



Products

WE INCREASE
UPTIME AND EFFICIENCY
IN THE REFRIGERATION INDUSTRY

Instruction manual

HBSC2 – CO₂ switch

For detecting liquid CO₂ in refrigeration systems





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Safety Instructions

CAUTION! Read the instruction manual before commencing work! Heed all warnings to the letter! Installation of HBSC2 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.

	<p>CAUTION! Refers to a possible limitation of functionality or risk of use.</p> <p>NOTE! Contains important 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 to avoid damage to people and materials.</p>
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Intended use, conditions of use The HBSC2 switch is made to detect liquid CO₂ in refrigeration systems. If HBSC2 is to be used in a different way or for 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: HBSC2 is built so that the modules can easily be removed and sorted for disposal.

Introduction

HBSC2 is a level switch for detecting liquid CO₂ in refrigeration systems

Typically, it is installed in/on the receiver, but it is also suited for installation in other locations where one wants to obtain a level indication.

The sensor's measurement principle makes it unique for these purposes, since the properties

of the measurement principle as well as the construction allows it to withstand high pressure and low refrigerant temperatures.

The sensor is suited for use on transcritical CO₂ refrigeration systems.

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.

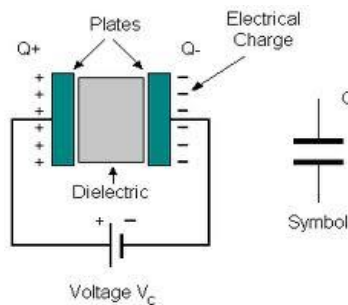
Rather than of the two plates, the sensor for level measurement is shaped as a cylindrical rod. When liquid covers the sensor, the measured capacity changes.

HB Products sensors are calibrated so that they differentiate between conductive and non-conductive liquids.

In refrigeration systems, the oil, HFCs and liquid CO₂ are not regarded as conductive fluids, whereas refrigerants such as ammonia, and brine are regarded as conductive.

Design

The sensor consists of a mechanical part and an electronic part. These are easily separated by loosening 2 grub screws, or for mechanisms with mounting tabs, by pressing the electronic part in towards the mechanical part and turning the housing counter-clockwise until a wave washer pushes it from the mounted position. The electronic part is designed in accordance with IP65 waterproof rating and so as to withstand vibrations. The mechanical part is produced in AISI304/PTFE and tested to withstand high pressure.



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

Technical data

Connection:

Supply:	24 V AC/DC $\pm 10\%$ *
Current draw:	Max 50 mA
Current consumption:	< 10 mA
Plug:	DIN 43 650
Required cable size:	3 x 0,34 mm ²
Required cable glands:	PG7 / M8

Mechanical specifications:

Thread connection:	$\frac{3}{4}$ "
Materials, mechanical:	AISI304/PTFE
Materials, electronics:	Nylon 6 (PA)

Indication:

LED indication :	4 x LED (red)
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Output:

Transistor output:	PNP or NPN
Output function:	NC or NO

Installation conditions:

Ambient temperature:	-30...+50°C
Refrigerant temperature:	-55*...+30°C
Max. operational pressure:	150 bar
Waterproof rating:	IP65
Vibrations:	IEC 68-2-6 (4g)

Authorisations:

EMC Emission:	EN61000-3-2
EMC Immunity:	EN61000-4-2
GOST R:	No 0903044

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

NOTE! Supply Voltage may differ from the data given in the manuals. Applicable will always be the sensor label.

Function

HBSC2 is a level switch for detecting liquid CO₂ in refrigeration systems.

Typically, it is installed in/on the refrigerant container, but it is also suited for installation in other locations where one wants to obtain a level indication.

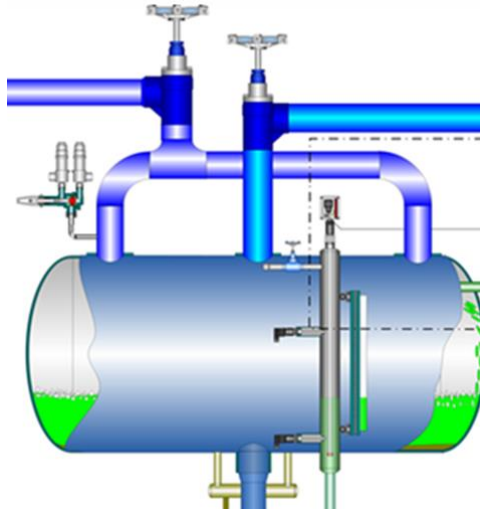
The sensor differentiates between liquid CO₂ and gas, so that the electrical signal from the sensor changes when the liquid level drops below/rises above the level it was installed at.

The sensor is calibrated to switch in the centre of the sensor's cylindrical part, with a hysteresis of about 1 mm. When the CO₂ liquid is on the same level or above this point, 4 LEDs light up (irrespective of the output function NO/NC).

