Level measurement
Product overview for applications in liquids and bulk solids
Endress+Hauser – Your partner

Endress+Hauser is a global leader in measurement instrumentation, services and solutions for industrial process engineering

With dedicated sales centers and a strong network of partners, Endress+Hauser guarantees competent worldwide support. Our production centers in twelve countries meet your needs and requirements quickly and effectively. The Group is managed and coordinated by a holding company in Reinach, Switzerland. As a successful family-owned business, Endress+Hauser is set to remain independent and self-reliant.

Endress+Hauser provides sensors, instruments, systems and services for level, flow, pressure and temperature measurement as well as analytics and data acquisition. The company supports you with automation engineering, logistics and IT services and solutions. Our products set standards in quality and technology.

We work closely with the chemical, petrochemical, food and beverage, oil and gas, water and wastewater, power and energy, life science, primary and metal, renewable energy, pulp and paper and shipbuilding industries. Endress+Hauser helps customers to optimize their processes in terms of reliability, safety, economic efficiency and environmental impact.

To learn more about Endress+Hauser, visit: www.endress.com
Level measurement – still leading the way

Constant product quality, plant safety and economic efficiency – these are important aspects for any level measuring point. Levels in liquids, pastes, bulk solids or liquefied gases are often measured in tanks, silos or movable containers. Examples come from all industry sectors from the chemical and petrochemical industries, the pharmaceutical and life sciences industries, water and wastewater or the food and energy industries.

The broad range of measuring principles available means that finding the ideal solution is easy. No principle is suited to all application areas. Therefore measuring systems must be selected that work reliably under the conditions of a particular application and, at the same time, meet the economic situations in the future.

As the market leader in level measurement, we support you from planning and commissioning through to the maintenance of your measuring point. In addition, we assist you in automation, asset management and the visualization of process data.
Fuel for thought

With vast experience in the oil & gas sector, we help you to perform, comply and thrive

From exploration to refinery, from storage to distribution, from plant upgrades to new projects, we have the application expertise to help you succeed. At a time when the sector 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:

- Assured plant safety
- Optimized return on investment
- Best-fit products, solutions and services

✅ Advantages at a glance

- 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
For use in hazardous areas and in applications with functional safety up to SIL 3 with one device.

**Micropilot FMR51**
Radar instrument for highest demands in level measurement
Maximum reliability even under extreme process conditions like high temperature and high pressure due to an innovative and patented sensor-design.

**Deltabar FMD72**
Electronic differential pressure system utilizing one transmitter and two sensor modules
Elimination of typical issues of traditional differential pressure measurement installations.

**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.

**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

**Micropilot S and Proservo**
High precision gauges for custody transfer applications
NMi- and PTB-approvals and meeting the requirements according to OIML R85 and API 3.1B.
Global chemicals, competitive and safe

Get the extra project skill and know-how you need to boost your plant’s safe 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

- 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**
Failsafe overfill prevention 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 FMR62**
80GHz radar for measurement in aggressive liquids
Improved focusing and smaller emitting angle, particularly in tanks with many baffles.

**Micropilot FMR51**
Radar sensor for highest demands in level measurement
Maximum reliability under extreme process conditions and due to Multi-Echo Tracking.

**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.

**Gammapilot FMG50**
Compact transmitter for radiometric measurement
The first compact two-wire transmitter ensures SIL ex factory. With Heartbeat Technology you get diagnostics and verify the device without process interruption and with legally watertight documentation.

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.
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
- 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 FMR67**
Level measurement with 80GHz technology for highest demands in bulk solids
Less tank wall effects and reduced interference with obstacles. Large measuring range up to 125m (410ft) possible.

**Micropilot FMR57**
For high demands in bulk solids level measurement
Highest reliability due to the innovative signal analysis Multi-Echo Tracking. Advanced diagnostic functions for process optimization and automatization.

**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 incendive hazardous areas.

**Micropilot FMR52**
For level measurement in aggressive liquids
For applications in aggressive liquids
Micropilot FMR52 offers extraordinary advantages with its completely PTFE-filled flush-mounted horn antenna.

**Gammapilot FTG20**
Geiger-Mueller counter for point level detection with separate transmitter
Even under extreme process conditions like high pressure, high temperature, corrosiveness, toxicity and abrasion, the radiometric measuring principle can be employed without any problems.

**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.

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**Radar measurement in bulk solids**
Micropilot FMR57 is the sensor for the high demands in bulk solids, optimally suited to measurements in high silos, bunker's 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
Nourishing your productivity

Your global partner for accurate measurements and expert support in food and beverages automation

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
Product highlights

**Liquiphant FTL33**
Most universal point level switch for all kinds of pumpable media
Fully welded and independent from medium and mounting position.

**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.

**Liquicap FMI51**
Continuous level measurement with capacitance probes provides fastest response times
For water based media the devices are already pre-calibrated ex works.

**Micropilot FMR52**
Non-contact continuous level measurement for hygiene applications
3-A und EHEDG approvals. The measurement is not affected by changing media, temperature changes, gas blankets or vapors.

**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.

**Micropilot FMR62**
80GHz radar for hygienic applications
Improved focusing and smaller emitting angle; particularly for small tanks and tanks with many baffles.

