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.

ATEX/Ex versions included

Introduction

HBLC, HBLT , HBSLC and HBSLT are intelligent liquid level sensors which can be installed in a vessels or in a standpipes. The sensors can be mounted 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 inner rod and the outer pipe. Installation and configuration is similar for the two product types and they share the electronic heads.

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 cable for direct valve control. All versions emits a 4-20mA analog signal, which is proportional or disproportional to the liquid level, via the M12 plug. The sensors are available in special versions which contains a controller able to control a valve directly, without using a PLC.

INTERTEK ISO 9001:2008 CE

Table of contents

Safety Instructions

CAUTION! Always read the instruction manual before commencing work! Heed all warnings to the letter! Installation of the sensor requires technical knowledge of both refrigeration and electronics. Only qualified personnel should work with the product. The technician must be aware of the consequences of an improperly installed sensor and must be committed to adhering to the applicable local legislation.

If changes are made to type-approved equipment, this type approval becomes void. The product's input and output, as well as its accessories, may only be connected as shown in this guide. HB Products assumes no responsibility for damages resulting from not adhering to the above.

Explanation of the symbol for safety instructions. In this guide, the symbol below is used to point out important safety instructions for the user. It will always be found in places in the chapters where the information is relevant. The safety instructions and the warnings in particular, must always be read and adhered to.

	CAUTION! Refers to a possible limitation of functionality or risk in usage. NOTE! Contains important information about the product and provides further tips. The person responsible for operation must commit to adhering to all the legislative requirements, preventing accidents, and doing everything to avoid damage to people and materials.

Intended use, conditions of use. The level sensor is designed for continuous measurement of liquids, but please note the sensor design and setup has to comply with the liquid. The table show how sensors comply to liquids. It can be used in refrigeration systems and similar environments. If the sensor is to be used in a different way and if the operation of the product in this function is determined to be problematic, prior approval must be obtained from HB Products.

Prevention of collateral damage Make sure that qualified personnel assess any errors and take necessary precautions before attempting to make replacements or repairs, to avoid collateral damage.

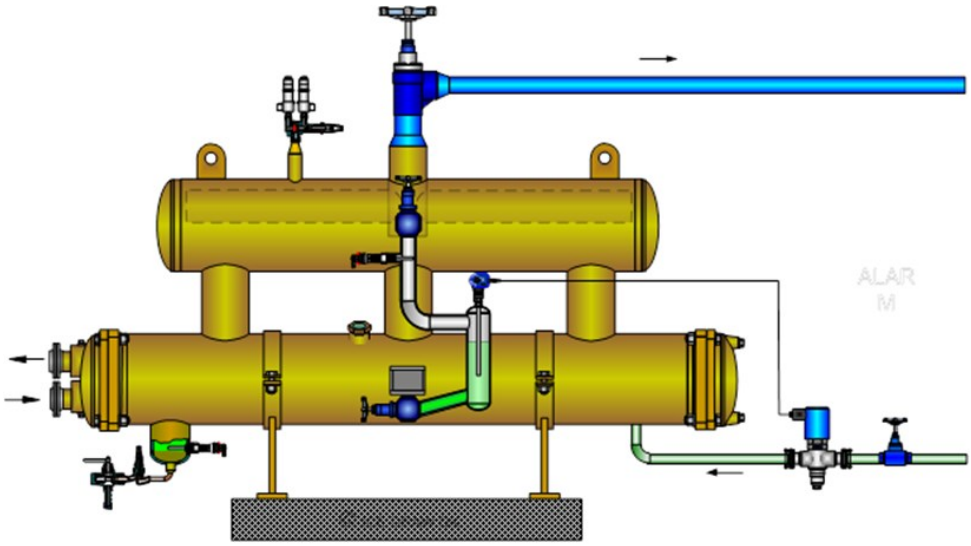
Disposal instructions: The sensor is constructed so that the modules can easily be removed and sorted for disposal.

● Comply
○ Not comply

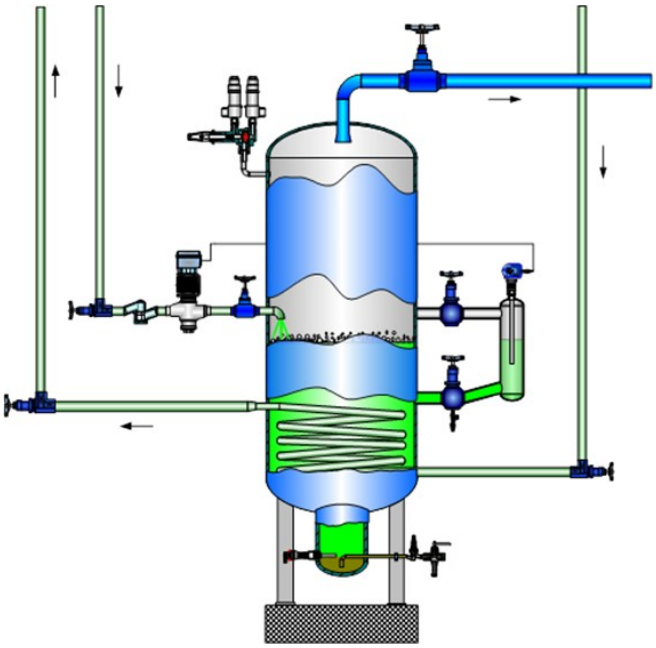
Products	HFC, HFO	Oil, Hydro-carbons, CO2	NH3, Water, Alcohols
HBLC-Fgas	●	●	○
HBLC & HBSLC-CO2 HBLC & HBSLC-Oil HBLC & HBSLC-HFC	●	●	○
HBLC & HBSLC	○	○	●
HBLT & HBSLT-A2 & A3	○	○	●
HBLT-A1/AKS41	○	○	●
HBLT & HBSLT-Flex	●	●	○
HBLT & HBSLT-Wire	●	○	●

Application Examples HBLC and HBSLC

HBLC consist of a PTFE covered rod and requires a electrical connection to the overflow pipe or to the pipe segment where it is installed. The sensor is more sensitive to turbulent conditions but with a high filter time it is able to control the level even in turbulent conditions. The simple design is less sensitive to contamination compared to HBLT.



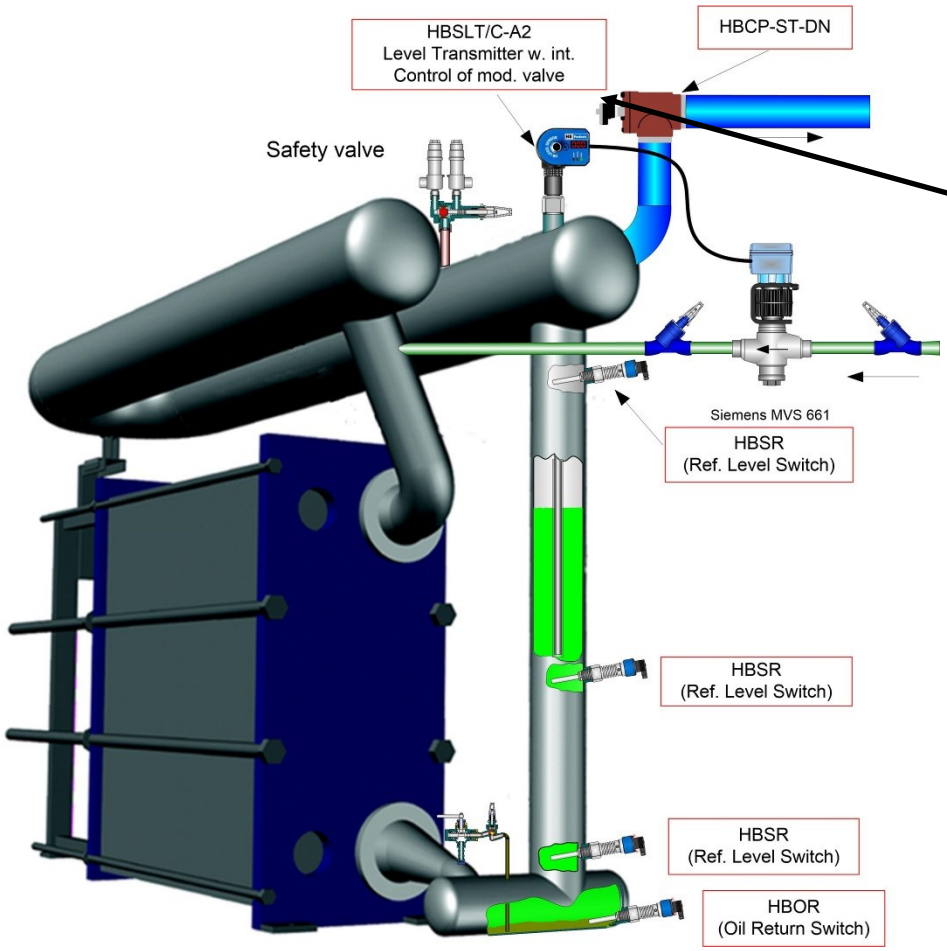
HBSLC connected to a modulating valve – an alternative to low pressure float control.



