Lodam
BY BITZER GROUP

Lodam Condensing Unit Controller

Technical manual

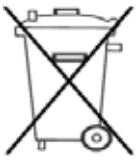
Version 6.0

LMC340i

Contents

1. Read this fist

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.



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.

1.1.1. 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.) and handling the PCB's correctly according to protection against ESD.

Installation of the LMC340i must be performed by authorized personnel only. All warranties are excluded in case installation is performed by unauthorized personnel or in case the LMC340i has not been correctly installed. Electrical plant failures are to be immediately solved, even though no immediate danger exists; the LMC340i must not be operating.

1.3. Safety

The LMC340i is not a safety component and cannot be used in “medical” or “life support” equipment.

The LMC340i 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 LMC340i, 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, LMC340i 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 LMC340i Condensing unit controller:

- Single compressor controlled by frequency inverter, equipped with unloader, or in On/Off operation
- Dual compressor equipped with unloaders, one FI and one On/Off, two FI
- 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
- Liquid compressor operation detection
- Web server
- Modbus interface to external master controller
- Supports many languages

This user manual applies to software version 2.1.6.x or later of LMC340i.

3. Definitions

BMS	Building Management System
ESD	Electro Static Discharge
FI	Frequency inverter
HW	Hardware/electronics
I/O	Input/output (electrical signals)
Limiter	Short form 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
T0	Saturated suction temperature calculated from the suction pressure
Tdis	Discharge pipe temperature
Tsuc	Suction pipe temperature

A Condensing unit kit from Lodam includes:

- 1 Lodam condensing unit controller (LMC340i) with Option board for extra I/O (LOM301) and Lodam Ethernet Module (LOM320)

- 1 Lodam full graphical colour display with keyboard (LUP200i)

- 1 Connector kit for LMC340i

- 3 NTC temperatures sensors

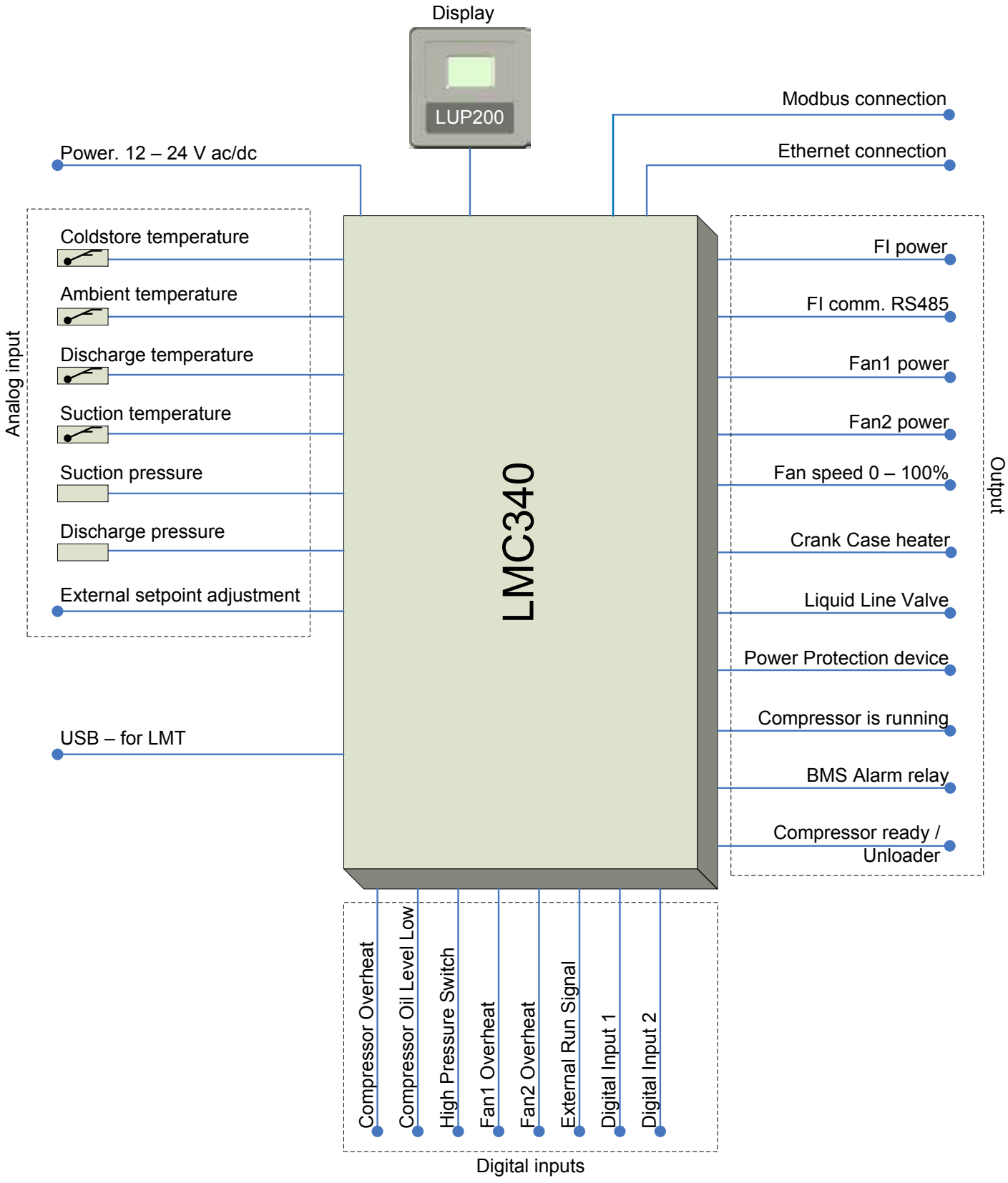
- 1 High temperature NTC temperatures sensors

- 2 Pressure sensors with cables

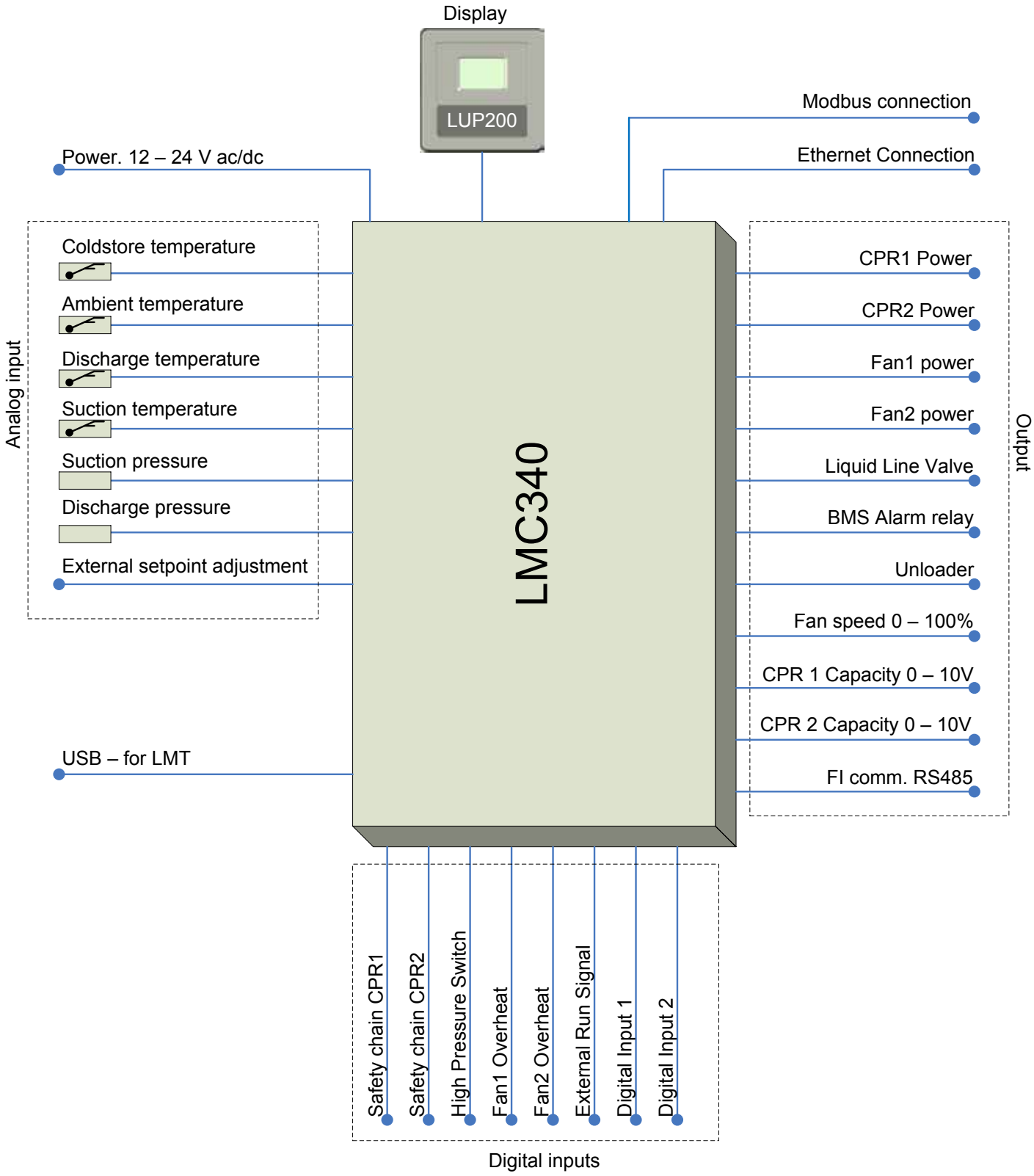
- 1 Access license to Lodam Multi Tool

3.1. Overview of the LMC340i Condensing unit controller

3.1.1. Single compressor configuration

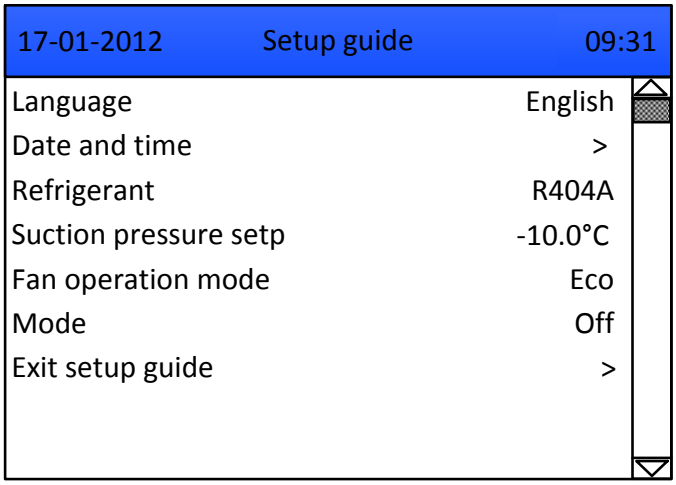


3.1.2. Dual compressor configuration



4. Quick guide

When the unit is powered up first time after piping and power are connected a setup guide is presented to the user with a short list of the most important settings to define for the unit.



The default settings are listed on the menu above. Apply changes to the default settings and set the **Mode** to **On** and the unit is running. The settings are also available in the **Installer. Basic setting** menu after finishing the setup guide.

- Select the used **Refrigerant**, default is **R404A.** The refrigerant is used for converting pressure to temperature for the saturated gas
- Adjust the needed setpoint, **Suction pressure setp** as needed. Default is -10°C

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 analogue input or by the use of the week program.

The setpoint can also be controlled by a Room temperature sensor in i.e. a cold store.

In the **Installer.Basic setting->Control mode** menu the temperature control mode can be **Suc. Pressure** or **Room temp.**

- The Fan operation mode is default **Eco.** It can be set to **LowSound** if the unit is placed in dense populated areas to reduce the sound pressure from the fans. This will impact a little on the energy efficiency. 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
- Set the Mode to **On** to start the unit. If the external release signal is used, the unit will start when this signal is applied to CN21:11 On/Off ACIN6A High voltage digital input

5. 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 periods with low load. 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.

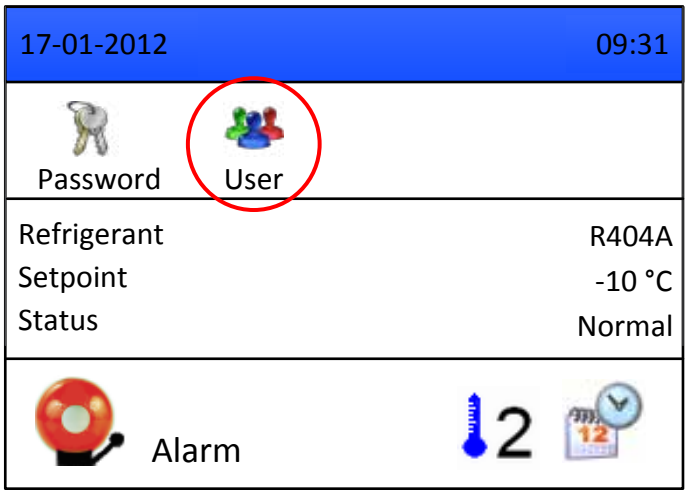
Please see also the section Heat recovery for reusing heat generated by the compressor.

6. How to...

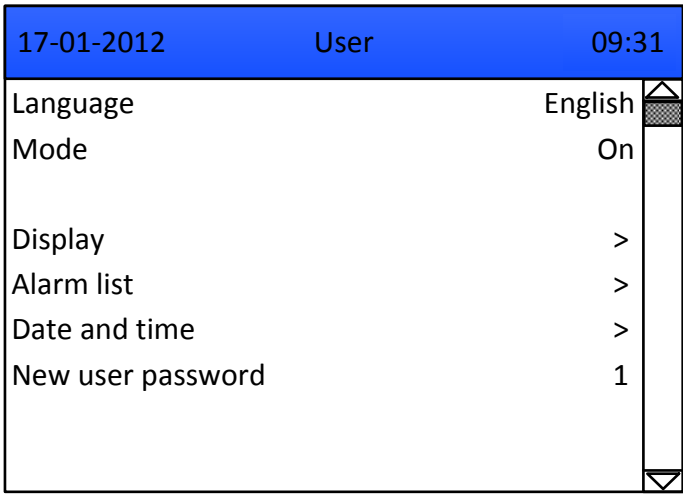
This section shows how to change settings which are commonly used.

6.1. Change language

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



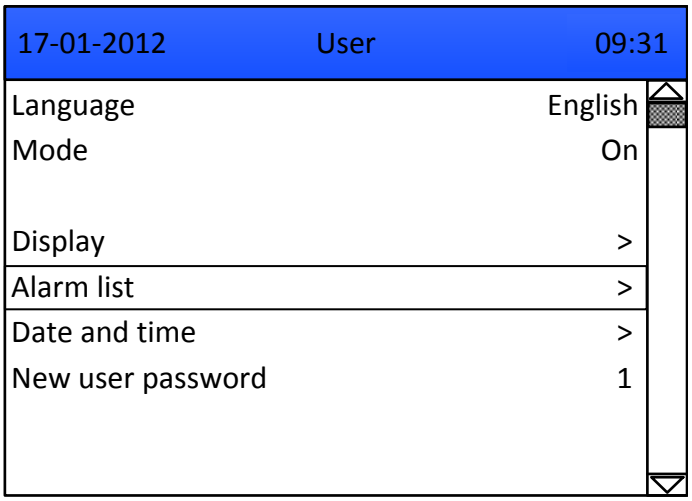
Open the user menu:



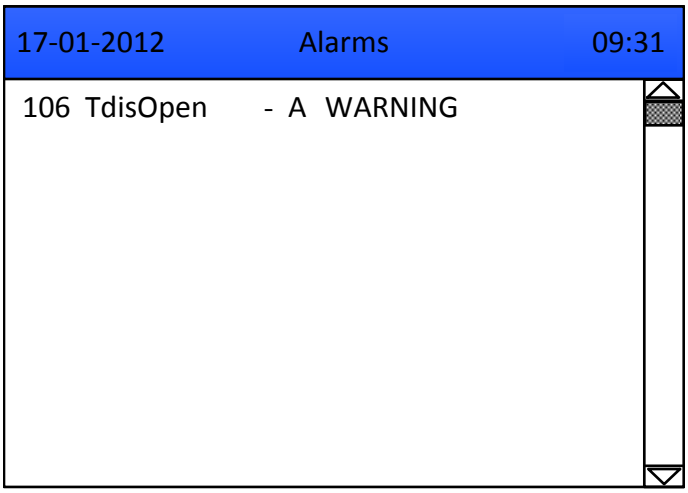
Press Enter to edit the language field and switch between English and the other languages, **German, French, Finnish, Spanish, Russian** and **Turkish** with the arrow keys. Acknowledge your choice with Enter.

6.2. List alarms

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



Scroll to the Alarm list line and press Enter.



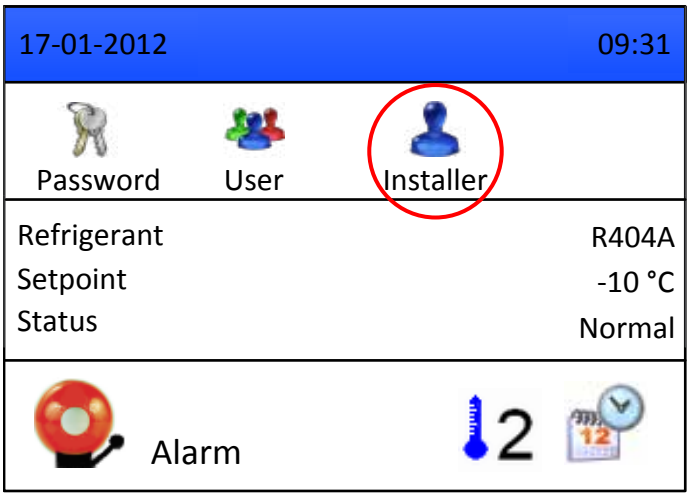
Here a sample alarm is listed. The menu can show up to 16 alarms.

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.

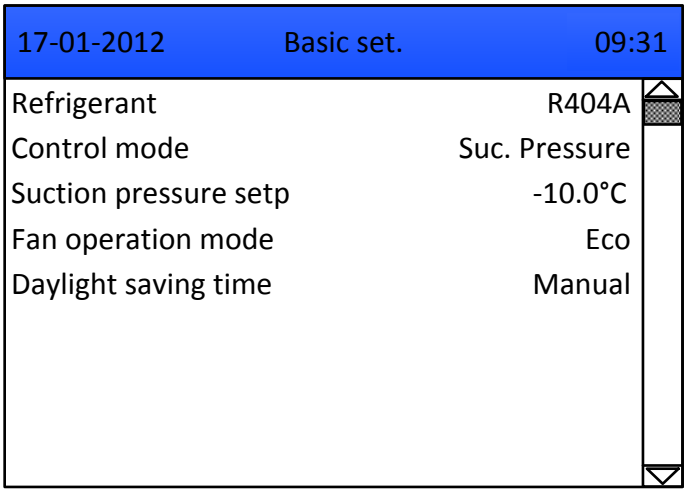
See the Alarm section for explanation of the possible alarms, causes and how to solve the cause of an alarm

6.3. Change refrigerant

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



Select the Basic settings menu to get the menu below:



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.

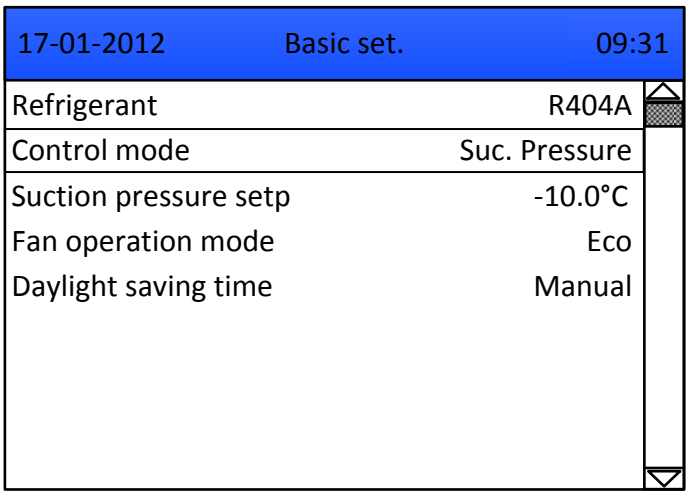
Refrigerants **R22, R134a, R404A** (default), **R407C** and **R507A.**

R407A, R407F and **R410A** are only allowed for certain units. This is defined at factory level and they are only visible if enabled to use.

