

A photograph of an industrial liquid level sensor system. A black probe is inserted into a tank, connected to a blue digital display unit. The display shows '0.00' in red. To the left, a metal valve with a red handle is visible. The background shows various pipes and electrical components of the industrial system.

LIQUID LEVEL SENSOR

Measurement and control of liquid levels

INTRODUCTION

This presentation is about our Liquid Level Sensors.

Please note that we constantly improve and modify our presentations. This is our latest version, 2024.

If you have comments or suggested improvements, please contact:

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WHY CHOOSE OUR LIQUID LEVEL SENSORS?

- No moving parts
- Long track record
 - On the market since 2014
 - Sold all around the world
 - 50.000 Level Sensors sold
- Measures gas and liquid or two immiscible liquids
- Can control a valve directly
- Split design electronic head can be replaced without evacuating the system
- Suited for high pressure up to 150 bars and aggressive liquids like NH₃
- Suited for media temperatures from -60°C to 80°C

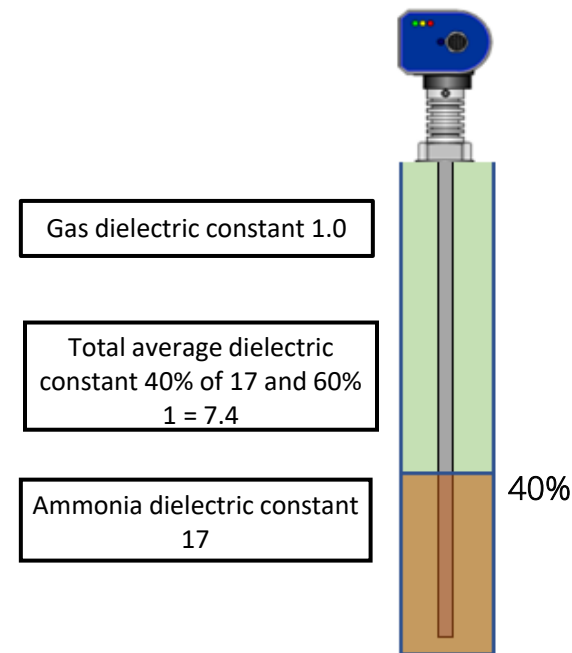


MEASUREMENT PRINCIPLE

Uses the capacitive measurement principle like most of the HB Product's sensors.

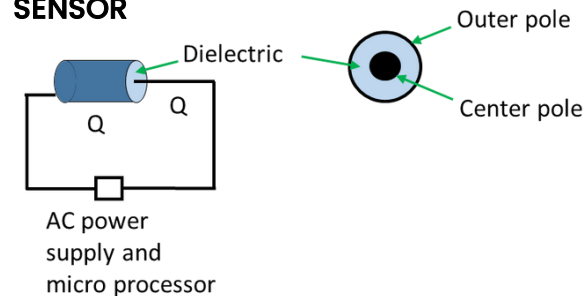
In principle, the sensor acts as a large capacitor where the liquid or gas is the dielectric, filling the gap between the two poles. The capacitance is based on the dielectric constant of the fluid between the center pole and the outer pole. Different liquids have different dielectric constants, some shown in the blue box.

The electronic unit applies a low voltage high-frequency AC to the sensor element to measure the capacitance. The measured capacitance, together with base dielectric parameters, allows the sensor to calculate a level.

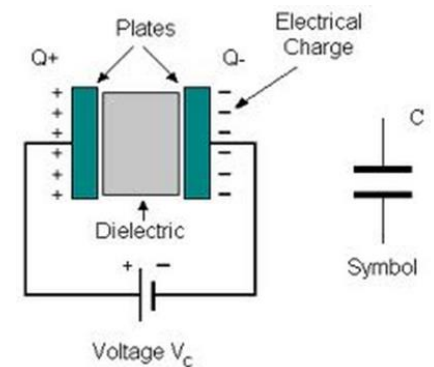


Dielectric Constant:	Temperature 20°C
Water/brine	80 (0°C is 88)
Ammonia	17 (-40°C is 22)
CO2	1.5 (-40°C is 2.0)
Oil type PAO, PEO	2.2 Mineral and synthetic types
Oil type PAG	3.5 Synthetic types
R134a	9.24
R22	6.35
R410A	7.78
R507	6.97
R1234ze	7.7
Air and gas	1.0
Ice	3.2

