

# Condensing Unit Controller



## LMC 340 Lodam Condensing Unit 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.

### 1.1. 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.Settings**, references to an entry in the menu system, please see the full menu system in "Menu system".

## 1.2. 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 LMC340 must be performed by authorized personnel only. All warranties are excluded in case installation is performed by unauthorized personnel or in case the LMC340 has not been correctly installed.

Electrical plant failures are to be immediately solved, even though no immediate danger exists; the LMC340 must not be operating.

## 1.3. Safety



The LMC340 is not a safety component and can not be used in "medical" or "life support" equipment.

The LMC340 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 LMC340, LOM320, LOM301 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 Condensing Unit Controller, LMC340 enable you to gain total control of your condensing unit to deliver cooling to one or more evaporators – thereby optimizing your system to save energy, time and money.

The Lodam Condensing Unit Controller is designed for most condensing units, with a range of frequency inverter driven compressors; a single On/Off driven compressor; single On/Off driven compressor with unloader; dual compressors with unloaders or dual compressors with electronically controlled unloaders.

Some benefits from the LMC340 Condensing unit controller:

- Single compressor controlled by frequency inverter, equipped with unloader, or in On/Off operation
- Dual compressor equipped with unloaders in On/Off operation
- Energy and cost saving through intelligent capacity control
- Eco or low sound fan mode
- Compressor protection
- 1 year data log
- Full graphical colour display
- Remote monitoring through a web interface
- Weekly program with real time clock
- Easy installation
- Higher max. capacity of compressors
- Refrigerant configurable
- Heat recovery

This user manual applies to software version 2.1.3 or later of LMC340.

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

Phone +45 73 42 37 37

### 3. Definitions

FI	Frequency inverter
HW	Hardware/electronics
I/O	Input/output (electrical signals)
Limiter	Shortform for a limiting function which monitors the operating conditions
LMT	Lodam Multi Tool (PC communication tool for Lodam 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	Saturated condensing temperature calculated from the discharge pressure
T <sub>0</sub>	Saturated suction temperature calculated from the suction pressure
Tdis	Discharge temperature

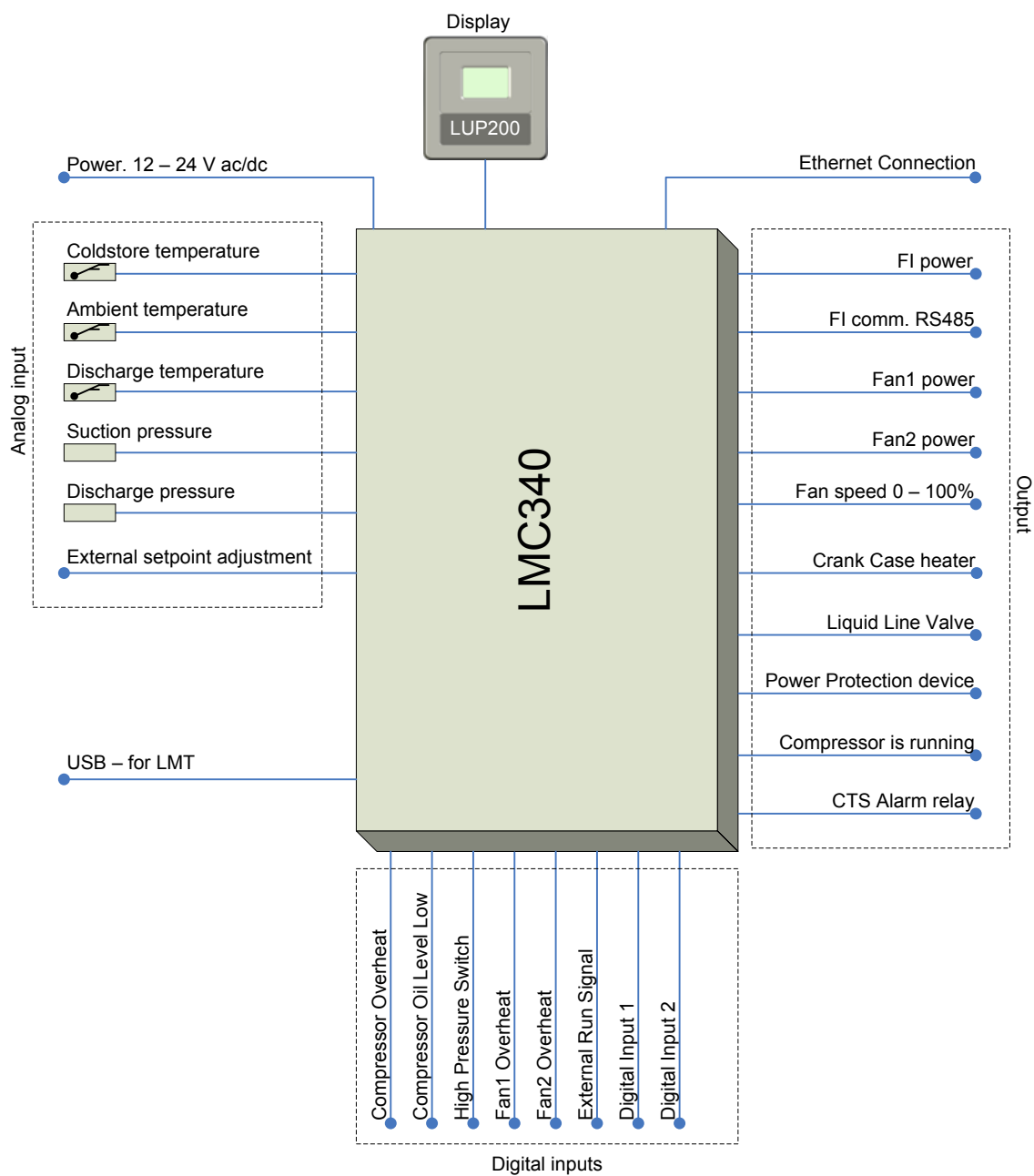


A Condensing unit kit from Lodam includes:

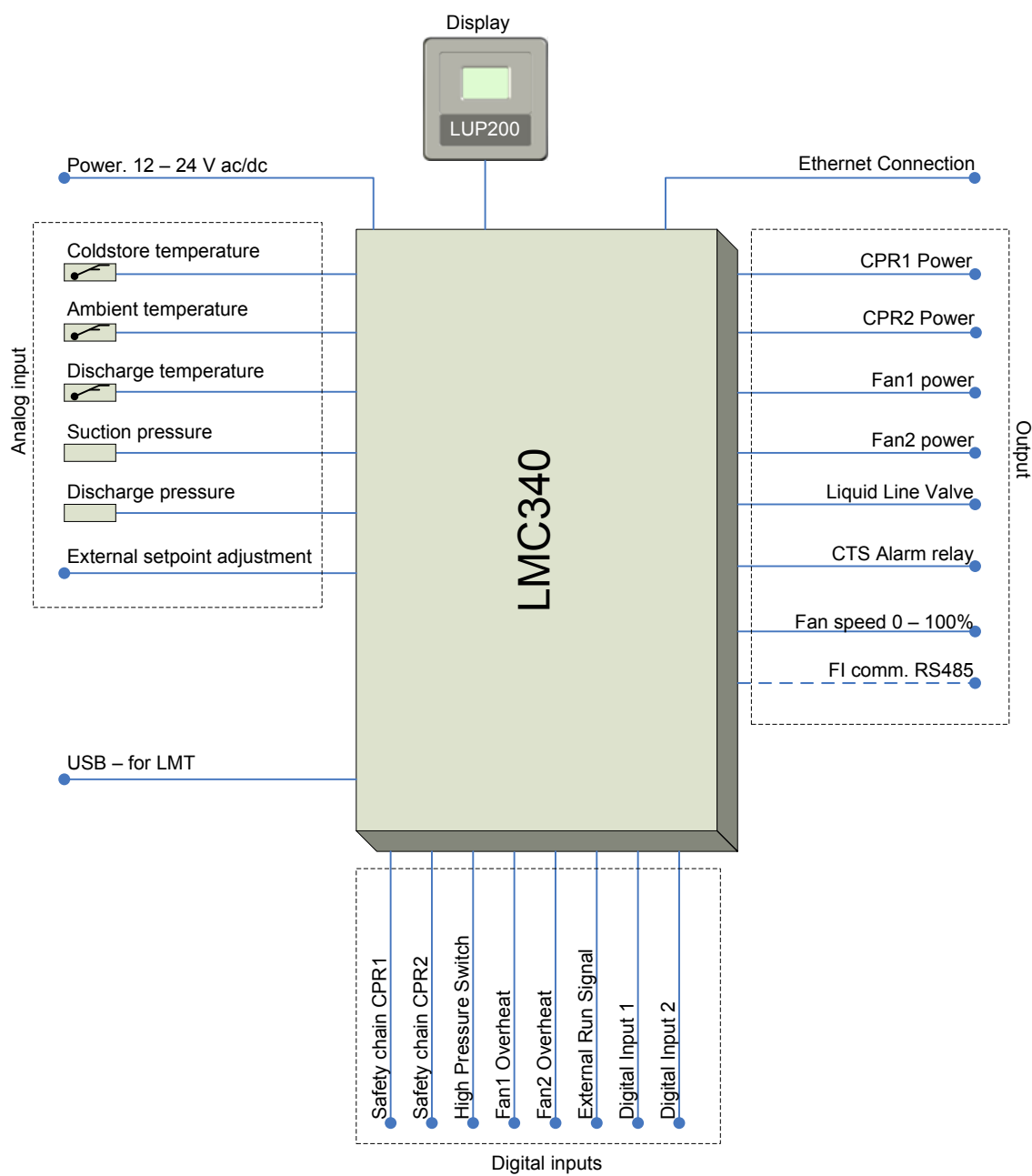
- 1 Pc Lodam condensing unit controller (LMC340) with Option board for extra I/O (LOM301) and Lodam Ethernet Module (LOM320)
- 1 Pc Lodam full graphical color display with keyboard (LUP200i)
- 1 Pc Connector kit for LMC340+LOM301
- 2 Pcs NTC temperatures sensors
- 1 Pcs high temperature NTC temperatures sensor
- 2 Pcs Pressure sensors with cables
- 1 Pc Access license to Lodam Multi Tool

### 3.1. Overview of the LMC340 Condensing unit controller

#### Single compressor configuration



## Dual compressor configuration



## 4. Quickguide

The condensing unit can be controlled through suction pressure or room temperature in a cold store. Default is suction pressure control mode.

When suction pressure pipe and liquid line pipe are connected and power is applied, only the next few settings needs to be entered and the unit is ready for operation!

In **Installer.Basic setting** section the quick settings can be adjusted for both modes.

Select the used refrigerant, default is **R404A**. The refrigerant is used for converting pressure to temperature for the saturated gas.

**Select the control mode: Suction pressure or Room temp.**

### 4.1. Suction pressure control mode

In this control mode, the suction pressure transmitter is used as the controlling sensor.

Default settings are:

Setpoint: -10 °C.

Fan mode: **Eco**, alternative **LowSound**.

Set the setpoint as high as possible to save energy. Generally the setpoint is set too cold, it is better to start with a higher temperature and then lower the setpoint if needed.

The setpoint can further be adjusted through a digital input, external analog input or by the use of the week program.

Set the fan mode to **LowSound** if the unit is placed in dense populated areas. This will impact a little on the energy efficiency.

### 4.2. Room temperature control mode

The controller can be used to directly control the room temperature in a cold store. The control sensor is the Room temperature sensor.

Default settings are:

Setpoint: +2 °C.

Fan mode: Eco, alternative LowSound.

Set the setpoint to the desired setpoint.

If the setpoint needs to be changed to adapt to different conditions, it can be externally adjusted; either through a digital input or an analog input for step less adaption. Further it can be adjusted by using the week program on a regularly basis.

If the sound pressure should be reduced at specific periods due to surroundings, the fan mode can be toggled between the two settings through a digital input or the week program.

#### **4.3. Optimizing energy use**

Through the use of a frequency inverter, the compressor speed can be adapted to the actual cooling demand.

The use of external input can raise the setpoint during low loads. Please see section Alternative setpoint – 2nd Setp.

The week timer can be used to trim the setpoint to regularly changes in cooling demand with up to 4 changes per day.

The condenser fans are speed controlled 10 % – 100 % and the condenser temperature is adjusted according to the ambient temperature and thereby minimizing the total power usage of the fans and the compressor.

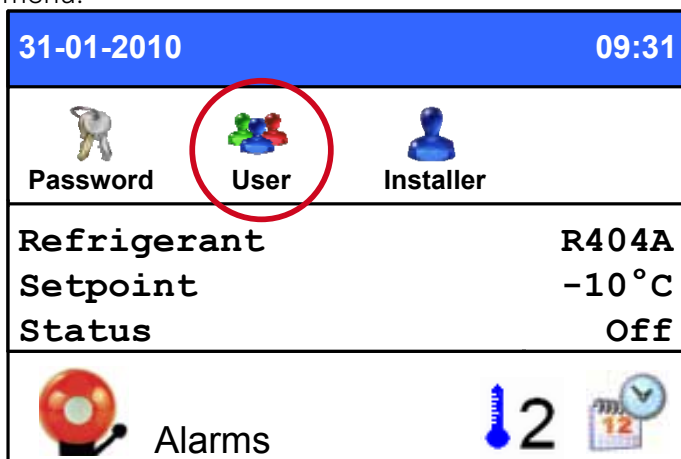
Please see also the section “Heat recovery” for reusing heat generated by the compressor.

## 5. How to ...

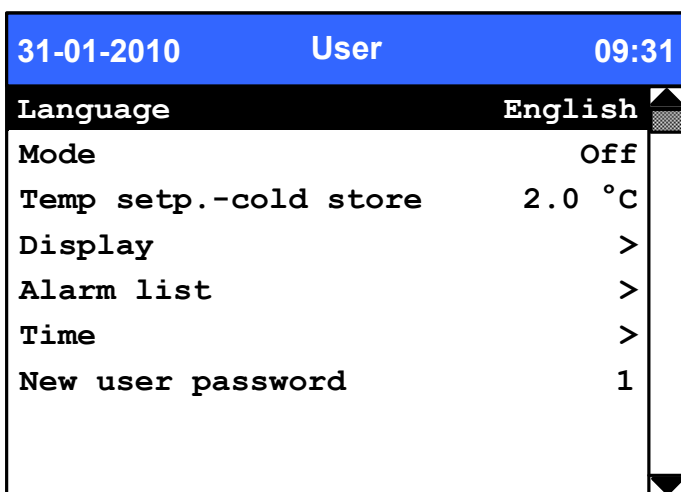
This section shows how to change settings which are commonly used.

### 5.1. Change language

This is a User setting. Enter the user password and select the User menu:



Open the user menu:



Press Enter to edit the language field and switch between English and the other languages, German, French, Finnish and Spanish with the arrow keys. Acknowledge your choice with Enter.

## 5.2. List alarms

This is a User setting. Enter the user password and select the User menu.

31-01-2010      User      09:31	
Language	English
Mode	Off
Temp setp.-cold store	2.0 °C
Display	>
Alarm list	>
Time	>
New user password	1

Scroll to the Alarm line and press Enter

31-01-2010      Alarm list      09:31	
W104: T3 Open - A WARNING	







Here a sample alarm is listed. The menu can show up to 16 alarms. Scroll to an alarm and acknowledge it with Enter. Only alarms starting with lower case axxx, wxxx or cxxx can be acknowledged and cleared from the list.

See the Alarm section for explanation of the possible alarms, causes and how to solve the cause of an alarm.



### 5.3. Change refrigerant

If the default settings must be changed, enter the installer password and go to the installer menu section:

31-01-2010		09:31	
			
Password	User	Installer	
Refrigerant		R404A	
Setpoint		-10 °C	
Status		Off	
		Alarms  2 	

Select the **Basic settings menu** to get the menu below:

31-01-2010		Basic set.		09:31	
Refrigerant		R404A		▲	
Control mode		Suc. Pressure			
Suction pressure setp		-10.0 °C			
Fan operation mode		Eco			
Date		>			
Summertime		Manual			
				▼	

Select the line with Refrigerant with the arrow keys if it is not highlighted. Press Enter key to edit the selected refrigerant and confirm your choice with another press on Enter.

#### 5.4. Change temperature control mode

If the temperature control mode must be changed, follow the description below.

Enter the installer password and go to the installer menu section.

Select the **Basic settings menu** to get the menu below:

31-01-2010 Basic set. 09:31	
Refrigerant	R404A
Control mode	Suc. Pressure
Suction pressure setp	-10.0 °C
Fan operation mode	Eco
Date	>
Summertime	Manual

Select the line with Control mode with the arrow keys if it is not highlighted. Press Enter key to select either Suction pressure or Room temp and confirm your choice with another press on Enter.

#### 5.5. Change the temperature setpoint

To adjust the temperature setpoint, enter the installer password and go to the installer menu section.

Select the Basic settings menu to get the menu below:

31-01-2010 Basic set. 09:31	
Refrigerant	R404A
Control mode	Suc. Pressure
Suction pressure setp	-10.0 °C
Fan operation mode	Eco
Date	>
Summertime	Manual

If the temperature control mode is Room temperature, line 3 says Temp. setp.-cold store. In Suction pressure it is Suc. Pressure. Select the line with setpoint with the arrow keys if it is not highlighted. Press Enter key to edit the setpoint and press Enter again to save it.

## 5.6. Change fan mode

To toggle the fan mode, enter the installer password and go to the installer menu section.

Select the Basic settings menu to get the menu below:

31-01-2010	Basic set.	09:31
Refrigerant	R404A	
Control mode	Suc. Pressure	
Suction pressure setp	-10.0 °C	
Fan operation mode	Eco	
Date	>	
Summertime	Manual	

Select the line with Fan mode with the arrow keys if it is not highlighted. Press Enter key and select between Eco mode and LowSound mode with the arrow keys. Confirm your choice with another press on Enter.

## 5.7. Reset controller to factory settings

To reset all settings to factory settings, log in with installer password. Open the Installer menu and select the service menu with the Enter key.

31-01-2010	Installer	09:31
Basic settings	>	
Settings	>	
Service	>	
New installer password	2	

Select the Factory reset line with the arrow keys and press Enter.

31-01-2010      Service      09:31	
Project	Standard
Model Code	Inv. F1
Controller LMC300 V.	2.1.3.0
Display LUP200 V.	1.1.3.2
IP Address	192.168.001.180
Netmask	255.255.255.000
Gateway	192.168.001.001
No-FI emergency mode	No
Fan controller used	Yes
Psuc fail FI speed	OFF Hz
Factory reset	No
Manual settings	>

Change **No** to **Yes** with the arrow keys and press Enter. After a short time the text **Yes** will change back to **No** to indicate the controller has changed all settings back to factory settings.

### 5.8. Activate Oil return function

The Oil return function is default not activated. It is used when the compressor often is operated at low speeds for longer periods and the unit has no oil separator. It will regularly speed up the compressor to pump the oil back to the compressor.

Enter the installer password and open the installer menu:

31-01-2010      Installer      09:31	
Basic settings	>
Settings	>
Service	>
New installer password	2

Scroll to Settings and switch menu with Enter.

31-01-2010 Settings 09:31	
Week program	>
Capacity control comp.	>
Inverter compr step 0	>
Inverter compr step 1	>
Fan control	>
Limiter control	>
Winter start	>
<b>Oil return</b>	>
Limiter alarms	>
Digital input	>
Oil heater	Active-UnitOn

Select Oil return line and press Enter.

