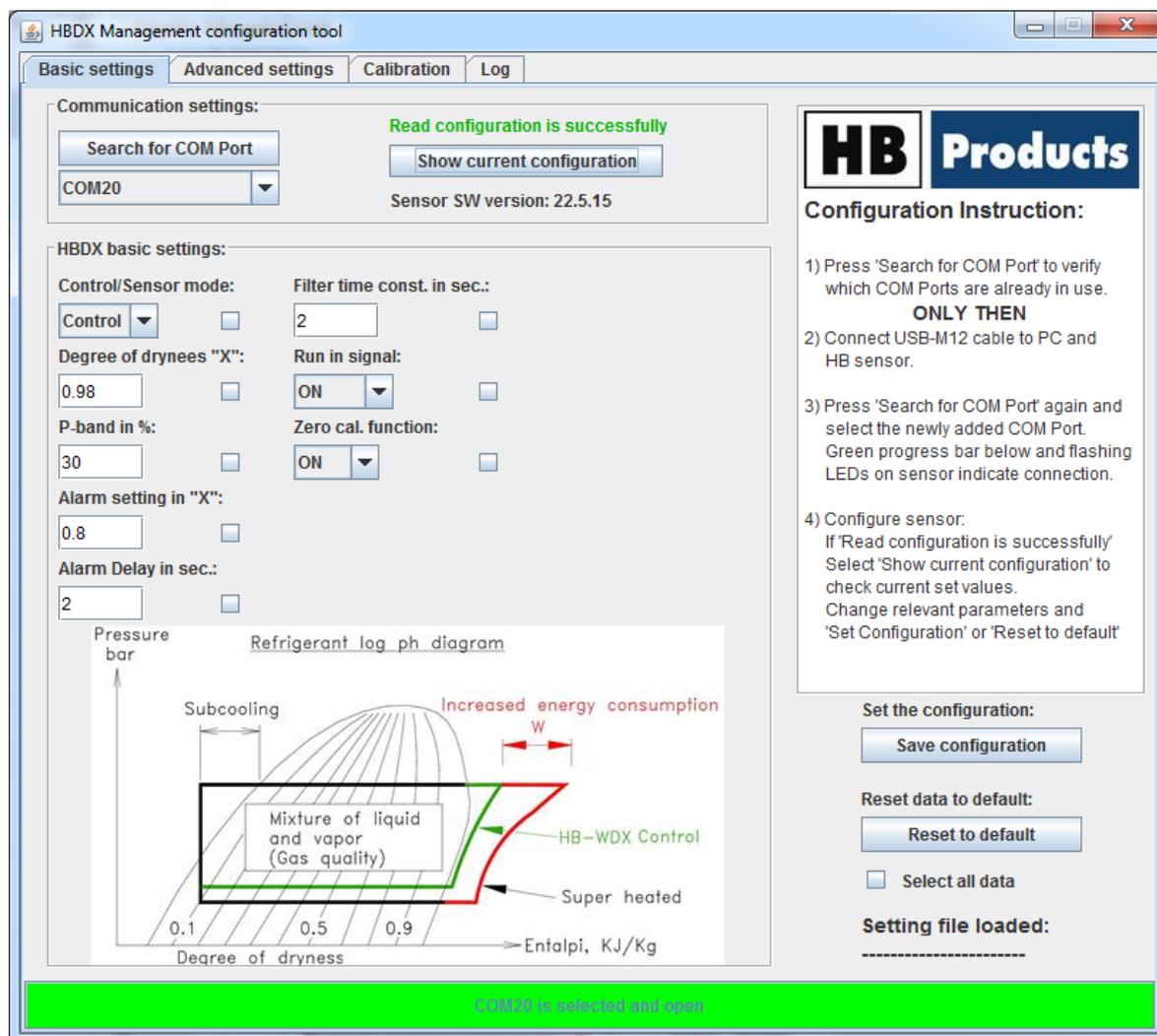


# Configuration Manual

## HBDX – SENSOR & REGULATOR

For gas quality measurement and regulation in industrial refrigeration systems



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## Safety Instructions

**CAUTION!** Always read the operational guidelines before commencing work! Heed all warnings to the letter! Installation of HBDX 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.