SENSOR

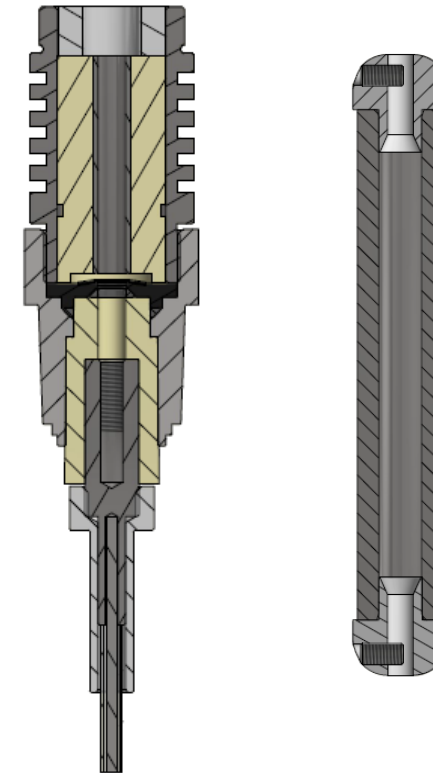
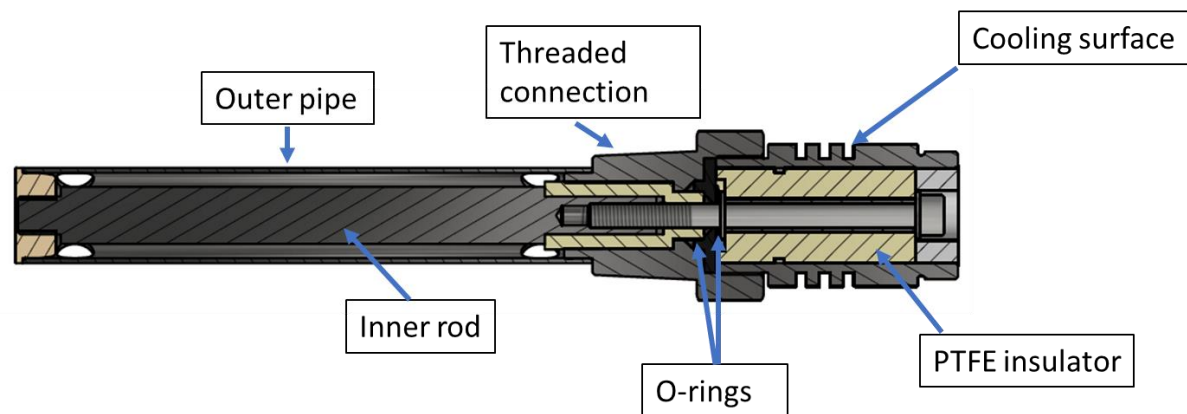


CAPACITOR



WHAT DOES THE SENSOR CONSIST OF?

- Stainless steel nipple and counterweight
- PTFE sealing
- Nylon plugs and protector
- PTFE-covered wire
- Stainless steel cooling neck






THE MECHANICAL PARTS

The mechanical part is made in different designs customized to the temperature range and type of liquid.

The interphase to the electronic unit can be either the V-track with set screws or a threaded union. The treaded union allows the sensor to comply with IP Class 66. The V-track complies with IP class 54.

Switches installed in ammonia and water have a rod covered by PTFE and use the tank or pipework as the second pole. Switches for all other liquids use a naked inner rod and an outer pipe.

The outer pipe has small holes for the liquid, except for the oil version used in cold temperatures, where the pipe has several holes to make sure the cold oil with high viscosity can drain from the switch.




Mechanical part	
Two wire based mechanical parts <ul style="list-style-type: none">• PTFE covered wire suited for NH3, water, alcohol, HFC & HFO• Wire and steel tube elements suited for CO2, HC and oil	
Mechanical part with outer pipe and naked probe <ul style="list-style-type: none">• Suited for HFC, HFO, HC, oil & CO2	
Mechanical part with PTFE covered center probe <ul style="list-style-type: none">• Reduce sensitivity• Suited for NH3, water & alcohol	

THE ELECTRONIC ELEMENT

Small, simple head without display and an ISO4400 connector. The output is analog only and typically used on F-gas sensors where a simple functionality is needed.

The advanced head with both analog output and the possibility to control a valve directly. The built-in controller is set up in the HB-tool and can control stepper motors and most modulating valves.

A special ATEX/Ex version is available for hazardous environments. This sensor uses a simple two-wire connection and is normally installed with a barrier.

