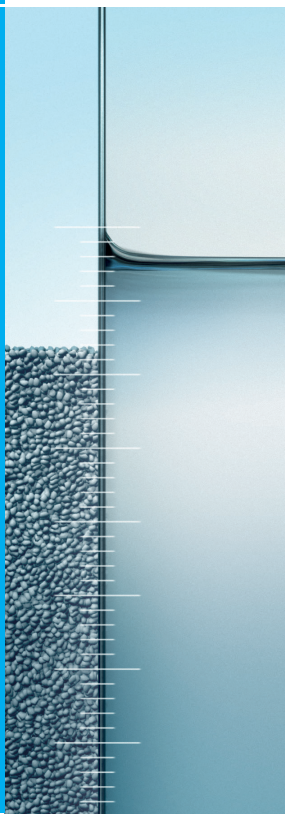
Point level detection in liquids and bulk solids

Selection and engineering guide

Level



Endress+Hauser

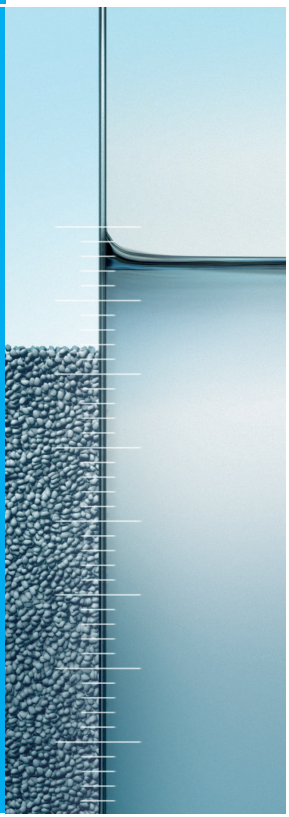
People for Process Automation

Legende

- Point level detection in liquids
  starting page 3

- Point level detection in bulk solids
  starting page 39

Point level detection in liquids
Selection and engineering guide



Endress+Hauser
People for Process Automation

Step by step

This selection and engineering guide provides information on different measuring principles for point level detection as well as their application and installation.

The pamphlet contains two chapters: Point level detection in liquids and point level detection in bulk solids.

This pamphlet exclusively concerns point level detection. A separate selection guide is available for continuous level measurement (see supplementary documentation CP00023F).

A

Overview of measuring principles
The first pages contain an overview of measuring principles for point level detection of Endress+Hauser in diagrams. Subsequently, the mode of operation of the measuring principle and the respective product family are introduced.

Checklist
You should know the specific requirements of your application for the selection of a suitable point level switch. The checklist provides an overview and is supposed to assist you in acquiring this data and taking it as completely as possible into consideration.

B

Selection of the measuring principles
The suitable measuring principle is selected according to two criteria:
- application and
- process requirements.

First, the measuring principles are listed in accordance with specific plant criteria (vessel, conveyor belt, etc.) and then in accordance with specific medium criteria (high temperatures, aggressiveness, etc.)
Select the measuring principle which meets, if possible, all of the criteria demanded by you or your plant. The measuring principles are listed from left to right according to their suitability. The ideal measuring principle is listed first and edged in blue.

C

Selection of the instrument
You now move to the area of the selected measuring principle where you can choose the suitable instrument of a product family. Compare your application and process data with the instrument data.

Engineering
After the selection of the optimum instrument, please check the installation instructions at the end of the respective measuring principle. You will find basic guidelines supporting safe instrument installation and application.

Contents

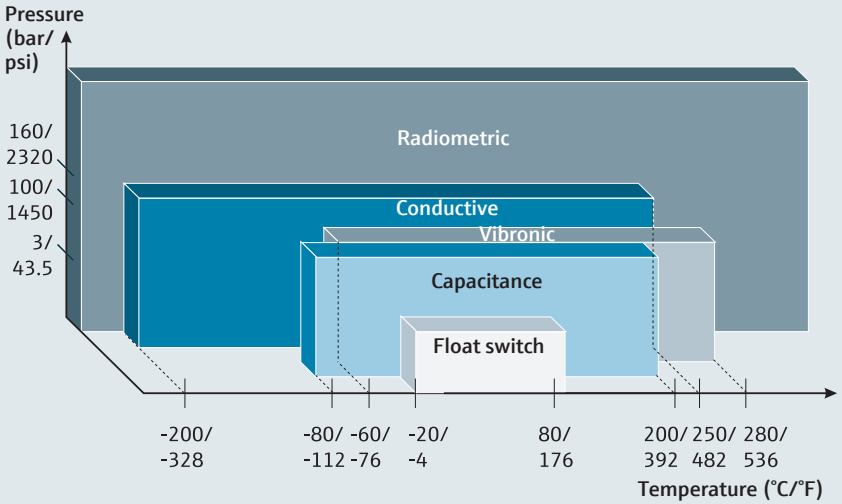
A

1. Overview of measuring principles

Segmentation

	Point level	Continuous
Liquids	Vibronic Conductive Capacitance Float switch Radiometric	Radar Guided radar Ultrasonic Hydrostatic Capacitance Radiometric
Bulk solids	Vibronic Capacitance Paddle Microwave barrier Radiometric	Radar Guided radar Ultrasonic Electromechanical system Radiometric

Process conditions



Flexible answers to individual needs.

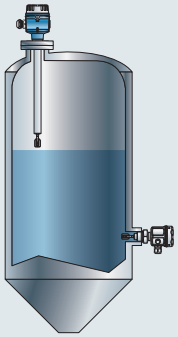
The basic idea of the FLEX structure is that depending on the application, there are different goals to achieve and different challenges to overcome. Some processes you must just monitor, others you want to optimize. Here is a overview of our selections:

Xpert Selection	Master your most challenging applications	■ Specialized products ■ Designed for demanding applications	F L E **X**
Extended Selection	Optimize your processes with innovative technologies	■ High-end products ■ Highly functional and convenient	F L **E** X
Lean Selection	Handle your core processes easily	■ Standard products ■ Reliable, robust and low-maintenance	F **L** E X
Fundamental Selection	Meet your basic measurement needs	■ Simple products ■ Easy to select, install and operate	**F** L E X

1. Overview of measuring principles

A

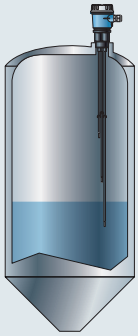
Contact measuring principles



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.

Liquiphant
Free of calibration and maintenance.
For all liquids, also if build-up, turbulence or air bubbles occur. Unaffected by the electric properties of the medium.

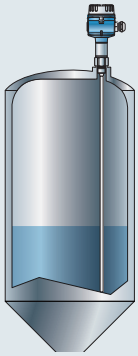
Process temperatures up to +280°C/+536°F
Process pressures up to 100bar/1,450psi



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.

Liquipoint
Simple and price-effective.
For conductive liquids like water, waste water and liquid foods, etc.

Process temperatures up to +250°C/+482°F
Process pressures up to 160bar/2,320psi



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

Liquicap
Available with active build-up compensation for highly viscous media.

Process temperatures up to +200°C/+392°F
Process pressures up to 100bar/1,450psi

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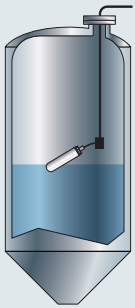
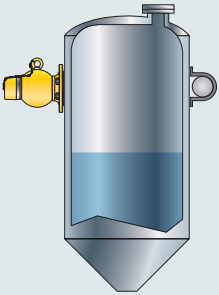


Float switch
As the switch floats up and down on the surface of a liquid, an installed sensor detects its position and triggers the switching operation.

Liquifloat
Simple and price-effective.
For liquids like water, waste water, acids and lyes.

Process temperatures up to +85°C/+185°F
Process pressures up to 3bar/43.5psi

Non-contact measuring principles



Radiometry
The gamma source, a cesium or cobalt isotope, emits 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 and a detector as a receiver.

Gammapilot
Non-contact measurement from outside, for all extreme applications, e.g. very abrasive, corrosive and aggressive media.

Any process temperature
Any process pressure

For more detailed information, please contact our application consultant in your country or use the Applicator selection software.

A

2. Checklist

You need to know your specific application requirements for a correct selection. The checklist opposite provides an overview of relevant process data and is supposed to help you to take these into consideration. If we have not included all of the data, please supplement this list with your criteria.
The checklist is used both for the selection of the measuring principle and the selection of the instrument.

TIP

Copy this checklist and complete it to have all relevant data readily available for the selection.

The most important terms/abbreviations

ATEX	AT= Atmosphere, EX = Explosive. Abbreviation of the French working title of the EU Guideline 94/9/EC
WHG	Wasserhaushaltsgesetz. Overfill prevention/leakage alarms are certified according to WHG
SIL	Safety Integrity Level. Safety levels according to IEC 61508/61511
VdTÜV100	Liquefied gas approval
Electronics	
IO-Link	Communication system for connecting intelligent sensors and actuators to an automation system
3-wire	Connection for Endress+Hauser switching unit
AC	Connection for alternating voltage
DC-PNP	Connection for direct voltage with transistor output (open collector)
Relay + DPDT	Double Pole Double Throw; relay as double change-over contact
PFM	PulseFrequenzyModulation; extremely interference-proof signal transmission between sensor electronics and switching unit
NAMUR	Direct current interface for sensors and switching amplifiers (IEC 60947-5-6)
PROFIBUS®	Fieldbus technology PROFIBUS PA
HART®	Fieldbus technology
FF	FOUNDATION™ fieldbus
Instrumentation	
Compact	Signal output is directly available from probe electronics (e.g. DC-PNP, relay SPST)
Separate instrument.	Signal output is available via an additional switching unit (top-hat rail or 19" card) (e.g. relay SPDT). The switching unit also supplies the sensor with power
Certification	
EHEDG	„European Hygienic Equipment Design Group". An independent group with different subgroups which discuss special subjects concerning hygiene requirements and prepare their publication
3-A	„3-A Sanitary Standards" are voluntary norms of the American „International Association of Milk, Food and Environmental Sanitarian"
FDA	„Food and Drug Administration". American approval authority. Materials, special plastics are subject to respective guidelines for their use in pharmaceutical/food plants
3.1	Material test certificate for special steels
NACE	„National Association of Corrosion Engineering". Material test certificate for special steels including degree of hardness and cooling/annealing temperature of steel

A

		Please complete		Notes
Medium	Medium			
	Density	g/cm³		
	Conductivity	µS/cm		
	Dielectric constant (DC)			
	Viscosity			
	Resistance/e.g. coating			
	Build-up forming	yes	no	
Non-contact measurement		yes	no	
Measurement task	Point level detection	min.	max.	
	Overfill prevention	yes	no	
	Two-point control	yes	no	
	Dry-run protection	yes	no	
	Density measurement	yes	no	
Process data	Process temperature	min.	max.	
	Process pressure	min.	max.	
Installation	Sensor installation from the top	yes	no	
	Sensor installation laterally	yes	no	
	Tank	yes	no	
	Piping	yes	no	
	Switch point (sensor length)	mm		
	Type of connection			
Electric connection	DC, AC, relay, PNP, PFM, PROFIBUS®, NAMUR, 8/16mA			
Surface requirements	Roughness	µm		
	Coating	yes	no	
	Labsfree	yes	no	
	Others			
Approvals	Ex (dust)	yes	no	
	Ex (gas)	yes	no	
	WHG	yes	no	
	Ship building	yes	no	
	EHEDG	yes	no	
	3-A	yes	no	
Certificates/ manufacturer declarations	3.1	yes	no	
	NACE	yes	no	
	FDA listed material	yes	no	
	SIL	yes	no	
	EG1935	yes	no	
Special requirements				

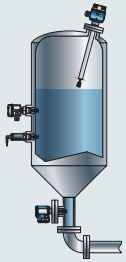
3.1 Selection of measuring principle according to application

B

	Our proposal **Vibronic** **Liquiphant**	**Capacitance** **Liquicap M**
		
Advantages	▪ Safe and easy to use ▪ Free of calibration and maintenance ▪ Unaffected by medium ▪ May be used in applications involving turbulences, gassing liquids and build-up forming media ▪ Developed according to SIL IEC 61508 ▪ LED and Bluetooth module, Heartbeat Technology	▪ Universally adaptable probe technology ▪ Reliable operation also in strong build-up formation and viscous media ▪ Foam causes capacity change and is recognized
Technical data ▪ Process temperature ▪ Ambient temperature ▪ Process pressure ▪ Medium properties ▪ Sensor length ▪ Process connection ▪ Supply/ Communication ▪ Approvals	 -60 to +280°C/-76 to +536°F -60 to +70°C/-76 to +158°F -1 to +100bar/-14.5 to 1,450psi Viscosity up to 10.000 mPas ≤ 6.000mm/≤ 236″ Thread, flange, hygiene AC-2-wire, 8/16mA HART, IO-Link, DC-PNP, 3-wire, relay, NAMUR, PFM Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL	 -80 to +200°C/-112 to +392°F -50 to +120°C/-58 to +248°F -1 to +100bar/-14.5 to 1,450psi – 100 to 10,000mm/3.9 to 394″ Thread, flange, hygiene AC-2-wire, DC-PNP 3-wire, 3-wire 3 to 12V, relay, 8/16mA, NAMUR Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL
Application limits	▪ For viscous media see capacitance with build-up compensation ▪ Standard instruments do not recognize foam as a liquid	▪ Condensate formation in nozzle – select inactive length ▪ DC < 1.6