6.4. 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:

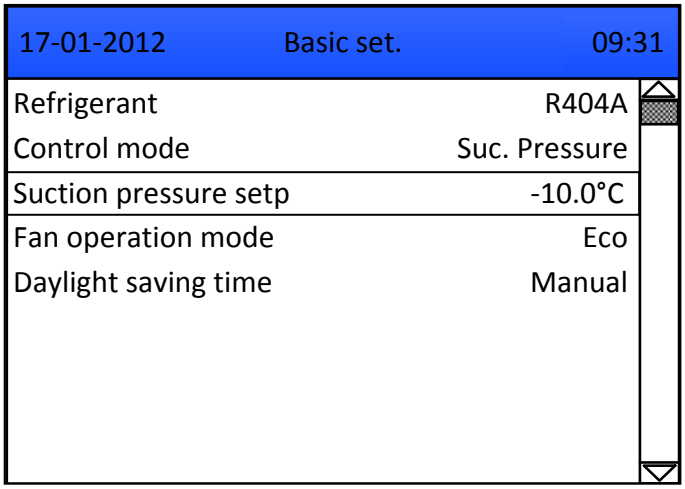


Select the line with (temperature) **Control mode** with the arrow keys if it is not highlighted. Press Enter key to select either Suction pressure, **Suc Pressure** or Room temperature, **Room temp** and confirm your choice with another press on Enter.

6.5. 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:



If temperature **Control mode** is room temperature, line 3 says **Temp. setp.-cold store.**

In suction pressure **Control mode** it is **Suction Pressure setp.**

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 after the change with the arrow keys.

6.6. Change fan mode

To toggle the fan operation mode, enter the installer password and go to the **Installer** menu section. Select the **Basic settings** menu to get the menu below:

17-01-2012	Basic set.	09:31
Refrigerant		R404A
Control mode		Suc. Pressure
Suction pressure setp		-10.0°C
Fan operation mode		Eco
Daylight saving time		Manual

Select the line with **Fan operation 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.

6.7. 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.

17-01-2012	Installer	09:31
Basic settings		>
Settings		>
Service		>
New installer password		2

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

17-01-2012	Service	09:31
Project		Standard
Model Code		Inv. F3
Controller LMC300 V.		2.1.4.3
Display LUP200 V.		1.1.4.4
Eth-Board LOM320 V.		1.2.0.4
IP Address		192.168.001.180
Netmask		255.255.255.000
Gateway		192.168.001.001
MAC address		00:1F:79:00:02:B0
No-FI emergency mode		Yes
Fan controller used		Yes
Psuc fail FI Speed		Off Hz
Suction gas temp sensor		Yes
Factory reset		No
Setup guide		No
Manual settings		>
Digital I/O Display		>

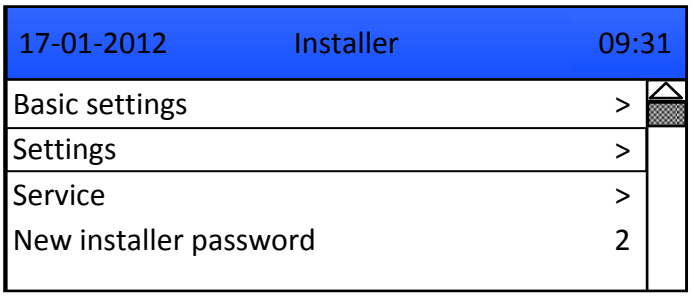
Change **No** to **Yes** with the arrow keys and press Enter. After a short time the text Yes will change back to **No** to indicate the controller **has changed** all settings back to factory settings.

The **Setup guide** menu will show next to be sure that the main settings are verified.

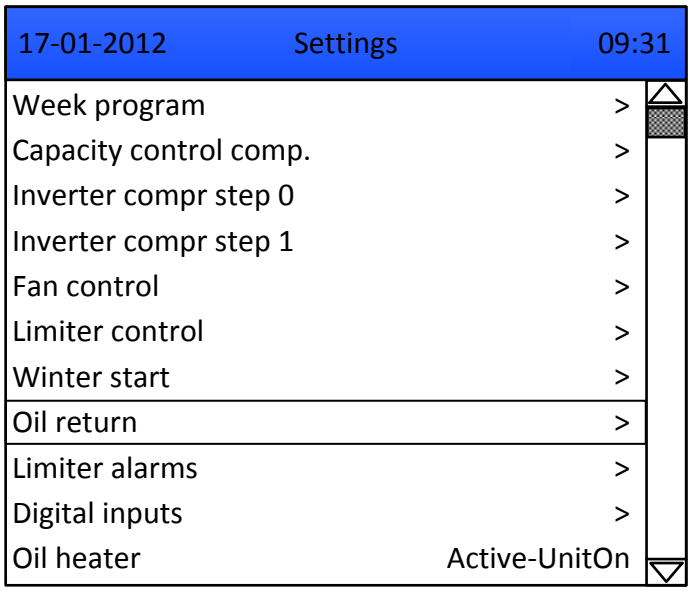
6.8. Activate Oil return function

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.

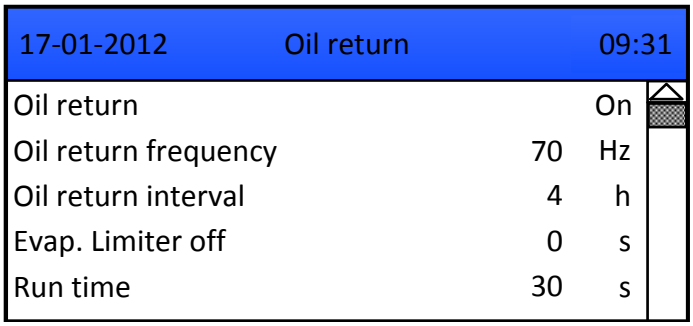
Enter the installer password and open the **Installer** menu:



Scroll to Settings and switch menu with Enter.



Scroll to **Settings** and switch menu with Enter.



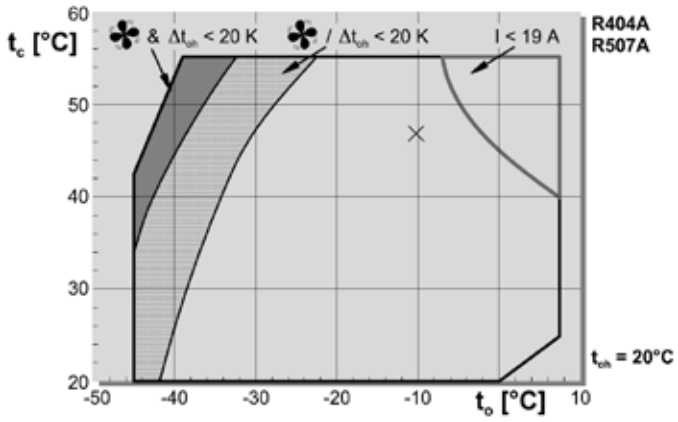
Select **Oil return** line and press Enter.

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

7. Functions

7.1. 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 compressor 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 to **Off, Auto** or **Day**. Default is **Off.**

Auto means the oil return function runs automatically. **Day** means the Oil return function is disabled between 22:00 (10 PM) and 6:00 (6 AM).

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 where compressor overheating, low oil level detection etc. can be added. Distinction between an overheated compressor and a low oil level alarm is not possible and due to this a manual reset must be performed by powering off the unit.

7.2. Liquid-carry-over detection

Longer periods of liquid slugging will harm the compressor due to removal of lubrication and thus reducing the lifetime of the compressor.

By measuring the difference between the saturated temperature and the actual temperature in a refrigerant pipe it is possible to estimate if the pipe carries gas only or a mix of liquid and gas. When the saturated temperature and the actual temperature are equal the pipe contains liquid.

Liquid-carry-over can be detected on the discharge line; if a suction temperature sensor is mounted liquid-carry-over can also be detected in the suction line.

Two types of events can be detected; a single long event where the overheat is below the limit for a long time liquid-carry-over and multiple short events where the overheat drops below the limit shortly, but multiple times.

The detection of liquid carry over does not stop the condensing unit but the following alarms are signalled:

Alarm code	Text	Description
W624	Suc. Liq.	Warning for liquid in the suction line. Active when a short event is detected and until the overheat is above the limit again.
C625	Suc. Liq.	Critical alarm for liquid in the suction line. Active when a long event is detected and until the overheat is above the limit again.
W626	Dis. Liq.	Warning for liquid in the discharge line. Active when a short event is detected and until the overheat is above the limit again.
C627	Dis. Liq.	Critical alarm for liquid in the discharge line. Active when a long event is detected and until the overheat is above the limit again.
C628	M. Dis. Liq.	Critical alarm for multiple short liquid-carry-over events in the discharge line. Active when the event counter for the discharge line exceeds the limit and until the event counter is reset at midnight.
C629	M. Suc. Liq.	Critical alarm for multiple short liquid-carry-over events in the suction line. Active when the event counter for the suction line exceeds the limit and until the event counter is reset at midnight

7.3. Sound reduction

In dense populated areas and other areas sound from installations can 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.

7.4. 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:

Model Code	Description
One CPR ON/OFF	One compressor ON/OFF controlled.
One CPR Unl.	One compressor ON/OFF controlled. Compressor equipped with ON/OFF controlled unloader.
One CPR 0-10V	One compressor with frequency inverter. Frequency inverter controlled by a 0 – 10V signal
Inv. F1	One BITZER VARISPEED type F1 compressor. Control of frequency inverter using serial bus.
Inv. F1 R134a only	One BITZER VARISPEED type F1 compressor. Control of frequency inverter using serial bus. Configured for R134a only.
Inv. F3	One BITZER VARISPEED type F3 compressor. Control of frequency inverter using serial bus.
Dual CPR Unl.	Dual compressors ON/OFF controlled. Both compressors equipped with ON/OFF controlled unloaders.
Dual CPR 0-10V	Dual Compressors ON/OFF controlled. Both compressors with unloaders. Unloaders controlled stepless 25% – 100% by a 0 – 10V signal.
Inv. F4 30A	One BITZER VARISPEED compressor type F4 30A. Control of frequency inverter using serial bus.
Inv. F4 50A	One BITZER VARISPEED compressor type F4 50A. Control of frequency inverter using serial bus..
Dual F1 / OnOff	One VARISPEED type F1 and one equal sized On/Off compressor. FI is controlled and monitored via RS485 bus communication.
Dual F3 / OnOff	One VARISPEED type F3 and one equal sized On/Off compressor. FI is controlled and monitored via RS485 bus communication.
Dual F4_30 / OnOff	One VARISPEED type F4 30A and one equal sized On/Off compressor. FI is controlled and monitored via RS485 bus communication.
Dual F4_50 / OnOff	One VARISPEED type F4 50A and one equal sized On/Off compressor. FI is controlled and monitored via RS485 bus communication.
Dual Ext / OnOff	One compressor with external FI and equal sized On/Off compressor. FI is controlled via 0 – 10 V analogue speed signal, no FI monitoring.

- "Inv." – With frequency inverter, Danfoss FCM series or Leroy Somer using serial bus. E.g. VARISPEED type F1, F3 and F4.
- "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 if both compressors are with FI or On/Off.

7.5. 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.**

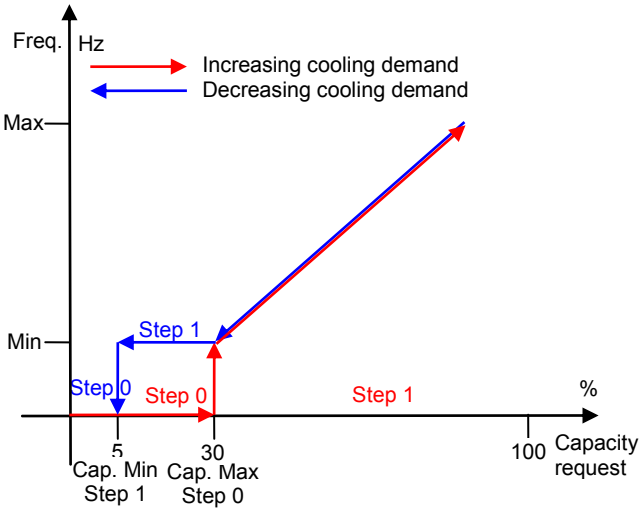
Gain sets the gain part (P) of the PI regulator. **Integral time** set the integrator of the PI regulator. **Delta max** is used for setting the maximum rate change per second.

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 analogue input. Please see section 7.7 External setpoint adjustment. **Adjustment offset** is the level of adjustment in K.

7.5.1. Control mode single compressor with frequency inverter:

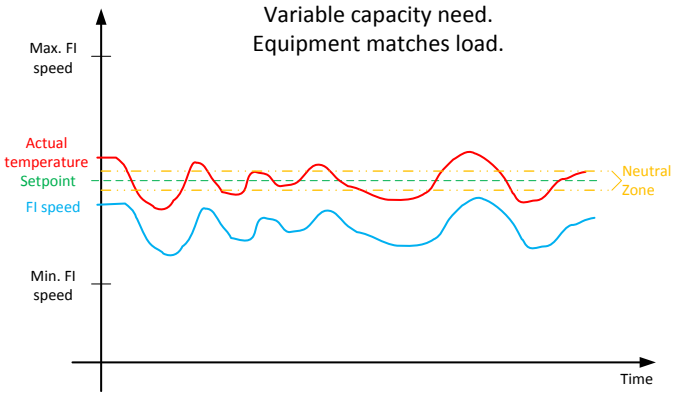
The difference from the actual temperature to the wanted setpoint is expressed as a capacity request from 0 to 100% where 100% is full compressor speed whether with or without frequency inverter.



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.

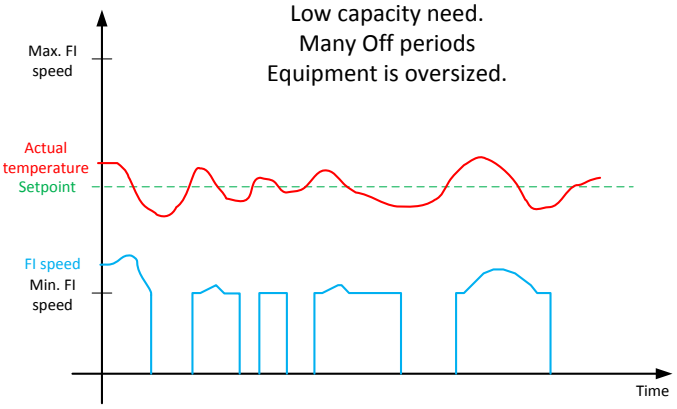
Below is a sketch of how the capacity regulator will work in a normal operation where the load and the condensing unit size are well matched.



The **Neutral Zone** is shown for reference but it is not recommended for use with a FI since the speed of the compressor is constantly being adjusted via the FI speed with a resolution of 0.1 Hz.

Using the **Neutral zone** will only ensure the capacity is never exactly on the required level.

On the sketch below the condensing unit is oversized or the load is momentarily much too low leading to too many off periods since even minimum speed is still giving too much capacity.



The **Gain** parameter is set conservatively at 5 giving a good response to changes in actual temperature but without giving a "nervously" reacting system, where many changes to the FI speed may disturb neighbours.

Setting the **Gain** at a too high level may lead to instability. **Delta max** may then also have to be adjusted.

The **Integral time** is set at 120 seconds to give a smooth operation with still good reaction to changes over time. If set at shorter time the changes in temperature might become larger and potentially even instable. If set at a too large timing the controller will react to slow on changes in the capacity need.

Standard ways of tuning the PI controller can of cause be applied to the system.

The **Delta max** parameter sets the maximum allowable capacity change per second. It is default 1.0 %/s.

It works as a damper on reaction to large changes in the actual temperature.

If set to a higher value the controller can change compressor speed more according to changes in the actual temperature. Although not the case this may by some people be experienced as instability due to the audible changes in the compressor speed.

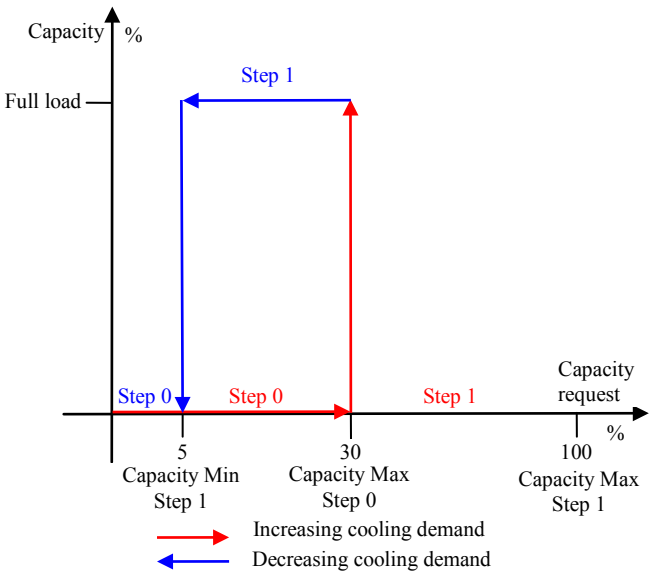
In Model codes **F1, F3** and **F4** the frequency inverter is monitored for alarms and limited against overload using the status information from the frequency inverter via the serial bus communication.

7.5.2. 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.**

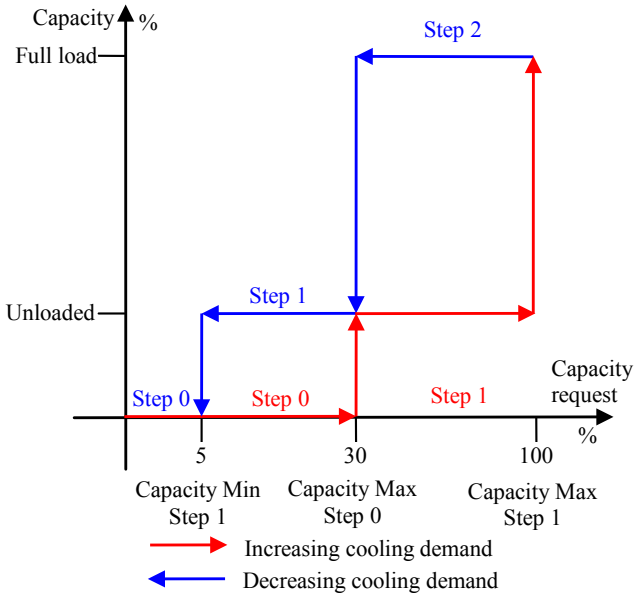
7.5.3. Control mode Unloader – single compressor

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.**

7.5.4. 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.

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

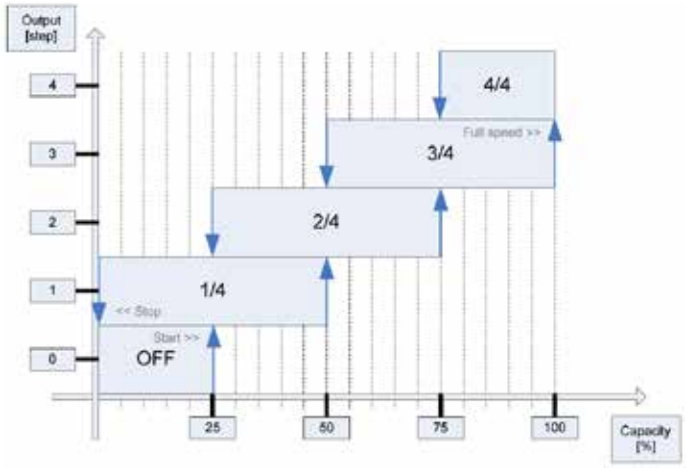
7.5.5. Dual compressor in On/Off control and both with unloader with 0 – 10V control

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.

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



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.

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

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

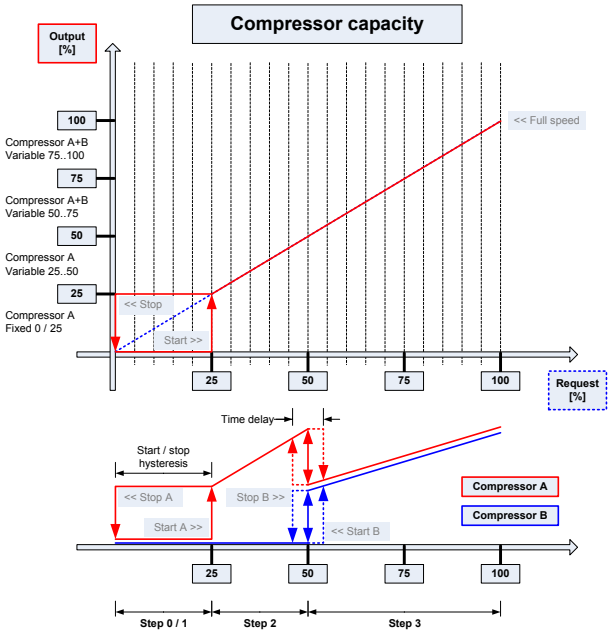
When starting from off state the minimum capacity is ½ * ½ = 25% of full capacity, given by running one compressor alone with full unload.

