



INDUSTRIALHUB BD

RELIABILITY & ENGINEERING SERVICE PARTNER

LEVEL SENSOR

Radar, ultrasonic, float, capacitive and fork sensors: choose, fit and maintain them.



How to use this guide

For maintenance and process engineers who choose, fit and look after level sensors on tanks, sumps and silos.

CONTENTS

03 Level basics

04 Choose the principle

05 Radar

06 Ultrasonic

07 Float and rod

08 Capacitive and guided wave

09 Hydrostatic

10 Point-level switches

11 Choosing by application

12 Mounting and position

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HOW TO USE IT

Define

Medium, height, pressure

Choose

Pages 4 to 10

Match

Page 11

Fit and wire

Pages 12 to 14

Order

Pages 15 to 17



ifm level, pressure and flow sensors



HYDAC float-and-rod level sensors



Endress+Hauser probes for liquids and solids

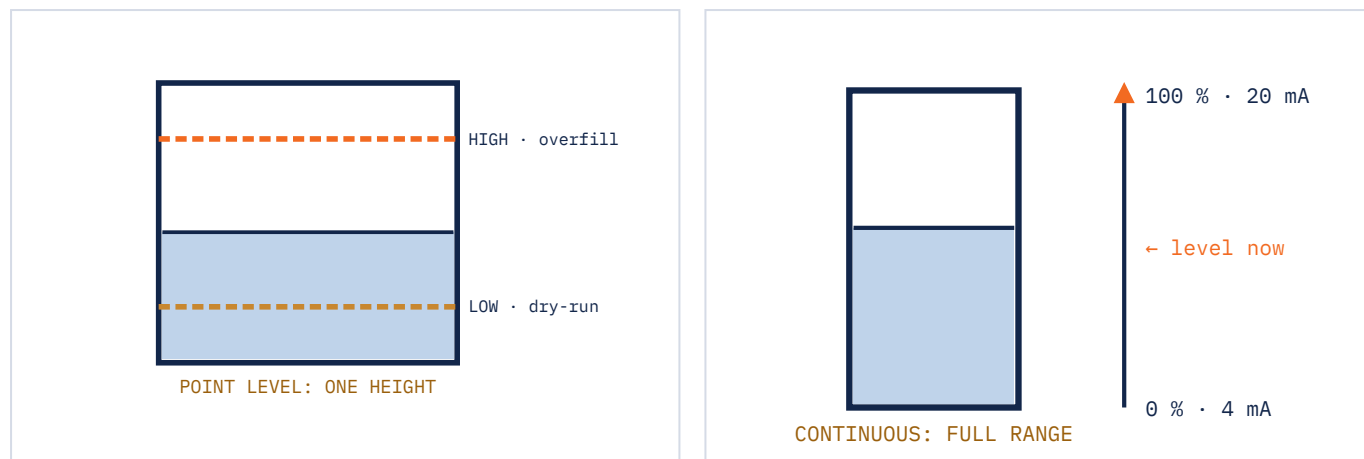
Data status

Values are typical maker datasheet data and general practice. Confirm range, medium and approvals against the current data sheet before you order. Not stated means the documents we reviewed do not list it. Photos come from those documents; confirm usage rights before external use.

Read this first: check the medium, pressure, temperature and area approval before you pick a sensor.

Point or continuous level

Every level sensor answers one of two questions: is the liquid at this height, or how high is it now?



2

kinds of sensor: point and continuous

4-20 mA

standard analogue signal

IO-Link

digital: level, status, set-up

Point level

Switch output at a set height. Use for overflow alarm, low alarm and pump protection.

Continuous level

Signal for the full range. Use for stock, trends and control of pumps and valves.

Overflow

Stop the filling in time.

Dry-run

Protect the pump.

Stock

Know what is in the tank.

Control

Keep the level steady.

KEY NOTE • HOW IT WORKS

A point sensor is like a tripwire: it only tells you the liquid has reached one height. A continuous sensor is like a ruler: it gives the level all the way up and down, as a signal that rises from 4 mA when empty to 20 mA when full. Plants use the ruler to run the process and the tripwire as a separate safety stop.