Electronic unit	
Advanced electronic unit <ul style="list-style-type: none">Analog output only	
<ul style="list-style-type: none">ATEX/Ex versions available/two wire	
Advanced electronic unit <ul style="list-style-type: none">Analog output and direct valve control	

THE MECHANICAL ELEMENT

O-rings for primary tightening.

PTFE is used as an insulator and secondary tightening

Stainless steel outer pipe and inner rod.

Two different connectors.

V-grove union for normal use.

Treaded union for cold applications.

The mechanical element consists of an inner and outer element that sits in the liquid and works as a capacitor. Then there is the threaded connection which includes the tightening.

The outside part of the sensor includes a cooling/heating surface and a connector to the electronic element.

The connection is either a threaded union connection, mainly used on sensors in cold applications or the conventional V-grove union.



Connector for threaded union

THE ELECTRICAL ELEMENT

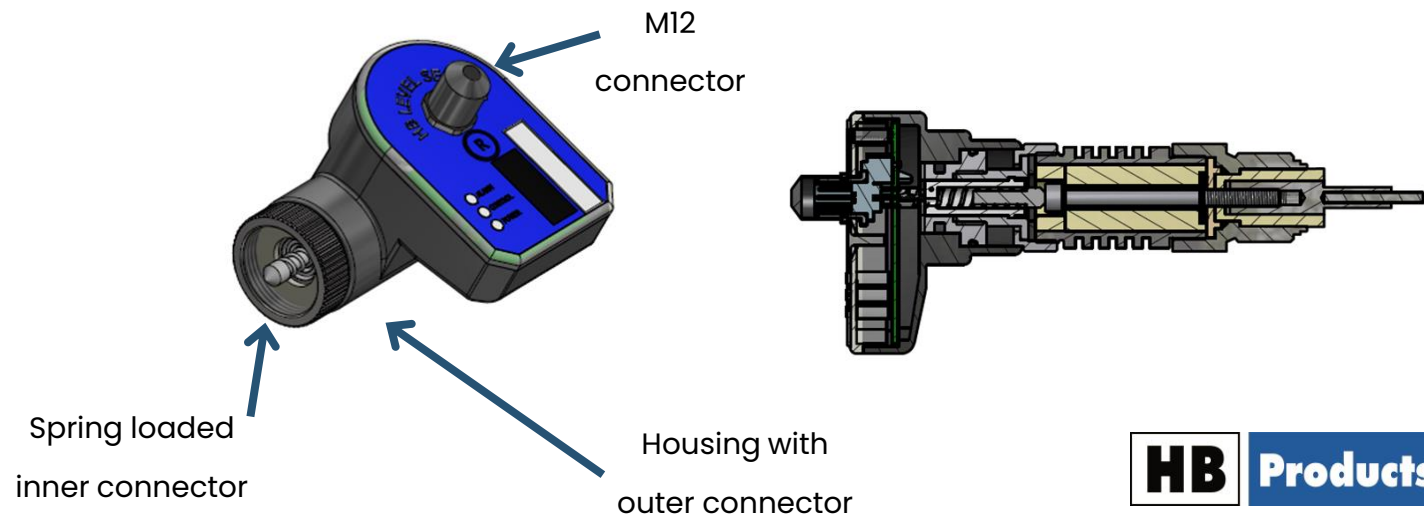
Spring-loaded inner connector
Housing with outer connector
Electronic circuit board
M12 connector
Cable for valve control (optional)

The electrical element consists of a connector to the mechanical element. It consists of a spring-loaded inner connector and an outer connector with either a threaded union or V-grove.

The housing contains the electronic circuit board cast into a resin for protection against moisture and chemicals.