Tank / vessel

- Operational point level
- Overfill prevention (WHG)
- Leakage monitoring
- Changing media
- Turbulences



B

	Conductive Liquipoint T	Float switch Liquifloat T	Radiometric Gammapilot
			
	▪ Very simple measuring principle, easy handling ▪ Multipoint detection with one process connection ▪ Simple rod adjustment ▪ Compact or separate instrumentation	▪ Simple and price-effective ▪ Connecting cable for different media (resistance)	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
	-200 to +250°C/-328 to +482°F -200 to +250°C/-328 to +482°F -1 to 160bar/-14.5 to 2,320psi – 50 to 15,000mm/2 to 590" Thread, flange PNP, relay, NAMUR Regional Ex approvals	-20 to +85°C/-4 to +185°F -20 to +85°C/-4 to +185°F 0 to 3bar/0 to 43.5psi – 5,000 to 20,000mm/ 197" to 787" cable Cable feedthrough AC/DC 3-wire, NAMUR ATEX	As required -40 to +120°C/-40 to +248°F (starting 80°C/176°F water cooling) As required As required – From outside with assembly clamp 2-wire 4 to 20mA HART, relay, 8/16mA Regional Ex approvals, WHG, SIL
	▪ Conductive foam is recognized as a liquid ▪ Conductivity too low (< 10µS/cm) ▪ Electrode corrosion	▪ Medium density < 0.8g/cm³ ▪ Medium viscosity ▪ Lye and acid resistance is limited	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

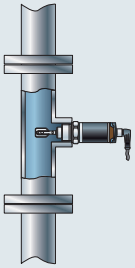
3.1 Selection of measuring principle according to application

B

	Our proposal **Vibronic** **Liquiphant**	**Conductive** **Liquipoint**
		
Advantages	▪ Safe and easy to use ▪ Free of calibration and maintenance ▪ Unaffected by medium ▪ May be used in applications involving turbulences, gassing liquids and build-up forming media ▪ Developed according to SIL IEC 61508 ▪ LED and Bluetooth module, Heartbeat Technology	▪ Truly flush mounted installation ▪ Continuous functionality through changing media ▪ Reliable point level detection even with build-up
Technical data ▪ Process temperature ▪ Ambient temperature ▪ Process pressure ▪ Medium properties ▪ Sensor length ▪ Process connection ▪ Supply/ Communication ▪ Approvals	 -60 to +280°C/-76 to +536°F -60 to +70°C/-76 to +158°F -1 to +100bar/-14.5 to 1,450psi Viscosity up to 10.000 mPas ≤ 6.000mm/≤ 236" Thread, flange, hygiene AC-2-wire, 8/16mA HART, IO-Link, DC-PNP, 3-wire, relay, NAMUR, PFM Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL	 -20 to +100°C/-4 to +212°F -40 to +70°C/-40 to +158°F -1 to +25bar/-14.5 to 362,5psi – 1 µS/cm to 100 mS/cm Thread, hygiene DC-PNP, IO-Link, 3-wire PNP Hygiene approvals
Application limits	▪ Bridging by hardening build-up ▪ Flow losses in pipes due to sensor design ▪ Solid content in medium	▪ Non-conductive media ▪ Dry, non-conductive build-up

Piping

- Installation in pipes as pump or dry-run protection
- Changing media
- Turbulences
- Nominal width of pipe starting DN25



B

	Capacitance Liquicap M	Radiometric Gammapilot
		
	▪ Universally adaptable probe technology ▪ Reliable operation also in strong build-up formation and viscous media ▪ Foam causes capacity change and is recognized	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
	-80 to +200°C/-112 to +392°F -50 to +120°C/-58 to +248°F -1 to +100bar/-14.5 to 1,450psi – 100 to 10,000mm/3.9 to 394" Thread, flange, hygiene AC-2-wire, DC-PNP 3-wire, 3-wire 3 to 12V, relay, 8/16mA, NAMUR Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL	As required -40 to +120°C/-40 to +248°F (starting 80°C/176°F water cooling) As required As required – From outside with assembly clamp 2-wire 4 to 20mA HART, relay, 8/16mA Regional Ex approvals, WHG, SIL
	▪ Condensate formation in nozzle – select inactive length ▪ DC < 1.6	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

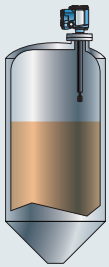
3.2 Selection of measuring principle according to process requirements

B

	Our proposal Vibronic Liquiphant	Capacitance Liquicap M
		
Advantages	▪ Gastight process seal (Second Line of Defense) ▪ Self-monitoring for build-up and corrosion ▪ Digital, safe and easy to use ▪ Developed according to SIL IEC 61508 ▪ Coatings (ECTFE, PFA, Email), sensor in Alloy C22 ▪ LED and Bluetooth module, Heartbeat Technology	▪ Fully insulated probe (PFA/PTFE) ▪ Gastight process seal (Second Line of Defense) ▪ Developed according to SIL IEC 61508 ▪ Foam causes capacity change and is recognized
Technical data ▪ Process temperature ▪ Ambient temperature ▪ Process pressure ▪ Medium properties ▪ Sensor length ▪ Process connection ▪ Supply/ Communication ▪ Approvals	 -60 to +280°C/-76 to +536°F -60 to +70°C/-76 to +158°F -1 to +100bar/-14.5 to 1,450psi Viscosity up to 10.000 mPas ≤ 3,000mm/≤ 118" Thread, flange AC-2-wire, 8/16mA HART, DC-PNP, 3-wire, relay, NAMUR, PFM Regional Ex approvals, WHG, marine approvals, SIL	 -80 to +200°C/-112 to +392°F -50 to +120°C/-58 to +248°F -1 to +100bar/-14.5 to 1,450psi – 100 to 10,000mm/3.9 to 394" Thread, flange, hygiene AC-2-wire, DC-PNP 3-wire, 3-wire 3 to 12V, relay, 8/16mA, NAMUR Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL
Application limit	▪ For viscous media, see capacitance with build-up compensation ▪ Standard instruments do not recognize foam as a liquid ▪ Gas bubbles in pipes	▪ Condensate formation in nozzle – select inactive length ▪ DC < 1.6

Aggressive media
(e.g. chemical industry applications)

- Coatings
- Functional safety (SIL)
- Gastight process seal (Second line of defense)
- Process monitoring



B

Radiometric
Gammapilot

- Non-contact from outside
- Exact measurement under extreme conditions
- Monitoring of build-up formation

As required
-40 to +120°C/-40 to +248°F
(starting 80°C/176°F water cooling)
As required
As required
–
From outside with assembly clamp
2-wire 4 to 20mA HART, relay, 8/16mA

Regional Ex approvals, WHG, SIL

- Observe radiation protection provisions
- Further information from our sales team
- Applicator for configuring the measuring point

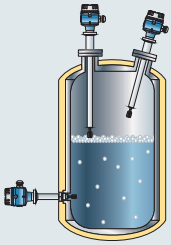
3.2 Selection of measuring principle according to process requirements

B

	Our proposal **Vibronic** **Liquiphant**	**Conductive** **One rod probe 11961Z**
	 	
Advantages	▪ Gastight process seal (Second Line of Defense) ▪ Self-monitoring for build-up and corrosion ▪ Digital, safe and easy to use ▪ Developed according to SIL IEC 61508 ▪ Unaffected by medium ▪ LED and Bluetooth module, Heartbeat Technology ▪ Optionally with coating for aggressive media	▪ Safe and reliable measurement even in aggressive medium ▪ Can be deployed particularly with high pressure or vacuum ▪ Can be used for liquid gases
Technical data ▪ Process temperature ▪ Ambient temperature ▪ Process pressure ▪ Medium properties ▪ Sensor length ▪ Process connection ▪ Supply/ Communication ▪ Approvals	 -60 to +280°C/-76 to +536°F -60 to +70°C/-76 to +158°F -1 to +100bar/-14.5 to 1,450psi – ≤ 3,000mm/≤ 118″ Thread, flange AC-2-wire, 8/16mA HART, DC-PNP, 3-wire, relay, NAMUR, PFM Regional Ex approvals, WHG, marine approvals, SIL	 -200 to +250°C/-328 to 482°F -200 to +250°C/-328 to 482°F -1 to +160bar/-15 to +2,320psi – 100 to 2.000mm/5.9 to 78.7″ Thread – ATEX, WHG
Application limit	▪ For viscous media, see capacitance probes with build-up compensation ▪ Standard instruments do not recognize foam as a liquid ▪ Gas bubbles in pipes	▪ Observe medium conductivity

High process pressures / high temperatures
(e.g. oil & gas industry)

- Materials according to NACE
- Gastight process seal (Second line of defense)
- Functional safety (SIL)
- Process monitoring



B

Radiometric
Gammapilot

- Non-contact from outside
- Exact measurement under extreme conditions
- Monitoring of build-up formation

As required
-40 to +120°C/-40 to +248°F
(starting 80°C/176°F water cooling)
As required
As required
–
From outside with assembly clamp
2-wire 4 to 20mA HART

Regional Ex approvals, WHG, SIL

- Observe radiation protection provisions
- Further information from our sales team
- Applicator for configuring the measuring point

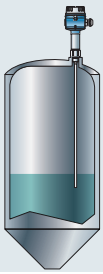
3.2 Selection of measuring principle according to process requirements

B

	Our proposal Capacitance Liquicap M	Conductive One rod probe 11961Z
		
Advantages	▪ Active build-up compensation ▪ Foam causes capacity change and is recognized	▪ Safe and reliable measurement even in aggressive medium ▪ Can be deployed particularly with high pressure or vacuum ▪ Can be used for liquid gases
Technical data		
▪ Process temperature ▪ Ambient temperature	-80 to +200°C/-112 to +392°F -50 to +120°C/-58 to +184°F	-200 to +250°C/-328 to 482°F -200 to +250°C/-328 to 482°F
▪ Process pressure ▪ Medium properties ▪ Sensor length ▪ Process connection ▪ Supply/ Communication ▪ Approvals	-1 to 100bar/-14.5 to 1,450psi – 100 to 10,000mm/3.9 to 394″ Thread, flange, hygiene AC-2-wire, DC-PNP 3-wire, 3-wire 3 to 12V, relay, 8/16mA, NAMUR Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL	-1 to +160bar/-15 to +2,320psi – 100 to 2.000mm/5.9 to 78.7″ Thread – ATEX, WHG
Application limit	▪ Condensate formation in nozzle – select inactive length ▪ DC < 1.6	▪ Observe medium conductivity

Low temperature requirements
(e.g. refrigerating plant and cooling processes)

- Cryogenic conditions
- Functional safety (SIL)
- Build-up



B

	Vibronic Liquiphant	Radiometric Gammapilot
		
	▪ Gastight process seal (Second Line of Defense) ▪ Self-monitoring for build-up and corrosion ▪ Digital, safe and easy to use ▪ Developed according to SIL IEC 61508 ▪ Unaffected by medium	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
	-60 to +280°C/-76 to +536°F -60 to +70°C/-76 to +158°F -1 to +100bar/-14.5 to 1,450psi – ≤ 6,000mm/≤ 236" Thread, flange AC-2-wire, 8/16mA HART, IO-Link, DC-PNP, 3-wire, relay, NAMUR, PFM Regional Ex approvals, WHG, SIL	As required -40 to +120°C/-40 to +248°F (starting 80°C/176°F water cooling) As required As required – From outside with assembly clamp 2-wire 4 to 20mA HART Regional Ex approvals, WHG, SIL
	▪ For viscous media, see capacitance with build-up compensation ▪ Standard instruments do not recognize foam as a liquid ▪ Gas bubbles in pipes	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

3.2 Selection of measuring principle according to process requirements

B

	Our proposal	
	Vibronic **Liquiphant**	**Capacitance** **Liquicap M**
		
Advantages	▪ Free of calibration and maintenance ▪ Standard instruments do not recognize foam as a liquid ▪ Self-monitoring for build-up and corrosion ▪ Safe and easy to use	▪ Foam causes capacity change and is recognized ▪ Reliable operation also in strong build-up
Technical data		
▪ Process temperature	-60 to +280°C/-76 to +536°F	-80 to +200°C/-112 to +392°F
▪ Ambient temperature	-60 to +70°C/-76 to +158°F	-50 to +120°C/-58 to +248°F
▪ Process pressure	-1 to +100bar/-14.5 to 1,450psi	-1 to +100bar/-14.5 to +1,450psi
▪ Medium properties	–	–
▪ Sensor length	≤ 6,000mm/≤ 236"	100 to 10,000mm/3.9 to 394"
▪ Process connection	Thread, flange, hygiene	Thread, flange, hygiene
▪ Supply/ Communication	AC-2-wire, 8/16mA HART, IO-Link, DC-PNP, 3-wire, relay, NAMUR, PFM	AC-2-wire, DC-PNP 3-wire, 3-wire 3 to 12V, relay, 8/16mA, NAMUR
▪ Approvals	Regional Ex approvals, hygiene approvals, WHG, SIL	Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL
Application limit	▪ For viscous media, see capacitance probes with build-up compensation ▪ Gas bubbles in pipes	▪ Non-conductive foam is not recognized as a liquid ▪ Condensate formation in nozzle – select inactive length ▪ DC < 1.6