Use both for safety. A continuous sensor runs the process. An independent switch stops an overflow.

Seven ways to measure level

Seven ways to find the level. Each one has a place, and each one has a limit.

1 Float and rod

Magnetic float on a rod: precise, for clean oils

2 Capacitive rod

No moving parts: oils, water, coolant

3 Guided wave radar

Probe pulse: foam, steam, changing media

4 Radar

Non-contact: dust, heat, pressure

5 Ultrasonic

Non-contact: open or vented tanks

6 Hydrostatic

Pressure at the bottom: deep tanks, sumps

7 Vibrating fork

Point switch: any liquid, any mount

? Not sure?

Page 11 matches the sensor to your tank and medium.



Float, radar, ultrasonic and optical sensors for liquids and bulk solids



Float-and-rod sensors with display and a capacitive probe

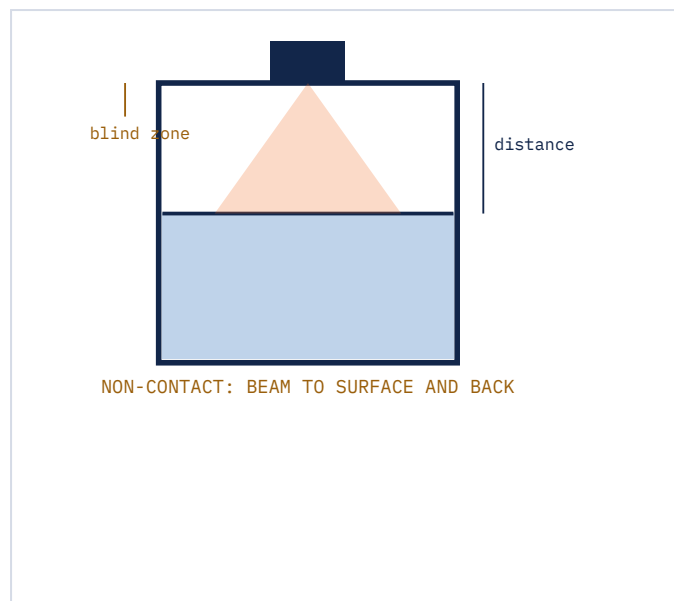
KEY NOTE · HOW IT WORKS

Level sensors split into two families. Contact sensors touch the medium: floats, rods, guided wave probes, hydrostatic cells and forks. Non-contact sensors look at it from above with a radio or sound beam: radar and ultrasonic. Contact types cope well with foam and clutter. Non-contact types cope well with dirt, heat and sticky fluids.

Contact or non-contact? If the medium is dirty, hot or sticky, start with non-contact radar or a fork.

Radar level sensors

A radar sensor sits above the liquid and sends a beam. It does not touch the medium.



- Works in steam, dust and vapour
- Pressure and temperature do not change the reading
- Reads through a plastic window or lid
- Liquids and many bulk solids (dielectric constant of 2 or more)



HIGHER FREQUENCY, NARROWER BEAM



60 GHz

typical compact radar

±6°

beam angle

5 cm

blind zone

2-15 m

range, water

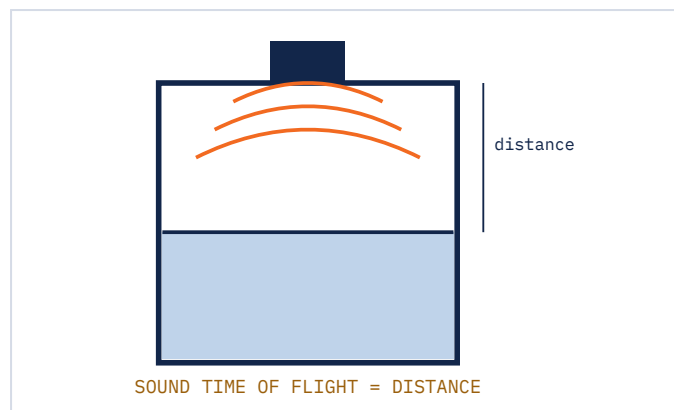
KEY NOTE • HOW IT WORKS

Radar sends a short radio pulse down at the liquid and times the echo from the surface. Because radio waves are not changed by air, steam or dust, the reading stays steady in conditions that confuse other sensors. A higher frequency makes a tighter beam, so it can fit a small nozzle and picks up fewer echoes from the tank wall.

