HB Products WE INCREASE UPTIME, SAFETY AND EFFICIENCY

Instruction manual
HBCP – Compressor Protection
For liquid hammer protection of compressors

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Safety Instructions

CAUTION! Read the instruction manual before commencing work! Heed all warnings to the letter! Installation of HBCP 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 products, 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 particularly the warnings, must always be read and adhered to.

	CAUTION! Refers to a possible limitation of functionality or risk of use. 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 so as to avoid damage to people and materials.

Intended use, conditions of use. The HBCP sensor and controller is made to measure and control refrigerant. If HBCP is to be used in a different way or with another purpose, 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 faults and take necessary precautions before attempting to make replacements or reparations, so as to avoid collateral damage.

Disposal instructions: HBCP is built so that the modules can easily be removed and sorted for disposal.

Introduction

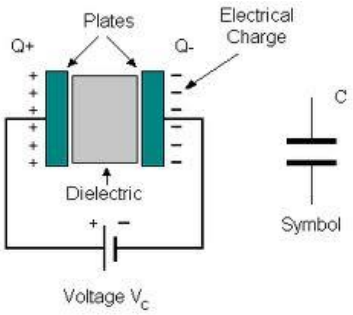
HBCP is an intelligent sensor with a built-in microprocessor. It is designed to detect liquid hammer in industrial refrigeration systems.

The sensor's sensitivity is configurable based on the capacitive measurement principle, and it can react to just a few single drops.

Measurement Principle

The sensor is a capacitive sensor. The capacitive measurement principle is based on the electrical properties in the proximity of a capacitor. A capacitor is an electrical component that is capable of building and sustaining an electrical charge

Principally, a capacitor consists of two plates. When a charge is applied to a plate, the other plate will be charged with the opposite polarity and retain the charge until it has been grounded. The magnitude of the charge (the capacitance) that can be generated depends, among other things, on what is found between the plates. The substance between the plates is referred to as a dielectric.



The conductivity of a material can vary depending on temperature, chemical composition, and the homogeneity of the material, and therefore it can sometimes require a different factory calibration.

Rather than two plates, the sensor for level measurement is shaped as a cylindrical rod. When liquid covers the sensor, the measured capacity is changes.

HB Products sensors are calibrated so that they differentiate between conductive and non-conductive liquids.
In refrigeration systems, the oil and liquid CO_2 are not regarded as conductive fluids, whereas refrigerants such as ammonia, HFCs, and brine are regarded as conductive.

Design

The sensor consists of a mechanical part and an electronic part. These can easily be separated with a union nut. The electronic part is designed in accordance with IP65 waterproof rating and to withstand vibrations. The mechanical parts have been produced with AISI304/PTFE and tested to resist high pressures.

Software

The sensor is supplied with the latest firmware.
The sensor is configured with a configuration tool, "HB Tool", using a PC. It is capable of determining the version that was supplied.

Technical Data

Supply:	
Voltage:	24 V AC/DC ±10%*
Current draw:	Max 600 mA
Plug:	M12, 5 pins
DIN 0627	
Output:	
Alarm functions:	High
Output function:	PNP
Contact function:	NO / NC
Output:	1A (24V)
Installation conditions:	
Ambient temperatures:	-30…+60°C
Refrigerant temperature:	-60…+80°C
Max. operational pressure:	50 bar
Waterproof rating:	IP65
Vibrations:	IEC 68-2-6 (4g)
Authorisations:	
EMC Emission:	EN61000-3-2
EMC Immunity:	EN61000-4-2

