

Instruction manual

HBLC – SENSOR & CONTROLLER

For low and high pressure control of liquid levels in industrial refrigeration systems



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Safety Instructions

CAUTION! Read the instruction manual before commencing work! Heed all warnings to the letter! Installation of HBLC 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 HBLC sensor and controller is made to measure and control refrigerant. If HBLC 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: HBLC is built so that the modules can easily be removed and sorted for disposal.

Introduction

HBLC is an intelligent sensor with a built-in microprocessor. It is designed to control refrigerant levels in both low pressure and high pressure systems. It emits a 4-20 mA signal, which is proportional to the sensor's set range of measurement.

Apart from the 4-20 mA signal, the sensor also has a built-in controller.

The controller can be set-up with all the parameters necessary for controlling a modulating motor valve.

The sensor can be delivered with a cable for direct supply to and control of motor valves.

Measurement Principle

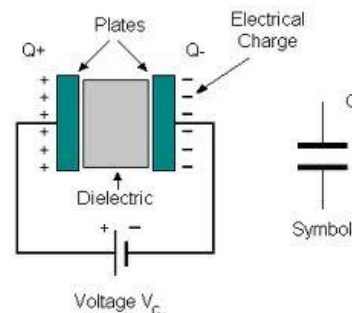
The sensor is a capacitive sensor. The capacitive measurement principle is based on the electrical properties in the proximity of a capacitor. A capacitor is an electrical component that is capable of building and sustaining an electrical charge

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 is changes.

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

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



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.

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.

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 which was supplied.

The latest version of the tool is backwards compatible.

It is not possible to update the software on a sensor which has already been supplied.

Technical Data

Supply:

Voltage:	24 V AC/DC $\pm 10\%$ *
Current draw:	Max 50 mA
Power consumption:	30 VA*
Plug:	M12, 5 pins DIN 0627

Valve control:

Analogue output:	4-20 mA
Output function:	P control
Alarm output:	Max 1 A (24W)
Cable length:	3 m
Cable size:	2 x 0,75 mm ²
Cable glands:	PG7 / M8

Installation conditions:

Ambient temperatures:	-30...+50°C
Refrigerant temperature:	-60...+80°C
Max. operational pressure:	100/150 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

*Power consumption is including consumption on Siemens MVS661 valve.

Mechanical specifications:

Thread connection:	$\frac{3}{4}$ " NPT or BSPP
Sensor length:	300 mm
Materiale – mekaniske dele:	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
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HBLC can be connected to other modulating 24 V DC valves.



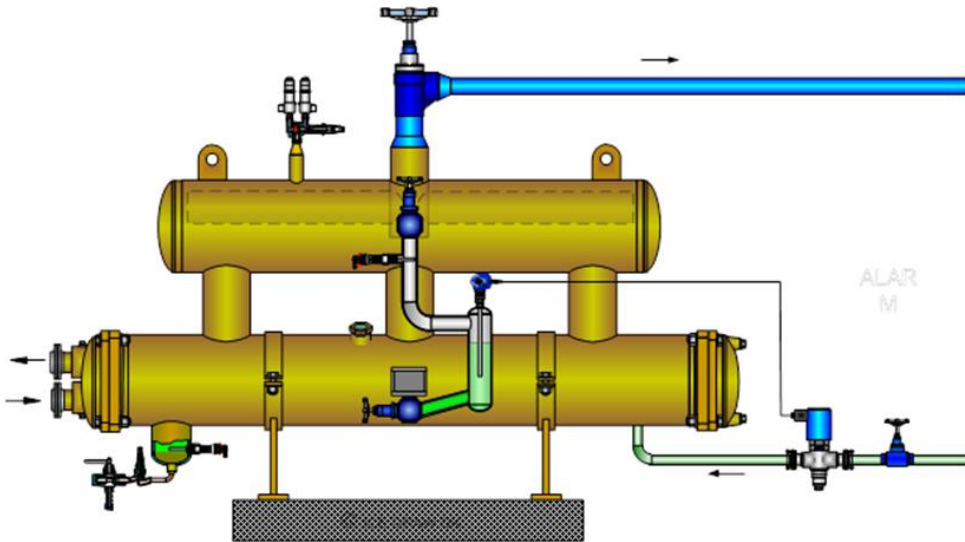
NOTE! All terminals are protected against incorrect termination with a supply voltage of up to 40V. If the supply voltage is greater than 40 V, the electronics will be damaged.