A narrow beam fits small nozzles and gives fewer false echoes from tank walls and fittings.

Ultrasonic level sensors

An ultrasonic sensor times a sound pulse to the surface and back. The time gives the distance.



Distance = speed of sound × time ÷ 2. Built-in temperature compensation corrects for warm or cold air.

- Non-contact, no wear
- Needs a flat, still surface
- Mount straight down

OPERATING RANGE BY VERSION



≤ 8 m

longest range

±1 %

of the measured value

≤ 0.6 m

blind zone

IP 67

typical housing

DO

- Open or vented tanks
- Clean liquids, water and effluent
- Sumps and open channels

DO NOT

- Foam, heavy vapour or steam
- Vacuum or pressure vessels
- Surfaces with strong waves

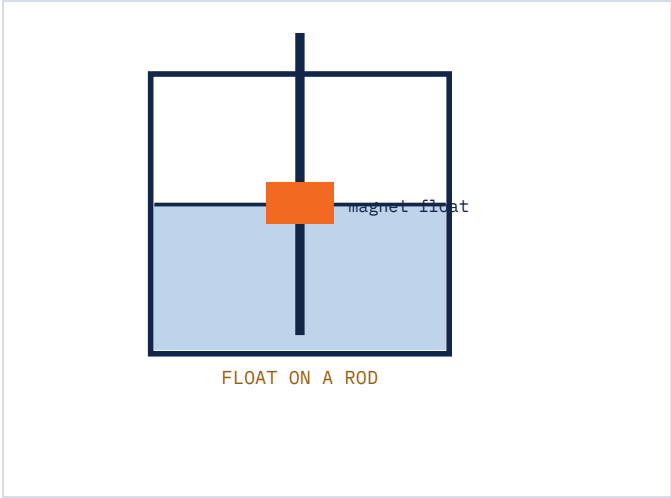
KEY NOTE • HOW IT WORKS

Sound travels at a known speed in air, so the time between the pulse and its echo gives the distance to the surface. Air temperature changes that speed, which is why the sensor measures temperature and corrects for it. Foam soaks up sound and waves scatter it, so a calm, flat surface gives the best reading.

No pressure rating. Use ultrasonic only on vented tanks. Choose radar when the tank is closed or pressurised.

Float and rod level sensors

A magnet in the float is read along a steel rod. It gives a precise, continuous level in clean fluids.



Item	Detail
Rod length	250–730 mm; up to 2500 mm on request
Accuracy	±1 % of full scale
Output	4–20 mA or 0–10 V
Medium	Hydraulic oils and coolants, –40... +120 °C
Tank pressure	3 bar; short peaks to 10 bar
Connection	G ¾ thread, 30 Nm

1, 2 or 4

switch outputs with display

Float

plastic or stainless steel

No limit

on speed of level change



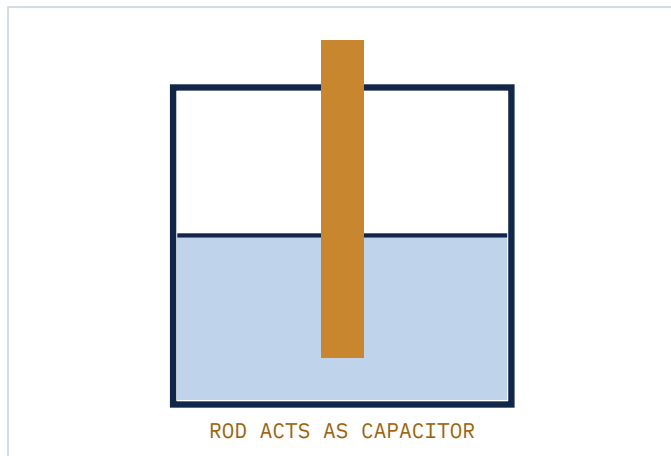
KEY NOTE · HOW IT WORKS

Inside the rod sits a row of tiny magnetic sensors. The float carries a magnet that triggers the sensors at its own height, so the electronics know exactly where the float, and so the liquid surface, is. It works well in clean oil and coolant, and the level can change as fast as you like. Chips or sludge can jam the float.

