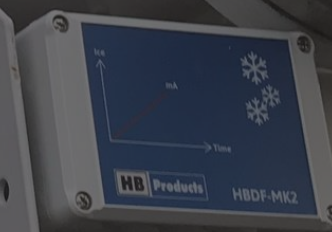
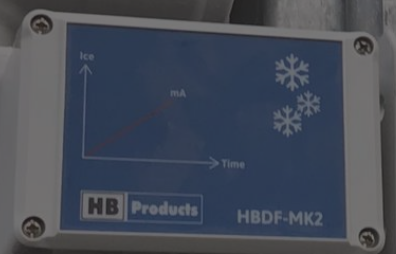


DEFROST SENSOR

Controlling the frost layer on evaporators

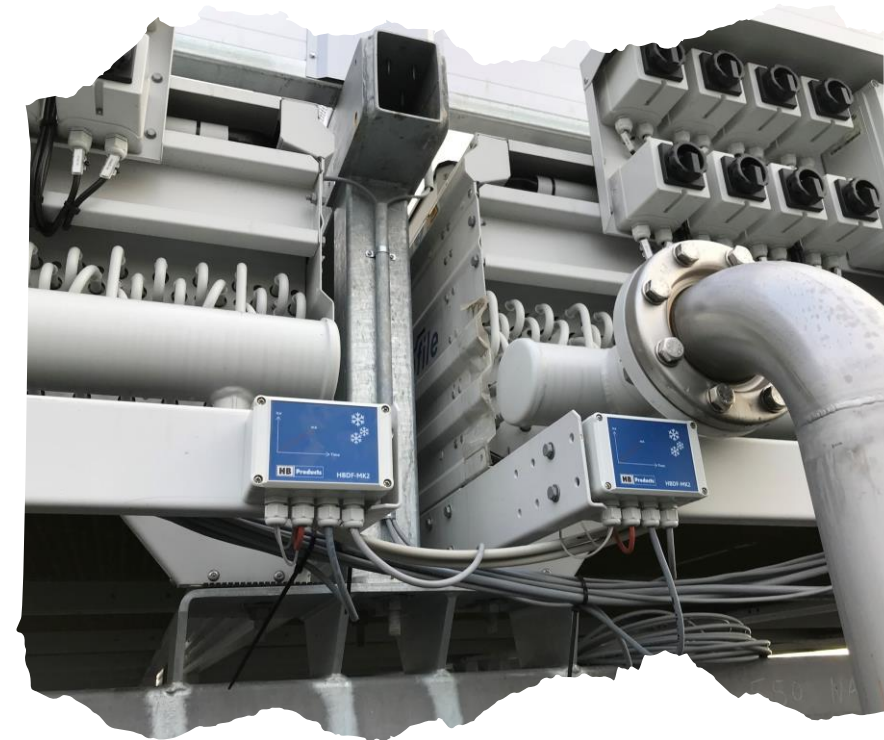


INTRODUCTION

This is a presentation of the demand defrost sensor from HB products – a unique sensor that measures the frost thickness on evaporators. The sensor is typically used in cold storage and freezing tunnels with massive frost built up.

Please note that we constantly improve and modify our presentations. This is our latest version, 2024.

If you have comments or suggested improvements, please contact:
Henrik Kudsk, Product Manager (hk@hbproducts.dk)



MEASUREMENT PRINCIPLE

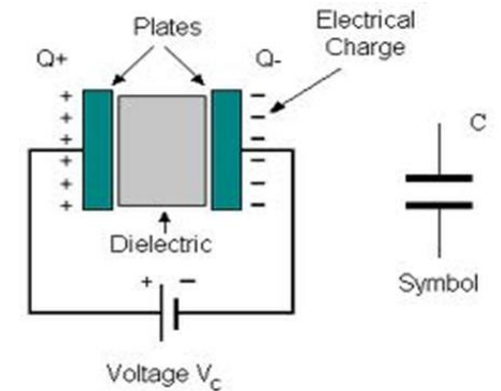
The sensor uses the capacitive measurement principle like most switches and sensors from HB products.

