

# Heat Pump Controller



## LMC 320 Lodam Heat Pump Controller



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# 1. Read this first!

The contents of this manual are subject to change without notice.

Lodam electronics holds the copyright to this user's manual. The user shall follow any instructions given in this user manual entirely and not only partly. Any non-following of this user manual result in exclusion of all warranties, guarantees, and liabilities.

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## Disposing of the parts of the controller:



INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:


1. WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. The public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment;
3. The equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
4. The symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
5. In the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

## Reading instructions

The following symbols are used to draw the reader's attention to different warning levels.



Important information.


 Danger!! General danger.

 Danger!! High voltage. Danger of electrical current or voltage.


### Reading

Text listed as **Installer.Service**, references to an entry in the menu system, please see the full menu system in Menu system.

### User manual


 Before installation the user should be thoroughly familiarized with this user manual, especially with purposes, installation, settings and operation.

Special care should be taken when installing and connecting external equipment (sensor, high voltage etc).

 Installation of the LMC320 must be performed by authorized personnel only. All warranties are excluded in case installation is performed by unauthorized personnel or in case the LMC320 has not been correctly installed.


Electrical plant failures are to be immediately solved, even though no immediate danger exists; the LMC320 must not be operating.

### Safety

 The LMC320 is not a safety component and can not be used in "medical" or "life support" equipment.

The LMC320 is not a safety component according to the Machinery Directive.

Before plant commissioning the service technician shall ensure that personal safety requirements are met in conformity with the Machinery Directive on the basis of safety estimations.

 Although the LMC320, LOM309 and the LUP200 are approved against the specified EMC standards, the final condensing unit must also be tested against the applying standards.



## 2. General

Lodam's Heat Pump Controller, LMC320 enable you to gain total control of domestic hot water and heating for domestic comfort – thereby optimizing your system to save time, money and energy. Our Lodam Heat Pump Controller is designed for most heat pump applications.

The LMC320 Lodam Heat Pump controller can be used in most heat pump applications to obtain highest possible COP.

- Ground - Brine / Water Heat Pumps
- Air / Water Heat Pumps
- Water / Water Heat Pumps
- Domestic Hot tap water Heat Pumps
- Hot tap water Heat Pump with attached solar panel
- House heating with Heat Pump and optional supply heat

Some benefits from the LMC320 Heat Pump Controller

- Energy and cost saving through intelligent capacity control via frequency inverter
- Higher maximum capacity of compressors using frequency inverter
- Intelligent Defrost Scheduling – Saves energy and ensures low capacity waste
- Intelligent Winter/Summer and Ambient temperature compensation – Provides comfort and saves energy.
- Use of a solar panel for Domestic Hot Tap Water
- Air or Ground source
- User friendly

This user manual applies to software version 1.00 of LMC320.

Lodam support  
[www.Lodam.com](http://www.Lodam.com)

Phone +45 73 42 37 37

### 3. Definitions

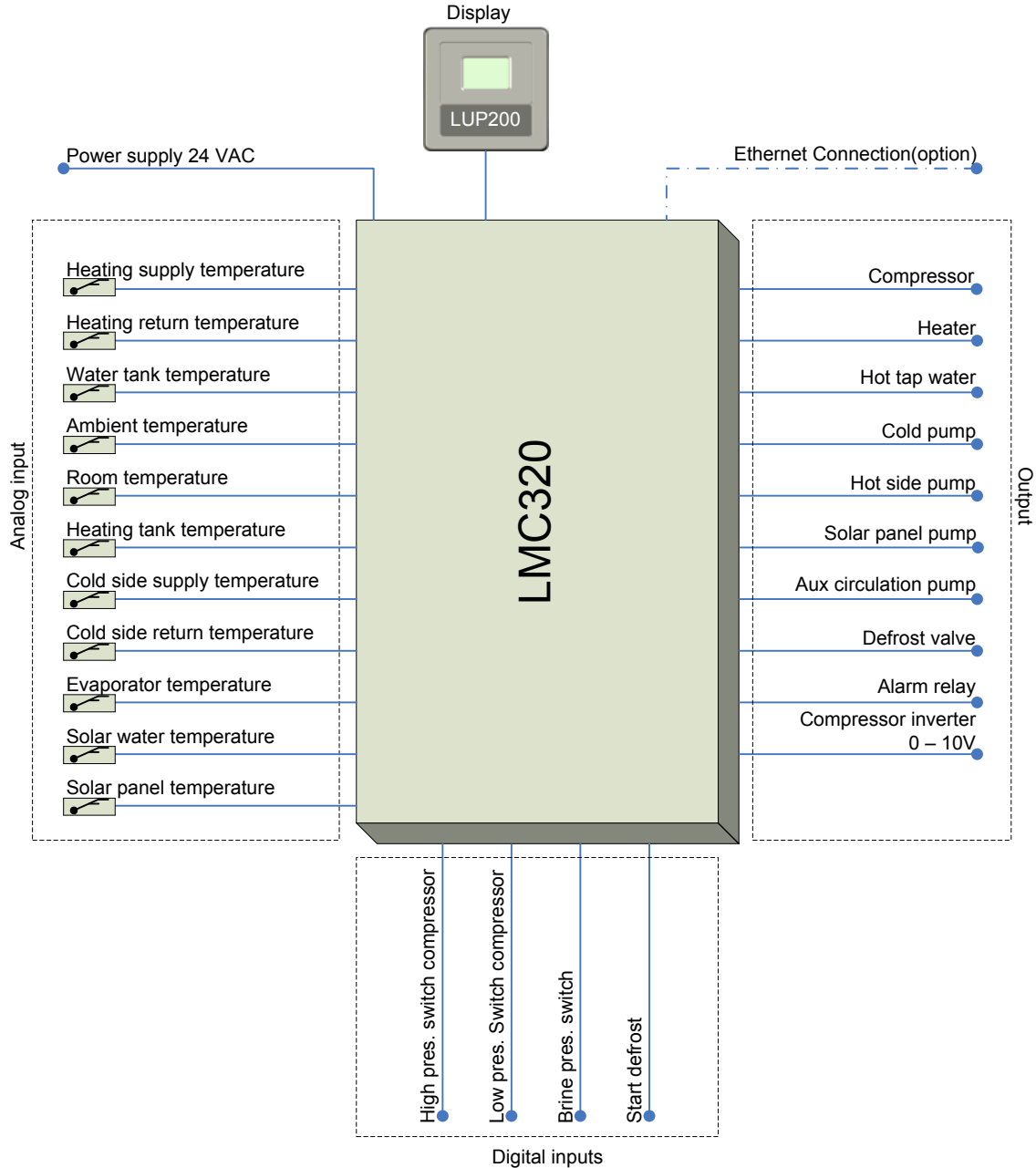
COP	Coefficient Of Performance
FI	Frequency inverter
HW	Hardware/electronics
I/O	Input / Output (electrical signals in and out of a unit)
Limiter	Shortform for a limiting function which monitors the operating conditions
LMT	Lodam Multi Tool (PC communication tool for Lodams controllers)
NC	Normally Closed (relay)
NO	Normally Open (relay)
Pdis	Discharge pressure
Psuc	Suction pressure
PWM	Pulse Width Modulated. Achieve an average value over time
RS485	Serial communication interface
SW	Software
Tamb	Ambient temperature
Tc	Condensing temperature calculated from saturated discharge temperature
Tdis	Discharge temperature (NTC temperature sensor)
To	Suction temperature calculated from saturated suction pressure

A LMC320 Heat pump controller kit from Lodam includes:

- 1 Pc Lodam Heat Pump controller (LMC320)
- 1 Pc Optional board for extra I/O (LOM309)
- 1 Pc Lodam full graphical colour display (LUP200)
- 1 Pc Cabinet and foil for LUP200
- 1 Pc Connector kit for LMC320+LOM309
- 1 Pc Access license to Lodam Multi Tool









# 4. Overview of the LMC320 Heat Pump Controller



## 5. How to ...




### Use the display and the menu system

The buttons on the user panel have the following functions:



- 
Esc button
Cancel editing of a setting / Return to higher level menu
- 
Left arrow
Select icon to the left
- 
Right arrow
Select icon to the right
- 
Up arrow
Select menu item one step up / Increase value in editing mode.  
Holding the button down in editing mode will increase step speed.
- 
Down arrow
Select menu item one step down / Decrease value in editing mode  
Holding the button down in editing mode will increase step speed.
- 
Enter button
Open sub-menu under the icon or lines ending with a ">" / Start editing mode.  
The value on the line is shown with inverted colours.

## Show User information

The following menu is the main menu and the default. The user panel returns to this after 10 min without user activity.

<b>31-01-2010</b>		<b>09:31</b>	
			
Password	User		
<b>Status</b>	<b>Heating</b>		
<b>Seasonal status</b>	<b>Winter</b>		
<b>Room temperature</b>	<b>21°C</b>		
	<b>Alarm</b>		

From the main menu, press the Right arrow to highlight the User icon and press the Enter button to show the User menu

<b>31-01-2010</b>	<b>User</b>	<b>09:31</b>
<b>Language</b>	<b>English</b>	
Display	>	
Alarm	>	
Time	>	
Room temp. Set point	21.0°C	
Hot water set point	45.0°C	
Ambient curve offset	0.0°C	
Seasonal mode	Auto	
New password	1	
		

### Display actual measured temperatures

Show the user information as listed above and use the Down arrow to highlight the Display menu line. Press the Enter button to show the Display menu with measured temperatures and status.

31-01-2010		Display	09:31
<b>Status</b>	<b>Heating</b>		▲
Heating supply temp.	35.7°C		
Heating return temp.	30.9°C		
Water tank temp.	44.0°C		
Ambient temp.	2.1°C		
Room temp.	20.8°C		
Heating tank temp.	35.5°C		
Cold side supply temp.	-3.3°C		
Cold side return temp.	0.0 °C		
Evaporator temp.	-0.5°C		
Heating set point	35.4°C		
Hot water set point	45.0°C		
Compressor frequency	4.71V		
Solar panel Status	Ready		
Solar panel temp.	19.3°C		
Solar panel water temp.	34.7°C		▼

### Set hot water temperature

Open the User menu and scroll to the Hot water set point with the Up or Down arrows. Press the Enter button to enter editing mode and adjust the temperature of the hot tap water setpoint to the desired temperature. Save the new setting by pressing the Enter button.

31-01-2010		User	09:31
Language	English		▲
Display		>	
Alarm		>	
Time		>	
Room temp. Set point	21.0°C		
<b>Hot water set point</b>	<b>45.0°C</b>		
Ambient curve offset	0.0°C		
Seasonal mode	Auto		
New password	1		

### Set room temperature for heating

Open the User menu and scroll to the Room temp. set point with the Up or Down arrows. Press the Enter button to enter editing mode and adjust the temperature of the Room temperature set point to the desired temperature. Save the new setting by pressing the Enter button.

31-01-2010	User	09:31
Language	English	
Display	>	
Alarm	>	
Time	>	
<b>Room temp. Set point</b>	<b>21.0°C</b>	
Hot water set point	45.0°C	
Ambient curve offset	0.0°C	
Seasonal mode	Auto	
New password	1	

In the Ambient / Room temperature compensation menu, **Installer – Ambient / Room compensation** the level of compensation can be set.

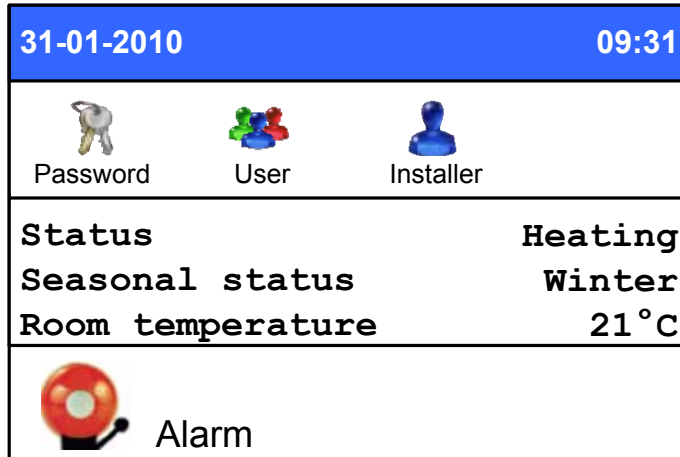
### Access to the installer section

To activate access to the installer section the correct password must be entered. The default installer password is 2. Select the Password icon from the main menu and press Enter. The password menu is shown.

