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IN THE REFRIGERATION INDUSTRY

## Instruction Manual

# HBLT-C1 – Controller

For pump control of levels in industrial refrigeration systems





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## Safety Instructions

**CAUTION!** Always read the instruction manual before commencing work! Heed all warnings. Installation and use of the controller may only be carried out by adequately qualified individuals. The operator must be aware of the consequences of setting up the controller incorrectly. Factory settings do not guarantee safe operation, since the configuration parameters depend on the type of system.

If changes are made to type-approved equipment, this type approval becomes void. The equipment's inputs and outputs as well as its accessories may only be connected as shown in this guide. HB Products assumes no responsibility for damages that result from failing to abide by the above.

**Explanation of symbols:** In this instruction manual, the following symbol is used to indicate important safety instructions to the user. The symbol will always appear when the information is necessary. The safety instructions, and particularly the warnings, must always be read and adhered to.

	<p><b>CAUTION!</b> Refers to threats to system components or a possible limitation of functionality.</p> <p><b>NOTE!</b> Contains important further information about the product, and provides additional tips. It is found in instructional documents describing the correct execution of a certain action. In this context, the head of operations is urged to abide by all the mandatory regulations, so as to avoid accidents and do everything possible to prevent damage to people and materials in the situation in question.</p>
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**Intended use and terms of use:** HBLT-C1 level controller is designed to continuously measure and regulate refrigerants in industrial refrigeration systems. If you want to use HBLT-C1 for a different purpose, and if you evaluate that it will not be able to function without problems in this capacity, then prior permission must be obtained from the manufacturer.

**Prevention of collateral damage:** Make sure that faults are assessed and relevant precautions are formulated by qualified personnel. In this way, you will prevent collateral damage from the HBLT-C1, which would result in damages to persons and materials.

**Environmentally-correct behaviour and disposal instructions:** HBLT-C1 is also built according to environmentally-correct behaviour. The modules can easily be disassembled to allow sorting, and are sent for recycling after sorting.

## Introduction

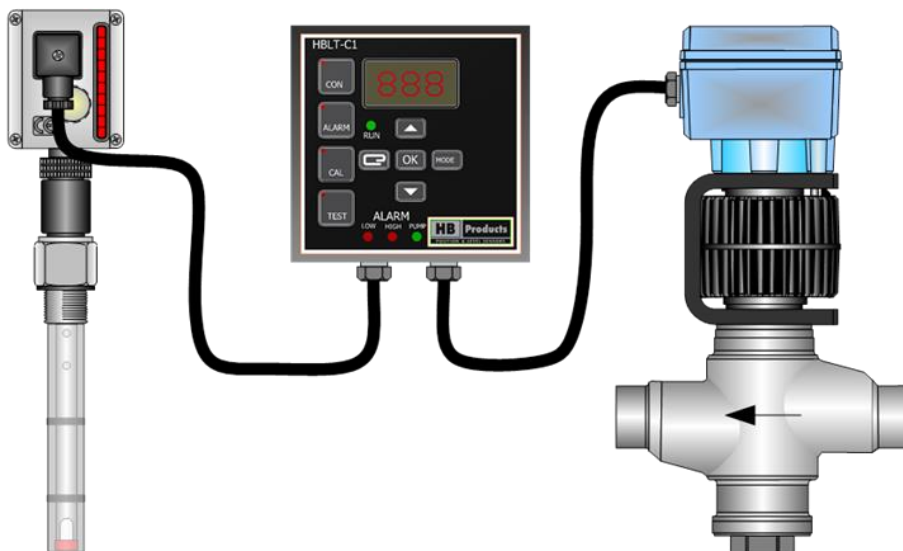
HBLT-C1 is designed for level control in vessels in industrial refrigeration systems. It can be used in connection with the HBLT-A1 analogue level sensor or other similar sensors with a 4-20 mA output signal.

## Design

The controller can be configured for the variations in application that occur in industrial refrigeration systems. Set-up is carried out using a simple menu system with buttons on the front. The measured value can also be read from a 3-figure display on the front of the component. LED lamps indicate low, high, and pump status. Valve feedback will be visualised with 5 led and 3-digit display.