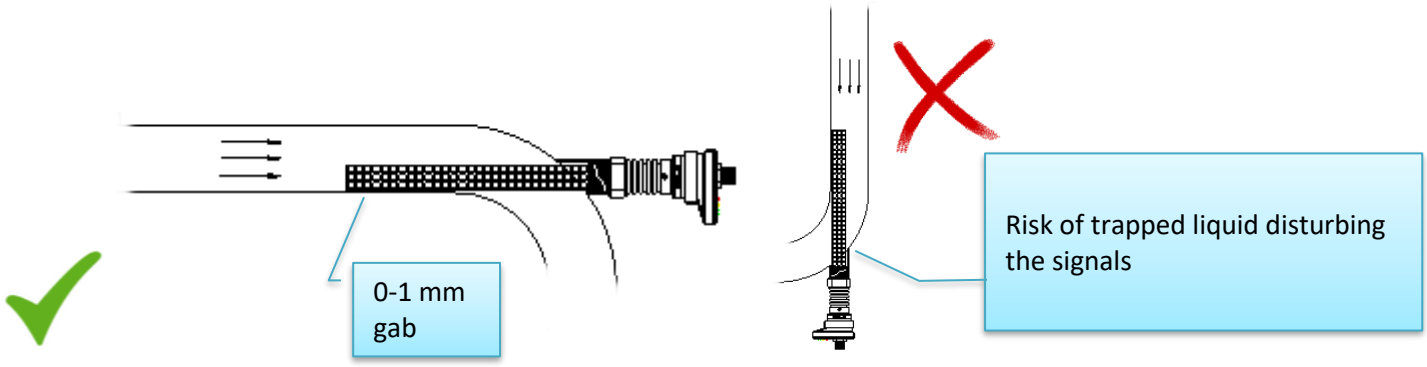
Mechanical specifications:	
Thread connection:	¾”/1” NPT or BSPP
Materials – mechanical parts:	AISI304
Materials – electronic parts:	Nylon 6 (PA)
Housing design:	Front
Configuration & indication:	
Configuration	With a PC
LED indication	Green, yellow, and red
Cable (included):	
M12 cable – 5 m:	HBxC-M12/5
Cable size:	5 x 0,34 mm^2
Cable glands:	PG7 / M8
Plug type:	Angle - 90°
Cable type:	PUR-OB grey
Cable approval:	CSA
Accessories:	
Configuration tool:	HB Tool

NOTE! All terminals are protected against incorrect termination with a supply voltage of up to 40V. If the supply voltage is greater than 40 V, the electronics will be damaged.

Installation Guide

The following applies to the design of the system:

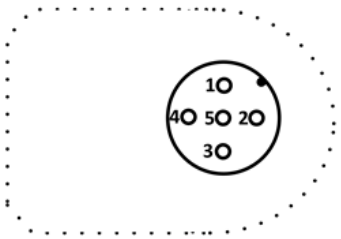
1) Selection of size:
    1. ¾” is used for pipes with a dimension of < 2”
    2. 1” is used for pipes with a dimension of > 2”
2) Should be mounted in a bend with the end of the sensor sticking into the lowest point of a horizontal pipe – just where you expect liquid to flow. The sensor may touch the inner wall of the pipe. Don’t install the sensor so liquid can be trapped around it.
3) HBCP can be mounted very closely to the compressor or up to 5m away from it.
4) The sensor is installed with a standard cable without a sheath. If EMC is higher than described in EN 61326, a sheathed cable must be used.



CAUTION! In case of welding work on the unit, please make sure that proper earthing is carried out to avoid damaging the electronics.

Electrical connection

HBCP: Supply voltage to 1 & 2. Output on 2 and 3. Run-in is connected to 2 & 5. The run-in signal is the signal that activates or deactivates the sensor's function. If an alarm is triggered and if the liquid is not removed 100%, it may be necessary to deactivate the sensor during start-up.



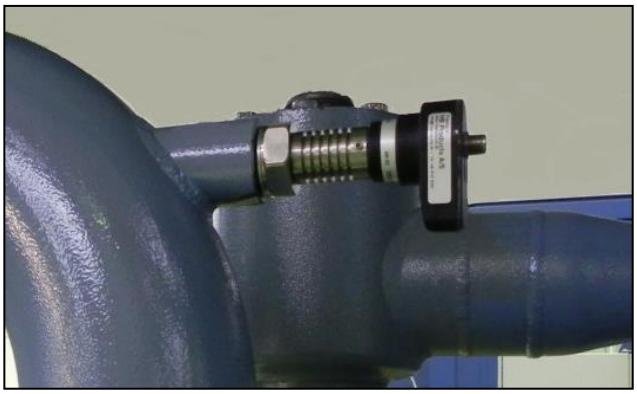
Supply 24V AC/DC
1 = Brown +
2 = White -
3 = Blue, DO, Alarm, PNP, 1A
4 = Black, AO, Control output, 4-20mA
5 = Gray, DI, Run in signal (5 to 24 VDC)

Mounting of sensor

For the installation of HBCP, you require a 2.5mm Allen key, a shifting spanner, as well as gasket material depending on the thread type.

Loosen the two set screws that secure the electronic part to the mechanical part. Separate the electronics from the mechanical part.