	<p><b>CAUTION!</b> Refers to a possible limitation of functionality or risk in usage.</p> <p><b>NOTE!</b> Contains important additional information about the product and provides further tips.</p> <p>The person responsible for operation must commit to adhering to all the legislative requirements, preventing accidents, and doing everything so as to avoid damage to people and materials.</p>
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**Intended use, terms of use.** The purpose of the HBDX sensor and regulator is refrigerant measurement and regulation. If the HBDX 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.

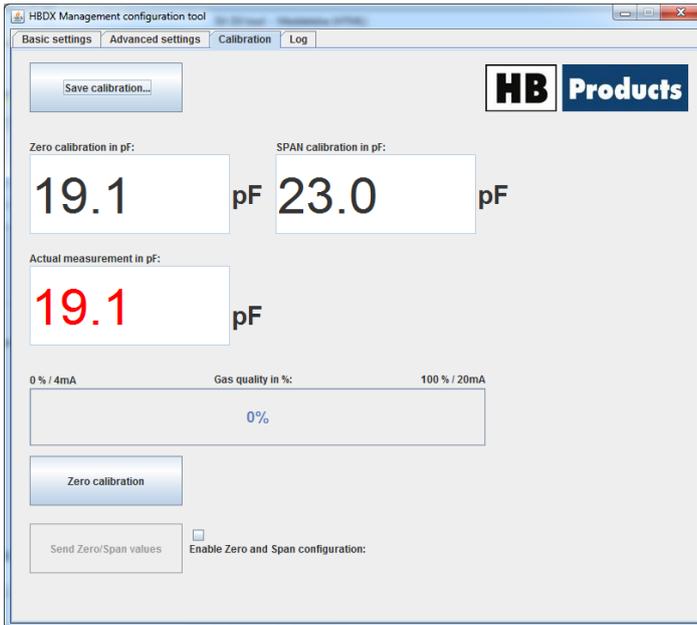
**Preventing collateral damage:** Make sure that qualified personnel assess any errors and take necessary precautions before attempting to make replacements or repairs so as to avoid collateral damage.

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

## Start-up and 0% Calibration

For setup, use the provided black programming cable as well as the PC-based tool, which can be downloaded from [www.hbproducts.dk](http://www.hbproducts.dk).

During the first start-up, select the “Diagnostic” menu, where you can calibrate the sensor and program SPAN. 0% calibration is carried out to program the sensor to the system’s 0 point. SPAN is set to indicate the measurement area, which depends on the gas and liquid speed (must be 10...30 m/s), the sensor’s construction, as well as the sensor’s design (In-Line or Rod).



### 0 % calibration:

1. Start the compressor with the expansion valve closed, i.e. only with gas in the pipeline.
2. Check “Enable Zero and Span Configuration”
3. When the measurement is stable (indicated by a stable gas quality display in the bar graph), activate the “Zero calibration” button. The value displayed in “Actual measurement” is automatically moved to “Zero calibration”.
4. Press “Save diagnostic” to save the sensor data.

### Setting up SPAN:

SPAN is set according to the application and is set to:

Application	Inline type	Rod type
Evaporator Control	5-10 pF (10 pF during start-up)	10-50 pF (50 pF during start-up)
Re-circulation	10-20 pF (20 pF during start-up)	50-100 pF (100 pF during start-up)

If SUPERHEAT is too low at setpoint X=0.98, the SPAN value must be lowered.



Inline type

Rod type

## Setup Options and Factory Settings:

The sensor is delivered with the following installation options and factory settings: The sensor can be set up to function as a sensor, i.e. to indicate 4..20 mA (Sensor mode) or to regulate the valve directly (Control mode). If it should only function as a sensor, set the sensor mode to “sensor”. Similarly, you have the option to set the alarm limits and filter function. If you do not want to use the alarm limits, set “Alarm” to 100%. The filter function averages the measurement so that the output signal does not fluctuate/pulsate excessively.