Foaming media
(e.g. dairy, brewing or vacuum processes)

- Switch point setting
- Switching in foam or liquids
- Unaffected by gas bubble formation

B

	Conductive Liquipoint	Radiometric Gammapilot
		
	▪ Truly flush mounted installation ▪ Continuous functionality through changing media ▪ Reliable point level detection even with build-up ▪ Pasty and sticky media	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
	-20 to +100°C/-4 to +212°F (+150°C/+302°F for 1 h) -40 to +70°C/-40 to +158°F -1 to +25bar/-14.5 to 362,5psi 1µS/cm to 100mS/cm – Thread, hygiene DC-PNP, IO-Link Hygiene approvals	As required -40 to +120°C/-40 to +248°F (starting 80°C/176°F water cooling) As required As required – From outside with assembly clamp 2-wire 4 to 20mA HART, relay, 8/16mA Regional Ex approvals, WHG, SIL
	▪ Non-conductive media ▪ Dry, non-conductive build-up	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

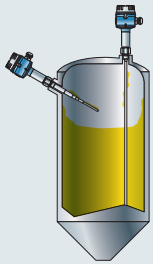
3.2 Selection of measuring principle according to process requirements

B

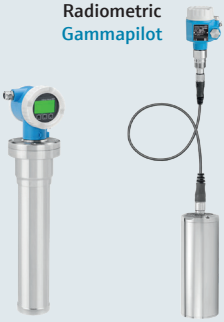
	Our proposal	
	Capacitance **Liquicap M**	**Vibronic** **Liquiphant**
		
Advantages	▪ Reliable operation also in strong build-up formation and highly viscous liquids ▪ Foam causes capacity change and is recognized	▪ Digital, safe and easy to use ▪ Developed according to SIL IEC 61508 ▪ Coatings (ECTFE, PFA, Email), sensor in Alloy C22 ▪ Predictive maintenance and increased plant availability through Heartbeat Technology
Technical data ▪ Process temperature ▪ Ambient temperature ▪ Process pressure ▪ Medium properties ▪ Sensor length ▪ Process connection ▪ Supply/ Communication ▪ Approvals	 -80 to +200°C/-112 to +392°F -50 to +120°C/-58 to +248°F -1 to 100bar/-14.5 to 1,450psi – 100 to 10,000mm/3.9 to 394″ Thread, flange AC-2-wire, DC-PNP 3-wire, 3-wire 3 to 12V, relay, 8/16mA, NAMUR Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL	 -60 to +280°C/-76 to +536°F -60 to +70°C/-76 to +158°F -1 to +100bar/-14.5 to 1,450psi – ≤ 6,000mm/≤ 236″ Thread, flange, hygiene AC-2-wire, 8/16mA HART, IO-Link, DC-PNP, 3-wire, relay, NAMUR, PFM Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL
Application limit	▪ Condensate formation in nozzle – select inactive length ▪ DC < 1.6	▪ For viscous media, see capacitance with build-up compensation ▪ Standard instruments do not recognize foam as a liquid ▪ Gas bubbles in pipes

Build-up forming media
(e.g. paints or milk of lime)

- Long-term stability by build-up compatibility or compensation
- Unaffected by gas bubble formation



B

	Conductive Liquipoint	Radiometric Gammapilot
		
	▪ Truly flush mounted installation ▪ Continuous functionality through changing media ▪ Reliable point level detection even with build-up ▪ Pasty and sticky media	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
	-20 to +100°C/-4 to +212°F (+150°C/+302°F for 1 h) -40 to +70°C/-40 to +158°F -1 to +25bar/-14.5 to 362,5psi 1µS/cm to 100mS/cm – Thread, hygiene DC-PNP, IO-Link Hygiene approvals	As required -40 to +120°C/-40 to +248°F (starting 60°C/140°F water cooling) As required As required – From outside with assembly clamp 2-wire 4 to 20mA HART, relay, 8/16mA Regional Ex approvals, WHG, SIL
	▪ Non-conductive media ▪ Dry, non-conductive build-up	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

3.2 Selection of measuring principle according to process requirements

B

	Our proposal Vibronic Liquiphant	Capacitance Liquicap M
		
Advantages	▪ Polished sensor surfaces Ra < 0.3µm ▪ Self-monitoring for build-up and corrosion ▪ Hygiene process connections and housing designs ▪ FDA-conforming sensor materials	▪ Tried and tested ▪ Hygienic process connection and housing ▪ FDA-conforming sensor materials ▪ Foam causes capacity change and is recognized
Technical data ▪ Process temperature ▪ Ambient temperature ▪ Process pressure ▪ Medium properties ▪ Sensor length ▪ Process connection ▪ Supply/ Communication ▪ Approvals	 -50 to +150°C/-58 to +302°F -50 to +70°C/-58 to +158°F -1 to 64bar/-14.5 to 928psi – ≤ 3,000mm/≤ 118" Thread, hygiene AC-2-wire, 8/16mA HART, IO-Link, DC-PNP, 3-wire, relay, NAMUR, PFM Regional Ex approvals, hygiene approvals, WHG, SIL	 -80 to +200°C/-112 to +392°F -50 to +120°C/-58 to +248°F -1 to 100bar/-14.5 to 1,450psi – 100 to 10,000mm/3.9 to 394" Thread, hygiene AC-2-wire, DC-PNP 3-wire, 3-wire 3 to 12V, relay, 8/16mA, NAMUR Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL
Application limit	▪ For viscous media, see capacitance with build-up compensation ▪ Standard instruments do not recognize foam as a liquid ▪ Gas bubbles in pipes	▪ Condensate formation in nozzle – select inactive length ▪ DC < 1.6

Hygiene application
(e.g. production of foods or pharmaceuticals)

- Surface finish
- Approvals (EHEDG, 3-A)
- FDA conforming materials
- Capable of CIP and SIP
- Hygiene process connections

B

	Conductive Liquipoint FTW33	Capacitance/Conductive Liquipoint FTW23
		
	▪ Truly flush mounted installation ▪ Continuous functionality through changing media ▪ Reliable point level detection even with build-up	▪ CIP and SIP cleanability up to protection class IP 69 ▪ No individual adjustment to each medium necessary ▪ LED display for on-site function check
	-20 to +100°C/-4 to +212°F (+150°C/+302°F for 1 h) -40 to +70°C/-40 to +158°F -1 to +25bar/-14.5 to +362.5psi 1µS/cm to 100mS/cm – Thread, hygiene DC-PNP, IO-Link Hygiene approvals	-20 to +100°C/-4 to +212°F (+135°C/+275°F for 1 h) -40 to +70°C/-40 to +158°F -1 to +16bar/-14.5 to +232psi DC value > 20 – Thread, hygiene DC-PNP Hygiene approvals
	▪ Non-conductive media ▪ Dry, non-conductive build-up	▪ Water-/alcohol-based media ▪ Build-up

4. Instrument selection within the measuring principle

C

	Liquiphant FTL50H/51H, FTL43, FTL63	Liquiphant FTL51B, FTL50/51
		
Applications	▪ Point level switch for hygiene applications including all required approvals and process connections	▪ Universal standard modular system including all required approvals, process connections and electrical connections ▪ Digital, safe and easy to use
Special features	▪ Density adaptation ▪ Polished sensor surfaces ▪ Sensor materials FDA conform ▪ Heartbeat Technology ▪ Bluetooth operation and maintenance with the SmartBlue App/DTM ▪ Recurring test by push button	▪ Density adaptation ▪ Heartbeat Technology ▪ Bluetooth operation and maintenance with the SmartBlue App/DTM ▪ Recurring test by push button
Technical data		
▪ Process pressure	-1 to 64bar/-14.5 to 928psi	-1 to 100bar/-14.5 to 1450psi
▪ Process temperature	-50 to +150°C/-58 to +302°F	-50 to +150°C/-58 to +302°F
▪ Process connection	Thread, flange, hygiene	Thread, flange
▪ Ambient temperature	-50 to +70°C/-58 to +158°F	-60 to +70°C/-76 to +158°F
▪ Sensor material	316L	316L, Alloy C22
▪ Surface finish	< 1.5µm, < 0.3µm, < 0.38µm electro-polished	< 3.2µm
▪ Electrical connection	AC-2-wire, 8/16mA HART, DC-PNP 3-wire, relay, PROFIBUS®, NAMUR, PFM	AC-2-wire, 8/16mA HART, DC-PNP 3-wire, relay, PROFIBUS®, NAMUR, PFM
▪ Approvals	Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL	Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL
▪ Design	Compact and with tube extension	Compact and with tube extension

Vibronic

Most universal liquid limit switch
- Unaffected by media
- Ready for use without calibration
- Self-monitoring for build-up and corrosion
- May be used in turbulent and effervesce liquids

Continued on page 30

	Liquiphant FTL62/FTL51C	**Liquiphant FTL64**	**Liquiphant FTL80/81, FTL85**
			
	▪ Modular system for aggressive media, e.g. chemicals ▪ Numerous coatings	▪ For high temperatures and high pressures, e.g. in the petrochemical and chemical industry, power plants	▪ For high degree of failure safety: Safety Integrity Level up to SIL3 e.g. in the petrochemical and chemical industry, oil & gas
	▪ Density adaptation ▪ Heartbeat Technology ▪ Bluetooth operation and maintenance with the SmartBlue App/DTM ▪ Recurring test by push button	▪ Sensor materials designed for high temperatures ▪ Gastight process seal ▪ Heartbeat Technology ▪ Bluetooth operation and maintenance with the SmartBlue App/DTM	▪ Redundant sensor design in one instrument ▪ Integrated self-testing every 3 seconds ▪ Proof test interval may be extended up to 12 years ▪ Gastight process seal (Second Line of Defense)
	-1 to 40bar/-14.5 to 580psi -50 to +150°C/-58 to +302°F Flange -60 bis +70°C/-76 to +158°F	-1 to 100bar/-14.5 to 1,450psi -60 to +280°C/-76 to +536°F Thread, flange -60 bis +70°C/-76 to +158°F	-1 to 100bar/-14.5 to 1,450psi -60 to +280°C/-76 to +536°F Thread, flange -60 bis +70°C/-76 to +158°F
	316L/10487; coating: ECTFE, PFA, Email –	Duplex 316/318L, Alloy C22, optional with coating (PFA) < 3.2µm	316L, 318L, Alloy C22, coating: Emaille, PFA, ECTFE, PFA conductive < 3.2µm
	AC-2-wire, DC-PNP 3-wire, 8/16mA HART, Relais, PROFIBUS®, NAMUR, PFM Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL Compact and with tube extension	AC-2-wire, 8/16mA HART, DC-PNP 3-wire, relay, PROFIBUS®, NAMUR, PFM Regional Ex approvals, WHG, marine approvals, SIL Compact and with tube extension	4 to 20mA, optional with separate switching unit Regional Ex approvals, WHG, marine approvals, SIL, VdTÜV100 Compact and with tube extension

4. Instrument selection within the measuring principle

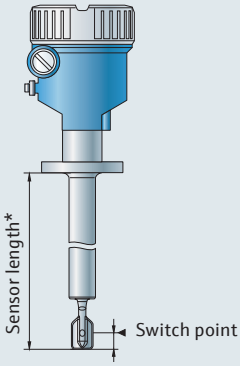
Vibronic

Continued from page 29

C

	Liquiphant FTL33	Liquiphant FTL31	Liquiphant FTL41
			
Applications	▪ Food applications, e.g. dairies or breweries ▪ Compact sensor ▪ Suitable for tight installation conditions with skid builders	▪ Compact sensor ▪ Suitable for installation even in confined conditions, especially in the machinery industry	▪ Universeller standard level switch for basic requirements ▪ Pipe extension up to 2m/6.6ft
Special features	▪ Gap-free housing design ▪ External performance test possible	▪ External performance test possible	▪ Simple to use with plug and play functionality based on active sensor technology
Technical data			
▪ Process pressure	-1 to 40bar/ -14.5 to 580psi	-1 to 40bar/ -14.5 to 580psi	-1 to 40bar/ -14.5 to 580psi
▪ Process temperature	-40 to +150°C/ -40 to +302°F	-40 to +150°C/ -40 to +302°F	-40 to +150°C/ -40 to +302°F
▪ Process connection	Thread, hygiene	Thread	Thread, flange
▪ Ambient temperature	-40 to +70°C/ -40 to +158°F	-40 to +70°C/ -40 to +158°F	-40 to +70°C/ -40 to +158°F
▪ Sensor material	316L	316L	316L
▪ Surface finish	< 1.5µm, < 0.76 µm	< 3.2 µm	< 3.2 µm
▪ Electrical connection	AC-2-wire, DC-PNP 3-wire	AC-2-wire, DC-PNP 3-wire	DC-PNP 3-wire, relay, NAMUR
▪ Approvals	Hygiene approvals	WHG, marine approvals	Regional Ex approvals, WHG
▪ Design	Compact and short tube version	Compact and short tube version	Compact and with tube extension

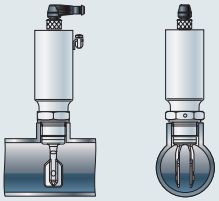
Vibronic installation instructions



Determine switch point
The sensors of the Liquiphant family have a switch point exact to the millimeter-under reference conditions (density 1g/cm³, 23°C, pe 0bar).