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.

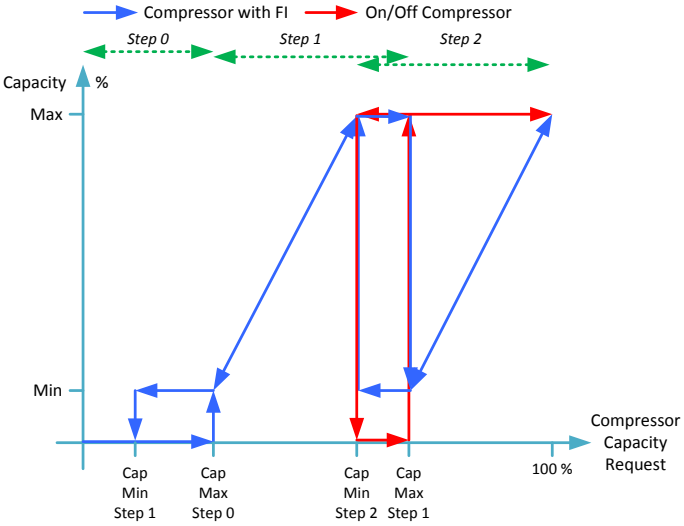


7.5.6. Dual compressor with one FI and one On/Off compressor

One compressor is speed controlled by the FI and the second compressor is On/Off controlled. For optimum performance the compressors should be of equal size. This gives an almost linear regulation from 25% to 100% capacity.

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 with both frequency inverter and On/Off compressor.

The FI is always started first and the On/Off compressor starts second.



When both compressors are stopped, the compressor with FI 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.

When this is not enough the On/Off compressor is started and the speed of the FI is reduced to **Inverter min frequency** and the FI speed is increased up to **Inverter max frequency.**

Variations in cooling demand are handled by adjusting the FI speed. If the requested capacity is below **CapMax1** the FI speed is kept, but the capacity request is still being reduced. When the requested capacity is below **CapMin2,** the On/Off compressor is stopped and the FI speed is set to **Inverter max frequency.**

Below **CapMax0** the FI speed is kept until the requested capacity is below **CapMin1** where the FI is stopped.

7.6. 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.

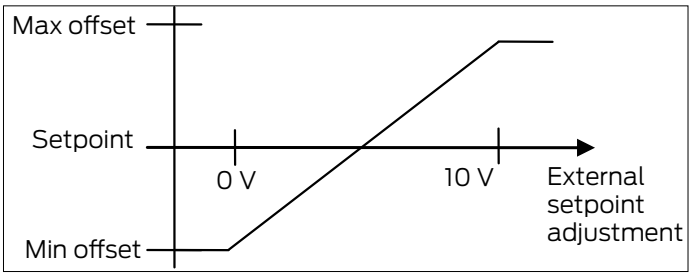
The above setpoints are static and a change on the userpanel would be needed to do dynamic changes. The External setpoint adjustment can be used for applying dynamic adjustments to the entered setpoint. This could be due to dynamic changes in the setpoint, due to adaption to calibrated sensors etc. This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

7.7. External setpoint adjustment

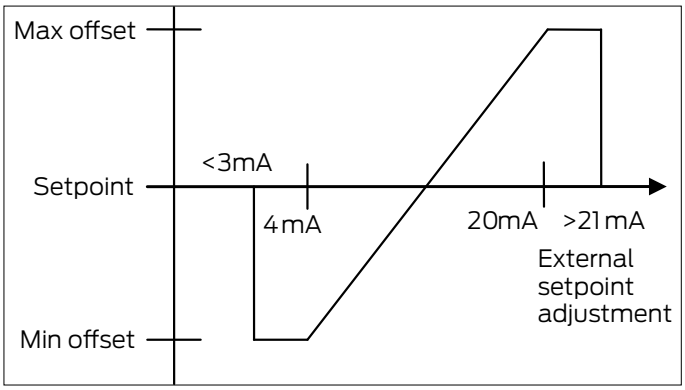
Note: There must be a 10kΩ resistor from the Temp10 temperature input to GND. If the input is setup for 4 mA – 20 mA, a 150 Ω resistor must be added parallel with the 10 kΩ resistor for signal conversion.

The external setpoint adjustment function is enabled in **Installer.Settings.Capacity** control comp. menu by setting **Setpoint adjustment** to either **0 – 10V** or **4 – 20mA.**

0 – 10V input:



4 -20mA input:



Adjustment offset value is used with sign, i.e. -5 K to +5 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.

7.8. 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 f**an 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.**

7.9. Frequency inverter control

The frequency inverter (FI) is controlled and monitored through a bus communication link for **Inv. F1, Inv. F3** and **Inv. F4** control modes.

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

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 section 17 Alarm system and trouble shooting.

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

7.10. 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. If the speed is above the **Oil return frequency** setting the next **Oil return interval** starts counting from the last time the speed was above the setting. **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 running when the Oil return function is scheduled for a start the speed is increased if it is below the Oil return frequency setting. If the compressor is stopped it is started with the Oil return frequency speed.

7.11. 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 T0 is below ambient temperature. **Pressure difference min** is the minimum pressure difference between suction pressure, Psuc and discharge pressure, Pdis. **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 T0 is allowed to become below the T0 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.

7.12. 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, Tc. When **Condensing temp max** is reached, the capacity-request starts to be reduced. **Evaporating temp min** is used for the lowest acceptable suction pressure, T0. Below **Evaporating temp min,** the capacity request is reduced with accelerated speed. At T0 – 5K a low pressure cut out and a compressor stop is performed. **Discharge gas temp max** is set to 130°C. The Tdis 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 cannot 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.**

7.13. 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

7.14. 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.

7.15. Day light savings handling

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

The field I**nstaller.Basic set.Daylight saving time** can be either **Manual** or **Auto.** In manual mode the controller does not change the time. In automatic daylight saving mode, the controller follows the Central European Daylight saving time.

7.16. 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.

7.16.1. 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 2nd 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

7.16.2. 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

7.16.3. 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 cannot 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 I**nstaller. 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

7.16.4. Heat recovery

In this mode the condenser fans are only operated if the condenser temperature passes the threshold I**nstaller. 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

7.17. 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.

7.18. 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 I**nstaller.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.

7.19. 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. A Gateway is a different name for a Router.

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. Provid-

ed that **RE1 – Contactor K1** is set to **On**, the compressor should be running with the selected speed.

7.20. 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. 5 months. This is a compromise between detailed logging data and datalog space.

The stored data is uploaded from the controller using the LMT - PC software package. LMT can show detailed data and also provide graphical views of the data. Please see section **Downloading the datalog from the controller.**

In the datalog are stored alarms, events and logs.

An alarm is written to the datalog when the alarm is added to the alarm list on the user panel.

See section 17 Alarm system and trouble shooting for a list of possible alarms, causes and troubleshooting.

Data are collected continuously.

An event is a change in the system state initiated from a user or external input.

- The following events are stored with a timestamp: yymmddhhmm:
- Power on of the unit
- Startup (when set to ON mode)
- Stop (when set to OFF mode)
- Manual mode
- Database reset – reset to factory settings
- Compressor emergency mode
- Fan emergency mode
- Suction sensor emergency mode

A log is a collection of data recorded at the same time. The date and time is stored as yymmddhhmm.

The log contains the following data:

To [°C],

Tc [°C],

Tdis [°C],

FI current [A],

FI freq [Hz],

fan speed [%],

actual limiter [0-6}

Tcoldstore [°C]

Setpoint [°C],

Tambient [°C],

Ext. setpoint adjust [°C],

FI temperature [°C],

Actual capacity [%],

Runtime hours [h.],

Unit running,

HP switch,

Oil failure,

Compressor overheat,

Fan1 overheat,

Fan2 overheat,

Temp. [°C] (Tsuc)

7.21. 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.

7.22. Reset to factory settings

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

7.23. 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 BMS signal is turned **On** when the unit is powered on and has no alarms else it is turned **Off.** Since the BMS 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.

7.24. Restart handling

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

Depending on the severity of an error, the LMC340i 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.

7.25. Web page

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

7.26. Remote maintenance

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

8. 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.

8.1. Room temperature control mode

Parameters for refrigerants R22, R134a, R404A and R407A.

Field(s)	Refrigerant	R22	R134a	R404A	R407A
User.Room setpoint Installer.Basic.Settings.Setpoint Installer.Settings.Digital input.2ndSetp	Min	-40.0 °C	-25.0 °C	-40.0 °C	-30.0 °C
	Default	+2.0 °C	+2.0 °C	+2.0 °C	+2.0 °C
	Max	+22.5 °C	+35.0 °C	+17.5 °C	+10.0 °C
Installer.Settings.WeekProgram.Setpoint	Min	-30 °C	-30 °C	-45 °C	-35 °C
	Default	+2 °C	+2 °C	+2 °C	+2 °C
	Max	+22 °C	+35 °C	+17 °C	0 °C
Installer.Settings.Fan control.Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Fan control.Setpoint min	Min	+15 °C	+15 °C	+15 °C	+15 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Fan control.Economy Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+45 °C	+45 °C	+45 °C	+45 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Fan control.LowSound Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+50 °C	+50 °C	+50 °C	+50 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Limiter control.Tc max	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+63 °C	+80 °C	+55 °C	+60 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C

Field(s)	Refrigerant	R22	R134a	R404A	R407A
Installer.Settings.Limiter control.To min	Min	-45 °C	-30 °C	-45 °C	-35 °C
	Default	-45 °C	-30 °C	-45 °C	-35 °C
	Max	+13 °C	+25 °C	+7 °C	0 °C
Installer.Settings.Limiter control.Hotgas max	Min	+70 °C	+70 °C	+70 °C	+70 °C
	Default	+130 °C	+130 °C	+130 °C	+130 °C
	Max	+140 °C	+140 °C	+140 °C	+140 °C
Installer.Settings.Limiter control.dP max	Min	5 bar	5 bar	5 bar	5 bar
	Default	22 bar	25 bar	22 bar	23 bar
	Max	22 bar	25 bar	22 bar	23 bar
Installer.Settings.Limiter control.dP min	Min	2.0 bar	2.0 bar	2.0 bar	2.0 bar
	Default	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
Installer.Settings.Winter start.dP min	Default	1.8 bar	1.2 bar	2.1 bar	1.8 bar
Installer.Settings.Digital input.Heat rec.	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+57 °C	+75 °C	+50 °C	+57 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C

Parameters for refrigerants R407C, R407F, R410A and R507A.

Field(s)	Refrigerant	R407C	R407F	R410A	R507A
User.Room setpoint Installer.Basic.Settings.Setpoint Installer.Settings.Digital input.2ndSetp	Min	-20.0 °C	-30.0 °C	-25.0 °C	-40.0 °C
	Default	+2.0 °C	+2.0 °C	+2.0 °C	+2.0 °C
	Max	+22.5 °C	+10.0 °C	+22.5 °C	+17.5 °C
Installer.Settings.WeekProgram.Setpoint	Min	-25 °C	-35 °C	-30 °C	-45 °C
	Default	+2 °C	+2 °C	+2 °C	+2 °C
	Max	+22 °C	0 °C	+22 °C	+17 °C
Installer.Settings.Fan control.Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Fan control.Setpoint min	Min	+15 °C	+15 °C	+15 °C	+15 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Fan control.Economy Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+45 °C	+45 °C	+45 °C	+45 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Fan control.LowSound Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+50 °C	+50 °C	+50 °C	+50 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Limiter control.Tc max	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+62 °C	+60 °C	+62 °C	+55 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Limiter control.To min	Min	-25 °C	-35 °C	-30 °C	-45 °C
	Default	-25 °C	-35 °C	-30 °C	-45 °C
	Max	+13 °C	0 °C	+13 °C	+8 °C
Installer.Settings.Limiter control.Hotgas max	Min	+70 °C	+70 °C	+70 °C	+70 °C
	Default	+130 °C	+130 °C	+130 °C	+130 °C
	Max	+140 °C	+140 °C	+140 °C	+140 °C
Installer.Settings.Limiter control.dP max	Min	5 bar	5 bar	5 bar	5 bar
	Default	23 bar	23 bar	34 bar	23 bar
	Max	23 bar	23 bar	34 bar	23 bar

Field(s)	Refrigerant	R407C	R407F	R410A	R507A
Installer.Settings.Limiter control.dP min	Min	2.0 bar	2.0 bar	3 bar	2.0 bar
	Default	10.0 bar	10.0 bar	10.0 bar	10.0 bar
	Max	3.5 bar	3.5 bar	5.5 bar	3.5 bar
Installer.Settings.Winter start.dP min	Default	1.7 bar	1.8 bar	2.8 bar	2.2 bar
Installer.Settings.Digital input.Heat rec.	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+57 °C	+57 °C	+57 °C	+50 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C

8.2. Suction pressure control mode

Parameters for refrigerants R22, R134a, R404A and R407A

Field(s)	Refrigerant	R22	R134a	R404A	R407A
Installer.Basic.Settings.Setpoint Installer.Settings.Digital input.2ndSetp	Min	-45.0 °C	-30.0 °C	-45.0 °C	-35.0 °C
	Default	-10.0 °C	-10.0 °C	-10.0 °C	-10.0 °C
	Max	+12.5 °C	+25.0 °C	+7.5 °C	0.0 °C
Installer.Settings.WeekProgram.Setpoint	Min	-30 °C	-30 °C	-45 °C	-35 °C
	Default	-10.0 °C	-10.0 °C	-10.0 °C	-10.0 °C
	Max	+12 °C	+25 °C	+7 °C	0 °C
Installer.Settings.Fan control.Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Fan control.Setpoint min	Min	+15 °C	+15 °C	+15 °C	+15 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Fan control.Economy Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+45 °C	+45 °C	+45 °C	+45 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Fan control.LowSound Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+50 °C	+50 °C	+50 °C	+50 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Limiter control.Tc max	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+63 °C	+80 °C	+55 °C	+60 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C
Installer.Settings.Limiter control.To min	Min	-45 °C	-30 °C	-45 °C	-35 °C
	Default	-45 °C	-30 °C	-45 °C	-35 °C
	Max	+13 °C	+25 °C	+7 °C	0 °C
Installer.Settings.Limiter control.Hotgas max	Min	+70 °C	+70 °C	+70 °C	+70 °C
	Default	+130 °C	+130 °C	+130 °C	+130 °C
	Max	+140 °C	+140 °C	+140 °C	+140 °C
Installer.Settings.Limiter control.dP max	Min	5 bar	5 bar	5 bar	5 bar
	Default	22 bar	25 bar	22 bar	23 bar
	Max	22 bar	25 bar	22 bar	23 bar
Installer.Settings.Limiter control.dP min	Min	2.0 bar	2.0 bar	2.0 bar	2.0 bar
	Default	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
Installer.Settings.Winter start.dP min	Default	1.8 bar	1.2 bar	2.1 bar	1.8 bar

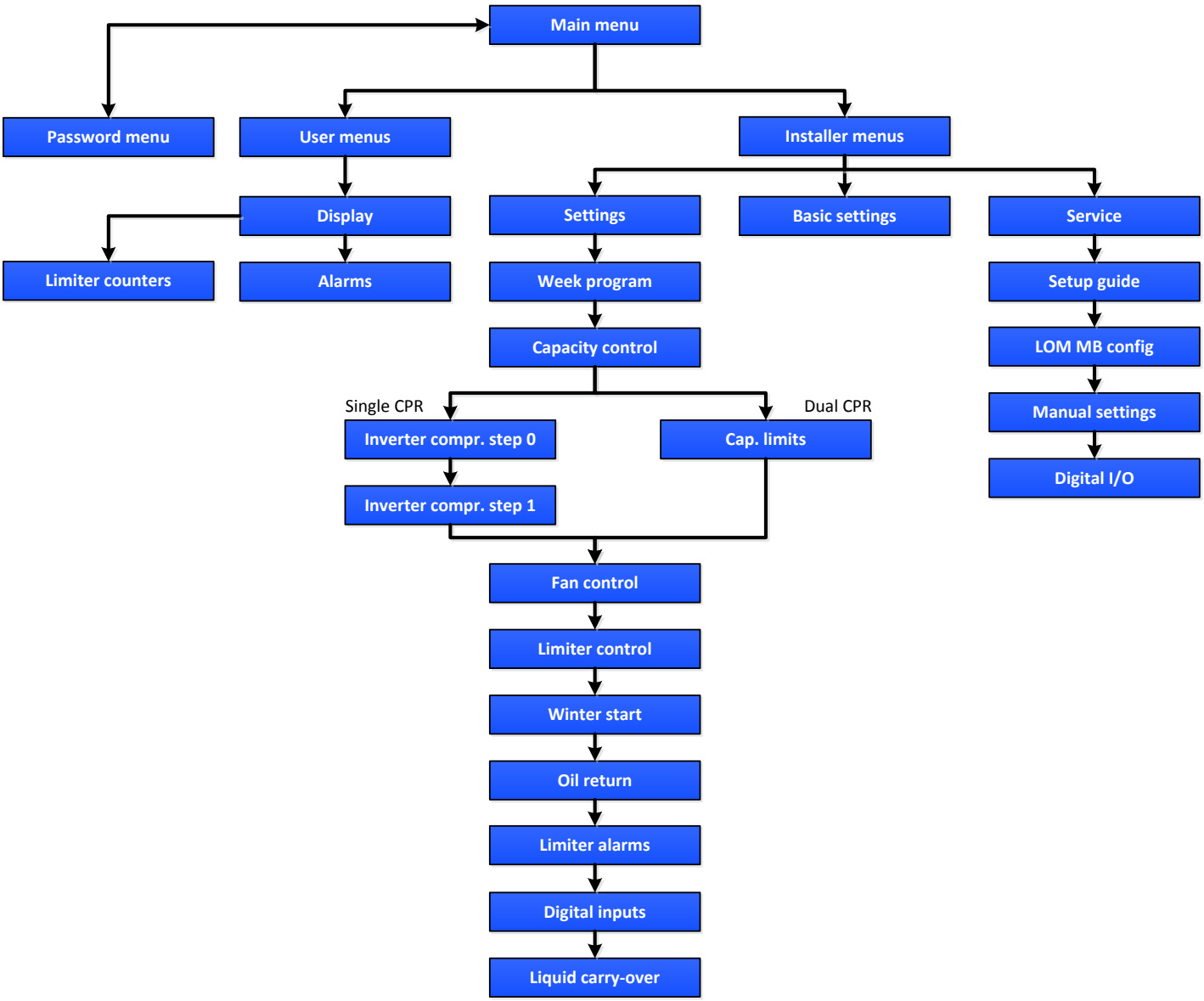
Field(s)	Refrigerant	R22	R134a	R404A	R407A
Installer.Settings.Digital input.Heat rec.	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+57 °C	+75 °C	+50 °C	+57 °C
	Max	+63 °C	+80 °C	+55 °C	+60 °C

Parameters for refrigerants R407C, R407F, R410A and R507A.