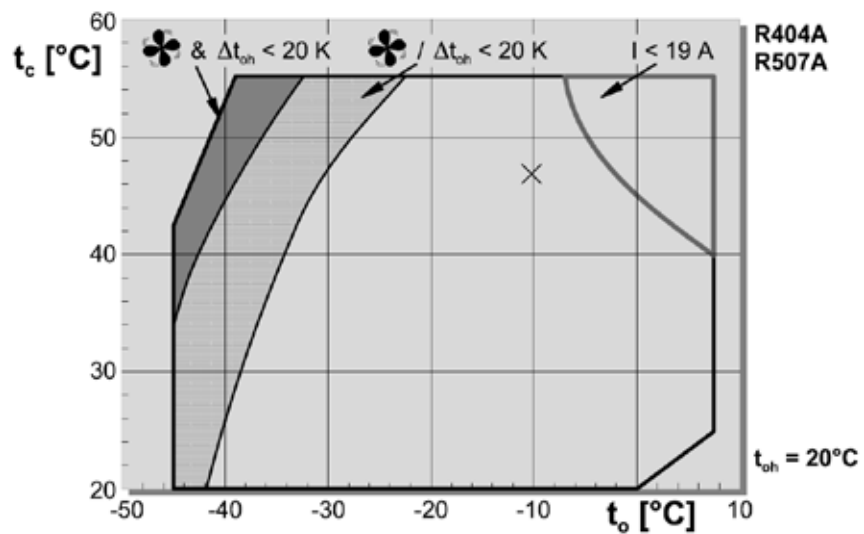
31-01-2010 Oil return 09:31	
<b>Oil return</b>	<b>Off</b>
Oil return frequency	70 Hz
Oil return interval	4 h
Evap. Limiter off	0 s
Run time	30 s

Switch Oil return to **On** with Enter and adjust other settings according to the installation needs.

## 6. Functions

### 6.1. Compressor protection

A compressor has a "safe area" (envelope) where it can operate safely. The controller monitors a set of parameters and will reduce compressor frequency or increase fan speed if one of the parameters will bring the compressor out of this safe area.



Sample safe area – application limits

If suction pressure becomes too low, compressor speed is reduced or stopped. If discharge pressure is becoming too high, first the fan speed is increased and if this is not enough, the compressor speed is reduced.

If the difference between suction pressure and discharge pressure is too low, the fan speed is lowered as there is a needed minimum pressure difference across the compressor.

In **Installer.Settings.Limiter Control**, the limit values for safe operation can be set. The settings are for Bitzer compressors. They are adjusted depending on the selected refrigerant and compressor. See "Limiting functions – Limiter control".

When operating long time at low compressor speed, the oil may stay in the evaporator(s) due to low flow speed.

In **Installer.Settings.Oil return** a function for automatically returning the oil can be enabled. Oil return can be set **On** or **Off**, default is **Off**.

**Oil return frequency** is the speed the compressor is running during oil return. **Oil return interval** is the time between two oil returns.

**Evap. Limiter off** is how long time [s] the compressor is allowed to run if T0 is below the T0 Cut-out limit.

**Run time** defines how long time the speed in **Oil return frequency** is maintained.

The compressor can be mounted with external monitoring devices for over heat protection and low oil level alarm.

Single compressor mode: There are two separate inputs for these devices.

An automatic restart is performed 15 min after a compressor overheat has been signalled.

A low oil level alarm will lead to a stop of the compressor as damage may occur during continuous operation. There is no restart attempt; a manual reset by power off is needed.

Dual compressor mode: There is a safety chain input for each compressor. A distinction between a compressor overheat and a low oil level alarm is not possible and due to this a manual reset must be performed by powering off the unit.

## 6.2. Sound reduction

In dense populated areas or other areas sound from installations could become a problem.

The default setting is to let the controller run the condensing unit as energy efficient as possible. However the fan control can be permanently changed from **Eco** to **LowSound** in **Installer.Basic setting.Fan operation mode**.

The P-band of the normal **Eco** mode is multiplied with 3; this will lead to a higher condenser temperature and a little higher energy consumption.

The fan mode can be set by the week program to **LowSound** to lower the sound pressure during nights and then shift to **Eco** in daytime to increase energy efficiency. It can also be adjusted through a digital input, for example from a signal from the shutters in the display cabinets.

### 6.3. Compressor control modes – Model code

The controller can be configured to control the compressor in different ways. This is configured at the factory by the Model code. The model code is visible in **Installer.Service.Model code**.

The control model codes are:

1. One CPR ON/OFF One compressor in On/Off operation
2. One CPR Unl. One compressor with unloader, On/Off operation.  
The unloader is turned On and Off depending on capacity.
3. One CPR 0-10V One compressor controlled via an external FI using 0 - 10V signal
4. Inv. F1 One compressor controlled via a Danfoss FCM series FI
5. Inv. F1 134a One compressor controlled via a Danfoss FCM FI – only for R134a
6. Inv. F3 One compressor controlled via a Leroy Somer FI
7. Dual CPR Unl. Dual compressor both with unloader
8. Dual CPR 0-10V Dual compressor, both with unloader – controlled via 0 - 10V signal.  
The 0 - 10V signal is for an external unloader controller where the voltage represents the percentage of needed capacity.

"Inv." – With frequency inverter, Danfoss FCM series or Leroy Somer using serial bus.

"On/Off" – Normal On/Off Compressor mode

"Unl." – Compressor with one unloader.

In **FI/Inverter** mode the control of the inverter is via a serial bus and all control data are transmitted via the bus. Also all alarm signals are read via the serial bus.

**CPR 0 – 10V** is with an inverter, however the speed reference is 0 – 10V and is transmitted via analog output ANOUT2. 0V is 0 Hz and 10V is max frequency.

There is no alarm monitoring of the FI!

**On/Off** mode resembles a traditional control of a compressor via monitoring of the pressures.

**Unloader** uses a relay to operate an unloader, the compressor is



without inverter and another relay turns the compressor On or Off.

**Dual** mode means that two compressors are used to achieve the needed capacity. The compressors are turned on with respect to load sharing.

## 6.4. Capacity control

The controller uses a PI controller to maintain the selected setpoint whether **Suction pressure** or **Room temp** control is used.

The settings of the PI controller are in **Installer.Settings.Capacity control comp.**

**Gain** sets the gain part (P) of the PI regulator. **Integral time** set the integrator of the PI regulator. **Delta max** is used for setting the maximum rate change per second.

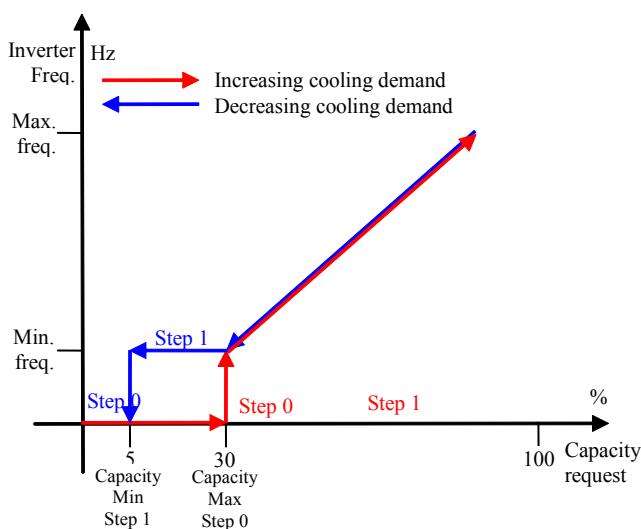
**Neutral zone** can be used for removing instability with a hysteresis.

**Setpoint adjustment** can be **Off**, 0-10V or 4-20mA. If it is either **0-10V** or **4-20mA**, the analog input Temp10 is used as analog input. Please see External setpoint adjustment.

**Adjustment offset** is the level of adjustment in K.

Control modes single compressor with frequency inverter:

The difference from the actual temperature to the wanted setpoint is expressed as a capacity request from 0 to 100% where 100% is full compressor speed whether with or without frequency inverter.



When the compressor is stopped, it will be started with **Inverter min frequency** when the calculated capacity based on cooling demand is

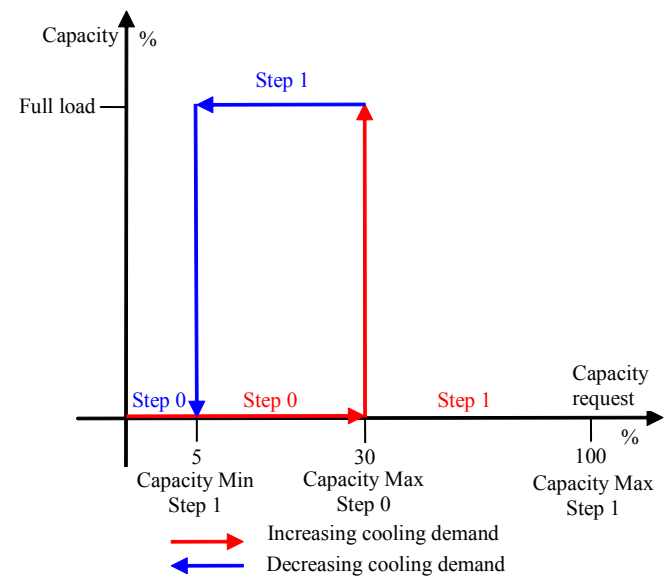
higher than **Capacity Max Step 0**; the speed will be increased up to **Inverter max frequency** if the capacity need continues to increase. If the cooling demand decreases, the calculated capacity will also decrease and the speed of the compressor will decrease. When the speed has decreased down to **Inverter Min frequency** the speed stays there until the calculated capacity is below **Capacity Min Step 1** and the compressor is then stopped.

Only in **F1** and **F3** modes the frequency inverter is monitored against alarms and limited against overload using the status information from the frequency inverter via the serial bus communication.

Control mode On/Off – single compressor

Like in inverter operation, the output from the PI controller is used to determine whether the compressor is stopped or running full load. Relay no. 1 is used for start and stop of the compressor.

Capacity step	Relay 1
Step 0	Off
Step 1	On



The control function can be adjusted by **Capacity Min Step 0**, **Capacity Max Step 0** and **Capacity Max step 1**.

The start and stop of the compressor can be adjusted by setting the **Min Start interval** and **Runtime Min** in **Installer.Settings.Inverter compr step 1**.

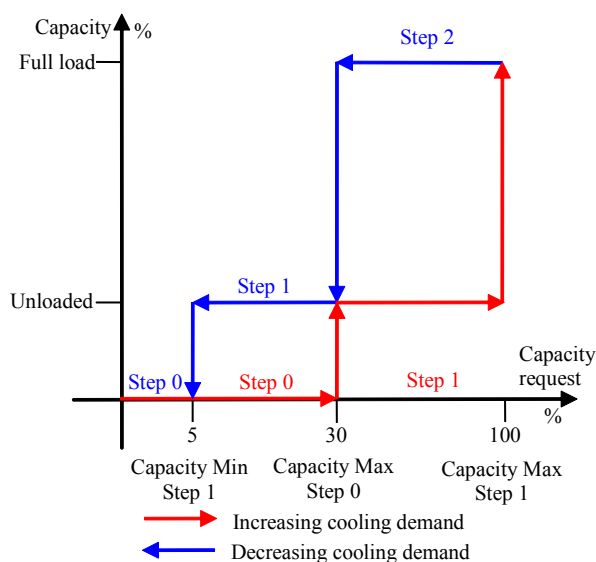
### Control mode Unloader – single compressor

Like in inverter operation, the output from the PI controller is used to determine whether the compressor is stopped, running unloaded or running full load.

The relay no. 9 is used for the unloader valve and relay no. 1 is used for start and stop of the compressor.

In step 1 the unloader valve is energized in order to unload the compressor. In step 2 the unloader valve is not energized.

Capacity step	Relay 1	Relay 9
Step 0	Off	Off
Step 1	On	On
Step 2	On	Off



The control function can be adjusted by **Capacity Min Step 0**, **Capacity Max Step 0** and **Capacity Max step 1**.

The start and stop of the compressor can be adjusted by setting the **Min Start interval** and **Runtime Min** in **Installer.Settings.Inverter compr step 1**.

### Dual compressor in On/Off control and both with unloader with On/Off control

Using two compressors each equipped with unloader gives the possibility to have four capacity steps – 25%, 50%, 75% and 100%. The capacity request is from the PI controller calculated from the cooling demand.

To even out the load – runtime levelling is applied. Runtime levelling

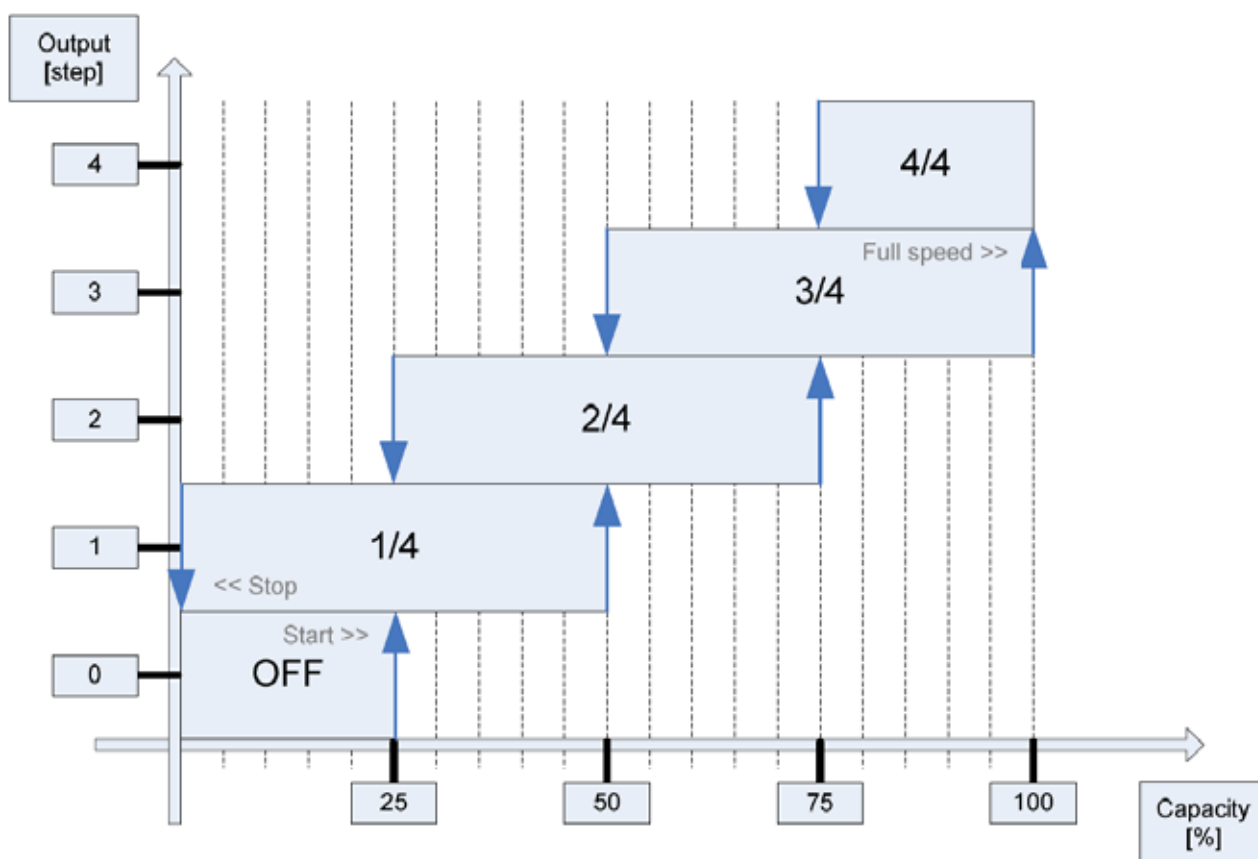
is achieved by deciding which compressor to start and which one to stop when a new output step is selected in the table below.

To keep the same compressor operational (warm), the change of positions A and B is allowed only when one compressor is more than 100 hours ahead in run time. However, Restart time and Minimum runtime are respected for each compressor.

The unloaders are operated in On/Off operation based on capacity request.

Step	Capacity [%]	Compressor A	Unloader A	Compressor B	Unloader B
Off	0..25	–	–	–	–
1	0..50	On	On	–	–
2	25..75	On	–	–	–
3	50..100	On	–	On	On
4	75..100	On	–	On	–

Either compressor 1 or 2 can be attached to A or B. This depends on the runtime levelling.



## Dual compressor in On/Off control and both with unloader with 0 – 10V control

Using two compressors with electronically controlled unloaders allows the controller to control the capacity in three steps as shown in the table below.

In each step the controller output is a combination of a start/stop signal and one 0 – 10V analog signal for each compressor. This allows the capacity of each compressor to be either zero or 50 % to 100 %.

The external capacity modulating module(s) are responsible of operating the unloader valves within appropriate period and pulse shape limits specified by the compressor manufacturer.

Each compressor has software runtime counters and start / stop timers to avoid excessive wear and obtain equal life time of the two compressors. Starting and stopping compressors can be limited by adjusting the Restart, Start and Stop time parameters.

Runtime levelling is achieved by deciding which compressor to start and which one to stop when a new output step is selected in the table below.

To keep the same compressor operational (warm), the change of positions A and B is allowed only when one compressor is more than 100 hours ahead in run time.. However, Restart time and Minimum runtime are respected for each compressor.

Step	Capacity [%]	CPR-A [Relay]	Unl.-A [Volt]	CPR-B [Relay]	Unl.-B [Volt]	Description
OFF	0..25	–	0	–	0	Both compressors stopped
1	25..0	ON	0	–	0	Compressor A : fully unloaded
2	25..50	ON	0 - 10	–	0	Compressor A : modulated
3	50..100	ON	0 - 10	ON	0 - 10	Compressor A + B : modulated

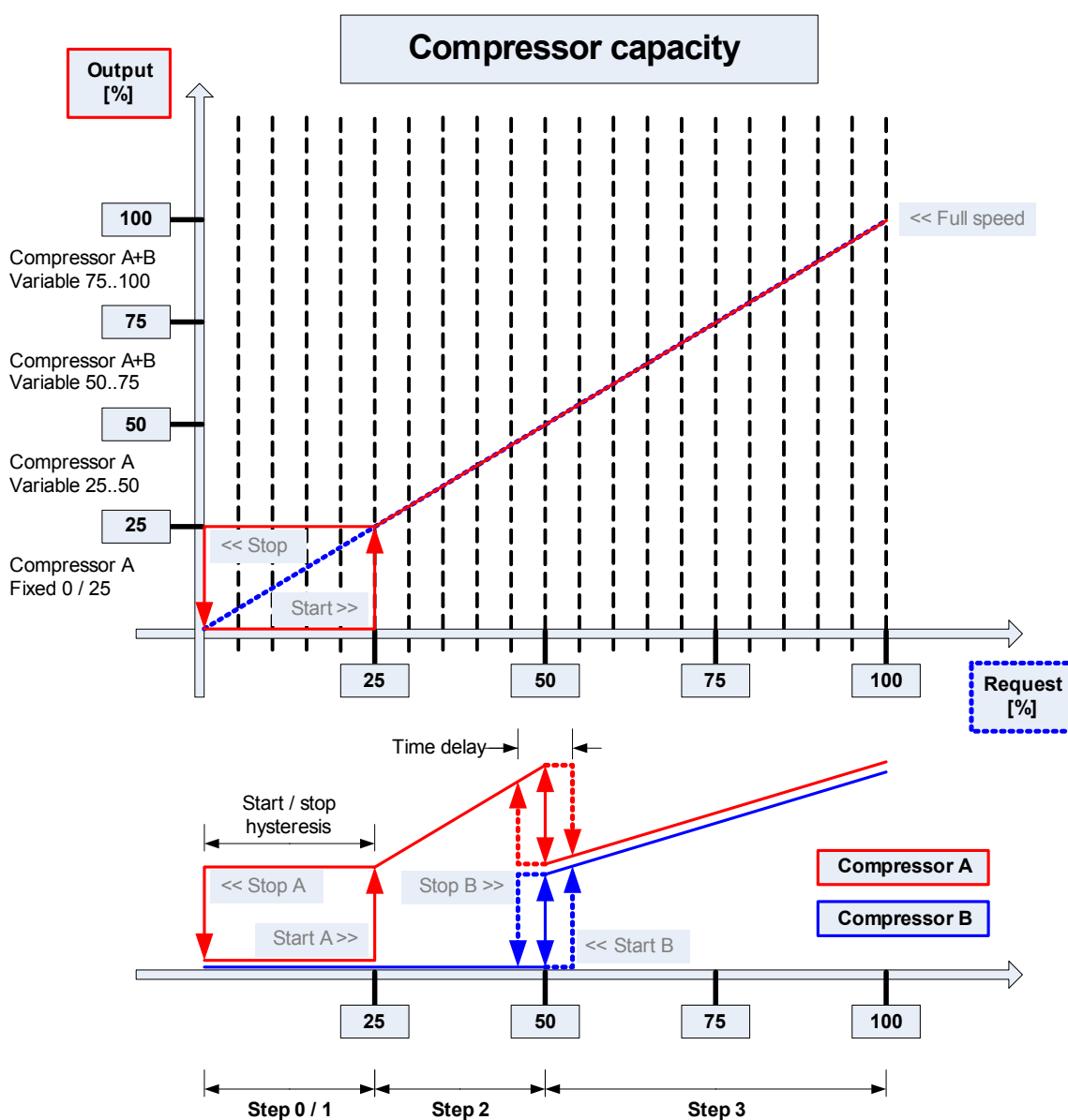
Either compressor 1 or 2 can be attached to A or B. This depends on the runtime levelling.