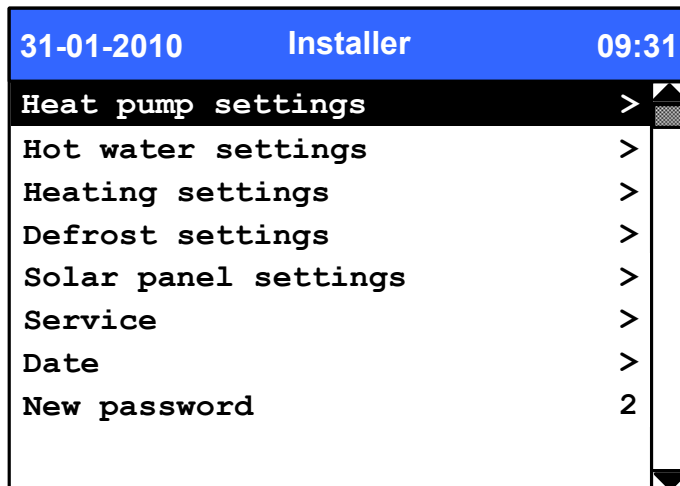
31-01-2010	Password	09:31
<b>Password</b>	<b>0</b>	

Press the Enter button to start editing mode and enter the correct password with use of the up and down arrows. Press the Enter button to select it.

Press the Esc button to return to main menu from where there now is access to the installer section:



Select the Installer icon with the right arrow and press Enter button to show the Installer menu:





## Set control mode for the installation

Open the Installer menu and scroll to the line with Service. Under Service menu open the sub menu Manual by pressing the Enter button.

31-01-2010	Manual	09:31
<b>MainSwitch</b>	<b>On</b>	▲
RE1 - Compressor	Off	
RE2 - Heater	Off	
RE3 - Hot water	Off	
RE4 - Cold pump	Off	
RE5 - Hot pump	Off	
RE7 - Solar panel pump	Off	
RE8 - Cold pump low	Off	
RE9 - Aux circ pump	Off	
RE10- Defrost valve	Off	
AN1 - Compressor speed	0.0 %	
AN1 - Compressor speed	0.0 V	▼

In MainSwitch field, **On** means the unit is running, **Off** the unit is stopped and **Manual** that the outputs can be operated from this menu for service purposes. Manual mode should be used by trained personnel only!

## Setting the defrost function

Open the Installer section, Installer menu and scroll to the line with Defrost settings

31-01-2010	Installer	09:31
Heat pump settings	>	▲
Hot water settings	>	
Heating settings	>	
<b>Defrost settings</b>	<b>&gt;</b>	
Solar panel settings	>	
Service	>	
Date	>	
New password	2	▼

Press the Enter button to show the Defrost menu

31-01-2010 Defrost 09:31	
<b>Defrost method</b>	<b>Auto</b>
Ice level	-2.0°C
Relative ice level	7.0°C
Ice time	20min
Min time between defrost	60min
Evaporator stop temp.	5.0°C
Max defrost time	10min
Advanced defrost setting	>

### Enable use of a solar panel

Open the Installer section, Installer menu and scroll to the line with Hot water settings.

31-01-2010 Installer 09:31	
Heat pump settings	>
<b>Hot water settings</b>	<b>&gt;</b>
Heating settings	>
Defrost settings	>
Solar panel settings	>
Service	>
Date	>
New password	2

Press the Enter button to open the How water settings menu

31-01-2010 Hot water 09:31	
<b>Hot water source</b>	<b>HP+EH+SP</b>
Hot water set point	65.0°C
Hot water neutral zone	4.0°C
Hot water capacity	80%
Hot water minimum	35.0°C
Legionella interval	OFF

In Hot water source select a setting which uses the solar panel: **SP**, **HP+SP**, **SP+EH**, **HP+EH+SP**, **SP+HP-DUAL**. Default setting is only to use the heat pump, **HP**.

Settings for the solar panel can be set by opening the Solar panel settings menu

31-01-2010	Installer	09:31
Heat pump settings	>	
Hot water settings	>	
Heating settings	>	
Defrost settings	>	
<b>Solar panel settings</b>	>	
Service	>	
Date	>	
New password	2	

After pressing the Enter button the Solar panel settings menu will be shown

31-01-2010	Solar panel	09:31
<b>Sensor selection</b>	<b>Water tank</b>	
Start temp. diff.	5.0 °C	
Stop part	0.0 -	
Max solar panel temp	95.0 °C	
Max water temp.	70.0 °C	
Max restart temp.	70.0 °C	

## 6. Functions of the LMC320

The LMC320 controller is designed for heat pumps for domestic heating. The system contains an evaporator for cooling air or brine, a compressor with either fixed or variable speed and either a common or dual condensers for heating of water. For air evaporator a defrost control system for hot gas bypass or air defrost is available.

The system can also contain a solar panel for heating of domestic hot water. On the water system a change-over valve between production of domestic hot water and hot water for heating is controlled. Control of the pumps when using a heating accumulation tank is included. Electrical heaters in series with the heat pump condenser are used for backup.

The controller includes a number of functions which are listed below.

### **Seasonal mode - summer/winter operation**

During the summer period there is no need for heating and to save energy the controller will only generate hot tap water using the heat pump and/or an optional solar panel. On the main (default) menu, the actual seasonal status is shown.

The user can manually select between Summer and Winter on the **User menu**.

The unit will switch automatically if set to Auto based on the settings below:

- If the temperature has been above 17 °C for 24 hours, the unit switches to Summer mode.
- If the temperature has been below 13 °C for 24 hours, the unit switches to Winter mode.

### **Ambient room temperature compensation / heating setpoint control**

There are the following heating setpoint control modes which use different strategies to calculate the needed capacity:

- Min comp.
- Ambient
- Room
- Amb + room
- Room On/Off

### Heating control – Min comp.

Compensation is disabled and setpoint for return water temperature is set to minimum allowed return water temperature.

### Heating control – Ambient

Use the actual ambient temperature to calculate a needed setpoint.

It is possible to pre-program the setpoint for the return water temperature with respect to the actual ambient temperature.

The desired return water temperature is adjusted for 5 ambient temperatures: -20 °C, -10 °C, 0 °C, +10 °C and -20 °C.

Based on these settings, the needed return water temperature is calculated based on interpolation between the given temperatures. Below -20 °C and above +20 °C the programmed settings for -20 °C respectively +20 °C are used.

There are 10 pre-programmed curves. Please see section Ambient compensation curves for actual curves.

### Heating control – Room

Compensation of return water temperature is calculated using only the room temperature.

The return water temperature control is based only on the measured room temperature and the selected setpoint.

Return water temperature is limited by Heating.Set point Min and **Heating.Set point Min + Ambient/Room comp.Max room comp.** It is therefore important to set these values accordingly.

### Heating control Amb + room

Room temperature compensation with respect to both ambient and room temperature.

Compensation of return water temperature based on ambient temperature is not always sufficient since influence of wind and sun can affect the heating demand significantly.

Room temperature compensation has the possibility to ensure the wanted room temperature in a selected "representative" room where the best achievable comfort is desired.

Room temperature compensation will raise the return water

temperature if the room temperature in the critical room can not be maintained with the calculated return water temperature setpoint from ambient compensation.

Room compensation has two settings, first the wanted setpoint in the room and second the maximum number of degrees the return water temperature may be increased to maintain the wanted room temperature. Typical values would be 20 °C for room temperature and 10 °C for maximum increase of return water temperature – **Ambient/room comp.Max room comp.**

Room temperature compensation can only increase the return water temperature with respect to the calculated return water temperature from the ambient compensation function. It is therefore important that the ambient compensation is adjusted to minimum values for return water temperature

### **Heating control – On/Off room temperature control**

Room temperature can be controlled based on a simple start and stop of the heatpump.

Room temperature setpoint is set on the user menu – **Room temp. Set point** and the acceptable difference is set in installer menu - **Heating settings.Heating neutral zone.**

When the room temperature is below the setpoint minus half of the difference, the heat source reference setpoint is set to the maximum allowable temperature. When the room temperature is above the setpoint + half of the allowable difference, the heat source is stopped by setting the reference setpoint to minimum allowable temperature.

Minimum and maximum return water temperatures are respected and so are the restart times for the compressor. Hot tap water production can overrule this function.

If the room temperature sensor is defect, the reference for the returns water temperature is set to **Heating.Set point Min.**

### **Heating control**

If heating is activated, the controllers will primarily use the heat pump controller for heating and only use supplemental (electrical or boiler) heating if the capacity of the heat pump is too low.

There are four modes of the heating control

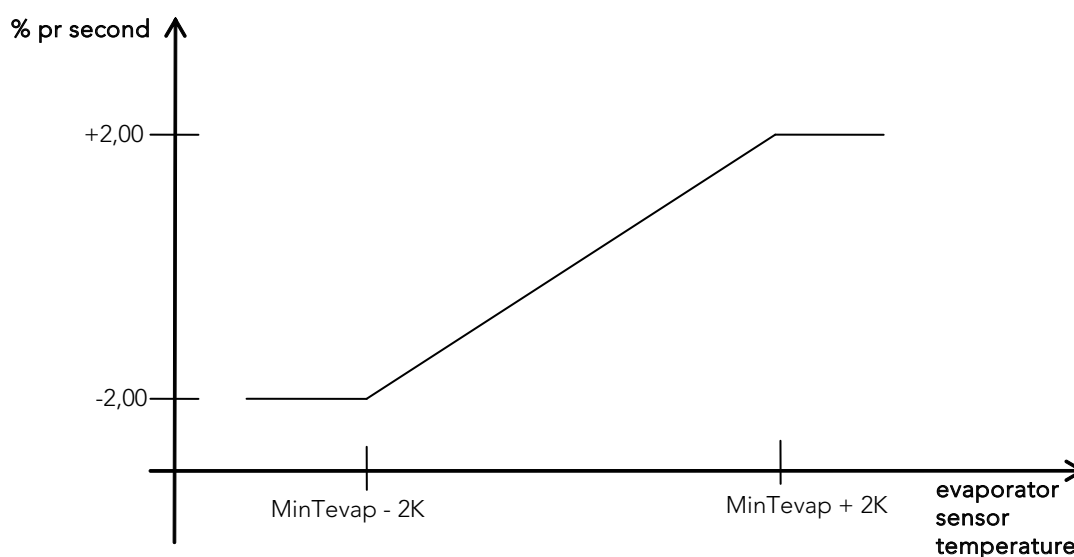
1. On/Off compressor control based on return water temperature
2. Modulating compressor control based on supply water temperature
3. On/Off compressor control based on heating accumulator water tank temperature
4. Modulating compressor control based on heating accumulator water tank temperature – uses inverter

In heating control modes 2 and 4 the capacity is controlled by a PI controller. The output is the requested capacity. The actual capacity is formed based on the requested capacity (CapReq). The rate of actual capacity (CapAct) change is limited to max +/-1% per second and if evaporator sensor temperature is close to a preset value (MinTevap) the rate of change limited according to the graph below. Gain (Gain) and integration time (Tn) is adjustable.

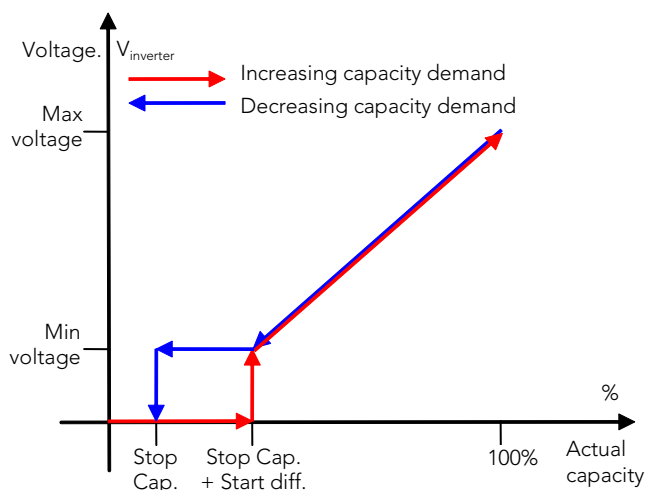
In heating control modes 1 and 3 the compressor is started when the selected temperature is below the setpoint – neutral zone. The compressor is stopped when the temperature is above the setpoint.

When capacity exceeds a preset value (StartCap) the compressor is started. When the capacity is lower than a preset value (Stop Cap) the compressor is stopped. The PI controller runs continuously also during off periods.

The compressor relay is open when the compressor is stopped.



The first 5 second after start a constant preset voltage ( $U_{start}$ ) is sent to the inverter. After that a voltage linear to the capacity is sent to the output (see graph below). The rate of capacity change is limited to max 1% per second.