Field(s)	Refrigerant	R22	R134a	R404A	R407A
Installer.Basic.Settings.Setpoint Installer.Settings.Digital input.2ndSetp	Min	-25.0 °C	-35.0 °C	-30.0 °C	-45.0 °C
	Default	-10.0 °C	-10.0 °C	-10.0 °C	-10.0 °C
	Max	+12.5 °C	0.0 °C	+12.5 °C	+7.5 °C
Installer.Settings.WeekProgram.Setpoint	Min	-25 °C	-35 °C	-30 °C	-45 °C
	Default	-10.0 °C	-10.0 °C	-10.0 °C	-10.0 °C
	Max	+12 °C	0 °C	+12 °C	+7 °C
Installer.Settings.Fan control.Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Fan control.Setpoint min	Min	+15 °C	+15 °C	+15 °C	+15 °C
	Default	+30 °C	+30 °C	+30 °C	+30 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Fan control.Economy Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+45 °C	+45 °C	+45 °C	+45 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Fan control.LowSound Setpoint	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+50 °C	+50 °C	+50 °C	+50 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Limiter control.Tc max	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+62 °C	+60 °C	+62 °C	+55 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C
Installer.Settings.Limiter control.To min	Min	-25 °C	-35 °C	-30 °C	-45 °C
	Default	-25 °C	-35 °C	-30 °C	-45 °C
	Max	+13 °C	0 °C	+13 °C	+8 °C
Installer.Settings.Limiter control.Hotgas max	Min	+70 °C	+70 °C	+70 °C	+70 °C
	Default	+130 °C	+130 °C	+130 °C	+130 °C
	Max	+140 °C	+140 °C	+140 °C	+140 °C
Installer.Settings.Limiter control.dP max	Min	5 bar	5 bar	5 bar	5 bar
	Default	23 bar	23 bar	34 bar	23 bar
	Max	23 bar	23 bar	34 bar	23 bar
Installer.Settings.Limiter control.dP min	Min	2.0 bar	2.0 bar	3 bar	2.0 bar
	Default	10.0 bar	10.0 bar	10.0 bar	10.0 bar
	Max	3.5 bar	3.5 bar	5.5 bar	3.5 bar
Installer.Settings.Winter start.dP min	Default	1.7 bar	1.8 bar	2.8 bar	2.2 bar
Installer.Settings.Digital input.Heat rec.	Min	+10 °C	+10 °C	+10 °C	+10 °C
	Default	+57 °C	+57 °C	+57 °C	+50 °C
	Max	+62 °C	+60 °C	+62 °C	+55 °C

9. Menu system

9.1. Overview of the menu system



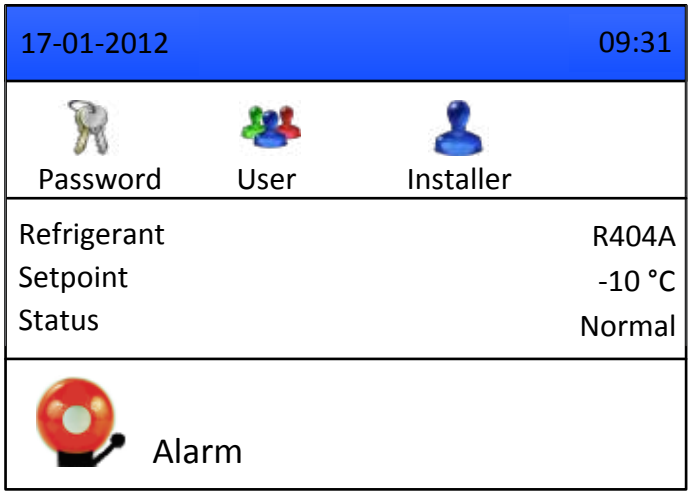
9.2. Main menu

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.



9.2.1. Status line

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

Status line	
Off	The unit is in Off mode (set in the User menu)
Normal	Normal operation
Stopped	The unit is On, but there is no external release signal ("run" signal)
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 limier 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 2nd setpoint function is enabled, but the corresponding digital input is not activated

The 2nd 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.

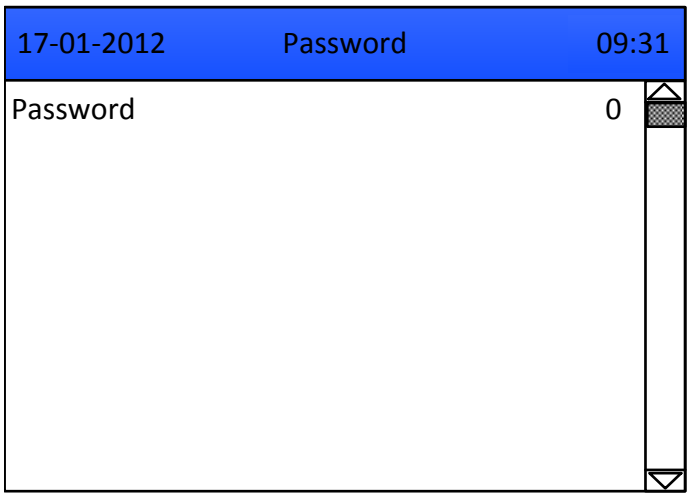
The week program is active

9.3. Password menu

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

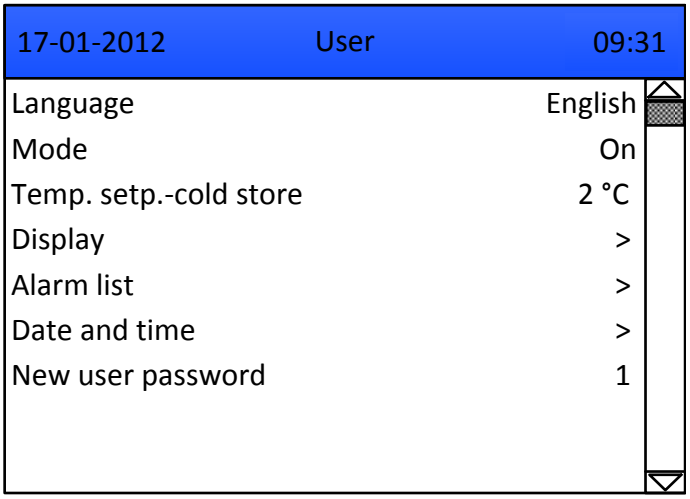
Default passwords:

6. Opens access to user level information
7. Installer settings are now available



9.4. 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, Spanish, Russian and Turkish
- 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 -45ºC to +30ºC. Depends on the used refrigerant
- Default +2 ºC (R404A)
- Line is not visible in Suction pressure control mode

Display

- View data from the unit
- Alarm list
- A list with up to 16 alarms

Date and time

- Set the date and time

New user password

- New code for the user section

9.5. User - Display menu

17-01-2012	Display	09:31
Status		Suc. Pressure
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
Compressor frequency		0.0 Hz
Compressor current		0.0 A
Suction temperature		-1.0 °C
Superheat temperature		3.0 °C
Active limiter		None
Suction pressure setp		-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		>

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
- Only visible if Suction temperature sensor has been enabled in the Service – Menu

Superheat temperature

- Superheat temperature
- Only visible if Suction temperature sensor has been enabled in the Service – Menu

Compressor frequency

- Compressor frequency in Hz

Active limiter

- Show actual capacity limitation function: None, High Tc, Hotgas, High Tfi, dP Max, To Min, FI Curr.

Suction pressure setp / 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

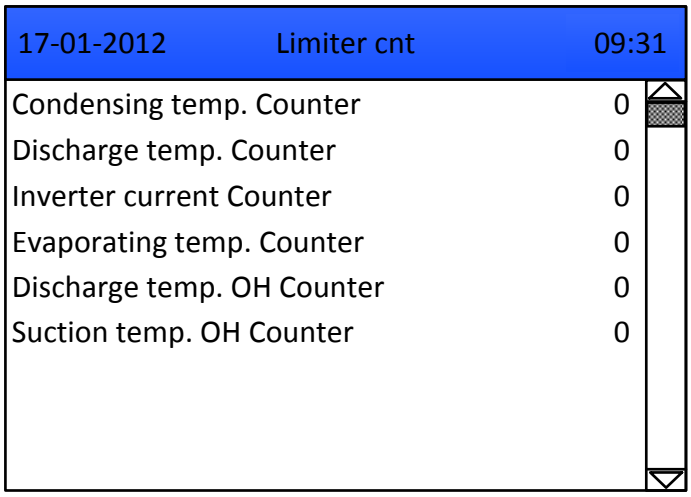
- Run time in hours

Limiter counter per day

- Menu with limiter function counters total per day

9.6. 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. Counters are reset at midnight.



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

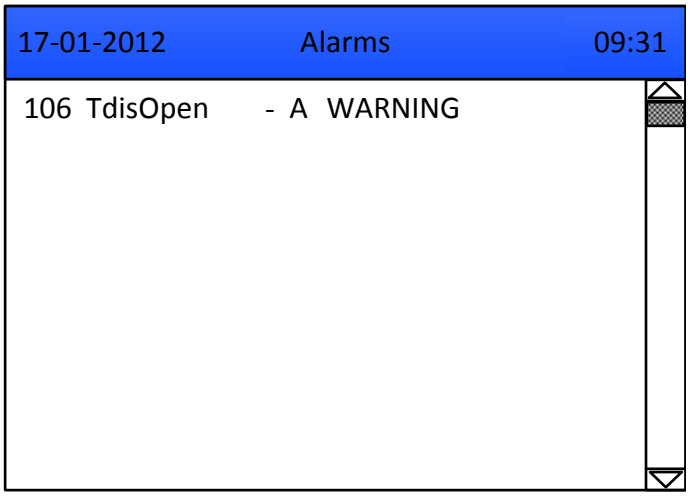
Discharge temp OH Counter

- Shows number of discharge temperature overheat limiter actions for today

Suction temp. OH Counter

- Shows number of suction temperature overheat limiter actions for today

9.7. 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.

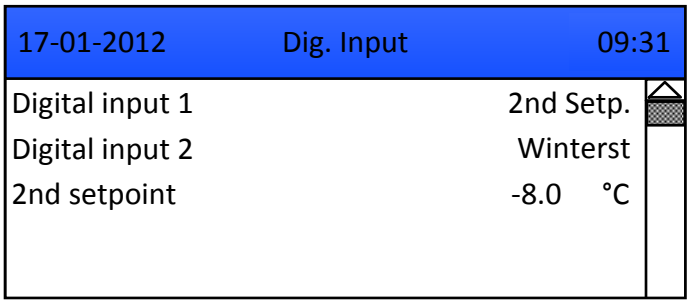
If the first letter is in small capital like w104, it can be acknowledged with the Enter key and will then be deleted from the list.

Default is No alarm.

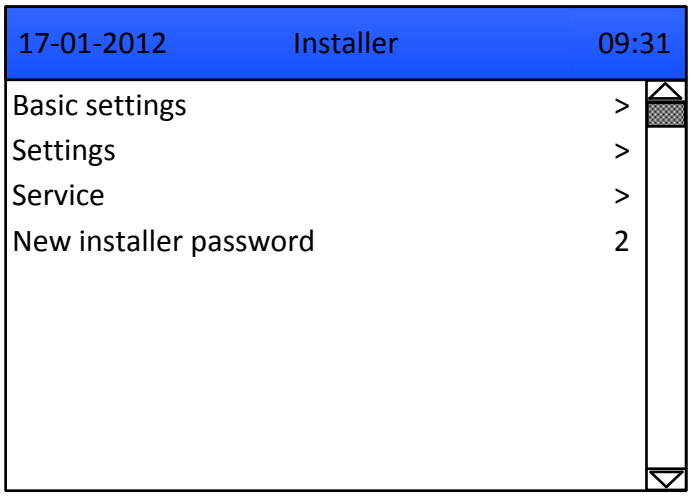
9.8. User - Date and time setting

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

Hour is in 24h format.



9.9. Installer menu



Basic settings

- Set customer settings

Settings

- Set operating parameters

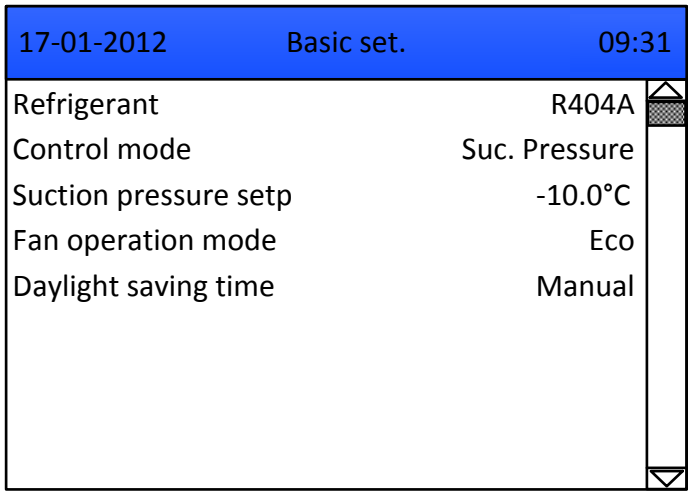
Service

- Access to the service menus

New password

- Set a new password for the installer section

9.10. Installer - Basic settings



Refrigerant

- Refrigerant selection
- R22, R134a, R404A, R407A, R407C, R407F, 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

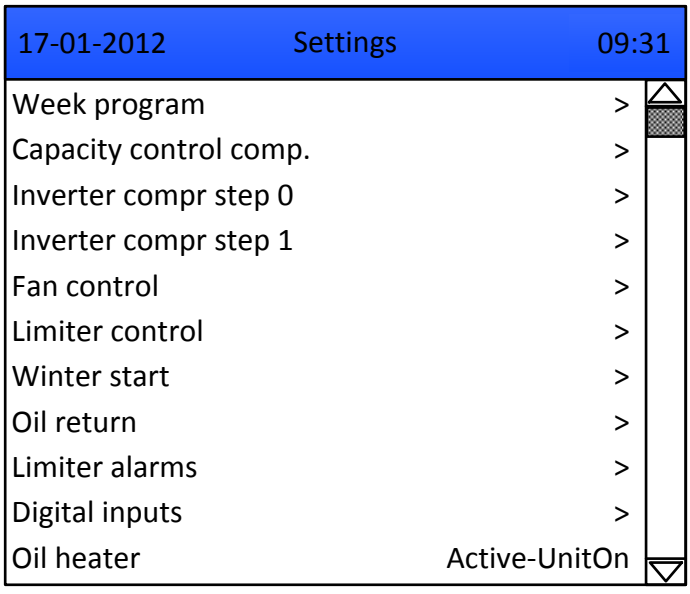
- Set the regulating mode of the fans, Eco or LowSound
- LowSound reduces the fan speed to reduce the sound from the fans
- Default is Eco

Daylight saving time

- Handling of daylight saving time shift by the real time clock
- Manual or Auto (MET)
- Default is Manual

9.11. Installer - Settings - Single compressor mode

Collection of menus for adjusting operating parameters.

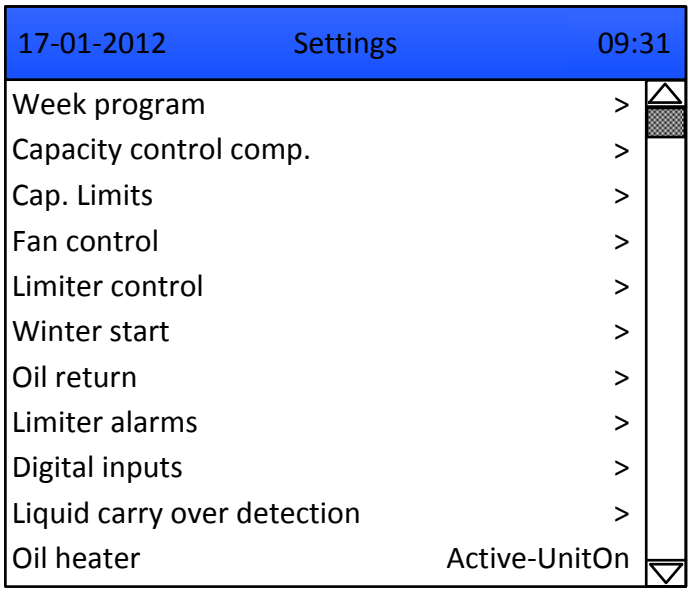


Oil heater

- 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

9.12. Installer – Settings – Dual compressor mode

Collection of menus for adjusting operating parameters

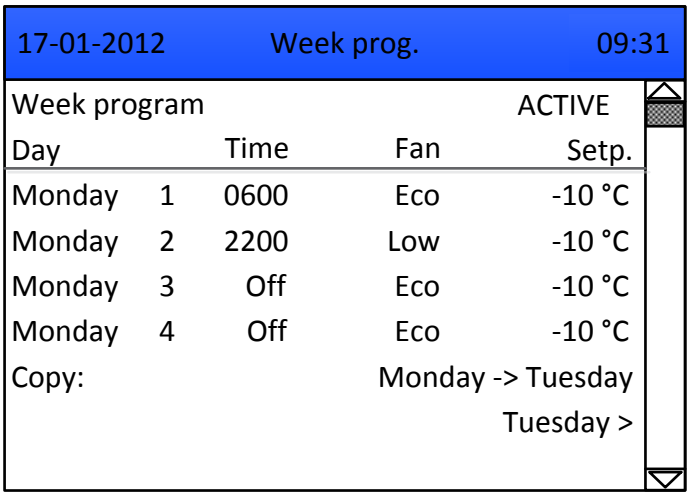


Oil heater

- 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

9.13. 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. Use the left and right arrows to move to the previous / next day.



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.

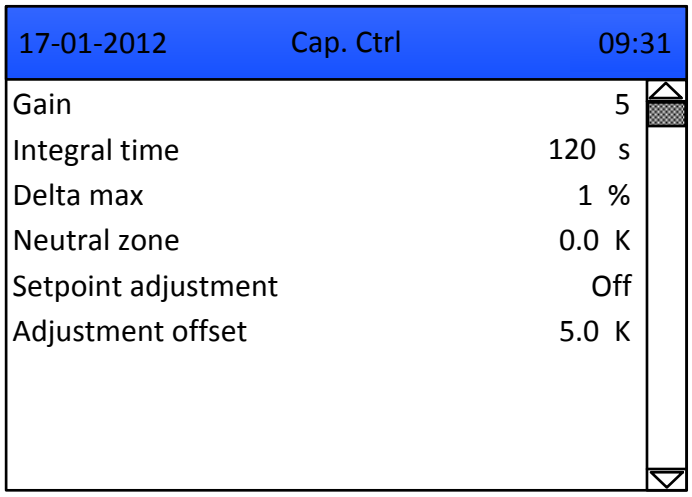
- Set the setpoint
- Default -10°C in Suction pressure mode, +2°C in Room temperature mode

Copy

- Copy settings for the shown day to the selected day

9.14. 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 sec.

Delta max
- Max capacity change in %/min.
- Range 0.2 – 5.0%
- Default 1.0%

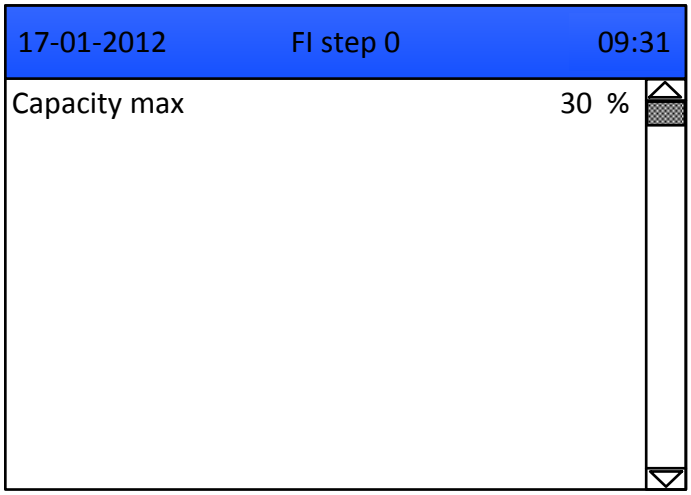
Neutral zone
- Neutral band [°C]
- Range 0.0 K – 10.0 K
- Default 0.0 K

Setpoint adjustment
- External setpoint adjustment
- Off, 4 – 20mA, 0 – 10V
- Default Off

Adjustment offset
- External setpoint adjustment
- Mainly for coldstores
- 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

9.15. Installer – FI step 0

Setup for the first step of the controllers “gear box”. Single compressor mode only. Please see section Capacity control.



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

9.16. Installer – FI step 1

Setup of the second step of the controllers “gear box”. Single compressor mode only. See section Capacity control.

17-01-2012	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

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 sec.
- 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 sec.
- Default 10 sec.

9.17. Installer – Capacity limits – Dual compressor mode

Setup for the steps of the controllers “gear box” for Dual compressor mode only. See section Capacity control.

17-01-2012	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	%

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%.

9.18. Installer - Configuration menu

Setup for the steps of the controllers “gear box” for Dual compressor mode only. See section Error! Reference source not found. in the User manual.

17-01-2012	Cap. Limits	09:31
Step 0 Cap. max	30	%
Step 1 Cap. min	5	%
Step 1 Cap. max	70	%
Step 2 Cap. min	60	%
Inverter min frequency	25	Hz
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

Step 0 Cap. max.

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

Step 1 Cap. min.

- Minimum capacity for this step
- Range 0% - 100%
- Default 5%

Step 1 Cap. max.

- Maximum capacity for this step before shift to next step
- Range 0% - 100%
- Default 70%

Step 2 Cap. min.

- Minimum capacity for this step.Range 0% - 100%
- Default 60%

Inverter min.

- Minimum compressor speed frequency (FI)
- Range 25 Hz. – 87 Hz.
- Default 25 Hz.

Inverter max.

- Maximum compressor frequency 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.

- Minimum compressor (FI) frequency during the start process
- Range 25 Hz. – 87 Hz.
- Default 50 Hz.

Runtime

- Run time with the frequency between Inverter min start freq. and Inverter max start freq
- Range 0 – 60 sec.
- Default 10 sec.

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 sec.
- Default 10 sec.