### Basic Settings

Setup	Setup options	Factory settings	Start-up parameters	Control mode	Sensor mode
Sensor mode	Sensor/Control	Sensor	X		
Desired degree of dryness “X”	0...0.99	0.98		X	
Proportional band	0...100 %	30 %		X	
Alarm degree of dryness “X”	0...1.0	0.8		X	X
Time delay - alarm	0...600 s.	20 s		X	X
Filter function	0...200 s.	2 s		X	X
Decentralised activation (Run in signal)	ON/OFF	ON	X		
Zero cal. function	ON/OFF	ON	X		

### Advanced Settings

Setup	Setup options	Factory settings	Start-up parameters	Control mode	Sensor mode
Alarm – contact function	NO/NC	NO	X		
Start op – ramp	0...100 % / sec	2 %		X	
Valve – degree of opening	0.25..10% / sec	5 %		X	
Valve – degree of closure	0.25..10% / sec	10 %		X	
Valve – minimum degree of opening	0..50 %	0 %		X	
Valve – maximum degree of opening	25...100 %	100 %		X	

### Stepper Motor Settings

Setup	Setup options	Factory settings	Start-up parameters		
Stepper motor step	25...5000	480	X		
Stepper motor speed in mS	2...40 m/s	20	X		
Home recall time in hours	0...255 hours	24	X		
Stepper motor phase current	0...750 mA	450 mA	X		
Stepper motor holding current	0...250 mA	100 mA	X		

### Data Logger Settings

Setup	Setup options	Factory settings
Select values to display	Selected / Not selected	Yes@ Values in % or pF, Yes@Show gas alarms log, Yes@Show gas level logs
Select Log interval	1s	1s, 30s, 1m, 5m 10m, 30m, 1h