### Supplemental heating

If the heat pump has insufficient capacity external heating, electrical or a boiler will be used as supplemental heat source.

The default delay before the supplemental heating is activated is 30 min – after a compressor start.

### Hot water control

Hot water is produced using the heat pump, a supplemental heating, a solar panel or a combination of these heat sources. Supplemental heating has a lower set point and is only meant as a backup function for producing hot water. The solar panel is delivering hot water when it can and is operated in parallel with the other two heat sources.

If the compressor is controlled by a frequency inverter, the capacity (speed) is kept at a constant level during hot water production. This setting, **Hot water capacity** is default at 80 % of maximum speed and can be adjusted to the most energy efficient setting of the compressor and installation.

Since the mechanical losses are reduced with reduced speed and the losses at each start are minimized, a compressor with a frequency inverter has a more stable water temperature, a longer lifetime and better energy efficiency.



### Hot tap water valve

The output for the 3-way valve is inactive when the water temperature is within the setpoint – neutral zone setting. When there is a request for more hot water in the tank, the relay is activated whether the compressor or supplemental heating is used.

The solar panel is independent of this 3-way valve.

If an installation is with a dual condenser, see Examples of application use, the output can be used for a circulation pump.

### Anti-Legionella function/treatment

In hot water tanks with lower hot water temperatures there can be a growth in Legionella bacteria's in the water. To prevent this growth, the controller can be scheduled for regularly Legionella treatments where the water temperature is raised to 60 °C.

This is done using the heat pump, external heat supply if available and solar panel if available.

If the temperature is not reached after 5 hours within two attempts with normal time interval, alarm 607 Legionella failed is raised.

### Solar panel control

The heat pump installation can be equipped with a solar panel as a supplemental hot water source. The solar panel must have its own coil for heat exchange in the water tank and must be self-secured against overheating if there is no more need for hot water in the hot water tank. See section Examples of application use.

The solar panel is controlled by its own state machine and is only affected from the main program if a total stop condition occurs. This will also stop the solar panel heating.

In section **Installer – Solar panel settings** the different parameters and ranges are described.

### Defrost handling

A ground / water heat pump does not need defrosting, so for this type of installation the automatic defrost must be deactivated.

Since an air evaporator in air/water heat pumps can be filled with

frost at low ambient temperatures the LMC320 is equipped with an automatic defrost system.

The defrost method can be **Air**, **Hot gas**, **Auto** or **Off**. **Air** means only the fan is used for melting the ice in the evaporator. **Hot gas** uses a hot gas/bypass valve to let the hot gas from the discharge side of the compressor through the evaporator and thereby melting the ice from the "inside". In **Auto** mode hot gas is only used at ambient temperatures below 3 °C. **Off** is used to disable automatic defrost.

The settings are accessible on the **Installer – Defrost settings** menu where the different settings are also described.

### Safety cut out

There are three safety cut outs:

- High pressure    The controller will attempt 3 restarts before user intervention is needed
- Low pressure    The user must acknowledge the alarm for starting again
- Brine leakage    The user must acknowledge the alarm for starting again

### Sensor monitoring

The sensors are monitored against short circuit or lost connection and the appropriate alarm is set. Please see section Alarm system and trouble shooting for a list of alarms and how to trouble shoot an alarm.

### Hot side pump control

The relay for the hot side pump can be used for different configurations. However the hot side pump is running together with the compressor except during defrosting. This pump is also motioned during pump exercises.

### Cold pump control

After the heat pump has stopped, the fan / brine pump will run another 1 min to ensure there evaporator temperature is stabilized. The next compressor start will have lower pressure difference across the compressor and give less mechanical wear on the compressor. At start up of the heat pump, the fan / brine pump starts a little later

to allow heat to be created.

A low limit ambient temperature can be set and below this temperature the fan / brine pump will run continuously even if the heat pump is stopped. Default this setting is off.

There is also a high limit ambient temperature for the fan / brine pump. Above this setting the continuous operation of the fan/brine pump is cancelled.

### **Aux pump control**

The aux pump is used for circulating heating water from the heating accumulator tank to the radiators in the building.

### **Pump exercise function**

If a pump is standing still for longer periods, dirt and minerals can grow so solid the pump is sticking. To prevent this, the pumps are exercised at regular intervals for short time, default 15 s. The interval can be adjusted.

### **Freeze protection**

The controller has anti-freeze protection functions to prevent damages to the installation. These anti-freeze functions are always active including in the Off-mode. Malfunctioning sensors could prevent these functions to work.

- If the ambient temperature drops below 2 °C, the circulation pump for central heating is started. Hereby the installation in cold areas is secured and the water temperature can be monitored.
- If hot tap water temperature or heating water temperature drops below 2 °C, all circulations pumps are started together with the heat pump and supplemental heating to try to raise the water temperatures above 5 °C.

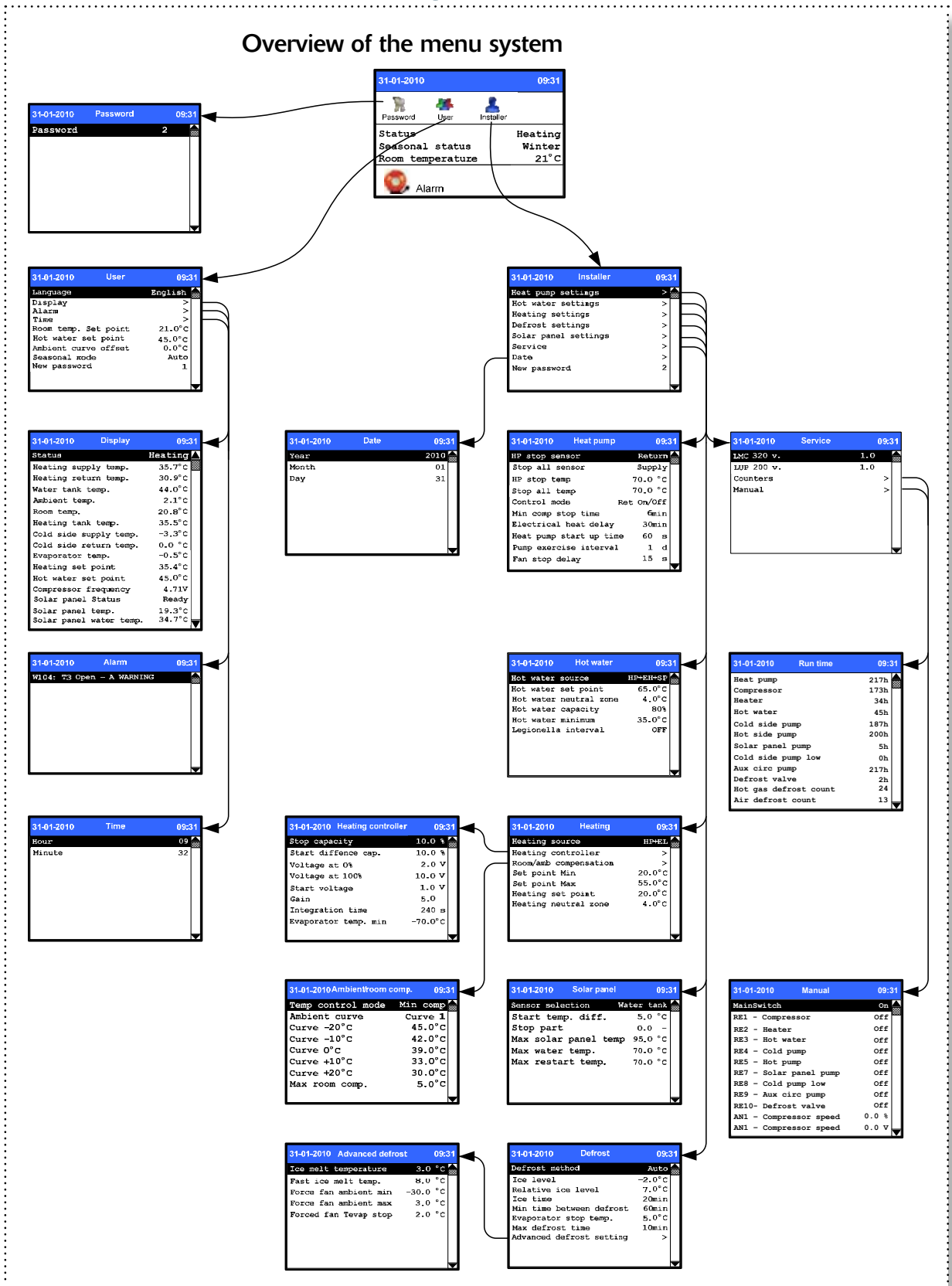
A warning, AL604 Frost protection will be set if the start condition is set but there is no temperature rise.

### **Minimum evaporator/brine temperature limiter**

If the brine temperature of the brine gets too low, there is a risk of freezing the brine and thereby damaging the installation. If this limit is reached, the heat pump is turned off but the pump is kept running constantly.

# 7. Menu system

## Overview of the menu system



**Main menu**

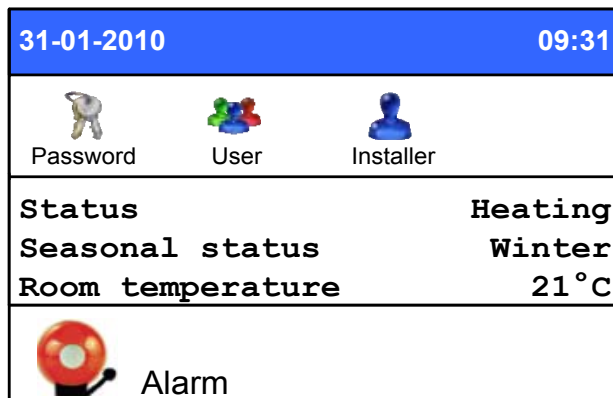
When the user – or installer password has been entered, the respective icon appears. By moving the cursor to the wanted icon and pressing Enter key, the submenus are shown.

Status shows the status of the heat pump

Seasonal status can be Summer or Winter. This affects the settings.

Room temperature shows the temperature at the room control sensor.

If the alarm icon is flashing, the listed alarm is active or unacknowledged.



**Password menu**

Enter the password for the desired user category.

Default passwords:

- User            1
- Installer       2



31-01-2010		User	09:31
<b>Language</b>	<b>English</b>		
Display	>		
Alarm	>		
Time	>		
Room temp. Set point	21.0 °C		
Hot water set point	45.0 °C		
Ambient curve offset	0.0 °C		
Seasonal mode	Auto		
New password	1		

## User menu

### Language:

At the moment only English is available.

### Display:

View values from the unit

### Alarm:

A list with up to 16 alarms

### Time:

Set the time

### Room temp. Set point:

View or adjust the wanted room temperature

Range 5.0 – 40.0 °C

Default 20.0 °C

### Hot water set point:

View or adjust the wanted hot water temperature

Range 5.0 – 55.0 °C

Default 20.0 °C

### Ambient curve offset:

Set an adjustment/fine tuning for the selected temperature curve.

This offset is applied for the entire curve regardless of selected curve.

Range -10.0 – 10.0 °C

Default 0.0 °C

### Seasonal mode:

Switch between only producing hot water and hot water and heating.

Summer: Only hot water is produced

Winter: Hot water and heating is produced

Auto: The ambient temperature is used for automatic switching between Summer and Winter

Default is Auto.

### New password:

New code for the user section

## User - Display menu

View readings and settings for the heat pump.

### Status:

Heating, Hot water, Off

### Heating supply temp.:

Supply temperature for heating system.

### Heating return temp.:

Return temperature for heating system.

### Water tank temp.:

Temperature of the water in the hot tap water tank.

### Ambient temp.:

Ambient temperature

### Room temp.:

Show actual room temperature.

### Heating tank temp.:

Temperature of the heating tank.

### Cold side supply temp.:

Inlet temperature of the cold side.

### Cold side return temp.:

Outlet temperature of the cold side.

### Evaporator temp.:

Evaporator temperature.