In principle, the sensor acts as a large capacitor where the frost and air are the dielectric, which fills the gap between the two poles. The capacitance is based on the dielectric constant of the frost and air between the wire and the fins. Different liquids have different dielectric constants, some shown in the blue box.

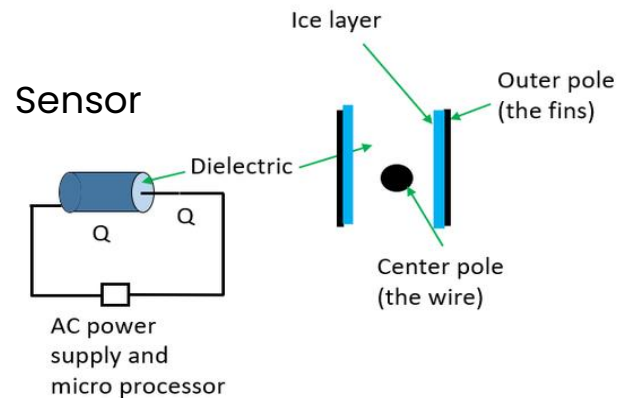
The electronic unit applies a low voltage high-frequency AC to the wire to measure the capacitance. The measured capacitance and base dielectric parameters, allow the sensor to measure the frost layer.

Dielectric Constant:	Temperature 20°C
Water/brine	80 (0°C is 88)
Ammonia	17 (-40°C is 22)
CO2	1.5 (-40°C is 2.0)
Oil type PAO, PEO Oil type PAG	2.2 Mineral and synthetic types 3.5 Synthetic types
R134a	9.24
R22	6.35
R410A	7.78
R507	6.97
R1234ze	7.7
Air and gas	1.0
Ice	3.2

Capacitor



Sensor



DEFROST SENSOR CONSTRUCTION

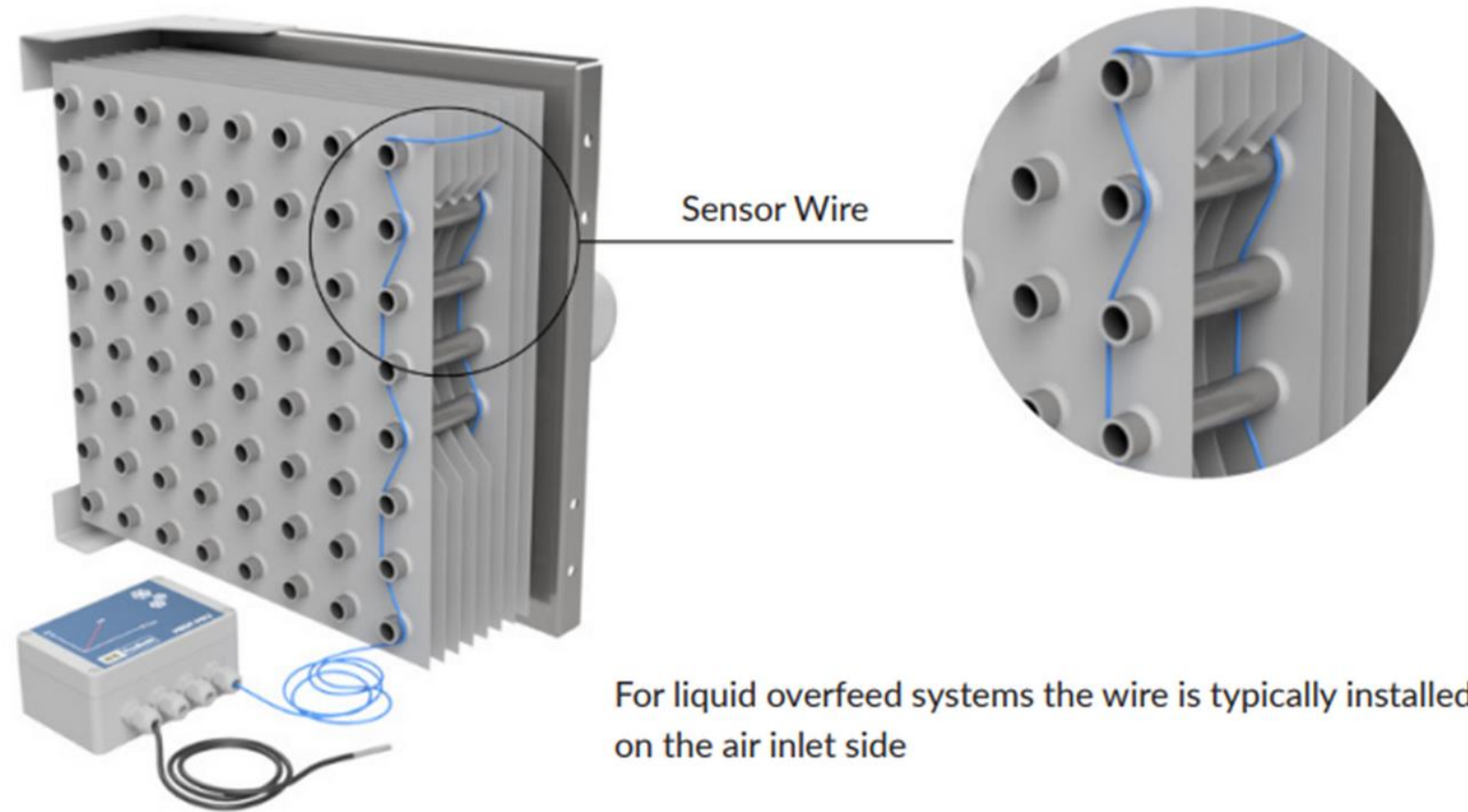
- The sensor consists of a box that contains an electronic circuit board.
- A short ground wire is electrically connected to the fins.
- Insulated steel wire to be mounted between the fins.
- The temperature sensor detects when the frost is melted.