An economiser with an HBSLC connected to the modulating valve, type Siemens MVS661.

Application Examples

HBLT and HBSLT are designed for level measurement of liquids and is typically used in chillers, pump separators, coolers and condensers. The sensors can be mounted in vessels , containers and standpipes without an external pipe.



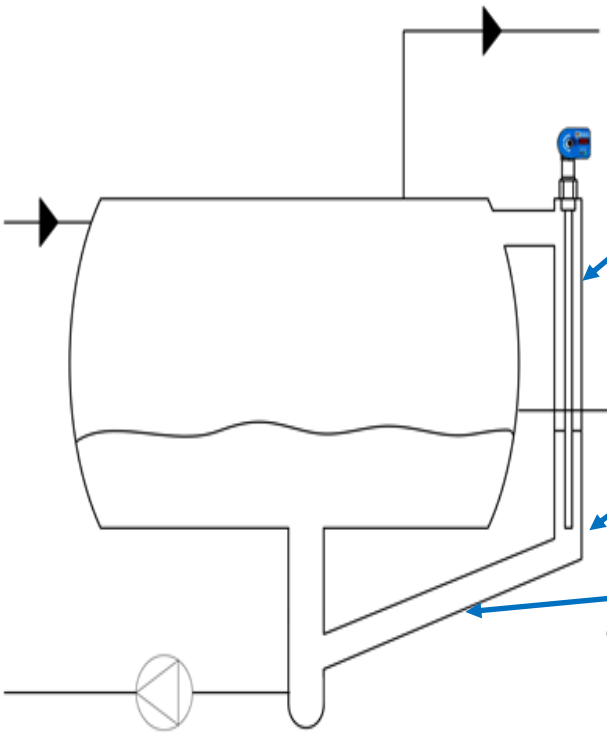
HBSLT/C

Sensor with integrated cable for direct control of 4-20 mA controlled modulating valve like Siemens MVS-series or Danfoss ICM-series or similar.

LED display is included

HBSLT/S

Sensor with integrated cable for direct control of stepper motor valves. HBSLT/S-version is without LED display.



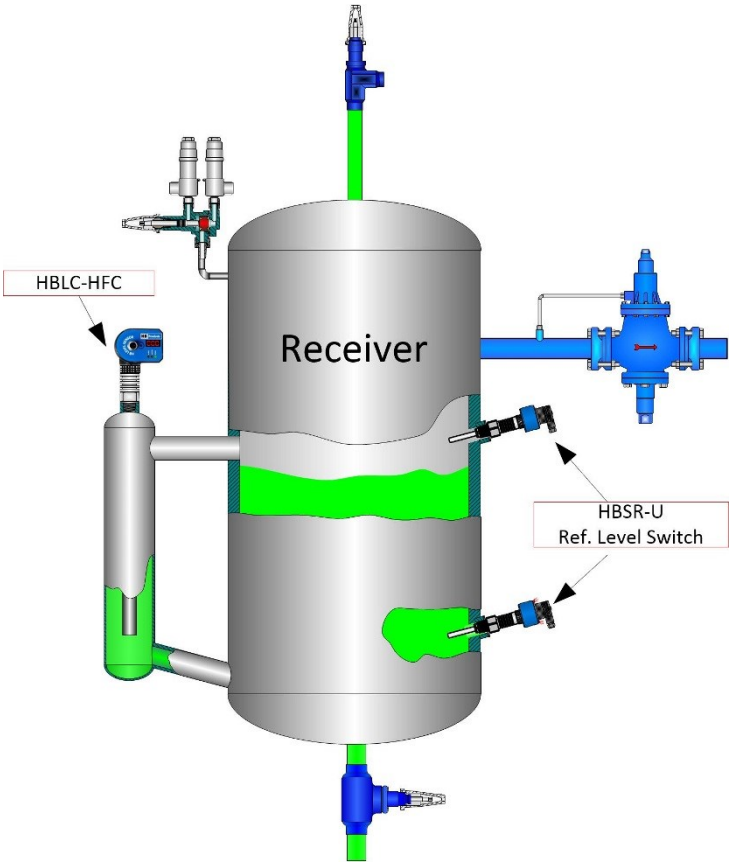
Standpipe should be insulated to reduce boiling in the standpipe.

Sensor must have a minimum of 50 mm between the sensor end and the bottom of the pipe.

Drain pipe must be placed at an angle of 5-10°, to avoid oil pockets in standpipe as these cause inaccurate measurement.

Application Examples HBLC and HBSLC

Level sensor installed directly in a vessel



Level sensor installed in a standpipe connected to a receiver.

Installation Instructions

Mount the sensor rod in a standpipe or vessel with the right thread connection. Liquid sealant is used for sensors without an outer pipe and the conic NPT thread. For the BSPP threads a washer is used. Teflon tape can be used on versions with an outer pipe.

CAUTION! In case of welding work on the unit, we recommend to remove the electronic head or at least to make sure that proper earthing is carried out to avoid damaging the electronics.

Mounting instruction

The electronic head is mounted and demounted using either the three pinon screws or a union. The threaded union is mainly used on sensors for low temperature applications. The threaded union should be tightened firmly using a tool to secure good electrical contact and avoid loose connections.

Teflon tape can be used for HBLT and HBSLT and products with an outer pipe

Liquid sealant should be used for HBLC and HBSLC and products with a rod without outer pipe

Mount the sensor on the vessel. Torque 80-150 Nm.

Connection diagram for simple sensor

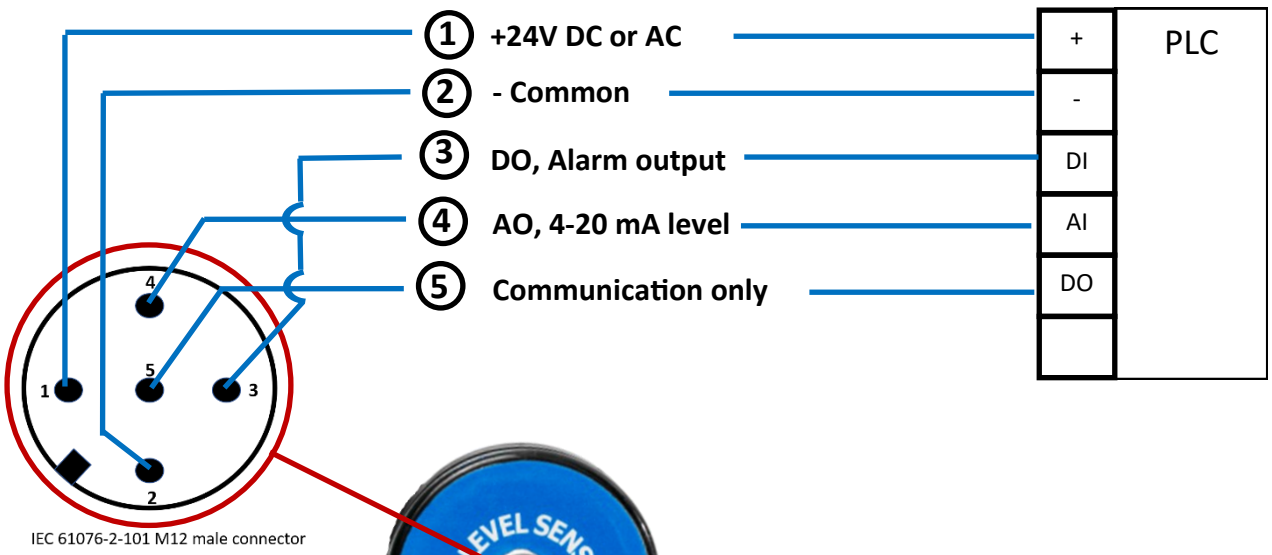
Suited for

- **Sensors with simple electronic head**

Connection diagram for sensors without control cable.