### Heating set point:

Heating set point

### Hot water setpoint:

Hot water setpoint

### Compressor frequency:

Actual voltage sent to the inverter for the compressor

### Solar panel status:

Off, Heating, Forced stop

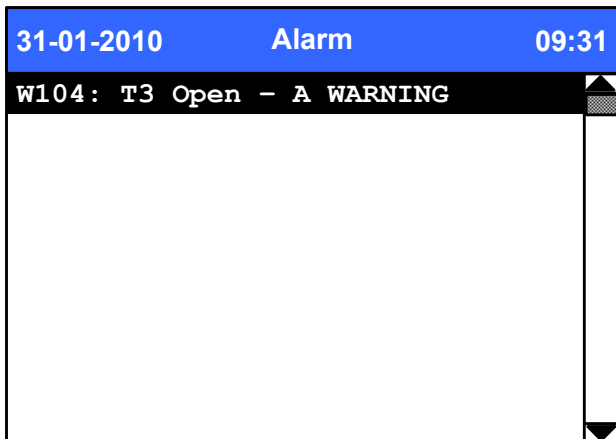
### Solar panel temp.:

Temperature of the solar panel.

### Solar panel water temp.:

Water temperature of the solar panel

31-01-2010		Display	09:31
Status	Heating ▲		
Heating supply temp.	35.7°C		
Heating return temp.	30.9°C		
Water tank temp.	44.0°C		
Ambient temp.	2.1°C		
Room temp.	20.8°C		
Heating tank temp.	35.5°C		
Cold side supply temp.	-3.3°C		
Cold side return temp.	0.0 °C		
Evaporator temp.	-0.5°C		
Heating set point	35.4°C		
Hot water set point	45.0°C		
Compressor frequency	4.71V		
Solar panel Status	Ready		
Solar panel temp.	19.3°C		
Solar panel water temp.	34.7°C		▼



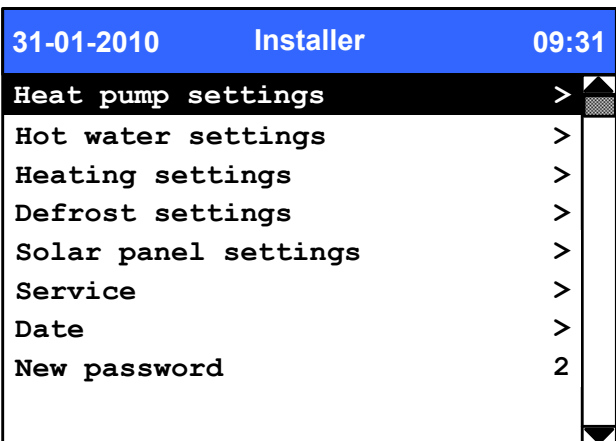
**User- Alarm menu**

Show active or unacknowledged alarm and warnings. Only alarms starting with a capital before the text Warning, Alarm or Critical can be acknowledged and will be cleared from the list. Default is No alarm.



**User - Time setting menu**

Set the hour and minute in the real time clock of the controller.



**Installer menu**

**Heat pump settings:**

Settings for the heat pump

**Hot water settings:**

Settings for the hot water.

**Heating settings:**

Heating setup

**Defrost settings:**

Adjustment of defrost function

**Solar panel settings:**

Use of the solar panel

**Service:**

Access to the service menus

**Date:**

Set the data for the controllers real time clock

**New password:**

Set a new password for the installer section



## Installer - Heat pump settings

Settings for controlling the heat pump.

### HP stop sensor:

Control sensor to use for stopping the heat pump at high temperature  
Return, Supply, None.  
Default Return.

### Stop all sensor:

Control sensor to stop the entire unit including the solar panel.  
Return, Supply, None.  
Default Supply

### HP stop temp.:

The heat pump will stop when this temperature is reached  
Range 30.0 °C – 70.0 °C  
Default 70.0 °C

### Stop all temp.:

All supply heat will be stopped when this temperature is reached  
Range 30.0 °C – 90.0 °C  
Default 70.0 °C

### Control mode:

Control methods of the heat pump when generating heating  
*Ret On/Off*: On/Off control of the heat pump based on the return temperature of the heating system  
*HTank On/Off*: On/Off control of the heat pump based on the temperature of the heating accumulator tank

### Sup Modul:

Speed control of compressor via a FI based on supply temperature of the heating system.

### HTank Mod.:

Speed control of compressor via a FI is based on temperature of heating accumulator tank

31-01-2010 Heat pump 09:31	
HP stop sensor	Return
Stop all sensor	Supply
HP stop temp	70.0 °C
Stop all temp	70.0 °C
Control mode	Ret On/Off
Min comp stop time	6min
Electrical heat delay	30min
Heat pump start up time	60 s
Pump exercise interval	1 d
Fan stop delay	15 s

Default: Ret On/Off

**Min comp stop time:**

Minimum off time for the compressor.

Range 1 – 15 min

Default 6 min.

**Electrical heat delay:**

Minimum wait time before the electrical supply heating is turned on.

Range 0 – 60 min

Default 30 min.

**Heat pump start up time:**

Time from pump start to compressor start.

Range 15 – 120 s

Default 60 s.

**Pump exercise interval:**

Select how often the pumps should be activated to prevent pump damage during standstill periods of the heat pump.

The pumps will run for 15 s

Range 0 – 60 d

Default 1 d.

**Fan stop delay:**

Select how long time the fans/ cold pump should run after the compressor stops.

Range 0 – 60 s

Default 15 s.

31-01-2010	Hot water	09:31
<b>Hot water source</b>	<b>HP+EH+SP</b>	
Hot water set point	65.0°C	
Hot water neutral zone	4.0°C	
Hot water capacity	80%	
Hot water minimum	35.0°C	
Legionella interval	OFF	

**Installer - Hot water settings**

Setup of hot water sources, temperature and control.

**Hot water source:**

Different sources and combinations.

NONE: No one defined

HP: Heat pump

HP-DUAL: Heat pump with dual condenser

EH: Electrical heat

SP: Solar panel

HP+EH

HP+SP

SP+EH

HP+EH+SP: All sources are used according to best energy efficiency

SP+HP-DUAL

Default: HP

**Hot water set point:**

Desired hot water temperature

Range 5 ° to 55 °C

Default 45 °C

**Hot water neutral zone:**

Neutral band from hot water setpoint.

Range 0.1 to 15.0 °C

Default 4.0 °C

**Hot water capacity:**

Use a specific capacity / speed when producing hot water (only for modulating control).

A frequency inverter controlled heatpump may have a better energy efficiency at lower speed than at max speed.

Range 10 – 100 %

Default 80 %

**Hot water minimum:**

If hot tap water temperature is below hot water minimum for more then "Electrical heat delay", the electrical heater is turned on.

If hot tap water temperature is above hot water minimum, the heater is turned off.

Range 5 – 55 °C

Default 35 °C

**Legionella interval:**

Intervals between anti-Legionella operations.

Range 0 – 21 d

0 d = Off.

Default 7d

31-01-2010 Heating 09:31	
<b>Heating source</b>	HP+EL
Heating controller	>
Room/amb compensation	>
Set point Min	20.0 °C
Set point Max	55.0 °C
Heating set point	20.0 °C
Heating neutral zone	4.0 °C

### Installer - Heating settings

Setup of house heating control.

#### Heating source:

Different heat sources are selectable:

HP: Heat pump

EH: Electrical heat supply

HP + EH: Heat pump and electrical heat supply.

Default HP

#### Heating controller:

Heat controller setup menu

#### Room/ambient compensation:

Menu for setup of room temperature compensation according to actual ambient temperature. Installation specific.

#### Set point Min:

Low limit for heating setpoint.

Range 0.5 – 55.0 °C

Default 20.0 °C

#### Set point Max:

High limit for heating setpoint.

Range 0.5 – 55.0 °C

Default 55.0 °C

#### Heating setpoint:

Calculated setpoint for heating.

Only view, calculated according to ambient / room compensation settings and setpoint min / max.

#### Heating neutral zone:

Neutral band for On/Off control (not for modulating control).

Range 0.1 – 15 °C

Default 4.0 °C

### Installer - Heating controller menu

The settings in this menu are only used when frequency inverter operation is used –modulating control.

Setup of the heating controller.

The heating control is a PI-regulator that calculates a capacity request. Please see the function.

#### Stop capacity:

Capacity is 0 to 100 %, below this setting the heating is stopped.

For use with frequency inverter

Range 0.1 – 100 %

Default 10.0 %

#### Start difference cap.:

Hysteresis in capacity before heating is started again.

For use with frequency inverter

Range 0 - 100%

Default 30%

#### Voltage at 0%:

Output voltage to achieve stop capacity + start difference with a frequency inverter

Range 0.0 – 10.0 V

Default 2.0 V

#### Voltage at 100%:

Output voltage to achieve 100% capacity with a frequency inverter

Range 0.0 – 10.0 V

Default 10.0 V

#### Start voltage:

Initial start-up capacity/speed of the compressor with a frequency inverter.

Range 0.0 – 10.0 V

Default 1.0 V

#### Gain:

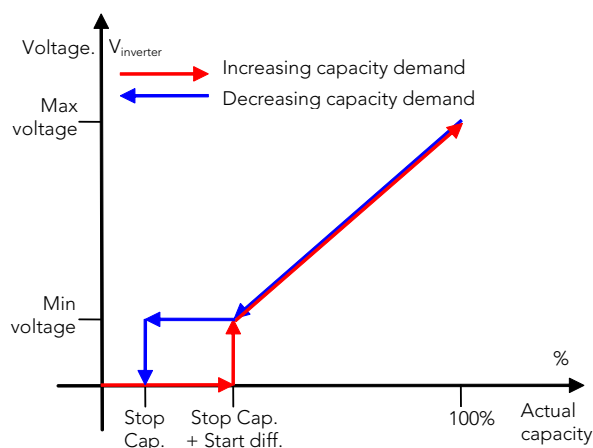
Gain of the heating

PI- regulator

Range 1 – 20

Default 5.0

31-01-2010 Heating controller 09:31	
Stop capacity	10.0 %
Start difference cap.	10.0 %
Voltage at 0%	2.0 V
Voltage at 100%	10.0 V
Start voltage	1.0 V
Gain	5.0
Integration time	240 s
Evaporator temp. min	-70.0 °C



**Integration time:**

Integration time for the heating PI-regulator.  
 Range 30 – 600 s  
 Default 240 s

**Evaporator temp. min:**

Limit for limitation function.  
 When the evaporator temperature is below this value, the capacity is reduced to avoid low pressure cut-out.  
 Range -70.0 – 0 °C  
 Default -70.0 °C

31-01-2010 Ambient/room comp. 09:31	
Temp control mode	Min comp
Ambient curve	Curve 1
Curve -20°C	45.0°C
Curve -10°C	42.0°C
Curve 0°C	39.0°C
Curve +10°C	33.0°C
Curve +20°C	30.0°C
Max room comp.	5.0°C

**Installer - Ambient / Room temperature compensation menu**

The controller will try to maintain a stable room temperature if heating is enabled.  
 A heating setpoint is calculated according to the settings on this menu.  
 To maintain a comfortable room temperature the controller can compensate for ambient temperature and/or room temperature. This is achieved using different compensation curves where the effect of different ambient temperatures on the heating setpoint can be set.  
 Please see section for a full description.

**Temp control mode:**

With or without ambient / room temperature compensation.  
 Options:  
 Min comp: No ambient compensation, fixed setpoint  
 Ambient: With ambient compensation.  
 Room: Only room compensation.  
 Amb+room: With ambient and room compensation.  
 Room on/off: No ambient compensation.  
 Default: Min comp

**Ambient curve:**

Select between 10 preconfigured curves or a manual configured curve

Default curve 1

**Curve -20°C:**

Corrected room temperature setpoint at ambient temperature of -20 °C

Range -100.0 – 100.0 °C

Default 45.0 °C (Curve 1)

**Curve -10°C:**

Corrected room temperature setpoint at ambient temperature of -10 °C

Range -100.0 – 100.0 °C

Default 42.0 °C (Curve 1)

**Curve 0°C:**

Corrected room temperature setpoint at ambient temperature of 0 °C

Range -100.0 – 100.0 °C

Default 39.0 °C (Curve 1)

**Curve +10°C:**

Corrected room temperature setpoint at ambient temperature of +10 °C

Range -100.0 – 100.0 °C

Default 33.0 °C (Curve 1)

**Curve +20°C:**

Corrected room temperature setpoint at ambient temperature of +20 °C

Range -100.0 – 100.0 °C

Default 30.0 °C (Curve 1)

**Max room comp.:**

Maximum allowed corrected room temperature setpoint.

Range -100.0 – 100.0 °C

Default 5.0 °C

31-01-2010 Defrost 09:31	
<b>Defrost method</b>	<b>Auto</b>
Ice level	-2.0°C
Relative ice level	7.0°C
Ice time	20min
Min time between defrost	60min
Evaporator stop temp.	5.0°C
Max defrost time	10min
Advanced defrost setting	>

### Installer - Defrost settings

Settings for the automatic defrost of the evaporator in air evaporator systems. Not used for brine systems.

