



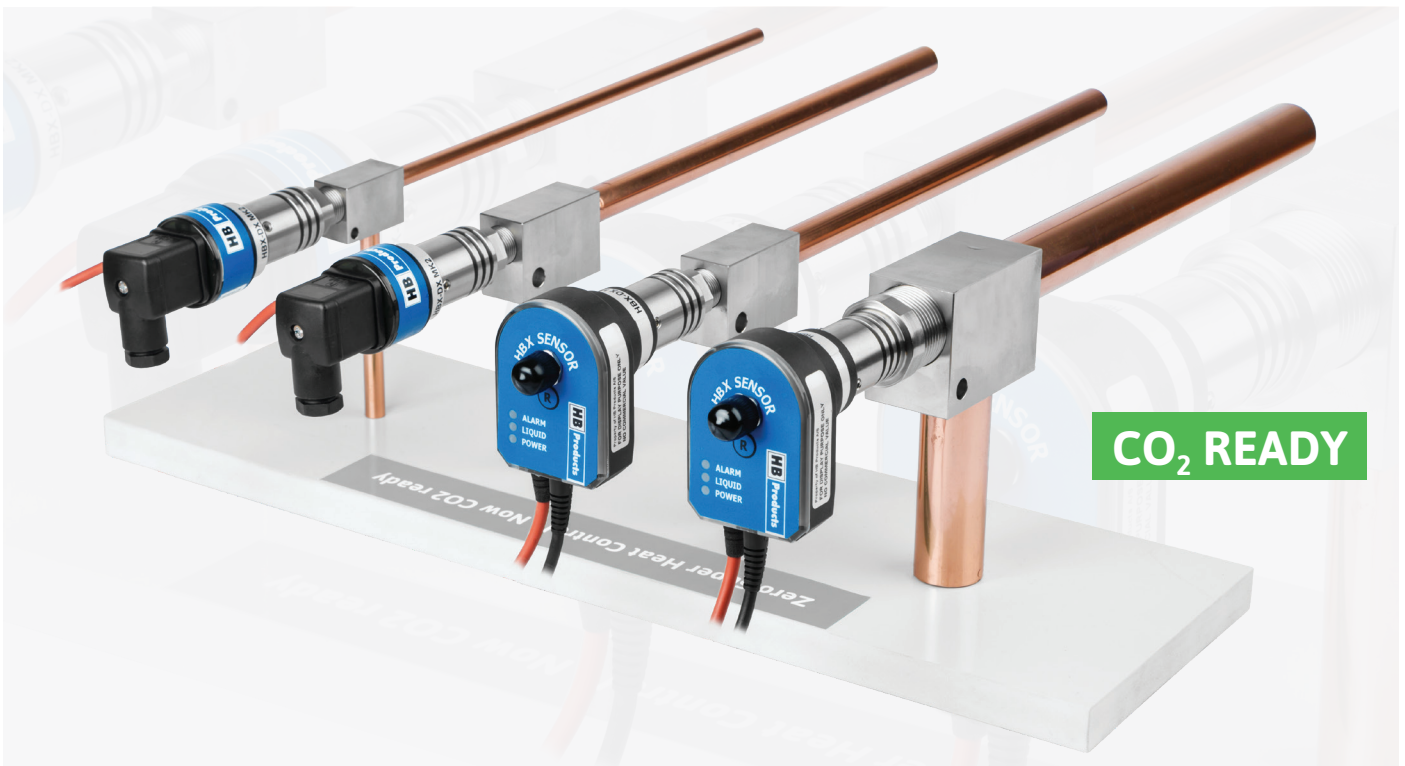
Products

WE INCREASE UPTIME,
SAFETY AND EFFICIENCY



Zero Superheat Control → GWP↓

Optimization of key processes in refrigeration systems
New Sensor Technology Controls the Phase of Refrigerant as Vapor Quality



Savings:

Energy >20%

Installation >30%

Maintenance >30%

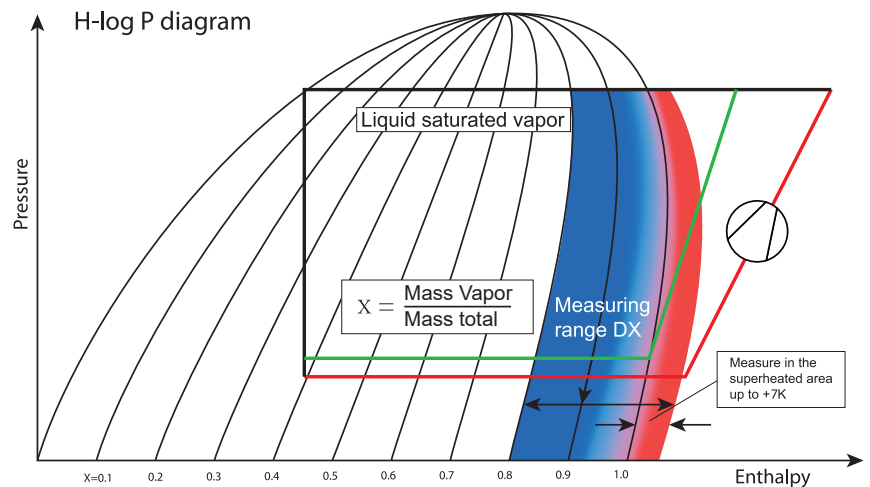
- Semi flooded evaporator operation for optimum heat transfer at all loads
- Higher evaporation temperature and suction pressure
- Lower discharge temperature
- Optimum performance in all climates
- Compressor protection
- Smaller refrigerant charge compared to flooded systems
- Simple DX System design

HBX-Vapor-Quality Patented Sensor technology

Facts:

With a revolutionary, new and patented technology we are now ready to solve one of the main challenges when using CO₂ refrigerant. By nature CO₂ is highly dynamic and reacts strongly to even small changes in evaporator load.

This, in conjunction with Superheat control causes unstable operation.



HBX Closed loop Evaporator Control Solution reduces Energy Consumption and increases Efficiency

Semi Flooded Operation & Zero Superheat

With an increased focus on the use of natural refrigerants, HB Products has developed a new and effective evaporator control system to control the capacity of all kinds of evaporators in cooling- and heat pump systems.

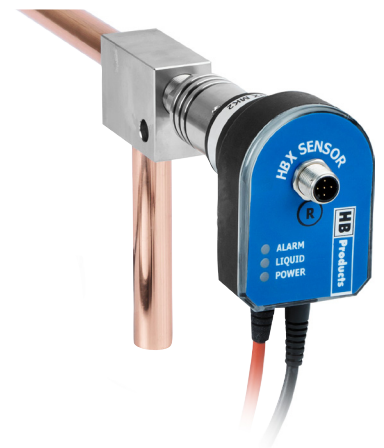
The control system is available in different versions, with or without control function.

The controller is integrated in the sensor and is connected directly to an electronic expansion valve, which will then function as a closed loop control system.

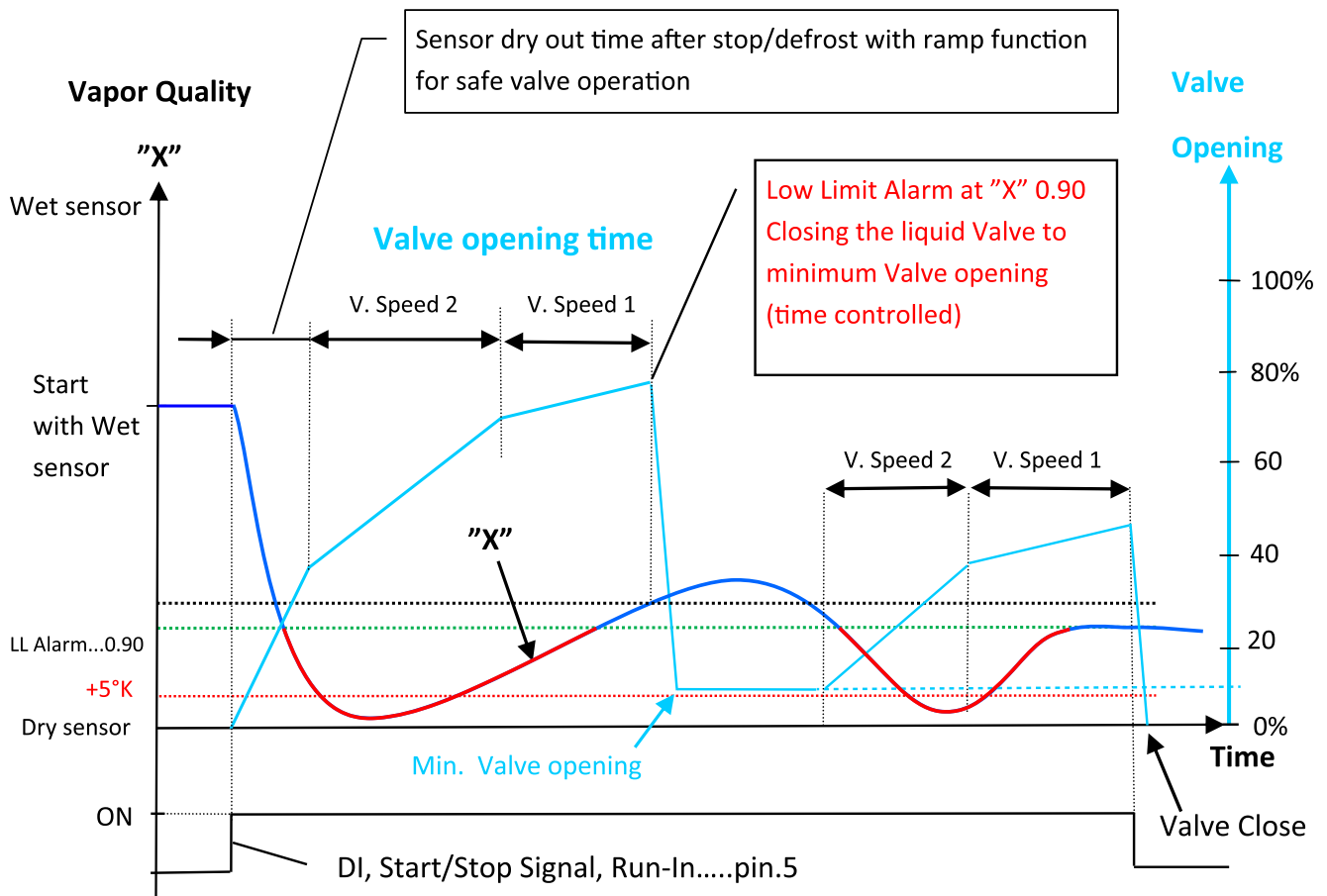
The system comes with all necessary IN/OUTPUT signals for start/stop and output signals for data logging.