Needs a clean fluid. Metal chips or sludge can jam the float. Use a capacitive or guided wave sensor instead.

Capacitive and guided wave

Neither sensor has a moving part. Both replace a float switch that sticks.

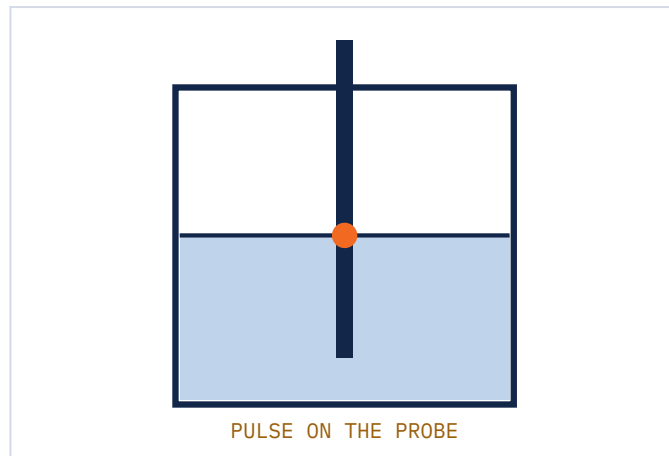


CAPACITIVE ROD • ELECTRONIC, FLOATLESS

- Ceramic-coated rod, rods 170–590 mm
- Oil or water: set in the menu
- Up to 4 switch points and one analogue output
- Chips do not matter

Choose capacitive when

The medium is oil or coolant with chips, and you want a simple, low-cost rod.



GUIDED WAVE RADAR • PROBE UP TO 2 M

- A pulse runs down the probe
- Cut the probe to length
- Foam and build-up are suppressed
- Coaxial tube for oils

Choose guided wave when

There is foam, steam or build-up, or the medium changes between liquids.

±2 % FS

capacitive accuracy

4–20 mA

plus switch outputs

–25...+100 °C

typical medium

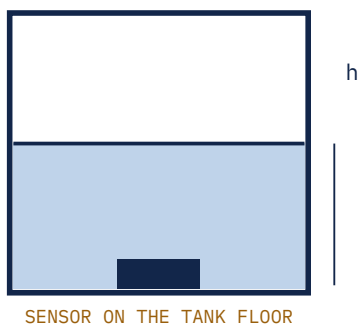
KEY NOTE • HOW IT WORKS

A capacitive rod works like a capacitor: the liquid between the rod and the tank wall changes the electrical signal, and the electronics turn that change into a level. Guided wave radar sends a pulse down a probe and times the echo from the liquid surface. Neither has parts that can stick, which is why they replace floats in dirty tanks.

Calibrate in the real medium. A different oil or coolant changes the dielectric constant and the reading.

Hydrostatic level sensors

A pressure sensor on the tank floor reads the weight of the liquid above it. More level means more pressure.



SENSOR ON THE TANK FLOOR

$$p = \rho \times g \times h$$

Pressure = density × gravity × height. Water gives about 98 mbar for every metre of level.

- Works in deep tanks, sumps and wells
- Not affected by foam or surface waves
- Submersible probe on a vented cable

98 mbar

per metre of water

4-20 mA

typical output

Density

sets the scale



Compact pressure sensor body with M12 connector



Foam on the surface does not disturb a hydrostatic reading

DO

- Enter the real density of the liquid
- Use a vented cable for gauge pressure
- Clean the diaphragm in sludge

DO NOT

- Mount where sediment piles up
- Use it when density changes a lot
- Kink or cut the vent tube

KEY NOTE • HOW IT WORKS

A column of liquid pushes down on the floor of the tank with a force that grows with its height. The sensor measures that pressure and works backwards to the height, using the density you enter. That is why a heavier liquid reads as a higher level, even when the actual level has not changed.