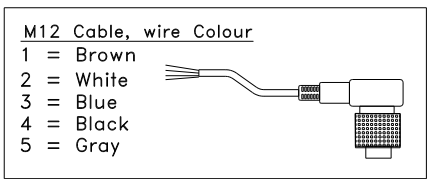
Suited for

- **HBLC**
- **HBLT and HBLT-wire**



IEC 61076-2-101 M12 male connector

M12 Cable, wire Colour
1 = Brown
2 = White
3 = Blue
4 = Black
5 = Gray



Digital output on pin 3

The sensor versions without a cable has an alarm output on pin 3. Remote setpoint is not available

How to connect the sensor

Three different type of sensors

- A simple sensor version with 4-20 mA output
- A advanced sensor version with 4-20 mA output, LED indications, display and multiple settings
- A controller version with both cable for direct valve control and analog output, LED indications, display and multiple settings

The M12 connection is also used for power supply. Some versions are able to control a valve directly. They have a cable, which can be connected directly to the valve.

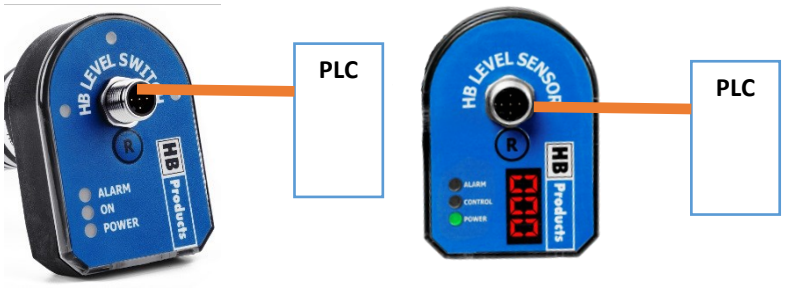
Simple version

- Analog output
- Simple setup

Circular head with ISO4400/DIN43650 connector

Advanced version

- Analog output
- Advanced setup
- LED indicators
- Display (option)

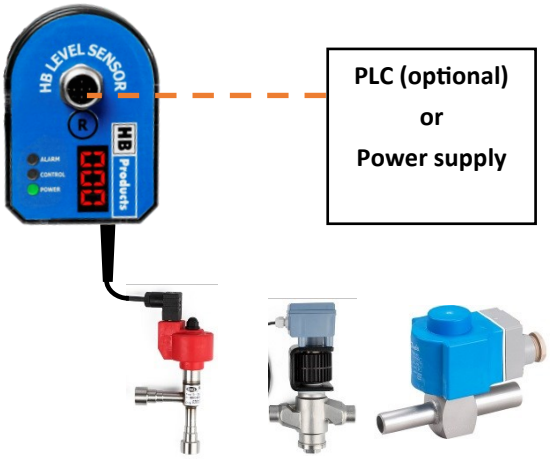


Large head with M12 EN61076-2 connector

With or without display and output cable

Controller sensor

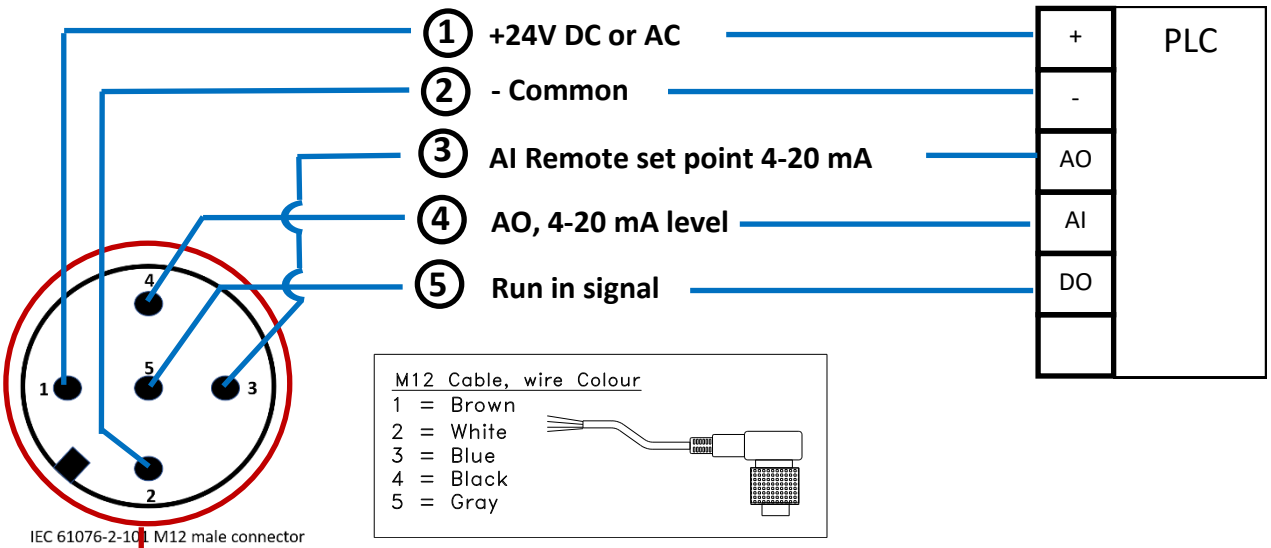
- Analog output
- Advanced setup
- Display
- LED indicators
- Valve control



Connection diagram for sensors with control cable for all common stepper motor valves — here shown with Carel E2V

Suited for

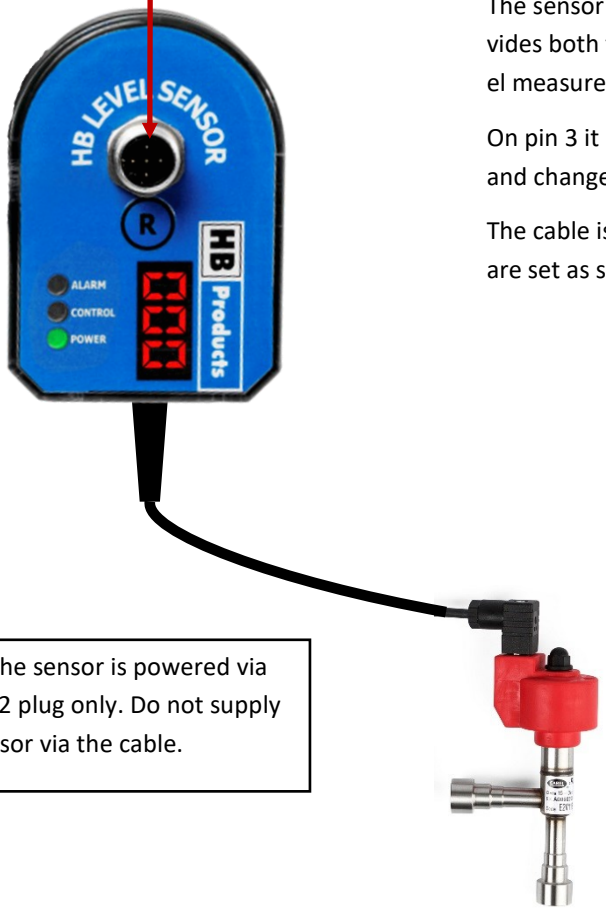
- **HBSLT/S and HBSLT–wire/S**
- **HBSLC/S**



The sensor has a build in controller for a stepper valve. The sensor provides both the analog output via the cable to control the valve. The level measurement signal for the PLC comes via the M12 plug .