9.19. Installer – Fan control

Condenser control

17-01-2012	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	%

Ambient compensation

- Use ambient compensation
- On, Off
- When set On the speed of the condenser fans is adjusted to maintain a certain temperature difference between the condenser temperature and the ambient temperature
- Default On

Uncomp. Setpoint

- Setpoint for condenser temperature if ambient compensation is off
- Line only visible if Ambient compensation is set to Off
- Full 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
- Range 0% - 100%
- Default 30%

Delta max.

- Change in fan speed [% / sec.]
- Range 0% – 10%
- Default 5%

Setpoint min.

- Minimum condensing temperature
- Range 0°C – 80°C
- Default 15°C

Economy setpoint max.

- Maximum condensing temperature (100% speed) operating in Eco fan speed mode
- Refrigerant dependent
- Range 0°C – 80°C
- Default 45°C

LowSound setpoint max.

- Maximum condensing temperature (100% speed) operating in LowSound fan speed mode
- Refrigerant dependent
- 0°C – 80°C. Default 50°C

Fan capacity min.

- 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%

Fan capacity max.

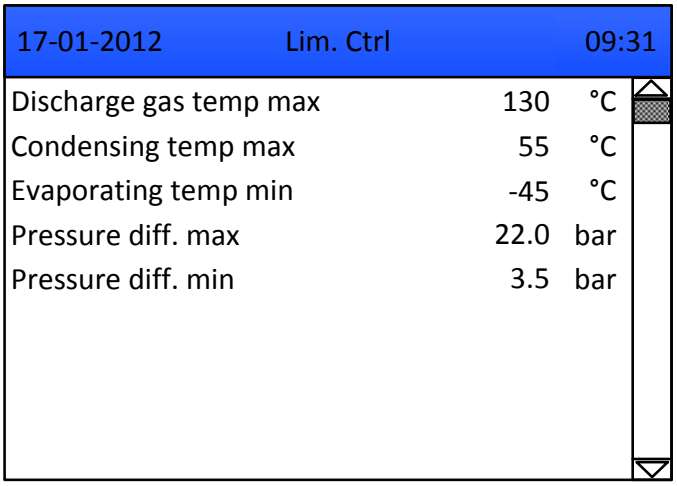
Maximum reference for fan controller

Range 0% - 100%

Default 60%

9.20. Installer – Limiter controller

Lists settings for the capacity limiting functions.



Discharge gas temp. max.

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

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

Pressure diff. max.

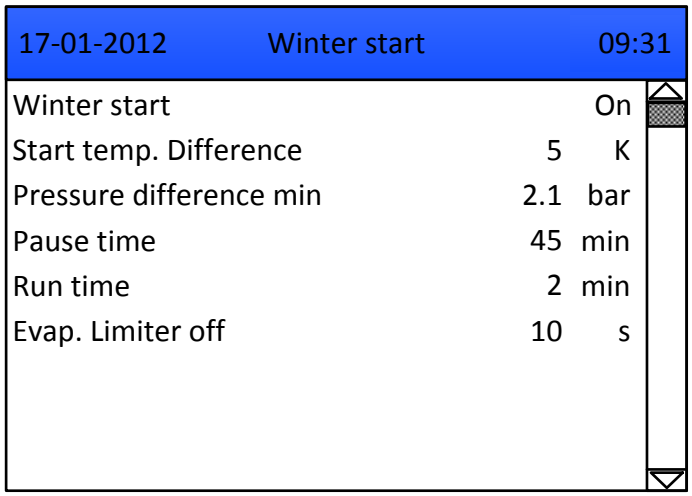
- Maximum pressure difference before capacity is increased
- Depends on refrigerant and compressor
- Range 2.0 bar – 34.0 bar
- Default 22.0 bar

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

9.21. 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 5 K

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

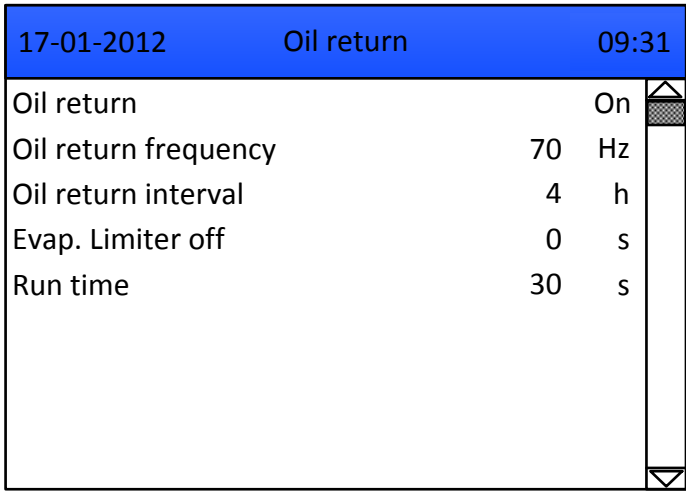
- Run time during the forced winter start
- Range 0 min. – 15 min.
- Default 2 min.

Evap. Limiter off

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

9.22. Installer – Oil return

Oil return feature settings. The function is used for changing the compressor speed 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

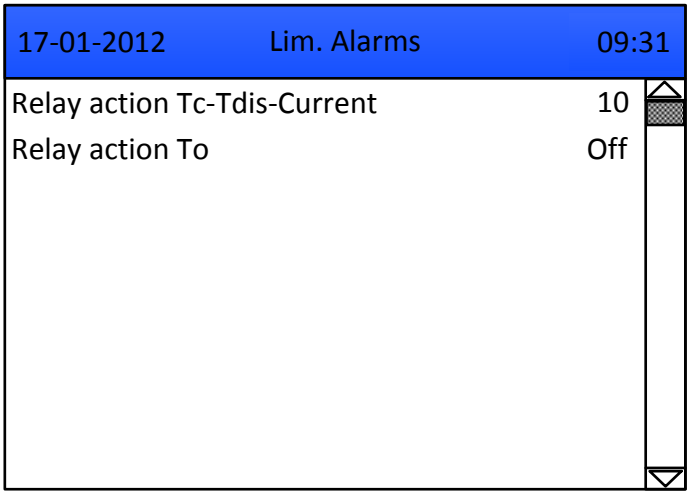
- Time the compressor is allowed to run with unchanged frequency even if TO is below the Evaporating temp. min. limiter setting
- Range 0 sec. – 30 sec.
- Default 0 sec.

Run time

- Run time with Oil return frequency speed
- Range 0 sec. – 180 sec.
- Default 30 sec.

9.23. Installer – Limiter alarms

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



Relay action Tc-Tdis-Current

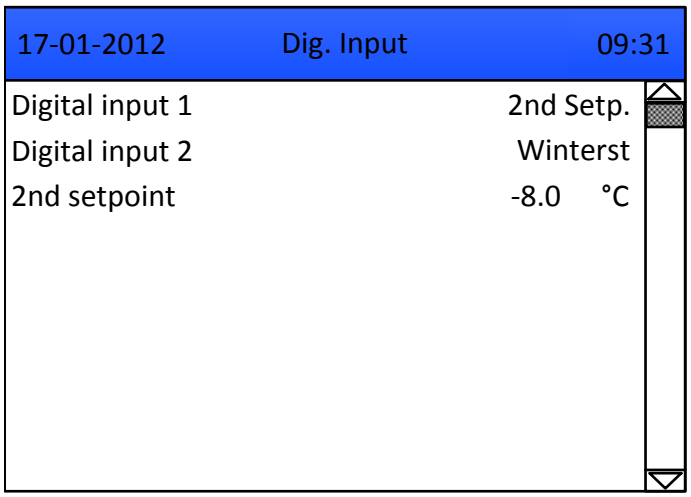
- Allowed number of alarms without activating the CTS alarm relay
- Valid for Condensing temp. max.
- Discharge gas temp. max. and FI current limiters
- Range 0 – 999. 0 = Off
- Default 10

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

9.24. Installer – Digital input

Digital input 1 and 2 selectable functions (DIN1 and DIN2). A function can only be selected for one digital input and is not selectable for the other digital input.



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

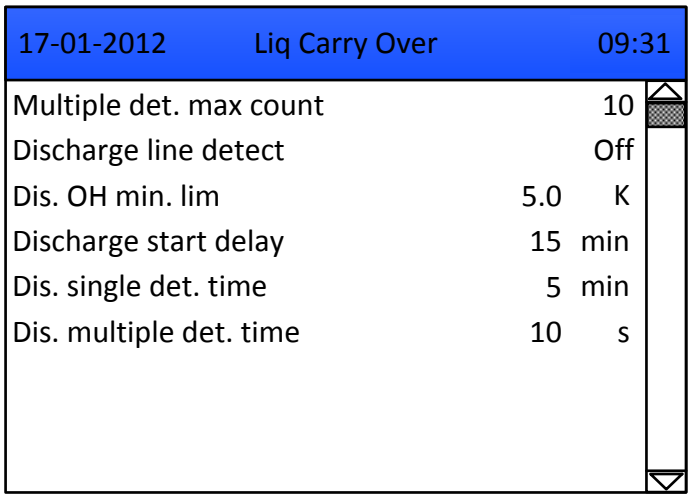
Heat recovery fan start

- 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

9.25. Installer – Liquid-carry-over detection

Liquid refrigerant can harm the compressor and should be avoided. The controller can give a warning or alarm if this situation occurs based on the settings in this menu.

There is a detection function for both suction line and discharge line, they are default deactivated.



Multiple det. max count

- The number of detections before the alarms C628 “M. Dis. Liq” or C29 “M. Suc. Liq.” is signalled.
- Range 0 – 100
- Default 10

Discharge line detect:

- Liquid-carry-over function for the discharge line.
- On or Off
- Default Off

Dis. OH min. lim:

- Minimum required over-heat temperature.
- Range 2.0 K to 20.0 K
- Default 5.0 K

Discharge start delay

- Compressor runtime before detection starts.
- Range 1 min. to 60 min.
- Default 15 min.

Dis. single det. time

- Time to stay below the minimum overheat temperature

before a long overheat event is detected.

- Range 1 min to 25 min
- Default 5 min

Dis. multiple det. time:

- Time to stay below the minimum overheat temperature before a short overheat event is detected.
- Range 5 s to 100 s
- Default 10 s.

The following lines are only visible if the suction. Temperature sensor has been enabled in the service menu.

17-01-2012	Liq Carry Over	09:31
Multiple det. max count		10
Discharge line detect		Off
Dis. OH min. lim	5.0	K
Discharge start delay	15	min
Dis. single det. time	5	min
Dis. multiple det. time	10	s
Suction line detect		Off
Suc. OH min. Lim	5.0	K
Suction start delay	15	min
Suc. single det. time	5	min
Suc. multiple det. time	10	s

Suction line detect

- Liquid-carry-over function for the suction line
- On or Off
- Default Off

Suc. OH min. lim

- Minimum required over-heat temperature
- Range 2.0 K to 20.0 K
- Default 5.0 K

Suction start delay

- Compressor runtime before detection starts
- Range 1 min. to 60 min.
- Default 15 min.

Suc. single det. time

- Time to stay below the minimum overheat temperature before a long overheat event is detected
- Range 1 min. to 25 min.
- Default 5 min.

Suc. multiple det. time

- Time to stay below the minimum overheat temperature before a short overheat event is detected
- Range 5 sec. to 100 sec.
- Default 10 sec.

9.26. Service menu

The Service menu shows the configuration of the unit.

17-01-2012	Service	09:31
Project		Standard
Model Code		Inv. F3
Controller LMC300 V.		2.1.6.2
Display LUP200 V.		2.1.6.2
Eth-Board LOM320 V.		1.2.2.0
IP Address		192.168.001.180
Netmask		255.255.255.000
Gateway		192.168.001.001
MAC address		00:1F:79:00:02:B0
No-FI emergency mode		No
Fan controller used		Yes
Psuc fail FI Speed		Off Hz
Suction gas temp sensor		Yes
Factory reset		No
Setup guide		No
LOM MB config		>
Manual settings		>
Digital I/O Display		>

Project

- This is always Standard

Model Code

- Shows the actual compressor control configuration

Controller LMC300 V.

- Software version of the LMC340i controller

Display LUP200 V.

- Software version of the LUP200 display

Eth-Board LOM320 V.

- Software version of the LOM320 web server board

IP Address

- Network IP address of the optional LOM320 web server board
- The IP address can be changed to the required IP address for the site

Netmask

- Network mask of the optional LOM320 web server board
- The netmask can be adjusted to fit the network setup

Gateway(1)

- Network IP address of the gateway the optional LOM320 is connected to

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 andthe unit should be kept under surveillance!
- Range Off, Inverter min freq. – Inverter max freq.
- Default Off

Suction gas temp sensor

- Select if a suction gas temperature sensor is mounted
- Yes, No
- If set to Yes, the menu for adjusting the Liquid-carry-over protection function is extended with suction line protection settings
- Default Yes

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

Setup guide

- Select if the setup guide should be shown. This brings up the setup guide menu and returns to the main menu after exiting this setup guide
- Yes, No
- Default No

LOM MB config

- Menu for configuring the Modbus settings of the RS485 port on the Web module

Manual settings

- Menu for controlling outputs in manual mode for service purposes

Digital I/O Display

- Menu for displaying actual state of digital inputs and outputs

Note 1: A gateway is also commonly known under the name “a router”

9.27. Service – Manual settings

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

17-01-2012	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 - Compressor ready	Off	
AN0 - Fan Speed	0	%
AN1 - Comp. Speed	0	%

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 analogue output ANOUT0
- Range 0% - 100%
- Default 0%

AN1 – Comp. Speed

- Set the compressor speed on the analogue output ANOUT1
- Range 0% - 100%
- Default 0%.

9.28. Service – Display of digital input/outputs

Show the status of the digital inputs and outputs.

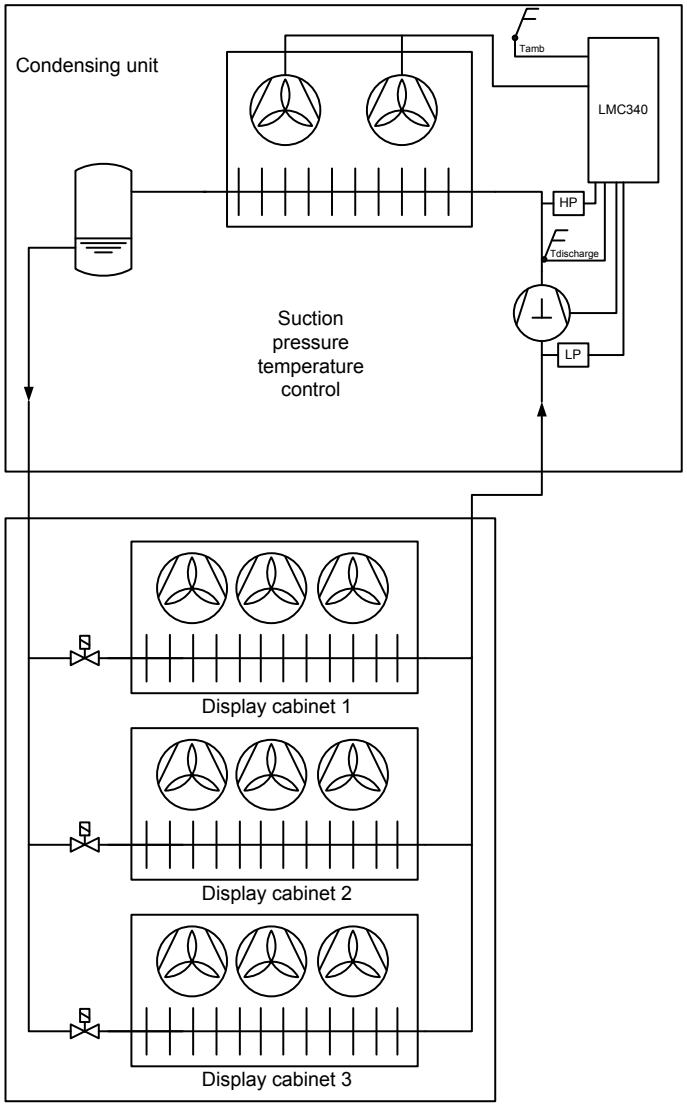
17-01-2012	Digital I/O	09:31
RE1 - Contactor K1	Off	
RE2 - Valve LLV/Oil Ret.	Off	
RE3 - Crankcase heater	Off	
RE4 - OLC-K/SE-B	Off	
RE5 - Alarm relay	Off	
RE6 - Fan 1	Off	
RE7 - Fan 2	Off	
RE8 - Comp. run sig OLC	Off	
RE9 - Compressor ready	Off	
ACIN1 - Fan 1	Off	
ACIN2 - Fan 2	Off	
ACIN3 - SE-B	Off	
ACIN4 - OLC-K	Off	
ACIN5 - Contactor K1	Off	
ACIN6 - Ext. relase	Off	
DIN1 - Function 1	Off	
DIN2 - Function 2	Off	
DIN3 - Not used	Off	
DIN4 - Not used	Off	

- RE1 to RE9 are digital outputs
- ACIN1 to ACIN6 are 230 VAC digital inputs
- DIN1 and DIN2 are digital inputs used for the digital input functions
- DIN3 and DIN4 are not used

10. Examples of application use

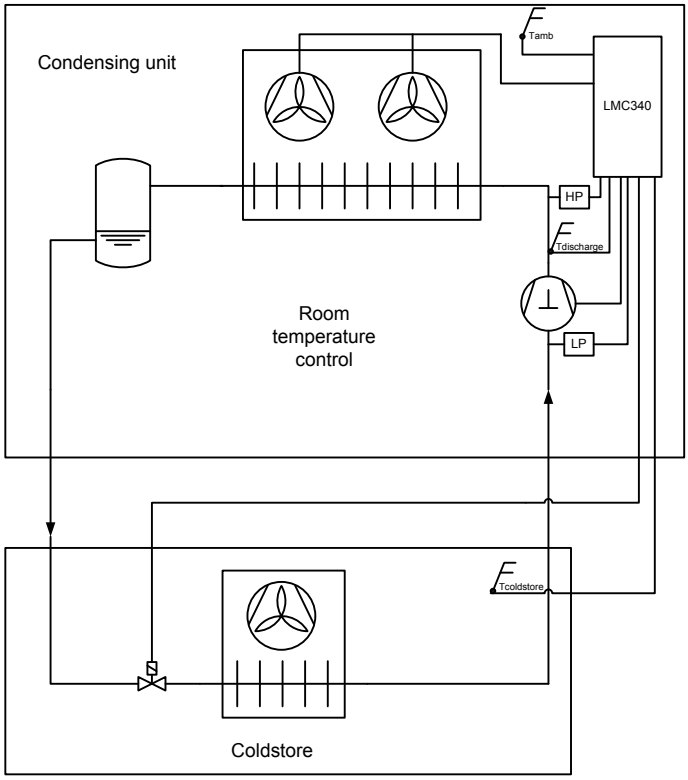
10.1. Suction pressure control mode

One or more display cabinets etc. can be supplied by one Condensing unit via the LMC340i Condensing unit controller.



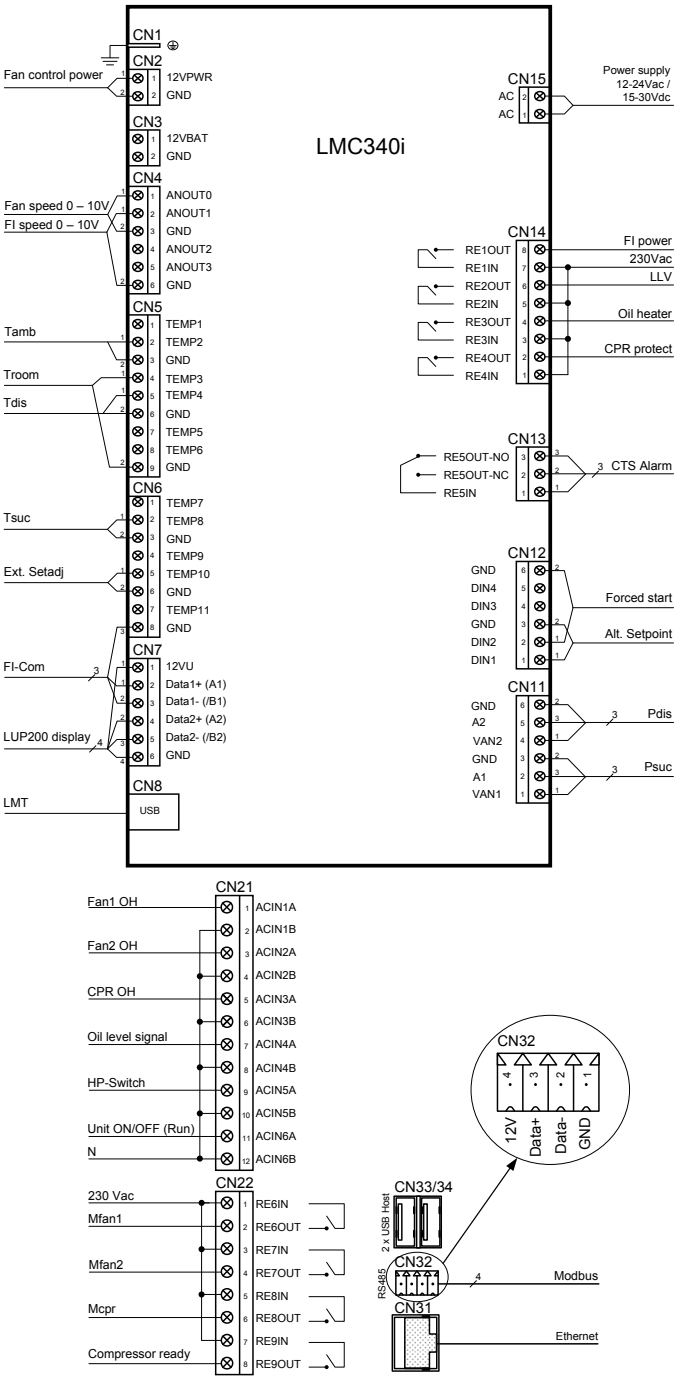
10.2. Room temperature control mode

The temperature in a coldstore can be controlled by the LMC340i Condensing unit controller.