To achieve maximum efficiency of the evaporator the defrost handling can be fine tuned to the actual installation.

Defrost start criteria is fulfilled when:

$$T_{\text{evap}} < \text{Ice level setting and} \\ (T_{\text{ambient}} - T_{\text{evap}}) > \text{Relative ice level setting}$$

#### Defrost method:

Defrost method can be:

Auto: Automatic defrost method selection  
Hot gas is only used at ambient temperatures below 3 °C

AIR: Only use air for defrost

HG: Only use hot gas

OFF: No defrost

Default is OFF

#### Ice level:

Defines the maximum evaporator temperature at which ice is formed.

Range -70 – 10 °C

Default 0.5 °C

#### Relative ice level:

Defines the minimum temperature difference between ambient temperature and evaporator temperature at which ice is formed.

Define at ambient temperature of 0 °C.

Range 2.0 – 15.0 °C

Default 6.0 °C

#### Ice time:

Defines the time the defrost start criteria must be fulfilled before a defrosting is started.

Range 0 – 240 min



Default 20 min

#### Min time between defrost:

Minimum time between two automatic defrosts.

Range 10 – 480 min

Default 60 min

#### Evaporator stop temp.:

Defrost stops when the evaporator temperature exceeds this setting.

Only used for hotgas defrost.

Range 1.0 – 25.0 °C

Default 5.0 °C

#### Max defrost time:

Maximum allowable time for the evaporator temperature to reach the Evaporator stop temp during a defrost.

Defrost stops when defrost time exceeds this setting.

Range 1 – 240 min

Default 10 min

#### Advanced defrost setting:

Menu for advanced defrost settings

#### Installer - Advanced defrost settings menu

In this menu a further fine tuning of the installation can be done for air to water installations.

Instead of operating with fixed defrost intervals an 'ice timer' is used for calculating time for the next defrost.

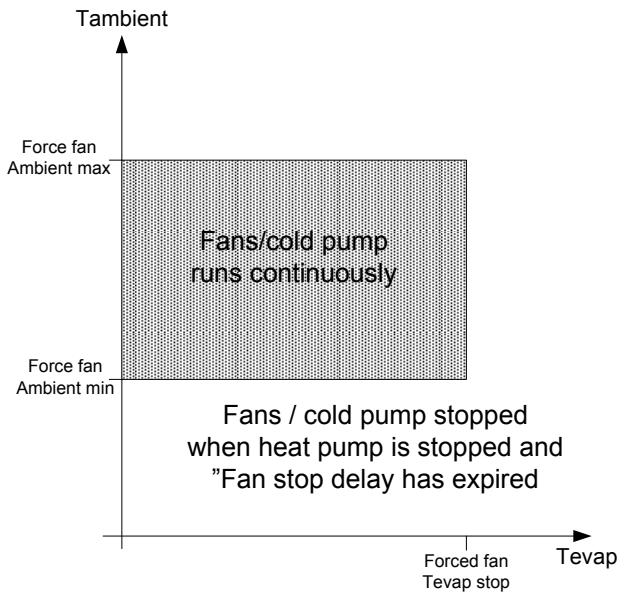
#### Ice melt temperature:

Defines the ambient temperature above which the ice timer is decremented when the compressor is switched off or when the evaporator temperature is above 1 °C.

Range -70.0 – 30.0 °C

Default 3.0 °C

31-01-2010 Advanced defrost		09:31
Ice melt temperature	3.0 °C	▲
Fast ice melt temp.	8.0 °C	
Force fan ambient min	-30.0 °C	
Force fan ambient max	3.0 °C	
Forced fan Tevap stop	2.0 °C	▼



**Fast ice melt temp.:**

Defines the ambient temperature above which the ice timer is decremented fast when the compressor is switched off or when the evaporator temperature is above 1 °C.  
 Range -70.0 – 30.0 °C  
 Default 8.0 °C

**Force fan ambient min:**

Min limit for continuous run of brine pump/ fan when heat pump has stopped.  
 Range -70.0 – 10.0 °C  
 Default -30.0 °C

**Force fan ambient max:**

Max limit for continuous run of brine pump/ fan when heat pump has stopped.  
 Range -70.0 – 10.0 °C  
 Default 3.0 °C

**Forced fan Tevap stop:**

Run brine pump / fan continuous until evaporator temperature exceeds this setting.  
 Range -70.0 – 10.0 °C  
 Default 2.0 °C

31-01-2010 Solar panel 09:31	
Sensor selection	Water tank
Start temp. diff.	5.0 °C
Stop part	0.0 -
Max solar panel temp	95.0 °C
Max water temp.	70.0 °C
Max restart temp.	70.0 °C

**Installer - Solar panel settings**

Settings for use of the solar panel. The settings are only relevant if a solar panel is set as a heating source for hot water or heating.

**Sensor selection:**

- Selection of the controlling sensor.
- Water tank: Temperature sensor in the water tank
- Solar water: Temperature sensor in the solar panel
- Default: Water tank

**Start temp. diff.:**

Hysteresis for starting the circulation pump for the solar panel.  
 Range 1.0 – 40.0 °C  
 Default 5.0 °C

**Stop part:**

Scale of Start temp. diff used for stopping hot water production again.

0.0: stop at set point;

0.5: stop at  $\frac{1}{2}$  \* Start temp. diff

Range 0.0 – 1.0

Default 0.0 (Stop at setpoint)

**Max solar panel temp.:**

Max allowable solar panel temperature.

Above this the circulation pump is stopped to prevent damage on the rest of the installation.

Range 70.0 – 120.0 °C

Default 100.0 °C

**Max water temp.:**

Max allowable water tank temperature.

Above this temperature the circulation pump is stopped.

If "Solar water" sensor is selected, both water tank temperature and solar water temperature must be below this setting.

Range 50.0 – 90.0 °C

Default 70.0 °C

**Max restart temp.:**

Solar panel temperature at which operation can be continued again after an stop due to overheat of the solar panel.

Range 30.0 – 90.0 °C

Default 70.0 °C

31-01-2010	Service	09:31
LMC 320 v.	1.0	
LUP 200 v.	1.0	
Counters	>	
Manual	>	

### Installer - Service menu

Show software version, runtime counters and use manual mode for trouble shooting purposes.

#### LMC 320 v.:

Software version of the LMC320 heat pump controller.

#### LUP 200 v.:

Software version of the LUP 200 operating panel

#### Counters:

Menu with various runtime counters for the installation

#### Manual:

Menu with controller outputs which can be controlled manually when the unit is in manual mode for trouble shooting or service purposes.

31-01-2010	Date	09:31
Year	2010	
Month	01	
Day	31	

### Installer- Date menu

Set the date of the controller

Year: Set the year of the controller

Month: Set the actual month

Day: Set the actual day

### Installer - Runtime counters

Hour counter or activation counters for different functions in the controller

31-01-2010	Run time	09:31
Heat pump	217h	
Compressor	173h	
Heater	34h	
Hot water	45h	
Cold side pump	187h	
Hot side pump	200h	
Solar panel pump	5h	
Cold side pump low	0h	
Aux circ pump	217h	
Defrost valve	2h	
Hot gas defrost count	24	
Air defrost count	13	

### Installer – Manuel mode menu

For trouble shooting purposes the outputs listed to the left can be activated to check the functionality. The controller must first be set in manual mode in the Heat pump menu in the field **Control mode**. If the controller is not in manual mode all settings will always be **Off** or **0.00V**.

#### MainSwitch:

- Operation mode.
- Off: Unit is stopped
- On: Unit is running
- Manual: Unit is in manual mode for service
- Default: On

#### RE1 – compressor:

If set to On the relay for the compressor is activated.

#### RE2 – Heater:

If set to On the relay for the heater is activated.

#### RE3 – Hot water:

If set to On the relay for the 3-way valve is activated.

31-01-2010	Manual	09:31
<b>MainSwitch</b>	<b>On</b>	
RE1 - Compressor	Off	
RE2 - Heater	Off	
RE3 - Hot water	Off	
RE4 - Cold pump	Off	
RE5 - Hot pump	Off	
RE7 - Solar panel pump	Off	
RE8 - Cold pump low	Off	
RE9 - Aux circ pump	Off	
RE10- Defrost valve	Off	
AN1 - Compressor speed	0.0 %	
AN1 - Compressor speed	0.0 V	

**RE4 – Cold pump:**

If set to On the relay for the cold pump is activated.

**RE5 – Hot pump:**

If set to On the relay for the hot water circulation pump is activated.

**RE7 – Solar panel pump:**

If set to On the relay for the solar panel pump is activated.

**RE8 – Cold pump low:**

If set to On the relay for the cold pump low is activated.

**RE9 – Aux circ pump:**

If set to On the relay for the aux circulation pump is activated.

**RE10 – Defrost valve:**

If set to On the relay for the defrost valve is activated.

**AN1 – Compressor speed:**

The entered percentage will be sent out to output ANOUT0 as a voltage for compressor speed based on entered scaling.

Range 0.0 – 100.0 %.

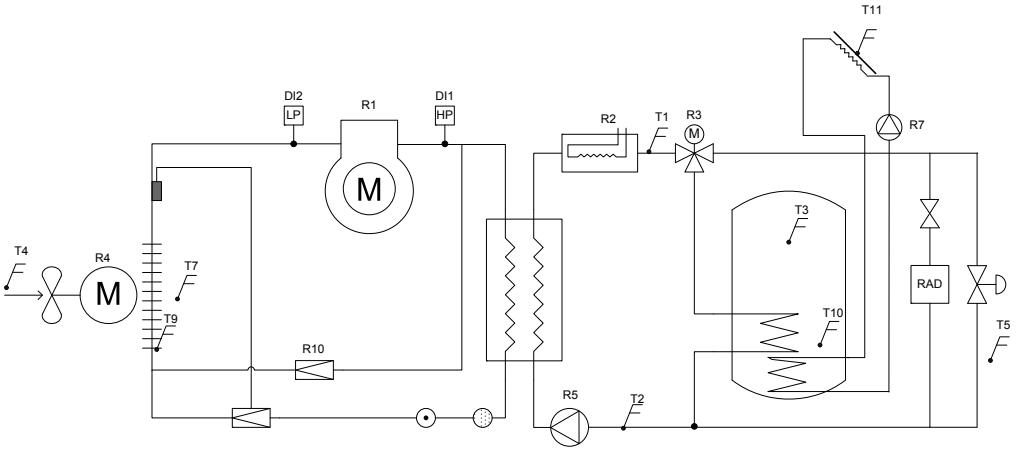
Default 0.0 %

**AN1 – Compressor speed:**

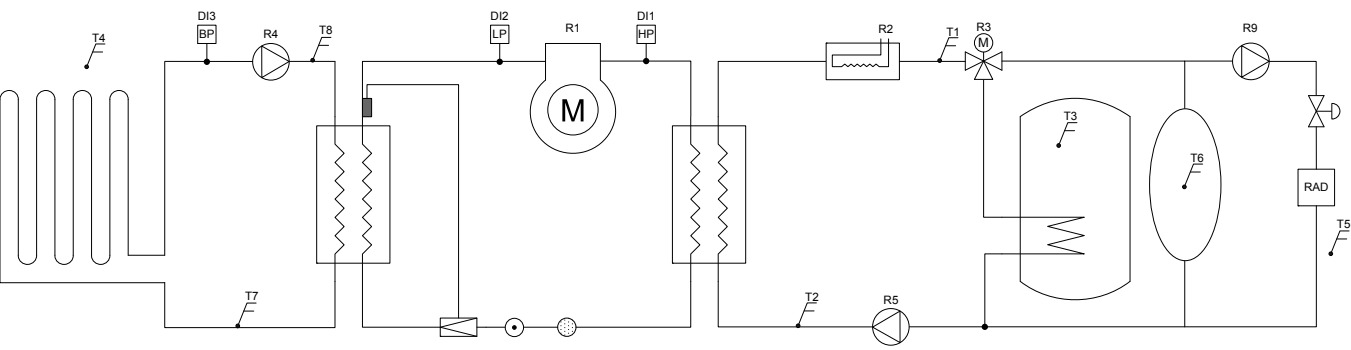
The shown voltage is the calculated voltage sent out to output ANOUT0 for compressor speed.