The sensor is available in two basic variants:

1. HBX-DX-XXX-CU; Vapor Quality measurement and PI control with integrated stepper motor driver or PWM control or modulating 4-20mA for electronic expansion valves.
2. HBX-DX-CU/T; only Vapor Quality measurement with temperature/pressure compensation.



Control pattern



The illustration above shows control pattern with Sensor Dry Out time during start-up and after defrost. Dry out time is adjustable with ramp function for safe opening of the liquid valve. (Controls the valve opening time).

The sensor has integrated Advanced Control which enables it to control all types of evaporators. Opening and closing times of Expansion Valve can be adjustable from 0.1 to 10% / sec. Start-up with ramp function and sensor dry out ensures a secure start-up. The low limit safety alarm will close the liquid valve to minimum opening.

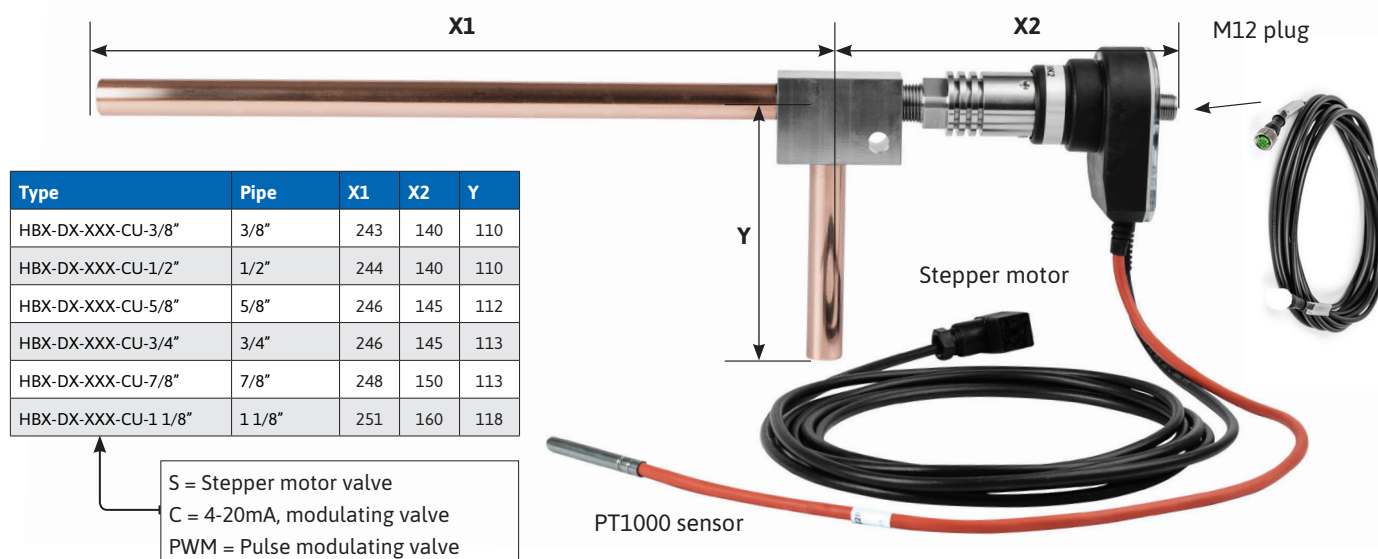
An external start and stop function from a master control system is required when the sensor is used as controller for liquid valve opening.