## Software

The controller is supplied with a microprocessor-based design. It is always delivered with the newest software. We continuously develop our products and so there may be changes in the software. The controller cannot be updated after delivery. The controller is designed with a simple menu structure that does not allow for resetting to factory settings. The actual software version can be viewed in the display by pushing on [UP] and [DOWN] at same time.



*The HBLT-C1 controller connected to sensor type HBLT-A1 as well as a modulating motor valve (III. MVS661).*

## Technical Data

	HBLT-C1	HBLT-C1-ENC
<b>Supply:</b>		
Voltage	24 V AC/DC $\pm$ 10 %	100..240 V AC
Frquency	50/60 Hz	50/60 Hz
Current draw	Max 40 mA	Max 1.5 A
Connection	Screw terminal	Screw terminal
Wire size	< 2,5 mm <sup>2</sup>	< 2,5 mm <sup>2</sup>
<b>Installation conditions :</b>		
Surrounding temperature	-20...+70°C	-20...+70°C
Protection class	IP45	IP65
Relative humidity	20...80 %	20...80 %
<b>Approvals:</b>		
EMC Emission	EN61000-3-2	EN61000-3-2
EMC Immunity	EN6100-4-2	EN6100-4-2
GOST R	No 0903044	
<b>Mechanical specifications:</b>		
Mounting	In front of panel	On wall
External measurement	96x96x94 mm (BxHxD)	298x198x182 mm (BxHxD)
Cut-out measurement	92,8x92,8 mm	N.A.
Material	Plastic	Plastic
Weight	0.2 kg	1.4 kg
<b>Display:</b>		
Digit's display	3 digits, red	3 digits, red
Alarm indication	LED (green og red)	LED (green og red)
Programming	From front	From front
Updatting	1 time each second	1 time each second
Valve position indication	5 x LED	5 x LED
<b>Input:</b>		
Analogue input - sensor	4-20 mA	4-20 mA
Analogue input – valve feedback	4-20 mA	4-20 mA
Alarm – max level	Relay – 5...25 V DC	Relay – 5...25 V DC
<b>Output:</b>		
Analogue output	4-20 mA	4-20 mA
Load	3A/24 VDC	3A/24 VDC
Relay output	@24VAC/VDC: 3 x 3A	@24VAC/VDC: 3 x 3A
	@110 VAC: 3 x 5A	@110 VAC: 3 x 5A
	@220 VAC: 3 x 5A	@220 VAC: 3 x 5A
Solid state output	NC/NO-1A-24VAC/VDC	NC/NO-1A-24VAC/VDC



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

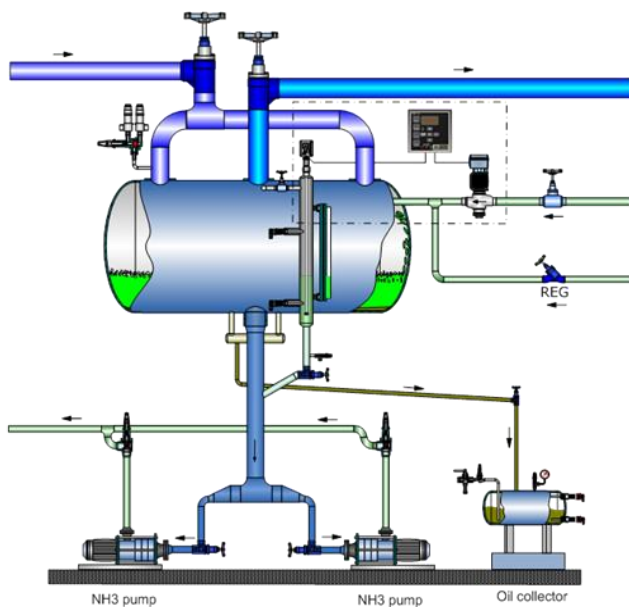


**NOTE!** Avoid direct sunlight, heavy dust, or heat. Do not expose the instrument to rain or strong humidity from ammonia vapour or other corrosive refrigerants.