# 8. Examples of application use

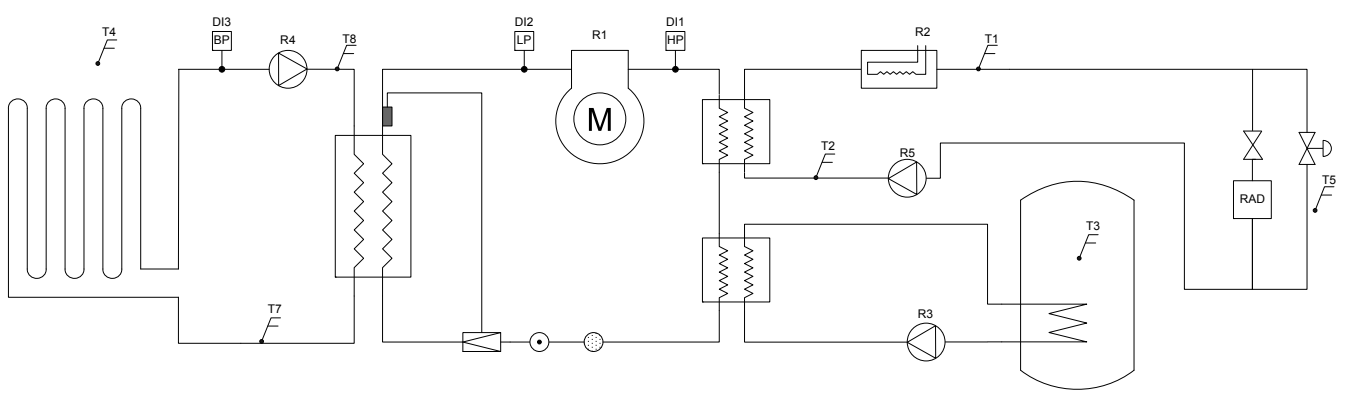
Air to water, compressor On/Off control, solar panel connected to hot water tank



Ground source to water, no solar panel, heating tank on heating system



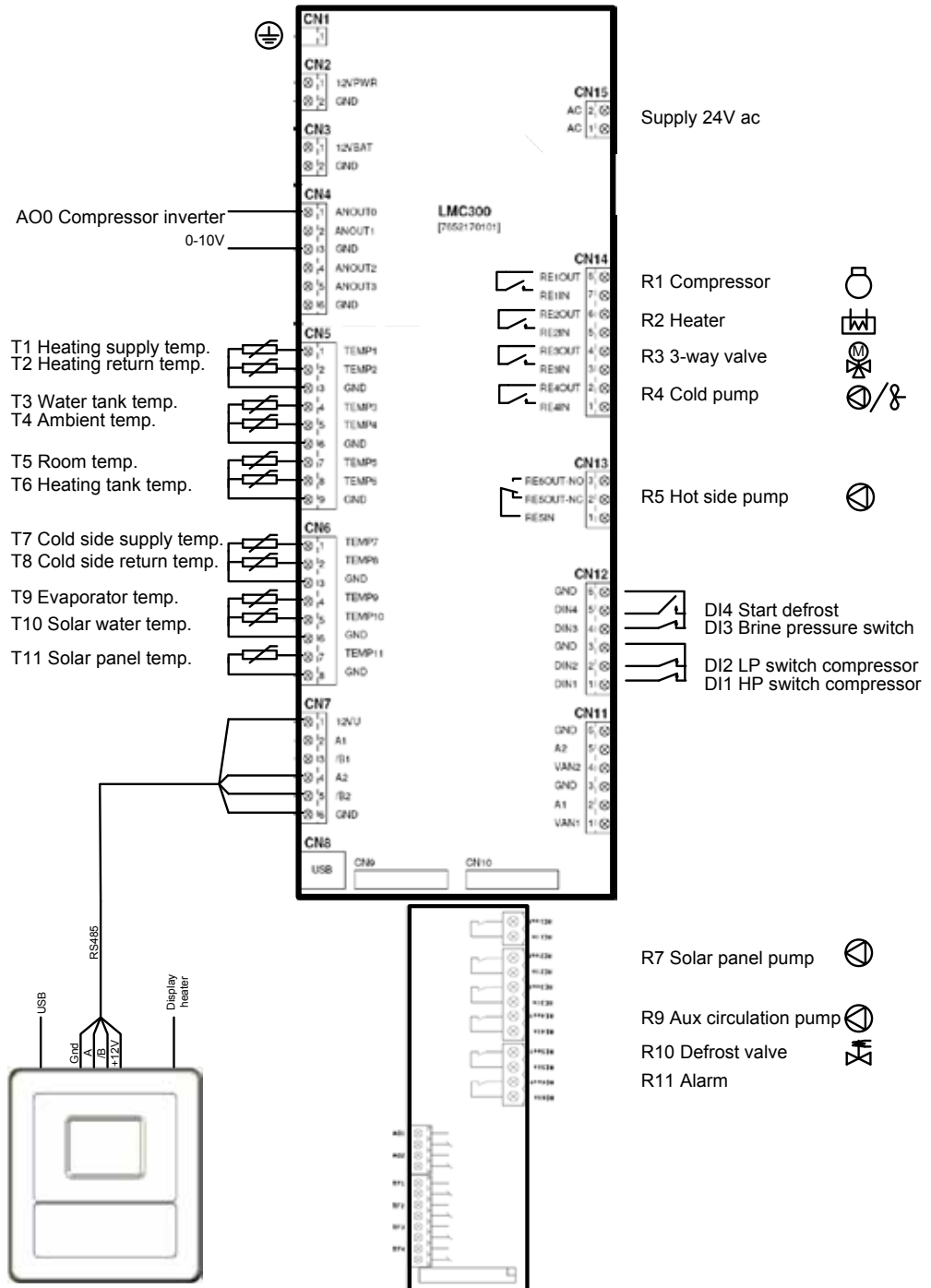
Ground source heat pump with dual condenser



# 9. Connections

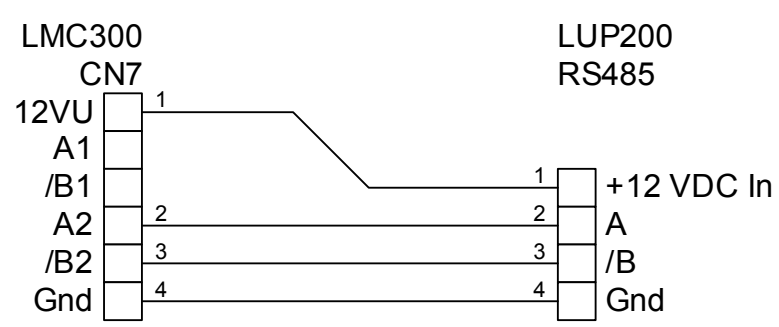
## Connections on the LMC300

LMC320 Heat Pump Controller  
LMC300 512 kB + LOM309

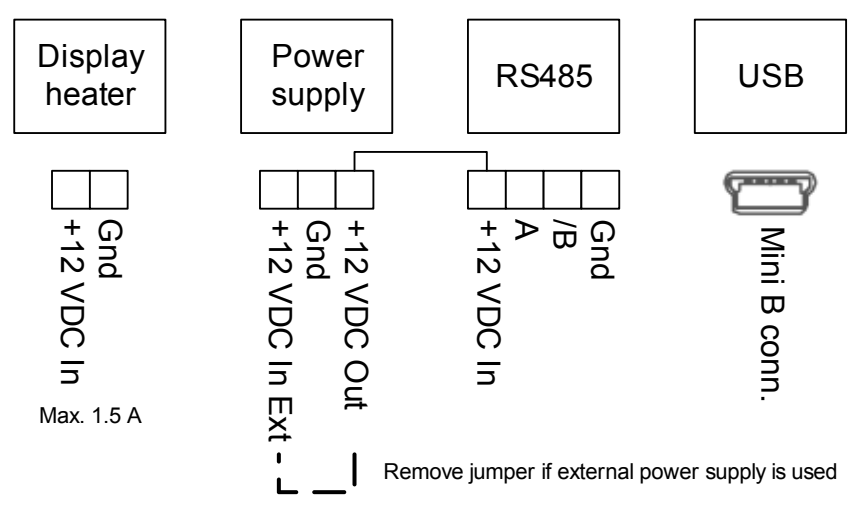




### Connection between LMC300 and LUP200



### Connections on the LUP200



## 10. Technical data

### LMC320 Heat Pump Controller with LOM309 Slave I/O Board

#### Technical specifications, LMC320+LOM309:

Size	175mm (l) * 100mm (w)
Power supply	12VDC (Vbat); 15 - 30VDC/12 - 24VAC; 110 - 230 VAC +/- 10%, 50-60 HZ
CPU	SAM7S512, 32bit 48 MHz - 512kB program memory
External flash	1 MB ~ 8 MB
Saving of parameter setting	10 kB
Operating temperature	-20°C ~ +60°C
Storage temperature	-30°C ~ +60°C
Temperature inputs, T1 to T11	11; for NTC sensors -40°C ~ +99°C, +/- 1°C accuracy; 2 can be used for 0-10V input", 9 can be used for digital inputs
Analog inputs, AI1 to AI2	2; 0 - 10V with 12 Volt supply, 0-5V with 5 Volt supply for radiometric pressure transmitters; Rin: 25KΩ
Digital inputs	4; not galvanic isolated - 0-5V with pull-up resistor, 2 can be used for secure inputs for RE1-2
Analog outputs, AO1 to AO4	4; 0-10V, +/- 3%, max 10mA; max frequency 1Hz
RAM	64kB
Safety relay outputs, RE1 and RE2	2; can be used together with digital inputs 1 and 2. - 10A 24VDC / 10A 250VAC
Relay outputs, RE3 to RE5	3; 10A 24VDC / 10A 250VAC. RE5 is a toggle relay
RS485 ports	2 with 12V 100mA outputs
USB port (slave mode only)	1; for software update and communication with a PC
Option connectors 1 and 2	2; 24 pins for option boards
Real time clock	With 1 year battery back up
12VDC output	Up to 1A depending on application

Note 1: The maximum cable length for a NTC temperature sensor is 30m.

Note 2: On the LMC300 board the wire jumper closest to Relay 5, between Relays 4 and 5, must be mounted. It must be mounted parallel with the relays.

### Technical specifications, LUP200:

Display	262k colors, graphical display 320x240 pixels
PCB dimensions	85mm (l) * 60mm (w) * 20mm (h)
Power supply	12V – 24VDC
CPU	AT91SAM7, ARM7 processor
Operating temperature	-20°C ~ + 60°C
Storage temperature	-30°C ~ + 60°C
RAM	16 MB
RS485 ports	1 port with 2 x connections and possibility of connecting 4 units in "daisy chain"
USB port	1 mini B connector (device mode only)
Temperature sensor	1 onboard NTC temperature sensor
Display backlight lifetime	30,000 hours at 20°C and "normal" brightness
Light intensity sensor	1 onboard light intensity sensor
Number of buttons	6 buttons
Languages	Ready for multiple languages & "special" characters
IP	66 <sup>(1)</sup>

Note1: IP66 if the LUP200 is mounted in a metal sheet cabinet of at least 1,5mm thickness and level accuracy better than 0,1mm.

Note2: Maximum cable length between the LMC320 and the LUP200 is 100 m.

### Technical specifications, LOM320:

Size	92mm (w) * 78mm (h)
Power supply	12 VDC
CPU	ARM920T, 32bit, 200MHz
Operating temperatures	-20°C ~ +60°C
Storage temperatures	-30°C ~ +60°C
Ethernet	1; 10/100 Mbit
RS485 ports	1
USB host	2 ports with A connector
USB device	1 port with mini B connector
(External) flash / Flash for data logging	16MB
RAM	64MB
GPRS/GSM	Modem Siemens MC55 incl. sim card reader
Option connector	24 pins for connection to LMC300
Optimized for linux applications	2 x USB host, webserver, mail, GSM/GPRS, datalog via internet, software update via internet, 4 LEDs, 1 button, 485 termination jumper

Note: The LOM320 Ethernet board is optional.

## 11. I/O list for the LMC320 Heat Pump Controller

Software interface consists of signals also mentioned in the hardware chart as I/O.

