

Instruction manual

HBSR – NH₃ & Brine switch

For the detection of refrigerants and/or phase separation between oil and ammonia



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Safety Instructions

CAUTION! Read the instruction manual before commencing work! Heed all warnings to the letter! Installation of HBSR 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 HBSR switch is manufactured so as to detect various refrigerant types, as well as to detect phase separation between oil and ammonia. If HBSR 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: HBSR is built so that the modules can easily be removed and sorted for disposal.

Introduction

HBSR is a level switch for detection of liquid refrigerants NH_3 and brine types.

Typically it is installed in/on the receiver, pump separators, economisers, heat exchangers, or as an oil-accumulation-alarm in ammonia systems.

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

other things, to detect phase separation between oil and ammonia.

The sensor is also built to resist high pressure and low temperatures.

HBSR is not suited for use on CO_2 and HFC systems. Here the HBSR-CO₂ and HBSR-HFC switch type must be used.

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.

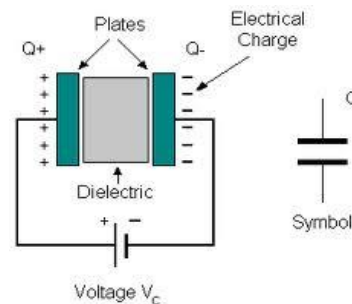
Rather than two plates, the sensor for level measurement is shaped as a cylindrical rod. When liquid covers the sensor, the measured capacity changes.

HB Products sensors are calibrated so that they differentiate between conductive and non-conductive liquids. In refrigeration systems, the oil, HFCs and liquid CO_2 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 presses it out of 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:	$\frac{3}{4}$ " NPT / BSP
Materials, mechanical:	AISI304/PTFE
Materials, electronic:	Nylon 6 (PA)

Output:

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

Indication:

LED indication :	4 x LED (red)
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Installation conditions:

Ambient temperature:	-30...+50°C
Refrigerant temperature:	-60...+80°C*
Max. operational pressure:	100 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

* Max temperature for switches manufactured after May 2014, with the batch number VUxxxxxxx. For batch number Vxxxxxxx produced before May 2014, the maximum temperature is +35 °C.



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

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

Function

HBSR is a level switch for detecting common refrigerants, including NH₃ and brine, but it can also be used for oil return management in ammonia refrigeration systems.

Typically it is installed in/on the receivers, pump separators, economisers, heat exchangers, or as an oil-accumulation-sensor on ammonia systems.

The sensor differentiates between refrigerant, gas, and oil, so that the electrical signal from the sensor changes when the liquid level drops below/rises above the level that 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 refrigerant is on the same level or above this point, 4 LEDs light up (irrespective of the output relay NO/NC).

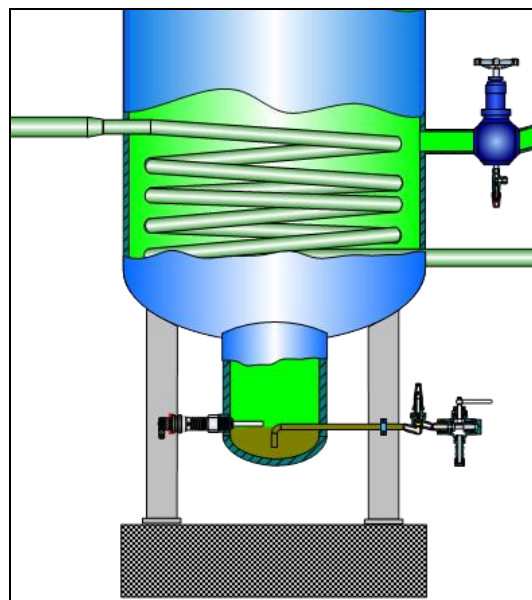
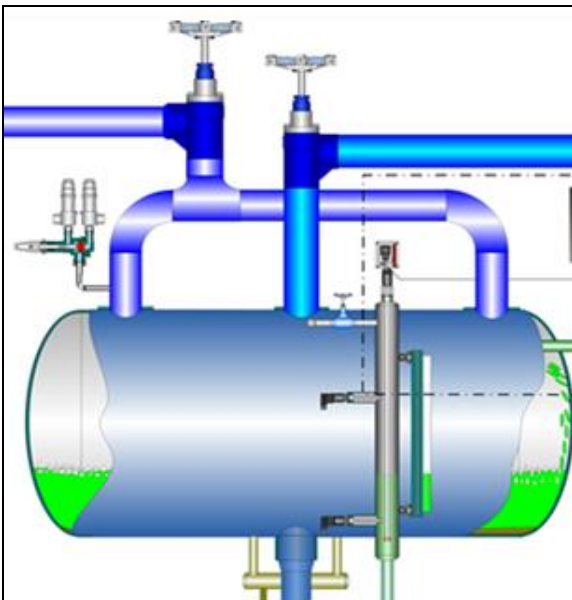
Examples of usage

The HBSR switch is well suited to be used for

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

On ammonia refrigeration systems, it can also be used for

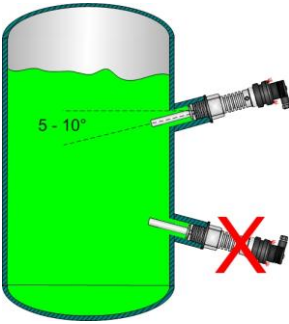
- Indication of accumulated oil in oil sumps, oil pots, liquid separators, economisers, inter mediate coolers. It is used here with a reversed contact function for automatic oil discharge/drainage.