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

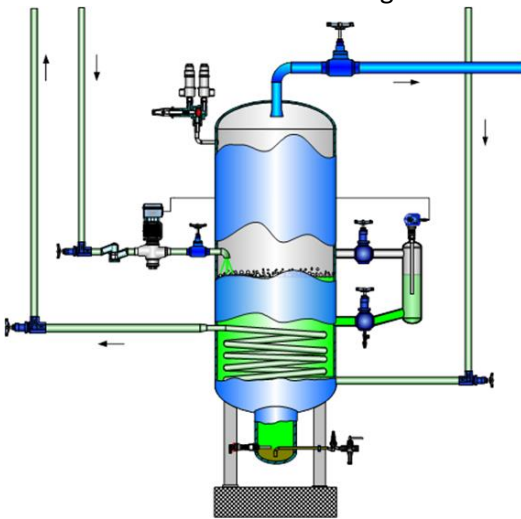
Design and Function

HBLC is designed for refrigerant level control in chillers, separators, coolers, and capacitors. If the sensor is installed in an overflow pipe, it is important that there is adequate air around the sensor, so that gas pockets do not form. The sensor is based on the capacitive measurement principle, which requires a metallic connection to the overflow pipe or to the pipe segment where it is installed.

The HBLC sensor also has a built-in controller. The parameters for controlling a modulating motor valve can easily be set up in a configuration tool (HB Tool).



HBLC connected to a modulating valve – an alternative to low pressure float control.



An economiser with an HBLC connected to the modulating valve, type Siemens MVS661.

Installation Guide

The following applies to the design of the system:

- 1) It must be mounted vertically.
- 2) HBLC can be mounted on an overflow pipe or a pipe segment where flow and turbulence are minimised.
- 3) 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.



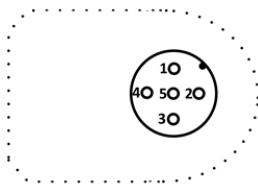
Note! HBLC uses the overflow pipe or the pipe segment as reference material. Therefore, use either conductive sealing material or make sure that the Teflon tape does not prevent a metallic connection.



Note! The sensor element may not touch the tank or other metal parts in the installed position. If so, the sensor will not give a correct signal.

Electrical connection

HBLC: With common supply and control cable.



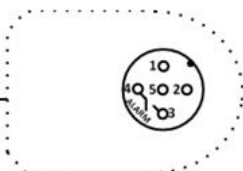
- Supply 24V AC/DC
- 1 = Brown +
 - 2 = White -
 - 3 = Blue, DO, Alarm, PNP, 1A
 - 4 = Black, AO, Control output, 4-20mA
 - 5 = Gray, DI, Run in signal (5 to 24 VDC)

HBLC/C: With separate supply and control cable to the modulating valve.

- 1 = Brown +
- 2 = White -
- 3 = Gray, AO 4-20mA

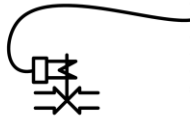


Modulating Valve
 24 V AC/DC Max 24W
 3 wire connection



- Supply 24V AC/DC, minimum 30 VA
- 1 = Brown +
 - 2 = White -
 - 3 = Blue
 - 4 = Black
 - 5 = Gray
 - (3)+(4) Potential free solid state ≈ supply voltage, 1 A
 - (5) DI, Run in Signal (5 to 24V DC)

HBLC/S: with separate supply and control cable to stepper motor:

**Stepper Motor Valve
4 wire connection**

A + = Yellow
A - = Green
B + = Brown
B - = White

Supply 24V AC/DC, minimum 30 VA

1 = Brown +
2 = White -
3 = Blue - DO, Alarm, PNP, 1A
4 = Black - AO, control output, 4-20mA
5 = Gray - Not in use (data only)

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

"Run In" signal is used as a signal to indicate whether the system is running (start/stop function). It can be (de)activated in the tool.

Mounting Guide

HBLC is installed on an overflow pipe or a pipe segment matching the sensor's installation length. Conductive sealing material or Teflon tape is applied to the thread, although one must ensure that there is metallic contact between the sensor and the overflow pipe. The sensor is tightened with a torque corresponding to the thread type and operational pressure.



For the installation of HBLC, there is required 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 and mechanically tighten in the vessel, and tighten depending on the thread type and size (80-150Nm).



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

LED Indication & Calibration

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 control.
 The blink sequence indicates if the valve is closing or opening.
- 3) Red LED indicates high or low level alarm, depending upon the setup.

LED signal	ON/OFF/Frequency	Functionality
Green	ON	Supply voltage connected
	Flash	Run In start signal / in operation.
	OFF	No supply voltage
Yellow	ON	Activation of valve control / and during calibration
	OFF	Valve control not active
Red	ON	Alarm, high or low level, depending upon the setup.
	Flash	Does not detect and sensor probe
	OFF	No alarm
Yellow + Red	Flash	Power supply not sufficient



Calibration:

0% or 100% calibration can be carried out independently of each other. HBLC level sensor is delivered pre-calibrated. For normal use, calibration is not necessary. If the signal changes over time, we recommend a 0% calibration with an empty overflow pipe or container.