Type: A, D, S, P      Analog, Digital, Serial, Power  
 I, O, B                Input, Output, Bidirectional

I/O list, LMC320 Heat Pump Controller				
Name	Type	Pin	Logic	Description
High pressure switch compressor HP	DI	DIN1	NO	High pressure safety switch signal Signal activated by short circuiting to ground. 3,3VDC, max 3,3mA, 1kΩ. Not galvanic isolated.
Low pressure switch compressor LP	DI	DIN2	NO	Low pressure switch signal Signal activated by short circuiting to ground. 3,3VDC, max 3,3mA, 1kΩ. Not galvanic isolated.
Brine pressure switch BP	DI	DIN3	NO	Brine pressure switch signal Signal activated by short circuiting to ground. 3,3VDC, max 3,3mA, 1kΩ. Not galvanic isolated.
Start defrost	DI	DIN4	NO	External signal, start defrost Signal activated by short circuiting to ground. 3,3VDC, max 3,3mA, 1kΩ. Not galvanic isolated.
Heating supply temperature T1	T	Temp1		Heating supply temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>● ±1°C in the range -30°C to 60°C</li> <li>● ± 3°C in the range -60°C to -30 °C</li> <li>● ± 3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>● Signal</li> <li>● Gnd</li> </ul>
Heating return temperature T2	T	Temp2		Heating return temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>● ±1°C in the range -30°C to 60°C</li> <li>● ± 3°C in the range -60°C to -30 °C</li> <li>● ± 3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>● Signal</li> <li>● Gnd</li> </ul>

Name	Type	Pin	Logic	Description
Water tank temperature T3	T	Temp3		Water tank temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• ±1°C in the range -30°C to 60°C</li> <li>• ± 3°C in the range -60°C to -30 °C</li> <li>• ± 3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>• Signal</li> <li>• Gnd</li> </ul>
Ambient temperature T4	T	Temp4		Ambient temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• ±1°C in the range -30°C to 60°C</li> <li>• ± 3°C in the range -60°C to -30 °C</li> <li>• ± 3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>• Signal</li> <li>• Gnd</li> </ul>
Room temperature T5	T	Temp5		Room temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• ±1°C in the range -30°C to 60°C</li> <li>• ± 3°C in the range -60°C to -30 °C</li> <li>• ± 3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>• Signal</li> <li>• Gnd</li> </ul>
Heating tank temperature T6	T	Temp6		Heating tank temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• ±1°C in the range -30°C to 60°C</li> <li>• ± 3°C in the range -60°C to -30 °C</li> <li>• ± 3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>• Signal</li> <li>• Gnd</li> </ul>
Cold side supply temperature T7	T	Temp7		Cold side supply temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• ±1°C in the range -30°C to 60°C</li> <li>• ± 3°C in the range -60°C to -30 °C</li> <li>• ± 3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>• Signal</li> <li>• Gnd</li> </ul>

Name	Type	Pin	Logic	Description
Cold side return temperature T8	T	Temp8		Cold side return temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>±1°C in the range -30°C to 60°C</li> <li>±3°C in the range -60°C to -30 °C</li> <li>±3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>Signal</li> <li>Gnd</li> </ul>
Evaporator temperature T9	T	Temp9		Evaporator temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>±1°C in the range -30°C to 60°C</li> <li>±3°C in the range -60°C to -30 °C</li> <li>±3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>Signal</li> <li>Gnd</li> </ul>
Solar water temperature T10	T	Temp10		Solar water temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>±1°C in the range -30°C to 60°C</li> <li>±3°C in the range -60°C to -30 °C</li> <li>±3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>Signal</li> <li>Gnd</li> </ul>
Solar panel temperature T11	T	Temp11		Solar panel temperature Lodam NTC sensor Measurement range: -60°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>±1°C in the range -30°C to 60°C</li> <li>±3°C in the range -60°C to -30 °C</li> <li>±3°C in the range +60°C to 130°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>Signal</li> <li>Gnd</li> </ul>
Compressor speed for inverter 0-10V	AO	Anout0		Compressor speed for inverter 0 – 10V, 5mA Not galvanic isolated.
Display (LUP200)	SB	A2 /B2 Gnd 12VU (RS485)		RS 485 for communication with LUP200 Half duplex, max. 100m twisted pair cable, 2 * 120Ω termination. Receiver impedance >= 12kΩ <ul style="list-style-type: none"> <li>+12V ±10% (I-limit approx. 100mA)</li> <li>GND</li> <li>A2</li> <li>/B2</li> </ul>
Compressor R1	DO	RE1OUT	NO	Relay for compressor ON Max 10A@250VAC/10A@30VDC
Heater R2	DO	RE2OUT	NO	Relay for Heater ON Max 10A@250VAC/10A@30VDC
Hot tap water R3	DO	RE3OUT	NO	Relay for 3-way Hot tap water valve Max 10A@250VAC/10A@30VDC

Name	Type	Pin	Logic	Description
Cold pump R4	DO	RE4OUT	NO	Relay for Cold pump ON Max 10A@250VAC/10A@30VDC
Hot side pump R5	DO	RE5OUT	NO (NC)	Relay for Hot side pump ON Max 10A@250VAC/10A@30VDC
Solar panel pump R7	DO	RE2OUT LOM309	NO	Relay for Solar panel pump ON Max 10A@250VAC/5A@30VDC
Aux circulation pump R9	DO	RE4OUT LOM309	NO	Relay for Aux circulation pump ON Max 10A@250VAC/5A@30VDC
Defrost valve R10	DO	RE5OUT LOM309	NO	Relay for Defrost (bypass) valve ON Max 10A@250VAC/5A@30VDC
Alarm R11	DO	RE6OUT LOM309	NO	Relay for Alarm active Max 10A@250VAC/5A@30VDC
Supply 24 VAC	P	AC		Controller Power Supply 24 VAC Max 18 VA

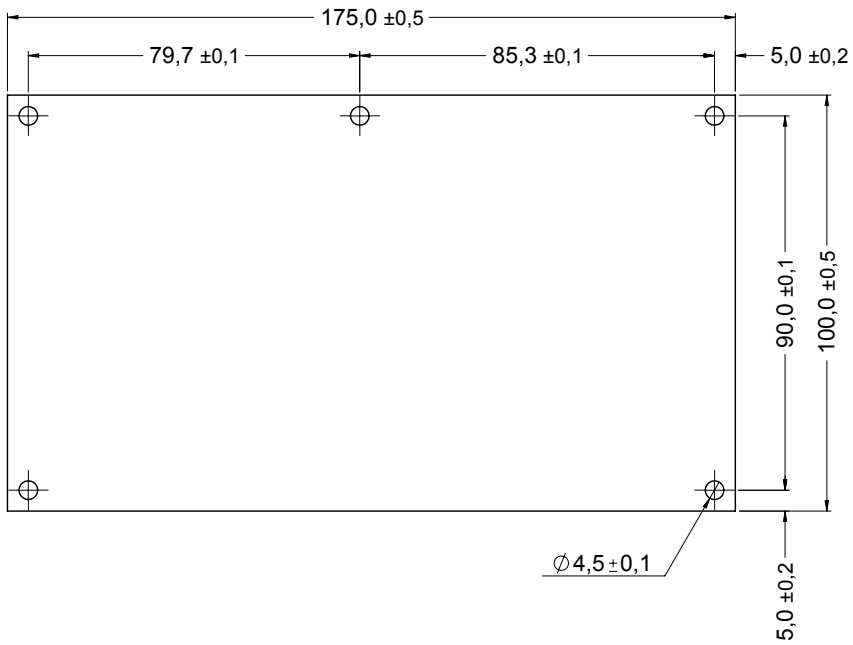


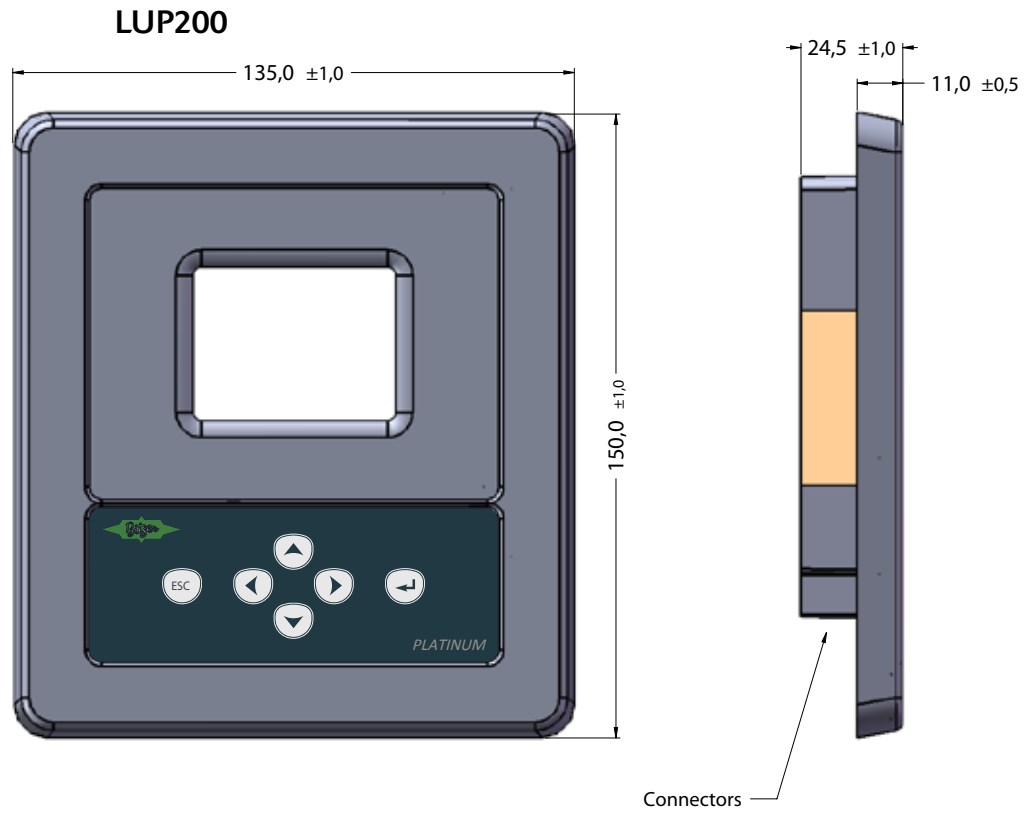
## 12. Drawings

All dimensions in mm.

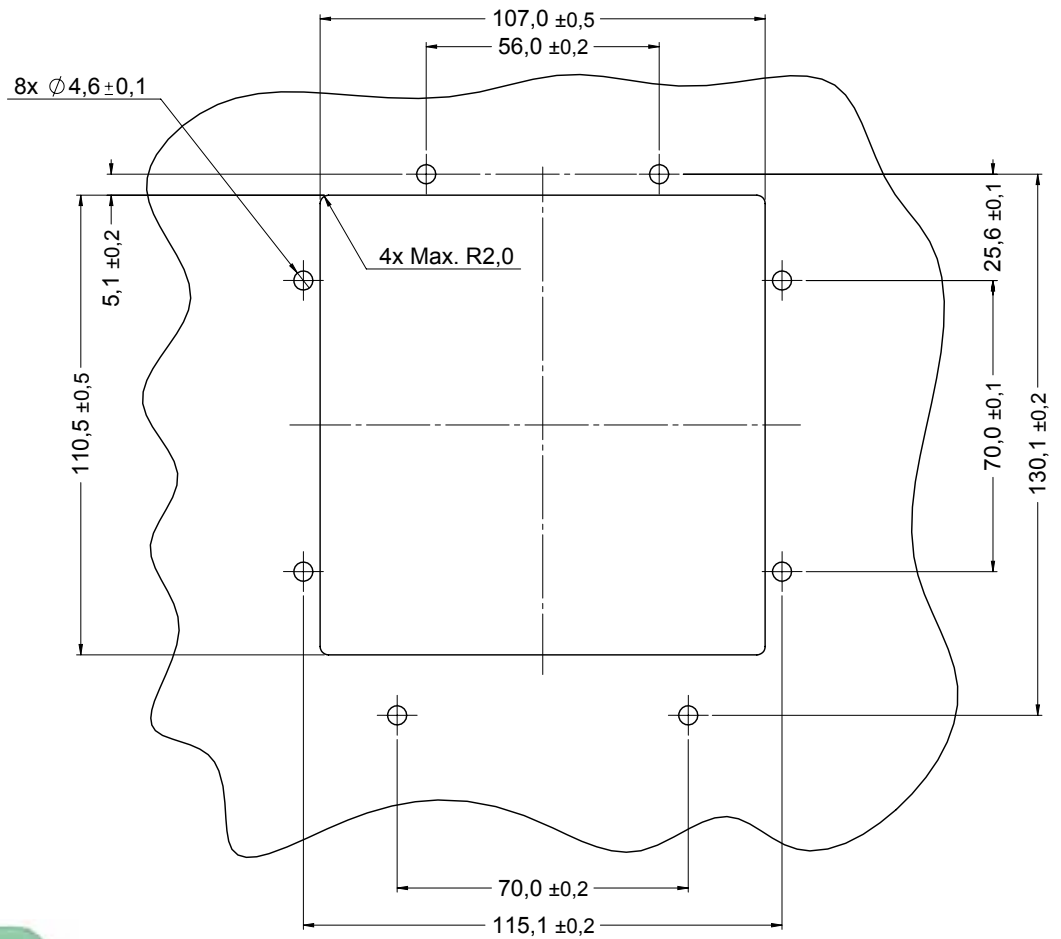
### LMC300

Mounting dimensions.