**Liquitrend QMW43**
Detect media and blending homogeneity quickly
With QMW43 you verify your cleaning process without opening the tank. You optimize your blending homogeneity and detect different media.

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**The standard due to unique impermeability**

In many food applications, the sensors are particularly strained by low temperatures. The air humidity condenses on cold surfaces. A temperature drop below the dew point at the sensor or sensor electronics might cause a breakdown. Periodic hot cleaning and the resulting pumping effect in the transmitter housing accelerate the process since the air humidity is constantly “drawn” into the transmitter housing from outside.

Deltapilot with the patented Contite measuring cell has been the transmitter for level and head pressure measurement in the food industry for years. The hermetically sealed measuring cell and the gas-tight glass feedthrough from the sensor cable to the electronic insert are unique and prevent the condensing air humidity from entering the measuring cell!
The pulse of life sciences

Trust a reliable partner who puts quality, compliance and cost control at the heart of life sciences

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 excellence, gained at the heart of the sector, will help you to:
- Streamline your projects
- Attain operational experience
- Make the right decisions

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 overfill 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 FMR52**
Non-contact continuous level measurement for hygienic applications
Certificates of compliance to ASME-BPE and USP Class VI. Measurement is not affected by changing media, temperature changes, gas blankets or vapors.

**Micropilot FMR62**
80GHz radar for hygienic applications
Improved focusing and smaller emitting angle: particularly for small tanks and tanks with many baffles.

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**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.

We successfully launched the new Levelflex instrument generation for guided radar in 2010. In this family, 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 is our life

Water quality, discharges, regulations, the environment... just rely on a 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
- 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.

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.

Micropilot FMR50
Radar for liquid level applications
Used for continuous, non-contact level measurement of liquids, pastes and slurries. Not affected by changing media, temperature changes, gas blankets or vapors.

Deltapilot FMB53
Hydrostatic pressure sensor with Contite measuring cell
Hermetically sealed Contite measuring cell with condensate-resistance, high reference accuracy and minimum temperature effects.

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 up your plant

Power plants play a vital role. We help minimize downtime whilst delivering safety and productivity

Your plant needs a multi-skilled, versatile partner. You need reliable solutions that meet your application requirements and industry quality standards. And you may need to upgrade ageing plants with proven and state-of-the-art technologies, to keep the output consistently high. As the industry shifts towards natural gas, renewables and the new market dynamics driven by shale gas, our mission is to provide the all-round support and experience you need.

This includes elevated standards of safety for your staff. And the ability to meet even-higher environmental demands in flue gas cleaning processes such as SCR catalysts for nitrogen oxide reduction, electrostatic precipitators (ESPs) for particle separation, and limestone scrubbing processes for desulphurization.

When you choose us, you:
- Boost the efficiency of your plant
- Heighten safety
- Maintain expertise

Advantages at a glance
- 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

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 of fine-grained to coarse-grained bulk solids, such as fly ash.

Micropilot FMR57
For highest demands in bulk solids level measurement up to 400°C
Highest reliability due to the innovative signal analysis Multi-Echo Tracking. Advanced diagnostic functions for process optimization and automatization.

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.

Liquiphant FTL70
Point level switch for liquids in high-temperature applications
For high process temperatures up to 280°C and can be used for Safety Instrumented Systems up to SIL2, in homogeneous redundancy up to SIL3. Integrated second line of defense offers the highest degree of safety.

Micropilot FMR67
Level measurement with 80GHz technology for highest demands in bulk solids
Less tank wall effects and reduced interference with obstacles. Large measuring range up to 125m (410ft) possible.

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.

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

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You have the choice to measure interfaces in your process with different measuring principles. To learn more, see from page 56.
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 “Δf” 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, pressurized tanks, the hydrostatic pressure of the liquid column causes a difference in pressure.

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 gamma source, a cesium or cobalt isotope, emits gamma radiation which is attenuated as it passes through materials. The measuring effect results from the absorption of radiation by the product to be measured which is caused by level changes. The measuring system consists of a source, a source container and a compact transmitter as a receiver.

Servo

A small displacer is accurately positioned in a liquid medium using a servo motor. The displacer is then suspended on a measuring wire which is wound onto a finely grooved drum housing. When the displacer is lowered and touches a liquid, the weight of the displacer is reduced by liquid buoyancy force. As a result, torque in the magnetic coupling changes, which is measured by 5 sets of Hall sensors.
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.

The Micropilot portfolio for applications in liquids

1. Micropilot FMR10/FMR20
   - Basic model for level liquid applications
   - Temperature: -40°C to +80°C (-40°F to +176°F)
   - Pressure: -1 to +30bar (-+43psi)
   - Measuring range: up to 20m (66ft)

2. Micropilot FMR60
   - For common applications in liquid level measurement with 80GHz technology
   - Temperature: -40°C to +130°C (-40°F to +266°F)
   - Pressure: Vacuum to +16bar (vacuum to +232psi)
   - Measuring range: up to 50m (164ft)

3. Micropilot FMR50
   - Temperature: -40°C to +130°C (-40°F to +266°F)
   - Pressure: -1 to +30bar (-+43.5psi)
   - Measuring range: up to 30m (98ft), up to 40m (131ft) with advanced dynamics