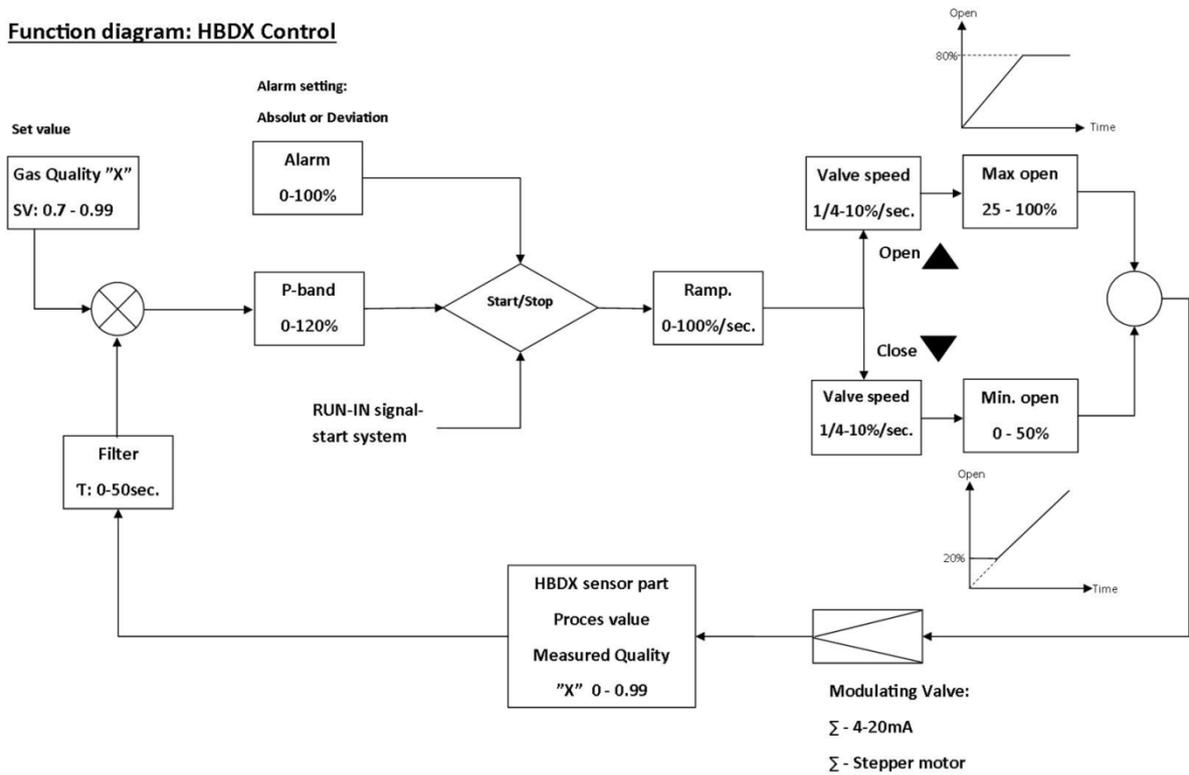


**CAUTION!** Factory settings do not guarantee safe operation since the configuration parameters depend on the system design

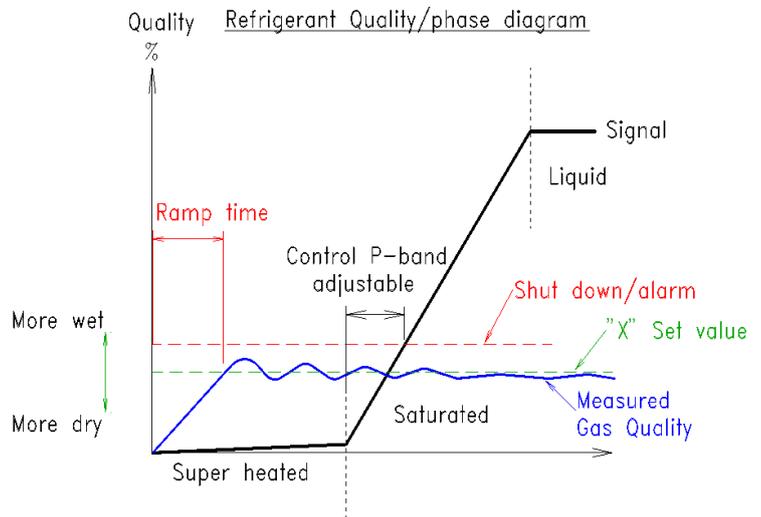
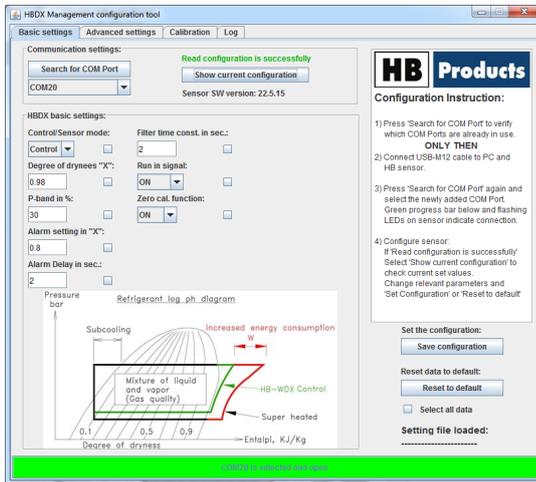
**Procedure – setup and start-up of valve regulation:**

- 1.) Setup the “start-up parameters” suitable for the system design
- 2.) If the valve is over-dimensioned, it can be damped if necessary. Damping can be done by limiting the valve’s degree of opening or closure and its minimum and maximum degree of opening.
- 3.) Start with the factory settings for alarm
- 4.) After setting up the above and calibrating and inputting the measurement area (SPAN), start the system.
- 5.) Note that it can take 10-20 minutes before the system is stable and regulated optimally.
- 6.) To begin with, select a P-band of 30%. A large P-band leads to slow regulation. A small P-band leads to fast regulation.
- 7.) When you are done, press “Save Configuration” to archive the sensor parameters in the sensor.
- 8.) If SUPERHEAT is too low at setpoint X=0.98, the SPAN value must be lowered.