Note: During start-up or after defrost there will be liquid droplets on the sensor part from the condensed vapor. These droplets will affect the sensor and give a high mA output. The alarm can also be activated if the alarm delay is too short. This phenomenon should be managed during start-up. We recommend drying out the sensor during start-up by opening the liquid valve for xx sec. and adding refrigerant to the evaporator. This ensures that the vaporized gas dries the sensor before starting a safe and reliable control from a dry sensor.

The increase of pressure will also condense some of the refrigerant vapor which then will become wet and thereby affects the sensor briefly until the system is in balance.

Options and further explanations can be found in the start-up guide which can be downloaded from our website: www.hbproducts.dk

HBX Closed loop evaporator control version

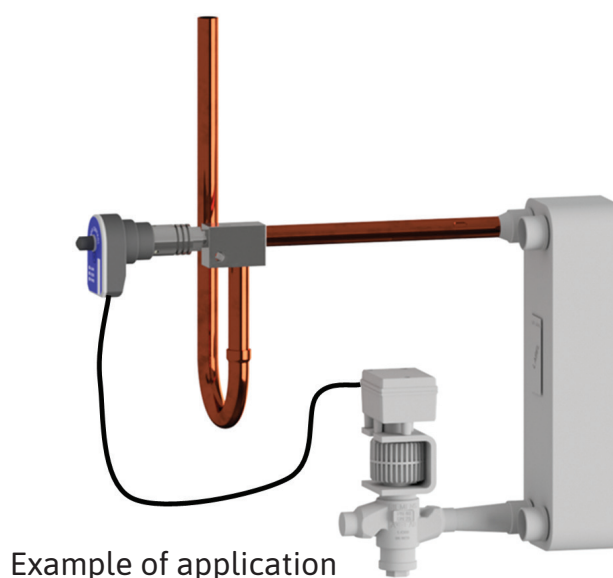


Type	Pipe	X1	X2	Y
HBX-DX-XXX-CU-3/8"	3/8"	243	140	110
HBX-DX-XXX-CU-1/2"	1/2"	244	140	110
HBX-DX-XXX-CU-5/8"	5/8"	246	145	112
HBX-DX-XXX-CU-3/4"	3/4"	246	145	113
HBX-DX-XXX-CU-7/8"	7/8"	248	150	113
HBX-DX-XXX-CU-1 1/8"	1 1/8"	251	160	118

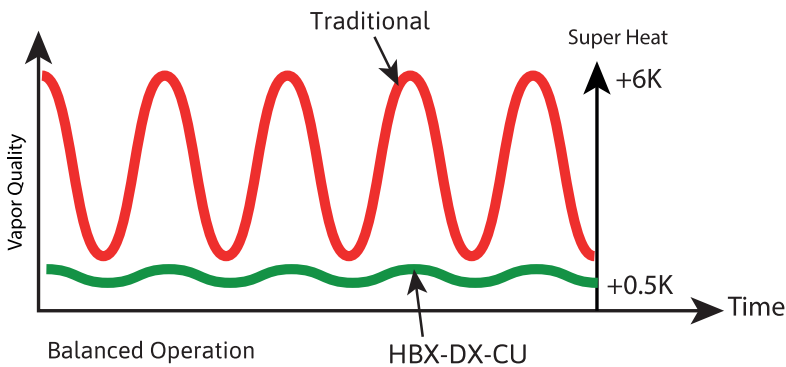
HBX-DX Vapor Quality Sensor/Control is a new sensor solution for optimizing Evaporator Control to **Zero Superheat**. The "X"-sensor measures the phase of refrigerant and Vapor Quality as degree of dryness. The electronical part is fully separated from the sensor's mechanical part and can be replaced without interference with the pressure side. The sensor is installed in the outlet of the evaporator, as part of the suction line. The soldering connections, fittings and pipes are all made of **high pressure copper type K65** in CU-version and in stainless steel for SS-version. Setting for commonly used refrigerant types, CO₂, Hydrocarbons, HFO's and HFC's is possible via special software.

Note: Hydrocarbons are flammable and usually require cULus, ATEX or IECEx approval.