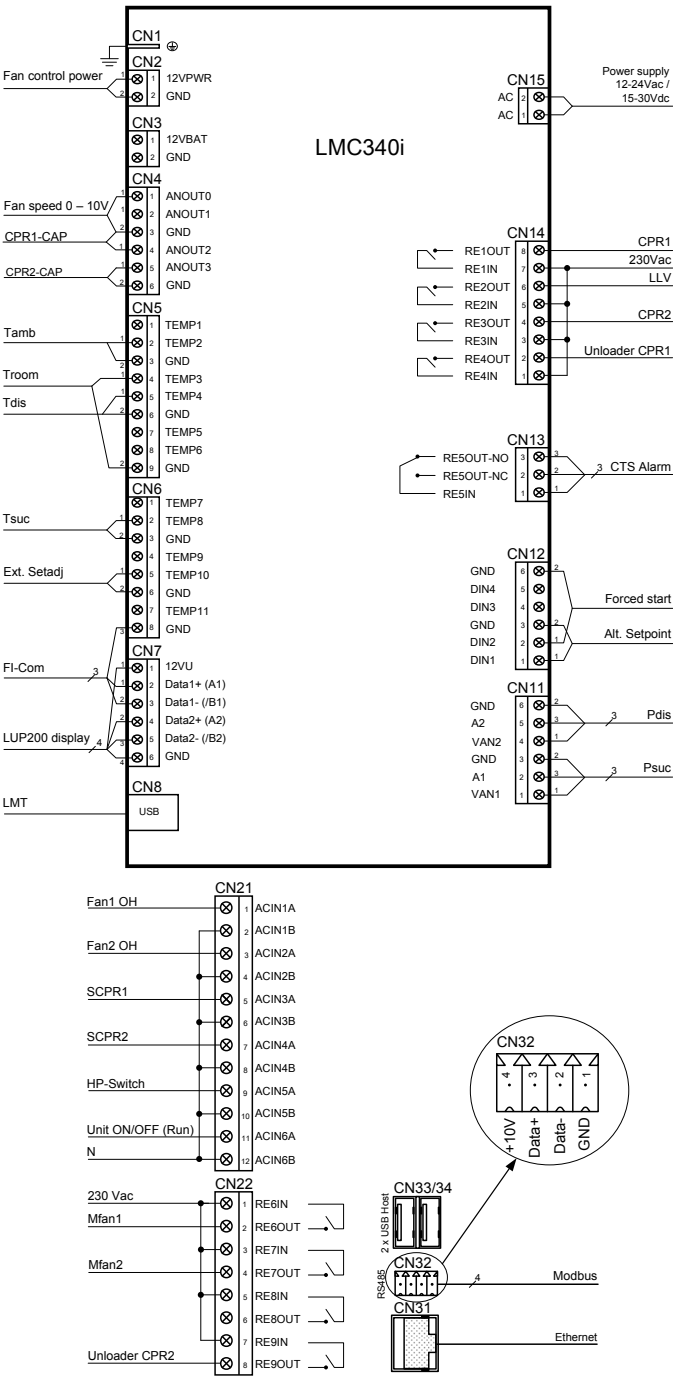


11. Connection

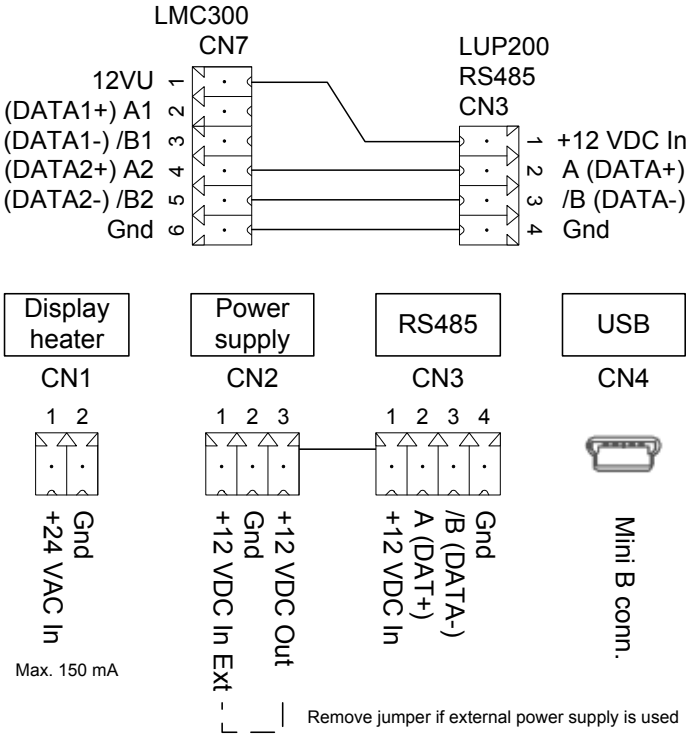
11.1. Single compressor configuration



11.2. Dual compressor configuration

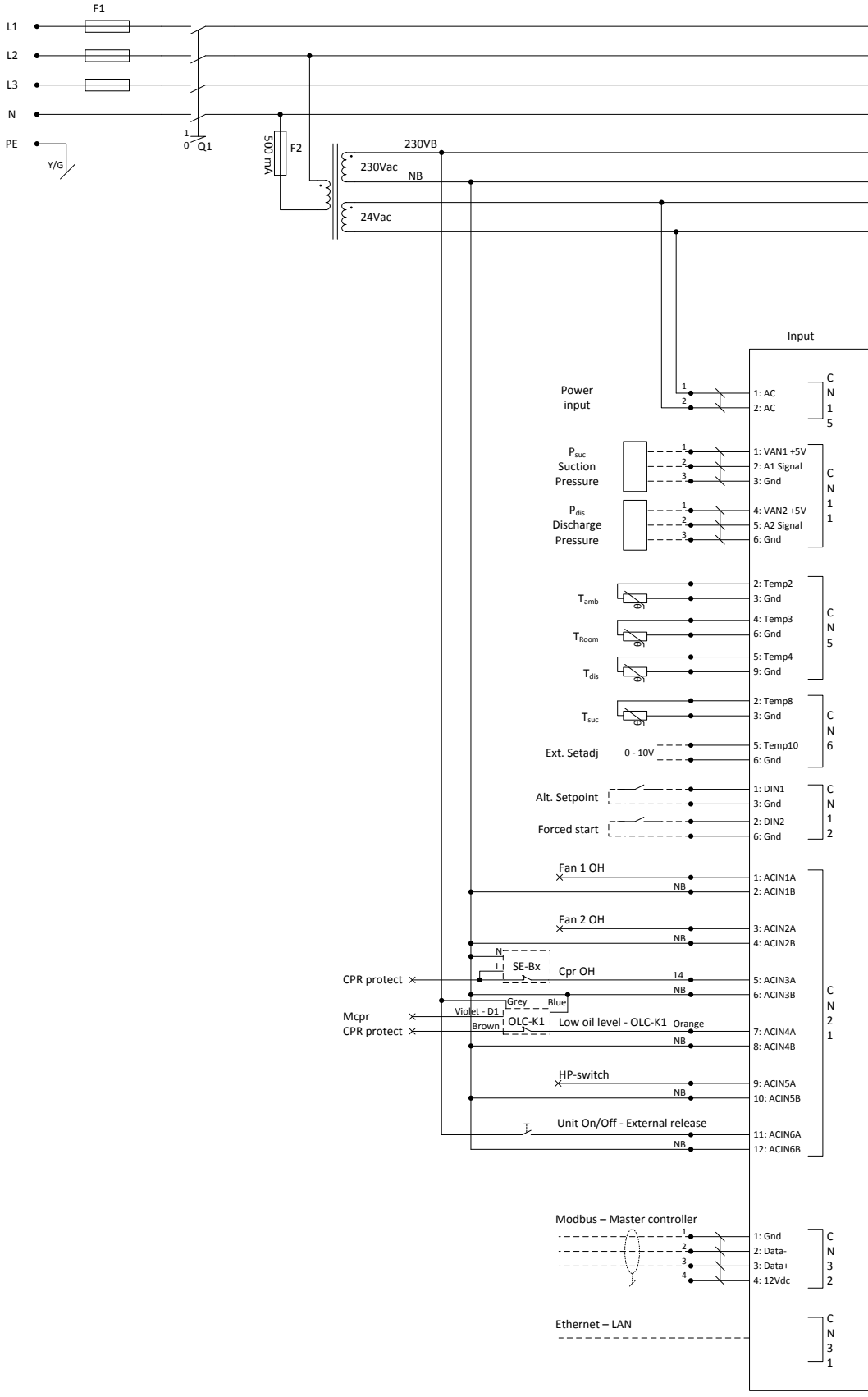


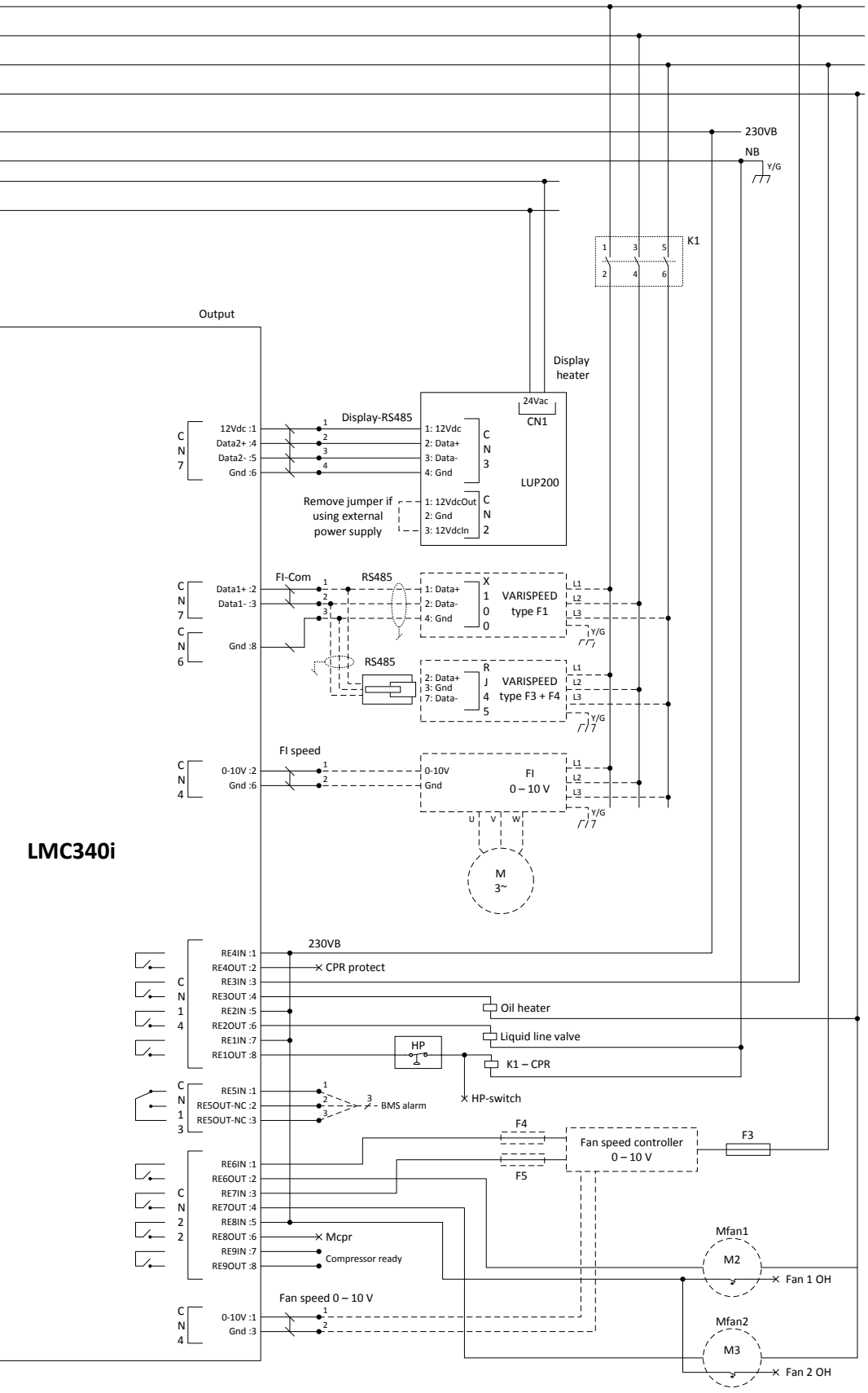
11.3. LUP200 connections



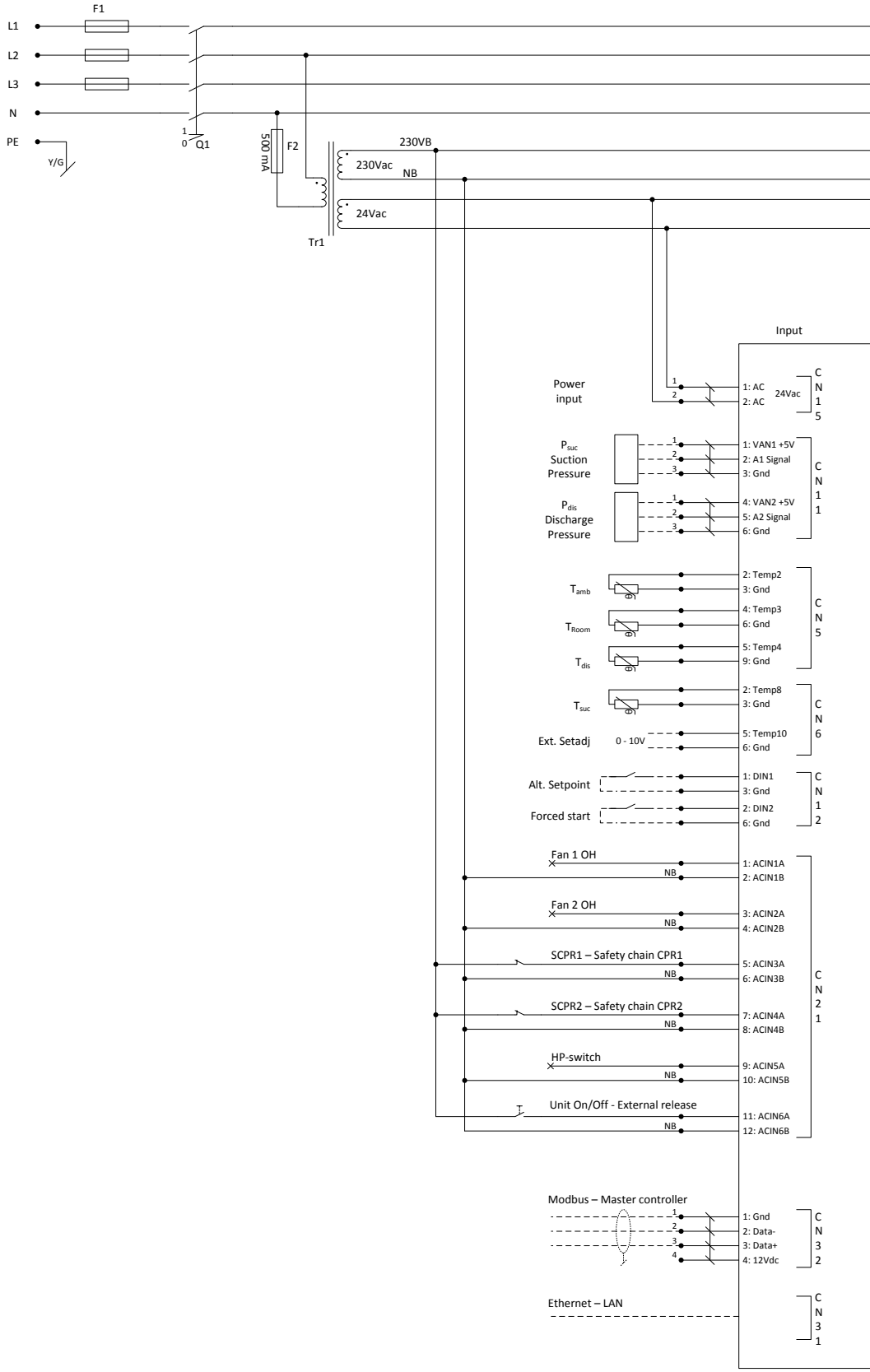
Note: The display heater must be connected to a 24VAC power supply capable of supplying up to 150 mA.