Apply liquid gasket / Teflon to the conical thread. Install the mechanical part and tighten it. Tighten depending on the thread type and size (80-150Nm).



Mount the electronic part again and secure with two set screws.

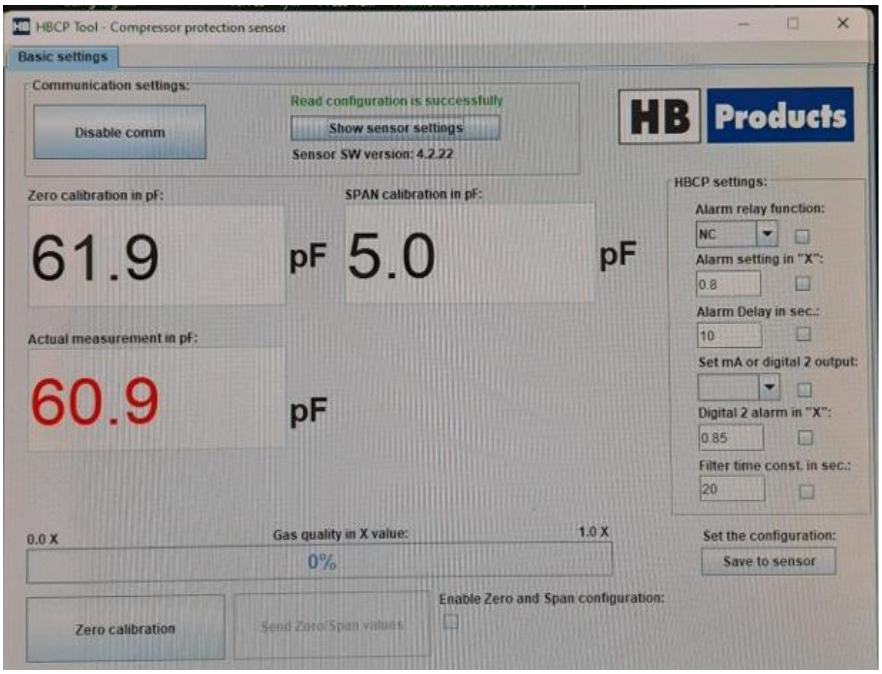
Setting up the sensor

The sensor is delivered with a basic setup which will provide an alarm when liquid is detected. The settings can be modified and provide a better balance between not getting too many and too few alarms.

To modify the settings you need to install the HB-tool from the top of the www.hbproducts.dk web page and the USB/M12 cable

Setting up procedure:

Start by making a dry calibration in dry gas. The sensor must be installed in the system and the system should be operating. The calibration is done by clicking on the “Zero calibration” button on the screen. When this is done the zero calibration in pF and the actual measurement should be the same within 0.2 pF. If this is not the case, make a new calibration



Making changes to the setup

After you have made changes in the settings you have to save the changes. This is done by clicking on the "save to sensor" button in the tool. All the fields with a check mark in the small square box will be saved on the sensor. If you change a value, the check box will be filled automatically.

The you must select NC normally closed or NO normally open for the alarm function. If you choose NC the will be positive signal on pin 3 until you get an alarm. If you choose NO you will get a positive signal on pin 3 when you get an alarm.

Alarm settings

You can setup two alarms in the sensor or one alarm and an analog signal linear to the liquid amount. The first alarm is provided on pin 3 the second alarm will be provided if you select digital in the field called "set mA or digital 2 output"

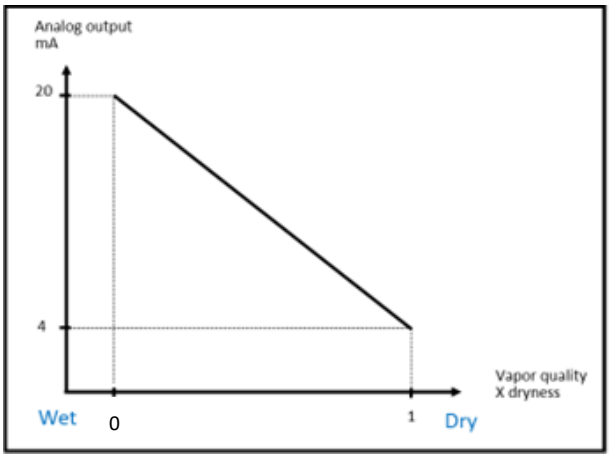
The sensitivity of the alarms is defined as an X value. The X-value can vary from 0 to 1 and a low value typically below 0.5 means low sensitivity and values above 0.8 means high sensitivity. You can add a delay and a filter time to the alarms and analog output. Both these values are in seconds and will make the alarms slower but eliminate rapid variations.

