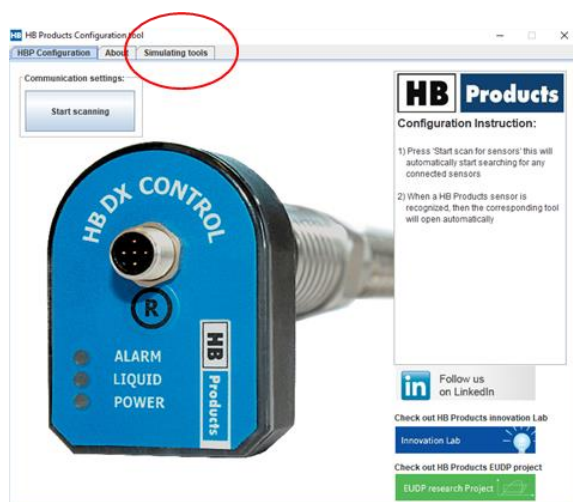


The HB tool

General guide to the more advanced parts of the tool



The tool is used for setup and modification of parameters for most of the sensors in the HB product's portfolio. For most of the sensors the tool is connected using the M12 plug.



To get familiar with the tool you can install it and play with it using the simulation tool. In here you can play with different settings and even upload settings files without disturbing the plant.

General introduction

Connecting to the sensor

The HB tool can be used on all the sensors from HB products having the 5 pin M12 plug and on some of the more advanced sensors using the circular electronic unit with the ISO4400 connector. To connect these sensors an adapter is needed.

Normally the tool is connected directly to the sensor using a USB cable. This cable supply power to the sensor suited for communication to the sensor and the measurement. If the sensor is controlling a valve directly or you like the control to work on the sensor while working on the settings, you need a splitter box in between.

With the box you can change settings in the sensor while it is working in the system. The box is not good for permanent operation as it can't deliver the run-in signal from the PLC to the sensor.



Sensor with ISO4400 output and the adapter to M12

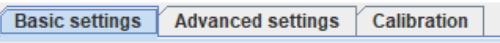


USB cable and splitter box

What can the tool be used for

The tool allows you to change settings in the sensor and to do trouble shooting.

The tool typically has three tabs with these basic settings:



Basic settings

- Sensor application
- The type of sensor and specifications
- Alarms

Advanced settings

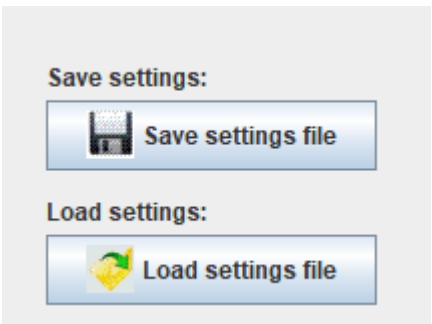
- Valve control parameters
- Advanced alarms

Diagnostics/Calibration

- Calibration
- Settings for analog output

Save the settings as a file for backup

The settings can be saved on a computer and be copied to a new sensor. The settings file can be valuable as a backup if something happens to the electronic unit. This is done under the advanced settings using the two buttons. The file is saved as a .hbp file and it can be edited as a text file. If you like to see the content you can download it to a sensor or into the simulation tool available from the frontpage of the tool



Control/level mode & Control/sensor mode

The sensors with an output cable can be set to “control” or “level”/”sensor” depending on the sensor type. When “control” is selected the built-in controller is active and the output cable is active. The control can be switched on and off by the run-in signal if this function is set to “on”. The run-in selector is only visible, when the sensor is in control mode.

When “sensor” or “level” is selected the controller is inactive and will work like a sensor without output cable.

Control/Level mode:

Control

Run in signal:

OFF

Filter time const. in sec.

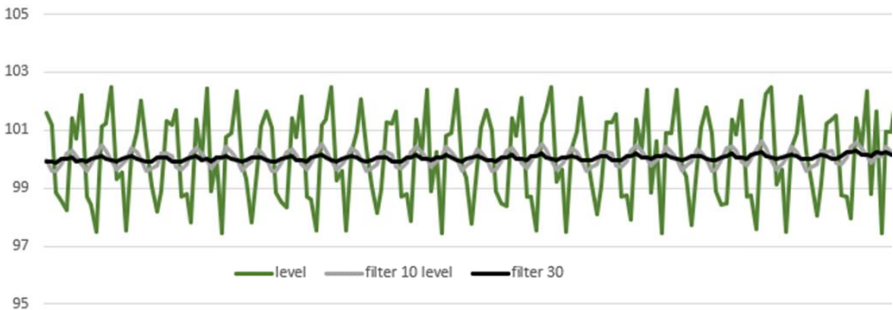
The filter function makes an average of the measurements over the specified time period. This average value is used for the analog output (mA) and for the control system.