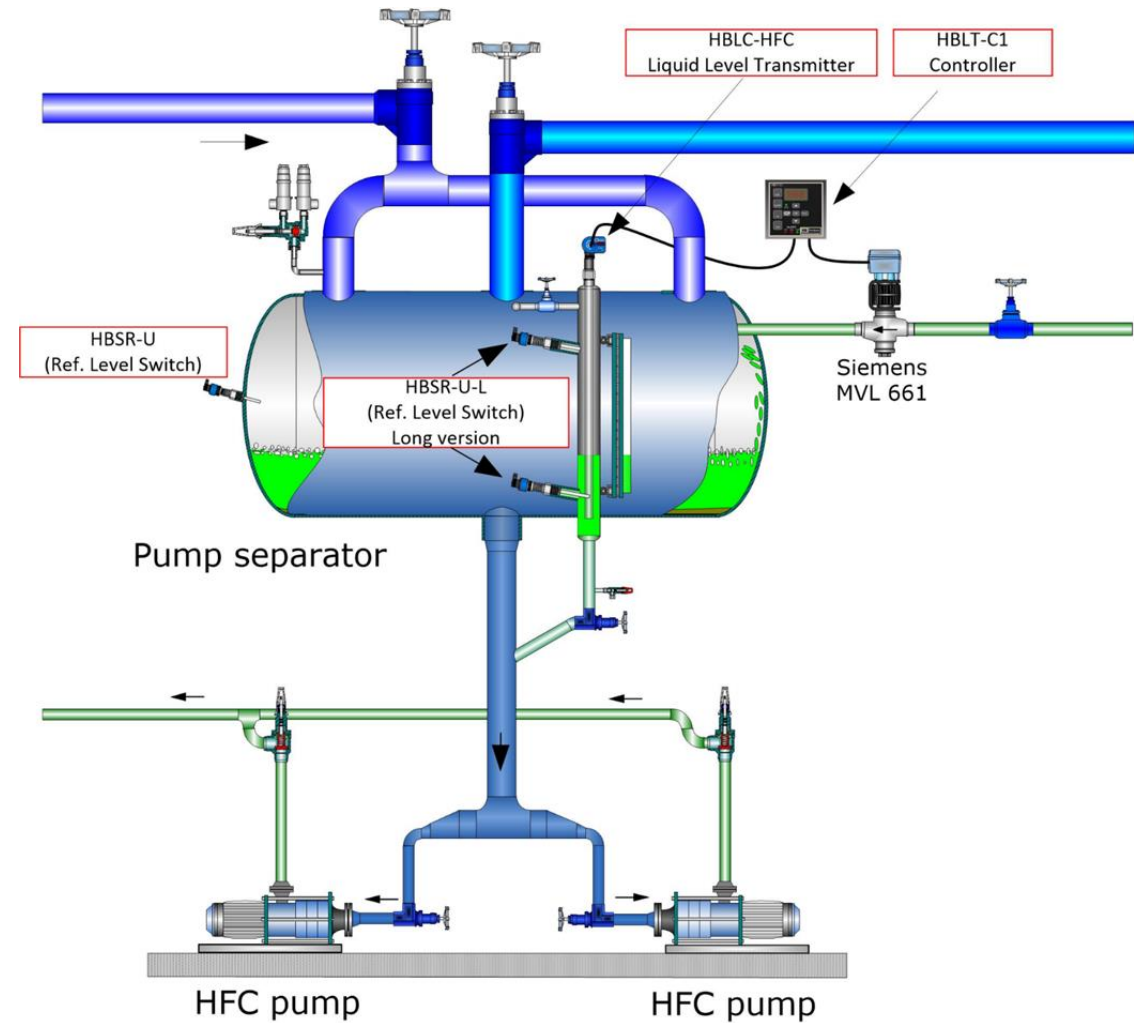
There is an M12 connector and option cables for valve control and temperature measurement on the outside. Some of the advanced elements have a 3-digit display showing the level.

All the advanced electrical elements have an R button which can be used for calibration as an alternative to the standard calibration using the HB-tool.



CONTROL CAPABILITIES

- Float function – automatic level control
- Built-in PI controller
- Direct valve control without PLC
 - Modulating valves
 - Stepper motors
 - PWM valves



SENSOR SETUP WITH THE HB-TOOL

The sensor is typically delivered in a plug-and-play version which means it will be operational without further modifications.