Instruction for 0% calibration:

- 1) The sensors calibration function shall be connected via the HB tool. See instruction for PC connection and configurations parameters in separate manuals.
- 2) Connect the power cable.
- 3) Empty container/overflow pipe
- 4) Activate "R" for 5 seconds to activate "calibration mode" = Yellow LED turns on (ON) during the 5 seconds activation, and goes off (OFF) when the calibration mode is activated.
- 5) Activate "R" once = Yellow LED blinks once. The green LED then blinks to confirm calibration.
- 6) Connect PC Tool again and disconnect the calibration function in tool.
- 7) Connect the power cable.

"Calibration mode" is complete and the sensor is then running normally.

Instruction for 100% calibration:

- 1) The sensors calibration function shall be connected via the HB tool. See instruction for PC connection and configurations parameters in separate manuals.
- 2) Connect the power cable.
- 3) Full container/overflow pipe up to a 100% level.
- 4) Activate "R" for 5 seconds to activate "calibration mode" = Yellow LED turns on (ON) during the 5 seconds activation, and goes off (OFF) when the calibration mode is activated.
- 5) Activate "R" **twice** = Yellow LED blinks **twice**. The green LED then blinks to confirm calibration.
- 6) Connect PC Tool again and disconnect the calibration function in tool.
- 7) Connect the power cable.

"Calibration mode" is complete and the sensor is then running normally.

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.

Setup and Connection of Valve

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.
Valve open and close to fast.	Refrigerant I boiling in standpipe	Increase "filter" settings and eventually increase P-band as well.
No contact activation	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 to the spring tip so as to avoid problems with moisture
Delay in sensor activation	May be caused by gas and bubbles in the system.	Check if the sensor is placed optimally so that gas is avoided.
The valve is not performing the control function.	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.
The valve is not performing the control function well enough.	Oil has accumulated in the level indicator glass which cannot escape.	Drain the level indicator of oil and, if necessary, clean the oil from the rod.
There is no agreement between the output signal and the level in the level indicator.	The sensor is incorrectly calibrated.	Perform calibration.

Practical measurement of output signals:

4-20 mA signal: Function and stability of the 4-20 mA signal can be controlled by connecting a hand-held multimeter. The output signal must be between 3.6 mA and 22 mA. If not, the electronics are defective.

Sensor Repair

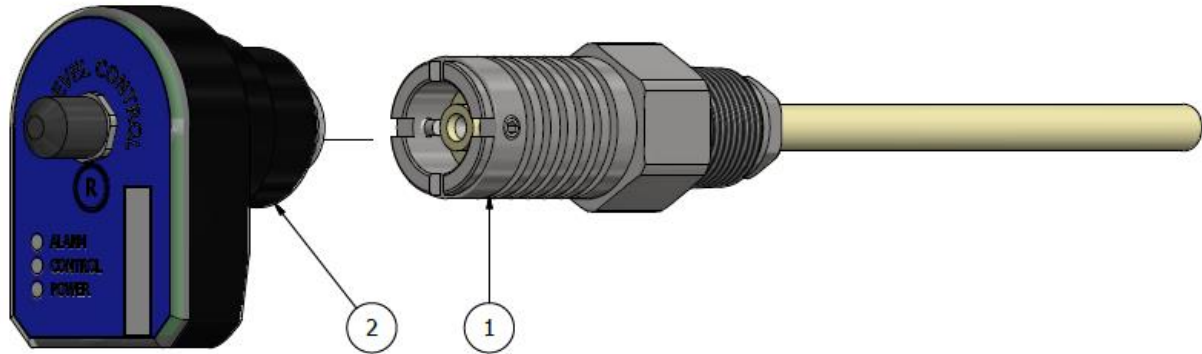
The sensor electronics are completely embedded and can therefore not be repaired.

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	Mechanical parts	3/4" NPT / 314 mm/NH3	HBLC-NH3-3.1-2-MEK
		3/4" BSPP / 314 mm/NH3	HBLC-NH3-3.1-6-MEK
		3/4" NPT / 314 mm/ CO2/HFC	HBLC-CO2/HFC-3.1-2-MEK
		3/4" BSPP / 314 mm/ CO2/HFC	HBLC-CO2/HFC-3.1-6-MEK
2	Electronic parts	Direct output (no cable)	HBLC-EL
		For modulating valve	HBLC/C-EL
		For stepper motor	HBLC/S-EL

Further Information

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