How to optimize the sensor.

There are two ways to optimize the sensor to your system. A systematic way and a try and error way.

The systematic way

Install the sensor and make a calibration in dry gas as described above.
Select analog output
Connect a data logger to the sensor between pin 2 and pin 4 and measure the mA signal for a typical period of time. The mA value will be linear to the X value like shown below. You will get 4 mA when the gas is dry X=1 and 20 mA when the gas is wet X=0. Based on the values and the variation you can calculate the X value which will not trigger the alarm in normal operation. It will always be a balance between not getting alarms during normal operation, but still getting the important alarms



Try and error way
Install the sensor and make a calibration in dry gas as described above.
Note the alarms over a representative period. Adjust the "Alarm settings in X" to a higher value if you don't any alarms and to a lower value if you get alarms. Continue this process until you get a satisfactory level of alarms.

Changing the Span value

In general, the Span (measuring window) should not be changed. However, if the sensor is too sensitive you can increase the Span value and make it less sensitive. This is done by clicking on the small check box "Enable Zero and Span configuration" then you can edit the value and saving it by clicking on save to sensor

LED indication

LED indication:

1) Green LED indicates 24 V DC supply; it blinks during operation. If "run-in" is not used, this function must be deactivated in the tool.
2) Yellow LED indicates low alarm (Warning).
3) Red LED indicates high alarm (Stop compressor).

LED signal	ON/OFF/Frequency	Functionality
Green	ON	Supply voltage connected
	Flash	Run-in start signal / in operation.
	OFF	No supply voltage
Yellow	ON	Alarm, low
	OFF	No low alarm
Red	ON	Alarm, high
	Flash	Does not detect and sensor probe
	OFF	No high alarm
Yellow + Red	Flash	Power supply not sufficient

Reset of alarm

In case of liquid hammer the yellow and / or red LED will be ON until the "R" is activated in 3 sec. Similarly, the transistor output will be active until the "R" is activated.

Installation of HB Configuration Tool

See separate manual.

NOTE! To be able to change the control parameters, you need a special USB/M12 configuration cable, as well as a configuration tool installed on a PC

PC Configuration

See separate manual.

Fault Detection

General:

NOTE! Fault detection in the electronics and/or replacement of the electronics can be carried out without releasing pressure on the system or removing the mechanical part of the sensor

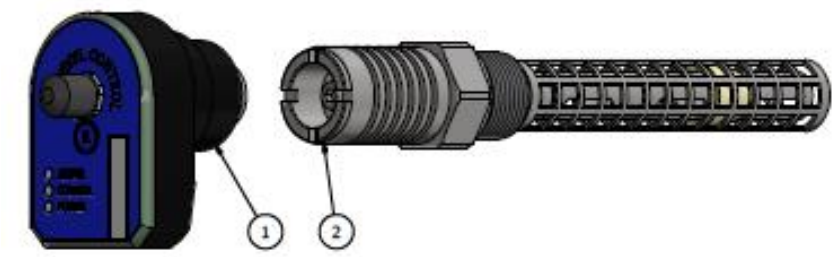
Fault	Reason	Correction of fault
No LED is on / not operating.	No supply to the sensor or defective cable/plug	Check and find faults in the power supply, or replace the supply cable.
Yellow and red LED flash.	Power supply is not sufficient.	Install proper power supply.
The sensor is not performing.	Wiring not done correctly or wrong dip switch setup.	Connect the valve correctly and/or configure the valve's dip switches according to the instructions.

Sensor Repair

The sensor electronics are completely embedded and can therefore not be repaired.
In case of faults with the sensor, it will typically only be necessary to replace the electronics.

Complaint cases are handled by the HB Products dealers/distributors.
Their complain procedures must be followed before returning the sensor.

Spare parts



Position	Type	Specification	Part number
1	Electronic parts	PC-programmable	HBCP-EL
2	Mechanical parts	¾" NPT	HBCP-2-MEK
		¾" BSPP	HBCP-6-MEK
		1" NPT	HBCP-9-MEK
		1" BSPP	HBCP-8-MEK

Further Information

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

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