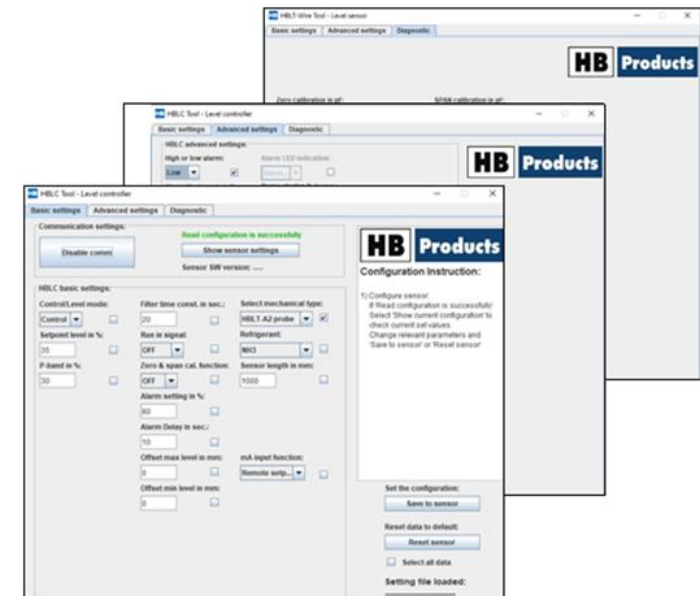
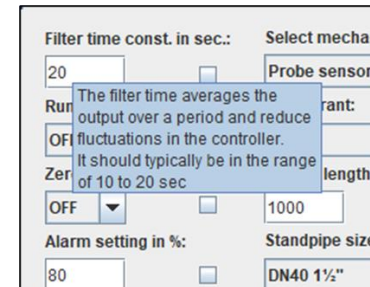
If the sensor must control a valve or high accuracy is needed, a calibration in the HB-tool is recommended.

The HB-tool is available for free download on www.hbproducts.dk

A special USB/M12 cable is needed to set up the sensor – the same cable can be used for all HB Products.










USB/M12 cable
for setting up the
sensor



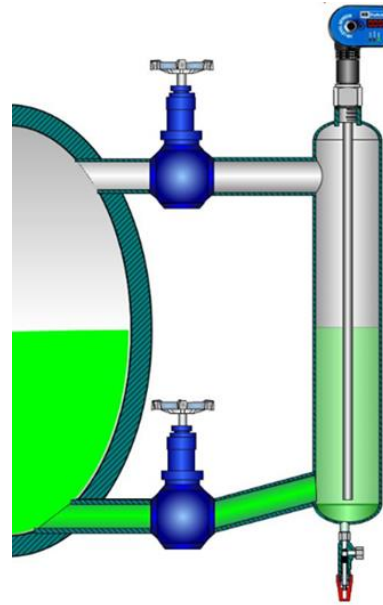
DIFFERENT VERSIONS OPTIMIZED FOR SPECIAL APPLICATIONS

- Different types exist for groups of liquid with similar dielectric constant levels.
- The sensors come with different treads and in different sizes.

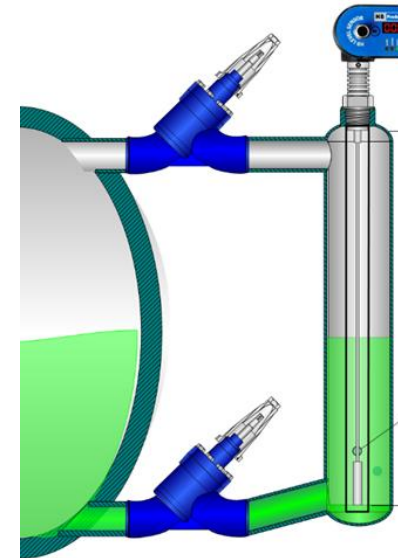
Product type		HFC, HFO	Oil, Hydro- carbons, CO2	NH3, Water, Alcohols
HBLC-Fgas		●	●	○
HBLC & HBSLC-CO2 HBLC & HBSLC-Oil HBLC & HBSLC-HFC		●	●	○
HBLC & HBSLC		○	○	●
HBLT & HBSLT-A2 & A3		○	○	●
HBLT-A1/AKS41		○	○	●
HBLT & HBSLT-Flex		●	●	○
HBLT & HBSLT-Wire		●	○	●

APPLICATIONS

- Installation in standpipes
- Installation directly in vessels
- Replace conventional floats
- Suited for all common liquids:
 - Water
 - Refrigerants
 - Oil