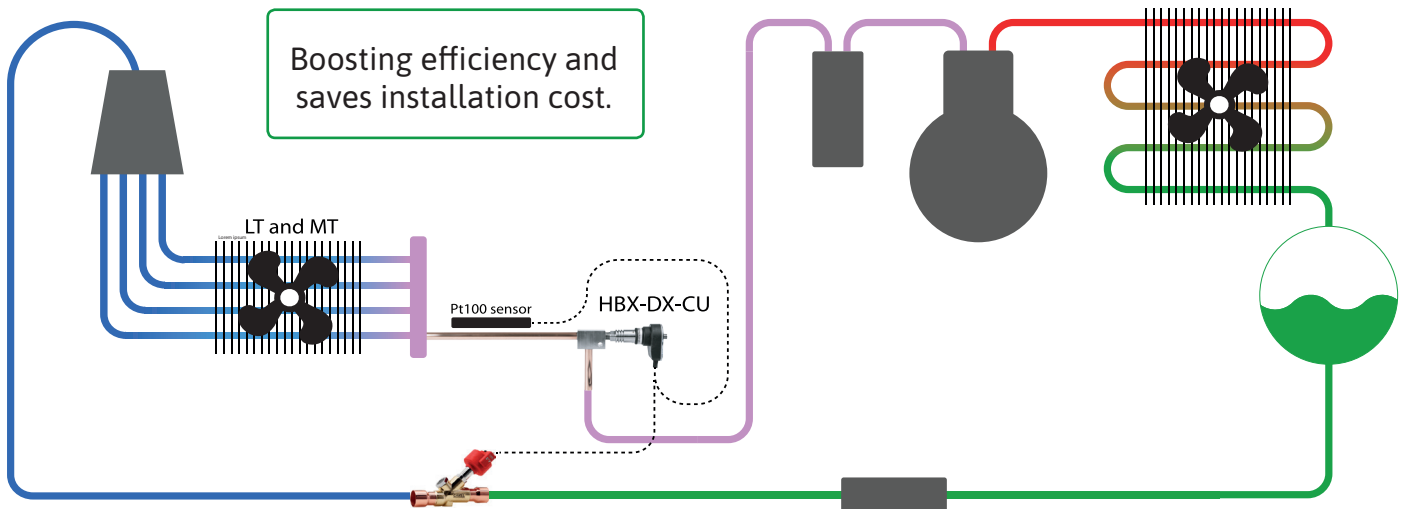
Voltage	24V AC/DC
Current consumption	250mA with heater
Electronic connection	M12, 5p
Output signal "X" 0.8 to 1.0	4-20mA/0-10V
Valve output, S or C or PWM	Stepper motor, mA, PWM
Ambient temperature	-40....+50°C
Refrigerant temperature	-55....+50°C
Vibration	IEC 68-2-6 (4G)
Pressure	Max 120bar
Material	CU K65, SS304, PA6
EMC	EN 61000-2
Size	See drawing above