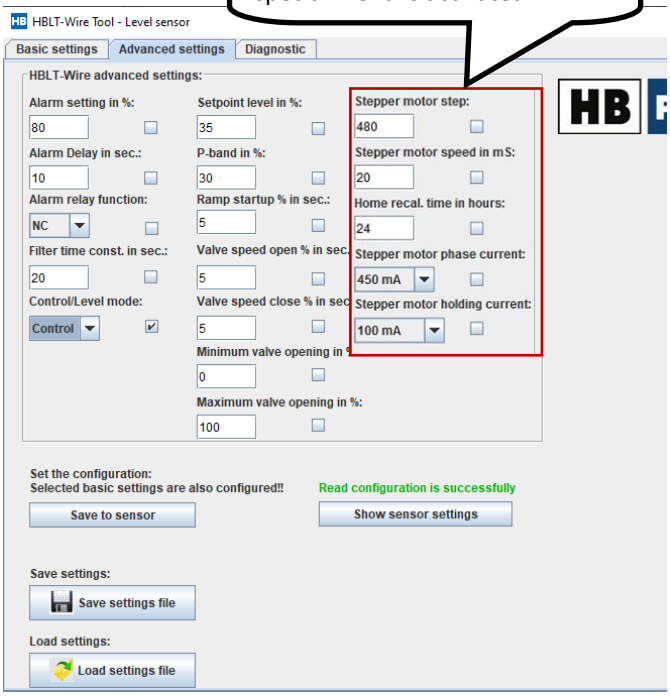
On pin 3 it is possible to send an analog 4-20 mA signal to the controller and change the setpoint. The signal is scaled linear like analog output.

The cable is connected according to the drawing and the parameters are set as shown in the next section.



Note: The sensor is powered via the M12 plug only. Do not supply the sensor via the cable.

For the stepper motor setup a special menu is activated



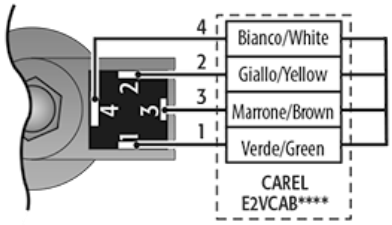
Color coding

A+ = yellow(2)

A- = white (4)

B- = green (1)

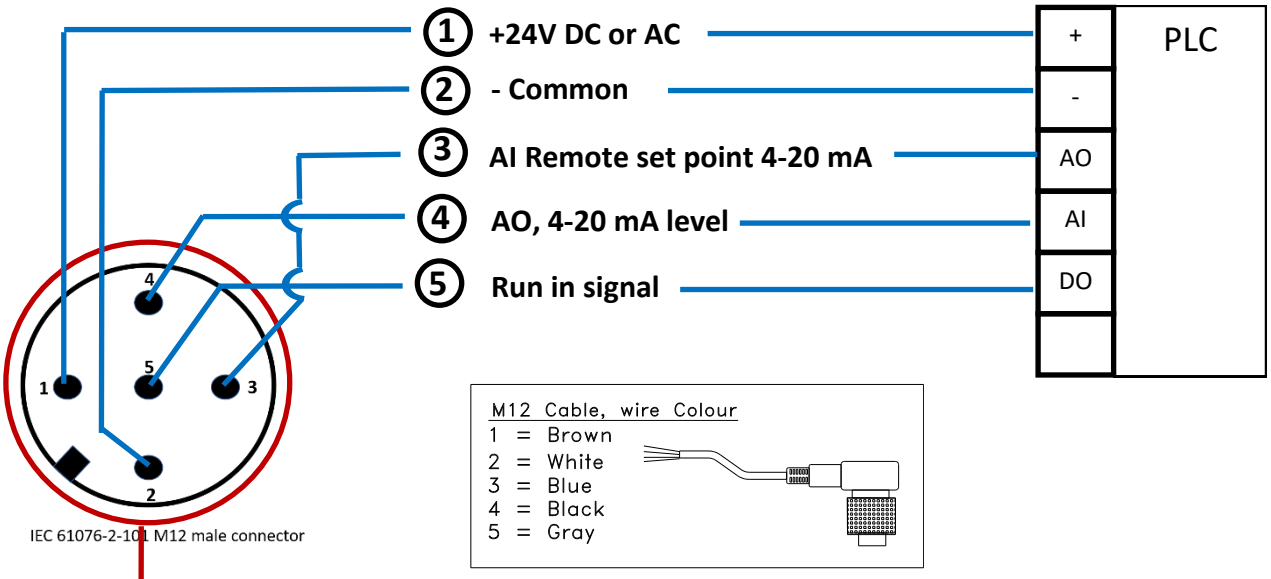
B+= brown (3)



Connection diagram for sensors with control cable for pulse modulating valve — here shown with Danfoss AKV/AKVA

Suited for

- **HBSLT/PWM and HBSLT–wire/PWM**
- **HBSLC/PWM**



The sensor has a build in controller for a pulse modulating valve. The sensor provides both the analog output via the cable to control the valve. The level measurement signal for the PLC comes via the M12 plug .

On pin 3 it is possible to send an analog 4-20 mA signal to the controller and change the setpoint. The signal is scaled linear like analog output.

The cable is connected according to the drawing and the parameters are set as shown in the next section.

Wiring using cable

Brown: + when using DC

White: - common when using DC

The cable can supply AC as well

Note: The sensor is powered via the M12 plug only. Do not supply the sensor via the cable.

Connection diagram for sensors with control cable for modulating valve — here shown with Siemens MVS661

Suited for

- **HBSLT/C and HBSLT–wire/C**
- **HBLC/C**

- = White common

+ = Brown Supply

AO = Grey , 4-20 mA

MVS661 motor valve

G0	-common
G	+ supply
Y	mA input
M	
U	mA output position
ZC	Open/Close valve

Close

Open

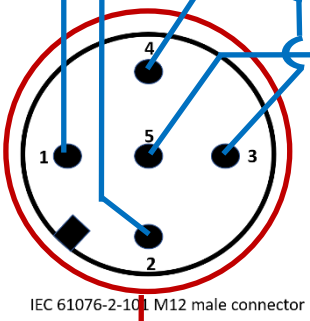
Manual open/close

Motor valve: 4-20 mA 24 V DC, max 24 W

3 wire connection

1	**+24V DC or AC**	+
2	**- Common**	-
3	**AI Remote set point 4-20 mA**	AO
4	**AO, 4-20 mA level**	AI
5	**Run in signal**	DO

PLC



IEC 61076-2-101 M12 male connector

M12 Cable, wire Colour

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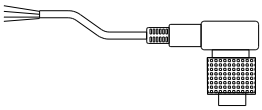


The sensor has a build in controller for a pulse modulating valve. The sensor provides both the analog output via the cable to control the valve. The level measurement signal for the PLC comes via the M12 plug .

On pin 3 it is possible to send an analog 4-20 mA signal to the controller and change the setpoint. The signal is scaled linear like analog output.