Examples of usage

The HBSC2 switch is well suited for:

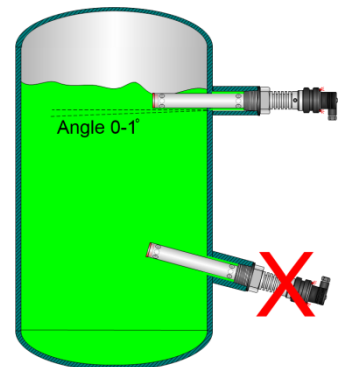
- Indication of high and low refrigerant levels in liquid separators, pump separators, economisers, and inter mediate coolers
- on/off control of liquid injection in liquid separators, pump separators, economisers, and inter mediate coolers



Installation instructions

The following applies during installation:

- 1) In case the sensor is installed in a threaded sleeve/pipe stub, this should be welded at a 0-1° **upwards angle** relative to the horizontal, so as to prevent the formation of both liquid and gas pockets that can interfere the sensor reading.
- 2) The installation length of the sensor must be taken into account, since there must be at least 2mm between the sensor's mechanical part and other fixed or moving parts.



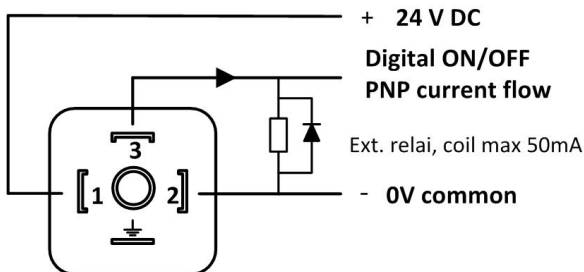
CAUTION! In case of welding work on the unit, please make sure that proper earthing is carried out to avoid damaging the electronics.

Power connection

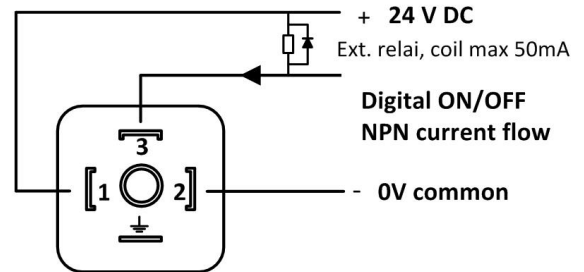
HBSC2 can be delivered with a PNP or NPN output.

The connection depends on the selected sensor type as well as the type of controller/PLC used.

Source / PNP



Sink / NPN



Sensor relay specifications:

- A) Voltage: 24 V,
- B) Max coil resistant: 475 ohm
- C) Coil effect: 1,2 W

Example on relay types:

- SCHRACK type MT221024
- OMRON type G22A-432A

NOTE! Supply Voltage may differ from the data given in the manuals. Applicable will always be the sensor label.



NOTE! In addition to the connections shown in this graphic the electrical connection requires further deciding whether to use the "contact mode" as NO (normally open) or NC (normally closed). NO / NC refer to the state that the switch occupies when it is "Dry", ie not influenced by the liquid. It should also be borne in mind that NONE of these combinations in itself is "Fail Safe". It is expected that the design of the control system in which these switches integrate, understand the requirements of a fail-safe structure. Especially when this is carried out with the "solid-state" switching technology as here. Damage incurred external equipment not supplied by HB Products, can generally not be covered by "HB Products" product warranty or 3ed party insurance. Should such HB Product 3ed party insurance coverage is desired, it requires at least our pre-approval of the "Fail Safe" design. This emphasizes that one can NOT currently buy a Fail Safe HB Products switch.

Installation guide

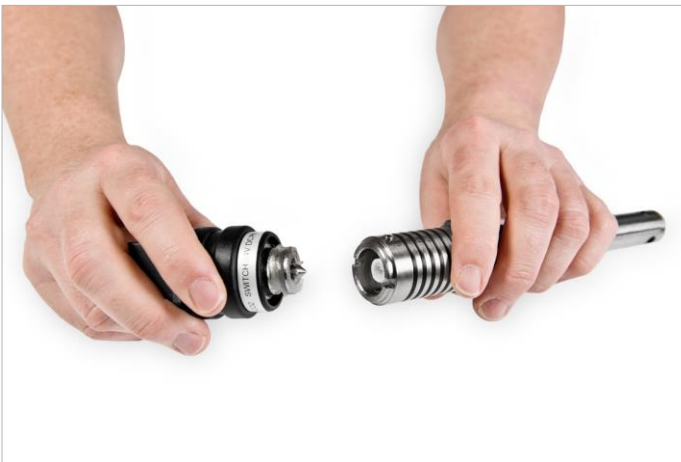
HBSC2 is installed on a pipe socket depending on the type of thread on the sensor. Sensors with NPT"/BSPT" are sealed with Teflon tape or liquid gasket. For other thread types, solid gasket is used.