**Function diagram: HBDX Control**

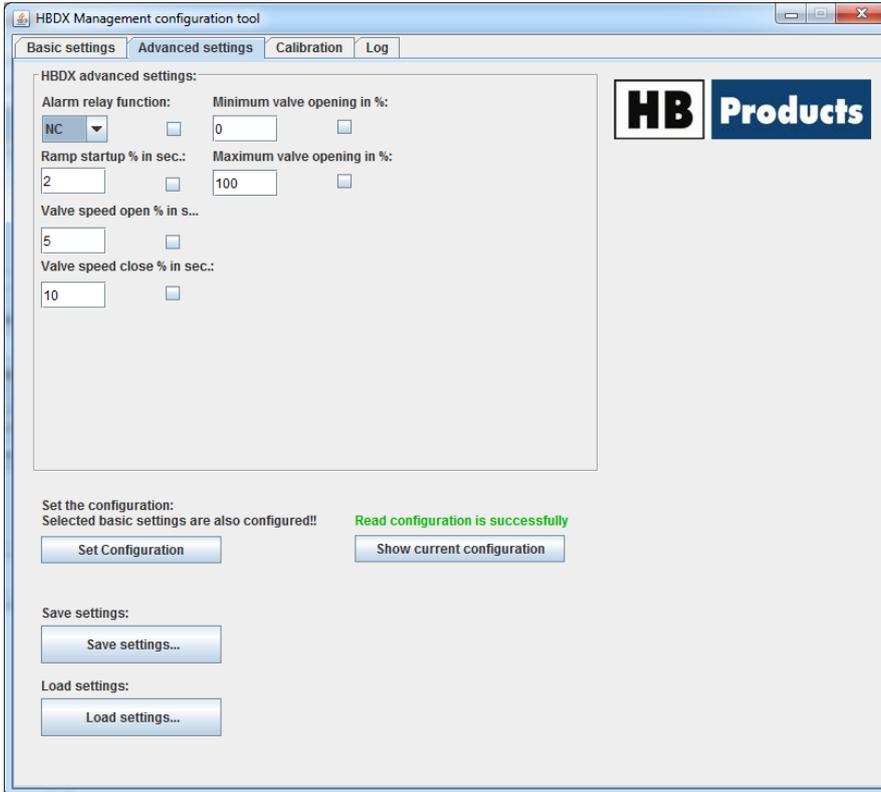


## Basic Settings



Setup options	Description of the setup options
Control/Level mode	Control/level mode: This is where you select whether the sensor/system should measure or regulate. Level mode = measurement and control mode = regulation (default).
Setpoint level in %	Desired level, degree of dryness "X": Indicates the dryness level used to regulate the system.
P-band in %	Proportional band: The regulation area that describes how much the valve should open depending on the deviation from the desired level. For example, if the proportional band is set to 10%, a liquid level that is 5% below leads to the valve opening 50%, and if the liquid level is 10% below, the valve opens 100%. A small proportional band leads to a fast responding system, and a large proportional band leads to a steadily responding system.
Alarm setting in %	Alarm in %: Indicates the percent level of the degree of dryness for which the sensor can/must trigger an alarm.
Alarm delay in sec	Time delay - alarm The time delay from when the dryness factor falls/increases to under/over the selected alarm, indicated in seconds.
Filter time const. in sec.	Filter function: Averages out the measurements so that control can be carried out based on an average measurement in a programmable time (in seconds). Is increased if there are small fluctuations in the measurement, which result in unstable regulation.
Run in signal	Decentralised activation: with this function it is possible to activate the regulation from the central control. If this function is not required, it must be set to OFF, otherwise the sensor will not regulate (power LED must flash when the run-in signal is active or if this function is deactivated).
Zero & span cal. function	Calibration function: ON in case calibration of the sensor is permitted. After start-up and possibly after the first calibration, the tool can be connected and deactivated.

## Advanced Settings



The screenshot shows the 'Advanced settings' tab of the 'HBDX Management configuration tool'. The settings are as follows:

- Alarm relay function:** Set to 'NC' (Normally Closed).
- Minimum valve opening in %:** Set to 0.
- Ramp startup % in sec.:** Set to 2.
- Maximum valve opening in %:** Set to 100.
- Valve speed open % in s...:** Set to 5.
- Valve speed close % in sec.:** Set to 10.