4. Micropilot FMR62
   - For level measurement in aggressive liquids or applications with hygiene requirements with 80GHz technology
   - Temperature: -40°C to +200°C (-40°F to +392°F)
   - Pressure: Vacuum to +25bar (vacuum to +362psi)
   - Measuring range: up to 80m (262ft)

5. Micropilot FMR51
   - The standard sensor for highest demands in liquid level measurement
   - Temperature: -196°C to +450°C (-321°F to +842°F)
   - Pressure: -1 to +160bar (-14.5 to +2320psi)
   - Measuring range: up to 40m (131ft), up to 70m (229ft) with advanced dynamics

6. Micropilot FMR52
   - For level measurement in aggressive liquids or applications with hygiene requirements
   - Temperature: -40°C to +200°C (-40°F to +392°F)
   - Pressure: -1 to +16bar (-14.5 to +232psi)
   - Measuring range: up to 40m (131ft), up to 60m (197ft) with advanced dynamics

7. Micropilot FMR53
   - For simple level measurement applications in liquids
   - Temperature: -40°C to +150°C (-40°F to +302°F)
   - Pressure range: -1 to +40bar (-14.5 to +580psi)
   - Measuring range: up to 20m (65ft)

8. Micropilot FMR54
   - For level measurement in liquids where strong steam or ammonia can occur
   - Temperature: -60°C to +600°C (-76°F to +1112°F)
   - Pressure: -1 to +160bar (-14.5 to +2320psi)
   - Measuring range: 20m (65ft)
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 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)

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.

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**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. **Prosonic FMU40/41/42/43/44**
   - 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)

3. **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)

4. **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

5. **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)

6. **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)

7. **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 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 and Deltabar portfolio for applications in liquids**

1. **Waterpilot FMX167/FMX21**
   - Reliable and robust level probe with ceramic measuring cell
   - Temperature: -10 to +70°C (-14 to +158°F)
   - Measuring range: +0.1 to +20bar (+1.5 to +300psi)
   - Accuracy: Standard ±0.2%, "Platinum" ±0.1%

2. **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%

3. **Deltapilot FMB70**
   - Highest performance pressure sensor with Contite cell for hydrostatic level measurement in liquids
   - Temperature: -10 to +100°C (-14 to +212°F)
   - Measuring range: +0.1 to +10bar (+1.5 to +150psi)
   - Accuracy: Standard ±0.1%, optional ±0.075%

4. **Deltabar FMD71/72**
   - Electronic differential pressure system utilizing two ceramic sensor modules and one transmitter
   - Temperature: -40 up to +150°C (-40 up to +302°F)
   - Measuring range: +100mbar up to +40bar (+1.5 up to +600psi)
   - Accuracy: ±0.075% single sensor, "Platinum" ±0.05% single sensor

5. **Deltabar FMD77**
   - Differential pressure transmitter with metal sensor
   - Temperature: -40 to +400°C (-40 to +752°F)
   - Measuring range: +100mbar to +40bar (+1.5 to +600psi)
   - Accuracy: ±0.075% + influence of diaphragm seal

6. **Deltabar FMD78**
   - Differential pressure transmitter with metal sensor
   - Temperature: -40 to +400°C (-40 to +752°F)
   - Measuring range: +100mbar to +40bar (+1.5 to +600psi)
   - Accuracy: ±0.075% + influence of diaphragm seal

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)
   - Measuring range: +0.1 to +10bar (+1.5 to +150psi)
   - Accuracy: Standard ±0.1%, optional ±0.075%

**Advantages at a glance**

- Established measuring principle for temperatures up to 400°C (752°F) and pressures up to 400bar (5,800psi)
- 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 measurings 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 Gammapilot

Radiometric instrumentation is used where other measuring principles can not be used anymore due to extreme process conditions or because of mechanical, geometric or construction conditions. Besides continuous level measurement, the Gammapilot can be used for point level detection, interface and density measurement.

The Radiometry portfolio for applications in liquids

1. Gammapilot FMG50
   The compact two-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
   - Temperature: No limitation (non-invasive, extraneous)
   - Pressure: No limitation (non-invasive, extraneous)

4. Source container FQG61/62
   Radiation source container with source holder for manual or pneumatic switch-on/switch-off
   - Temperature: No limitation (non-invasive, extraneous)
   - Pressure: No limitation (non-invasive, extraneous)

5. Source container FQG63
   Lightweight radiation source container with flexible extension element
   - Temperature: -52 to +200°C (-62 to +392°F) (ambient), up to +400°C (+752°F) (process)
   - Pressure: No limitation (non-invasive, extraneous)

6. Source container FQG66
   Radiation source container with sliding source support rod for manual or pneumatic on/off switching
   - Temperature: No limitation (non-invasive, extraneous)
   - Pressure: No limitation (non-invasive, extraneous)

Advantages at a glance

- Four measuring tasks in one measuring principle
- Non-contact, external measurement for the highest degree of safety and reliability under the most extreme process conditions
- Functional safety up to SIL2/3 according to IEC 61508
- Overfill prevention WHG
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.