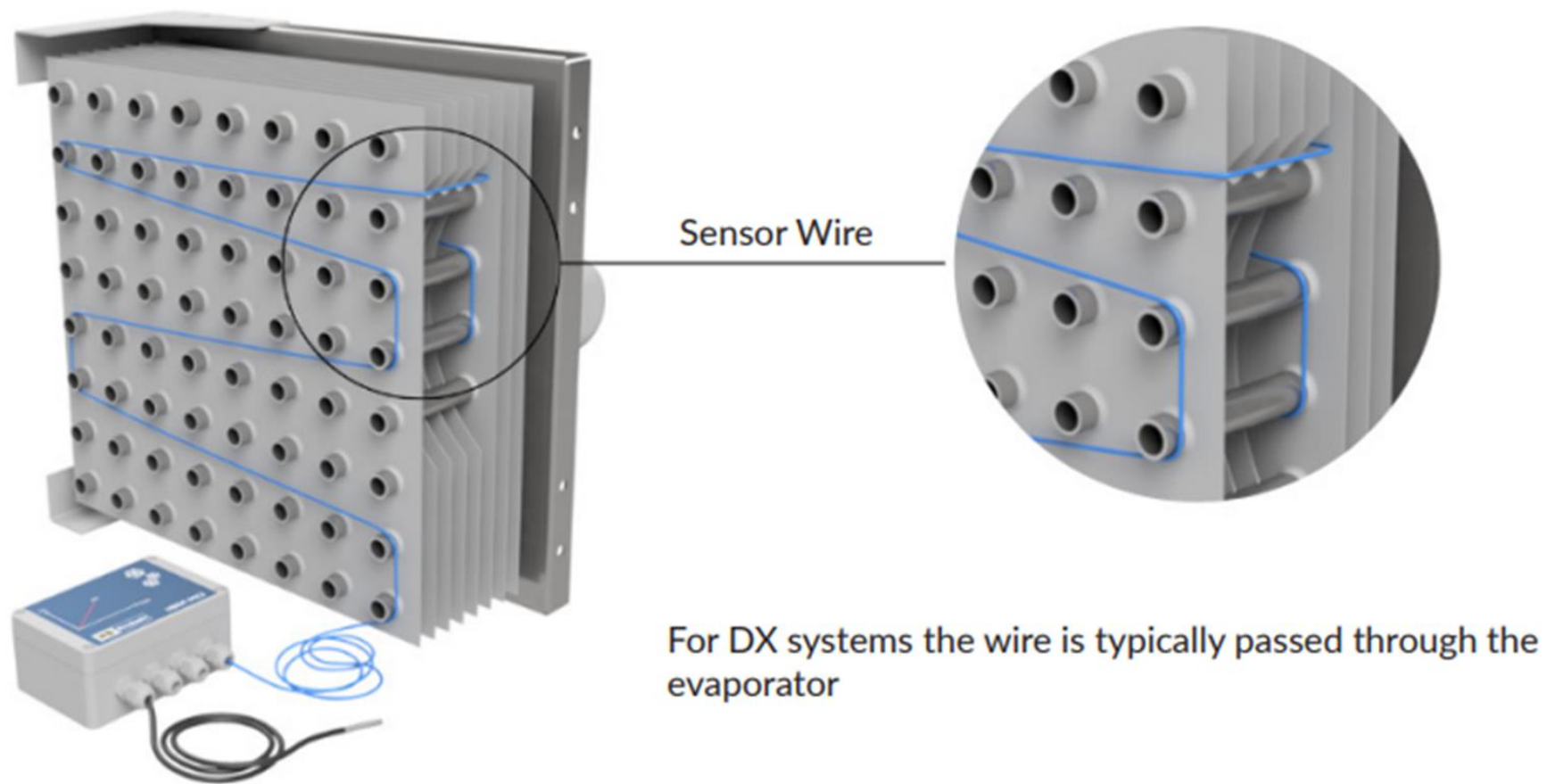
Facts

Temperature sensor PT1000
Power connection
Output: Analog or relays

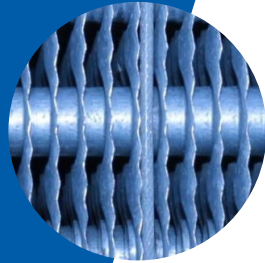
HOW TO INSTALL IN AN OVERFEED SYSTEM



HOW TO INSTALL IN A DX SYSTEM



WHY INSTALL DEFROST

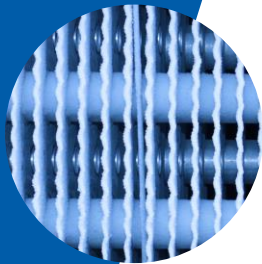


In many cold stores, defrosting is done based on a timer, which often leads to defrosting evaporators, which are not needed.

The applied heat needs to be removed by the refrigeration system, which increases energy consumption.

If the evaporators are covered with frost, they are inefficient, and the system's efficiency becomes poor. This leads to increased energy consumption.

When replacing the timer-based defrosting with a measurement, it is possible to reduce energy consumption significantly.

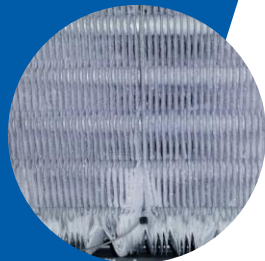


Defrosting is only done when there is a need.

Reduce defrosting cycles by 50%.

Applied heat is reduced.

Defrosting is done when needed thick frost layers can be avoided.



HOW TO INSTALL

The box is installed on the evaporator frame, and the ground cable is electrically connected to the frame and fins. This acts as one of the poles in a condenser.

The wire is mounted between the fins on the evaporator where frost is built up. On some DX evaporators, frost is built up on the air inlet side, but on others, it is in the center or on the outlet side. On pump-circulated evaporators, it is generally on the air inlet side. The wire is the second pole in the condenser.