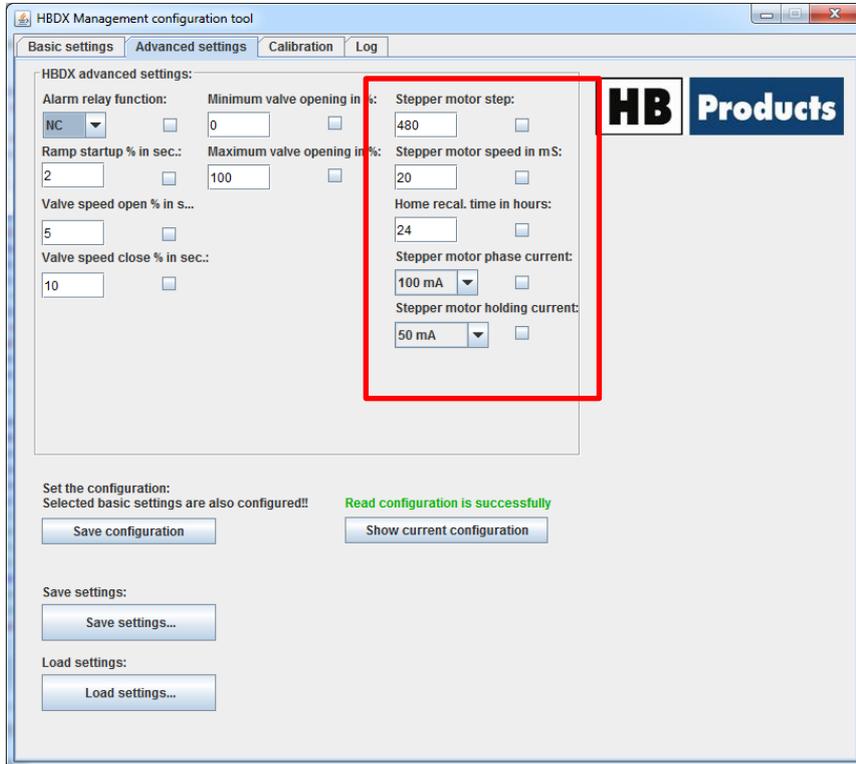
Below the settings, there are status messages and control buttons:

- Message: "Set the configuration: Selected basic settings are also configured!!"
- Message: "Read configuration is successfully"
- Buttons: "Set Configuration", "Show current configuration", "Save settings...", "Load settings..."

Setup options	Description of the setup options
Alarm relay function	Alarm relay function: Here the relay function is specified. It depends on the control – NO or NC (normally open/normally closed).
Ramp function % in sec:	Since large fluctuations can occur in the process parameters during process start-up, it is possible to create a ramp function (only at start-up during activation of RUN-IN). When it is set to "0", the function is not active. Can be set in the area 0.1..1/1...100 seconds.
Valve speed open % in s...	Opening speed for the valve – [% in seconds]: This function is integrated in some valves, but since it does not exist in all of them, you have the option to damp the valve. Can be set in the area 0.1..1/1...100 seconds.
Valve speed close % in s...	Valve closure speed – [% in seconds]: This function is integrated in some valves, but since it does not exist in all of them, you have the option to damp the valve. Can be set in the area 0.1..1/1...100 seconds.
Minimum valve opening in %	Minimum degree of opening for the valve: Here you select the minimum valve opening during normal operation. Can be set in the area 0...50%.
Maximum valve opening in %	Maximum degree of opening for the valve: Here you select the maximum valve opening during normal operation. Can be set in the area 25...100%.