When starting from off state the minimum capacity is  $\frac{1}{2} * \frac{1}{2} = 25\%$  of full capacity, given by running one compressor alone with full unload. In step 2 from 25 to 50 % one compressor is gradually released until its full capacity.

In step 3 from 50 to 100 % both compressors are run in parallel with equal unloader percentage.

On the chart below is shown the combined unit capacity as well as the individual compressor operation.

In the range from 0 to 25 % capacity the unit must select between stopped or running with one compressor at half capacity. From 25 to 100 % the unit will modulate one or both compressors to meet the requested capacity with no significant gaps.



## 6.5. Setting the setpoint

The controller is flexible with the setpoint setting and can use a combination of a static setpoint and dynamic setpoint control depending on the demands at the installation. This functionality is available in both Suction pressure mode and Room temperature control mode.

The setpoint set on the user panel is used for installations where no changes in the setpoint are needed.

If periodic changes in the setpoint are recommended say due to opening hours, the weekprogram timer can be used to switch between the different setpoints on a regular weekly basis. The weekprogram sets the setpoint in the Basic settings menu when the time for the next change arises – as if a user had entered it manually. If for example the opening hours changes often, the 2nd setpoint can be used together with a digital input and use an external switch to switch between two different setpoints.

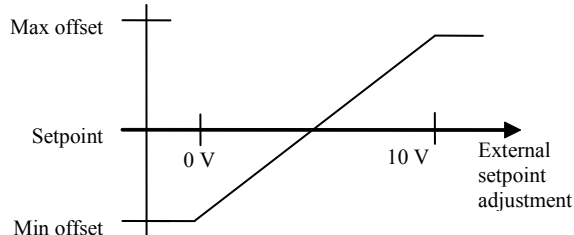
The above setpoints are static and a change on the userpanel would be needed to do dynamic changes. The External setpoint adjustment can be used for applying dynamic adjustments to the entered setpoint. This could be due to dynamic changes in the setpoint, due to adaption to calibrated sensors etc. This applies to both the normal setpoint and the 2nd setpoint.

## 6.6. External setpoint adjustment

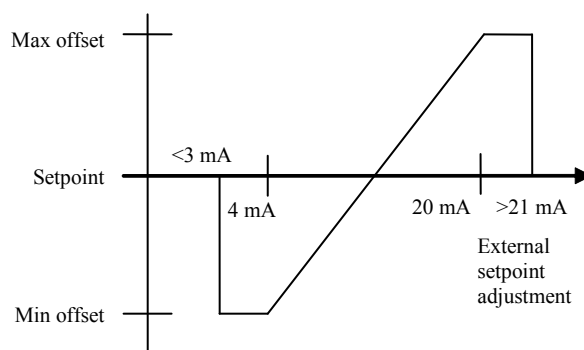
Note: There must be a 10k $\Omega$  resistor from the Temp10 temperature input to GND. If the input is setup for 4 mA – 20 mA, a 150  $\Omega$  resistor must be added parallel with the 10 k $\Omega$  resistor for signal conversion.

The external setpoint adjustment function is enabled in **Installer. Settings.Capacity control comp.** menu by setting **Setpoint adjustment** to either **0 – 10V** or **4 – 29mA**.

0 – 10V input:



4 -20mA input:



**Adjustment offset** value is used with sign, i.e.  $-5^{\circ}$  to  $+5^{\circ}$  K offset adjustment.

This function can be used for manual or automatic stepless adjustment of the setpoint based on the local varying conditions. It could also be used where calibrated sensors are demanded and using their readings to adjust the setpoint.

### 6.7. Condenser control – fan control

The fan speed is controlled to maintain as stable a liquid temperature as possible as this will lead to the best performance of the evaporator controllers.

If the condenser temperature is set to follow the ambient temperature, the total power usage of the condensing unit is minimized.

In **Installer.Settings.Fan control** section are the parameters for condenser control.

**Ambient compensation** sets if the ambient temperature should be followed or not. The **Uncomp. Setpoint** is only used if **Ambient compensation** is set to **Off**. **Ambient temp. diff.** and **Stop hysteresis** defines how close the ambient temperature is followed.

**Proportional band** is the temperature band from 0 % to 100 % fan speed. **Start speed** is used for securing enough torque to start the fans with dirt, leaves, snow etc. **Delta max** controls the change of rate in the fan speed according to condenser temperature changes.

There must be a certain pressure difference across the compressor; **Setpoint min** set the minimum condenser temperature. Below this, the fans will not be started. There are two separate maximum condenser



temperatures for **Eco** and **LowSound** fan modes, **Economy setpoint max** and **LowSound setpoint max**. Above this setting the fans are running at full speed.

Depending on the fan controller, there may be a minimum speed of the fans. This is set in **Fan capacity min**. **Fan capacity max** can be set to a lower value than 100% if there is no more speed change above a certain level. If this is not adjusted to actual behaviour, the wanted fan speed will not reflect the actual speed.

In **Settings. Basic settings** the fan mode is permanently set to either **Eco** or **LowSound**.

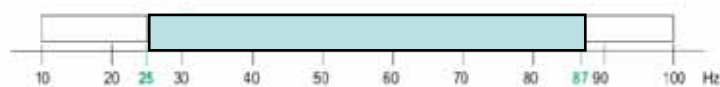
For temporarily changes, please see sections Week program and Force LowSound mode.

## 6.8. Frequency inverter control

The frequency inverter (FI) is controlled and monitored through a bus communication link.

Control is start and stop commands and the wanted speed of the compressor motor.

This is only for single compressor units.



Higher max. capacity of compressors when using frequency inverters.

The controller is monitoring the status information from the FI about temperature, current, warnings and critical error.

Temperature and current are used for limiting the compressor speed for avoiding overload of the compressor for example at start up in ambient temperatures etc.

The communication through RS485 is at the moment specific for the Danfoss FCM300 series and Leroy Somer Varmeca 30 series. Other inverter types on request.

Warnings are set short time before the FI is entering the critical area and stops. They are used for reducing the compressor speed and/or increasing fan speed.

The main purpose is to let the compressor run as long time as possible without stops as a reduced speed in a period is better than a complete stop.

Alarms are generated if a stop could not be prevented. Please see the list in "Alarm system and trouble shooting".

After an FI alarm, restart attempts are used to see if the error condition should have been solved.

### 6.9. Oil handling

It is essential for the compressor that there is sufficient lubrication of its bearings. With compressors with frequency inverters, running long periods at low speed may leave the oil in the evaporator or evaporators due to the lower speed of the gas in the piping compared to compressors running at net frequency.

To protect the compressor two methods are used. First an oil level monitoring device can be mounted. If the device does not detect oil within a certain time span after compressor start, it will set an alarm signal relay.

The controller will generate alarm 602 Oil level and stop the compressor. This is a critical alarm and it must be reset manually, there are no restart attempts.

Second an "Oil return" function can be enabled by setting it to **On**, default it is set **Off**. See the settings in **Installer.Settings.Oil return** menu. **Oil return frequency** is the speed which the compressor should be running. **Oil return interval** is the time between Oil return speed-ups. **Evap. Limiter off** is the time in seconds T0 is allowed to get below the T0 limit. The expansion valve may close too fast and the suction pressure will then get low. **Run time** is the time in seconds the speed **Oil return frequency** should be kept.

If the compressor is already running the speed is increased else the compressor is started with the selected speed.

### 6.10. Operation at low temperatures

If the condensing unit is standing outside in cold conditions, all the refrigerant may end up in the compressor or the receiver. In suction

pressure control mode, the controller will not get any signal that an expansion valve has opened as there is no pressure difference to detect. If **Winter start** is enabled (default **On**) in **Installer.Settings.Winter start** menu, the controller will start up the compressor at regularly intervals to see if there should be an undetected cooling demand.

**Start temp. Difference** is the temperature difference  $T_0$  is below ambient temperature. **Pressure difference min** is the minimum pressure difference between suction pressure,  $P_{suc}$  and discharge pressure,  $P_{dis}$ . **Pause time** is the interval between start attempts in minutes. **Run time** is the running time in minutes to see if a flow should be established.

**Evap. Limiter off** is the time in seconds  $T_0$  is allowed to become below the  $T_0$  limit.

As there might not be a flow immediately, it is important that the compressor is allowed to run a little time to generate a flow. There will always be a little amount of refrigerant in the piping.

See also "Forced (winter) start – Winterst".

### 6.11. Limiting functions – Limiter control

Instead of waiting for the compressor to reach the limits of its safe operating area, the controller has limiting functions which will overrule the cooling demands by reducing the needed capacity in Capacity control. This way the compressor will be kept running as long as possible and avoiding application situations/ranges where the compressor must to be turned off for protection.

A limiter functions acts by reducing the calculated capacity request. The reduction factor is linearly increased the further the monitored parameter is away from the limit.

The following parameters are being monitored. **Condensing temp max** is the maximum allowed condenser temperature,  $T_c$ . When **Condensing temp max** is reached, the capacity-request starts to be reduced. **Evaporating temp min** is used for the lowest acceptable suction pressure,  $T_0$ . Below **Evaporating temp min**, the capacity request is reduced with accelerated speed. At  $T_0 - 5K$  a low pressure cut out and a compressor stop is performed. **Discharge gas temp max** is set to 130 °C. The  $T_{dis}$  sensor is used for this. Capacity is being reduced at **Discharge gas temp max** – 10 K. **Pressure diff. max** is the pressure

across the compressor. Decrease of capacity request starts at **Pressure diff. max** - 2 bar and until **Pressure diff. max** + 2 bar. **Pressure diff. min** is the minimum allowed pressure across the compressor. Below **Pressure diff. min** the fan speed is reduced to increase the pressure difference. **Pressure diff. max** and **Pressure diff. min** are refrigerant dependant, see "Setup – Parameters".

There are also two parameters for the frequency inverter, maximum temperature and maximum current which are fixed and can not be adjusted. They are for the Danfoss FCM300 series and the Leroy Somer Varmeca 30 series. Other inverter types on request.

When the inverter temperature exceeds the limit, the capacity request starts to be decreased.

If the inverter current exceeds the limit, the compressor speed is gradually reduced – down to FI min in **Installer.Settings.FI step 1.Inverter min frequency**.

### 6.12. Limiter alarms

To highlight that the condensing unit is running close to its limits, the controller will generate a limiter alarm in case of repeating activation of one of the limiter functions,

There is an individual alarm for each limiter function but not all limiter functions are monitored.

If the number of limiter functions per day is above the threshold for the alarm and this alarm is enabled, the corresponding operation alarm is being activated and the CTS relay is released and the alarm icon is flashing.

At midnight and at power-on all counters are reset to 0.

The actual settings for the limiter functions are used together with a temperature offset

Limiter function	Limit	Counter value	Default	Alarm text
Tdis	TdisMax + 10K	>10	On	Tdis Lim
Tc	TcMax + 3K	>10	On	Tc Lim
IFI	IFIMax + 0,5A	>10	On	IFI Lim
To	ToMin – 5K	>200	Off	To Lim

### 6.13. Week program

The controller has a week program function, where regularly changes of setpoint and fan mode can be performed up to 4 times per day.


There are 4 setups for Monday, 4 for Tuesday, etc. up to Sunday. A setup for a day can be copied to the next day; Monday to Tuesday, Tuesday to Wednesday etc. This makes an easy setup possible.

Settings are in the menu **Installer.Settings.Week program**.

For every setup, the **Time** must be set from 00:15 to 23:45 in 15 minute steps. 00:00 equals **Off** which means nothing happens. **Fan** (mode) can be **Eco** or **Low**. **Setp.** is the setpoint that should be used from this time and on to the next setup.

When the time specified in a setup is up, the changes are performed.

If the unit is without power, nothing is changed.

The icon  is visible on the main menu if the week program is enabled.

#### 6.14. Day light savings handling

Change to and from summer time can be done manually or automatically by the controller.

The field **Installer.Basic set.Summertime** can be either **Manual** or **Auto**. In manual summer time mode the controller does not change the time. In automatic summertime mode, the controller follows the Central European Summertime.

#### 6.15. Digital inputs

To expand the functionality of the application, two digital inputs can be configured for four different functionalities: "**2nd Setp.**", "**LowSound**", "**Winterst**" and "**Heat Rec**"



A digital input can only be used for one function and is then not available for other functions.

#### Alternative setpoint – 2nd Setpoint

This input could for example be connected to a signal when the shutters of the cabinets are being shut for the night.

If enabled, an active low signal on the attached digital input will make the controller switch to the second setpoint setting in **Installer.Settings.Digital inputs.2nd setpoint** as long as the signal is low.

On the main menu the status of the 2<sup>nd</sup> setpoint function is illustrated by the two icons:



	The function is enabled, but the corresponding digital input is not activated.
	The function is enabled and the digital input is activated

### Force LowSound mode

If enabled, an active low signal on the attached digital input will make the controller switch the fans to **LowSound** mode as long as the signal is low.

The weekprograms fan setting will be overridden.



On the main menu the status of the forced LowSound function is illustrated by the two icons:

	.The function is enabled, but the corresponding digital input is not activated.
	The function is enabled and the digital input is activated

### Forced (winter) start – Winterst

When the ambient temperature is close to the setpoint in suction pressure control, there is no pressure difference and the controller can not by using T0 measure if there is a capacity need. To force a start, the digital input can be activated (a pulse is enough). Automatic winter start is hereafter performed with the settings in **Installer.Settings.Winter start** section until the unit is powered off. After a power-off the signal must be set again.

On the main menu the status of the forced Winter start function is illustrated by the two icons:

	The function is enabled, but the corresponding digital input is not activated.
	The function is enabled and the digital input is activated



### Heat recovery

In this mode the condenser fans are only operated if the condenser temperature passes the threshold **Installer.Settings.Digital inputs.**

**Heat recovery fan start.** If the condenser temperature passes the threshold, the heat recovery device has insufficient capacity.

The Condensing temperature limiter is still active and will still protect the compressor.

On the main menu the status of the heat recovery function is illustrated by the two icons:

	The function is enabled, but the corresponding digital input is not activated.
	The function is enabled and the digital input is activated

### 6.16. Oil – Crank case heater

The oil (crank case) heater is used for boiling out refrigerant from the oil so that there is always oil for lubrication in the compressor.

This costs energy so there are two modes for control of the oil heater.

In the **Installer.Settings.Oil heater** parameter the default setting is **Active-UnitOn**. With this setting the heater is always running when the compressor is stopped as long as there is power to the unit. This is used where the condensing unit must always be available for a quick start.

The other setting, **Ext. Release** is for use in for example air conditioning where the unit may be off for long periods. In this mode, the external On/Off signal must be **On** before the oil heater is used. Still, the heater is only turned **On** if the compressor is stopped.

### 6.17. Forced liquid line valve opening

In Room temperature control mode, if the **Evaporating temp min** limiter function has been activated and the compressor therefore is stopped, an increase in the room temperature above setpoint will not make the compressor start again.

In Room temperature control mode the liquid line valve is normally closed during compressor stop, however this function opens the liquid line valve for a short time and thereby allowing the suction pressure to increase again and releasing the compressor for operation again.

The conditions are:

- Compressor is stopped by the controller
- Room temperature is above setpoint
- Suction pressure is below **Evaporating temp min** limiter setpoint.

If the conditions are fulfilled, the valve is opened a short time defined in **Installer.Settings.Inverter compr step 1.Valve open time**. Default is 10 s. If the suction pressure does not rise by this, the valve is opened

again every 5 minutes until a start can be performed.

### 6.18. Liquid carry over detection

The compressor must be protected against liquid carry over for longer periods of time because liquid refrigerant removes lubrication and thereby greatly increase wear and tear on the compressor. The motor insulation may also be damaged.

#### Suction line detection

When the temperature in the suction line is equal to the suction pressure T0 it indicates that liquid refrigerant is reaching the compressor. Detection occurs when min. superheat has been below min. superheat limit for at least 10 seconds.

Upon detection four actions are possible (User setting):

0. Do nothing (default).
1. Show a warning.
2. Show a critical alarm and restart the unit with default restart time.
3. Show a critical alarm and stop the unit (no restart).

The settings can only be changed via LMT.

The min. Superheat field is Param.SucLiqDetTsh. Default is 10K.

The action upon detection field is Param.SucLiqDetAct. Default detection action is no action.

#### Liquid carry over, discharge line detection

A sudden temperature drop on the discharge line indicates that liquid refrigerant has been pumped through the compressor.

Warning detection occurs when Tdis drops at least 5K within 5 seconds, and shows a warning but the unit keeps running.

Stop detection occurs when Tdis drops at least 10K within 5 seconds, and stops the unit on hold. The unit must then be manually restarted.

The setting can only be changed via LMT.

The function can be enabled with the field Param.DisLicDetEna: 0 = Disabled (default), 1 = Enabled.

### 6.19. Service function

In the **Installer.Service** menu section the unit configuration is listed in **Project** and **Model Code** parameters. The actual software versions in



the LMC300 controller and the LUP200 display are also listed here. Settings for the LOM320 Ethernet module are also listed; this applies also if there is no LOM320 Ethernet module mounted as the settings are stored in the LMC300 controller. **IP address**, **Netmask** and IP address of the network **Gateway** are listed. The **IP address** can be altered to suit the local network settings. Changing the Netmask is possible, but may affect network performance.

In case of emergency operation or operation without a frequency inverter, the use of the frequency inverter can be stopped by setting **No-FI emergency mode** to **Yes**. The use of the fan controller can also be stopped by changing Fan controller used from **Yes** to **No**.

The field **Psuc fail FI Speed** is for emergency cases where the suction pressure transmitter is defect and a spare is not available. The parameter defines the fixed speed of the compressor. Since there is no monitoring of the suction pressure this setting must only be used under surveillance! It gives the possibility to still have some cooling capacity even though the controller can't adjust the speed automatically without the controlling sensor.

When the field **User.Mode** is set to **Manual**, the fields in the **Manual** menu can be used for testing the outputs of the controller during service. For single compressor with frequency inverter the field **Inverter freq –LP trans off** can be set to 0 Hz = off or in the range 25 to 87 Hz. Provided that **RE1 – Contactor K1** is set to **On**, the compressor should be running with the selected speed.

## 6.20. Datalogger

At regularly intervals, data from the database are stored in the controllers (flash) memory. The memory is non-volatile and needs no battery backup.

With the default settings, the oldest data will start to be overwritten after approx. 4 weeks. This is a compromise between detailed logging data and datalog space.

The stored data can not be seen on the display, it must be uploaded from the controller using the LMT - PC software package.

In the datalog are stored alarms and logs. An alarm is written to the

datalog when the alarm is added to the alarm list on the user panel. See Alarm system and trouble shooting for a list of possible alarms, causes and troubleshooting.

A log is a collection of data recorded at the same time.

There are two types of logs, a fast which is logged every 2 minutes and a slow which is logged every hour. The logging speed is different to have more space yet maintaining a small time between logging of dynamic data.

With every log the log type and the date and time is also stored as yymmddhhmm.

The fast log contains the following data:

To, Tc, Tdis, Tsuc, FI current, FI speed, fan speed, actual active limiter function and Tcoldstore.

The slow log contains the following data:

Setpoint, Tamb, External setpoint adjustment, FI temperature, Actual capacity, Runtime hours, External run signal, High pressure switch failure, Low oil level failure, Compressor overheat failure, Fan1 overheat failure, Fan2 overheat failure, Tsuc.

### 6.21. Reset of passwords

By short circuiting digital input DIN3 to GND for more than 3 seconds, passwords for the user panel and the webpage are reset to default values.

### 6.22. Reset to factory settings

All settings can be reverted to factory setting by setting the field **Installer.Service.Factory reset** to **Yes**. After 1 second, the controller will reset all changeable values to default settings.