The wire is passed behind some of the pipes to secure the position.

The temperature sensor is installed where the frost remains for the longest time.

When the sensor is installed and connected, it must be calibrated. This is a simple push-on button in the box.



CALIBRATION

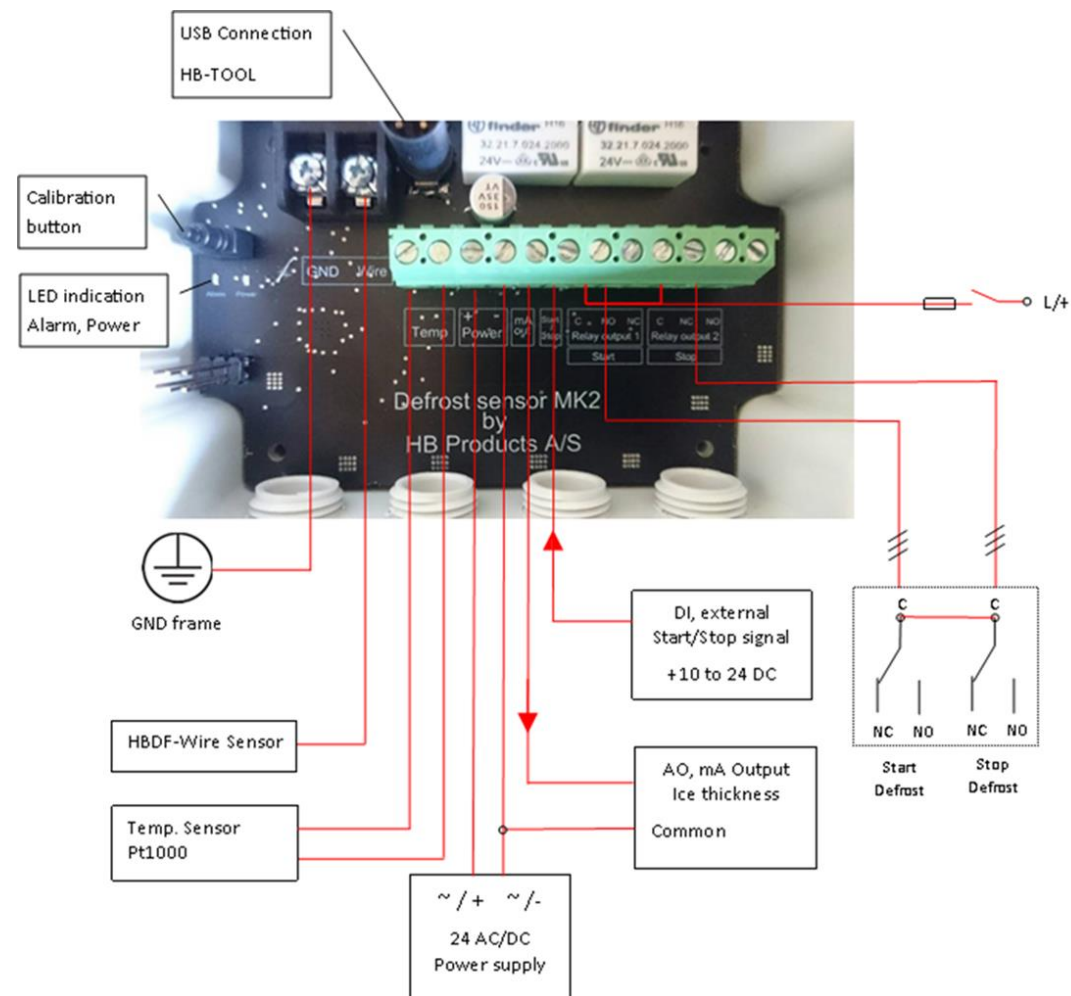
Calibration when it is dry, and the wire is installed.