Rigid sensors



Wire or Flex
sensors

LEVEL SENSOR IN COMBINATION WITH OTHER SENSORS

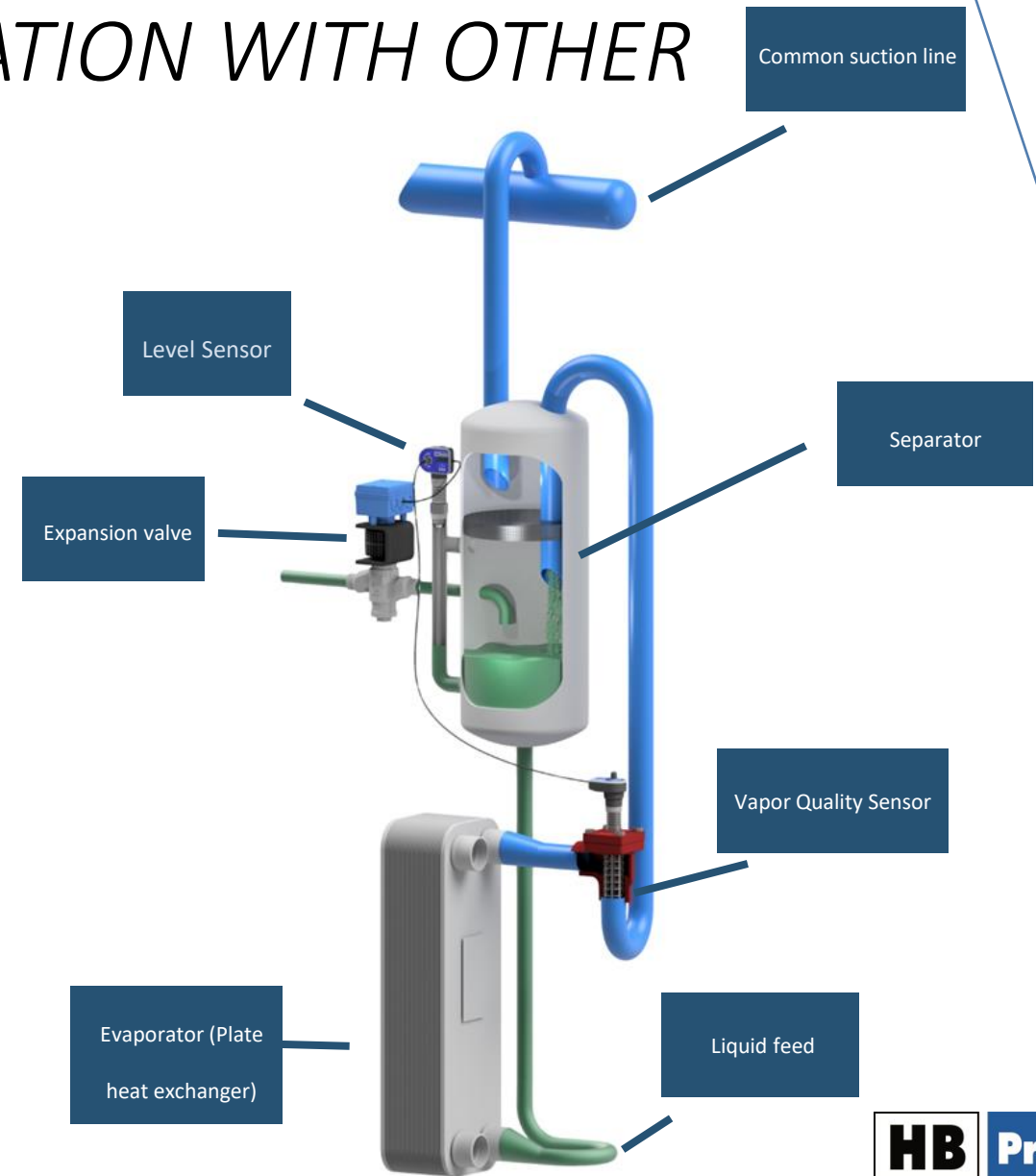
Achieve both better efficiency and capacity by using the Vapor Quality Sensor.

When using the sensor, is it possible to optimize both the energy efficiency of the cooling system by 10 % and the capacity also by 10%

This is done by securing the right mixture of gas and liquid in the output. The best efficiency is obtained when the liquid/gas mixture of the evaporator has a liquid content between 10-30%.