### 6.23. Alarm handling

Alarms from the refrigeration system are sent to the controller through HW interfaces like switches, temperature sensors, pressure transmitters etc. The controller alarm system takes care about the alarm messages (display) and protects the system from damage by reducing capacity or stopping the compressor.

The CTS signal is turned **On** when the unit is powered on and has no alarms else it is turned **Off**. Since the CTS signal is on a shift relay, both the **NO** (Normal Open) and the **NC** (Normal Closed) signal can

be used.

See "Alarm system and trouble shooting" section for more details.

## 6.24. Restart handling

If an error occurs, there are different restart strategies depending on the error.

Depending on the severity of an error, the LMC340 controller may restart the unit again to see if the error has disappeared. The default restart time is 15 min.

The following Critical alarms will make the unit stop without more restart attempts:

- C602 Oil Pres
- C605 FAN OH
- C123 P1 Short (3rd time)
- C600 High pressure (3rd time)
- C621 + C622 Fault on both compressors in dual compressor mode.

With other critical alarms, a restart attempt will be done with variable restart times.

- For C600 Hi Pres the restart time is 2 \* default time.
- For C123 P1 Short, the restart time is multiplied with actual restart attempt number.

The counter for C123 alarms is decremented with 1 at midnight if the alarm is not active.

- For C601 Compressor overheat the restart alarm is the default time.
- For C500 FC Missing the restart time is always 1 minute.

The highest severity defines the restart time or if the unit stops.

With warnings, the unit does not stop, but a default value for the input reading is used. This way some cooling capacity is available at the cost of precision or maximum capacity.

## 6.25. Web page

The web pages of the LOM320 are described in a separate document as the web pages are more dynamical.

## 6.26. Remote maintenance

The data available for remote maintenance is described in a separate document.

## 7. Setup – Parameters

Default settings – per refrigerant and temperature control mode.

When the refrigerant is changed in Installer.Basic.settings.Refrigerant, a number of parameters are changed. They limit some of the settings and thereby adjust application settings to limits that will keep the compressor in its safe operating area.

If the temperature control mode is changed, default setpoint and the weekprogram setpoints are changed to the default value, i.e. -10 °C for suction pressure control mode and +2 °C for room temperature control mode.

### 7.1. Room temperature control mode

Field(s)	Refrigerant	R22	R134a	R404A	R407C	R410A	R507A
User.Room setpoint Installer.Basic.Settings.Setpoint Installer.Settings.Digital input.2ndSetp	Min	-40.0 °C	-25.0 °C	-40.0 °C	-20.0 °C	-25.0 °C	-40.0 °C
	Default	+2.0 °C	+2.0 °C	+2.0 °C	+2.0 °C	+2.0 °C	+2.0 °C
	Max	+22.5 °C	+35.0 °C	+17.5 °C	+22.5 °C	+22.5 °C	+17.5 °C
Installer.Settings.WeekProgram.Setpoint	Min	-30 °C	-30 °C	-45 °C	-25 °C	-30 °C	-45 °C
	Default	+2 °C	+2 °C	+2 °C	+2 °C	+2 °C	+2 °C
	Max	+22 °C	+35 °C	+17 °C	+22 °C	+22 °C	+17 °C
Installer.Settings.Fan control.Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+63 °C	+80 °C	+55 °C	+62 °C	+62 °C	+55 °C
Installer.Settings.Fan control.Setpoint min	Min	+15 °C	+15 °C	+15 °C	+15 °C	+15 °C	+15 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+63 °C	+80 °C	+55 °C	+62 °C	+62 °C	+55 °C
Installer.Settings.Fan control. Economy Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+45 °C	+45 °C	+45 °C	+45 °C	+45 °C	+45 °C
	Max	+63 °C	+80 °C	+55 °C	+62 °C	+62 °C	+55 °C
Installer.Settings.Fan control. LowSound Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+50 °C	+50 °C	+50 °C	+50 °C	+50 °C	+50 °C
	Max	+63 °C	+80 °C	+55 °C	+62 °C	+62 °C	+55 °C
Installer.Settings.Limiter control.Tc max	Min	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+63 °C	+80 °C	+55 °C	+62 °C	+62 °C	+55 °C
	Max	+63 °C	+80 °C	+55 °C	+62 °C	+62 °C	+55 °C
Installer.Settings.Limiter control.To min	Min	-45 °C	-30 °C	-45 °C	-25 °C	-30 °C	-45 °C
	Default	-45 °C	-30 °C	-45 °C	-25 °C	-30 °C	-45 °C
	Max	+13 °C	+25 °C	+7 °C	+13 °C	+13 °C	+8 °C

Field(s)	Refrigerant	R22	R134a	R404A	R407C	R410A	R507A
Installer.Settings.Limiter control. Hotgas max	Min	+70 °C	+70 °C	+70 °C	+70 °C	+70 °C	+70 °C
	Default	+130 °C	+130 °C	+130 °C	+130 °C	+130 °C	+130 °C
	Max	+140 °C	+140 °C	+140 °C	+140 °C	+140 °C	+140 °C
Installer.Settings.Limiter control.dP max	Min	5 bar	5 bar	5 bar	5 bar	5 bar	5 bar
	Default	22 bar	25 bar	22 bar	23 bar	34 bar	23 bar
	Max	22 bar	25 bar	22 bar	23 bar	34 bar	23 bar
Installer.Settings.Limiter control.dP min	Min	2.0 bar	2.0 bar	2.0 bar	2.0 bar	3 bar	2.0 bar
	Default	10.0 bar	10.0 bar	10.0 bar	10.0 bar	10.0 bar	10.0 bar
	Max	3,5 bar	3.5 bar	3.5 bar	3.5 bar	5.5 bar	3.5 bar
Installer.Settings.Winter start.dP min	Default	1.8 bar	1.2 bar	2.1 bar	1.7 bar	2.8 bar	2.2 bar
Installer.Settings.Digital input.Heat rec.	Min	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+57 °C	+75 °C	+50 °C	+57 °C	+57 °C	+50 °C
	Max	+63 °C	+80 °C	+55 °C	+62 °C	+62 °C	+55 °C

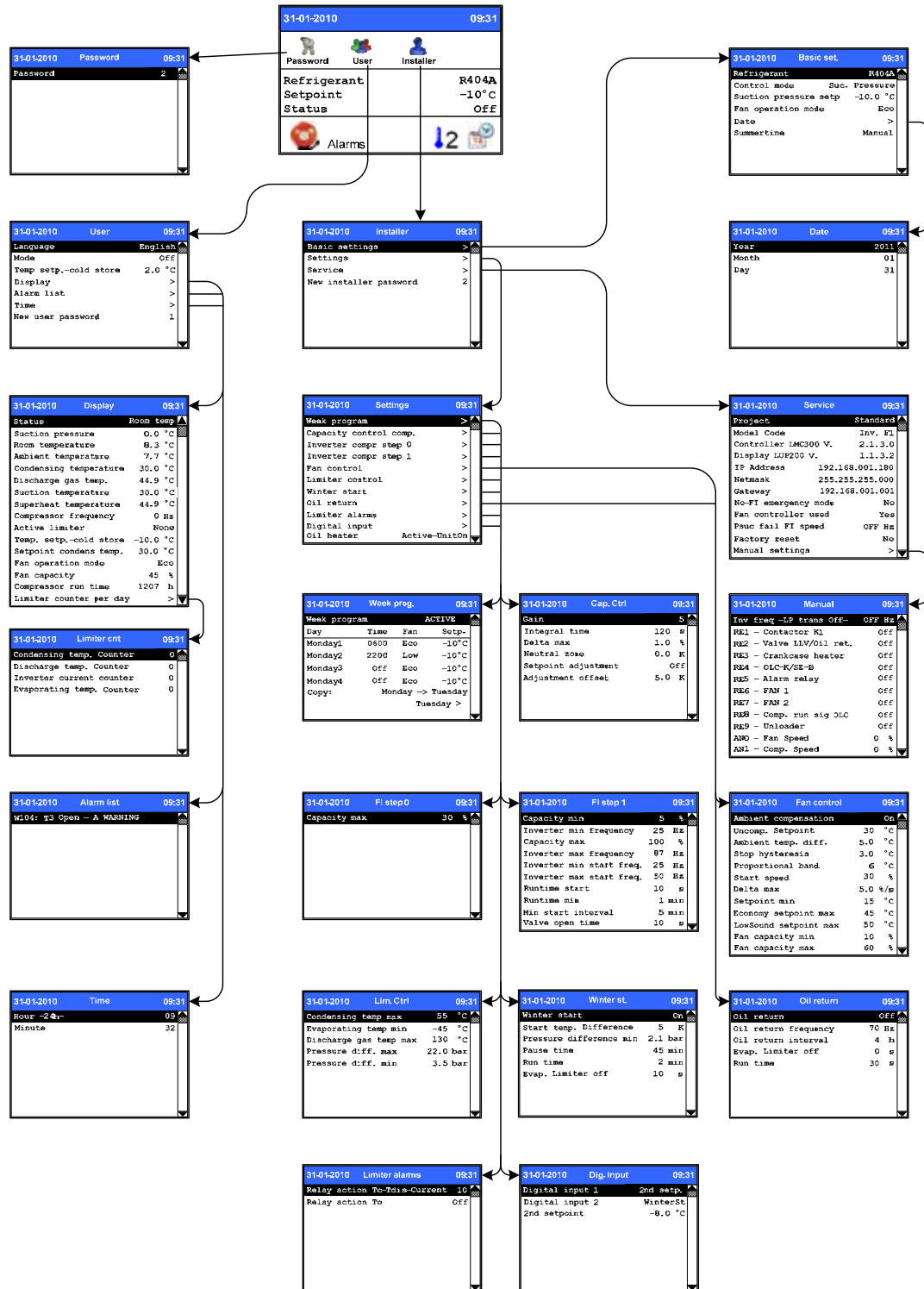
## 7.2. Suction pressure control mode

Field(s)	Refrigerant	R22	R134a	R404A	R407C	R410A	R507A
Installer.Basic.Settings.Setpoint Installer.Settings.Digital input.2ndSetp	Min	-45.0 °C	-30.0 °C	-45.0 °C	-25.0 °C	-30.0 °C	-45.0 °C
	Default	-10.0 °C	-10.0 °C	-10.0 °C	-10.0 °C	-10.0 °C	-10.0 °C
	Max	+12.5 °C	+25.0 °C	+7.5 °C	+12.5 °C	+12.5 °C	+7.5 °C
Installer.Settings.WeekProgram.Setpoint	Min	-30 °C	-30 °C	-45 °C	-25 °C	-30 °C	-45 °C
	Default	+2 °C	+2 °C	+2 °C	+2 °C	+2 °C	+2 °C
	Max	+12 °C	+25 °C	+7 °C	+12 °C	+12 °C	+7 °C

The remaining fields are as for room temperature control mode.

## 8. Menu system

### 8.1. Overview of the menu system









Note: '>' indicates that a sub menu will be opened

## 8.2. 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.

Refrigerant is the used refrigerant of the installation.  
Setpoint shows the actual setpoint.  
Status shows the actual status of the unit, please see the list below.







31-01-2010		09:31	
			
Password	User	Installer	
Refrigerant		R404A	
Setpoint		-10 °C	
Status		Off	
	Alarms		 2 

### Status line

The status line on the main menu shows the actual unit status.

Status line	
Off	The unit is in Off mode
Normal	Normal operation
Stopped	The unit is On, but there is no external release
Restarting	The unit is restarting after a warning, an alarm or a critical alarm
Critical Stop	Unit stop due to a critical alarm
Oil Return	The Oil return function is active
Min Run	The unit is running the minimum run time of the compressor
Min Pause	The compressor is started when the minimum pause time has elapsed
Lim Tc	The limiter for maximum condensing temperature is active
Lim Tdis	The limiter for maximum discharge gas temperature is active
Lim Tfi	The limiter for maximum frequency inverter temperature is active
Lim dP	The limiter for pressure difference across the compressor is active
Lim Psuc	The limiter for minimum suction pressure is active
Lim Ifi	The limiter for maximum frequency inverter current is active
NO FI	There is no communication with the frequency inverter
Psuc Emerg.	The unit is running in emergency mode without Psuc pressure transmitter
Manual	The unit is in manual mode

The following icons can be visible on the main menu:

	If the alarm icon is flashing, one or more alarms are active; if the icon is steady there is an unacknowledged alarm but no active alarms.
	The 2 <sup>nd</sup> setpoint function is enabled, but the corresponding digital input is not activated.
	The 2 <sup>nd</sup> setpoint function is enabled and activated.
	The force LowSound function is enabled, but the corresponding digital input is not activated.
	The force LowSound function is enabled and activated.
	The forced Winter start function is enabled, but the corresponding digital input is not activated.
	The forced Winter start function is enabled and activated.
	The heat recovery function is enabled, but the corresponding digital input is not activated.
	The heat recovery function is enabled and activated.
	The week program is active



### 8.3. Password menu

Enter the password for getting access to the wanted level of information.

Default passwords:

- 1 Opens access to user level information.
- 2 Installer settings are now available

31-01-2010	Password	09:31
Password		2

### 8.4. User menu

The User menu is used to turn the unit On and Off, display unit reading and show the alarm list.

#### Language

Select the language of the menu system.  
Possible choices are English, German, French, Finnish and Spanish.  
Default is English

#### Mode

Set the mode of the condensing unit. On, Off or Manual.  
Default is Off.  
If the unit is in Manual mode when powered off, it will start in Off mode

#### Temp setp.-cold store

Set the setpoint for room temperature control mode.  
Limits -45 °C to +30 °C. Depends on the used refrigerant  
Default +2 °C (R404A)  
Line is not visible in Suction pressure control mode

#### Display

View data from the unit

31-01-2010	User	09:31
Language		English
Mode		Off
Temp setp.-cold store		2.0 °C
Display		>
Alarm list		>
Time		>
New user password		1

**Alarm**

A list with up to 16 alarms

**Time** Set the time**New password**

New code for the user section

31-01-2010      Display      09:31	
Status	Room temp ▲
Suction pressure	0.0 °C
Room temperature	8.3 °C
Ambient temperature	7.7 °C
Condensing temperature	30.0 °C
Discharge gas temp.	44.9 °C
Suction temperature	3.0 °C
Superheat temperature	3.0 °C
Compressor frequency	0 Hz
Active limiter	None
Temp. setp.-cold store	-10.0 °C
Setpoint condens temp.	30.0 °C
Fan operation mode	Eco
Fan capacity	45 %
Compressor run time	1207 h
Limiter counter per day	> ▼

**8.5. User - Display menu****Status**

Temperature control mode. Suc. pressure / Room temp

**Suction pressure**

Suction temperature (saturated temperature based on pressure)

**Room temperature**

Show actual room temperature. Line is only visible in room temperature control mode.

**Ambient temperature**

Ambient temperature

**Condensing temperature**

Condensing temperature

**Discharge gas temp.**

Hotgas (Tdis) temperature

**Suction temperature**

Suction line temperature

**Superheat temperature**

Superheat temperature

**Compressor frequency**

Actual compressor frequency in Hz

**Active limiter**Show actual capacity limitation function:  
None, High Tc, Hotgas, High Tfi, dP Max, To Min, FI Curr.**Temp. setp.-cold store**

Suction pressure or Room temperature setpoint.

**Setpoint condens temp.**

Condenser temperature setpoint when ambient compensation is disabled

**Fan operation mode**

Actual fan mode. Eco or LowSound. User select or through activating a digital input

**Fan capacity**

Actual condenser fan setpoint  
10 % (min) to 100 % (max)

**Compressor runtime**

Run time in hours

**Limiter counter per day**

Limiter function counters total per day

**8.6. User - Limiter counters**

Lists the number of times today every single limiting function has reached its maximum limitation setting, meaning the unit has almost reached its application limit.

**Condensing temp. Counter**

Shows number of condensing temperature limiter actions for today

**Discharge temp. Counter**

Shows number of discharge gas temperature limiter actions for today

**Inverter current Counter**

Shows number of inverter current limiter actions for today

**Evaporating temp. Counter**

Shows number of evaporating temperature limiter actions for today

31-01-2010	Limiter cnt	09:31
Condensing temp. Counter	0	
Discharge temp. Counter	0	
Inverter current counter	0	
Evaporating temp. Counter	0	

31-01-2010	Alarm list	09:31
W104: T3 Open - A WARNING		

8.7. User - Alarms

Show active or unacknowledged alarm and warnings. If the first letter of the alarm number is in capital, the alarm or warning is still active, i.e. W104. If the first letter is in small capital like w104, it can be acknowledged with the Enter key and will then be deleted from the list.  
Default is No alarm.

31-01-2010	Time	09:31
Hour -24h-	09	
Minute	32	

8.8. User - Time setting

Set the hour and minute in the real time clock of the controller. 24h format.

31-01-2010	Installer	09:31
Basic settings >		
Settings	>	
Service	>	
New installer password	2	

8.9. Installer menu

Basic settings	Set customer settings
Settings	Set operating parameters
Service	Access to the service menus
New password	Set a new password for the installer section

## 8.10. Installer - Basic settings

**Refrigerant** Refrigerant selection  
R22, R134a, R404A, R407C, R410A,  
R507A.

Default is R404A

### Control mode

Temperature control mode  
Suction pressure or Room  
temperature mode.

Default is Suction pressure

### Suction pressure setp / Temp. setp.-cold store

Set the setpoint for Room  
temperature or Suction pressure  
control mode.

Maximum limits -45 °C to +30 °C,  
but also limited based on selected  
refrigerant

Default -10°C in Suction pressure  
mode, +2°C in Room temperature  
mode.

**Fan mode** Set the regulating mode of the fans,  
Eco or LowSound.

LowSound reduces the fan speed to  
reduce the sound from the fans.

Default is Eco

**Date** Set the date

**Summertime** Handling of summertime shift by the  
real time clock.

Manual or Auto (MET).

Default is Manual

31-01-2010	Basic set.	09:31
<b>Refrigerant</b>		<b>R404A</b>
<b>Control mode</b>	<b>Suc. Pressure</b>	
<b>Suction pressure setp</b>	<b>-10.0 °C</b>	
<b>Fan operation mode</b>	<b>Eco</b>	
<b>Date</b>	<b>&gt;</b>	
<b>Summertime</b>	<b>Manual</b>	

31-01-2010	Date	09:31
Year	2011	
Month	01	
Day	31	

**8.11. Installer - Date**

Set the year, month and day for the controllers' real time clock.

31-01-2010	Settings	09:31
Week program	>	
Capacity control comp.	>	
Inverter compr step 0	>	
Inverter compr step 1	>	
Fan control	>	
Limiter control	>	
Winter start	>	
Oil return	>	
Limiter alarms	>	
Digital input	>	
Oil heater	Active-UnitOn	

**8.12. Installer - Settings - Single compressor mode**

Collection of menus for adjusting operating parameters

**Oil heater**

The oil heater (crank case heater) can be operated in two modes.  
In Active-UnitOn the oil heater is On when the compressor is stopped.  
In Ext. Release the oil heater is On when the compressor is stopped and the external On/Off release signal is On.

31-01-2010	Settings	09:31
Week program	>	
Capacity control comp.	>	
Cap. Limits	>	
Fan control	>	
Limiter control	>	
Winter start	>	
Oil return	>	
Limiter alarms	>	
Digital input	>	
Oil heater	Active-UnitOn	

**8.13. Installer - Settings - Dual compressor mode**

Collection of menus for adjusting operating parameters

**Oil heater**

The oil heater (crank case heater) can be operated in two modes.  
In Active-UnitOn the oil heater is On when the compressor is stopped.  
In Ext. Release the oil heater is On when the compressor is stopped **and** the external On/Off release signal is On.

#### 8.14. Installer - Week program

Menu for the week program timer.

There can be up to four individual activations per day.

The menu shows the default settings for all days when in suction pressure temperature control mode.

- Select** Activate program or reset it.  
Off, Active or Clear. Default Off.  
Clear: Set all weekdays to the shown default values.
- Time** Set the time when the activation should be done. Step is in 15 min.  
Time 0000 equals Off.
- Fan** Set fan control mode to Eco or Low (LowSound).
- Setp.** Set the setpoint  
Default -10°C in Suction pressure mode, +2°C in Room temperature mode
- Copy** Copy settings for the shown day to the selected day.