HBX Closed loop evaporator control version

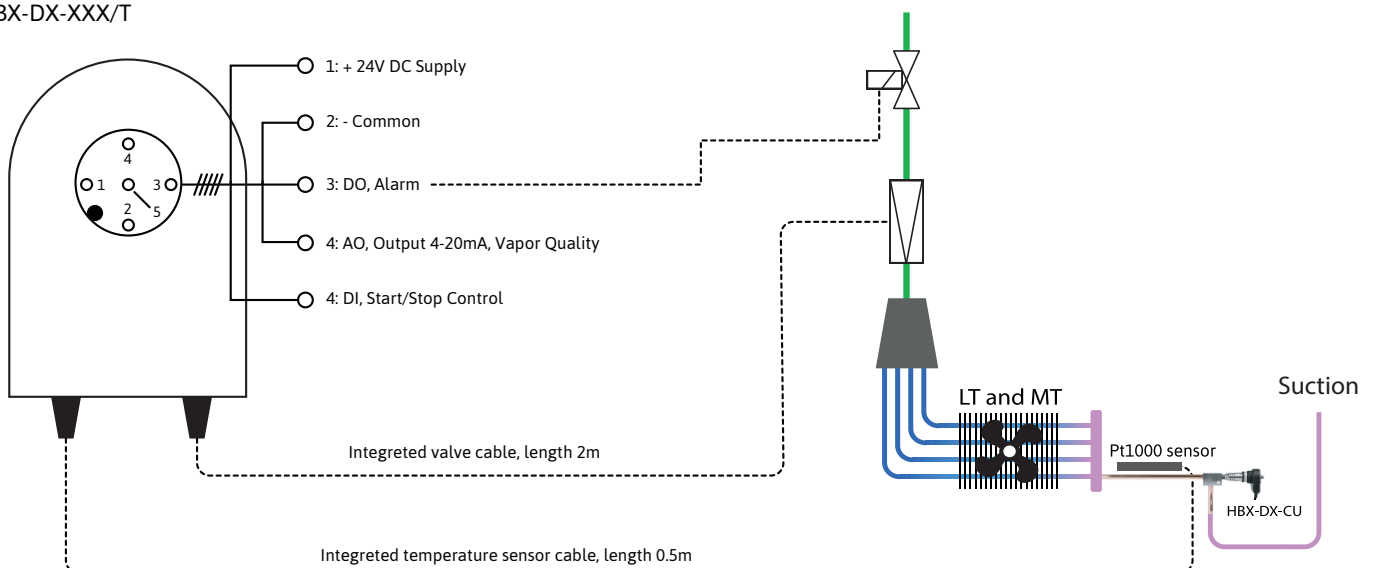


This graph shows a typical image of the difference between Superheat and Vapor Quality Control. The Vapor Quality/ Dryness Control gives a more balanced system without the delay and influence of temperature and pressure measurements as used in Superheat control.

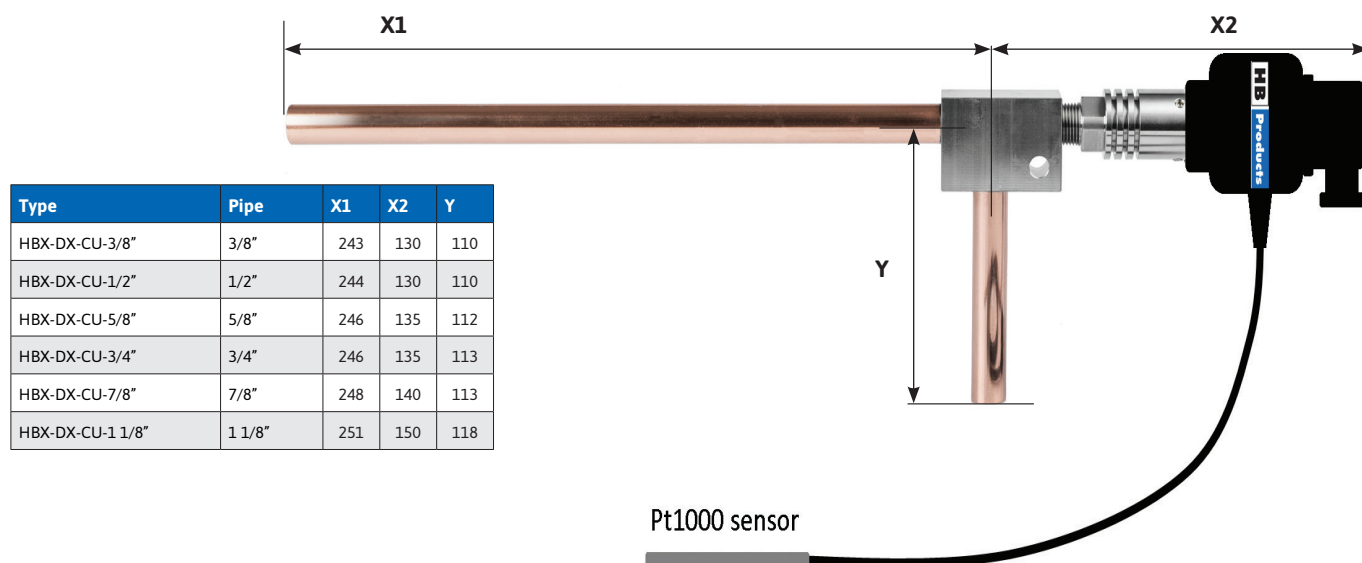


With Control function:

HBX-DX-XXX/T



HBX standard version



HBX-DX Vapor Quality Sensor/Control is a new sensor solution for optimizing Evaporator Control to Zero Superheat.

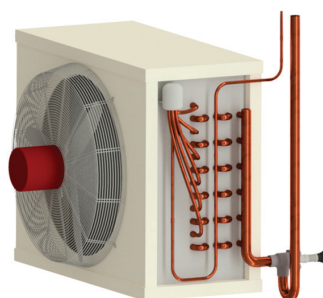
The "X"-sensor measures the phase of refrigerant and Vapor Quality as degree of dryness. The electronical part is fully separated from the sensor's mechanical part and can be replaced without interference with the pressure side. The sensor is installed in the outlet of the evaporator, as part of the suction line. The soldering connections, fittings and pipes are all made of **high pressure copper type K65** in CU-version and in stainless steel for SS-version. Setting for commonly used refrigerant types, CO₂, Hydrocarbons, HFO's and HFC's is possible via special software.