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**The Proservo for applications in liquids**

1. **Micropilot NMR81**
   - Drip-off lens antenna with 80GHz transmitting frequency for free-space custody transfer applications with NMi and PTB approvals
   - Temperature: -40 to +200°C (-40 to +392°F)
   - Pressure: Vacuum to +16bar (Vacuum to +232psi)
   - Measuring range: up to 70m (230ft)

2. **Micropilot NMR84**
   - Drip-off planar antenna with 6GHz transmitting frequency for custody transfer stilling well applications with NMi and PTB approvals
   - Temperature: -40 to +150°C (-40 to +302°F)
   - Pressure: Vacuum to +25bar (Vacuum to +362psi)
   - Measuring range: up to 40m (131ft)

3. **Micropilot NMR530/533**
   - 6GHz high accuracy pulse radar for custody transfer free-space applications with NMi and PTB approvals
   - Temperature: -40 to +200°C (-40 to +392°F)
   - Pressure: Vacuum to +64bar (Vacuum to +928psi)
   - Measuring range: 25 to 40m (82 to 131ft)

4. **Micropilot FMR52**
   - 6GHz high accuracy pulse radar for custody transfer applications in stilling wells with NMI and PTB approvals
   - Temperature: -40 to +200°C (-40 to +392°F)
   - Pressure: Vacuum to +64bar (vacuum to +928psi)
   - Measuring range: 25 to 40m (82 to 131ft)

5. **Micropilot FMR530/533**
   - 6GHz high accuracy pulse radar for custody transfer free-space applications with NMi and PTB approvals
   - Temperature: -40 to +200°C (-40 to +392°F)
   - Pressure: Vacuum to +64bar (Vacuum to +928psi)
   - Measuring range: 25 to 40m (82 to 131ft)

6. **Micropilot FMR540**
   - 26GHz high accuracy pulse radar for custody transfer free-space applications with NMi and PTB approvals
   - Temperature: -40 to +200°C (-40 to +392°F)
   - Pressure: Vacuum to +16bar (Vacuum to +232psi)
   - Measuring range: up to 40m (131ft)

7. **Micropilot FMR532**
   - 6GHz high accuracy pulse radar for custody transfer free-space applications with NMi and PTB approvals
   - Temperature: -40 to +200°C (-40 to +392°F)
   - Pressure: Vacuum to +16bar (Vacuum to +232psi)
   - Measuring range: up to 40m (131ft)

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**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 ±0.4mm (±0.02”)
- 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 liquids
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 “Δf” 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 gamma source, a cesium or cobalt isotope, emits gamma radiation which is attenuated as it passes through materials. The measuring effect results from the absorption of radiation by the product as the level changes. The measuring system consists of a source, source container and a compact transmitter as a receiver.

Advantages

- Unaffected by product properties
- Light bulk solids
- Unaffected by DC value

Advantages

- Non-contact measurement from outside
- Made for extreme measuring tasks where other principles can not be used anymore
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.

<table>
<thead>
<tr>
<th>Micropilot FMR56</th>
<th>The sensor for high demands in bulk solids level measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature: -40 to +80°C (-40 to +176°F)</td>
<td></td>
</tr>
<tr>
<td>Pressure: up to +3bar (up to +43.5psi)</td>
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</tr>
<tr>
<td>Measuring range: up to 30m (98ft)</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Micropilot FMR57</th>
<th>The sensor for high demands in bulk solids level measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature: -40 to +400°C (-40 to 752°F)</td>
<td></td>
</tr>
<tr>
<td>Pressure: up to +16bar (up to +232psi)</td>
<td></td>
</tr>
<tr>
<td>Measuring range: up to 70m (230ft)</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Micropilot FMR67</th>
<th>For highest demands in bulk solids. Level measurement with 80GHz technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature: -40 to +200°C (-40 to 392°F)</td>
<td></td>
</tr>
<tr>
<td>Pressure: Vacuum to +16bar (Vacuum to +232psi)</td>
<td></td>
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<tr>
<td>Measuring range: up to 125m (410ft)</td>
<td></td>
</tr>
</tbody>
</table>

### 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 +16 bar (up to 232 psi)
   - Measuring range: up to 12 m (39 ft)

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 +16 bar (up to 232 psi)
   - Measuring range: rod up to 4 m (13 ft), rope up to 45 m (148 ft)

**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 FMU40/41/42/43/44
   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)

2. Prosonic FDU90/91/92/93/95
   Ultrasonic sensor for level and flow measurement for connection to FMU9x
   - Temperature: -40 to +105°C (-40 to +221°F)
   - Pressure: +0.7 to +4bar (+10 to +58psi)
   - Measuring range: up to 45m (148ft)

3. 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

4. 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)

5. 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)

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 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 +3 bar (+11.6 to +43.5 psi)
   - Measuring range: up to 70 m (230 ft)

2. **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 +1.1 bar (+11.6 to +15.95 psi)
   - Measuring range: up to 32 m (105 ft)

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**Advantages at a glance**

- Proved, reliable measurement up to 70 m (230 ft)
- Safe measurement in extremely dusty environments
- Robust system with high tensile force prevents breakdown due to an immersed weight
- Compact instrument with 4 to 20 mA current output as well as additional freely programmable signal outputs (e.g., counting pulses, relays)
Radiometry – the Gammapilot

Radiometric instrumentation is used where other measuring principles can not be used due to extreme process conditions or because of mechanical, geometric or construction conditions.