Density matters. A change from water to a heavier liquid changes the reading even when the level stays the same.

Point-level switches

A vibrating fork is the first choice for a point switch. It works in almost any liquid and needs no calibration.

- No moving parts to stick
- Not affected by foam, build-up or conductivity
- Self-monitoring: it flags corrosion and damage
- Same switch for water, oil and sludge

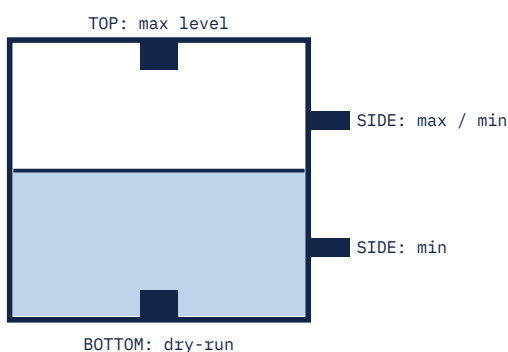


UNCOVERED
about 1000 Hz



COVERED
frequency drops: switch

WHERE TO FIT IT



Top

Overfill: stop the filling.

Side

Max or min, to the exact height.

Bottom

Low: stop the pump running dry.

Capacitive switch

Senses through a plastic tank or a sight glass. Good for oils and powders.

Float switch

Simple and cheap for clean water. It can stick in dirty tanks.

KEY NOTE • HOW IT WORKS

The fork is kept vibrating at its natural frequency, about 1000 Hz in air. When liquid covers the tines the vibration slows and the frequency drops, and the electronics flip the switch. Because it senses vibration and not the liquid itself, it works in water, oil and sludge alike, and it can tell if it is corroded when its frequency shifts.

Keep it away from the inlet. Falling product causes false alarms.

Choosing by application

Start with the medium and the tank. The table gives the first choice; check the limits on pages 5 to 10.

Your situation	First choice
Water or coolant tank	Radar, guided wave radar or capacitive
Hydraulic oil tank	Magnetostrictive float or capacitive
Foam, steam or condensate	Radar or guided wave radar
Pump dry-run and overflow	Vibrating fork switch
Powder or granulate silo	Radar, or a fork for max and min
Deep tank, sump or well	Hydrostatic pressure sensor
Open or vented tank, clean liquid	Ultrasonic

THEN CHECK

Range

Tank height plus blind zone.

Process

Pressure and temperature.

Output

4–20 mA, 0–10 V, switch, IO-Link.

Fit

Thread, flange and area approval.



Level sensor installed on a plant vessel



Probe types for liquids and solids



ifm sensors for level, pressure and flow

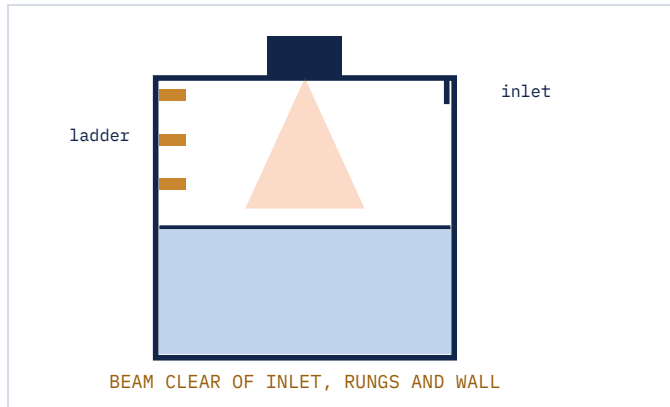
KEY NOTE • HOW IT WORKS

Read the table from the medium, not from the sensor. Ask what is in the tank, whether it foams or steams, whether the tank is closed, and whether you need a level to control with or an alarm to protect with. The first choice here is a starting point; the limits on pages 5 to 10 decide the final pick.