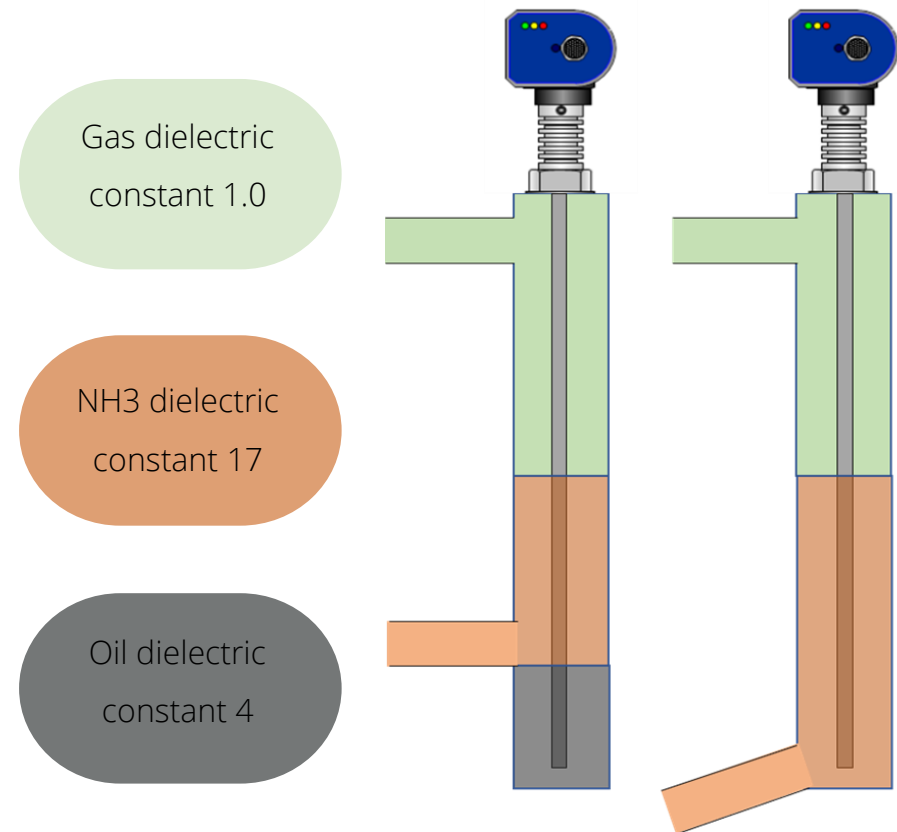
With a Vapor Quality Sensor installed in the evaporator outlet, it is possible to measure and control the flow rate to get an optimal liquid/gas mixture.

A Liquid Level Sensor in the standpipe attached to the vessel can control the optimum flow rate.



MORE THAN TWO MEDIAS IN A STANDPIPE IS PROBLEMATIC

- The sensor does not work correctly with three different media, which vary in level
- Design must be modified to get the most accurate reading
- The offset function does not compensate properly