31-01-2010		Week prog.	09:31
Week program		ACTIVE	
Day	Time	Fan	Setp.
Monday1	0600	Eco	-10°C
Monday2	2200	Low	-10°C
Monday3	Off	Eco	-10°C
Monday4	Off	Eco	-10°C
Copy:		Monday -> Tuesday	
		Tuesday >	

#### 8.15. Installer - Capacity control

Temperature control. Controls the capacity of the compressor by using a PI regulator.

- Gain** Controller gain [%/°C].  
Range 1 – 40.  
Default 5
- Integral time** Integration time (sec).  
Range 20 – 1200 sec.  
Default 120 s.
- Delta max** Max capacity change in %/min.  
Range 0.2 – 5.0%  
Default 1.0 %
- Neutral zone** Neutral band [°C]  
Range 0.0 K – 10.0 K.  
Default 0.0 K.

31-01-2010		Cap. Ctrl	09:31
Gain		5	
Integral time		120	s
Delta max		1.0	%
Neutral zone		0.0	K
Setpoint adjustment		Off	
Adjustment offset		5.0	K

**Setpoint adjustment**

External setpoint adjustment.

Off, 4 – 20mA, 0 – 10V.

Default Off.

**Adjustment offset**

External setpoint adjustment.

The internal setpoint will be adjusted from  
Min to Max

0.0 – 50.0 °C. E.g. 0V will adjust with -5.0 K  
and 10V will adjust with +5 K.

Default 5.0 K.

31-01-2010	FI step 0	09:31
Capacity max	30	%

**8.16. Installer – FI step 0**

Setup for the first step of the controllers "gear box".

Single compressor mode only.

See section "Capacity control"

**Capacity max** Maximum capacity for this step  
before shift to next step.  
Range 0 % - 100 %.  
Default 30 %.

31-01-2010	FI step 1	09:31
Capacity min	5	%
Inverter min frequency	25	Hz
Capacity max	100	%
Inverter max frequency	87	Hz
Inverter min start freq.	25	Hz
Inverter max start freq.	50	Hz
Runtime start	10	s
Runtime min	1	min
Min start interval	5	min
Valve open time	10	s

**8.17. Installer – FI step 1**

Setup of the second step of the controllers "gear box".

Single compressor mode only.

See section "Capacity control"

**Capacity min** Minimum capacity for this step.  
0 % - 100 %. Default 5 %.

**Inverter min Frequency**

Minimum compressor speed (FI).

Range 25 Hz – 87 Hz.

Default 25 Hz.

**Capacity max** Maximum capacity for this step.  
Range 0 % - 100 %.  
Default 100 %.



**Inverter max Frequency**

Maximum compressor speed.

Range 25 Hz – 87 Hz.

Default 87 Hz.

**Inverter min Start freq.**

Minimum compressor (FI) frequency during the start process.

Range 25 Hz – 87 Hz.

Default 25 Hz.

**Inverter max Start freq.**

Maximum compressor (FI) frequency during the start process.

Range 25 Hz – 87 Hz.

Default 50 Hz.

**Runtime start** Run time with the frequency between Inverter min start freq. and Inverter max start freq.

Range 0 – 60 s.

Default 10 sec.

**Runtime min** Minimum runtime.

Range 1 min – 10 min.

Default 1 min.

**Min start interval**

Restart timer. Minimum time since last start.

Range 0 – 20 min.

Default 5 min

**Valve open time**

In room temperature control mode:

Time liquid line valve opens to raise suction pressure.

Range 0 – 30 s.

Default 10 s.

31-01-2010		Cap. Limits		09:31
Step 0	Cap. max	25	%	
Step 1	Cap. min	0	%	
Step 1	Cap. max	25	%	
Step 2	Cap. min	25	%	
Step 2	Cap. max	50	%	
Step 3	Cap. min	50	%	
Step 3	Cap. max	100	%	
Step 4	Cap. min	0	%	
Step 4	Cap. max	0	%	

## 8.18. Installer – Capacity limits – Dual compressor mode

Setup for the steps of the controllers “gear box” for Dual compressor mode only.

See section “Capacity control”

### Step 0 Cap. max

Maximum capacity for this step before shift to next step.  
Range 0 % - 100 %.  
Default 25 %.

### Step 1 Cap. min

Minimum capacity for this step.  
Range 0 % - 100 %.  
Default 0 %.

### Step 1 Cap. max

Maximum capacity for this step before shift to next step.  
Range 0 % - 100 %.  
Default 25 %.

### Step 2 Cap. min

Minimum capacity for this step.  
Range 0 % - 100 %.  
Default 25 %.

### Step 2 Cap. max

Maximum capacity for this step before shift to next step.  
Range 0 % - 100 %.  
Default 50 %.

### Step 3 Cap. min

Minimum capacity for this step.  
Range 0 % - 100 %.  
Default 50 %.

### Step 3 Cap. max

Maximum capacity for this step before shift to next step.  
Range 0 % - 100 %.  
Default 100 %.

### Step 4 Cap. min

Minimum capacity for this step.

Range 0 % - 100 %.

Default 0 %.

#### Step 4 Cap. max

Maximum capacity for this step  
before shift to next step.

Range 0 % - 100 %.

Default 0 %.

### 8.19. Installer – Fan control

Condenser control

#### Ambient compensation

Use ambient compensation.

On, Off.

Default On

#### Uncomp. Setpoint

Setpoint for condenser temperature  
if ambient compensation is off.

Range 10 °C – 80 °C (depends on  
refrigerant)

Default 30 °C

#### Ambient temp. diff.

Ambient compensation difference.

Range 0 °C – 60 °C.

Default 5.0 °C

#### Stop hysteresis

Stop hysteresis. Added to ambient  
temp. diff.

Range 0 °C – 60 °C.

Default 3.0 °C

#### Proportional band

Span in °C from Fan capacity min  
speed to Fan capacity max speed in  
Eco mode.

LowSound span = 3 \* Eco mode  
span.

Range 0 °C – 60 °C

Default 6 °C

#### Start speed

Start speed of fans. The fan(s)  
must have enough start torque to  
start under all conditions.

31-01-2010 Fan control		09:31
Ambient compensation		On ▲
Uncomp. Setpoint	30	°C
Ambient temp. diff.	5.0	°C
Stop hysteresis	3.0	°C
Proportional band	6	°C
Start speed	30	%
Delta max	5.0	%/s
Setpoint min	15	°C
Economy setpoint max	45	°C
LowSound setpoint max	50	°C
Fan capacity min	10	%
Fan capacity max	60	% ▼

	Range 0 % - 100 %. Default 30 %
<b>Delta max</b>	Change in fan speed [% / sec] Range 0 % – 10 %. Default 5 %
<b>Setpoint min</b>	Minimum condensing temperature Range 0 °C – 80 °C. Default 15 °C
<b>Economy setpoint max</b>	Maximum condensing temperature (100 % speed) operating in Eco fan speed mode. Refrigerant dependent. Range 0 °C – 80 °C. Default 45°C.
<b>LowSound setpoint max</b>	Maximum condensing temperature (100 % speed) operating in LowSound fan speed mode. Refrigerant dependent. 0 °C – 80 °C. Default 50°C.
<b>Fan capacity min</b>	Minimum reference for fan controller. Ensure there is enough torque for the fans to operate at this speed under all conditions. Range 10% - 100%. Default 10 %
<b>Fan capacity max</b>	Maximum reference for fan controller. Range 0% - 100%. Default 60 %

## 8.20. Installer – Limiter controller

Lists settings for the capacity limiting functions.

### Condensing temp max

Maximum condensing temperature before capacity is decreased.  
Depends on refrigerant.  
Range 50 °C – 80 °C.  
Default 55 °C.

### Evaporating temp min

Minimum suction temperature T0 before capacity is decreased.  
Depends on refrigerant.  
Range -60 °C – +30 °C.  
Default -45 °C.

### Discharge gas temp max

Maximum Hotgas (Tdis) temperature before capacity is decreased.  
Depends on refrigerant.  
Range 70 °C – 140 °C.  
Default 130 °C.

### Pressure diff. max

Maximum pressure difference before capacity is increased.  
Depends on refrigerant and compressor.  
Range 2.0 bar – 34.0 bar.  
Default 22.0 bar.

### Pressure diff. min

Minimum pressure difference before fan speed is decreased.  
Depends on refrigerant and compressor.  
Range 1.0 bar – 6.0 bar.  
Default 3.5 bar.

31-01-2010	Lim. Ctrl	09:31
Condensing temp max	55	°C
Evaporating temp min	-45	°C
Discharge gas temp max	130	°C
Pressure diff. max	22.0	bar
Pressure diff. min	3.5	bar

31-01-2010		Winter st.	09:31
Winter start		On	▲▼
Start temp. Difference	5	K	
Pressure difference min	2.1	bar	
Pause time	45	min	
Run time	2	min	
Evap. Limiter off	10	s	

### 8.21. Installer – Winter start

Winter start settings. Settings must be fulfilled to release a winter start attempt.

**Winter start** Winter start feature On, Off.  
Default On.

#### Start temp. Difference

Difference between suction pressure  
To and ambient temperature.  
Setpoint + Start temp Difference >  
ambient temperature.  
Range 0 K – 10 K.  
Default 5K

#### Pressure difference min

Minimum pressure difference between  
suction pressure and discharge  
pressure.  
Range 0.3 bar – 6.0 bar.  
Default 2.1 bar

**Pause time** Minimum time since last compressor  
stop.  
Range 5 min – 12 h.  
Default 45 min.

**Run time** Run time during the forced winter  
start.  
Range 0 min – 15 min.  
Default 2 min.

#### Evap. Limiter off

Time the compressor is allowed to run  
after To falls below evaporating temp.  
min cut out limit.  
Range 0 s – 30 s.  
Default 10 s.

## 8.22. Installer – Oil return

Oil return feature settings. The function is used for speeding up the compressor to force the oil back to the compressor.

**Oil return** Oil return feature Off, Auto, Day.  
Day means the Oil return function is disabled between 22:00 (10 PM) and 6:00 (6 AM). Auto means the function is always enabled. Off means the function is disabled.

Default Off.

The compressor speed limit during start is disabled during oil return compressor start. Liquid line valve is opened during oil return in suction pressure control mode.

### Oil return frequency

Compressor frequency (FI) during oil return operation.

Range 25 Hz – 87 Hz.

Default 70 Hz

### Oil return interval

Minimum time since last oil return start.

Range 1 h – 48 h.

Default 4 h.

### Evap. Limiter off

Time the compressor is allowed to run with unchanged frequency even if To is below the Evaporating temp min limiter setting.

Range 0 sec – 30 sec.

Default 0 sec.

**Run time** Run time with Oil return frequency speed.

Range 0 sec – 180 sec.

Default 30 s.

31-01-2010 Oil return 09:31	
<b>Oil return</b>	Off
<b>Oil return frequency</b>	70 Hz
<b>Oil return interval</b>	4 h
<b>Evap. Limiter off</b>	0 s
<b>Run time</b>	30 s

31-01-2010	Limiter alarms	09:31
Relay action Tc-Tdis-Current	10	
Relay action To	Off	

**8.23. Installer – Limiter alarms**

Number of limiter activations per day before an alarm is set active.

**Relay action Tc-Tdis-Current**

Allowed number of alarms without activating the CTS alarm relay.

Valid for Condensin temp max, Discharge gas temp max and FI current limiters.

Range 0 – 999. 0 = Off.

Default 10.

**Relay action To**

Allowed number of alarms without activating the CTS alarm relay.

Valid for Evaporating temp min limiter.

Range 0 – 999. 0 = Off.

Default Off.

31-01-2010	Dig. Input	09:31
Digital input 1	2nd setp.	
Digital input 2	WinterSt	
2nd setpoint	-8.0 °C	

**8.24. Installer – Digital input**

Digital input 1 and 2 selectable functions (DIN1 and DIN2).

**Digital input 1**

Selectable functions.

Off, 2nd setp., LowSound, Winterst, Heat rec.

Default "2nd setp".

**Digital input 2**

Selectable functions.

Off, 2nd setp., LowSound, Winterst, Heat rec. Default "Winterst".

**2nd setpoint**

Only visible if function is selected on one of the digital inputs. Closed contact means 2nd setpoint is active.



Range as normal setpoint.

Default -8.0 °C

### Heat recovery fan start

Only visible if function is selected.

Setpoint for maximum allowed  
condensing temperature  
before activation of fans.

Closed contact means:

Ambient compensation is turned off,  
condenser fans starts if Heat recovery  
setpoint is reached and uses normal  
P band.

Range 10 °C – 80 °C.

Default 50 °C

## 8.25. Service menu

The Service menu shows the configuration of the unit.

<b>Project</b>	This is always Standard
<b>Model Code</b>	Shows the actual compressor control configuration.
<b>Controller LMC300 V.</b>	Software version of the LMC340 controller
<b>Display LUP200 V.</b>	Software version of the LUP200 display.
<b>IP Address</b>	Network IP address of the optional LOM320 web server board. The IP address can be changed to the required IP address for the site.
<b>Netmask</b>	Network mask of the optional LOM320 web server board. The netmaks can be adjusted to fit the network setup.
<b>Gateway</b>	Network IP address of the gateway the optional LOM320 is connected to.

31-01-2010 Service 09:31	
Project	Standard ▲
Model Code	Inv. F1
Controller LMC300 V.	2.1.3.0
Display LUP200 V.	1.1.3.2
IP Address	192.168.001.180
Netmask	255.255.255.000
Gateway	192.168.001.001
No-FI emergency mode	No
Fan controller used	Yes
Psuc fail FI speed	OFF Hz
Factory reset	No
Manual settings	> ▼

**No-FI emergency mode**

Switch to emergency mode if the FI has a fault and unit must continue to operate.

Select No and the compressor will run in On/Off operation using PWM modulation.

Yes, No.

Default Yes.

Remember to rewire power connection to the compressor to avoid motor damage if it is used for "emergency mode" operation!

**Fan controller used**

If set to No, the fans will be operated in emergency mode = full speed in PWM modulation.

Yes, No.

Default Yes.

Remember to rewire so wiring is without the use of the fan controller.

**Psuc fail FI speed**

If the suction pressure sensor should fail a fixed FI speed can be set.

There is no monitoring of the suction pressure as the sensor is faulty and the unit should be kept under surveillance!

Range Off, Inverter min freq. –

Inverter max freq.

Default Off.

**Factory reset** If set to Yes, the controller will reset all settings except factory configuration, runtime counter and passwords to factory settings.

Yes, No.

Default No.

**Manual settings**

Menu for controlling outputs in manual mode for service purposes.

## 8.26. Service – Manual mode

Activation of these outputs are only active if the condensing unit has been set in manual mode in **User.Mode**.

### Inv freq –LP trans Off-

Set the speed of the compressor.

Range 0 = Off. 25 – 87 Hz.

Default Off.

Remember to apply power to the FI and protection modules.

**RE1 – RE9** Set the specified output to On or Off.  
Default Off.

### AN0 – Fan Speed

Set the fan speed on the analog output ANOUT0.

Range 0% - 100%

Default 0%.

### AN1 – Comp. Speed

Set the compressor speed on the analog output ANOUT1.

Range 0% - 100%

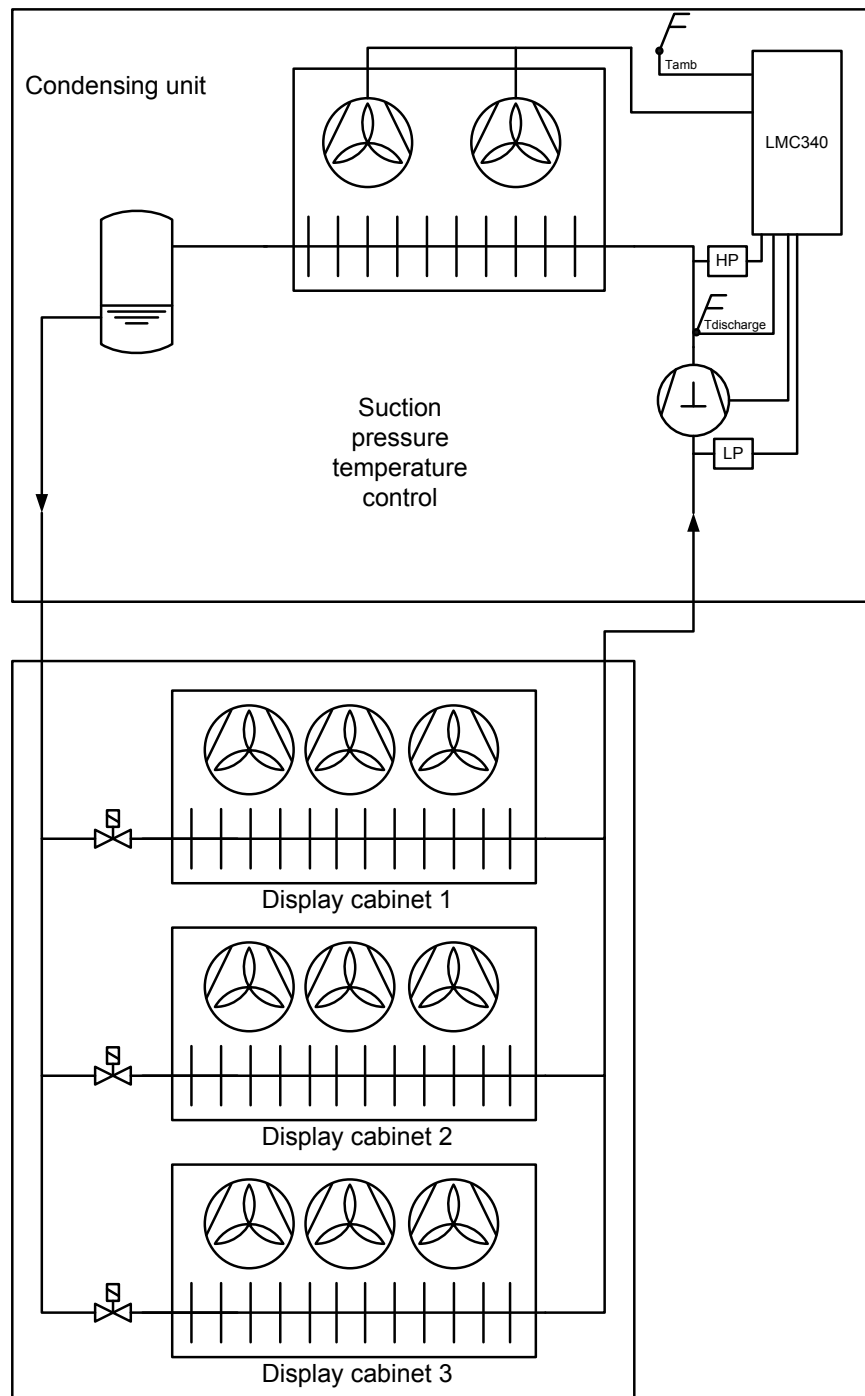
Default 0%.