We help you choose. IndustrialHub BD supports solutions from Endress+Hauser, Siemens, VEGA, WIKA, Hydac and ifm, subject to technical suitability and availability.

Mounting and position

A good position fixes most level problems before they start.



- Mount away from the filling inlet
- Keep the beam clear of ladders, coils and pipes
- Keep the minimum distance to the tank wall
- Leave the blind zone free above the highest level
- Fit on a nozzle: it must not reach into the beam

20-30 Nm

typical tightening torque

G³/₄ / G1

common threads

IP 67

housing rating

DO

- Use the seal that comes with the sensor
- Ground the housing
- Support long probes and rods

DO NOT

- Aim a beam at a ladder or heating coil
- Use a float in dirty or sticky fluid
- Tighten past the torque limit

KEY NOTE • HOW IT WORKS

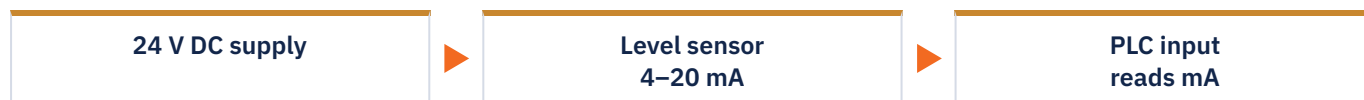
A non-contact sensor sees whatever its beam sees. A ladder rung, a heating coil or a stream of filling product in the beam makes a false echo, and the reading jumps. Most reading problems are position problems, so spend the time at the nozzle and in the beam before changing any settings.

Isolate first. Depressurise and drain before you remove a sensor from a tank. Check the area approval for hazardous zones.

Wiring and signals

Pick the signal your controller reads. Then wire it the same way every time.

TWO-WIRE 4–20 MA LOOP



4 mA = empty • 20 mA = full • below 3.6 mA = wire break

4 mA empty	20 mA full	< 3.6 mA wire break
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SIGNALS AT A GLANCE

Signal	Type	Use
4–20 mA	Analogue, 2- or 3-wire	Long cables, noise-free
0–10 V	Analogue, 3-wire	Short runs
PNP / NPN	Switch output	Up to 0.25–1.2 A per output
IO-Link	Digital, standard cable	Set-up and diagnosis

Screened cable

Ground the screen at one end only. Keep it away from motor cables.

IO-Link

Read level, status and diagnosis, and change settings from the control room.

KEY NOTE • HOW IT WORKS

The loop carries both the power and the signal on one pair of wires. The sensor holds the current between 4 and 20 mA to show the level, so a reading of 0 mA is not an empty tank, it is a broken wire. Screens pick up noise, but if grounded at both ends they carry it as a current, so earth one end only.

Check the load. A 4–20 mA output drives at most about 500 Ω. A 0–10 V output needs 1 kΩ or more.

Troubleshooting and care

Most faults come from the position, the medium or the wiring. Check in that order.

Symptom	Likely cause and action
Reading jumps	Foam, turbulence or inlet in the beam: move the sensor or damp the signal
Reads full when empty	Build-up on the probe, or a false echo from a tank part
Reading stuck	Float or fork jammed, or the wiring is open
0 mA or over 20 mA	Open circuit or fault: check cable and supply
Drifts with temperature	Medium out of range: check the data sheet limits
Wrong after a refill	Density or medium changed: set it again

MAINTENANCE ROUTINE

Daily

Read the level; compare with the sight glass.

Monthly

Look for leaks, build-up and loose cable glands.

Shutdown

Clean probes, check seals and calibrate.

After a change

Set the medium and range again.



Vibrating fork level switches



Two guided wave and capacitive probes

Keep spare sensors and seals for critical tanks.