The Radiometry portfolio for applications in bulk solids

1. Gammapilot FMG50
   The compact two-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
   - Temperature: No limitation (non-invasive, extraneous)
   - Pressure: No limitation (non-invasive, extraneous)

4. Source container FQG61/62
   Radiation source container with source holder for manual or pneumatic switch-on/switch-off
   - Temperature: No limitation (non-invasive, extraneous)
   - Pressure: No limitation (non-invasive, extraneous)

5. Source container FQG63
   Lightweight radiation source container with flexible extension element
   - Temperature: -52 to +200°C (-62 to +392°F) (ambient), up to +400°C (+752°F) (process)
   - Pressure: No limitation (non-invasive, extraneous)

6. Source container FQG66
   Radiation source container with sliding source support rod for manual or pneumatic on/off switching
   - Temperature: No limitation (non-invasive, extraneous)
   - 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
- 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.

Advantages
• Unaffected by media
• Ready for use without calibration
• Self-monitoring
• Can be used in turbulent and effervesce liquids

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.

Advantages
• Tried and tested in operation, robust and safe
• Simple commissioning
• Versatile
• Reliable function independent of build-up

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.

Advantages
• Multipoint detection with one process connection
• Simple instrumentation
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 gamma source, a cesium or cobalt isotope, emits gamma radiation which is attenuated as it passes through materials. The measuring effect results from the absorption of radiation by the product to be measured which is caused by level changes. The measuring system consists of a source, source container and a detector as a receiver.

Advantages

- Favourable measuring principle
- Also for Ex area applications

Advantages

- Non-contact measurement from outside
- Made for extreme measuring tasks where other principles can not be used anymore
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 FTL31B
   - Vibration point level switch for liquids in all industries
   - Temperature: -50 to +150°C (-58 to +302°F)
   - Pressure: -1 to +64bar (-14.5 to +928psi)

4. Liquiphant FTL51C
   - Point level switch for liquids with highly corrosion-resistant coating
   - Temperature: -50 to +150°C (-58 to +302°F)
   - Pressure: -1 to +40bar (-14.5 to +580psi)

5. Liquiphant FTL50H/51H
   - Vibration 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)

6. Liquiphant FTL70/71
   - Point level switch for liquids in high-temperature applications
   - Temperature: -60 to +280°C (-76 to +540°F), +300 °C (+572°F), 50h accumulated
   - Pressure: -1 to +100bar (-14.5 to +1,450psi)

7. 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.

<table>
<thead>
<tr>
<th>The Liquicap and Liquipoint portfolio for applications in liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Liquicap FTI51</td>
</tr>
<tr>
<td>For liquids that are highly viscous and tend to form build-up</td>
</tr>
<tr>
<td>- Temperature: -80 to +200°C (-112 to +392°F)</td>
</tr>
<tr>
<td>- Pressure: Vacuum to +100bar (vacuum to +1,450psi)</td>
</tr>
<tr>
<td>- Sensor length: up to 6m (20ft)</td>
</tr>
<tr>
<td><strong>2</strong> Liquicap FTI52</td>
</tr>
<tr>
<td>For liquids that are highly viscous and tend to form build-up for large measuring ranges</td>
</tr>
<tr>
<td>- Temperature: -80 to +200°C (-112 to +392°F)</td>
</tr>
<tr>
<td>- Pressure: Vacuum to +100bar (vacuum to +1,450psi)</td>
</tr>
<tr>
<td>- Sensor length: up to 12m (39ft)</td>
</tr>
<tr>
<td><strong>3</strong> Liquipoint FTW23</td>
</tr>
<tr>
<td>Compact probe for operation in water base media</td>
</tr>
<tr>
<td>- Temperature: -20 to +100°C (-4 to +212°F), CIP/SIP to +135°C (+275°F) for 1h</td>
</tr>
<tr>
<td>- Pressure: -1 to +16bar (-14.5 to +232psi)</td>
</tr>
</tbody>
</table>

🚀 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).

The Liquipoint portfolio for applications in liquids

1. Liquipoint FTW31
   Rod probe for multi-point detection up to 5 switch points
   - Temperature: -60 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)

Advantages at a glance

- Simple measuring principle
- Multi-point detection with one process connection
Float switch – der 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 Liquifloat for applications in liquids

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
• Also for Ex area applications
Radiometry – the Gammapilot

Radiometric instrumentation is used where other measuring principles can not be used due to extreme process conditions or because of mechanical, geometric or construction conditions.

The Radiometry portfolio for applications in liquids

1. **Gammapilot FMG50**
   - The compact two-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. **Gammapilot FTG20**
   - Geiger-Mueller counter for point level detection with separate transmitter
   - Temperature: No limitation (non-invasive, extraneous)
   - Pressure: No limitation (non-invasive, extraneous)
   - Switch time: Up to 0.4 seconds

3. **Source container FQG60**
   - Radiation source container with radiation source insert with manual switch-on and switch-off
   - Temperature: No limitation (non-invasive, extraneous)
   - Pressure: No limitation (non-invasive, extraneous)

4. **Source container FQG61/62**
   - Radiation source container with source holder for manual or pneumatic switch-on/switch-off
   - Temperature: No limitation (non-invasive, extraneous)
   - Pressure: No limitation (non-invasive, extraneous)

5. **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)

6. **Source container FQG66**
   - Lightweight radiation source container with sliding source support rod for manual or pneumatic on/off switching
   - Temperature: -52 to +200°C (-62 to +392°F) (ambient), up to +400°C (+752°F) (process)
   - Pressure: No limitation (non-invasive, extraneous)

Advantages at a glance

- Four measuring tasks in one measuring principle
- Non-contact, external measurement for the highest degree of safety and reliability under the most extreme process conditions
- Functional safety up to SIL2/3 according to IEC 61508
- Overfill prevention WHG
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.