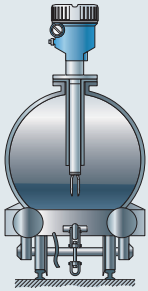
Define length of sensor
For the optimum adaptation to tanks and pipes the instruments are produced in different lengths. Length details always refer to the distance between the sealing face and the tip of the fork.
*Sensor length:
- Compact design between 55mm ... 69mm/2.2"...2.7" (depending on process connection)
- Tube extension 118mm/4.6"; 148mm...6,000mm/5.8"...236"

Variable switch point
For applications which do not permit the determination of the switch point during planning, the same may be subsequently adjusted via a sliding sleeve.



Optimum installation
Align tuning fork in such a way that the narrow sides of the tines point upwards and downwards allowing the liquid to drip freely (also applicable to higher viscous media). Sufficient free space should be provided for assembly, connections and setting.

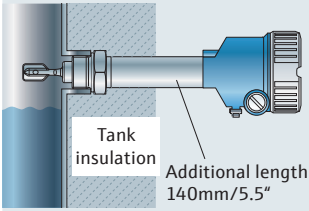
Build-up on the tank wall
Provide sufficient space between the expected product build-up on the tank wall and the tuning fork.



Installation involving low viscosity (up to 2,000mm²/sec.)
Deburr nozzle

Installation in pipes starting 2"
Flow rates up to 5m/s with a viscosity of 1mm²/sec. and a density of 1g/cm³. In different conditions the function must be tested.

Dynamic load
In case of strong dynamic loads, support instruments with tube extension by appropriate measures.



Installation in insulated tanks
A spacer is recommended for higher temperatures. This avoids breaking the tank insulation and protects the electronic insert from higher temperatures. In addition, a pressure-proof feedthrough is included which keeps the tank pressure off the housing up to 64bar/928psi in case of sensor damage.

C

4. Instrument selection within the measuring principle

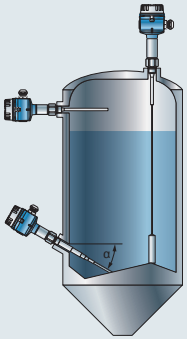
Capacitance

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

C

	Liquicap M FTI51/52	Liquipoint FTW23
		
Applications	▪ Universal switch without block distance ▪ Process tanks ▪ Suitable for extreme process conditions	▪ Pipes with small diameters ▪ Small vessels
Special features	▪ Build-up compensation ▪ Gastight process seal ▪ Foam causes capacity change and is recognized ▪ Plug and play functionality	▪ CIP and SIP cleanability ensured - up to protection class IP 69 ▪ Individual adjustment to each medium not necessary ▪ LED display for on-site function check
Technical data		
▪ Process pressure	-1 to 100bar/-14.5 to 1,450psi	-1 to +16bar/-14.5 to +232psi
▪ Process temperature	-80 to +200°C/-112 to +392°F	-20 to +100°C/-4 to +212°F (+135°C/+275°F for 1 h)
▪ Process connection	Thread, flange, hygiene	Thread, hygiene
▪ Ambient temperature	-50 to +120°C/-58 to +248°F	-40 to +70°C/-40 to +158°F
▪ Sensor material	PTFE, PFA, FEP, 316L	Sensor: 316L Sensor isolation: PEEK
▪ Surface finish	–	–
▪ Electrical connection	AC-2-wire, DC-PNP 3-wire, 3-wire 3 to 12V, relay, 8/16 mA, NAMUR	DC PNP, IO-Link
▪ Approvals	Regional Ex approvals, hygiene approvals, WHG, marine approvals, SIL	Hygiene approvals
▪ Design	Rod, rope design	Compact

Capacitance installation instructions



Determine switch point
In point level detection, the minimum capacity change should amount to ΔC_{min} = 5 to 10pF

Define sensor length
In order to obtain optimum adaptation to tanks and pipes the instruments are produced in custom-made lengths. Length details always refer to the distance between the sealing face and the end of the probe.
- Rod 100 to 4,000mm/3.9 to 158"
- Rope 420 to 10,000mm/16.5 to 394"

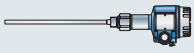
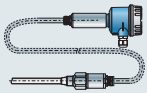
Rule of thumb for minimum probe length
Non-conductive media $L_{min} = \Delta C_{min} / (C_s \cdot (\varepsilon r\text{-}1))$

C_s = Probe capacity, see technical information

Installation recommendations
Rod probes should be installed horizontally only up to a length of 1m. An inclined α installation angle supports dripping of higher viscous media.

Non-conductive media – estimate with rule of thumb
Conductive media (> 100µS/cm) – no special attention to anything

Probe selection

Without ground tube	▪ For conductive liquids ▪ For highly viscous liquids	
With ground tube	▪ For non-conductive liquids ▪ For plastic tanks ▪ For agitator vessels	
Inactive length	▪ Installation in assembly nozzles ▪ In case of condensate formation on tank ceiling	
Fully insulated inactive length, with plated flange	▪ Particularly suited to aggressive liquids	
Active build-up compensation	▪ In case of strong (conductive) build-up formation on the probe	
Gastight feedthrough	▪ For LPG tanks ▪ Against condensate formation in the probe in extreme temperature conditions ▪ For toxic media	
Separate housing	▪ For high environmental temperature ▪ If limited space is required	

C

4. Instrument selection within the measuring principle

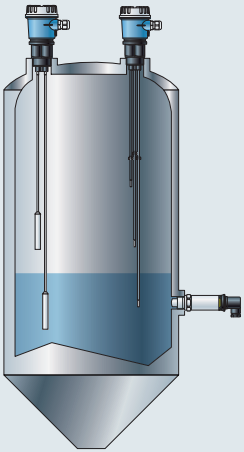
Conductive

- Multipoint detection with one process connection
- Price-effective instrumentation

C

	Liquipoint T FTW31/ FTW32 	Liquipoint FTW33 	Konduktiv Einstabsonde 11961Z 
Application	▪ Multipoint control ▪ Water-, waste water application ▪ Two-point control ▪ Metal or plastic tanks	▪ Pipes with small diameters ▪ Small vessels ▪ Pasty media	▪ Process or storage tanks ▪ Pump protection ▪ Overfill prevention ▪ Two-point control ▪ For high pressure or vacuum
Special features	▪ 2/3/5 rods or ropes ▪ Separate design with Nivotester FTW325 ▪ Line monitoring ▪ Simple probe adjustment	▪ Truly flush mounted installation ▪ Continuous functionality through changing media ▪ Reliable point level detection even with build-up ▪ Capable of CIP and SIP ▪ Conductive foam can be detected or hidden	▪ Corrosion-resistant materials ▪ Ceramic insulation ▪ Simple probe adjustment
Technical data			
▪ Process pressure	-1 to 10bar/ -14.5 to 145psi	-1 to +25bar/ -14.5 to +362.5psi	-1 to +160bar/ -15 to +2,320psi
▪ Process temperature	-40 to +100°C/ -40 to +212°F	-20 to +100°C/ -4 to +212°F (+150°C/+302°F for 1 h)	-200 to +250°C/ -328 to 482°F
▪ Process connection	Thread	Thread, hygiene	Thread
▪ Ambient temperature	-40 to +70°C/ -40 to +158°F	-40 to +70°C/ -40 to +158°F	-200 to +250°C/ -328 to 482°F
▪ Sensor material	Rod: 316L, PP insulated Rope: 316Ti, FEP insulated	Sensor: 316L Isolation: PEEK	Ceramic, 316TI
▪ Electrical connection	AC, DC (relay), NAMUR, switching unit (relay)	DC PNP, IO-Link	–
▪ Approvals	WHG, leakage, ATEX G	Hygiene approvals	ATEX, WHG
▪ Design	2, 3 and 5 rod probes or rope design	Compact	

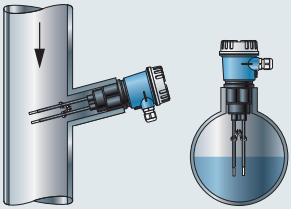
Conductive installation instructions

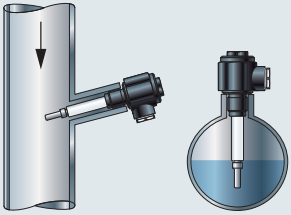


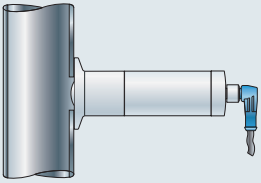
Min. or max. detection
Rod and rope probes may be used both for min. and max. detection.
- Switch point exact to the millimeter
- Subsequent adjustment of rods or ropes for switch point setting

Installation
- Tank of plastics or metal
- 1 rod and 2 rod probes in pipes
- Rod probes may be installed from the top, the side or the bottom. Rope probes are only installed from the top.
- In lateral installation:
  - The sensor should be installed as inclined as possible (10-30°)
  - The sensor should not be installed in the intake flow

Rope probe
- Install the probe as much in the center as possible so that the liquid cannot move the weight to the wall







C

4. Instrument selection within the measuring principle

Float switch

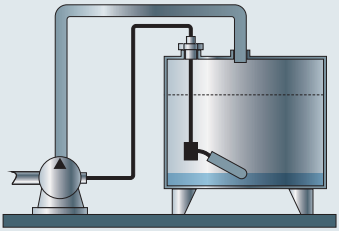
- Favourable measuring principle
- Controllers as initiators, microswitches
- Connection cable for different media
- Also Ex area applications

C

Liquifloat
FTS20

Application	▪ Level monitoring in tanks ▪ Pump control
Special features	▪ Cost-effective instrumentation
Technical data	
▪ Process pressure	Max. 3bar/43.5psi
▪ Process temperature	PVC cable: 5°C to +70°C/41 to +158°F PUR cable: -20°C to +85°C/-4 to +185°F CSM cable: -20°C to +85°C/-4 to +185°F
▪ Process connection	Cable entry
▪ Ambient temp.	See process temperature
▪ Sensor material	Shell of PP
▪ Roughness	–
▪ Electrical connection	AC/DC 3-wire, NAMUR
▪ Approvals	ATEX
▪ Design	Cable and float

Float switch instructions



Determine switch point
To determine the switch point the cable length must be reduced as follows.
Minimum length of cable between attachment point and float:
- PVC >= 50mm/2″
- PUR >= 100mm/3.9″
- CSM >= 100mm/3.9″

In top installation, the length of the weight must be taken into consideration (190mm/7.5″).
- Upper switch point +25° ±10°/+77°
- Lower switch point +14° ±10°/+57° measured against the horizontal line

Define sensor length
The cable may be adjusted according to customer requirement.

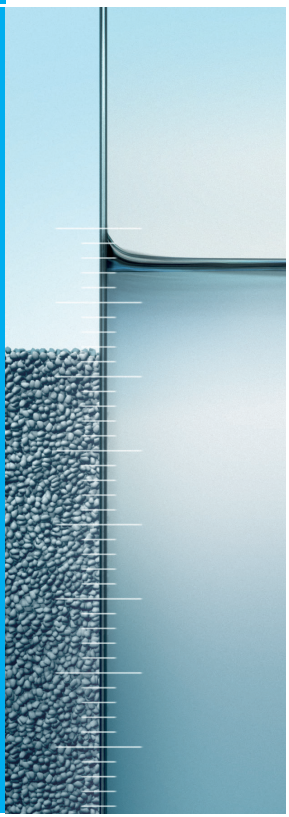
Optimum installation
The float switch may be externally fastened with bolts – through a G1A threaded hole. Use the weight in top installation.
- Note: The center of rotation should always be horizontal. If the weight is used, an additional traction relief (e.g. a knot in the cable) has to be provided behind the packing box screwed connection on the outside of the tank.

Medium compatibility
- PVC: For water and slightly aggressive liquids
- PUR: Preferred for fuel, heating oils and oil-containing media
- CSM: For many acids and lyes

Medium compatibility must be especially tested.

Point level detection in bulk solids

Selection and engineering guide



Endress+Hauser
People for Process Automation

Step by step

A

Overview of measuring principles
The first pages contain an overview of measuring principles for point level detection of Endress+Hauser in diagrams. Subsequently, the mode of operation of the measuring principle and the respective product family are introduced.

Checklist
You should know the specific requirements of your application for the selection of a suitable point level switch. The checklist provides an overview and is supposed to assist you in acquiring this data and taking it as completely as possible into consideration.

B

Selection of the measuring principle
The suitable measuring principle is selected according to two criteria:
- application and
- process requirements.

First, the measuring principles are listed in accordance with specific plant criteria (vessel, conveyor belt, etc.) and then in accordance with specific medium criteria (high temperatures, aggressiveness, etc.)
Select the measuring principle which meets, if possible, all of the criteria demanded by you or your plant. The measuring principles are listed from left to right according to their suitability. The ideal measuring principle is listed first and edged in blue.

C

Selection of the instrument
You now move to the area of the selected measuring principle where you can choose the suitable instrument of a product family. Compare your application and process data with the instrument data.