31-01-2010		Manual		09:31	
Inv	freq	-LP	trans	Off-	OFF Hz
RE1	-	Contactor	K1		Off
RE2	-	Valve	LLV/Oil ret.		Off
RE3	-	Crankcase	heater		Off
RE4	-	OLC-K/SE-B			Off
RE5	-	Alarm	relay		Off
RE6	-	FAN	1		Off
RE7	-	FAN	2		Off
RE8	-	Comp.	run sig	OLC	Off
RE9	-	Unloader			Off
AN0	-	Fan	Speed		0 %
AN1	-	Comp.	Speed		0 %

## 9. Examples of application use

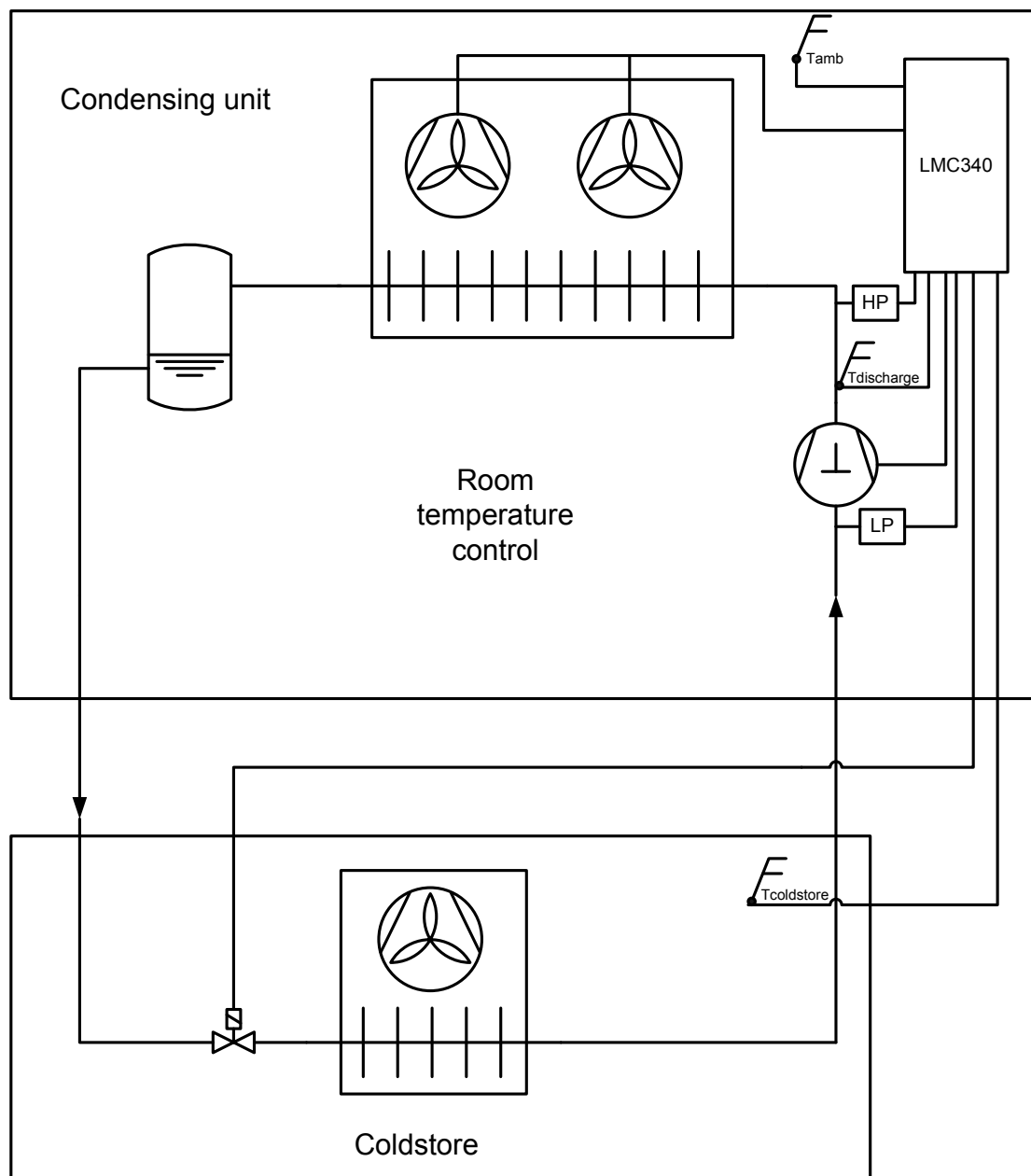
### 9.1. Suction pressure control mode

One or more display cabinets etc. can be supplied by one Condensing unit via the LMC340 Condensing unit controller



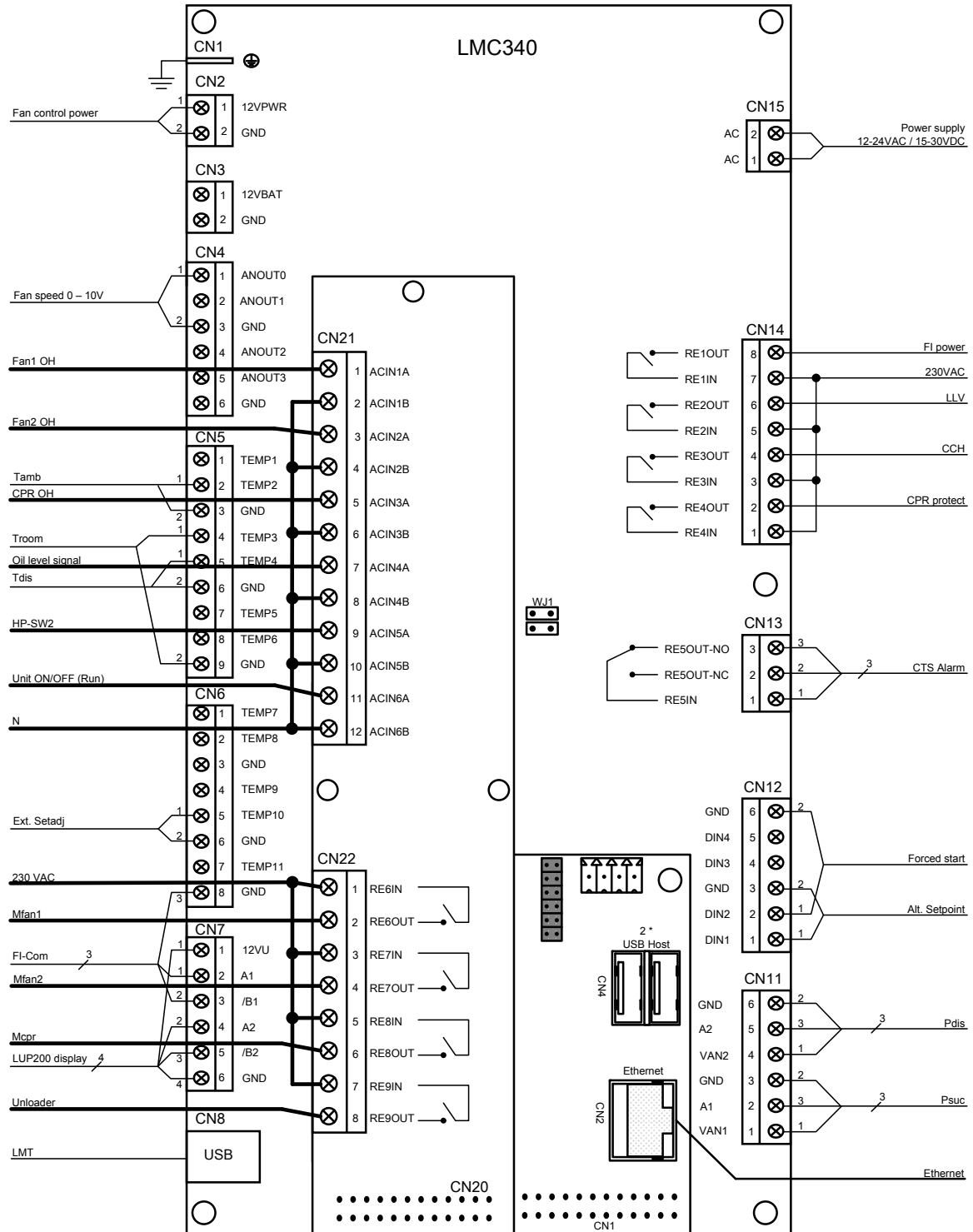
## 9.2. Room temperature control mode

The temperature in a coldstore can be controlled by the LMC340 Condensing unit controller

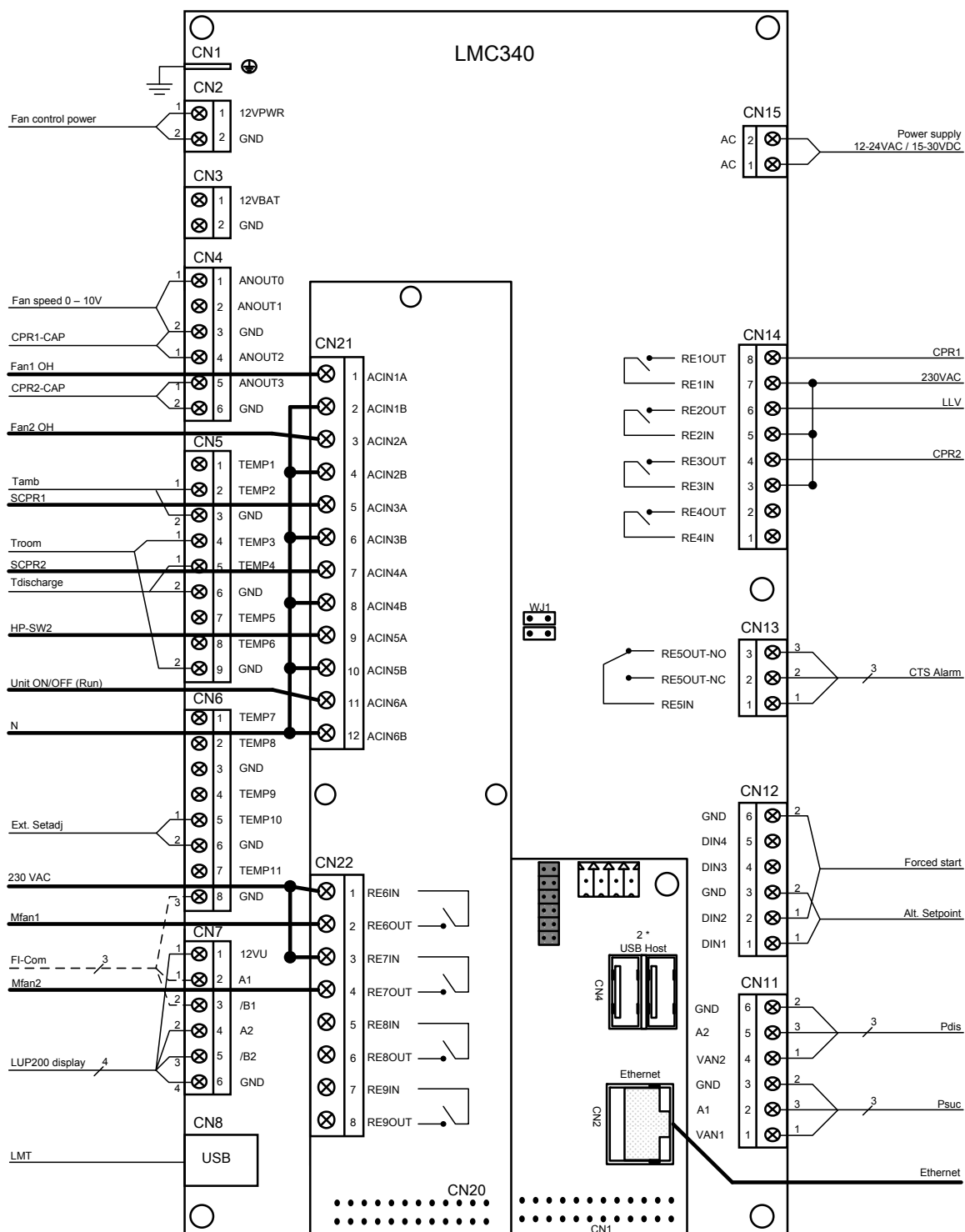


## 10. Connections

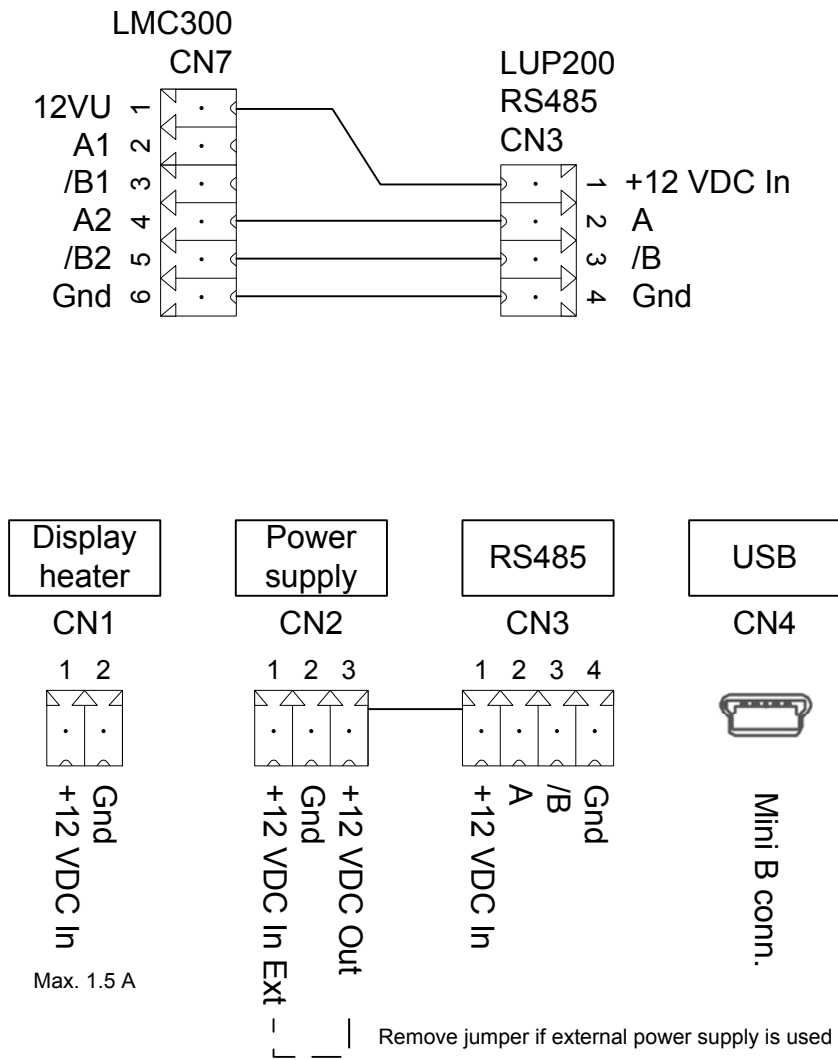
### 10.1. Single compressor configuration



## 10.2. Dual compressor configuration



10.3. LUP200 connections



Note: The display heater must be connected to a separate 12VDC power supply capable of supplying up to 1.5A as the LMC300 can not supply the display heater with power.



## 11. Technical data

Technical specifications, LMC340 Condensing Unit controller with LOM301 I/O board	
Size	175mm (l) * 100mm (w) * 43mm (h)
Power supply	15 - 30VDC/12 - 24VAC 50-60 HZ; typical 4 VA, max. 15 VA
Operating temperature	-20°C ~ +60°C
Storage temperature	-30°C ~ +60°C
Enclosure protection	IP00, pollution degree 2
Relative humidity	5% - 95%RH, non condensing
Temperature inputs	3 for Lodam NTC sensors -40°C to +130°C, +/- 1°C accuracy; 1 is used for 0-10V input. Remaining temperature inputs are not used.
Analog inputs	2, AI1 to AI2; 0-5V with 5 Volt supply for radiometric pressure transmitters; Rin: 25KΩ Use Sensata 2CP-49 for Psuc and Sensata 2CP-49 for Pdis or equivalent
Digital inputs	2; not galvanic isolated - 0-5V with pull-up resistor
Analog outputs	4, AnOut0 to AnOut3; 0-10V, +/- 3%, max 10mA; max frequency 1Hz
Relay outputs	9; RE1 to RE5: 10A 24VDC / 10A 250VAC; max 250VAC isolation between relays. RE5 is a toggle relay; max isolation 400VAC between relays. RE6 to RE9: 10A 24VDC / 10A 250VAC resistive, max 3A inductive load; double isolation to low power side; max. 250VAC isolation between relays
RS485 ports	2 with common 12V 100mA output; 1 used for display and 1 used for FI
USB port (slave mode only)	1; for software update and communication with a PC
Option connectors	2; 24 pins for option boards (1 used for option board LOM301, 1 used for Ethernet board LOM320)
Real time clock	With 1 year battery back up
12VDC output	Up to 1A
High voltage digital input	6; 180-265VAC digital input. Double isolation to low power side

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

Note 2: The two connection jumpers in WJ1 between relays RE4 and RE5 must be mounted.

Technical specification, LUP200i	
Display	262k colors, graphical display 320x240 pixels
Cabinet dimensions	135 mm (h) * 150mm (w) * 25mm (d)
Power supply	12 VDC
CPU	ARM7 processor
Operating temperature	-20°C ~ + 60°C
Storage temperature	-30°C ~ + 60°C
Enclosure protection	Front: IP 66 when mounted accordingly in cabinet <sup>1</sup> Other: IP 00
Relative humidity	5% - 95%RH, non condensing
RS485 ports	1 port
USB port	1 mini B connector (device mode only); for future use
Display backlight lifetime	30,000 hours at 20°C and "normal" brightness
Display heater	12V DC, max. 1.5A; thermo controlled
Number of buttons	6 buttons
Languages	English, German, French, Spanish and Finnish
Cabinet mounting	8 pcs. 4 mm screws Max screw-in depth 6 mm Max tightening torque 3 Nm

Note1: Front is IP 66 if the LUP200 is mounted with the supplied gasket in a metal sheet cabinet of at least 1,5mm thickness and level accuracy better than 0.1 mm over the entire mounting area.

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

Technical specification, LOM320 Lodam Ethernet Module	
Size	92mm (w) * 78mm (h)
Power supply	12 VDC
CPU	ARM9, 32bit, 200MHz
Operating temperatures	-20°C ~ +60°C
Storage temperatures	-30°C ~ +60°C
Enclosure protection	IP 00
Relative humidity	5% - 95%RH, non condensing
Ethernet connection	1; 10/100 Mbit
RS485 ports	1; optional 120 Ω termination jumper
USB host	2 ports with A connector
Flash for data logging	16MB
RAM	64MB
Option connector	24 pins for connection to LMC300

Note1: The LOM320 Lodam Ethernet Module is only available in some configurations. It can not be installed afterwards.