- Universal point level switch
- Largest variety of certificates, housings, electronic inserts, process connections and sensor geometries
- Easy installation
- No wear and tear / maintenance-free

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.

- Tried and tested in operation, robust and safe
- Easy commissioning
- Versatile

Paddle

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

- Measuring principle for simple applications
- Calibration not required
- Rotation monitoring
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 gamma source, a cesium or cobalt isotope, emits gamma radiation which is attenuated as it passes through materials. The measuring effect results from the absorption of radiation by the product as the level changes. The measuring system consists of a source, source container and a detector as a receiver.
The Soliphant portfolio for applications in bulk solids

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).

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. Solicap FTI55
   Designed 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”)

4. 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”)

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. Minicap 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”)

7. Solicap FTI77
   Point level detection for bulk solids
   - 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 FQR56**
   Emitter for non-contact point level detection in bulk solids
   - Temperature: -40°C to +70°C (-40°F to +158°F)
   - Measuring range: up to 100m (328ft)

2. **Soliwave FDR56**
   Receiver for non-contact point level detection in bulk solids
   - Temperature: -40°C to +70°C (-40°F to +158°F)
   - Measuring range: up to 100m (328ft)

3. **Soliwave FQR50**
   Emitter for non-contact point level detection in bulk solids
   - Temperature: -40°C to +70°C (-40°F to +158°F)
   - Measuring range: up to 20m (65ft)

4. **Soliwave FDR50**
   Receiver for non-contact point level detection in bulk solids
   - Temperature: -40°C to +70°C (-40°F to +158°F)
   - Measuring range: up to 20m (65ft)

**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

Radiometric instrumentation is used where other measuring principles cannot be used due to extreme process conditions or because of mechanical, geometric or construction conditions.

Advantages at a glance

- Four measuring tasks in one measuring principle
- Non-contact, external measurement for the highest degree of safety and reliability under the most extreme process conditions
- Functional safety up to SIL2/3 according to IEC 61508
- Overfill prevention WHG
Density / Concentration
Vibronic – Liquiphant Density

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.
# Density measurement for quality monitoring and process control

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Vibronic – Liquiphant</th>
<th>Coriolis – Promass</th>
<th>Radiometry – Gammapilot</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Large number of process connection to choose from: universal usage</td>
<td>• Maximum process dependability, because density, temperature and mass flow are all measured directly</td>
<td>• Straightforward retrofitting without process interruption; the pipes do not have to be opened</td>
<td></td>
</tr>
<tr>
<td>• Useable in hygienic applications</td>
<td>• Approval for custody transfer applications</td>
<td>• No maintenance necessary</td>
<td></td>
</tr>
<tr>
<td>• Calculation of customer specific units e.g. °Brix, °Plato, °Baumé etc. possible</td>
<td>• No maintenance necessary</td>
<td>• Can be used in Newtonian as well as in Non-Newtonian fluids/media</td>
<td></td>
</tr>
</tbody>
</table>
| • Up to 5 Liquiphant Density sensors can be connect to the density computer FML621 | • Calculation of customer specific units e.g. °Brix, °Plato, °Baumé etc. possible | • 

<table>
<thead>
<tr>
<th>Installation options</th>
<th>Direct measurement in tanks and pipes</th>
<th>Direct measurement in the pipe</th>
<th>From outside through the pipe, in the bypass or tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process temperature</td>
<td>0 to +80°C/+32 to +176°F</td>
<td>-50 to +200°C/-58 to +392°F (-200 to +350°C/-328 to +662°F optional)</td>
<td>Independent</td>
</tr>
<tr>
<td>Process pressure</td>
<td>up to 25bar/363psi</td>
<td>up to 400bar/5,800psi</td>
<td>Independent</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.002g/cm³</td>
<td>0.0005g/cm³</td>
<td>±0.001g/cm³</td>
</tr>
<tr>
<td>Reproducibility</td>
<td>0.0007g/cm³</td>
<td>0.0025g/cm³</td>
<td>±0.0005g/cm³</td>
</tr>
<tr>
<td>Units of density</td>
<td>Norm density, °Brix, °Baumé, °Plato, % volume, concentration etc. with 2D and 3D tables. Formula editor to calculate customer specific units</td>
<td>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.</td>
<td>g/cm³, g/l, lb/gal, concentration, % mass, °Brix, °Baumé, °API, etc.</td>
</tr>
<tr>
<td>Output/communication</td>
<td>4 to 20mA, relay, Ethernet, PROFIBUS</td>
<td>4 to 20mA, HART, PROFIBUS PA/DP, FOUNDATION fieldbus, MODBUS</td>
<td>4 to 20mA, HART, PROFIBUS PA, FOUNDATION fieldbus</td>
</tr>
<tr>
<td>Approvals</td>
<td>ATEX, FM, CSA, IECEx, TIIS, NEPSI, 3-A, EHEDG, CRN, FDA</td>
<td>ATEX, FM, CSA, TIIS, SIL2, 3-A, EHEDG, IECEx</td>
<td>ATEX, FM, CSA, IECEx, TIIS, NEPSI</td>
</tr>
<tr>
<td>Additional information</td>
<td>Connect of temperature- and pressure transmitter for compensation</td>
<td>Approvals for applications in custody transfer (PTB, NMI, EAM/METAS, BEV)</td>
<td>With interface for a Pt100 temperature sensor for temperature compensation</td>
</tr>
<tr>
<td>Application limits</td>
<td>• Gas bubbles or build-up at the sensor fork</td>
<td>• Not for non-homogeneous mediums</td>
<td>• Not with degasification in the medium</td>
</tr>
<tr>
<td></td>
<td>• Fluid velocity &gt;2m/s in pipes</td>
<td>• Only for pipe diameters up to DN 250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Liquids with high viscosity &gt;350mPa·s</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