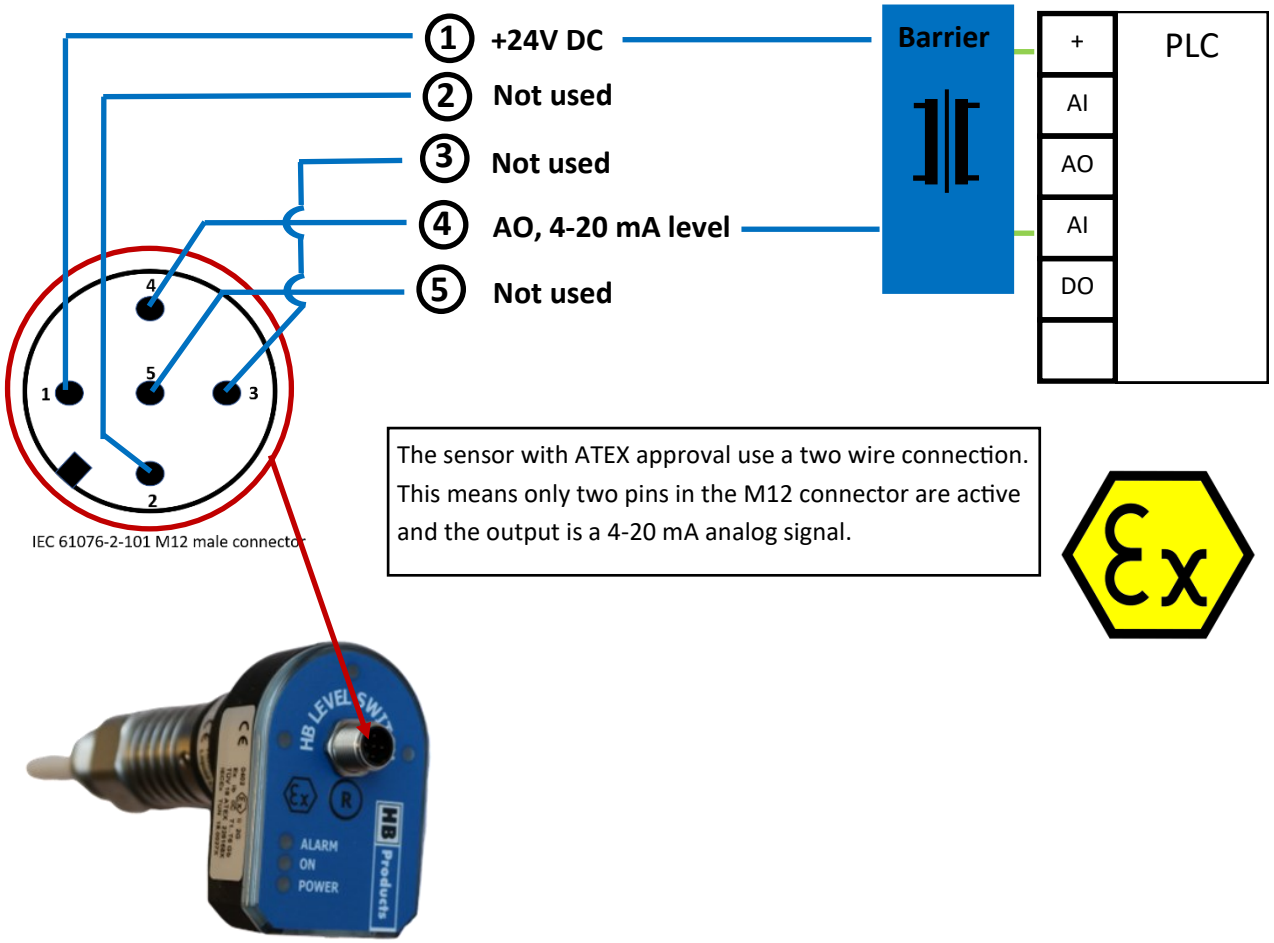
The cable is connected according to the drawing and the parameters are set as shown in the next section.

Note: The sensor is powered via the M12 plug only. Do not supply the sensor via the cable.

Connection diagram for sensors with EX approval and two wire connection

Suited for

- **HBLT and HBLT-wire**
- **HBLC**



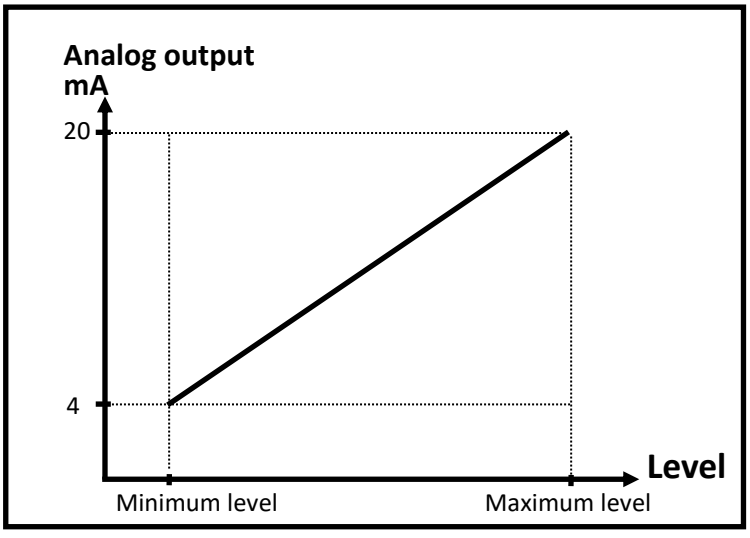
Scaling and offsetting the output

Scaling the analog output

The output is scaled linear from minimum to maximum and it is done in the HB-tool.

Offsetting minimum and maximum

If your sensor height doesn't match your vessel height it is possible move the minimum level and maximum level beyond the physical sensor by adjusting the offset value in the HB-tool. It is also possible to make the offset by making a calibrations to known levels also in the tool.

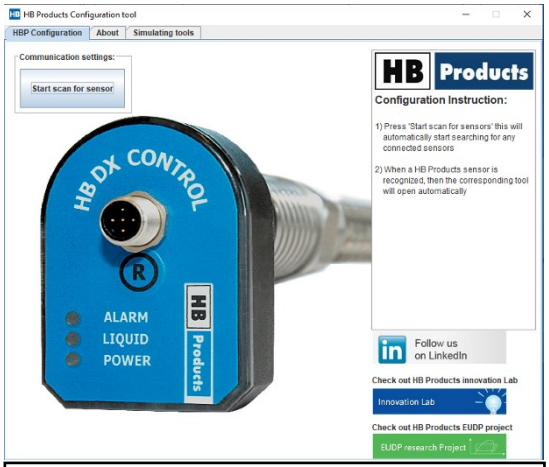


Setting up the sensor

When the sensor is delivered with one of the predefined liquids it is pre-calibrated and need no further calibration. The simple sensor can still be setup using a simple tool where filter time and calibration can be made. The advanced sensors has multiple parameters.

All sensor are connected to a PC using an USB/M12 cable and the simple sensor need an additional adapter.

The USB cable and the ISO4400/DIN43650 to M12 adapter



The HBtool is downloaded from the HBproducts web page.

Setup using a splitter box

When using a splitter box it is possible to run the refrigeration system and connect a PC to the sensor at the same time. The splitter box is not suited for normal operation, but only for installation and modification. The splitter box is connected to the M12 plug on the HBX sensor and then both the pc and the normal M12 plug can be connected.

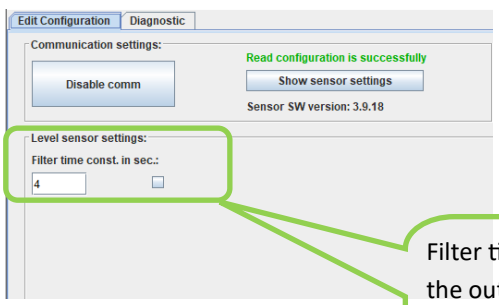
Use the HB tool for setting up the sensor

Simple versions only

The HB tool is very simple for this version. Only the filter time can be changed under the configuration tab.

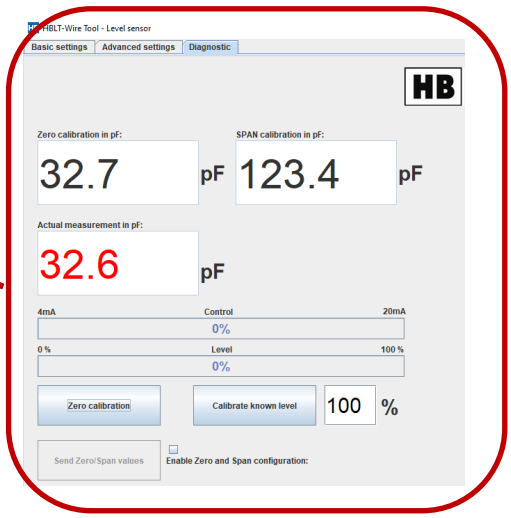
The calibration is similar to calibration of the advanced,

please follow the instruction further on in the manual.