Engineering
After the selection of the optimum
instrument please check the installation instructions at the end of the respective measuring principle. You will find basic guidelines supporting safe instrument installation and application.

Contents

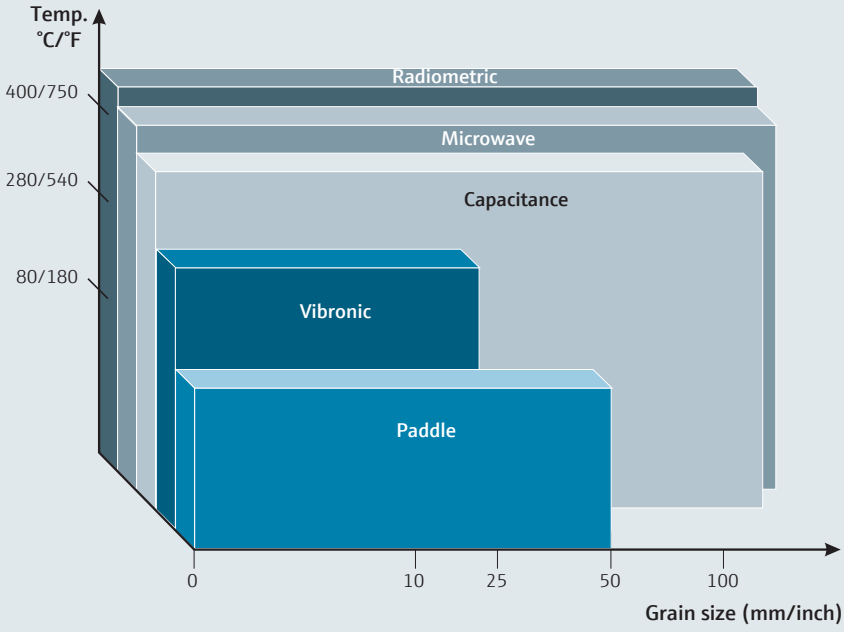
A

1. Overview of measuring principles

Segmentierung

	Point level	Continuous
Liquids	Vibronic Conductive Capacitance Float switch Radiometric	Radar Guided radar Ultrasonic Hydrostatic Capacitance Radiometric
Bulk solids	Vibronic Capacitance Paddle Microwave Radiometric	Radar Guided radar Ultrasonic Electromechanical system Radiometric

Process conditions



Flexible answers to individual needs.

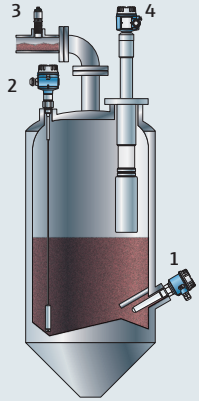
The basic idea of the FLEX structure is that depending on the application, there are different goals to achieve and different challenges to overcome. Some processes you must just monitor, others you want to optimize. Here is a overview of our selections:

Xpert Selection	Master your most challenging applications	■ Specialized products ■ Designed for demanding applications	F L E **X**
Extended Selection	Optimize your processes with innovative technologies	■ High-end products ■ Highly functional and convenient	F L **E** X
Lean Selection	Handle your core processes easily	■ Standard products ■ Reliable, robust and low-maintenance	F **L** E X
Fundamental Selection	Meet your basic measurement needs	■ Simple products ■ Easy to select, install and operate	**F** L E X

A

1. Overview of measuring principles

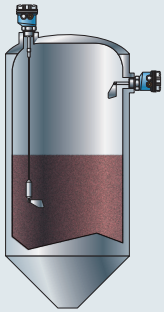
Contact measuring principles



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

Minicap (1)
Favorable limit switch, particularly for build-up forming media.
Solicap M (2)
Robust probe for coarse-grained media.
Nivector (3)
Most compact limit switch for bulk solids.
Solicap S (4)
For extremely high temperatures.

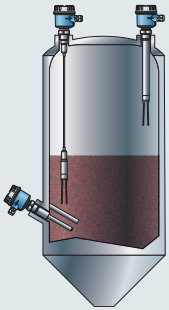
Process temperatures up to +400°C/+750°F
Process pressures up to 25bar/360psi
Dielectric constant DC min. 1.6



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

Soliswitch
Favorable limit switch for simple applications with fine-grained bulk solids.

Process temperatures up to +80°C/+180°F
Process pressures up to 1.8bar/26psi



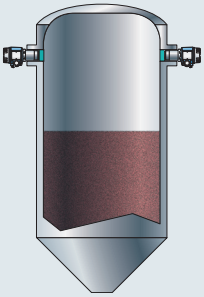
Vibronic
A one-rod sensor or a tuning fork is excited at its resonant frequency. The drive works piezoelectrically. The amplitude changes as the fork enters the medium. The change is analyzed and translated into a switching signal.

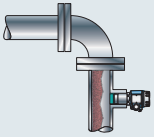
Soliphant
Universal limit switch for bulk solids, also if media change.

Process temperatures up to +280°C/+540°F
Process pressures up to 25bar/360psi
Medium density min. 10g/l

A

Non-contact measuring principles





Microwave

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

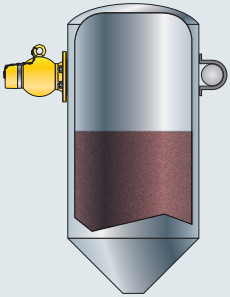
Soliwave

- Point level detection
- Combined point level detection and bulk flow monitoring
- For the purpose of monitoring and counting
- Detection of build-up, contamination or similar items

Solimotion

- Monitoring of pneumatic and mechanic transport processes
- Change of mass flow

For any process temperature or +450°C/+842°F (in case of direct installation with high-temperature adapter) for any process pressure or 21bar/350psi abs. (in case of direct installation with high pressure adapter).



Radiometric

The gamma source, a cesium or cobalt isotope, emits 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 and a detector as a receiver.

Gammapilot

Non-contact measurement from outside, for all extreme applications, e.g. very abrasive, corrosive and aggressive media.
Typical applications: Point level detection in pulp digesters, wood chip silos and fluidized bed reactors or in density and mass flow measurement.

- Unaffected by media
- Any process temperature
- Any process pressure
- Unaffected by gammagraphy (FHG65)

For more detailed information, please contact our application consultant in your country or use the Applicator selection software.

A

2. Checklist

You need to know your specific application requirements for a correct selection. The checklist opposite provides an overview of relevant process data and is supposed to help you to take these into consideration. If we have not included all of the data, please supplement this list with your criteria.
The checklist is used both for the selection of the measuring principle and the selection of the instrument.

TIP

Copy this checklist and complete it to have all relevant data readily available for the selection.

The most important terms/abbreviations

ATEX	AT= Atmosphere, EX = Explosive. Abbreviation of the French working title of the EU Guideline 94/9/EC
WHG	Wasserhaushaltsgesetz. Overfill prevention/leakage alarms are certified according to WHG
SIL	Safety Integrity Level. Safety levels according to IEC 61508/61511
VdTÜV100	Liquefied gas approval
Electronics	
IO-Link	Communication system for connecting intelligent sensors and actuators to an automation system
3-wire	Connection for Endress+Hauser switching unit
AC	Connection for alternating voltage
DC-PNP	Connection for direct voltage with transistor output (open collector)
Relay + DPDT	Double Pole Double Throw; relay as double change-over contact
PFM	PulseFrequenzyModulation; extremely interference-proof signal transmission between sensor electronics and switching unit
NAMUR	Direct current interface for sensors and switching amplifiers (IEC 60947-5-6)
PROFIBUS®	Fieldbus technology PROFIBUS PA
HART®	Fieldbus technology
FF	FOUNDATION™ fieldbus
Instrumentation	
Compact	Signal output is directly available from probe electronics (e.g. DC-PNP, relay SPST)
Separate instrument.	Signal output is available via an additional switching unit (top-hat rail or 19" card) (e.g. relay SPDT). The switching unit also supplies the sensor with power
Certification	
EHEDG	„European Hygienic Equipment Design Group". An independent group with different subgroups which discuss special subjects concerning hygiene requirements and prepare their publication
3-A	„3-A Sanitary Standards" are voluntary norms of the American „International Association of Milk, Food and Environmental Sanitarian"
FDA	„Food and Drug Administration". American approval authority. Materials, special plastics are subject to respective guidelines for their use in pharmaceutical/food plants
3.1	Material test certificate for special steels
NACE	„National Association of Corrosion Engineering". Material test certificate for special steels including degree of hardness and cooling/annealing temperature of steel

A

		Please complete		Notes
Medium	Density	g/l (kg/cm³)		
	Grain size	mm		
	Dielectric constant (DC)			
	Tacky/build-up forming	yes	no	
	Dusty	yes	no	
	Abrasive	yes	no	
	Aggressive	yes	no	
	Easily flowing	yes	no	
	Hygroscopic	yes	no	
Non-contact measurement		yes	no	
Process data	Pressurized process	min.	max.	
	Temperature at housing	min.	max.	
	Temperature in process	min.	max.	
	max. lateral load		max.	
	max. rope tensile load		max.	
Process connection	Threaded connection	yes	no	
	Flange	yes	no	
	Size	Ø		
	Pressure requirements	min.	max.	
	Hygiene requirements	yes	no	
Installation	Tank	yes	no	
	Orientation	lateral	from the top	
	Pipe/conveyor belt	yes	no	
	Point level detection	min.	max.	
	Control	min.	max.	
Electric connection	DC, AC, relay, bus systems, PFM, NAMUR, 8/16 mA			
Surface requirements	Surface finish	µm		
	Roughness	yes	no	
Approvals	Ex (dust)	yes	no	
	Ex (gas)	yes	no	
	WHG	yes	no	
	Ship building	yes	no	
	EHEDG	yes	no	
	3-A	yes	no	
Certificates/ manufacturer declarations	3.1	yes	no	
	FDA listed materials	yes	no	
	SIL	yes	no	
	EG1935	yes	no	
Special requirements	Extreme external vibration	yes	no	

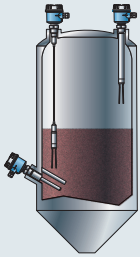
3.1 Selection of measuring principle according to application

B

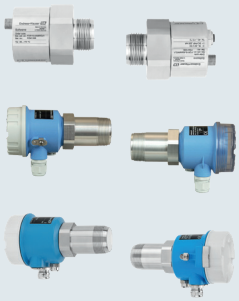
	Our proposal **Vibronic** Soliphant M/T	**Capacitance** Solicap S/M Minicap/Nivector	**Paddle** Soliswitch
			
Advantages	▪ Build-up and abrasion monitoring ▪ Independent of medium ▪ Unaffected by abrasion ▪ Maintenance-free ▪ Easy commissioning ▪ Also rod and rope versions	▪ Up to 400°C/750°F ▪ Unaffected by build-up ▪ Robust probe ▪ Easy commissioning ▪ Active build-up compensation	▪ Price-effective sensor ▪ Easy commissioning and handling ▪ Also rod and rope versions ▪ Rotation monitoring
Technical data ▪ Process pressure ▪ Process temperature ▪ Grain size ▪ Density ▪ Measuring range ▪ Approvals	 -1 to 25bar/-14 to 360psi -50 to +280°C/ -55 to +540°F Up to 25mm/1" Starting 10g/l 145 to 20,000mm/6 to 800" Regional Ex approvals, SIL	 -1 to 25bar/-14 to 360psi -50 to +400°C/ -60 to +750°F Up to 100mm/4" – 30 to 20,000mm/1 to 800" Regional Ex approvals, SIL	 -0.5 to 1.8bar/-7 to 26psi -20 to +80°C/ -4 to +180°F Up to 50mm/2" Starting 100g/l 75 to 2,000mm/3 to 80" ATEX
Application limits	▪ For media > 25mm/1" Ø or process temperature > 280°C/540°F see capacitance probes	▪ See vibronic for a DC value < 1.6 ▪ For media > 100mm/4" Ø see microwave barrier	▪ For process temperatures < 80°C/180°F and media > 50mm/2" Ø see capacitance probes

Silo / tank / bin / blow tank

- Changing media
- Alarm for empty and full tank
- Sensor installation from the top or laterally
- Static charging if a high portion of fine particles is present



B

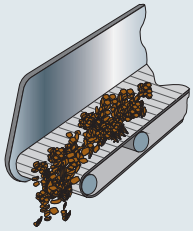
	Microwave Soliwave	Radiometric Gammapilot
		
	▪ Non-contact from outside in plastic or metal tanks with windows penetrable by microwaves ▪ Detection of build-up, contamination or similar matter ▪ Front-flush solutions ▪ Easy assembly ▪ Combined point level detection and bulk flow monitoring possible	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
	0.5 to 6.8bar/7.2 to 98psi abs. (+21bar/+305psi with HP-Adapter) -40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter) As required Starting 10g/l 30 to 100,000mm/1 to 4,000" Regional Ex approvals	As required As required As required As required As required Regional Ex approvals, SIL
	▪ See capacitance in case of build-up with highly conductive media ▪ See capacitance in case of very low attenuation	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

3.1 Selection of measuring principle according to application

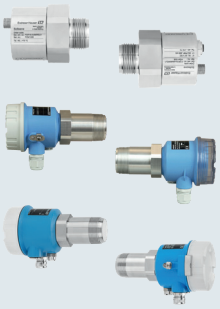
B

Conveyor belts

- Material flow detection / counter for packaged goods
- Monitoring of belt feed points, chutes
- Strong abrasion (non-contact)
- Fast reaction