## Design and Functions

HBLT-C1 is designed for measuring/regulating refrigerant levels in:

- Pump vessels
- Separators
- Inter coolers
- Economisers
- Condensators
- Receivers



*Pump separator installed with an HBLT-A1 analogue sensor for continuous level control of the vessel. The sensor is connected to the HBLT-C1 controller, which on the basis of current levels controls the modulating valve so that a constant level is maintained.*

The tank's/container's level is displayed based on the measured analogue value. Based on PI regulation, the controller can control the pump or the valve, and hence the rate at which the system is filled. HBLT-C1 supports all pumps and valves indicated in the technical data.

**The controller has the following functions:**

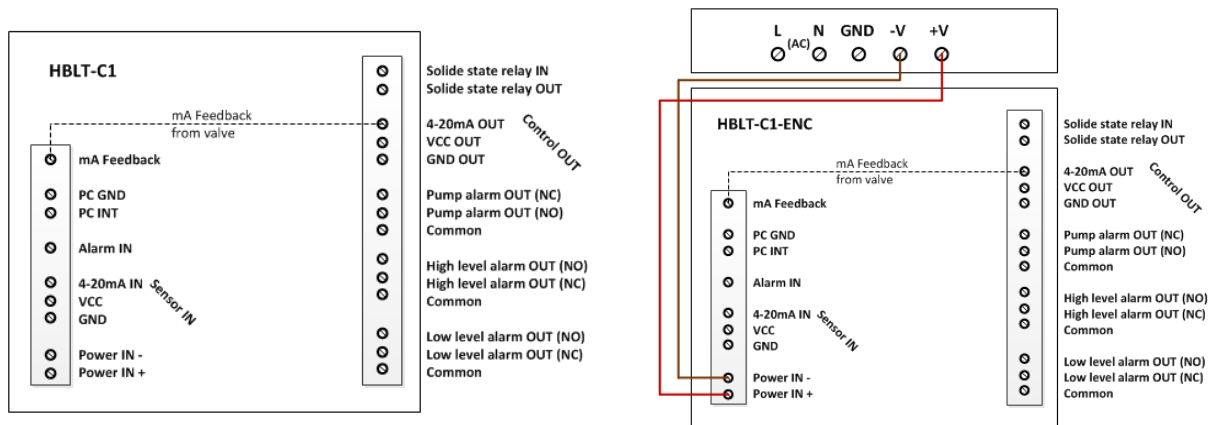
- Level control
- Alarm indication
- P-regulation
- High or low pressure regulation
- Pump start/stop
- Valve feedback

## Installation Instructions

The following applies to the design of the panel:

- 1) It must be installed on the front of the panel. The front is designed with protection class IP54. Rear facing electronics are designed in protection class IP45.
- 2) The instrument is placed at eye-level to make set-up and reading as easy as possible. Be careful with sunlight from windows as it can affect the reading on the display.
- 3) It is installed with a standard cable without insulation. If EMC from other sources of noise is greater than described in EN 6100-6-2, an insulated cable must be used.

## Electrical Connection



Terminal	Description
Power IN – 24 V AC/DC	Supply voltage to the controller
Sensor input	Input from the sensor, e.g. HBLT-A1
Alarm IN	Alarm in (5..24 VDC) can be used for extra high level alarm (GND from Power IN).
PC GND/INT	PC (no function)
mA feedb.	mA feedback (positioning of valve. GND is connected to Control out )
Low level –alarm out	Low level alarm in the vessel
High level – alarm out	High level alarm in the vessel
Pump	Signal to start the pump
Control out	4-20 mA analogue signal to the modulating valve or pump
Solid state relay	Solid state relay – AKVA valve (AC/DC)
Power IN – 100...240 VAC	Supply voltage with power supply built in

## Fitting Instructions

HBLT-C1 is fitted on the front of the panel. A 92.8 x 92.8 mm hole must be cut.

The module is fitted in a panel cut-out on the front of the panel. Mounting brackets (2 units) are placed on the side of the module, and the module is secured with the 2 screws.