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 gamma source which is usually installed inside the tank emits gamma radiation which is attenuated as it penetrates the container wall and the medium. Outside of the container, a detector converts the radiation received into an electric signal. The measuring effect results from the fact that different interfaces absorb (attenuate) the radiation differently. If the transmitter has been calibrated to the media by wet calibration once, a correlation to the measurement of the interface results automatically.
The application determines the sensor

<table>
<thead>
<tr>
<th>Measuring task</th>
<th>Measuring principle</th>
<th>Features / advantages</th>
<th>Application limits / conditions</th>
</tr>
</thead>
</table>
| Clear interface liquid / liquid | Guided radar Levllex FMP51/52/54 | • Simultaneous acquisition of interface layer and total level if clear interface  
• No wet calibration required  
• Not affected by the density of the medium  
• Applications up to +450°C/+400bar (+842°F/+5,800psi)  
• Probes can be shortened (rod/rope) | • DC of the upper medium may be max. 10  
• Difference of the DCs between the two media must be > 10  
• Emulsion layer up to max. 50mm (2") allowable  
• For interface measurement, the thickness of the upper phase must be min. 80mm (3.15") |
| Clear interface liquid / liquid | Multiparameter Levllex FMP55 | • Simultaneous acquisition of interface layer and overall level, also in case of emulsions  
• Independent of medium density  
• Wet calibration not required  
• Applications up to +200°C (+392°F)  
• PTFE-coated probe | • DC value changes of the upper medium affect the accuracy  
• DC value of the upper medium may be max. 10  
• DC value difference between both media must be >10  
• For interface layer measurement, the thickness of the upper phase must be minimum 80mm (3.15") |
| Interface with emulsion layer liquid / liquid | Capacitance Liquicap FM151/52 | • Tried and tested instrumentation  
• No wet calibration required  
• Not affected by the density of the medium  
• Unproblematic use in emulsion layers  
• Ideal for very small measuring ranges  
• Applications up to +200°C/+100bar (+392°F/+1,450psi) | • Difference of the dielectric constant (DC) between the two media must be > 10  
• The upper medium may not be conductive  
• Accuracy impairment in case of nonconductive build-up on the probe  
• The smaller the vessel the higher the influence of DC changes in the upper medium  
• The total level is not measured |
| Interface with emulsion layer liquid / liquid | Radiometry Gammapilot FMG50 | • Non-invasive and maintenance-free measuring method  
• Unaffected by pressure and temperature  
• Only slight influence by build-up  
• Unproblematic use in emulsion layers  
• Solution for multiphase interface layers using several detectors | • Density changes of the medium influences accuracy  
• The total level is not measured (possible with further source and detector)  
• Calibration with media necessary |
Smooth integration into your control system – thanks to digital communication

We offer all common electronic communication protocols. In addition to the classic analog electronics (output 4 to 20mA) digital electronic inserts are also available.

- FOUNDATION fieldbus offers easy testing of instruments, important additional information and diagnostic functionalities according to NAMUR NE107 as well as smooth system integration which increases the availability and safety of your plant.
- HART electronics (output 4 to 20mA with superimposed HART protocol) for additional functionalities and diagnostic functions.
- PROFIBUS PA electronics for the complete integration into digital industrial bus systems. Simplified instrument identification, brief uploading and downloading times during commissioning, diagnostic functionalities according to NAMUR NE107 and the smooth integration help to reduce costs and downtimes to a minimum.

All digital electronics may be smoothly integrated into different control systems and can be configured via a PC and the universal FieldCare/DeviceCare operating program as well as via all common PAM systems.

The integration capability of the instruments is tested at our system laboratory thus ensuring their system independence. We also offer training opportunities directed especially to the integration of instruments into respective control systems.
Operating cost savings due to instrument diagnosis

Plant asset management is one of the most important trends in process industry. Thanks to digital communication protocols, all current Endress+Hauser instruments support the diagnostic categories according to NAMUR NE107. The pertaining classification of failures into four categories ensures that the right information is transmitted to the right persons at the right time. This avoids operating failures, improves the maintenance cycle and finally reduces costs.

The correct use of diagnostic information can save operating costs in specific applications. Our level instrumentation has been equipped with numerous items of such information which may be very easily managed via a plant asset management system.