## 12. I/O list for the LMC340 Condensing Unit controller

### 12.1. Single compressor configuration

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

I/O list, LMC340 Condensing Unit controller - Single compressor configuration				
Name	Type	Pin	Logic	Description
Fan 1 OH	DI	ACIN1A	NC	Klixon for fan motor 1 230 VAC $\pm 15\%$ , 50/60Hz; min 5mA
Fan 2 OH	DI	ACIN2A	NC	Klixon for fan motor 2 230 VAC $\pm 15\%$ , 50/60Hz; min 5mA
Cpr. OH	DI	ACIN3A	NO	Compressor overheated. Signal from compressor protection module 230 VAC $\pm 15\%$ , 50/60Hz, min 5mA
Oil level	DI	ACIN4A	NO	Compressor oil level alarm. Signal from compressor protection module 230 VAC $\pm 15\%$ , 50/60Hz, min 5mA
HP-SW2	DI	ACIN5A	NC	High pressure safety switch signal <sup>1</sup> Activated by shortcircuiting to ground. 230 VAC $\pm 15\%$ , 50/60Hz, min 5mA
Unit ON/OFF (Run)	DI	ACIN6A	NO	Run command (On = Run) 230 VAC $\pm 15\%$ , 50/60Hz, min 5mA
Alt. setpoint (Digital input 1)	DI	DIN1	NO	Toggle setpoint (function for digital input 1) Signal activated by short circuiting to ground. 3.3VDC, max 3.3mA, 1k $\Omega$ . <sup>2</sup> Not galvanic isolated.
Forced_start (Digital input 2)	DI	DIN2	NO	Start a forced start (function for digital input 2) Signal activated by short circuiting to ground. 3.3VDC, max 3.3mA, 1k $\Omega$ . <sup>2</sup> Not galvanic isolated.
(Reset Password)	DI	DIN3	NO	Resets passwords when short circuiting to ground for more than 3 seconds. 3.3VDC, max 3.3mA, 1k $\Omega$ . Not galvanic isolated.
Tamb	T	Temp2		Ambient temperature Lodam NTC sensor Measurement range: -40°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• <math>\pm 1^\circ\text{C}</math> in the range -10°C to 60°C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range -40°C to -10 °C</li> <li>• <math>\pm 3^\circ\text{C}</math> 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
Troom	T	Temp3		Room (coldstore) temperature Lodam NTC sensor Measurement range: -60°C to 100°C Accuracy: <ul style="list-style-type: none"> <li>• <math>\pm 1^\circ\text{C}</math> in the range -30°C to 60°C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range -60°C to -30 °C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range +60°C to 100°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>• Signal</li> <li>• Gnd</li> </ul>
Tdis	T	Temp4		Discharge temperature Lodam NTC sensor Measurement range: -40°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• <math>\pm 1^\circ\text{C}</math> in the range -10°C to 60°C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range -40°C to -10 °C</li> <li>• <math>\pm 3^\circ\text{C}</math> 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>
Tsuc	T	Temp8		Suction line temperature Lodam NTC sensor Measurement range: -60°C to 100°C Accuracy: <ul style="list-style-type: none"> <li>• <math>\pm 1^\circ\text{C}</math> in the range -30°C to 60°C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range -60°C to -30 °C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range +60°C to 100°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>• Signal</li> <li>• Gnd</li> </ul>
Ext. Setadj	T	Temp10		External setpoint adjustment. A 10 k $\Omega$ resistor must be mounted from Temp10 to Gnd 0 – 10V 4 – 20 mA (a 150 $\Omega$ resistor must be mounted parallel with the 10 k $\Omega$ resistor) Not galvanic isolated.
Psuc	AI	A1		Suction pressure For use with Sensata 2CP5-49 200 psia (absolute) 0 – 5V
Pdis	AI	A2		Discharge pressure For use with Sensata 2CP5-47 500 psig (rel.) 0 – 5V
FC1-COM	AO	Anout0		Fan speed for condenser fan controller 0 – 10V, 5mA Not galvanic isolated.
FI-Speed	AO	Anout1		Compressor speed – for test purposes 0; 2.5 – 8.7V (Off; 25 – 87Hz) 0 – 10V, 5mA Not galvanic isolated.
N/A	AO	Anout2		N/A

Name	Type	Pin	Logic	Description
N/A	AO	Anout3		N/A
FI-com	S	A1 /B1 GND (RS485)		RS 485 cable for FI communication Half duplex, max. 100m twisted pair cable, grounded shield, shunt capacitance < 50pF/m, 100Ω resistance, AWG24, 2 * 120Ω termination. Receiver impedance >= 12kΩ • GND • A1 • /B1
Display (LUP200)	S	A2 /B2 Gnd 12VU (RS485)		RS 485 cable for display communication (LUP200) Half duplex, max. 100m twisted pair cable, 2 * 120Ω termination. Receiver impedance >= 12kΩ • +12V ±10% (I-limit approx. 100mA) • GND • A2 • /B2
Ethernet	S	Ethernet		10/100 Mbit TIA/EIA 568
Fan control power	P	12PWR GND		Power for fan controller 12V, max 1A.
FI power	DO	RE1OUT	NO	Relay for compressor ON Max 10A@250VAC/10A@30VDC
LLV Liquid line valve	DO	RE2OUT	NO	Relay for solenoid valve in liquid line Max 10A@250VAC/10A@30VDC
CCH Crank case heater	DO	RE3OUT	NO	Relay for crank case heater Max 10A@250VAC/10A@30VDC
Cpr protect	DO	RE4OUT	NO	Relay for power for compressor protection modules Max 10A@250VAC/10@30VDC
CTS Alarm	DO	RE5OUT-NO	NC	Relay for alarm Max 10A@250VAC/10@30VDC
Mfan1	DO	RE6OUT	NO	Relay for fan motor 1 Max 10A@250VAC/5A@30VDC
Mfan2	DO	RE7OUT	NO	Relay for fan motor 2 Max 10A@250VAC/5A@30VDC
Mcpr	DO	RE8OUT	NO	Relay signal that compressor is running (for compressor protection device) Max 10A@250VAC/5A@30VDC
Unloader	DO	RE9OUT	NO	Relay for an unloader Max 10A@250VAC/5A@30VDC
Power supply	P	AC	–	Power supply for the LMC340 12 – 24 VAC / 15 – 30 VDC; 4 – 15 VA

Note 1: Power to the compressor must be cut off by external safety chain when high pressure switch is activated!

Note 2: For the digital input DIN1 and DIN2 a galvanic isolated microcurrent relay must be used with a minimum current of 1 mA as the controller outputs 3,3 V / 3,3 mA on these terminals.

## 12.2. Dual compressor configuration

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

I/O list, LMC340 Condensing Unit controller - Dual compressor configuration				
Name	Type	Pin	Logic	Description
Fan 1 OH	DI	ACIN1A	NC	Klixon for fan motor 1 230 VAC $\pm 15\%$ , 50/60Hz; min 5mA
Fan 2 OH	DI	ACIN2A	NC	Klixon for fan motor 2 230 VAC $\pm 15\%$ , 50/60Hz; min 5mA
SCPR1	DI	ACIN3A	NO	Security chain compressor 1. Signal from compressor protection modules 230 VAC $\pm 15\%$ , 50/60Hz, min 5mA
SCPR2	DI	ACIN4A	NO	Security chain compressor 2. Signal from compressor protection modules 230 VAC $\pm 15\%$ , 50/60Hz, min 5mA
HP-SW2	DI	ACIN5A	NC	High pressure safety switch signal <sup>1</sup> Activated by shortcutting to ground. 230 VAC $\pm 15\%$ , 50/60Hz, min 5mA
Unit ON/OFF (Run)	DI	ACIN6A	NO	Run command (On = Run) 230 VAC $\pm 15\%$ , 50/60Hz, min 5mA
Alt. setpoint (Digital input 1)	DI	DIN1	NO	Toggle setpoint (function for digital input 1) Signal activated by short circuiting to ground. 3.3VDC, max 3.3mA, 1k $\Omega$ . <sup>2</sup> Not galvanic isolated.
Forced_start (Digital input 2)	DI	DIN2	NO	Start a forced start (function for digital input 2) Signal activated by short circuiting to ground. 3.3VDC, max 3.3mA, 1k $\Omega$ . <sup>2</sup> Not galvanic isolated.
(Reset Password)	DI	DIN3	NO	Resets passwords when short circuiting to ground for more than 3 seconds. 3.3VDC, max 3.3mA, 1k $\Omega$ . Not galvanic isolated.
Tamb	T	Temp2		Ambient temperature Lodam NTC sensor Measurement range: -40°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• <math>\pm 1^\circ\text{C}</math> in the range -10°C to 60°C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range -40°C to -10 °C</li> <li>• <math>\pm 3^\circ\text{C}</math> 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>
Troom	T	Temp3		Room (coldstore) temperature Lodam NTC sensor Measurement range: -60°C to 100°C Accuracy: <ul style="list-style-type: none"> <li>• <math>\pm 1^\circ\text{C}</math> in the range -30°C to 60°C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range -60°C to -30 °C</li> <li>• <math>\pm 3^\circ\text{C}</math> in the range +60°C to 100°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
Tdis	T	Temp4		Discharge temperature Lodam NTC sensor Measurement range: -40°C to 130°C Accuracy: <ul style="list-style-type: none"> <li>• ±1°C in the range -10°C to 60°C</li> <li>• ±3°C in the range -40°C to -10 °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>
Tsuc	T	Temp8		Suction line temperature Lodam NTC sensor Measurement range: -60°C to 100°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 100°C</li> </ul> 2 terminals per input <ul style="list-style-type: none"> <li>• Signal</li> <li>• Gnd</li> </ul>
Ext. Setadj	T	Temp10		External setpoint adjustment. A 10 k Ω resistor must be mounted from Temp10 to Gnd 0 – 10V 4 – 20 mA (a 150Ω resistor must be mounted parallel with the 10 kΩ resistor) Not galvanic isolated.
Psuc	AI	A1		Suction pressure For use with Sensata 2CP5-49 200 psia (absolute) 0 – 5V
Pdis	AI	A2		Discharge pressure For use with Sensata 2CP5-47 500 psig (rel.) 0 – 5V
Fan speed 0-10V	AO	Anout0		Fan speed for condenser fan controller 0 – 10V, 10mA Not galvanic isolated.
FI-Speed	AO	Anout1		Compressor capacity – for test purposes 0 – 10V (0 – 100%) 0 – 10V, 5mA Not galvanic isolated.
CPR1-CAP	AO	Anout2		Compressor 1 capacity 0 – 10V, 5mA Not galvanic isolated.
CPR2-CAP	AO	Anout3		Compressor 2 capacity 0 – 10V, 5mA Not galvanic isolated.
FI-com	S	A1 /B1 GND (RS485)		RRS 485 cable for FI communication Half duplex, max. 100m twisted pair cable, grounded shield, shunt capacitance < 50pF/m, 100Ω resistance, AWG24, 2 * 120Ω termination. Receiver impedance >= 12kΩ <ul style="list-style-type: none"> <li>• GND</li> <li>• A1</li> <li>• /B1</li> </ul>

Name	Type	Pin	Logic	Description
Display (LUP200)	S	A2 /B2 Gnd 12VU (RS485)		RS 485 cable for display communication (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>
Ethernet	S	Ethernet		10/100 Mbit TIA/EIA 568
Fan control power	P	12PWR GND		Power for fan controller 12V, max 1A.
CPR1	DO	RE1OUT	NO	Relay for compressor 1 ON/OFF Max 10A@250VAC/10A@30VDC
LLV	DO	RE2OUT	NO	Relay for solenoid valve in liquid line Max 10A@250VAC/10A@30VDC
CPR2	DO	RE3OUT	NO	Relay for compressor 2 ON/OFF Max 10A@250VAC/10A@30VDC
CTS Alarm	DO	RE5OUT-NO	NC	Relay for alarm for external system Max 10A@250VAC/10@30VDC
Mfan1	DO	RE6OUT	NO	Relay for fan motor 1 ON/OFF Max 10A@250VAC/5A@30VDC
Mfan2	DO	RE7OUT	NO	Relay for fan motor 2 ON/OFF Max 10A@250VAC/5A@30VDC
Power supply	P	AC	–	Power supply for the LMC340 12 – 24 VAC / 15 – 30 VDC; 4 – 15 VA

Note 1: Power to the compressor must be cut off by external safety chain when high pressure switch is activated!

Note 2: For the digital input DIN1 and DIN2 a galvanic isolated microcurrent relay must be used with a minimum current of 1 mA as the controller outputs 3.3 V / 3.3 mA on these terminals.

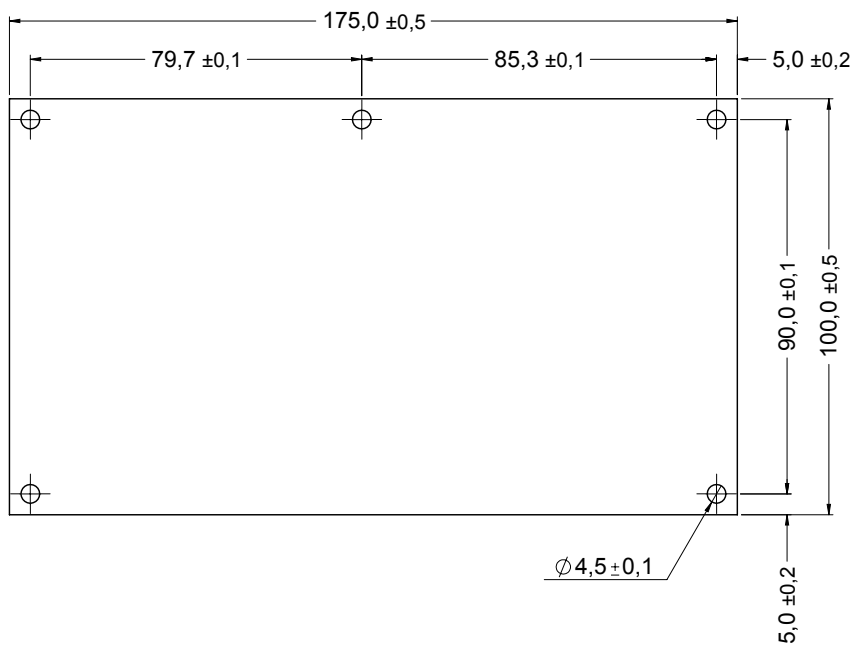


## 13. Drawings

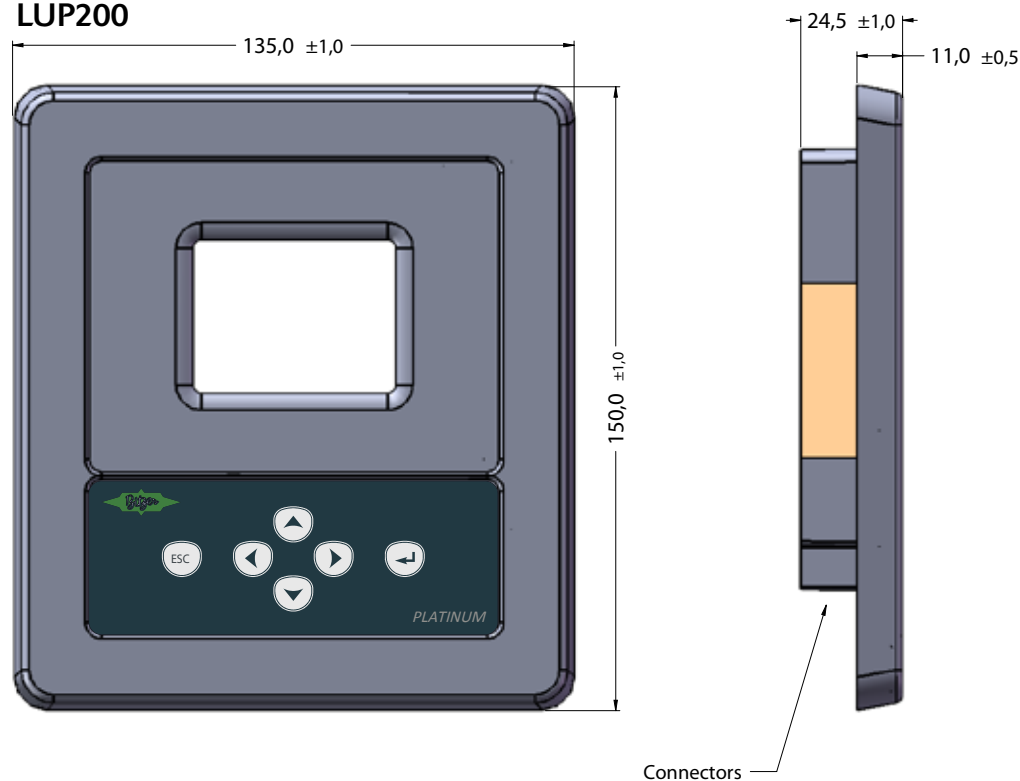
All dimensions in mm.

### 13.1. LMC300

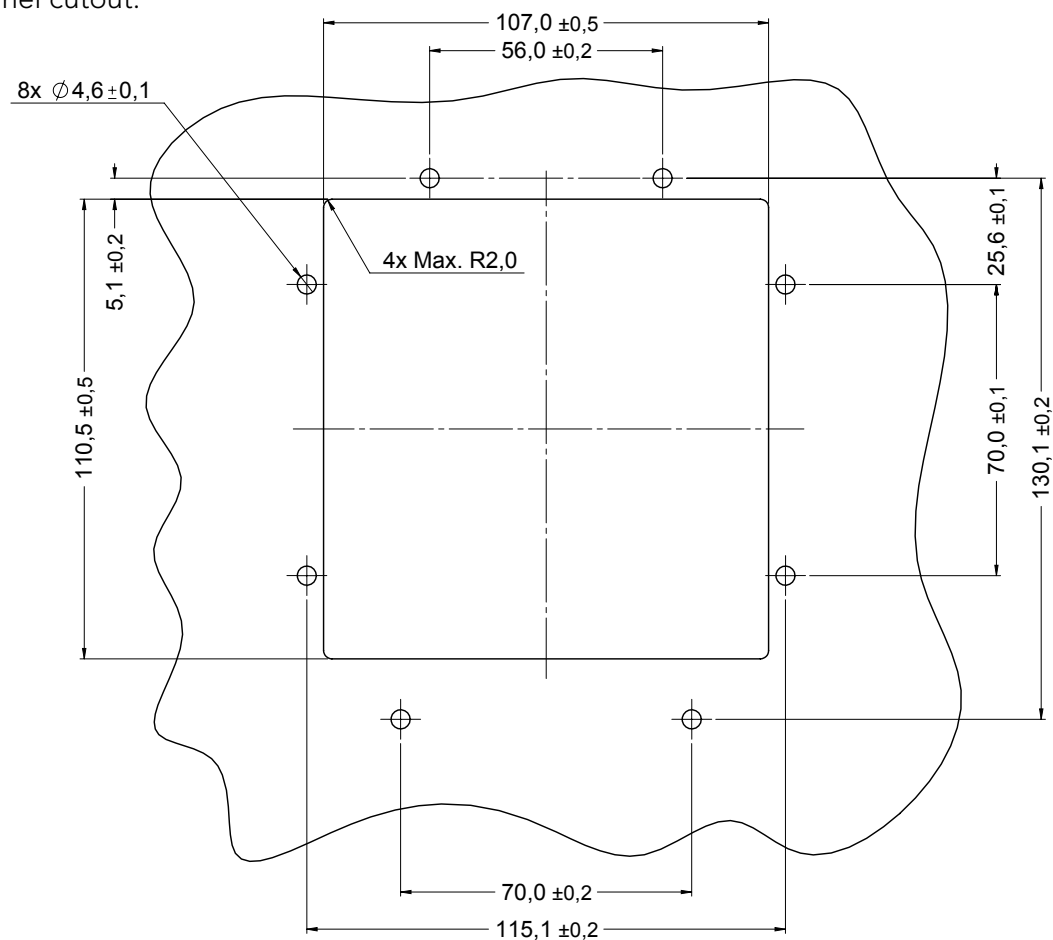
Mounting dimensions.



13.2. LUP200



Panel cutout.



## 14. 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).

## 15. Frequently Asked Questions, FAQ

Q: The condensing unit does not start.

A: There are several possibilities, however the status information gives a good hint to what the problem is. See "Status line" on the Main menu.

1) Is the external signal set to On?

*The signal must be applied.*

2) Is the unit in On mode?

*Set the unit in On mode.*

3) Is there an active alarm that prevents start of the unit?

*Check the alarm list and solve possible alarms.*

4) There has been an alarm and the unit is in restart – wait mode.

After the restart timeout period of 10 min or 15 min the unit will make a restart attempt again – except in case of low oil level alarm.

*Check the alarm list and solve problems if there are any.*

5) There is not enough charge on the system.

*Check the sight glass in the receiver if the refrigerant level is sufficient.*

6) The connection to the FI has been interrupted and a restart attempt will be done. The alarm 500 FI missing will be in-active in this period.

*Check the communication cable to the FI and the FI.*

7) The expansion valve is closed and the To limiter prevents a start.

*Check that the evaporator temperature is ok.*

*Check if the expansion valve is operating properly.*

8) The condensing unit is the coldest place in the system and at low ambient temperatures the refrigerant may stay in

the unit and an opening of the expansion valve does not lead to a change in the suction pressure.

*Check that the winter start function is enabled in suction pressure mode.*

9) The oil level is too low.

*Activate the oil return function. The compressor is running long periods at speeds below power frequency (50 Hz/ 60Hz) and as a result the oil stays in the evaporator due gas speed below the designed criteria.*

*Activate the oil return function.*

10) A control sensor has a malfunction.

*Check that the control sensor is valid. Suction pressure transmitter in suction pressure control mode and coldstore temperature sensor in room temperature control mode.*

11) Only one compressor in dual compressor mode is used.

*The load is too low to start the other compressor and the load levelling has not yet reached the level of switching over to use the other compressor.*

*Check also possible alarms for the compressor as there are no restart attempts due to the missing distinction between low oil level and compressor overheat.*

## 16. Alarm system and trouble shooting

The LMC340 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.

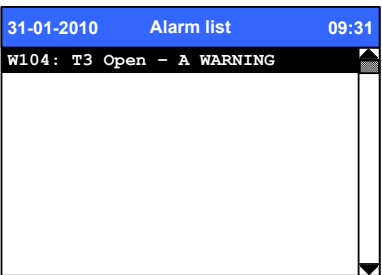
If the first letter is in uppercase, Axxx, Cxxx or Wxxx the alarm or warning is still standing and can't be acknowledged until the problem is solved.