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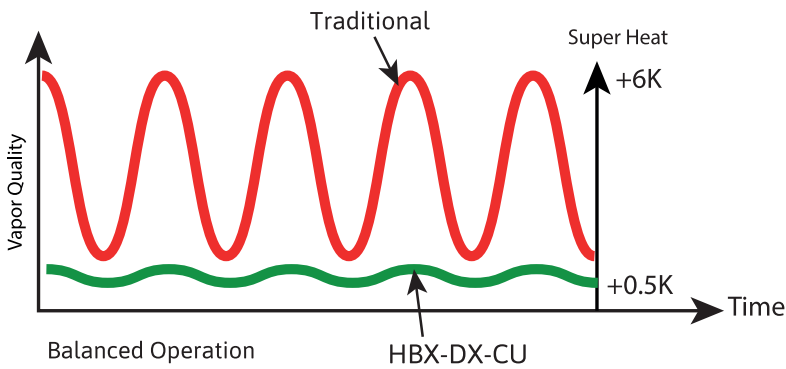
Voltage	24V AC/DC
Current consumption	250mA with heater
Electronic connection	DIN 43650, 3p
Output signal "X" 0.8 to 1.0	4-20mA/0-10V
Ambient temperature	-40....+50°C
Refrigerant temperature	-55....+50°C
Vibration	IEC 68-2-6 (4G)
Pressure	Max 120bar
Material	CU K65, SS304, PA6
EMC	EN 61000-2
Size	See drawing

HBX-DX-CU; only Vapor Quality measurement with temperature/pressure compensation.

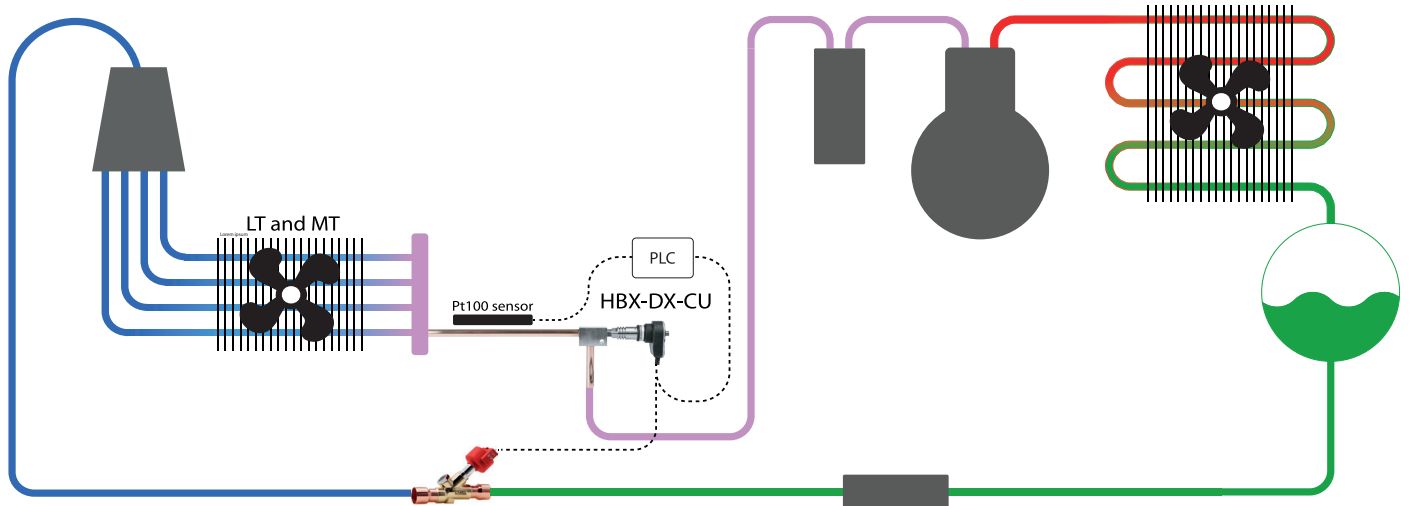
The HBX-DX-CU sensor can also be used to protect the compressor against liquid hammering, by changing the function to CP (compressor protection) in the free software "HB-TOOL".