If you like the raw data, you must set the value to 0.

Filter time const. in sec.:

20

The graph show how the averaged signal look for three different settings:
Green 0
Grey 10 sec
Black 30 sec



The filter function is valuable in systems with boiling liquids and similar applications where the level fluctuates.

Run in signal

The run-in signal relates to the built-in controller – and is only active when “control” is chosen. When set to “off” the controller runs constantly. When set to “on” the controller only operates when 10-24 VDC is applied to pin 5. This function is needed on a vapor quality control sensor controlling an expansion valve directly. When the compressor is switched off you don’t like the expansion valve to be open.

Run in signal:

OFF

Control/Level mode:

Control

Zero & span cal. function

The sensors has an R button below the M12 plug. This button can be used for calibrating the sensor. This functionality is switched on and off in this field. In set to “on” calibration can be used using the button and if set to “off” this function is disabled. Our recommendation is to set it to “off” to make the sensor “tamper proof” and avoid false calibration just because somebody press the reset like button.

Calibration of the sensor can be done by pressing the button until the yellow LED turn off (approx. 6 sec) and then press it once - just a short click

Zero & span cal. function:

OFF

General control for both level and vapor quality sensors

There are two means to control the valve

- The P or PI controller
- Maximum opening and closing speeds for the valve

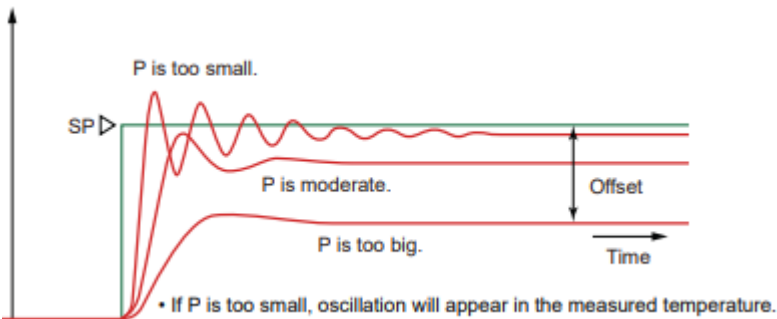
The restrictions interfere and especially the P controller will be limited by the opening speed of the valve and not work as intended.

The sensors has a built-in controller for direct control of a valve. This controller aim for a target called “setpoint level in %” for a level sensor and “degree of dryness “X”” for vapor quality.

The controller is a P or a PI controller. The output (the opening of the valve) will always depend on the deviation/offset between the target and the actual value.

The P controller is moderated by the P-band which is a parameter. The output is divided by the P-band which means that a high P value will make the control slow, and a small value makes the control fast and aggressive. The graph show the functionality of the P controller and how different P values affect the control.

The vapor quality sensor use a PI controller and her A large I value will make the control slow and a small I value make the controller fast. If you like a standard P controller you can set, I=0



Valve speed settings for level sensors

The sensors has settings for maximum valve opening and closing speeds. To allow for a fast startup there are two opening speeds.

Minimum valve opening in %:
☐

Maximum valve opening in %:
☐

Ramp startup % in sec.:
☐

Valve speed open % in sec.:
☐

Valve speed close % in sec.:
☐

The minimum opening is used in systems where you like a steady flow. Can be controlled by the run-in signal which allows you to only open when run-in signal is applied.

The maximum opening is typically used if the valve has to high capacity

Ramp startup is for fast adjustments when the distance between target and actual level is large

Valve speed open is used when close to target

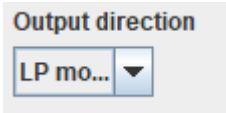
Valve speed close - for closing only

Output direction - LP or HP mode in level sensors

The level sensors in control mode can be used both for controlling valve before and after the vessel it is sitting in. In refrigeration systems this is related to being located either on the low- or high-pressure side.

In LP mode the controller will open a valve sitting before the vessel which means opening the valve if the level is too low.

In HP mode the controller will open a valve sitting after the vessel draining the vessel when opened. This means closing the valve if the level is too low.



Special valve settings for vapor quality settings

Minimum valve opening in %:

0

☐

Maximum valve opening in %:

100

☐

The minimum opening is used in systems where you like a steady flow. Can be controlled by the run-in signal which allows you to only open when run-in signal is applied.

The maximum opening is typically used if the valve has to high capacity

The sensor has settings for maximum valve opening and closing speeds. To allow for a fast startup there are two opening speeds.