Filter time averages the output over a period and reduce fluctuations

Calibration is similar to calibration of the advanced sensor versions



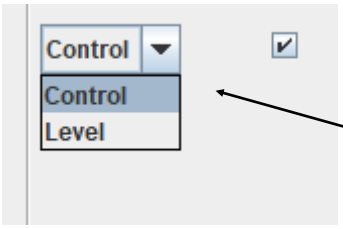
Use the HB tool for setting up the sensor

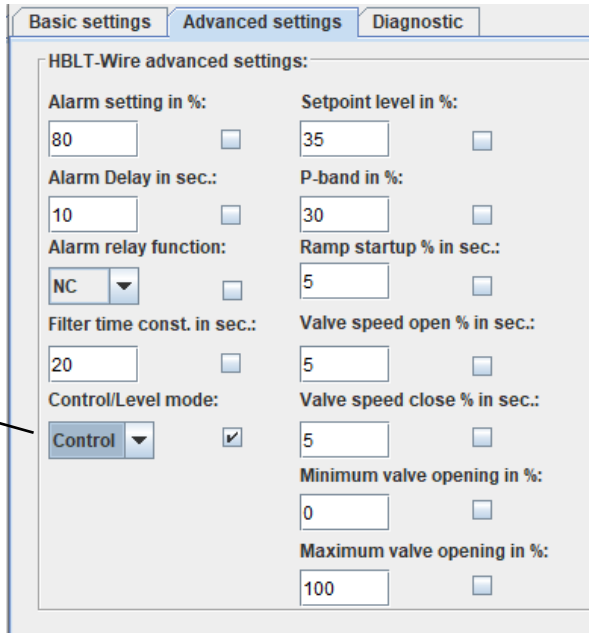
Advanced versions only

Setup — level or control

The sensor can operate in two different modes

- As sensor input to a PLC, computer or other device that

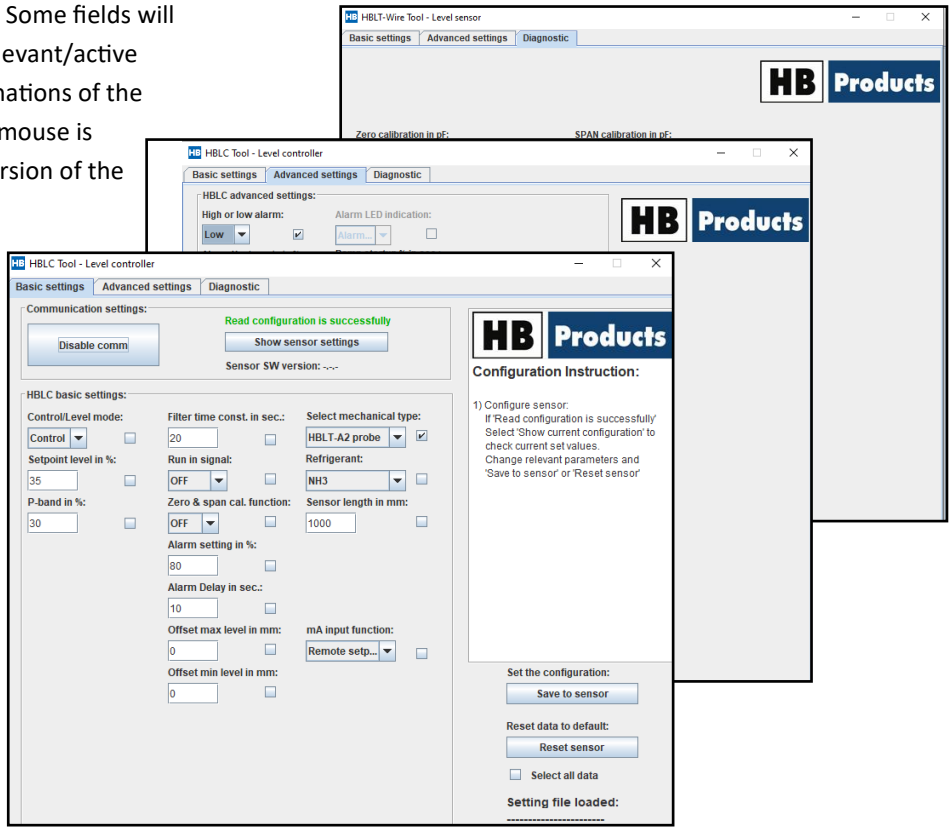




Setting up the sensor

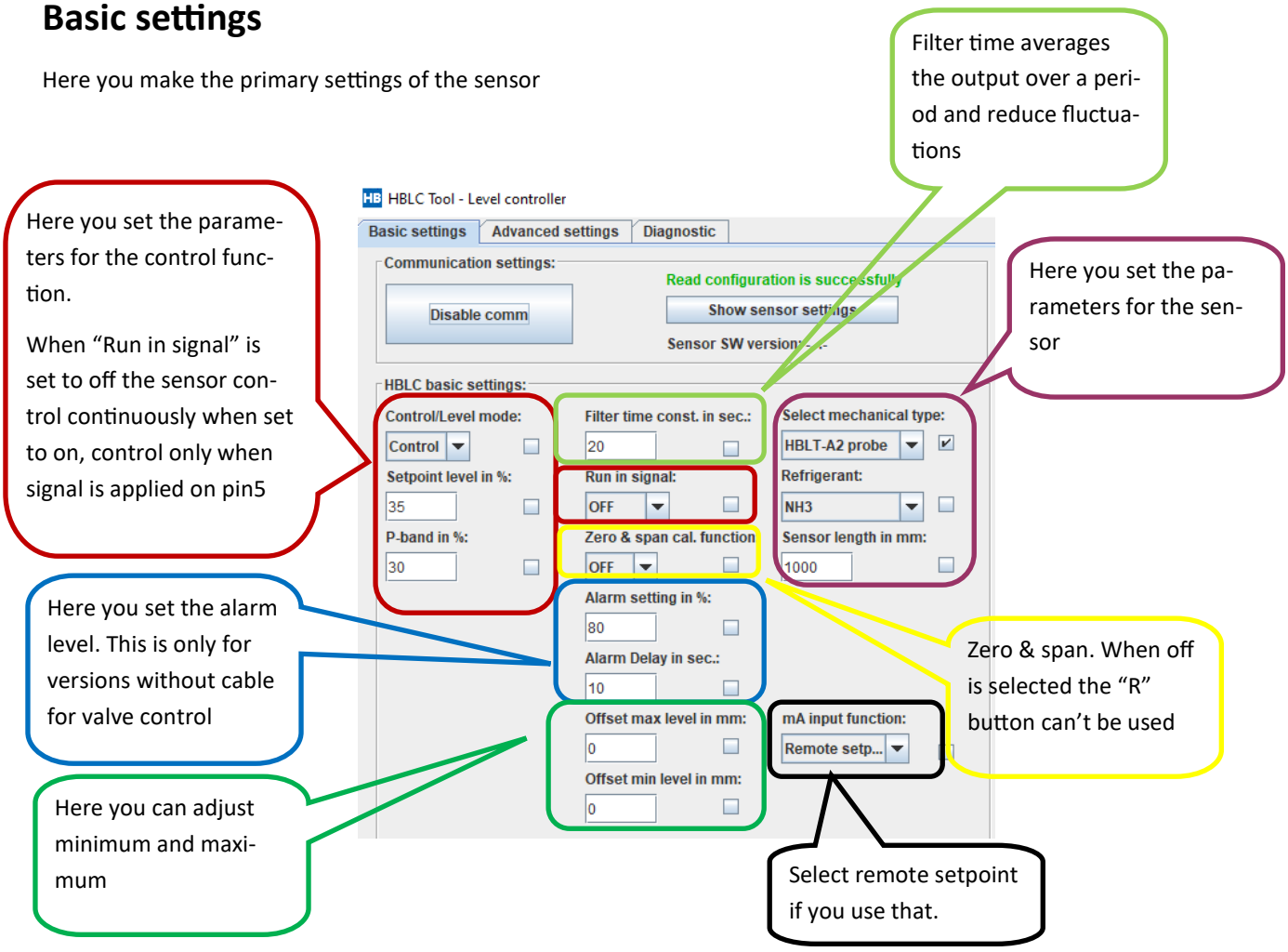
The HB tool has three pages of settings. Some fields will be shown in grey when they are not relevant/active with the setting chosen. Detailed explanations of the individual fields will show up when the mouse is moved over the field. Only the latest version of the tool has this feature.

When you like to change a setting ,you just type in a new value or select in the drop down. After changing the value you store the data by clicking “save to sensor”. The data is then saved and stored in the sensor and remains there even when the power supply is disconnected.



Basic settings

Here you make the primary settings of the sensor



Setpoint level in % (control mode only) Desired level: Shows the percentage level that one wants to remain in the container or the level indicator.

P-band in % (control mode only) Proportional band: Control area that describes how much the valve should open, dependent upon the deviation from the desired level. If proportional band is set to 10%, for example, a liquid level that is under 5% will make the valve open 50%; the valve will open to 100% if the level is under 10%. Small proportional band results in a system which reacts quickly, while a large proportional band results in a system that reacts more slowly.

Filter time const. in sec. Filter function**:** Averages the measurement so that the control function is performed based on an average measurement in a programmable time span (in seconds). This is increased if there are brief fluctuations in the measurement which lead to unstable control.