For the installation of sensors with a conical thread, a shifting spanner, 2.5 mm Allen key, and Teflon/liquid gasket material are required. For other thread types, solid gasket is used.



Loosen the 2 set screws that attach the electronic part to the mechanical part.



Separate the electronic part from the mechanical part.



Apply Teflon or liquid gasket on sensors with a conical thread. For other thread types, solid gasket is used.



Fasten the mechanical part with the shifting spanner (tightening torque 80-150 Nm, depending on thread type).



Install the electronic part again and secure with 2 set screws.

LED indication

4 x red LED's indicate the liquid level

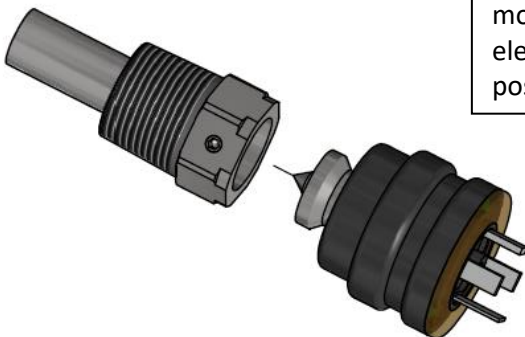
Irrespective of the output function NO/NC, LEDs are activated at CO₂ liquid level.



Fault detection



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



Connect power to electronic and mount the HB-TEST-ADAPTER. If the electronic switch, you can exclude the possibility of fault on the sensor.

The easiest way to carry out fault detection is to have an HB-TEST-ADAPTER available. If the electronics switch the way they are supposed to during the test, you can exclude the possibility of a fault on the sensor.



Note! LED is always activated when approx. half of the sensors are covered or immersed in refrigerant, irrespective of the sensor's output function NC/NO.

In case of fault, it is enough to only replace the electronic part.

Fault	Possible Reason	Correction of fault
No LED is on when the sensor is in the medium.	No supply to the sensor or defective cable/plug.	Check the power supply or replace the power supply cable.
No output (4 x red LEDs are on but the output signal is not active)	Check if the sensor's output matches the control input; if it is a PNP/NPN and NO or NC respectively. See the output charge instructions below.	Create alignment between the sensor and control so that the two are identical.
No contact activation (4 x red LEDs are not on, even though liquid should activate the sensor)	There may be dirt between the electronic housing and the mechanical housing.	Separate the two parts and clean the spring tip. Remember to apply silicone grease on the spring tip so as to avoid problems with moisture.
Delay in sensor activation	1) Can be caused by a gas pocket that displaces the liquid.	1) Install the sensor so that the gas pockets cannot displace the liquid.
Output and 4xLEDs are constantly activated, even though liquid is not in contact with the sensor.	Threaded sleeves are installed with a negative slope so that liquid can collect in the threaded sleeves, which activates the sensor	Place the threaded sleeves according to the instructions. See installation.

Function of charge output on pin 3 & 4:

NC: There should be no signal when it is in refrigerant.

NO: There should be a signal when it is in refrigerant.

Sensor repair:

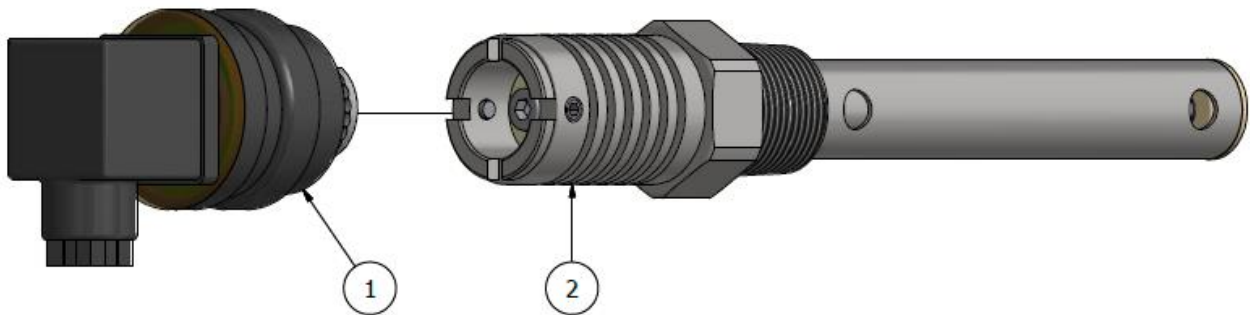
The sensor electronics are completely embedded and can therefore not be repaired.

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 complaints procedures must be followed before returning the sensor.

Spare parts:



Position	Specification	Type	Part number
1	Electronic part	PNP/NO	HBSC2-EL/PNP/NO
		PNP/NC	HBSC2-EL/PNP/NC
		NPN/NO	HBSC2-EL/NPN/NO
		NPN/NC	HBSC2-EL/NPN/NC
2	Mechanical part	3/4" NPT	HBSC2-MEK-2
		3/4" BSPP	HBSC2-MEK-6

Further information

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