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



## 16.1. Alarm list and trouble shooting

Failure code	Cause	Troubleshooting
Requesting data	Communication between display and controller faulty or interrupted.	Check cable and connector LMC340:CN7/1/4/5/6 <-> LUP200. Controller LED must be blinking
Temperature and pressure sensors		
W100/ W101	Circuit of discharge gas temperature sensor open or short circuit	Check cables and connector LMC340:CN5:1/6. Check resistance of sensor according to table: NTC temperature/resistance table
W102/ W103	Circuit of ambient temperature sensor open or short circuit	Check cables and connector LMC340:CN5:2/3. Check resistance of sensor according to table: NTC temperature/resistance table
W104/ W105	Circuit of cold store temperature sensor open or short circuit	Check cables and connector LMC340:CN5:4/9. Check resistance of sensor according to table: NTC temperature/resistance table
W112/ W113	Circuit of suction line temperature sensor open or short circuit	Check cables and connector. Check resistance of sensor according to table: NTC temperature/resistance table.
W106/ W107	Circuit of discharge gas temperature sensor open or short circuit	Check cables and connector LMC340:CN5:1/6. Check resistance of sensor according to table: NTC temperature/resistance table
C122/ C123	Circuit of low pressure transmitter open or short circuit	Check cables and connector LMC340:CN11:1/2/3. Replace low pressure transmitter
W124/ W125	Circuit of high pressure transmitter open or short circuit	Check cables and connector LMC340:CN11:4/5/6. Replace high pressure transmitter
Frequency inverter (FI)		
C500	No BUS communication to FI	Check data cable and connector LMC340:CN6:/8 and LMC340:CN7:2/3. Check power supply of FI. Replace data cable or FI if necessary.
C508	Short circuit in power cable from FI to compressor	Check cable between FI and compressor
C509	Internal failure of the FI	Disconnect power for 10 min. Restart. Replace FI if necessary.
C510	Earth fault in electric cable from FI to compressor or in compressor itself.	Check insulation of the FI -> compressor and resistance of compressor motor.
C511	Overcurrent at FI	Operation beyond compressor application limits or compressor damaged. Disconnect supply voltage of FI for 10 min. Then restart. Check operating conditions, replace compressor if necessary.
C512	Compressor motor too hot	Check motor cooling, discharge gas temperature sensor and oil level.
C513	FI overloaded / too hot	Check cooling of FI. Disconnect supply voltage of FI for 10 min. Restart. Replace FI or compressor if necessary.
C514	FI has unpermitted under-voltage	Supply voltage too low.
C515	FI has unpermitted over-voltage	Supply voltage too high.
A516	Phase failure at FI	Check supply voltage and all 3 phases at FI input.

Failure code	Cause	Troubleshooting
C517	FI overloaded	Interrupt supply voltage to FI. Wait 5 min. Check cooling of FI. Restart. Replace FI or compressor if necessary.
C518	Switching frequency of FI too high	Check supply voltage and data cable to FI.
W574	FI overloaded	Interrupt supply voltage to FI. Wait 5 min. Check power out connector of FI and cooling of FI. Restart. Replace FI or compressor if necessary.
W579	Voltage of the intermediate circuit of the FI too low or operation outside of the application limits of the compressor.	Check supply voltage on input of FI and make sure that operation is within the application limits of the compressor.
W591	Phase failures at FI	Check supply voltage and all three phases at FI input.
W595/ W597	FI overloaded / too hot	Interrupt supply voltage to FI. Wait 5 min. Check cooling of FI. Restart. Replace FI or compressor if necessary.
A519 / A556 W572 / W583 W588 / W590 W596	Internal failure of the FI	Disconnect power for 10 min. Restart. Replace FI if necessary.
C599	Number of faults has exceeded critical threshold	Check previous alarm messages, eliminate causes and delete messages. Disconnect power for 10 min. Restart. Replace FI if necessary.
<b>Operation</b>		
C600	High pressure limiter switch has cut out	Condenser fans blocked? Check condenser. Is operating point within application limits?
C601	Compressor overheat protection device has cut out or relay module LOM301 is defect.	Check signal voltage (230VAC).
C602	Oil level too low.	Check oil level. Check and protect oil return. Check oil level detector circuit.
W603/ W604/ W605	Motor of fan 1 or fan 2 or both overheated.	Fan blocked? Check cables and fan thermostat. Replace fan if necessary.
W606	External setpoint adjustment beyond allowed limits.	Check cables and signal level and power supply. Check potential levels.
C607	A sensor, transmitter or a cable belonging to it is damaged.	Search alarm messages for failure and eliminate cause. Switch of main switch and restart after 2 minutes.
C608	Tdis limiter activated repeatedly	Check if the fans are operating ok.
C609	Tc, condenser temperature limiter activated repeatedly	Check if the condenser is blocked/dirty.
C610	FI current limiter activated repeatedly	Interrupt supply voltage to FI. Wait 10 min. Restart. Replace FI or compressor if necessary.



Failure code	Cause	Troubleshooting
C611	To, suction temperature activated repeatedly	The capacity of the compressor is too high or to small expansion valve.
C620	Pressure switch active	The capacity of the compressor is too high or the expansion valve is too small. Unit restarts when signal is valid again.
C621	Compressor 1 failure (Dual compressor mode)	Check temperature and oil level. Safety chain for compressor 1 is faulty.
C622	Compressor 2 failure (Dual compressor mode)	Check temperature and oil level. Safety chain for compressor 2 is faulty.
C623	HP faults	Too many successive high pressure faults. Unit stops.
W624	Liquid in suction line	Check injection regulators on the evaporator. Check defrost intervals.
C625	Liquid in suction line	Check injection regulators on the evaporator. Check defrost intervals
W626	Liquid in discharge line	Check injection regulators on the evaporator. Check defrost intervals.
C627	Liquid in discharge line	Check injection regulators on the evaporator. Check defrost intervals.
Controller		
W905	Failure in the data base of the controller	Update LMC340 controller software. Replace LMC340 controller if necessary.
W907	Failure of the LM340 controllers real time clock	Replace the LMC340 controller.
W908	Voltage of battery of real time clock too low. Controller been switched of too long.	Set date and time of controller in menu system. Replace LMC340 controller if necessary.
W999	The unit is in manual mode	Change mode from <b>Manual</b> to <b>On</b> in <b>User.Mode</b>

## 17. Emergency operation

### 17.1. Frequency inverter

The LMC340 controller can control the compressor by controlling a frequency inverter or directly using a contactor in On/Off operation. Best efficiency and regulation is with the frequency inverter.

In operation without frequency inverter, either due to installation or due to breakdown of the frequency inverter two things must be observed:



Power connection to the compressor motor is different from with to without frequency inverter!

Consult the manual for the compressor for correct connection as the motor may else be permanently damaged due to overvoltage!

A setting in the LMC340 controller must be changed to enable On/Off operation.

In **Installer.Service.Inverter used** the default **Yes** must be changed to **No**.

### 17.2. Fan controller

In case of fan controller malfunction or operation without a 0 – 100% fan speed controller, the LMC340 can use PWM operation of the fan motors instead. The most stable condenser temperature will be with a stepless fan speed controller.

From 0 to 50% fan speed only Fan1 relay output will be used in On/Off operation to achieve an average fan speed. Above 50 % fan speed Fan1 relay is always On and only Fan2 relay will be used for On/Off operation.

In **Installer.Service.Fan controller used** the default **Yes** must be changed to **No** for activating PWM operation of the fan motors.

## 18. Expansion options

Lodams Compressor protection modules SE-B1 and SE-B2 can be used for protection the compressor against overheating.

## 19. Networking

Communication from the Internet or intranet is possible through the Ethernet connection on the LOM320 Ethernet board.

Please see the User manual for the LOM320 Ethernet Module – Webserver.

## 20. Firmware update

Firmware update is done from Lodams Multi Tool, LMT.

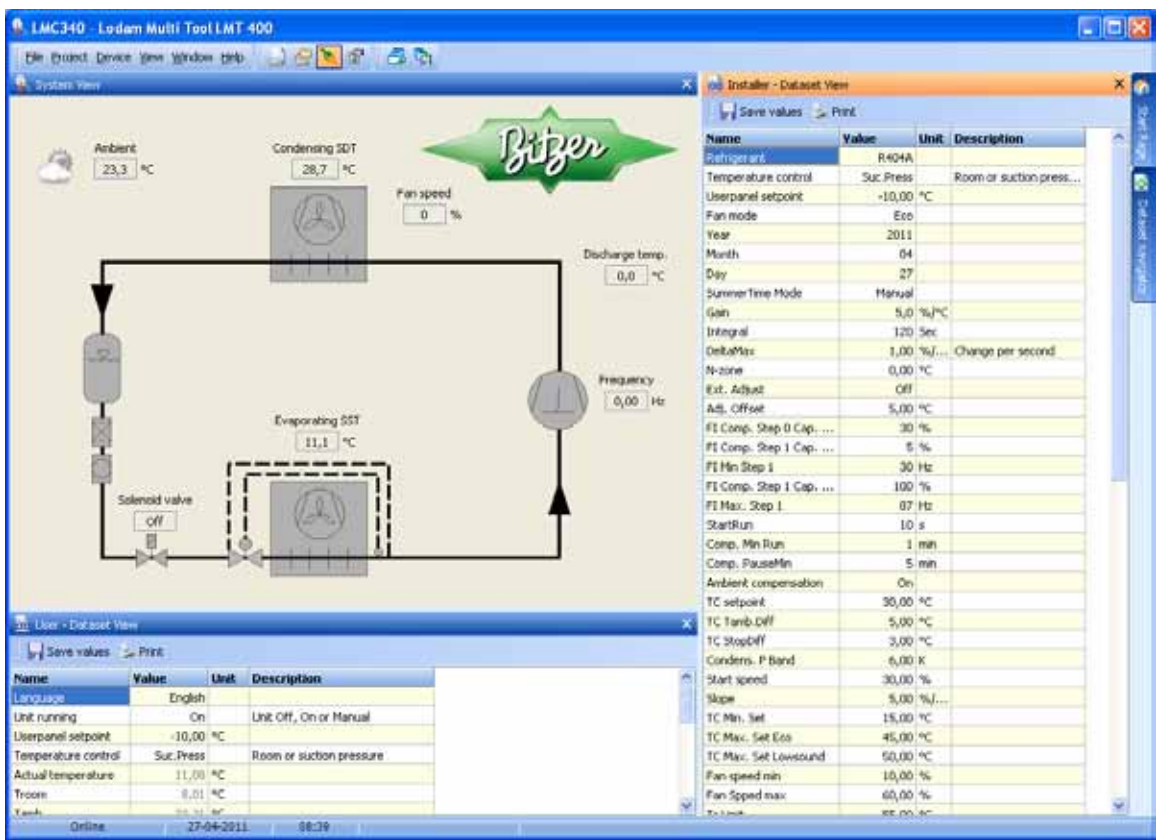
This will update the software in the LMC340 controller and the LUP200 display if necessary.

If the firmware in the Ethernet board, LOM320 should be updated, this can be done using a USB memory stick in one of its 2 USB type A connectors or via a firmware update on its webpage.

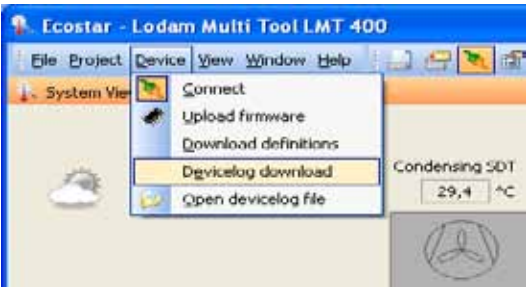
## 21. Downloading the datalog from the controller

For service purposes the LMC340 is equipped with a datalog where data is stored in non-volatile memory.  
The datalog is extracted with LMT – Lodams Multi Tool. The tool connects to the controller and retrieves the datalog from the controller.

Main menu from LMT:

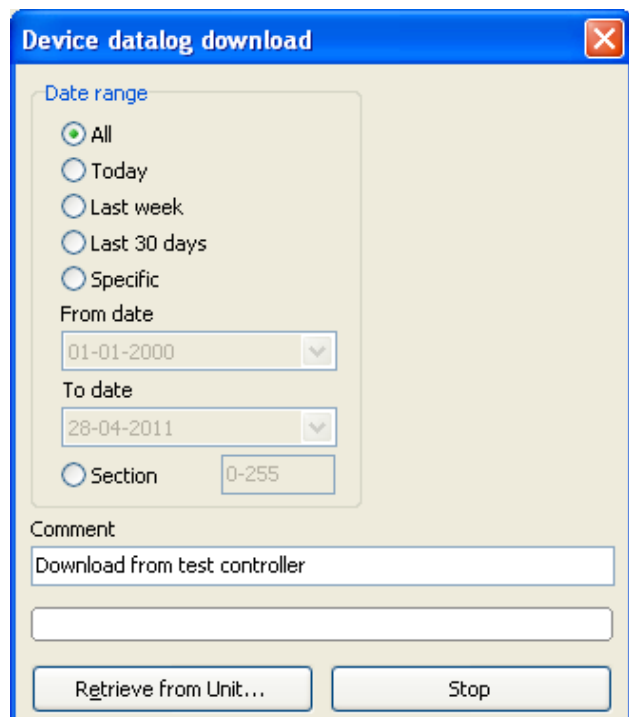


Select the DeviceLog download in the Device menu:

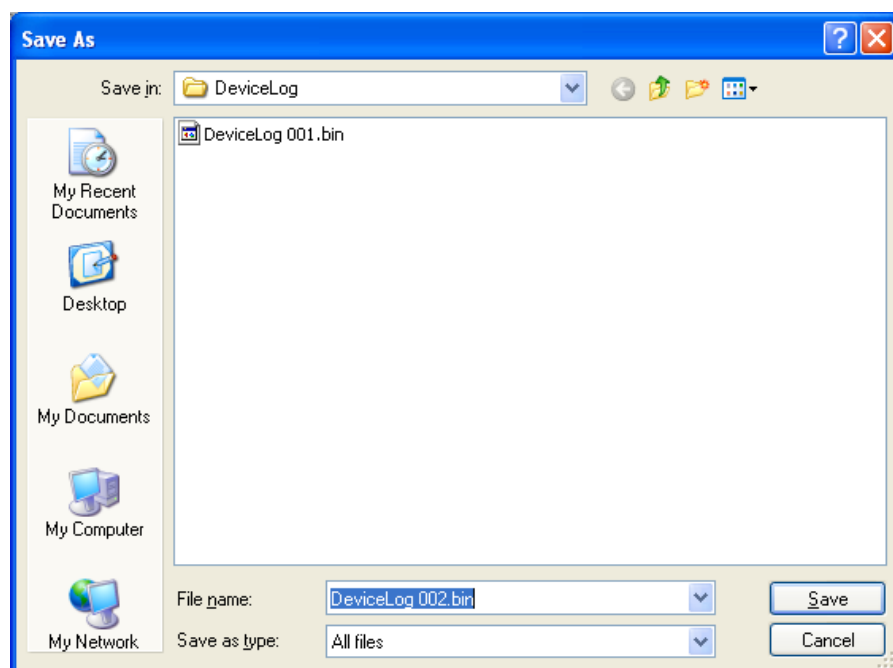


On the following menu the time range can be selected and a comment for the datalog can be added.

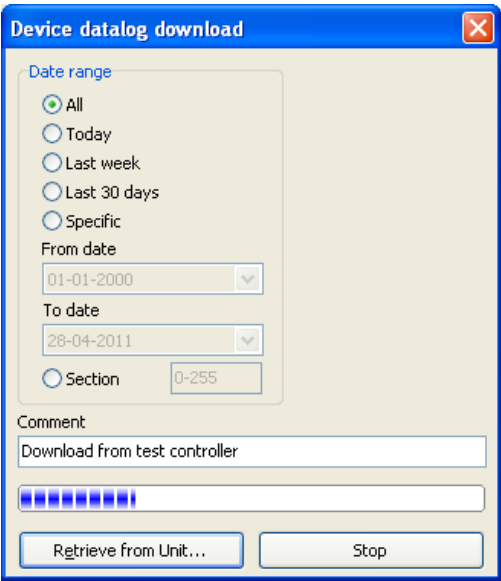
Click Retrieve from Unit... to start the download.



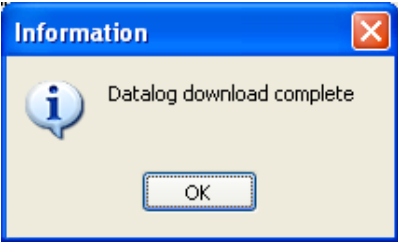
On this menu a filename for the downloaded datalog can be entered. The datalog can be loaded later again or used for troubleshooting purposes.



After clicking the Save button, the download starts.



And finishes with:



The datalog is then shown as a table with all the stored data, events and alarms.

DeviceLog 002 - Dataset log

GraphDataEventsAlarmsPrintHeader info

Time	FI Frequency [Hz]	Fan Speed [%]	Input IFC [I]	TO [°C]	TC [°C]	Tdis [°C]	Troom [°C]	Safe are
02-08-2010 13:46:35	998 Test version - Test version - Active count: 1 - Alarm count: 0							
03-08-2010 07:44:52	998 Test version - Test version - Active count: 1 - Alarm count: 0							
03-08-2010 07:46:53	33,60	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 07:48:54	56,00	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 07:50:55	78,30	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 07:52:56	87,00	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 07:54:57	87,00	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 07:56:58	87,00	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 07:58:59	87,00	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 08:01:00	87,00	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 08:03:01	87,00	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 08:05:02	87,00	0,00	0,00	26...	34...	0,00	8,00	
03-08-2010 08:07:03	87,00	0,00	0,00	26...	34...	0,00	8,00	

Please note: The sample data are from a test controller and not a real unit.  
Selecting the Graph view will show something similar to this



## 22. NTC temperature/resistance table

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

Temp. [ $^{\circ}\text{C}$ ]	Temp. [Ohm]	Temp.+ 2K [Ohm]	Temp.+ 4K [Ohm]	Temp.+ 6K [Ohm]	Temp.+ 8K [Ohm]
$^{\circ}\text{C}$	+ 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



## 23. NTC temperature/voltage table

For Tamb and Tsuc temperature sensors

Temp. °C	Temp. [V]	Temp. + 2K [V]	Temp. + 4K [V]	Temp. + 6K [V]	Temp. + 8K [V]
-50	3,149	3,126	3,102	3,074	3,044
-40	3,010	2,973	2,932	2,887	2,839
-30	2,786	2,730	2,670	2,606	2,539
-20	2,468	2,393	2,316	2,236	2,154
-10	2,071	1,986	1,900	1,814	1,728
0	1,643	1,559	1,477	1,397	1,318
10	1,242	1,169	1,099	1,032	0,967
20	0,906	0,848	0,794	0,742	0,693
30	0,647	0,605	0,564	0,527	0,491
40	0,459	0,428	0,399	0,373	0,348
50	0,325	0,303	0,283	0,265	0,248
60	0,232	0,217	0,203	0,190	0,178
70	0,167	0,156	0,147	0,138	0,129
80	0,121	0,114	0,107	0,101	0,095
90	0,090	0,084	0,080	0,075	0,071
100	0,067	0,063	0,060	0,057	0,053
110	0,051	0,048	0,045	0,043	0,041
120	0,039	0,037	0,035	0,033	0,031

For Tdis temperature sensor

Temp. °C	Temp. [V]	Temp. + 2K [V]	Temp. + 4K [V]	Temp. + 6K [V]	Temp. + 8K [V]
-50	3,284	3,282	3,279	3,276	3,272
-40	3,268	3,264	3,259	3,253	3,247
-30	3,240	3,233	3,224	3,214	3,204
-20	3,192	3,180	3,166	3,150	3,133
-10	3,115	3,095	3,074	3,050	3,025
0	2,998	2,969	2,937	2,904	2,869
10	2,831	2,791	2,749	2,705	2,659
20	2,611	2,560	2,508	2,454	2,398
30	2,341	2,282	2,223	2,162	2,100
40	2,037	1,975	1,912	1,848	1,785
50	1,723	1,660	1,599	1,538	1,478
60	1,420	1,362	1,306	1,251	1,198
70	1,146	1,096	1,048	1,001	0,956
80	0,912	0,871	0,831	0,792	0,755
90	0,720	0,686	0,654	0,623	0,594
100	0,566	0,539	0,502	0,490	0,467
110	0,445	0,424	0,404	0,385	0,367
120	0,350	0,334	0,319	0,299	0,282

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