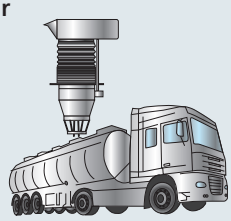


Our proposal

	Microwave Soliwave	Microwave Solimotion	Capacitance Solicap M
			
Advantages	▪ Non-invasive ▪ Counting of packaged goods possible ▪ Combined point level detection and bulk flow monitoring possible	▪ Non-invasive monitoring of pneumatic and mechanic transport processes ▪ Change of mass flow	▪ Very robust ▪ Tensile loads up to 60kN ▪ Abrasion resistant ▪ Active condensate build-up
Technical data ▪ Process temperature ▪ Grain size ▪ Measuring range ▪ Sensor material ▪ Direction of inst. ▪ Approvals	 -40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter) As required 30 to 100,000mm/ 1 to 4,000" Aluminum or 316Ti, PTFE or ceramic Laterally Regional Ex approvals	 -40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter) As required 30 bis 20,000mm/ 1 to 800" Aluminium or 316L, PTFE From the side or the top Regional Ex approvals	 -50 to +180°C/ -60 to +350°F Up to 100mm/4" 200 to 20,000mm/ 8 to 800" Steel, 316L, PTFE From the top Regional Ex approvals, SIL
Application limits	▪ See capacitance in case of build-up with highly conductive media ▪ See capacitance in case of very low attenuation	▪ In case of build-up with highly conductive media ▪ For very low solids flow speeds	▪ DC < 1.6 ▪ Grain size < 100mm/4" Ø

Filling nozzle / Loader

- Sensor as overfill prevention of the truck
- Changing fine-grained to dust-like media
- Medium surrounds the sensor
- Small design / separate instrumentation



B

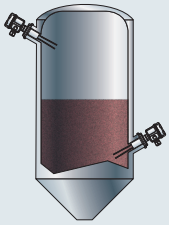
Our proposal

	Vibronic Soliphant M	Capacitance Minicap	Capacitance Solicap M
			
Advantages	▪ Instrument variant with separate electronics ▪ Abrasion-resistant, maintenance-free ▪ Also for very light media	▪ Very build-up compatible ▪ Maintenance-free ▪ High lateral load	▪ Very robust ▪ Tensile loads up to 60kN ▪ Abrasion resistant ▪ Active condensate build-up
Technical data ▪ Process pressure ▪ Process temperature ▪ Grain size ▪ Density ▪ Sensor length ▪ Sensor material	 -1 to 25bar/-14 to 360psi -50 to +280°C/ -60 to +530°F Up to 10mm/0.4" Starting 10g/l Starting 145mm/6" 316L	 -1 to 25bar/ -14 to 360psi -40 to +120°C/ -40 to +250°F Up to 30mm/1" – 140mm/5" PPS, FDA-listed	 -1 to 25bar/-14 to 360psi -50 to +180°C/ -60 to +350°F up to 100mm/4" – 500 to 20,000mm/20 to 800" Steel, 316L, PTFE
Application limits	▪ See capacitance for media > 10mm/0.4" Ø ▪ Strong build-up formation	▪ DC < 1.6	▪ DC < 1.6 ▪ Grain size < 100mm/4" Ø

3.2 Selection of measuring principle according to process requirements

Hygiene applications

- Applications with high demands on process connection, housing and sensor cleaning
- Sensor surfaces suitable for sanitary applications, high-quality finish
- Hazardous areas

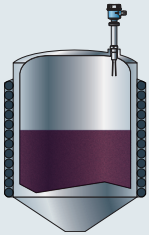


Our proposal

	Vibronic Soliphant M	Capacitance Minicap	Capacitance Nivector
			
Advantages	▪ Build-up and abrasion monitoring ▪ Sensor material 316L ▪ Surface roughness (0.8µm) ▪ Special steel housing ▪ Dairy fittings available ▪ 3.1 certificate ▪ Maintenance-free	▪ FDA-listed sensor material ▪ Build-up compensation ▪ Maintenance-free	▪ Protector for abrasion protection (FDA-listed) ▪ Small dimensions ▪ External measurement in plastic tanks
Technical data ▪ Process pressure ▪ Process temperature ▪ Process connection ▪ Grain size ▪ Density ▪ Sensor material ▪ Measuring range ▪ Approvals	-1 to 25bar/ -14 to 360psi -50 to +280°C/ -50 to +540°F Tri-Clamp, flanges, thread Up to 10mm/0.4" Starting 10g/l 316L (0.8µm), PTFE, ETFE 145 to 20,000mm/ 6 to 800" Regional Ex approvals	-1 to 25bar/ -14.5 to 360psi -40 to +120°C/ -40 to +250°F Thread Up to 30mm/1.2" – PPS 140 to 6,000mm/ 6 to 240" Regional Ex approvals	-1 to 6bar/ -14 to 80psi -20 to +80°C/ -4 to +180°F Thread Up to 10mm/0.4" – PC, ECTFE 30mm/1.2" Regional Ex approvals
Application limits	▪ See capacitance for media > 10mm/0.4" Ø	▪ See vibronic if metal sensor is required or for media with strong abrasion or DC < 1.6	▪ See capacitance for media > 10mm/0.4" Ø

High process temperatures
(e.g. fly ash, hot minerals,...)

- Silos/coolers with hot media (e.g. after furnaces)
- High temperatures above 150°C/300°F
- Separate instrumentation with separate electronics



B

Our proposal

	Vibronic Soliphant M	Capacitance Solicap S	Microwave Soliwave	Radiometric Gammapilot
				
Advantages	▪ Up to 280°C/540°F ▪ Universal ▪ For light weight media ▪ Build-up alarm	▪ Up to 400°C/750°F ▪ Very robust ▪ Inactive length, active condensate build-up ▪ Sword probe or rope probe	▪ Non-invasive from outside when using high-temperature adapters, plugs permitting microwave penetration or inspection glass	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
Technical data				
▪ Process pressure	-1 to 25bar/ -14 to 360psi	-1 to 10bar/ -14 to 140psi	0.5 to 6.8bar/7.2 to 98psi abs. (+21bar/+305psi with HP-Adapter)	As required
▪ Process temperature	-50 to +280°C/ -60 to +540°F	0 to +400°C/ 30 to +750°F	-40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter)	As required
▪ Grain size	Up to 10mm/0.4"	Up to 100mm/4" Ø	As required	As required
▪ Density	Starting 10g/l	—	Starting 10g/l	As required
▪ Sensor material	316L (0.8µm)	Steel, 316L	Alu or 316Ti, PTFE or ceramic	316L or Alu
▪ Measuring range	145 to 20,000mm/ 6 to 800"	200 to 20,000mm/ 6 to 900"	30 to 100,000mm/ 1 to 4,000"	As required
▪ Approvals	Regional Ex approvals	Regional Ex approvals, SIL	Regional Ex approvals	Regional Ex approvals
Application limits	▪ See capacitance for media > 10mm/0.4" Ø	▪ See microwave barrier for DC < 2 ▪ See microwave barrier for media > 100mm/4" Ø	▪ See capacitance in case of build-up with highly conductive media ▪ See capacitance in case of very low attenuation	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

3.2 Selection of measuring principle according to process requirements

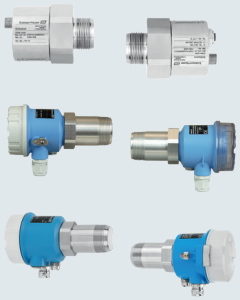
B

	Our proposal	
	Vibronic **Soliphant M** 	**Capacitance** **Solicap M** 
Advantages	▪ Build-up and abrasion monitoring ▪ Coated sensor surface available ▪ Maintenance-free	▪ Very robust ▪ Tensile load up to 60kN ▪ Compact or separate instrumentation available ▪ Active build-up compensation
Technical data		
▪ Process pressure	-1 to 25bar/-14 to 360psi	-1 to 25bar/-14 to 360psi
▪ Process temperature	-50 to +150°C/-60 to +300°F	-50 to +180°C/-60 to +350°F
▪ Grain size	Up to 10mm/0.4"	up to 100mm/4"
▪ Density	Starting 10g/l	–
▪ Sensor material	316L (0.8µm), ETFE coated	Steel, 316L
▪ Measuring range	145 to 20,000mm/6 to 800"	200 to 20,000mm/8 to 800"
▪ Approvals	Regional Ex approvals	Regional Ex approvals, SIL
Application limits	▪ See capacitance for grain size > 10mm/0.4" Ø ▪ See microwave barrier for installation in intake flow	▪ See vibronic for DC < 1.6 ▪ See microwave barrier for grain size > 100mm/4" Ø ▪ See microwave barrier for installation in intake flow

Aggressive / abrasive media

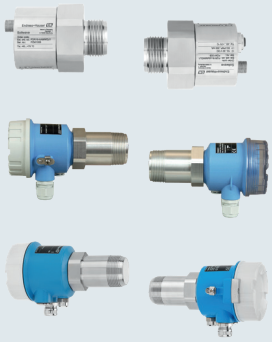
- Media generating strong abrasion at the sensor
- Robust sensor surface
- Gas/dust Ex-area
- Possible coated sensor surface

B

	Microwave Soliwave	Radiometric Gammapilot
		
	▪ Non-invasive from outside when for containers permitting microwave penetration or when using permeable plugs or similar things ▪ Front-flush solutions ▪ Easy assembly	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
	0.5 to 6.8bar/7.2 to 98psi abs. (+21bar/+305psi with HP-Adapter) -40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter) As required Starting 10g/l Alu or 316Ti, PTFE or ceramic 30 to 100,000mm/1 to 4,000" Regional Ex approvals	As required As required As required As required 316L or Alu As required Regional Ex approvals, SIL
	▪ See capacitance in case of build-up with highly conductive media ▪ See capacitance in case of very low attenuation	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

3.2 Selection of measuring principle according to process requirements

B

	Our proposal Capacitance Solicap M	Microwave Soliwave
		
Advantages	▪ Very robust ▪ Tensile load up to 60kN ▪ Compact or separate instrumentation available ▪ Active build-up compensation	▪ Non-invasive from outside when for containers permitting microwave penetration or when using permeable plugs, inspection glasses or similar things
Technical data ▪ Process pressure ▪ Process temperature ▪ Grain size ▪ Density ▪ Sensor material ▪ Measuring range ▪ Approvals	 -1 to 25bar/-14 to 360psi -20 to +180°C/-4 to +350°F Up to 100mm/4" – Steel zinc coated, 316L 200 to 20,000mm/8 to 800" Regional Ex approvals, SIL	 0.5 to 6.8bar/7.2 to 98psi abs. (+21bar/+305psi with HP-Adapter) -40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter) As required Starting 10g/l Alu or 316Ti, PTFE or ceramic 30 to 100,000mm/1 to 4,000" Regional Ex approvals
Application limits	▪ DC < 1.6 or grain size > 100mm/4" Ø	▪ See capacitance in case of build-up with highly conductive media ▪ See capacitance in case of very low attenuation

Lumpy media
(e.g. conveyor belts, stockpiles)

- Mining, crushers, salt production
- Grain size starting 20mm/8″
- Robust sensor surface
- Strong tensile and bending load

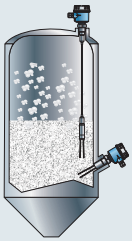
B

	Vibronic Soliphant T	Radiometric Gammapilot
		
	▪ Jamming not possible ▪ Sensor material 316L ▪ Maintenance-free ▪ Easy commissioning	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
	1 to 25bar/-14 to 360psi -40 to +150°C/-40 to +300°F < 25mm/1″ Starting 200g/l 316L 225 to 1,500mm/9 to 60″ Regional Ex approvals	As required As required As required As required 316L or Alu As required Regional Ex approvals, SIL
	▪ Grain size > 25mm/1″ Ø	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

3.2 Selection of measuring principle according to process requirements

Dusty / fluidizing media

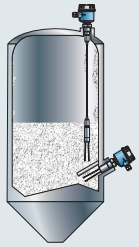
- Fluidizing to increase flow velocity
- Very low density (< 50g/l)
- Low conductibility (dielectric constant)
- Hazardous areas



	Our proposal Vibronic Soliphant M	Microwave Soliwave	Radiometric Gammapilot
			
Advantages	▪ Build-up and abrasion monitoring ▪ Ideal for media with low density ▪ Self-cleaning in case of static charging ▪ Maintenance-free	▪ Non-invasive from outside when for containers permitting microwave penetration or when using permeable plugs or similar things ▪ Front-flush solutions ▪ Easy assembly	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
Technical data			
▪ Process pressure	-1 to 25bar/ -14 to 360psi	0.5 to 6.8bar/7.2 to 98psi abs. (+21bar/+305psi with HP-Adapter)	As required
▪ Process temperature	-50 to +280°C/ -60 to +540°F	-40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter)	As required
▪ Grain size	Up to 10mm/0.4"	As required	As required
▪ Density	Starting 10g/l	Starting 10g/l	As required
▪ Sensor material	316L, PTFE, ETFE	Alu or 316Ti, PTFE or ceramic	316L or Alu
▪ Measuring range	145 to 20,000mm/ 6 to 800"	30 to 100,000mm/1 to 4,000"	As required
▪ Approvals	Regional Ex approvals	Regional Ex approvals	Regional Ex approvals
Application limits	▪ See capacitance for media > 10 mm/0.4" Ø	▪ See capacitance in case of build-up with highly conductive media ▪ See capacitance in case of very low attenuation	▪ Observe radiation ▪ protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