Run in signal remote activation**:** with this function it is possible to activate centralized control. If one does not want this, the function must be set to OFF, otherwise the sensor's control function will not work (power LED will flash when run-in signal is active or if this function is deactivated).

Zero & span cal. Function Calibrating function: ON in case calibration of the sensor is allowed. After start-up and possibly the first calibration, the tool can be connected and is deactivated.

Alarm setting in % Alarm, H/L: Indicates the desired alarm level. It is given in % of max measurement range.

Alarm delay in sec Delay – alarm: The delay from when the liquid level falls/rises to under/over the selected alarm, indicated in seconds.

Offset max/min level in mm. here you can adjust for a sensor smaller than the vessel at max level and min level

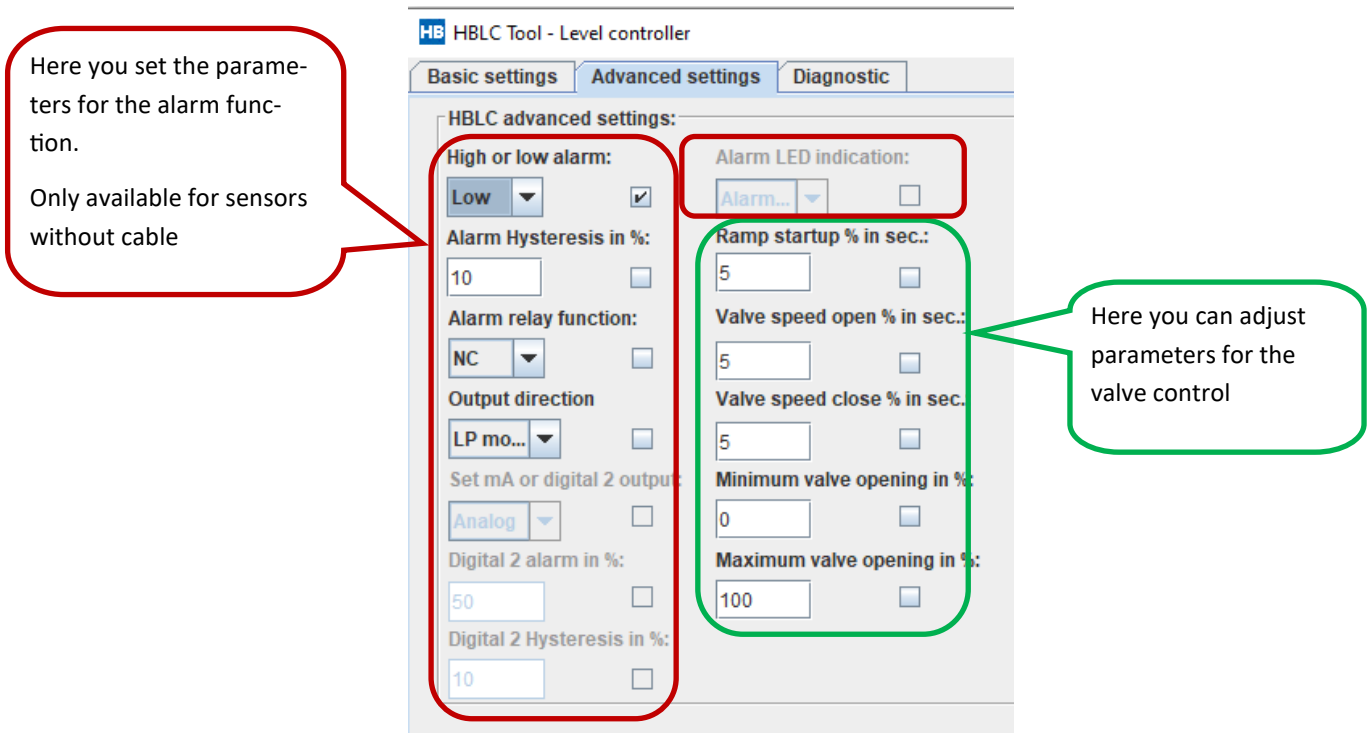
Select mechanical type: select the type of sensor you have

Refrigerant: Indicates the type of refrigerant the sensor shall measure on.

Measurement length in mm Measurement in mm: Indicates the length of the sensor in mm typically printed on the electrical part

Advanced settings

Here you make the advanced settings of the sensor



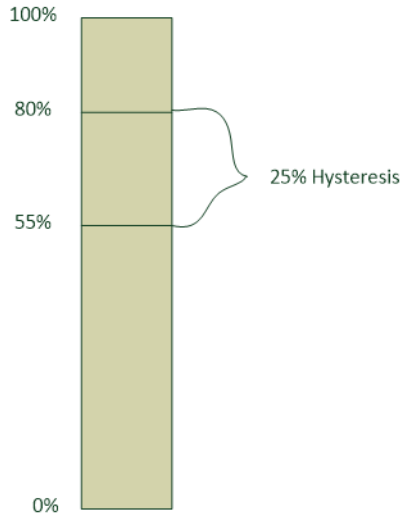
Alarm relay function: Here, the relay function is indicated, depending upon the instructions – NO or NC (normally open/normally closed). Here the signal can be changed from alarm on below or above the alarm setpoint

Output direction: Here you select either LP-mode (low pressure control) or HP -mode (high pressure control). In LP-mode, the container is filled so that the level is maintained, and in HP-mode the container is emptied so that the level is maintained. LP-mode = 4-20 mA. HP-mode = 20-4 mA.

Set mA or digital 2 output Select the sensor output digital or analog

Digital 2 alarm in %: set the alarm setpoint

Digital Hysteresis in %: %: Indicates the deviation required before the alarm is deactivated, following activation of the alarm. Alarm hysteresis in percent of the probes calibrated span 0 and 100%.



Alarm setting is as well in % of the probes calibrated span 0 and 100%.

E.g. alarm setting = 80%, Alarm hysteresis = 25%

Set LED indication: Determines the function LED lighting has.

Diagnostic (calibration of sensor)

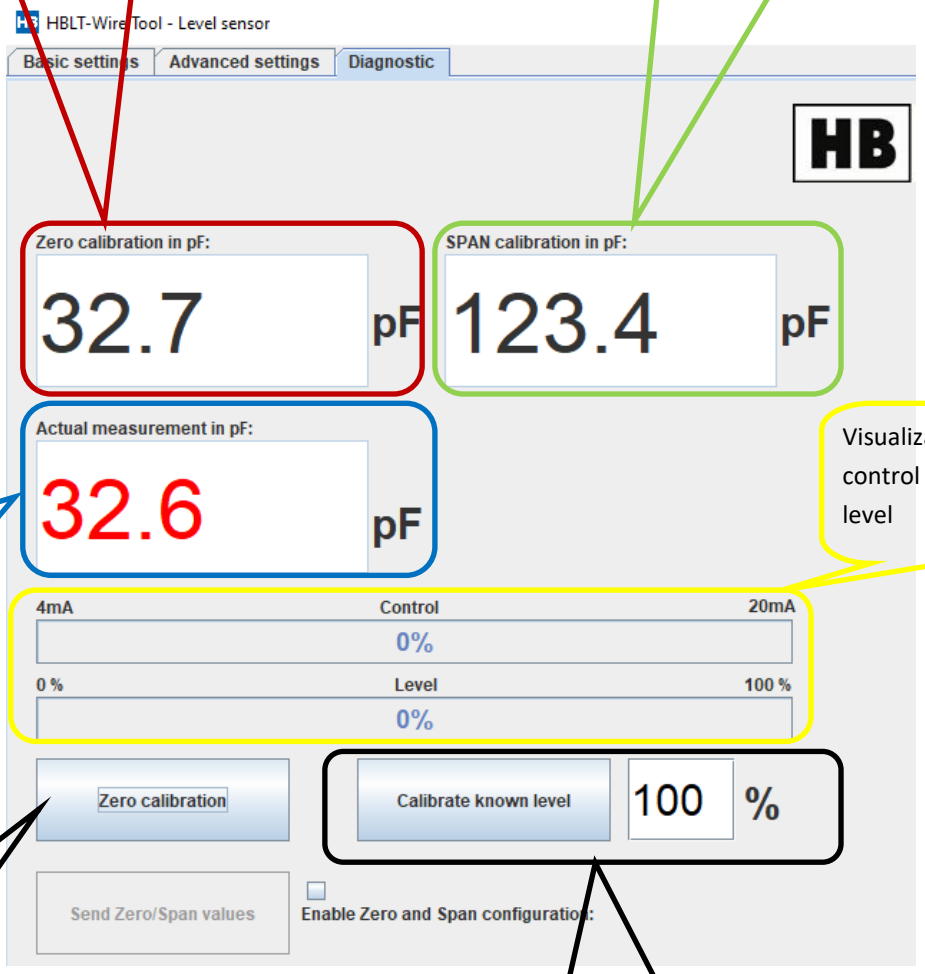
Here you make the calibration of the sensor. If the sensor is operating in one of the predefined liquid it is delivered with a calibration and does normally not need further calibration. If you need higher accuracy the sensor can be calibrated

Here you can see and change the zero calibration.