## LED Indication

The buttons have the following functions:

- [CON] : Provides access to the control parameters: Setpoint, P-band, ramp function, LP/HP mode, AKVA periodic time as well as valve position
- [ALARM] : Provides access to alarm level: low level, high level, as well as pump level and hysteresis
- [CAL] : Provides access to minimum and maximum calibration
- [TEST] : Starts the test mode, where all parameters are tested
- [ROTATE] : Used to switch between the alarm parameters.
- [OK] : Confirms/saves data and also functions as return/forward to the next function.
- [↑] : Changes the parameters in a positive direction with +1 for each click, or through its scroll function by holding the button down.
- [↓] : Changes parameters in a negative direction with -1 with each click, or through its scroll function by holding the button down.
- [Mode] : Change from operational mode to displaying of valve position in 3-digit display
- [Mode] : Possibility to set up manual operation of analogue output – 4...20 mA (0...100%)  
 Push the button in 10 sec. Led is flashing with a frequency of 2 Hz when the manual operation is activated.
- [Valve] : Displaying the valve position with 20% intervals.

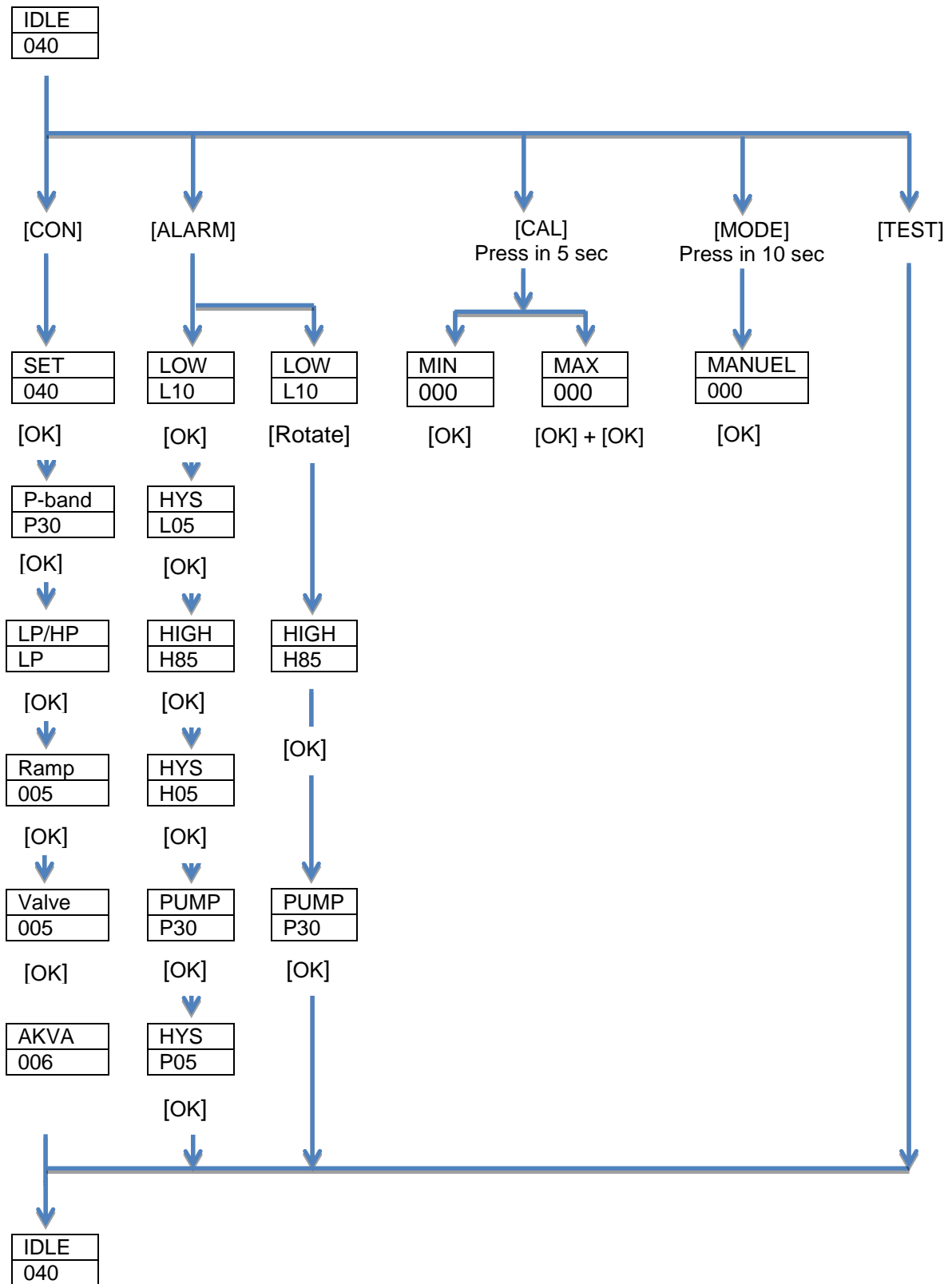
The LED lamps have the following functions:



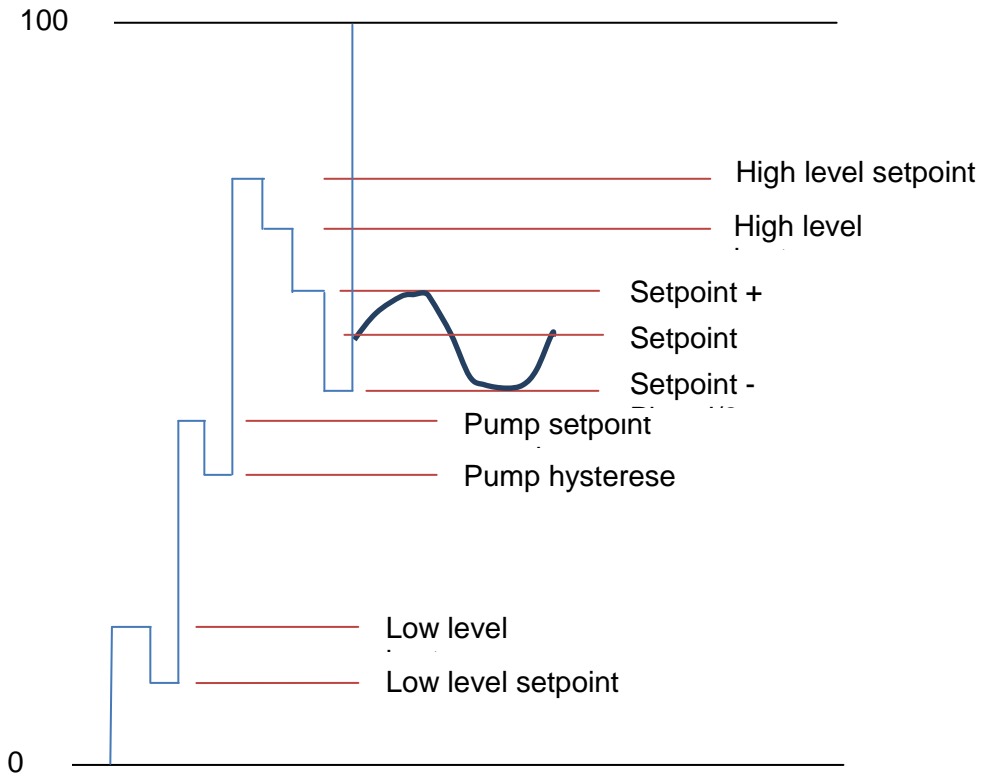
- RUN [green LED]: Indicates when the controller is in operation
- ALARM LOW [red LED]: Indicates a low level
- ALARM HIGH [red LED]: Indicates a high level
- PUMP [green LED]: Indicates pump function
- VALVE [5 x yellow ]: Indicates valve position



Menu flow chart:



**Test procedure:**



The frequency speed is 1 % each sec in test mode

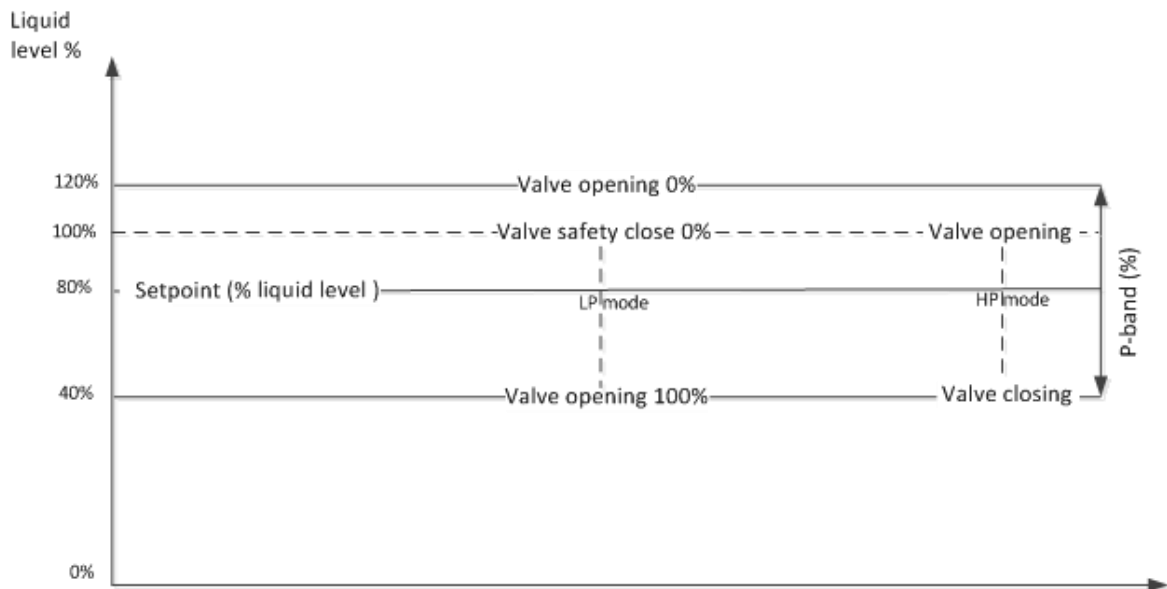
**3-digit display:**

Displays setpoint, programming parameters, as well as information to help navigate the display.

Display	Parameter	Units	Min	Max	Factory settings
<b>Operational parameters</b>					
Current liquid level in the 3 figure display		%	0	100	0
The valve's position with 5 LEDs		LEDs	0	5	0
<b>Control parameters</b>					
Setpoint		%	0	100	040
P-band		%	0	200	P30
LP/HP mode			LP	HP	LP
Ramp function – start up		%/sec	0	100	005
Valve reaction damping – opening/close		%/sec	0.1	100	005
Period time – pulse valve		sec	3	10	6
<b>Alarm parameters</b>					
Low level	Lxx	%	0	100	10
High level	Hxx	%	0	100	85
Pump level	Pxx	%	0	100	15

## CON Mode:

The desired **Setpoint** and **P-band** can be set in CON-mode. Both are set as a percentage (0-100%). The sum of the Setpoint and the P-band may not exceed 100%. If the Setpoint and P-band is set so it causing that the valve e.g. close at 120% (Setpoint = 80 % & P-band at 100 %), the valve will close at 100 % of security reasons.



**Ramp function:** Since there can be great fluctuations in the process parameters during process start-up, it is possible to establish a ramp function (at start-up only). When it is set to “0”, the function is inactive.

**Valve damping:** Depending which valve is installed, it may be necessary to dampen the speed at which the valve opens. This is used especially when the valve reacts too quickly/strongly. When it is set to “0”, the function is inactive.

If using an oversized valve for the system, a stable control is achieved by increasing the proportional band. It should be noted, however, that by having a large proportional band will have a level offset from the setpoint in controllen. Most often this will offset level does not mean anything in a plant, but if you want to achieve a lower set point with an oversized valve, you can set the desired setpoint in the controller slightly lower than the actual desired setpoint.

## Alarm Mode:

By pushing ALARM mode one gains access to setting up the following alarms, with corresponding hysteresis:

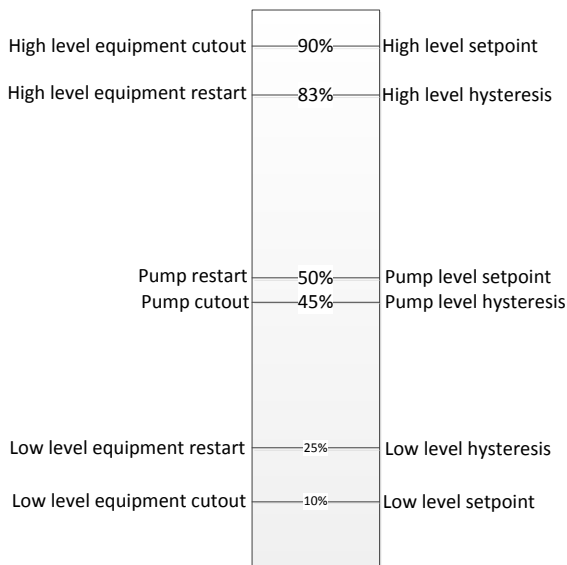
- LOW = low level (Lxx)
- Hysteresis LOW
- HIGH = high level (Hxx)

- Hysteresis HIGH
- PUMP= pump level (Pxx)
- Hysteresis PUMP

[OK] is used to move forward in the menu from LOW to Hysteresis PUMP.

[ROTATE] is used to switch between alarm setpoints. You can leave alarm mode by pressing [OK] in the hysteresis pump mode.

High level setpoint = 90%    Pump level setpoint = 50%    Low level setpoint = 10%  
 High level hysteresis = 7%    Pump level hysteresis = 5%    Low level hysteresis = 15%



**NOTE!** If [↓], [↑] or the [OK] button is not pressed within 10 seconds, automatic calibration mode is exited automatically.

## Calibration:

[CAL] provides access to 2-point calibration. A 2-point calibration can be carried out on two randomly selected points from 0-100%. Based on these two values, the controller itself calculates the sensor's full scale and 0-point.

You can access calibration by pressing [CAL] for 5 seconds. The RUN lamp is shut off and the red LED button in CAL is turned on when you have gained access to the calibration function.

The min/max calibration values are set with the up and down arrow function, and then confirmed with:

- Min. calibration is confirmed by pressing the [OK] button once = [OK]
- Max. calibration is confirmed by pressing the [OK] button twice = [OK] [OK]

After calibration and activation with [OK], ten seconds will pass before it automatically reverts back to normal operation. This is repeated for min. and max. respectively.

## Error Detection

Error	Cause	Error diagnostics
No light in the display and no LED lamps activated	No power to the unit or the wrong voltage	Measure the power on 24 V input terminals.
There is no change in display	1) Defective cable from sensor 2) Defective sensor 3) Valve shut 4) Wrong min./max. calibration.	1-2) Check the sensor. See error detection in the sensor's instruction manual. 3) Look at the valve's position on the 5LED on the front of the instrument.
The valve or the pump do not react to the signal from the controller.	Defective cable or lack of a connection to the pump of the valve.	Check the connection to the sensor or the valve
The display shows too low/high level in relation to the actual level in the vessel.	1) The cable is defective or there is no connection to the sensor 2) Calibration is not correct 3) Calibration is not carried out at the operating temperature 4) Sensor not calibrated to the correct refrigerant	1) Measure the signal from the sensor 2) Calibrate the controller 3) Calibrate at operational temperature 4) Calibrate the sensor. Look at the sensor's instruction manual.
High/low alarm occurs frequently	1) Turbulence in the liquid 2) Alarm set too close to the desired setpoint	1) Check the system's operational state 2) Set the high alarm at a greater difference in value to the desired setpoint.
The display flickers or is unstable	1) Loose connection in the power supply or the sensor 2) EMC interference from mobile telephones, frequency converters, or other equipment that does not meet the legal requirements for EMC.	1) Check for loose connections 2) Check the equipment that is causing flickering 3) Install insulated wire from the sensor to the operator.

## Repairing the Controller:

If repairs are required, the following procedure must be followed:

Go to [www.hbproducts.dk](http://www.hbproducts.dk) and access the menu called "servicering af produkter" (servicing products). Input all the information into the RMA form and receive an RMA-number. Print out the form and send it in together with the sensor. Following this procedure ensures quick processing.



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Please fill out one form per product type. Return the product to the nearest agent. The addresses of our agents can be found on our website.

## Further Information

For further information please visit our website [www.hbproducts.dk](http://www.hbproducts.dk) or send an email to [support@hbproducts.dk](mailto:support@hbproducts.dk)

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