- Build-up on the sensor is detected by the analysis of the “Relative Echo Amplitude” (predictive maintenance). Maintenance cycles can thus be planned in a significantly improved manner. In the same way, foam formation is detected in the process which, in turn, permits conclusions concerning the quality of the process or medium (process diagnosis).
- The supply voltage can be continually recorded and monitored during the verification of the field instrument installation. This, in turn, permits valuable conclusions concerning clamp corrosion and ensures the uninterrupted operation of the instrument (predictive maintenance).
Test Center

There are some things you can never get enough of – for example, safety

Our Test Center (internationally accredited test centre: FM, CSA) has three laboratories for device safety, application technology and electromagnetic compatibility. The various test units make it possible to ensure and improve the reliability and quality of our devices under realistic test conditions. In addition, the devices for new applications can be tested in advance during development.

In the various ‘durability tests’, devices are exposed to extreme conditions as can be expected in real applications. These include dust tests (explosion protection), abrasion and friction tests, climate tests (heat and cold), mechanical load tests and spray water leak tests. A fully automated tank test plant with a capacity of 24,000 liter, is used to simulate the most difficult applications. The Test Center also has an accredited EMC laboratory.

Apart from carrying out tests on our devices during development, the Test Center also trains service staff and even customers. Customer specific application problems are analyzed, tests to simulate new applications are run and device approvals are carried out.
Inventory Management Solutions

Inventory management is much more than level measurement

Process automation enterprises reduce inventory costs and increase their productivity by comprehensive inventory display around the clock.

How much raw material is available on site? Is it sufficient to produce incoming orders or is reordering required? How much storage space is still available? These are typical questions when processing, transporting and storing products like chemicals, crude oil or petrol. Monitoring and controlling the flow of materials constitutes a genuine challenge for companies of the most varied industries. The key for efficient inventory management is a comprehensive and precise chain of information from the field right through to the management level. Being an expert in level measurement, we offer the right measuring principle for any application from our complete instrumentation range. However, in inventory management solutions we take another step ahead: Software and gateways generate real information from data to facilitate decisions on basis of current values at any time and to optimize processes continually. The solutions are scalable in many ways: From mere monitoring of tanks and silos through to the highly accurate measurement of tank levels for custody transfer.

Custody transfer solutions for tank farms and terminals

Today, customers as well as the legislator place far-reaching requirements on the operator of a tank farm or terminal. The focus is on safety aspects, transparency of inventories and meeting custom-law regulations in custody transfer logistics. Our highly accurate tank gauging instruments of the latest generation, Proservo and Micropilot, meet these requirements. The exact measurement (with an accuracy up to ±0.4mm) and the compliance with functional safety (SIL2/3) are setting standards in the market today. In combination with temperature measuring chains and the Tankvision inventory software approved for custody...
Our inventory management solutions support you:

- Highest degree of transparency in recording product gains and losses by reconciling the inventory with additions and disposals in the plant.
- Increase in customer satisfaction by higher delivery reliability and the elimination of products out of stock and emergency shipments.
- Fast and efficient reaction to supply chain fluctuations due to company supply and value added chain optimization.
- Lower inventory management costs due to the integration of data in your system thus facilitating the fast and effective data exchange with your business partners and systems.
- Increase in productivity due to higher accuracy of your inventory monitoring and improved planning resources.
Inventory Management Solutions
Inventory Management Solutions
Tools for selection and operation

**Endress+Hauser Applicator**

Our Applicator software is a convenient selection and sizing tool for planning processes. Using the entered application parameters, e.g. from measuring point specifications, Applicator determines a selection of suitable products and solutions. Supplemented by sizing functions and a module for project administration Applicator will alleviate your daily engineering work.

[www.endress.com/applicator](http://www.endress.com/applicator)

**Endress+Hauser Operations App**

The app offers fast access to up-to-date product information and device details, e.g. order code, availability, spare parts, successor products for old devices and general product information - wherever you are, whenever you need it. Simply enter the serial number or scan the data matrix code on the device to download the information.

**Endress+Hauser SmartBlue App**

- Time saving mobile access to device, diagnostics and process information even in hazardous areas
- Secure data transmission for fast and reliable configuration and maintenance, reviewed by Fraunhofer Institute

**Endress+Hauser DC App**

The app offers comfortable access to several thousand DC values for all kinds of different media. You can search by the name of the medium or the chemical formula. The autocomplete functionality helps you if you don’t know the exact spelling of the name of your medium.
Services - by your side

Committed to your business, for improved plant performance

Our commitment to you is to support, to service and to optimize your process. Whatever your location or your industry, our global service force of over 1000 experts is strategically located worldwide ensuring active local presence to help you reach your goals. Based on our process knowledge and technical expertise, a uniform approach through clear procedures ensures that the work we conduct for you is done properly. Customized responses can also be adapted to your needs, contact us today.

Supporting
Need quick response to support you in emergency situations? We are near you – ready and willing to provide you with the appropriate support

- Diagnostic and repair
- Support services

Servicing
Looking for expertise? We offer a variety of services to complement the capabilities of your staff throughout your plant lifecycle

- Calibration services
- Commissioning services
- Maintenance services
- Training and seminars
- Engineering services

Optimizing
Need help to reduce costs while maintaining compliance? We offer effective ways to optimize your processes, enabling you to increase productivity and reach your business goals

- Maintenance optimization