**Panel cutout**



## 13. Standards

- EN61000-6-1 (EMC, Immunity for residential, commercial and light-industrial environments).
- EN61000-6-3 (EMC, Emission standard for residential, commercial and light-industrial environments).
- EN60204-1 (Safety of machinery. Electrical equipment of machines. General requirements).

## 14. Alarm system and trouble shooting

The LMC320 controller is equipped with a failure and alarm diagnoses system.

There are three alarm levels: Warning, Alarm and Critical.

A warning does not stop the unit but affects its temperature control precision.

An alarm will stop the unit and it will restart after the restart delay.

A critical alarm will make the unit stop, turn on the alarm LED and turn off the CTS relay.

If the first letter is in uppercase, Axxx, Cxxx or Wxxx the alarm or warning is still standing and can't be acknowledged until the problem is solved.

If the first letter is lower case, axxx, cxxx or wxxx the alarm situation is not active anymore and the alarm or warning can be acknowledged by pressing the Enter button.

There is also a short text to an alarm number. On the sample, W104 tells that temperature input T3 has an open connection and the problem is still there since W is in uppercase.

The alarm can not be acknowledged before the connection has been fixed.

Up to 16 alarms at the same time can be shown.



## Alarm list

Alarm number	Type	Name	Description	Elimination
Sensors				
100	Warning	T1 Open	Heating supply temperature open connection	Check cable and connectors
101	Warning	T1 Short	Heating supply temperature short-circuited	Check cable and connectors
102	Warning	T2 Open	Heating return temperature open connection	Check cable and connectors
103	Warning	T2 Short	Heating return temperature short-circuited	Check cable and connectors
104	Warning	T3 Open	Water tank temperature open connection	Check cable and connectors
105	Warning	T3 Short	Water tank temperature short-circuited	Check cable and connectors
106	Warning	T4 Open	Ambient temperature open connection	Check cable and connectors
107	Warning	T4 Short	Ambient temperature short-circuited	Check cable and connectors
108	Warning	T5 Open	Room temperature open connection	Check cable and connectors
109	Warning	T5 Short	Room temperature short-circuited	Check cable and connectors
110	Warning	T6 Open	Heating tank temperature open connection	Check cable and connectors
111	Warning	T6 Short	Heating tank temperature short-circuited	Check cable and connectors
112	Warning	T7 Open	Cold supply temperature open connection	Check cable and connectors
113	Warning	T7 Short	Cold supply temperature short-circuited	Check cable and connectors
114	Warning	T8 Open	Cold return temperature open connection	Check cable and connectors
115	Warning	T8 Short	Cold return temperature short-circuited	Check cable and connectors
116	Warning	T9 Open	Evaporator sensor temperature open connection	Check cable and connectors
117	Warning	T9 Short	Evaporator sensor temperature short-circuited	Check cable and connectors
118	Warning	T10 Open	Solar water temperature open connection	Check cable and connectors
119	Warning	T10 Short	Solar water temperature short-circuited	Check cable and connectors
120	Warning	T11 Open	Solar panel temperature open connection	Check cable and connectors
121	Warning	T11 Short	Solar panel temperature short-circuited	Check cable and connectors

Alarm number	Type	Name	Description	Elimination
Hardware				
200	Critical	LOM9 missing	LOM9 missing	Check connection
Operation				
600	Warning	Hi Pres	High pressure switch active	The unit restarts when the pressure drops below high pressure switch low-limit again. Check hot side pump/overflow valve on high temperature side. After 3 <sup>rd</sup> cutout the alarm must be acknowledged to start the unit again.
601	Critical	Low pres.	Low pressure switch active	Check refrigerant charge and expansion valve. The alarm must be acknowledged to start the unit again.
602	Critical	Leakage	Low pressure in brine - brine pressure switch active	Leakage check of the brine system. The alarm must be acknowledged to start the unit again.
603	Critical	Hi pres	High pressure switch repeatedly active	Check hot side pump/overflow valve on high temperature side. The alarm must be acknowledged to start the unit again.
604	Warning	Frost protection	Temperature too low (state freeze protect)	Heat pump and electrical heater running full capacity. Check that setting are not turned off.
605	Warning	Heat pump overhear	Supply temperature too high (condition total stop)	Check hot side pump/overflow valve on high temperature side.
606	Warning	Solar panel overhear	Solar panel is in forced stop condition. (SP state Forced stop)	Check connection to external temperature adjustment.
607	Warning	Legionella failed	Anti Legionella function has timed out twice.	Check electrical heaters and supply of heat to brine circuit.
Internal controller error				
904	Warning	Datalog	Error with internal log	Reserved. Not implemented yet.
905	Warning	Database	Error with internal database	Controller may be defect. Try update the firmware or replace the controller.
907	Warning	RTC err	Error with the internal real time clock	Replace the controller.
908	Warning	RTC inv	Invalid data from the real time clock	Unit powered off to long. Set time and date. Else replace the controller.
998	Warning	TestVer.	The software is a test version	Use the release version of the software.
999	Warning	Manual mode	The unit is in manual mode	Change mode from Manual to On.

## 15. Network

The LOM320 Ethernet board is optional.

## 16. Firmware update

Firmware update is done with Lodam Multi Tool, LMT.

This will update the software in the LMC320 controller and the LUP200 display if necessary.

## 17. Accessories

Lodam has the following NTC temperature sensors in stock for use with the LMC320 controller.

In the table are the suggested variant to use and an alternative sensor.

Only the listed NTC temperature sensors can be used as the characteristic of the NTS element must match.

433015 NTC temperature sensor, Ø6 mm \* 20 mm house, cable length 5 m

433016 NTC temperature sensor, Ø6 mm \* 20 mm house, cable length 2 m

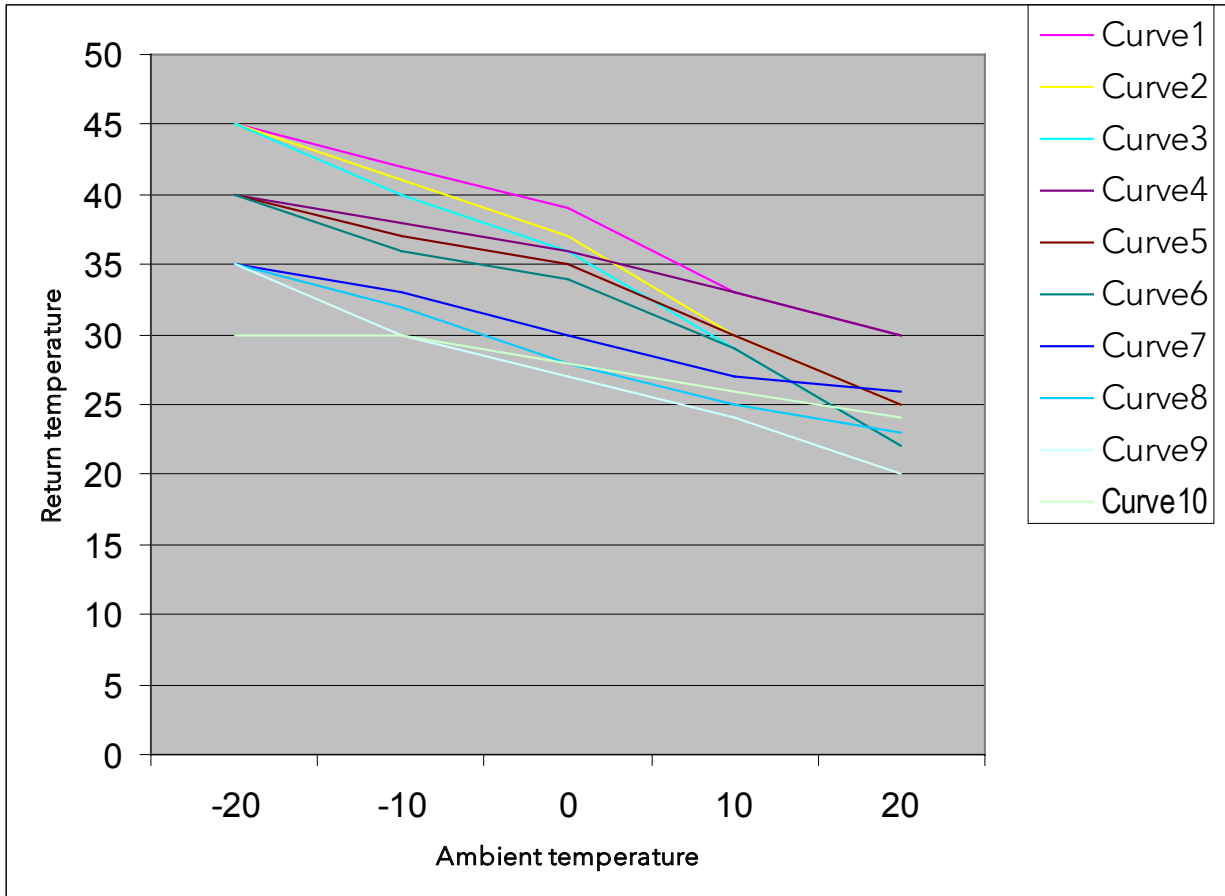
433028 NTC high temperature sensor, max 240 °C, Ø6 mm \* 20 mm house, cable length 0.95 m

ID	Description	NTC temperature sensor	Alternative sensor
T1	Heating supply temperature	433016 – 2 m cable	433015 – 5 m cable
T2	Heating return temperature	433016 – 2 m cable	433015 – 5 m cable
T3	Water tank temperature	433016 – 2 m cable	433015 – 5 m cable
T4	Ambient temperature	433015 – 5 m cable	433016 – 2 m cable
T5	Room temperature	433015 – 5 m cable	(433016 – 2 m cable)
T6	Heating tank temperature	433015 – 5 m cable	433016 – 2 m cable
T7	Cold side supply temperature	433016 – 2 m cable	433015 – 5 m cable
T8	Cold side return temperature	433016 – 2 m cable	433015 – 5 m cable
T9	Evaporator temperature	433016 – 2 m cable	433015 – 5 m cable
T10	Solar water temperature	433016 – 2 m cable	433015 – 5 m cable
T11	Solar panel temperature	433028 – 0.95 m cable	–

## 18. Ambient compensation curves

The user can choose between 10 predefined curves and also adjust a user specific curve.

A curve is used to calculate the reference setpoint for the return water temperature. Interpolation is used between the temperatures.



A poor insulation level means a higher impact of the ambient temperature on the room temperature and requires a higher calculated return water temperature.

The flat curves are for floor heating systems.

Curve 0 is reserved for a user defined curve.

Curve 9 is the one with the least adjustment and is for the best insulated house.

The calculated reference setpoint can be offset adjusted with **User Ambient curve offset**.



## 19. NTC temperature/resistance table

Table with relation between temperature and measured resistance in the NTC sensor. Resistance is in  $\Omega$  (Ohm) and temperature in  $^{\circ}\text{C}$ .

$^{\circ}\text{C}$	+ 0 $^{\circ}\text{C}$	+ 2 $^{\circ}\text{C}$	+ 4 $^{\circ}\text{C}$	+ 6 $^{\circ}\text{C}$	+ 8 $^{\circ}\text{C}$
-50	667828	579718	504230	439445	383712
-40	335671	294193	258307	227196	200184
-30	176683	156199	138322	122687	108991
-20	96974	86415	77121	68927	61693
-10	55298	49663	44610	40150	36183
0	32651	29500	26688	24173	21922
10	19904	18093	16465	15001	13683
20	12494	11420	10450	9572	8777
30	8056	7402	6807	6266	5774
40	5325	4916	4542	4200	3887
50	3601	3339	3098	2877	2674
60	2487	2315	2157	2011	1876
70	1752	1637	1530	1432	1341
80	1256	1178	1105	1037	975
90	916	862	811	768	720
100	679	640	604	571	540
110	510	483	457	433	401
120	389	369	350	332	315

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## 21. Notes

A series of 22 horizontal dotted lines for taking notes.