The value is normally calculated based on an automatic calibration and should not be changed

Here you can see and change the SPAN which is a part of the calibration

The value is normally calculated based on an automatic calibration and should not be changed



Here you can see the actual measurement value

Visualization of the control signal and the level

Use this button to make the zero calibration

Use the button and the field to make a calibration to a known level between 1 and 100%

LED indication

- Green LED indicates 24 V DC supply; it flashes during operation. If "run-in" is not used, this function must be deactivated in the tool.
- Yellow LED indicates control.
  The flashing sequence indicates if the valve is closing or opening.
- Red LED indicates high- or low-level alarm, depending upon the set-up.

3-digit display: (not available on /S stepper motor control version.)

Showing 0…100 % linearly corresponding to 4…20 mA.

LED Signal	ON/OFF/Frequency	Functionality
Green	ON	Supply voltage connected
	Flash	Run In start signal / in operation.
	OFF	No supply voltage
Yellow	ON	Activation of valve control / and during calibration
	OFF	Valve control not active
Red	ON	Alarm, high or low level, depending upon the setup.
	Flash slow	No contact to sensor probe or sensor probe shorted
	Flash fast	USB cable connected and communication active
	OFF	No alarm
Yellow + Red	Flash	Insufficient Power supply
All	Flash	USB cable connected and communication active
	OFF	No alarm

Calibration directly on the sensor (advanced versions only)

Calibration instructions:

0% or 100% for calibration **can be carried out independent of each other.** We recommend only calibrating at 0% if a high degree of accuracy is desired.

Note: To use this function the "Zero & span cal. Function " field found under basic settings have to be on - default is off

Instruction for 0% calibration:

- Connect the supply cable
- Empty the vessel
- Activate "R" for 5 seconds to activate calibration mode = Yellow LED is on (ON) during the 5 second activation and turns off (OFF) when calibration mode is activated.
- Activate "R" once = Yellow LED flash once. Afterwards, the green LED flashes to confirm calibration.

Instruction for 100% calibration:

- Fill the vessel to 100%.
- Activate "R" for 5 seconds to activate calibration mode = Yellow LED is on (ON) during the 5 second activation and turns off (OFF) when calibration mode is activated.
- Follow the instructions under "Configurations Instructions" regarding the installation of drivers in the program.
- Activate "R" twice = Yellow LED flashes twice. Afterwards, the green LED flashes to confirm calibration.

Fault detection

General: In case of fault, it is normally enough to replace the electronic part.

Fault	Reason	Correction of fault
No LED is on / not operating.	No supply to the sensor or defective cable/plug	Check and find faults in the power supply, or replace the supply cable.
Yellow and red LED flash.	Power supply is not sufficient.	Install proper power supply.
Valve open and close to fast.	Refrigerant is boiling in the stand-pipe	Increase “filter” settings and eventu-ally increase P-band as well.
No contact activation	There may be dirt between the elec-tronic housing and the mechanical housing.	Separate the two parts and clean the spring tip. Remember to apply sili-cone grease to the spring tip so as to
Delay in sensor activation	May be caused by gas and bubbles in the system.	Check if the sensor is placed optimal-ly so that gas is avoided.
The valve is not performing the control function well enough.	Oil has accumulated in the level indi-cator glass which cannot escape.	Drain the level indicator of oil and, if necessary, clean the oil from the rod.
There is no alignment between the output signal and the level in the	The sensor is incorrectly calibrated.	Perform calibration.

NOTE! Fault detection and/or changing the electronic function can be carried out without releasing pressure from the system or disassembling the mechanical part of the sensor.

Sensor Repair

In case of faults with the sensor, it will typically only be necessary to replace the electronics.

Please contact your local distributor about how to handle complaints.

Further Information

For further information, please visit our website, www.hbproducts.dk, or send an email to: support@hbproducts.dk.

HB Products A/S – Bøgekildevej 21 – DK8361 Hasselager – support@hbproducts.dk – www.hbproducts.dk

Quick guide

Installation

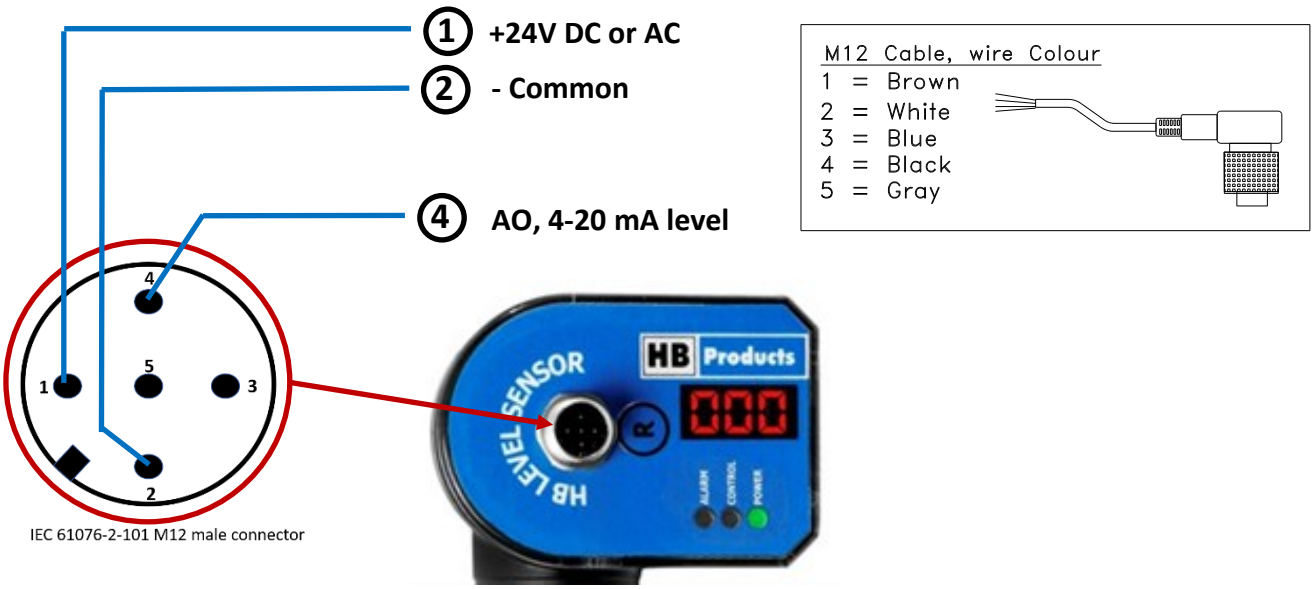
The sensor is installed in the vessel using liquid sealant or PTFE tape like shown in the manual and the electrical unit is connected. If the electronic unit has the threaded union, make sure it is firmly tightened to secure good electrical connection.

Setup

The sensor is delivered pre-calibrated for the liquid you specified when ordering and ready for use. To obtain a more accurate measurement you need to calibrate the sensor as described in the complete manual. You need a computer and a USB/M12 cable to do the calibration and more advanced setup. The setup is done in the HB-tool which is downloaded from the HBproduct web page www.hbproducts.dk

Measurement signal

The sensor output is a 4-20mA provided on pin 4 in the M12 plug. The signal grow linear to the level. More advanced wiring and wiring of sensors controlling a valve is described in the complete manual.



LED indication

When the sensor is operating the green LED should the green LED should be on or flashing

LED Signal	ON/OFF/Frequency	Functionality
Green	ON	Supply voltage connected
	Flash	Run In start signal / in operation.
	OFF	No supply voltage