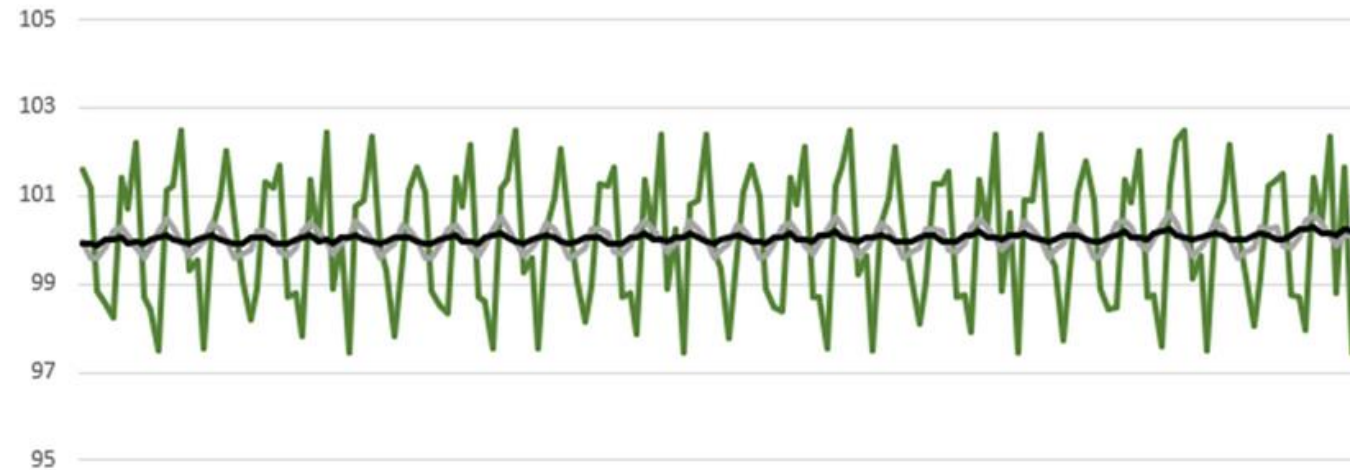


SPECIAL FEATURES

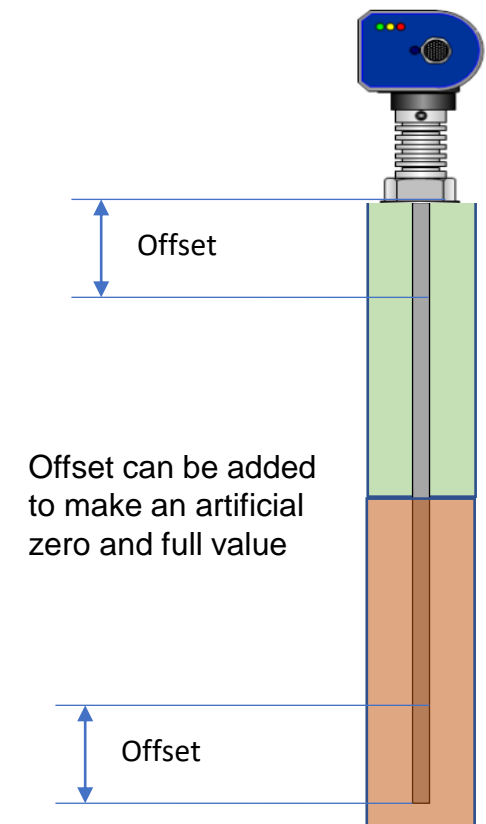
- FILTER TIME AND OFFSET

The output can be filtered in the electronic unit, and the filter time can be set up in the tool. This feature makes it possible to control the level even in a turbulent environment.

The HB-tool allows filtering of the output to make it more stable. Adding an offset to the sensor and making an artificial zero and total value is possible.



The figure shows how different filter times affect the output.



SPECIAL FEATURES

- TEMPERATURE COMPENSATION AND EXTERNAL DISPLAY

For CO2 applications, you can get temperature compensation to make the sensor more accurate.

Most electrical units have a display, but it might be difficult to read. For that purpose or if you just like an additional display, we have a separate display that can be installed anywhere.

When used in CO2 and other very dense gasses a temperature sensor can provide increased accuracy. All sensors can be delivered with temperature compensation if needed.



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Liquid Level Sensors

HB Products offers a wide range of capacitive level sensors for refrigeration and industrial use. Due to the capacitive principle the sensors are optimized and calibrated for different groups of liquids and different working conditions. All types are suited for measuring of liquid levels in gas or air.

Click for more information

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- Manuals
- Ammonia Brochure
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HB Products WE INCREASE UPTIME, SAFETY AND EFFICIENCY

Manual for rigid level sensors and controllers

Covers: HBLC, HBLT, HBSLC & HBSLT

For analog measurements of liquids like NH₃, water, HFC/HFO refrigerants, CO₂, Hydro carbons and alcohols.

Can be used in refrigeration systems and similar demanding systems.




Introduction

HBLC, HBLT, HBSLC and HBSLT are intelligent liquid level sensors which can be installed in a vessel or in a standpipe. The sensors can be installed directly in a stand pipe or in a vessel. The HBLC and HBSLC are sensor without an external pipe which means they measure between the sensor element and the vessel or standpipe whereas the other types has an external pipe and measures between the sensor rod and the stand pipe. Installation and configuration is similar for the two product types and they share the electronic basis.

The sensor can be installed in refrigeration systems and similar demanding applications with high pressures and aggressive fluids.

The sensors comes in different versions with or without a spike the direct valve control. All versions emit a 4-20mA analog signal, which is proportional to the liquid level, and the HBLT and HBSLT. The sensors are available in special versions which contain a controller able to control a valve directly, without using a PLC.

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HB Products WE INCREASE UPTIME, SAFETY AND EFFICIENCY

Manual for wire and flexible level sensors and controllers

Covers: HBLT & HBSLT

- Wire sensor suited for liquids like NH₃, water, HFC/HFO refrigerants
- Flex sensor suited for liquids like CO₂ and Hydro carbons


Can be used in refrigeration systems and similar demanding systems.



Introduction

Wire and flex are intelligent liquid level sensors which can be installed in a vessel or in a standpipe. For the wire sensor the sensor element is a stainless steel wire insulated with PTFE and for the flex sensor the element is a stainless steel wire mounted with stainless steel elements to increase the sensitivity. Both sensors can be installed directly in a stand pipe, if they need to be installed in a vessel they need an inner pipe. Both sensors measure between the wire/steel elements and the surrounding liquid.

The sensor can be installed in refrigeration systems and similar demanding applications with high pressures and aggressive fluids. The sensor emits a 4-20mA analog signal, which is proportional to the liquid level.

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