Installation instructions

The following applies during installation:

- 1) Where the sensor is installed in a threaded sleeve/pipe stub, this should be welded at a 5-10° **upwards angle** relative to the horizontal, so as to prevent the formation of liquid pockets.
- 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.



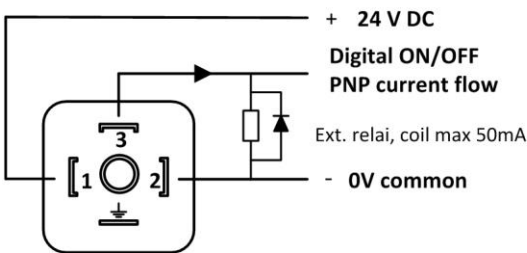
CAUTION! In case of welding work on the unit, please make sure that proper earthing is carried out to avoid damaging the electronics.

Power connection

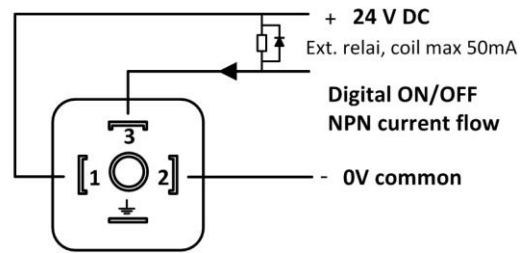
HBSR can be delivered with a PNP or NPN output.

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

Please 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

HBSR 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.



To install the HBSR sensor, a 2.5 mm Allen key, shifting spanner, and gasket must be used.



Loosen the two set screws.



Separate the electronic part from the mechanical part.



Apply liquid gasket on sensors with a conical thread, and solid gasket to sensors with a cylindrical thread.



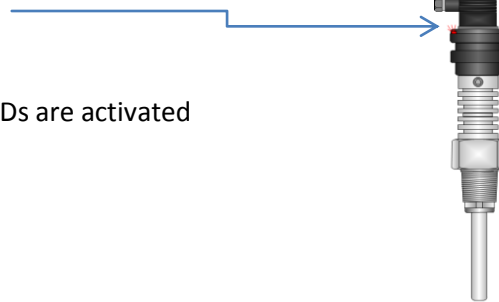
Install the mechanical part in the container or overflow pipe and tighten to a tightening torque dependant on the thread type (80-150 Nm)

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

LED indication

4 x red LEDs indicate the liquid level

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

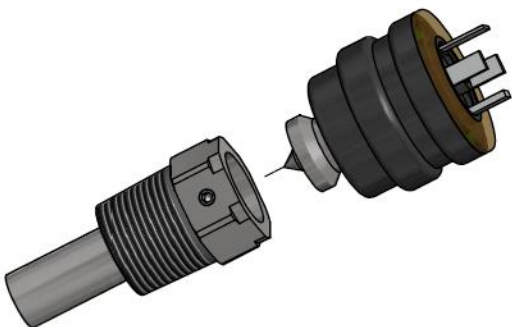


Fault detection



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

The easiest way to carry out fault detection is to have a HB-TEST-ADAPTER available.



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

If the electronics switch the way they are supposed to during the test, one 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 faults, 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's 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. 2) The sensor is sealed with (too much) Teflon tape so that there is no metallic contact between the sensor mechanism and the vessel.	1) Install the sensor so that the gas pockets cannot displace the liquid 2) Make sure that the sensor has a metallic connection to the container.
Output and 4xLED 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

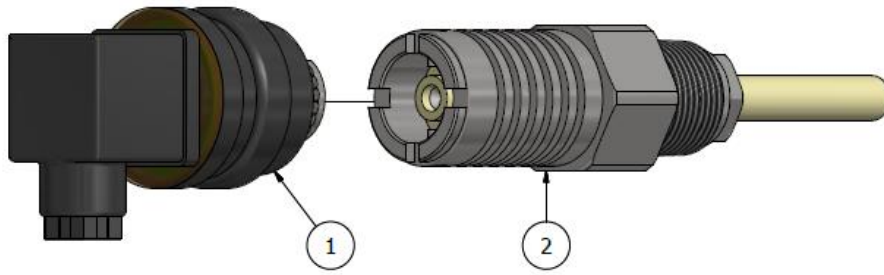
The sensor electronics are completely sealed and can therefore not be repaired.

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	HBSR-EL/PNP/NO
		PNP/NC	HBSR-EL/PNP/NC
		NPN/NO	HBSR-EL/NPN/NO
		NPN/NC	HBSR-EL/NPN/NC
2	Mechanical part	¾" NPT	HBSR-MEK-2
		¾" BSPP	HBSR-MEK-6

Further information

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

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