Valve speed 1 open % in sec.:

0.2

☐

Valve speed 2 open % in sec.:

0.5

☐

Valve speed close % in sec.:

0.3

☐

Valve speed 1 open is used when close to target

Valve speed 2 is for fast adjustments when the distance between target and actual level is large

Valve speed close - for closing only

The sensor has a special function for startup which can be used for drying out the system or kick start the system. A heat pump need plenty of refrigerant to get started because the evaporator is warm after a stop, whereas a refrigeration can startup more slowly

Dry out function in sec.:

15

☐

Ramp dry out % in sec.:

5

☐

The dry out function should only operate for a short period and then the regular control should take over

The ramp dry out specify how fast the valve will open. In this example the valve will open 5% in 15sec and be 75% open after the dry out function has ended.

General Diagnostic/Calibration settings

Zero calibration and Dry calibration

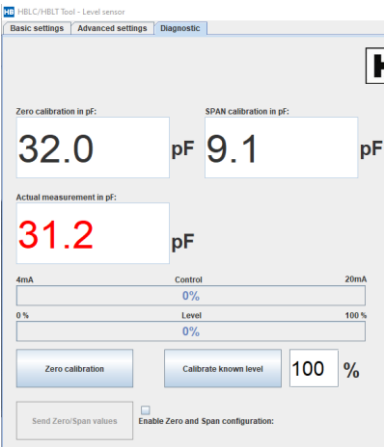
The “Zero calibration in pF” and “Dry calibration in pF” both represent the minimum point in the sensor’s measurement. Actual measurements below this point will not be visible in the mA output but will only be visible as a number in the tool. This means is you see an actual measurement below the zero or dry calibration during normal operation the sensor must be calibrated.

Level sensor

Calibration is done in the tool by clicking the calibration button – this must be done when minimum level is measured for a level sensor

Vapor quality sensor

The calibration for a vapor quality sensor must be done when the gas is dry. This is typically when the expansion valve is closed, and the superheat is high. The calibration is done by clicking on the calibration button.

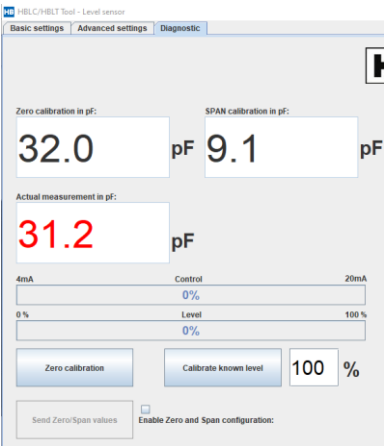


Span and actual measurement, level sensor

The sensor always provide an actual measurement in pF which is the measured capacitance of the mechanical part in the liquid or gas. This number can be read in the tool and is the basis for the analog output (mA on pin 4) the analog output is calculated based on the “Span calibration in pF” and the “Zero calibration in pF”.

The Span is the window for the analog output. This means the output will be 4 mA for measurements equal to and below the Zero calibration value. For measurements up to the Zero calibration + span the output will increase linear. For measurements equal to or above Zero calibration + span the output will be 20 mA.

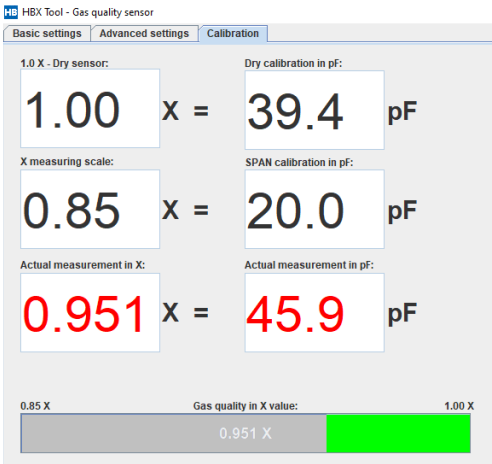
The span calibration value is preset from the factory for the sensor type and the liquid. It will normally be possible to make the sensor more accurate by making a “Zero calibration” and a “Calibration known level” When doing this both the “Zero calibration in pF” and “Span calibration in pF” will be changed.



Span, actual measurement, X measurement, HBX sensor

The sensor always provide an actual measurement in pF which is the measured capacitance of the mechanical part in the liquid or gas. This number can be read in the tool and is the basis for the analog output (mA on pin 4) the analog output is calculated based on the “Span calibration in pF” and the “Dry calibration in pF”.

The Span is the window for the analog output. This means the output will be 4 mA for measurements equal to and below the dry calibration value. For measurements up to the dry calibration + span the output will increase linear. For measurements equal to or above dry calibration + span the output will be 20 mA.



The span calibration value is preset from the factory for the sensor type and the liquid. Especially for the vapor quality sensor, the Span should not be changed because it is related to the calculation of the gas quality value called “Actual measurement in X” . This value is the vol % of liquid in the gas, and it is calculated based on the X measuring scale and the Span calibration in combination.

If the Span and X measuring scale is changed the sensor can still be used for evaporator control but the “Actual measurement in X” does not represent the vol % of liquid in the gas.