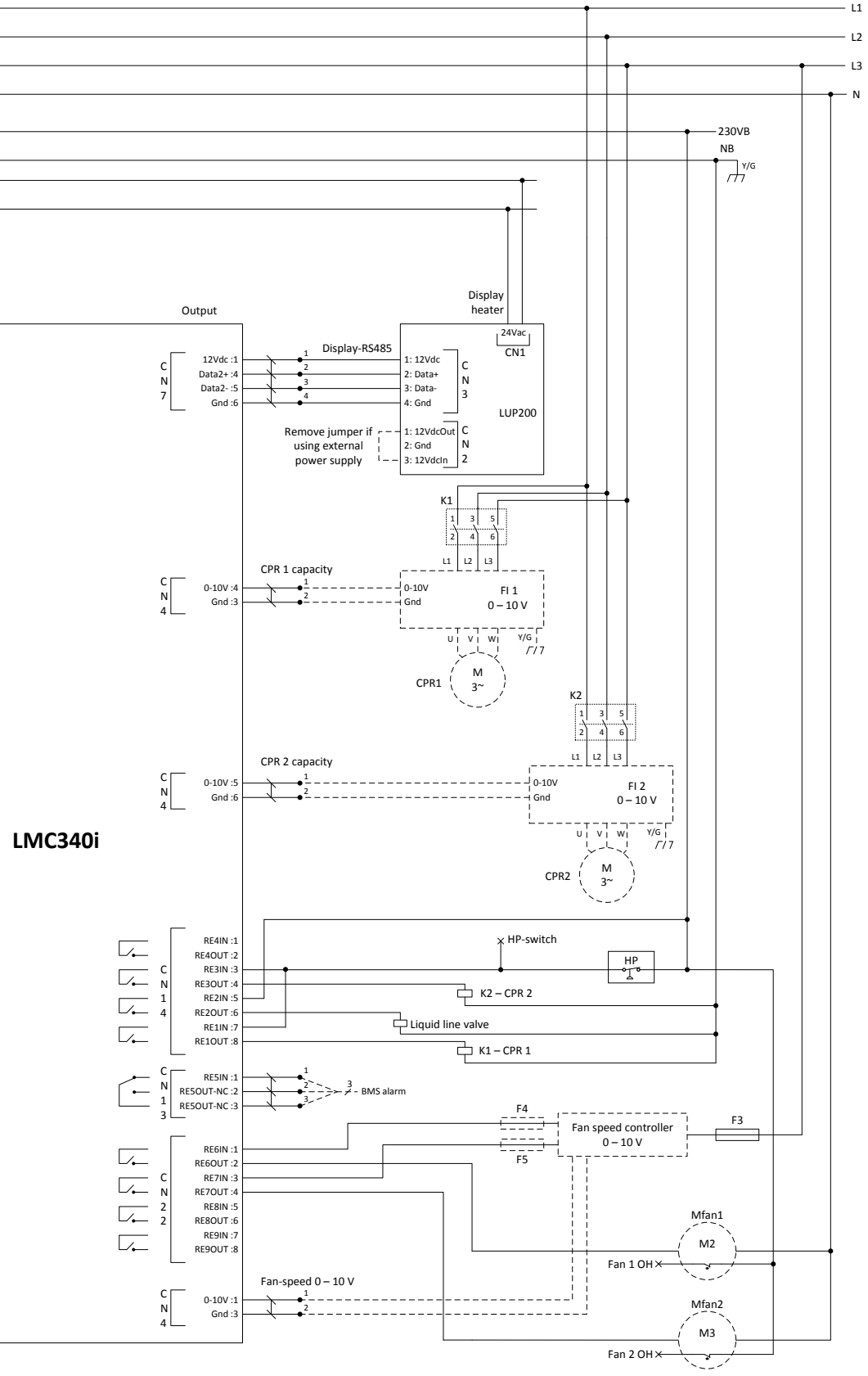
11.4. Wirediagram – single compressor use



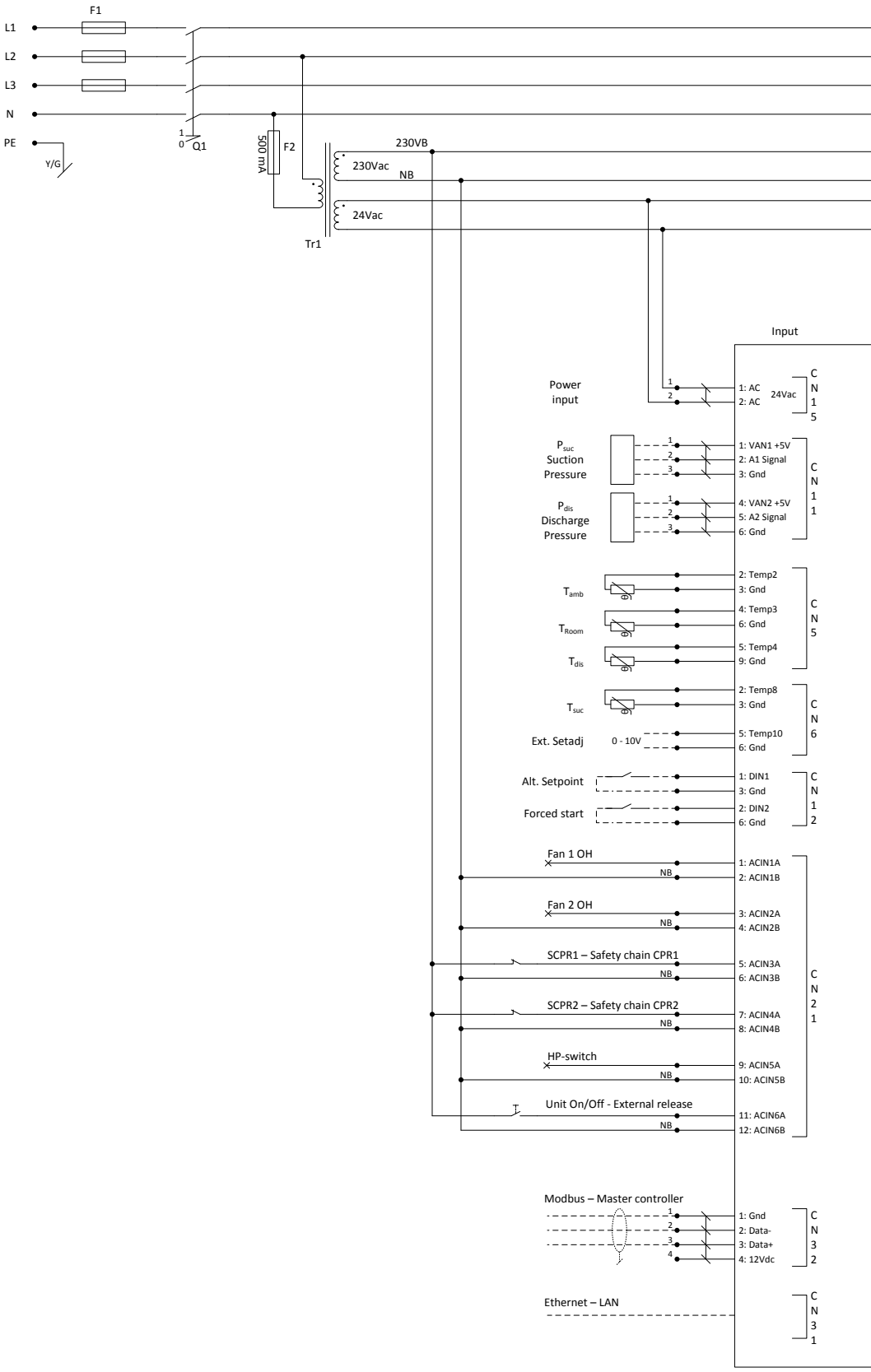

LMC340i
230VB
NB
Y/G
K1
Output
Display heater
24Vac
CN1
Display-RS485
12Vdc :1
Data2+ :4
Data2- :5
Gnd :6
C N 7
1: 12Vdc
2: Data+
3: Data-
4: Gnd
C N 3
LUP200
Remove jumper if using external power supply
1: 12VdcOut
2: Gnd
3: 12VdcIn
C N 2
FI-Com
RS485
Data1+ :2
Data1- :3
Gnd :8
C N 6
X 1 0 0
VARISPEED type F1
R J 4 5
VARISPEED type F3 + F4
L1
L2
L3
FI speed
0-10V :2
Gnd :6
C N 4
0-10V
Gnd
FI 0 – 10 V
U
V
W
M 3~
230VB
RE4IN :1
RE4OUT :2
RE3IN :3
RE3OUT :4
RE2IN :5
RE2OUT :6
RE1IN :7
RE1OUT :8
C N 1 4
CPR protect
Oil heater
Liquid line valve
HP
K1 – CPR
HP-switch
RE5IN :1
RE5OUT-NC :2
RE5OUT-NC :3
C N 1 3
BMS alarm
F4
F5
Fan speed controller 0 – 10 V
F3
RE6IN :1
RE6OUT :2
RE7IN :3
RE7OUT :4
RE8IN :5
RE8OUT :6
RE9IN :7
RE9OUT :8
C N 2 2
Mcpr
Compressor ready
Mfan1
M2
Fan 1 OH
Fan speed 0 – 10 V
0-10V :1
Gnd :3
C N 4
Mfan2
M3
Fan 2 OH

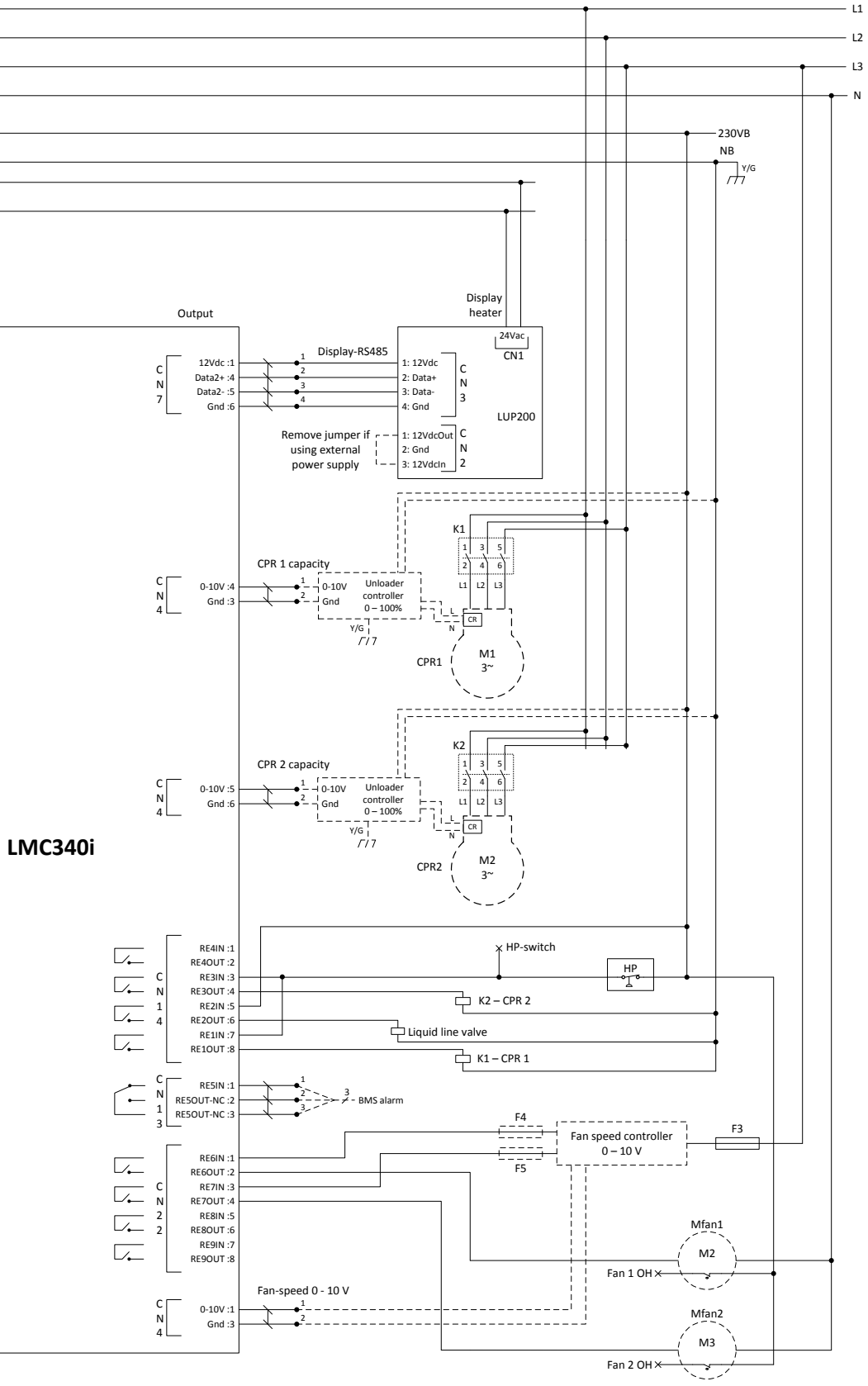
11.5. Wirediagram – dual compressors with FI or step less CR



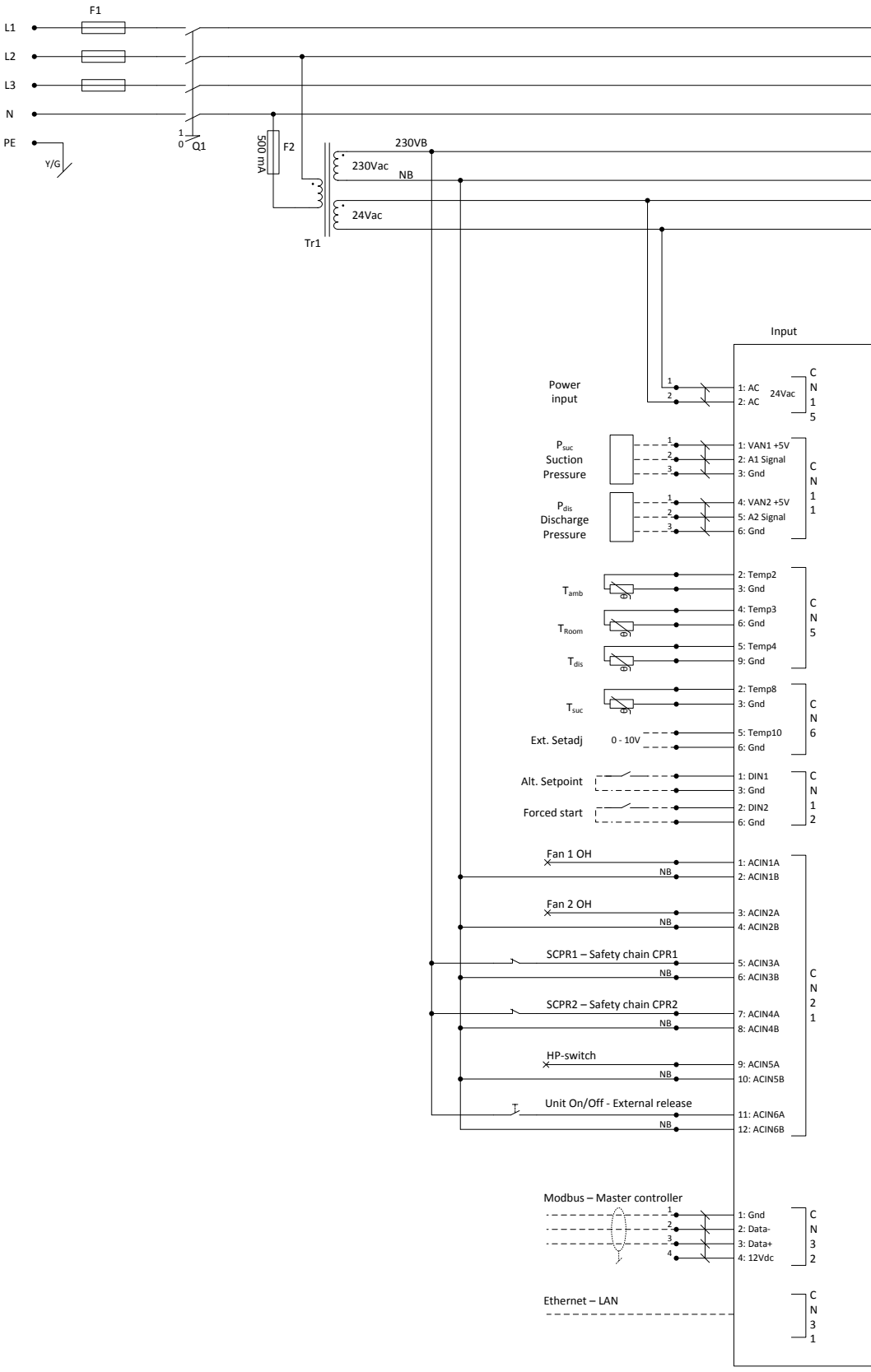

L1
L2
L3
N
230VB
NB
Y/G
Output
Display heater
24Vac
CN1
Display-RS485
12Vdc :1
Data2+ :4
Data2- :5
Gnd :6
CN7
1: 12Vdc
2: Data+
3: Data-
4: Gnd
CN3
LUP200
Remove jumper if using external power supply
1: 12VdcOut
2: Gnd
3: 12VdcIn
CN2
K1
L1 L2 L3
CPR 1 capacity
0-10V :4
Gnd :3
CN4
0-10V
Gnd
FI 1
0 – 10 V
U V W
Y/G
CPR1
M
3~
K2
CPR 2 capacity
0-10V :5
Gnd :6
FI 2
0 – 10 V
CPR2
LMC340i
RE4IN :1
RE4OUT :2
RE3IN :3
RE3OUT :4
RE2IN :5
RE2OUT :6
RE1IN :7
RE1OUT :8
CN14
HP-switch
HP
K2 – CPR 2
Liquid line valve
K1 – CPR 1
RE5IN :1
RE5OUT-NC :2
RE5OUT-NC :3
CN13
BMS alarm
F4
F5
Fan speed controller
0 – 10 V
F3
RE6IN :1
RE6OUT :2
RE7IN :3
RE7OUT :4
RE8IN :5
RE8OUT :6
RE9IN :7
RE9OUT :8
CN22
Mfan1
M2
Fan 1 OH
Fan-speed 0 – 10 V
0-10V :1
Gnd :3
CN4
Mfan2
M3
Fan 2 OH

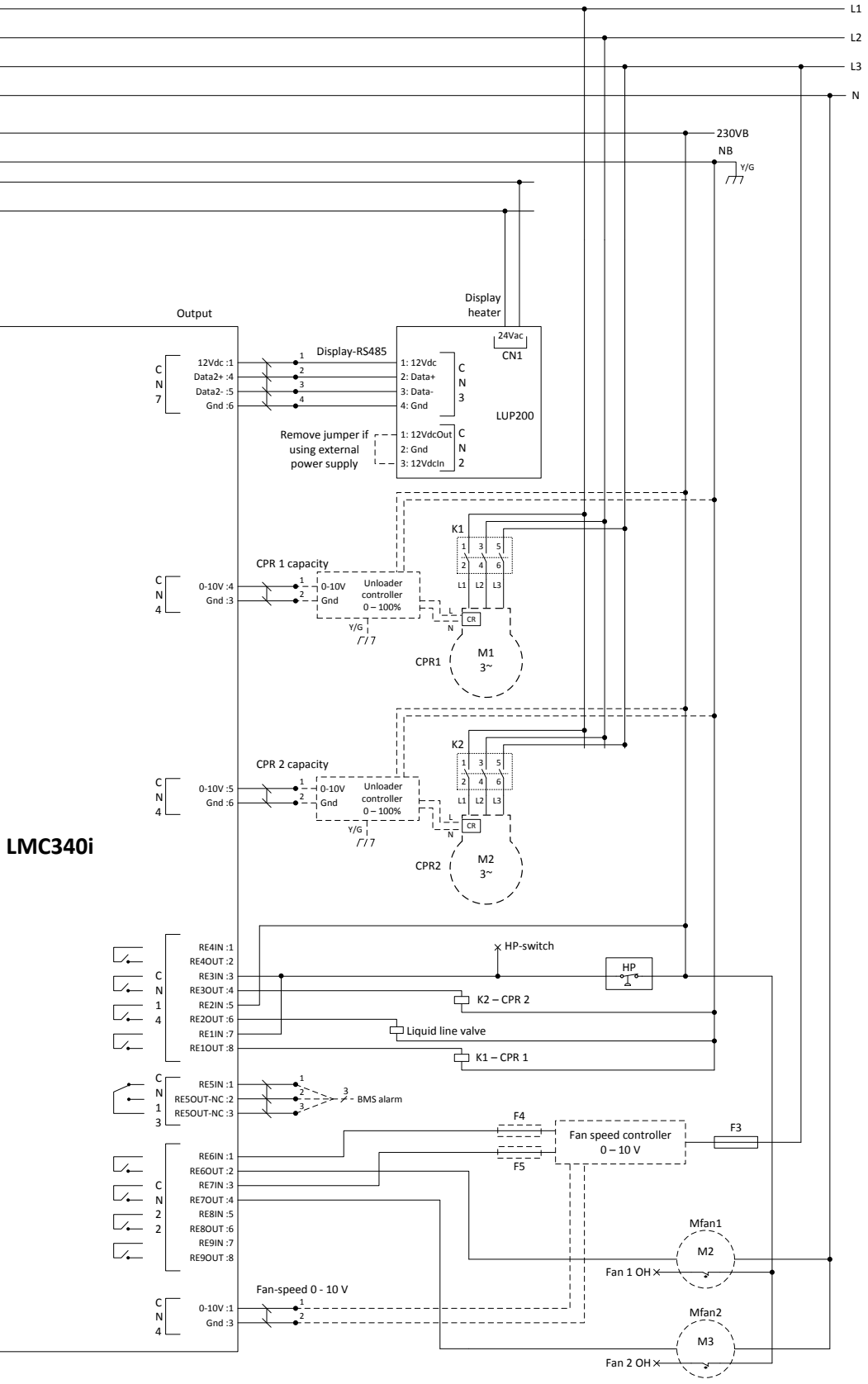
11.6. Wirediagram – dual compressor use with unloaders