Build-up forming / hygroscopic / tacky media

- Powdery media, tending to strong build-up on sensor and tank walls
- Clotting media
- Static charging
- Cornice formation in silos



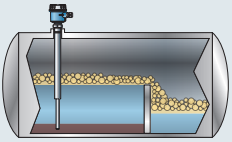
Our proposal

	Capacitance Minicap	Vibronic Soliphant M/T	Radiometric Gammapilot
			
Advantages	▪ Build-up compensation ▪ Maintenance-free ▪ High mechanical stability	▪ Build-up and abrasion monitoring ▪ Also for media with low density ▪ Self-cleaning effect by vibronic ▪ Maintenance-free	▪ Non-contact from outside ▪ Exact measurement under extreme conditions ▪ Monitoring of build-up formation
Technical data ▪ Process pressure ▪ Process temperature ▪ Grain size ▪ Density ▪ Measuring range ▪ Sensor material ▪ Approvals	 -1 to 25bar/ -14 to 360psi -40 to +120°C/ -40 to +250°F Up to 30mm/1.2" – 140 to 6,000mm/ 5 to 230" PPS Regional Ex approvals	 -1 to 25bar/ -14 to 360psi -50 to +280°C/ -60 to +540°F Up to 25mm/1" Starting 10g/l 145 to 20,000mm/ 6 to 800" 316L (0.8µm), PTFE Regional Ex approvals	 As required As required As required As required As required 316L or Alu Regional Ex approvals, SIL
Application limits	▪ See vibronic if metal sensor is required or for media with strong abrasion or DC < 1.6	▪ For media > 25mm/1" Ø or process temperature > 280°C/540°F see capacitance probes	▪ Observe radiation protection provisions ▪ Further information from our sales team ▪ Applicator for configuring the measuring point

3.2 Selection of measuring principle according to process requirements

Bulk solids under water

- Sensor does not react in case of water or liquids similar to water
- Detection of settled solids under water
- Possibly high process pressures



B

C

Our proposal

	Vibronic Soliphant M/T	Paddle Soliswitch	Radiometric Gammapilot
			
Advantages	▪ Maintenance-free	▪ Price-effective sensor	▪ Non-contact from outside ▪ Exact measurement under extreme conditions
Technical data			
▪ Process pressure	-1 to 25bar/ -14 to 360psi	-0.5 to 1.8bar/ -7 to 26psi	As required
▪ Process temperature	-50 to +280°C/ -60 to +540°F	-20 to +80°C/ -4 to +180°F	As required
▪ Grain size	Up to 25mm/1"	Up to 50mm/2"	As required
▪ Density	Starting 10g/l	Starting 100g/l	As required
▪ Measuring range	145 to 6,000mm/ 6 to 230"	75 to 2,000mm/ 3 to 80"	As required
▪ Sensor material	316L, PTFE, ETFE	Special steel (303)	316L
▪ Approvals	Regional Ex approvals	ATEX	Regional Ex approvals, SIL
Application limits	▪ Only sediment is detected ▪ Not for floating media	▪ Top installation only	▪ Observe radiation protection provisions ▪ Further information from our sales team

4. Instrument selection within the measuring principle

Capacitance

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

Continued on page 62

	Solicap S FTI77	Solicap M FTI55, FTI56
		
Applications	▪ Applications with temperatures up to 400°C/750°F ▪ Full and empty alarm ▪ Installation from top, side and bottom	▪ Robust sensor for lumpy and abrasive media ▪ Full and empty alarm ▪ Installation from top, side and bottom
Special features	▪ Robust probe ▪ Side load 800Nm ▪ Unaffected by condensate and build-up ▪ Active build-up compensation	▪ Tensile load up to 60kN ▪ Side load 300Nm ▪ Easy rope adjustment ▪ Modular design ▪ Active build-up compensation
Technical data ▪ Process pressure ▪ Process temperature ▪ Process connection ▪ Grain size ▪ Measuring range ▪ Sensor material ▪ Housing material ▪ Electric connection ▪ Approvals ▪ Settings ▪ Design ▪ DC	 -1 to 10bar/-14 to 140psi -20 to +400°C/-4 to +750°F Thread: 1½ (R, NPT) Flanges: EN, ANSI, JIS Up to 100mm/4" 200 to 20,000mm/8 to 800" Steel, 316L, ceramic Alu, Polyester, 316L Separate: PFM, 3-wire, NAMUR, 8/16mA compact: DC, relay, 2-wire Regional Ex approvals, SIL Min./max. safety Sword and rope probe Starting 2	 -1 to 25bar/-14 to 360psi -50 to +180°C/-60 to +350°F Thread: 1½ (R, NPT) Flanges: EN, ANSI, JIS Up to 100mm/4" 200 to 20,000mm/8 to 800" Steel, 316L, PTFE Alu, Polyester, 316L Separate: PFM, 3-wire, NAMUR, 8/16mA compact: DC, relay, 2-wire Regional Ex approvals, SIL Min./max. safety Rod and rope probe Starting 1.6

4. Instrument selection within the measuring principle

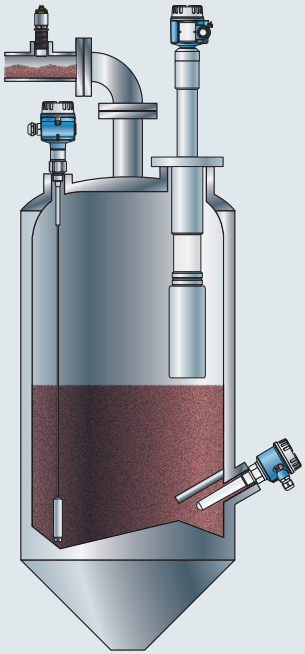
Capacitance

Continued from page 61

C

	Minicap FTC260, FTC262	Nivector FTI26
		
Applications	▪ Particularly for build-up forming media ▪ Full and empty alarm ▪ Installation from side, top and bottom	▪ Measurement from outside through plastic silos ▪ Powdery and fine-grained solids up to 10mm ▪ Full and empty alarm ▪ Installation from side and bottom
Special features	▪ FDA-listed material ▪ Maintenance-free ▪ Build-up compensation ▪ May be used without calibration	▪ Protector for abrasion protection (FDA-listed material)
Technical data		
▪ Process pressure	-1 to 25bar/-14 to 360psi	-1 to 6bar/-14 to 90psi
▪ Process temperature	-40 to +120°C/-40 to +250°F	-20 to +80°C/-4 to +180°F
▪ Process connection	Thread: 1, 1½ (R, NPT)	Thread: G1A
▪ Grain size	Up to 30mm/1.2"	Up to 10mm/0.4"
▪ Measuring range	140 to 6,000mm/5 to 230"	Starting 20mm/0.8" (front-flush)
▪ Sensor material	PPS, FDA-listed	PC, ECTFE
▪ Housing material	Alu, Polyester	PC, ECTFE
▪ Electric connection	DC, DPDT	AC, DC
▪ Approvals	Regional Ex approvals	Regional Ex approvals, hygiene approvals
▪ Settings	Min./max. safety, sensitivity	Min./max. safety
▪ Design	Rod and rope probe	Compact
▪ DC	Starting 1.6	Starting 2

Capacitance installation instructions



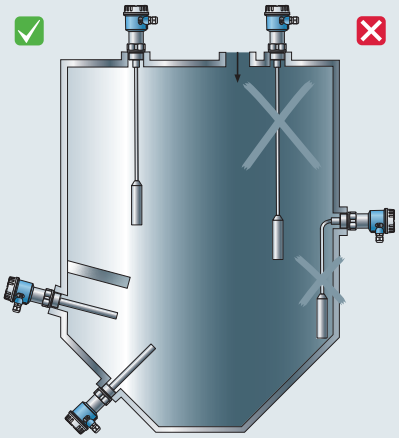
Min. or max. detection
Rod and rope probes may be used for both max. and min. detection.

Switch point
The switch point depends on the properties of the bulk solids (angled surface, dielectric constant, flow properties ...).

Installation position
Rod probes may be installed from the top, side or bottom. Rope probes only from the top.

In lateral position:
- Install the sensor as inclined as possible (10-30°)
- Install a protective cover for heavy bulk solids
- Do not install sensor in the intake flow
- Provide a distance between two rod probe ends of at least 200mm/8" (FTC260)

Rope probe
- Install probe as close to the center as possible so that the angled surface cannot press the weight to the wall
- The length of the rope may be adjusted
- Take tensile force into consideration
- Take intake flow into consideration



C

4. Instrument selection within the measuring principle

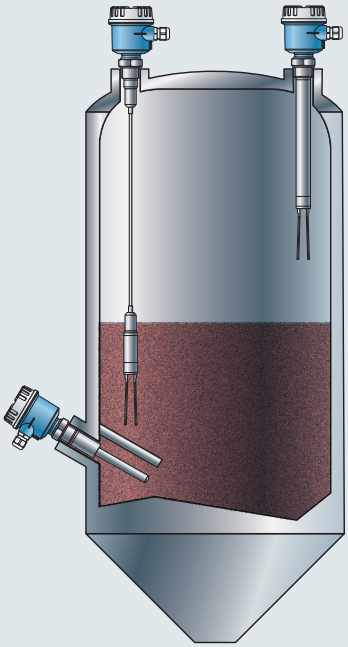
Vibronic

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

C

	Soliphant M – Vibronic fork FTM50/FTM51/FTM52	Soliphant T – Single rod sensor FTM20/FTM21
		
Applications	▪ Robust min. or max. point level switch for fine-grained bulk solids ▪ Installation from the side, top and bottom ▪ Also for fluidized media ▪ Solids under water ▪ Filling nozzle applications	▪ Cost-effective and universal sensor for all fine-grained and lumpy media ▪ Solids under water ▪ Full and empty alarm ▪ Installation from the side, top and bottom
Special features	▪ Build-up and abrasion monitoring ▪ Up to +280°C/+540°F ▪ Most universal sensor also for the finest media ▪ Coated and polished sensors	▪ Simple self-cleaning ▪ Preferred in clotting media
Technical data		
▪ Process pressure	-1 to 25bar/-14 to 360psi	-1 to 25bar/-14 to 360psi
▪ Process temperature	-50 to +280°C/-60 to +540°F	-40 to +150°C/-40 to +300°F
▪ Process connection	Thread: 1¼, 1½ (NPT, R), Tri-Clamp Flanges: ANSI, EN, JIS,	Thread: 1, 1¼, 1½ (R, G, NPT)
▪ Grain size	Up to 10mm/0.4"	Up to 25mm/1"
▪ Density	Starting 10g/l	Starting 200g/l
▪ Measuring range	145 to 20,000mm/6 to 800"	225 to 1,500mm/9 to 60"
▪ Sensor material	316L (0.8µm), PTFE, ETFE	316L
▪ Housing material	PE, 316L, Aluminum	PE, Aluminum
▪ Lateral load	600N	450N
▪ Electric connection	AC-2-wire, DC-PNP, relay, DPDT, PFM, 8/16mA, NAMUR	DC, DPDT
▪ Approvals	Regional Ex approvals, SIL	Regional Ex approvals
▪ Settings	Sensitivity, time delay, diagnosis, solids detection under water, min./max. alarm	Sensitivity, min./max. alarm
▪ Design	Compact, tube extension, rope extension	Compact, tube extension

Vibronic installation instructions



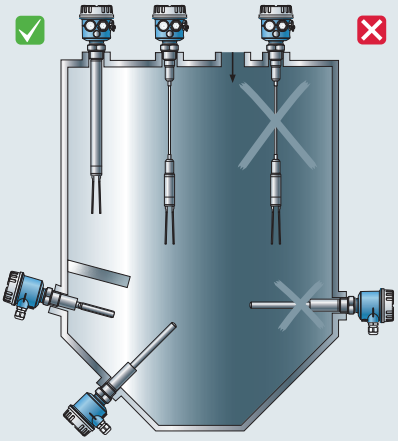
Min. or max. detection
Compact sensors as well as those with tube and rope extension can be used for both max. and min. detection.

Switch point
The switch point depends on the properties of the bulk solids (angled surface, density, grain size, flow properties ...).

Installation position
Compact sensors and probes with tube extension may be installed from the top, side or bottom. Probes with rope extension only from the top.

In lateral position:
- Ensure the tines (of the fork) are aligned longitudinally
- Install the sensor as inclined as possible (10-30°)
- Install a protective cover for heavy bulk solids
- Do not install sensor in the intake flow

Rope extension
- Install probe as close to the center as possible so that the angled surface cannot press the weight to the wall
- The length of the rope may be adjusted for the desired application (rope adjustment set)
- Take tensile force into consideration
- Take intake flow into consideration



Hygiene processes
- Hygiene applications, install sensor in a manner permitting cleaning in process.