KEY NOTE • HOW IT WORKS

Work in the order position, medium, wiring. Position faults are the most common and the cheapest to fix. Then ask whether the medium has changed: a new density, a foam layer or a sticky film. Only then trace the wiring. Writing down each fault and what fixed it turns a recurring problem into a one-line instruction for the next shift.

Treat one fault as a clue. If a reading jumps twice, move the sensor or change the principle, not the settings.

Global brands and cross-reference

IndustrialHub BD helps engineering teams choose level sensors and switches by medium, tank, pressure, temperature, output and area approval.

Endress+Hauser PROCESS LEVEL Global maker of process instrumentation. Model data not stated.	Siemens PROCESS LEVEL Global maker of process instrumentation and automation. Model data not stated.
VEGA RADAR · SWITCHES Global maker of level and pressure sensors. Model data not stated.	WIKA LEVEL · PRESSURE Global maker of pressure and level instruments. Model data not stated.
Hydac HYDRAULIC LEVEL Brand marking is visible on a sensor in the source photos. Model data not stated.	ifm SENSORS · IO-LINK Global maker of industrial sensors with IO-Link. Model data not stated.

CROSS-REFERENCE RULE

Never mix probes, cables or seals between brands. Match these points against the maker's own data first, then compare the offers.

Measuring principle	Range and blind zone	Medium and dielectric	Pressure and temperature	Output signal
Process connection	Accuracy	Protection class, IP	Area approval	Cable and connector

Maintenance team
Start from the job: medium, tank height, pressure and output. Cross out the sensors that miss one of these, then shortlist on page 16.

We support solutions from recognized brands including Endress+Hauser, Siemens, VEGA, WIKA, Hydac and ifm, subject to technical suitability, product availability and specific customer requirements.

Global brand comparison statement

Seven measuring principles on the points that decide most selections. Use it to shortlist by medium, then ask each supplier for the full data sheet.

MAJOR KEY POINTS

Principle	Contact	Best for	Limit	Typical data
Radar	No	Steam, dust, heat, pressure	Not for dielectric below 2	60 GHz; 2–15 m water
Ultrasonic	No	Open or vented tanks	No pressure; foam	≤ 8 m; ±1 %
Float and rod	Yes	Clean hydraulic oils	Chips, sludge	±1 % FS; 250–730 mm
Capacitive rod	Yes	Oils and coolants with chips	Calibrate per medium	±2 % FS; 170–590 mm
Guided wave radar	Yes	Foam, steam, changing media	Build-up on probe	Probe up to 2 m
Hydrostatic	Yes	Deep tanks, sumps, wells	Density changes	98 mbar per metre
Vibrating fork	Yes	Point level, any liquid	Point only	About 1000 Hz uncovered

How maintenance and procurement use this page

Maintenance picks the principle by medium, tank and pressure. Procurement then asks every supplier for the model and revision, process connection, cable and connector, calibration or set-up, area approvals, warranty, training and delivery time. Brand data for Endress+Hauser, Siemens, VEGA, WIKA, Hydac and ifm were not in the documents we reviewed; ask for current data sheets.

Not stated means the document we used does not list it. Ask for the current data sheet before you order. We support solutions from recognized brands including Endress+Hauser, Siemens, VEGA, WIKA, Hydac and ifm, subject to technical suitability, product availability and specific customer requirements.



REQUEST A QUOTATION

Send the medium, tank height, pressure, temperature and the output you need. We reply with the right level sensor, price and delivery time.

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★ WE STAY AFTER DELIVERY

AFTER-SALES SERVICE

- Commission and start up equipment
- Find faults and analyse failures
- Plan shutdowns and advise on repairs

★ 20 YEARS ON THE PLANT FLOOR

WHO LEADS US

- Erect, commission and revamp mills
- Operation, maintenance & shutdowns
- Troubleshoot and spares

WHAT WE SUPPLY AND SUPPORT

PARTS

- Radar and ultrasonic sensors
- Float, capacitive and guided wave
- Vibrating fork level switches
- Cables, connectors, mounts

SUPPORT

- Pick the principle for your medium
- Range, output and connection advice
- Wiring and set-up help
- Quotation and delivery follow-up