Three methods

- Type in the dimensions
- Active length
- Fin spacing
- Click on the button
- Use the green button in the box

The screenshot shows the 'HBDF MK2 Management configuration tool' window. It has two tabs: 'Basic settings' and 'Advanced settings'. The 'Basic settings' tab is active. At the top right, there is a green status message: 'Read configuration is successfully'. Below this, there is a 'Disable comm' button and a 'Show sensor settings' button. The 'Sensor SW version' is displayed as 'v1.0'. The main display area shows four large digital readouts: 'Zero calibration in pF' (500.0 pF), 'SPAN calibration in pF' (1000.0 pF), 'Actual measurement in pF' (1000.0 pF, in red), and 'Actual temperature in °C' (-5.0 °C). Below these, there is a horizontal bar graph for 'Ice thickness' ranging from 0% / 4mA to 100% / 20mA, with a green bar indicating 50%. At the bottom, there are two buttons: 'Zero calibration' and 'Defrost now'. On the right side, there is a 'HB Products' logo and a section for 'HBDF MK2 basic settings' with various configuration options: 'Enable Start/Stop function' (OFF), 'Mode' (Relay), 'Defrost start in %' (50), 'Defrost stop temp. °C' (5.0), 'Sensor delay in min.' (5), 'Sensor length in mm' (1000), and 'Distance between fins in mm' (5). At the bottom right, there are buttons for 'Set the configuration' (Save to sensor) and 'Reset data to default'.

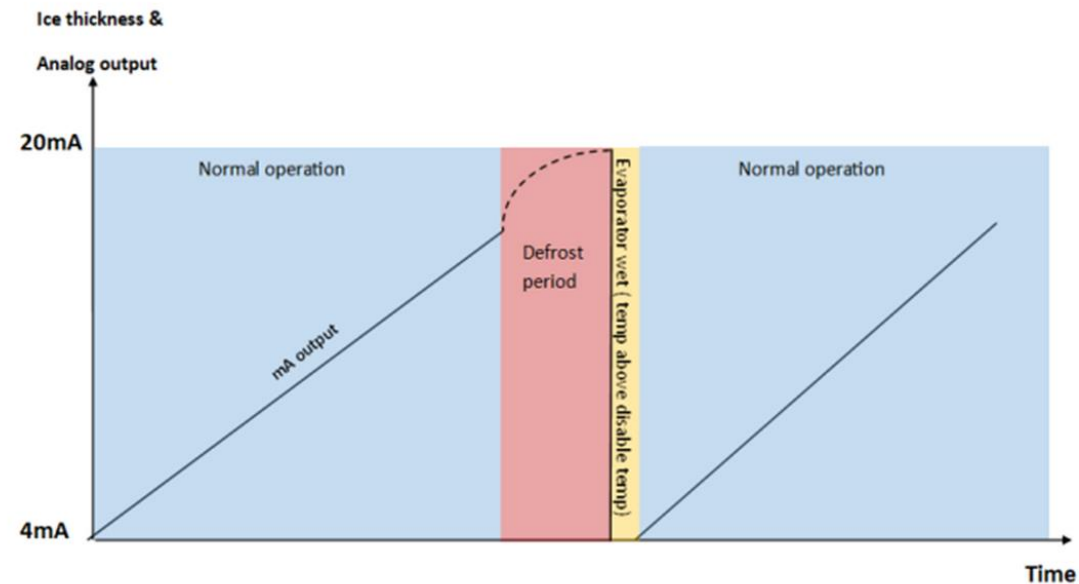
ELECTRICAL CONNECTIONS



THE SIMPLE ANALOG OUTPUT MODE

In this mode, the sensor provides an analog signal of 4-20 mA linear to the frost thickness. The temperature sensor is only used to eliminate measurements when the sensor is wet. The only additional data processing done is averaging the output based on the filtering constant.

- Filter time constant - averaging time in sec
- Disable temp – above this temperature the output will be 4 mA because the measurement is invalid due to water.