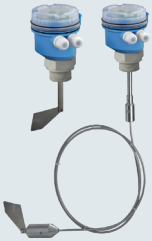
C

4. Instrument selection within the measuring principle

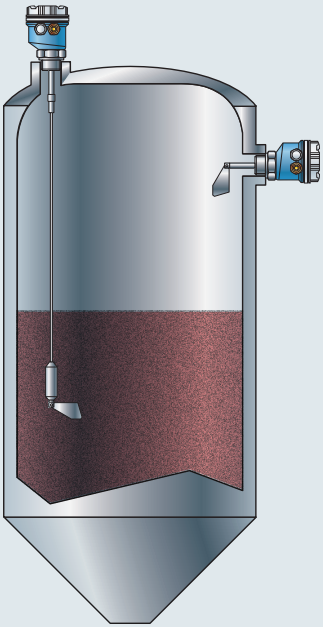
Paddle

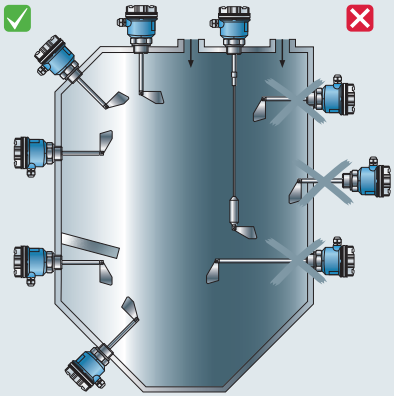
- Price-effective measuring principle for simple applications
- Calibration not required
- Rotation monitoring

C

	Soliswitch FTE20
	
Applications	▪ Full and empty alarm ▪ Installation from the side, top or bottom
Special features	▪ 3 switching pressure levels can be preset ▪ Rotation monitoring (optional) ▪ Slip clutch against load strength
Technical data	
▪ Process pressure	-0.5 to 1.8bar/-7 to 26psi
▪ Process temperature	-20 to +80°C/-4 to +180°F
▪ Process connection	Thread: 1½ (G, NPT), 1¼ NPT, ¾ G
▪ Grain size	Up to 50mm/2"
▪ Density	Starting 100g/l
▪ Measuring range	75 to 2,000mm/3 to 80"
▪ Dimensions	133mm/5.2" length
▪ Sensor material	Special steel 303
▪ Housing material	PE, IP 65, NEMA4
▪ Electric connection	AC, DC (relay output)
▪ Approvals	Regional Ex approvals
▪ Settings	Switching pressure
▪ Design	Compact, rope extension

Paddle installation instructions





Min. or max. detection
Compact sensors as well as those with rope extension can be used for both max. and min. detection.

Switch point
The FTE20 can be adjusted to the bulk material by presetting the switching pressure accordingly.

Installation position
Compact sensors and those with tube extension may be installed from the top, from below or side. Sensors with rope extension only from the top.

In lateral position:
- Provide a protective cover against collapsing cornices
- Ensure cable glands point downwards
- Install 10-30° inclined at the top or vertically

Please do not:
- Install in the product flow
- Use an extremely long threaded nozzle
- Install vertically with a shaft length > 300mm/11.8"
- Install inclined at the bottom

Rope extension
- Install probe as close to the center as possible so that the angled surface cannot press the weight to the wall
- Take tensile force into consideration
- Take intake flow into consideration

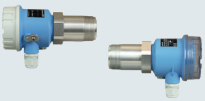
C

4. Instrument selection within the measuring principle

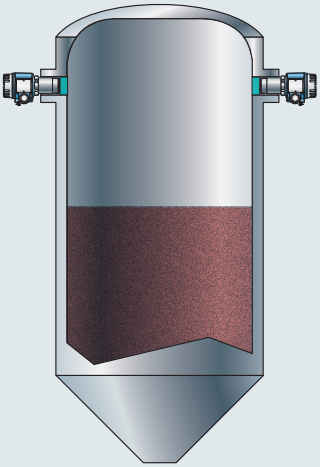
Microwave barrier

- Non-contact point level detection with optional bulk flow monitoring
- Non-contact installation (transmission window) or front-flush installation (contact)
- Measuring principle almost unaffected by process conditions (e.g. pressure, temperature, aggressive and abrasive media, dust, contamination buildup)
- Also applicable in difficult applications, where other measurement methods fail
- Full and empty detection

C

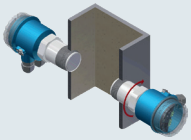
	Soliwave FDR16/FQR16	Soliwave FDR56/FQR56	Soliwave FDR57/FQR57/FTR525
			
Applications	▪ Detection of contamination, build-up or similar matter	▪ Detection of contamination, build-up or similar matter ▪ Ideal in hygiene applications	▪ Ideal in hygiene applications ▪ Combined point level detection and bulk flow monitoring possible ▪ Detection of contamination, build-up or similar matter
Special features	▪ Ultra-compact devices with integrated power supply and connectors ▪ Adjustable sensitivity and switching delay ▪ Detection even with changing product properties	▪ Display of signal intensity by LED bargraph ▪ 4 to 20mA analog output ▪ Integrated switch amplifier ▪ Electronics housing 360° rotatable	▪ With optional integrated bulk flow monitoring ▪ Comfortable and easy operation with graphical display ▪ Parallel mode in tightest conditions
Technische Daten			
▪ Process pressure	0.5 to 6.8bar/7.2 to 98psi abs. (+21bar/+305psi with HP-Adapter)	0.5 to 6.8bar/7.2 to 98psi abs. (+21bar/+305psi with HP-Adapter)	0.5 to 6.8bar/7.2 to 98psi abs. (+21bar/+305psi with HP-Adapter)
▪ Process temperature	-20 to +60°C/-4 to +140°F (+450°C/+842°F with HT-Adapter)	-40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter)	-40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter)
▪ Process connection	Thread: 1½ (R, G, NPT)	Thread: 1½ (R, G, NPT)	Thread: 1½ (R, G, NPT)
▪ Grain size	As required	As required	As required
▪ Density	Starting 10g/l	Starting 10g/l	Starting 10g/l
▪ Detection range	max. 20 m	0.03 to 100m/0.1 to 328ft	0.03 to 100m/0.1 to 328ft
▪ Sensor material	316L, PTFE	PTFE, ceramics, aluminum, 316Ti	PTFE, ceramics, 316Ti
▪ Housing material	316L	PE, aluminum, 316L	PE, Aluminium, 316L
▪ Signal output	DC-PNP 3-wire	Relay SPDT, analog 4 to 20mA, Solid-State-Relais	Relay, SPDT, Solid-State Relais, 4 to 20mA, Alarm Open Collector
▪ Approvals	Regional Ex approvals	Regional Ex approvals	Regional Ex approvals
▪ Settings	Sensitivity, switching delay	FDR56: Sensitivity, hysteresis, limit signal function, switching delays, attenuation	FTR525: Sensitivity, hysteresis, limit signal function, switching point and switching delays, attenuation

Microwave barrier installation instructions

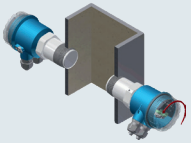


Easy installation

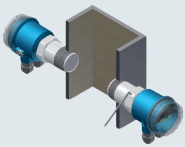
1. Screw self-tightening connection thread into the process (hexagon key of 55mm/2.2")



2. Orientate transmitter and transceiver to each other (both devices must face each other)



3. Fasten housing (internal hexagon 2.5mm/0.1")



Min. or max. detection
The microwave barrier may be used both in max. and min. detection.

Optional flow monitorin detecting
The bulk flow should flow as close as possible to the FDR57.

Switch point
The switch point exclusively depends on the orientation, the attenuation properties of bulk solids and poss. the parameterized delay.

4 to 20mA analog output
Optionally for the analysis of build-up, contamination or similar matter. E.g. the progression of contamination from „uncontaminated" to „contaminated" can be analyzed (limit values may be set individually).

Orientation
- Transmitter and transceiver must be installed on opposite sides of the tank.
- If it is not possible to arrange transmitter and transceiver on opposite sides for structural reasons, the microwave ray can be deflected via planar metal mirrors (reflectors) (lowers range by approx. 10%, respectively).
- Interfering reflections on metal parts are to be avoided.
- The parallel operation of several microwave barriers to acquire different levels/point levels is possible.

Assembly
- Direct assembly with 1½ (R, G, NPT) threaded connection through the tank wall (contact installation, independent of tank materials).
- Optional fastening by accessories (e.g. clamps or adapter flanges).
- If the tank wall is of material which does not permit microwaves to penetrate, additional windows permitting the penetration of microwaves are to be installed in the tank wall. For this purpose, extensive accessories are available (e.g. inspection glasses) and configurable accessories (e.g. plugs of plastics or ceramics).
- The electronics housing can be rotated 360°, thus providing optimum orientation after installation.

4. Instrument selection within the measuring principle

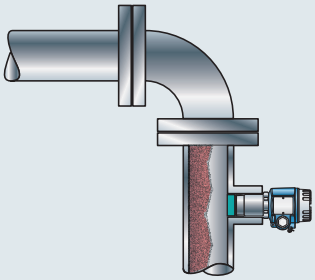
Flow indicator for bulk solids

- Non-contact monitoring of pneumatic and mechanical transport processes
- Non-contact installation (transmission window) or front-flush installation (contact)
- 4 to 20mA analog output to analyze changes in solids flows

C

	Solimotion FTR16	Solimotion FTR20
		
Applications	▪ Bulk solids movement detector ▪ Non-invasive movement detection	▪ Bulk solids movement detector to monitor pneumatic and mechanical transport processes ▪ Non-invasive detection in powdery to lumpy media ▪ Ideal for hygiene applications ▪ With optional accessories, e.g. inspection glasses and plugs of plastics and ceramics, may also be used in walls not permitting the penetration of microwaves
Special features	▪ Ultra-compact flow indicator for monitoring pneumatic and mechanical transport processes of bulk solids	▪ Cost-effective monitoring of bulk solids movements (movement / no movement) ▪ 4 to 20mA analog output to analyze changes of solids flows ▪ Electronics housing rotatable 360°
Technical data		
▪ Process pressure	0.5 to 6.8bar/7.2 to 99psi abs. (+21bar/ +305psi abs. with HP-Adapter)	0.5 to 6.8bar/7.2 to 99psi abs. (+21bar/ +305psi abs. with HP-Adapter)
▪ Process temperature	-20 to +60°C/-4 to +140°F (+450°C/+842°F with HT-Adapter)	40 to +70°C/-40 to +158°F (+450°C/+842°F with HT-Adapter)
▪ Process connection	Thread: 1½ (R, G, NPT)	Thread: 1½ (R, G, NPT)
▪ Grain size	As required	As required
▪ Density	< 10 g/l	As required
▪ Detection range	max. 5m/16ft	0.03 to 20m/0.1 to 66ft depending on bulk solid media
▪ Sensor material	316L, PTFE	PTFE, ceramics, aluminum, 316Ti
▪ Housing material	316L	PE, aluminum, 316L
▪ Electric connection	DC-PNP 3-wire	Relay SPDT, analog 4 to 20mA, solid state relay
▪ Approvals	Regional Ex approvals	Regional Ex approvals
▪ Settings	Sensitivity, switching delay	Detection range, amplification, hysteresis, limit signal function, switching delays, attenuation

Installation instructions for flow indicator for bulk solids

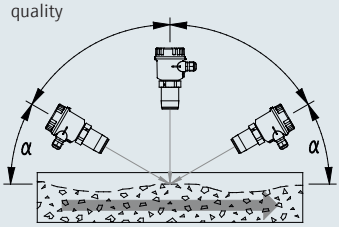


Detection of solids flows
The flow indicator for bulk solids may be used in all applications requiring monitoring of solids flows (**existing** or **not existing**) in a cost-effective manner.

Switch point
The switch point exclusively depends on the orientation, the attenuation properties of bulk solids and poss. parameterized settings.

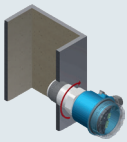
4 to 20mA analog output
Changes in the solids flow can additionally be analyzed via the optional 4 to 20mA current output.

Orientation
- The orientation is optional.
- Vibration is to be avoided.
- A small angle α can increase the signal quality

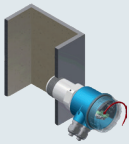


Easy installation

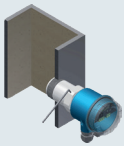
1. Screw self-tightening connection thread into the process (hexagon key of 55mm/2.2")



2. Orientate FTR20



3. Fasten housing (internal hexagon 2.5mm/0.1")



Assembly
- Direct assembly with 1½ (R, G, NPT) threaded connection through the process wall (contact installation, independent of wall materials).
- Depending on the application, FTR20 should be assembled as rigidly as possible (in low vibration of the entire plant) or completely decoupled (in stronger vibration).
- Optional fastening by accessories (e.g. clamps or adapter flanges).
- If the process wall is of material which does not permit microwaves to penetrate, additional windows permitting the penetration of microwaves are to be installed in the tank wall. For this purpose, extensive accessories are available (e.g. inspection glasses) and configurable accessories (e.g. plugs of plastics or ceramics).
- The electronics housing of FTR20 can be rotated 360°, thus providing optimum orientation after installation.

C

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