrated for the media by means of wet calibration, there is an automatic correlation to the interface measurement.



Endress+Hauser в России:

[www.avtsv.ru](http://www.avtsv.ru)

## Контактная информация

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ООО «АвтоматикаСервис»  
454008, Челябинская обл.,  
г. Челябинск, ул. Косарева,  
дом 2, офис 604

[www.avtsv.ru](http://www.avtsv.ru)

Телефон: +7 (351) 776-17-98  
Мобильный: +7 922 696-05-95  
E-mail: для общих вопросов: [info@avtsv.ru](mailto:info@avtsv.ru);  
для заказа продукции: [sakas@avtsv.ru](mailto:sakas@avtsv.ru)