THE SMART ANALOG OUTPUT MODE

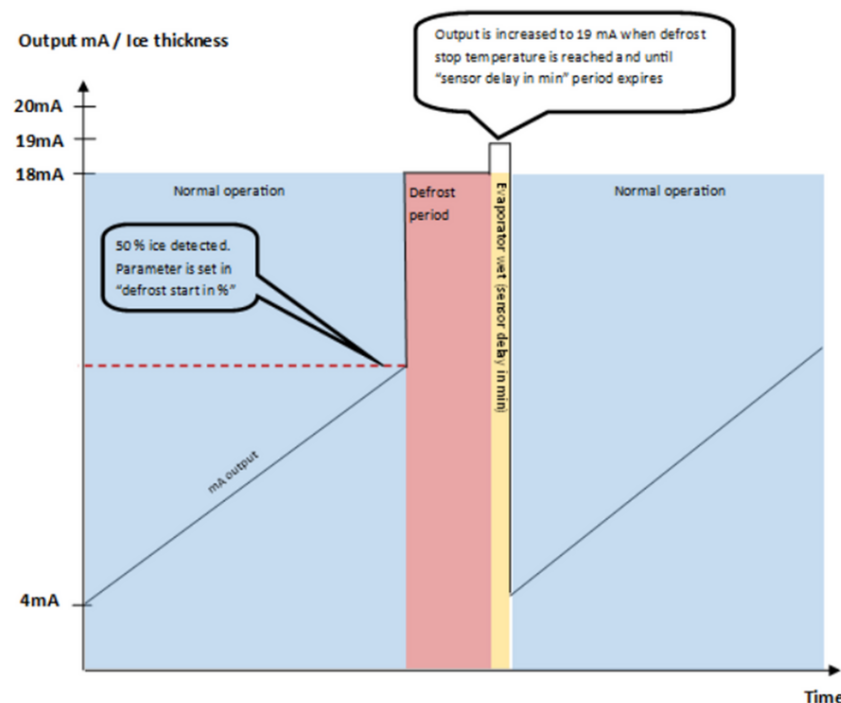
Parameters used for controlling the output:

- Filter time constant - averaging time in sec
- Disable temp – above this temperature the output will be 4 mA, because the measurement is invalid due to water.
- Defrost start in % - defines the frost thickness when defrost should start.
- Defrost stop temp °C - defines the temperature in °C at which the defrosting has ended.
- Sensor delay in min - defines the time in minutes where the sensor is wet, and output is 4 mA

In this mode, the sensor provides an analog signal 4-18 mA linear to the frost thickness until the frost thickness is reached.

Then, the sensor has a constant output of 18 mA until the temperature reaches the specified value, indicating that the defrosting is done.

At this point, the output is 19 mA for a period defined by a parameter. When time has passed, the evaporator should be dry and free from frost – ready for a new cycle

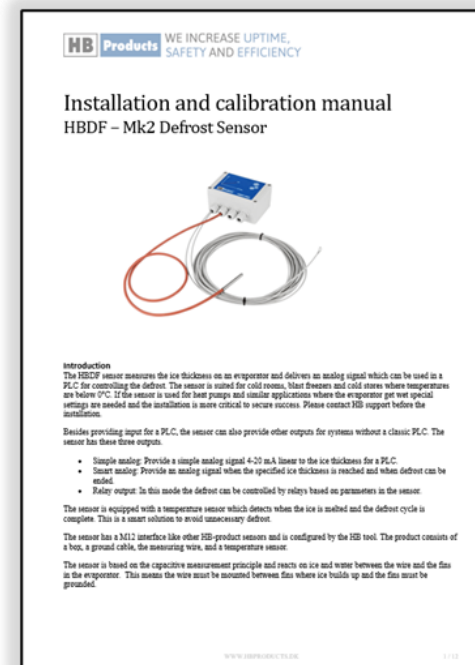


WOULD YOU LIKE MORE INFORMATION?

Product specifications



Instruction manuals





ADDITIONAL INFO

Contact: info@hbproduct.dk

Phone number: +45 87 47 62 00

Address: Bøgekildevej 21, Hasselager, Denmark