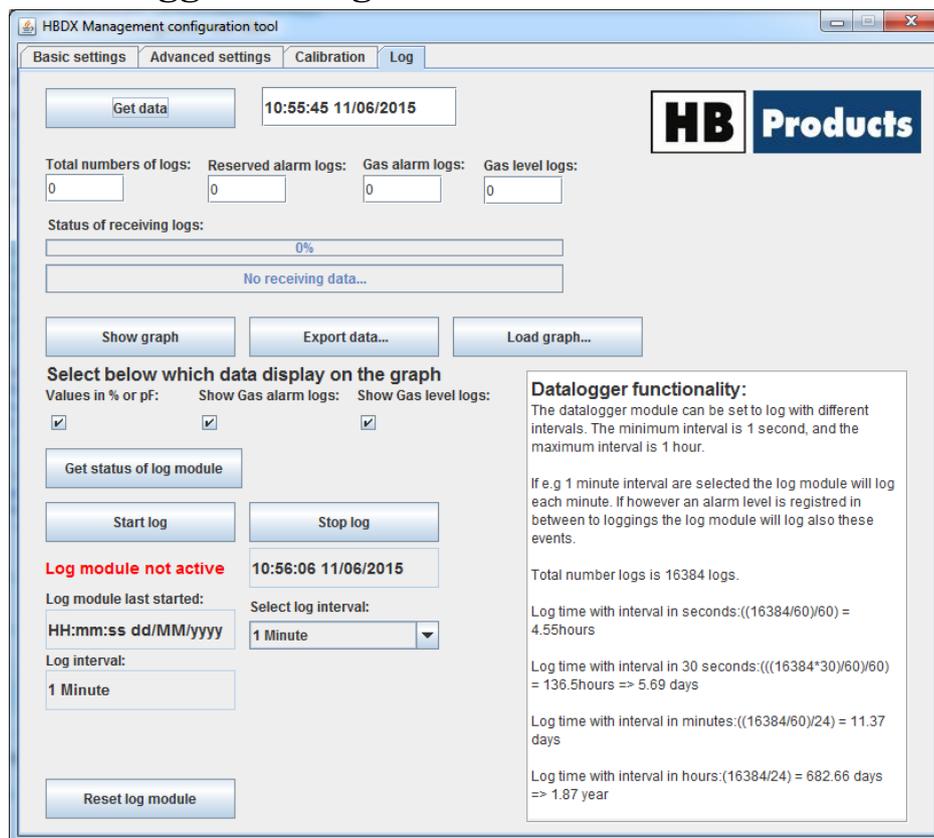
## Setup for Stepper Motor

If the HBDX is connected to a stepper motor, the following values must be input under advanced settings:



Setup options	Description of the setup options
Stepper motor step	Step motor step: Here, the step motor's maximum number of steps is set. This can be found in the valve's technical data. This value can be set in the area 25...5000 steps.
Stepper motor speed	Step motor speed: Here, the step motor speed is input in mm/s. This can be found in the valve's technical data. This value can be set in the area 2...40 m/s.
Home recal. time in hours	Return time to neutral position: Here, you can set the time that specifies how often the valve should recalibrate itself. This value can be set to 0...255 hours.
Stepper motor phase current	Step motor power usage: Here, the step motor's power usage is set. This can be found in the valve's technical data. This value can be set to 0...750 mA.
Stepper motor holding current	Step motor holding current: Here, the step motor's holding current is set. This can be found in the valve's technical data. This value can be set to 0...250 mA.

## Data Logger Configuration:



It is possible to connect data logging to the sensor. The data logger can log up to 16,000 sets of data. When this value is surpassed, the oldest data is deleted. The data logger can be set up with any set of data that you would like logged and with the desired time for data logging: 1s, 30s, 1m, 5m 10m, 30m, 1h

### Select values to display:

#### Select the data that should be logged:

- Values in % or pF:
- Show gas alarms log:
- Show gas level logs:

#### Select Log interval:

**Select log interval:** Here you choose how often a set of data should be saved in the log. You have the following options: 1s, 30s, 1m, 5m 10m, 30m, 1h. All alarms are logged for each second regardless of the chosen interval.

When these are selected, the log can be activated by pressing “start log” and stopped by pressing “stop log”. It is possible to display the log directly in the Tool, and it is also possible to export the data to Excel.

Reset log module allows you to reset the data log and start over.

By default, the Y-graph and the X-graph are displayed in “zero” and “span” values. However, the sensor is able to show values over 100% since the “span” area is a zoomed area.