HBX standard version

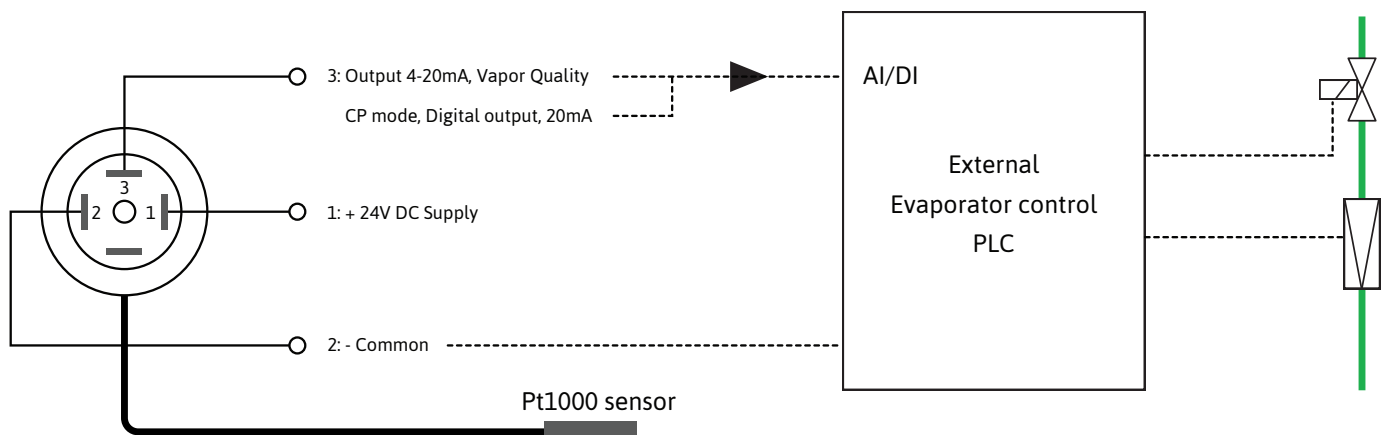


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Electrical connection

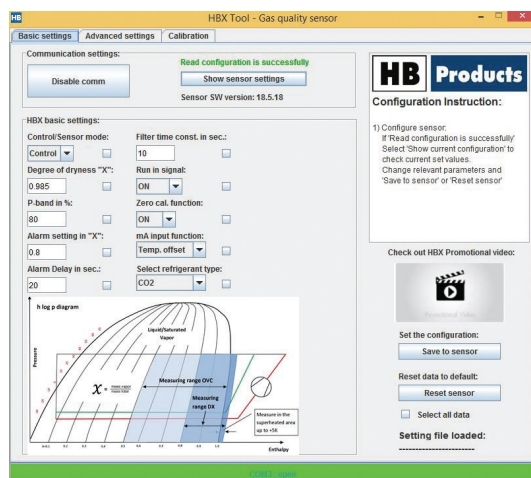
Only sensor with 4-20 mA signal:
HBX-DX-CU



HB-TOOL, SENSOR SETTINGS

Basic settings:

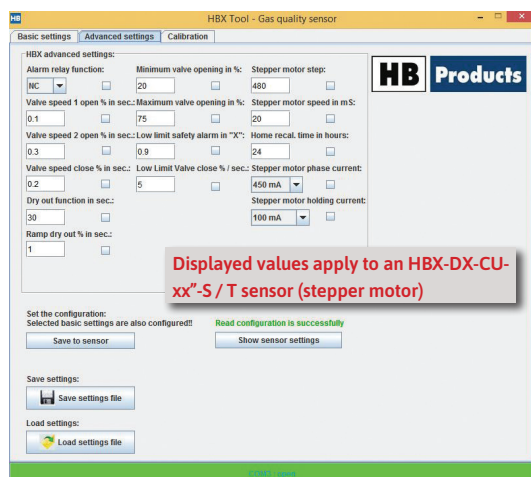
- Here you can choose "sensor", "control mode", "alarm settings" and "filter time range" from 1 to 120 sec. Default setting is 10 sec.
- Control mode settings: "Degree of dryness = set value", "P-band control", the expansion valve opens as a function of a deviation from the desired set value. The opening degree depends on the P-band setting and opening / closing times of the expansion valve.
- "Run in signal" (digital input pin 5) is used as an external start and stop signal when "ON" is selected.
- "Zero cal. Function": Choose "ON" if you want to use the push button "R" for zero calibration.
- "mA input function", choose "temp. offset" or "remote function".



Advanced settings:

- "Alarm output", NO or NC, default is normally closed "NC" (Fail safe function).
- "Valve speed 1", is for normal operation.
- "Valve speed 2", is used during start-up (fast opening).
- "Dry-out function" is used during start-up, default value is set to 30 sec.
- "Ramp dry-out opening" controls the valve opening.
- "Valve opening" could be limited to min. and max opening.
- "Low limit safety alarm", closes the valve to min. opening.
- "Low Limit Valve close in %/sec" is time setting for closing ramp.

Stepper motor setting is according to the valve type. (Setting for other valve type as PWM will automatically come up when this sensor type is connected to the HB-TOOL).



Calibration:

- Enable Dry & Span configuration
- Type in "X" measuring scale. Default value is 0.9
- Type in "Span calibration value", acc. to sensor size
- Save the data by activate the "push button"
- Zero calibration should be performed with a dry sensor during start-up.

"Upper Bargraph" shows the dryness as an "X" value "Lower Bargraph" shows the control output in % (only functioning in control mode)

Note: A safe way to obtain a dry sensor is to calibrate the sensor during operation when the superheat indicates higher than 15K.