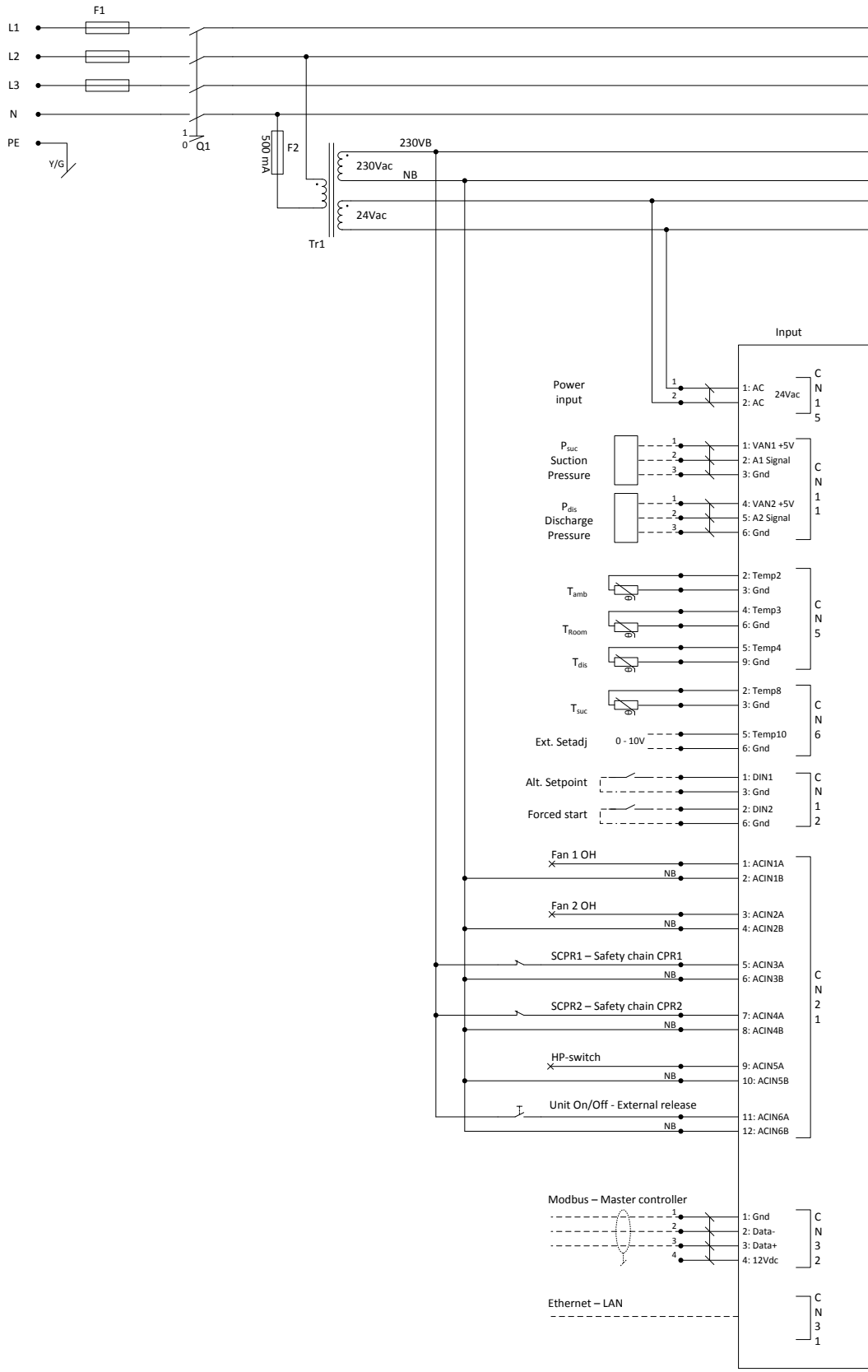

L1
L2
L3
N
230VB
NB
Y/G
Output
Display heater
24Vac
CN1
Display-RS485
C N 7
12Vdc :1
Data2+ :4
Data2- :5
Gnd :6
1: 12Vdc
2: Data+
3: Data-
4: Gnd
C N 3
LUP200
Remove jumper if using external power supply
1: 12VdcOut
2: Gnd
3: 12VdcIn
C N 2
K1
CPR 1 capacity
C N 4
0-10V :4
Gnd :3
0-10V
Gnd
Unloader controller 0 – 100%
CR
CPR1
M1 3~
K2
CPR 2 capacity
0-10V :5
Gnd :6
CPR2
M2 3~
LMC340i
C N 14
RE4IN :1
RE4OUT :2
RE3IN :3
RE3OUT :4
RE2IN :5
RE2OUT :6
RE1IN :7
RE1OUT :8
HP-switch
HP
K2 – CPR 2
Liquid line valve
K1 – CPR 1
C N 13
RE5IN :1
RE5OUT-NC :2
RE5OUT-NC :3
BMS alarm
F4
F5
Fan speed controller 0 – 10 V
F3
C N 22
RE6IN :1
RE6OUT :2
RE7IN :3
RE7OUT :4
RE8IN :5
RE8OUT :6
RE9IN :7
RE9OUT :8
Mfan1
M2
Fan 1 OH
Fan-speed 0 - 10 V
C N 4
0-10V :1
Gnd :3
Mfan2
M3
Fan 2 OH

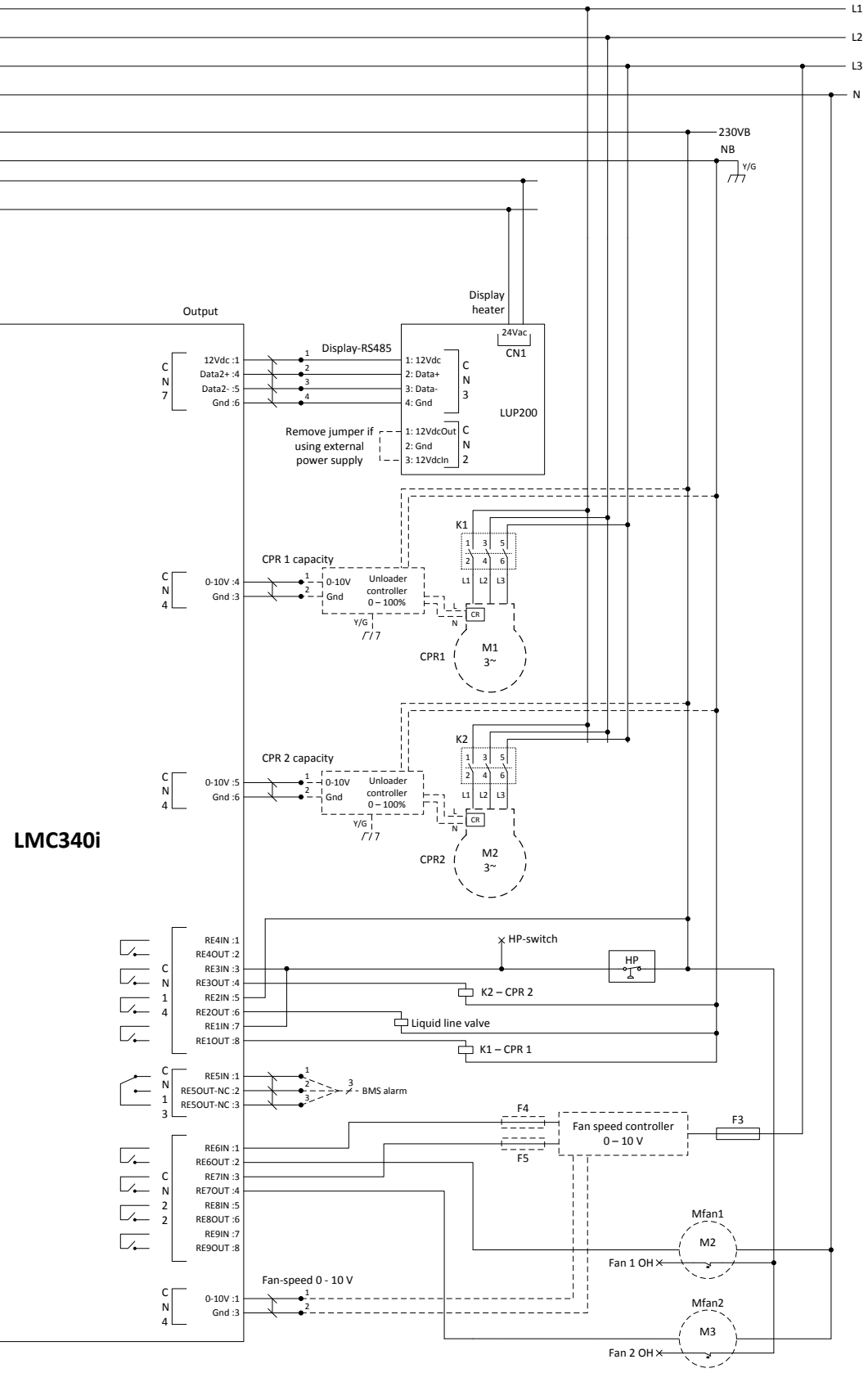
11.7. Wirediagram – dual compressor use with unloaders




L1
L2
L3
N
230VB
NB
Y/G
Output
Display heater
24Vac
CN1
Display-RS485
C N 7
12Vdc :1
Data2+ :4
Data2- :5
Gnd :6
1: 12Vdc
2: Data+
3: Data-
4: Gnd
C N 3
LUP200
Remove jumper if using external power supply
1: 12VdcOut
2: Gnd
3: 12VdcIn
C N 2
K1
CPR 1 capacity
C N 4
0-10V :4
Gnd :3
0-10V
Gnd
Unloader controller 0 – 100%
CR
CPR1
M1
3~
K2
CPR 2 capacity
0-10V :5
Gnd :6
CPR2
M2
3~
LMC340i
C N 14
RE4IN :1
RE4OUT :2
RE3IN :3
RE3OUT :4
RE2IN :5
RE2OUT :6
RE1IN :7
RE1OUT :8
HP-switch
HP
K2 – CPR 2
Liquid line valve
K1 – CPR 1
C N 13
RE5IN :1
RE5OUT-NC :2
RE5OUT-NC :3
BMS alarm
F4
F5
Fan speed controller 0 – 10 V
F3
C N 22
RE6IN :1
RE6OUT :2
RE7IN :3
RE7OUT :4
RE8IN :5
RE8OUT :6
RE9IN :7
RE9OUT :8
Mfan1
M2
Fan 1 OH
Fan-speed 0 - 10 V
C N 4
0-10V :1
Gnd :3
Mfan2
M3
Fan 2 OH

11.8. Wirediagram - dual compressor with one FI and one On/Off compressor




L1
L2
L3
N
230VB
NB
Y/G
Display heater
Output
24Vac
CN1
Display-RS485
12Vdc :1
Data2+ :4
Data2- :5
Gnd :6
CN7
1: 12Vdc
2: Data+
3: Data-
4: Gnd
CN3
LUP200
Remove jumper if using external power supply
1: 12VdcOut
2: Gnd
3: 12VdcIn
CN2
K1
CPR 1 capacity
0-10V :4
Gnd :3
CN4
0-10V
Gnd
Unloader controller 0 – 100%
CR
CPR1
M1
3~
K2
CPR 2 capacity
0-10V :5
Gnd :6
CPR2
M2
3~
LMC340i
RE4IN :1
RE4OUT :2
RE3IN :3
RE3OUT :4
RE2IN :5
RE2OUT :6
RE1IN :7
RE1OUT :8
CN14
HP-switch
HP
K2 – CPR 2
Liquid line valve
K1 – CPR 1
RE5IN :1
RE5OUT-NC :2
RE5OUT-NC :3
CN13
BMS alarm
F4
F5
Fan speed controller 0 – 10 V
F3
RE6IN :1
RE6OUT :2
RE7IN :3
RE7OUT :4
RE8IN :5
RE8OUT :6
RE9IN :7
RE9OUT :8
CN22
Mfan1
M2
Fan 1 OH
Fan-speed 0 - 10 V
0-10V :1
Gnd :3
CN4
Mfan2
M3
Fan 2 OH

12. Technical data

Technical specifications, LMC340i Condensing Unit controller	
Size	185mm (l) * 110mm (w) * 61mm (h)
Power supply	15 - 30VDC/12 - 24VAC 50-60 HZ; typical 4 VA, max. 15 VA
CPU	LMC340i ARM7 processor; Ethernet connection ARM9
Operating temperature	-20°C ~ +60°C
Storage temperature	-30°C ~ +60°C
Enclosure protection	IP20, 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.
Analogue inputs	2, AI1 and 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
High voltage digital input	6; 180-265VAC digital input. Double isolation to low power side
Analogue outputs	4, AnOut0 to AnOut3; 0-10V, +/- 3%, Rin > 10kOhm; max frequency 1Hz; not galvanically isolated
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 1 with optional 120 Ω termination resistor; used for Modbus
USB ports	1 device mode mini B for software update and communication with a PC 2 USB host A connector for software update and future use
Datalog	Up to 1 year capacity
Real time clock	With 1 year battery back up
12VDC output	Up to 500 mA
Ethernet connection	1; 10/100 Mbit

Note: The maximum cable length for a NTC temperature sensor is 30m. The cable used for extension should be screened and twisted-pair. Signal cable should be routed so the influence from the power cables is minimized.

Technical specification, LUP200i	
Display	262k colours, 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 cabinet1 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	24 VAC, max. 150 mA; thermo controlled
Number of buttons	6 buttons
Languages	English, German, French, Finnish, Spanish, Russian and Turkish
Cabinet mounting	8 pcs. 4 mm screws Max screw-in depth 6 mm Max tightening torque 3 Nm

Note1: Front is IP65 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.

13. I/O list for the LMC340i Condensing Unit controller

13.1. Single compressor configuration

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

I/O list, LMC340i Condensing Unit controller - Single compressor configuration

Name	Type	Pin	Logic	Description
Fan 1 OH	DI	ACIN1A CN21:1	NC	Klixon for fan motor 1 overheated 230 VAC ±15 %, 50/60Hz; min 5mA
Fan 2 OH	DI	ACIN2A CN21:3	NC	Klixon for fan motor 2 overheated 230 VAC ±15 %, 50/60Hz; min 5mA
Cpr. OH	DI	ACIN3A CN21:5	NC	Compressor overheated. Signal from compressor protection module 230 VAC ±15 %, 50/60Hz, min 5mA
Low oil level	DI	ACIN4A CN21:7	NC	Compressor oil level alarm. Signal from compressor protection module 230 VAC ±15 %, 50/60Hz, min 5mA
HP-Switch	DI	ACIN5A CN21:9	NC	High pressure safety switch signal 1 Activated by shortcutting to ground. 230 VAC ±15 %, 50/60Hz, min 5mA
Unit ON/OFF (Run) External release	DI	ACIN6A CN21:11	NO	Run command (On = Run) 230 VAC ±15 %, 50/60Hz, min 5mA
Alt. setpoint (Digital input 1)	DI	DIN1 CN12:1	NO	Toggle setpoint (function for digital input 1) Signal activated by short circuiting to ground. 3.3VDC, max 3.3mA, 1kΩ. 2 Not galvanic isolated.
Forced_start (Digital input 2)	DI	DIN2 CN12:2	NO	Start a forced start (function for digital input 2) Signal activated by short circuiting to ground. 3.3VDC, max 3.3mA, 1kΩ. 2 Not galvanic isolated.
(Reset Password)	DI	DIN3 CN12:4	NO	Resets passwords when short circuiting to ground for more than 3 seconds. 3.3VDC, max 3.3mA, 1kΩ. Not galvanic isolated.
(Not used)	DI	DIN4 CN12:5	NO	Not used 3.3VDC, max 3.3mA, 1kΩ. Not galvanic isolated.
Tamb Ambient temperature	T	Temp2 CN5:2		Ambient temperature Lodam NTC sensor Measurement range: -40°C to 130°C Accuracy: • ±1°C in the range -10°C to 60°C • ±3°C in the range -40°C to -10 °C • ±3°C in the range +60°C to 130°C 2 terminals per input • Signal • Gnd

I/O list, LMC340i Condensing Unit controller - Single compressor configuration				
Name	Type	Pin	Logic	Description
Troom Room temperature	T	Temp3 CN5:4		Room (coldstore) temperature Lodam NTC sensor Measurement range: -60°C to 100°C Accuracy: • ±1°C in the range -30°C to 60°C • ±3°C in the range -60°C to -30 °C • ±3°C in the range +60°C to 100°C 2 terminals per input • Signal • Gnd
Tdis Discharge temperature	T	Temp4 CN5:5		Discharge temperature Lodam NTC sensor Measurement range: -40°C to 130°C Accuracy: • ±1°C in the range -10°C to 60°C • ±3°C in the range -40°C to -10 °C • ±3°C in the range +60°C to 130°C 2 terminals per input • Signal • Gnd
Tsuc Suction line temperature	T	Temp8 CN6:2		Suction line temperature Lodam NTC sensor Measurement range: -60°C to 100°C Accuracy: • ±1°C in the range -30°C to 60°C • ±3°C in the range -60°C to -30 °C • ±3°C in the range +60°C to 100°C 2 terminals per input • Signal • Gnd
Ext. Setadj External setpoint adjust-ment	T	Temp10 CN6:5		External setpoint adjustment. · 0 – 10V · 4 – 20 mA: A 150 Ω resistor must be mounted from Temp10 to Gnd Not galvanic isolated.
Psuc Suction pressure	AI	A1 CN11:2		Suction pressure For use with Sensata 2CP5-49 200 psia (absolute) 0 – 5V
Pdis Discharge pressure	AI	A2 CN11:5		Discharge pressure For use with Sensata 2CP5-47 500 psig (rel.) 0 – 5V
Fan-speed 0 – 10 V	AO	Anout0 CN4:1		Fan speed for condenser fan controller 0 – 10V, 5mA Not galvanic isolated.
FI-Speed	AO	Anout1 CN4:2		Compressor speed – for test purposes 0; 2.5 – 8.7V (Off; 25 – 87Hz) 0 – 10V, 5mA Not galvanic isolated.
N/A	AO	Anout2 CN4:4		N/A
N/A	AO	Anout3 CN4:5		N/A
FI-Com	S	Data1+ CN7:2 Data1- CN7:3 GND CN6:8 (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 · Data+ (A1) · Data- (/B1)

I/O list, LMC340i Condensing Unit controller - Single compressor configuration				
Name	Type	Pin	Logic	Description
Display (LUP200)	S	Data2+ CN7:4 Data2- CN7:5 GND CN7:6 (RS485)		RS 485 cable for display communication (LUP200) Half duplex, max. 100m twisted pair cable, 2 * 120Ω termination. Receiver impedance >= 12kΩ • +12V (I-limit approx. 100mA) • GND • Data2+ (A2) • Data2- (/B2)
Ethernet	S	Ethernet CN31		10/100 Mbit TIA/EIA 568
Modbus External master controller	S	Data+ CN32:3 Data2- CN32:2 GND CN32:1 (RS485)		RS 485 cable for Modbus communication with external controller Half duplex, max. 100m twisted pair cable, 2 * 120Ω termination. Receiver impedance >= 12kΩ • +12V (I-limit approx. 100mA) • GND • Data+ (A) • Data- (/B)
Fan control power	P	12PWR CN2:1 GND CN2:2		Power for fan speed controller 12V, max 500 mA.
K1 Compressor FI power	DO	RE1OUT CN14:8		Relay for compressor ON Max 10A@250VAC/10A@30VDC
LLV Liquid line valve	DO	RE2OUT CN14:6		Relay for solenoid valve in liquid line / Signal that oil return function is active Max 10A@250VAC/10A@30VDC
Oil heater	DO	RE3OUT CN14:4		Relay for oli heater Max 10A@250VAC/10A@30VDC
CPR protect	DO	RE4OUT CN14:2		Relay for power for compressor protection modules Max 10A@250VAC/10@30VDC
BMS Alarm	DO	RE5OUT-NO CN13:3		Relay for alarm Max 10A@250VAC/10@30VDC
Mfan1	DO	RE6OUT CN22:2		Relay for fan motor 1 Max 10A@250VAC/5A@30VDC
Mfan2	DO	RE7OUT CN22:4		Relay for fan motor 2 Max 10A@250VAC/5A@30VDC
Mcpr	DO	RE8OUT CN22:6		Relay signal that compressor is running (for compressor protection device) Max 10A@250VAC/5A@30VDC
Compressor ready/ Unloader	DO	RE9OUT CN22:8		Relay for an expansion valve release / Unloader relay when using in compressor with unloader mode for capacity regulation Max 10A@250VAC/5A@30VDC
Power supply	P	AC CN15:1/2		Power supply for the LMC340i 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.

13.2. Dual compressor configuration

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

I/O list, LMC340i Condensing Unit controller - Dual compressor configuration				
Name	Type	Pin	Logic	Description
Fan 1 OH	DI	ACIN1A CN21:1	NC	Klixon for fan motor 1 overheated 230 VAC ffl15 %, 50/60Hz; min 5mA
Fan 2 OH	DI	ACIN2A CN21:3	NC	Klixon for fan motor 2 overheated 230 VAC ffl15 %, 50/60Hz; min 5mA
SCPR1	DI	ACIN3A CN21:5	NO	Security chain compressor 1. Signal from compressor protection modules 230 VAC ffl15 %, 50/60Hz, min 5mA
SCPR2	DI	ACIN4A CN21:7	NO	Security chain compressor 2. Signal from compressor protection modules 230 VAC ffl15 %, 50/60Hz, min 5mA
HP-Switch	DI	ACIN5A CN21:9	NC	High pressure safety switch signal 1 Activated by shortcutting to ground. 230 VAC ffl15 %, 50/60Hz, min 5mA
Unit ON/OFF (Run)	DI	ACIN6A CN21:11	NO	Run command (On = Run) 230 VAC ffl15 %, 50/60Hz, min 5mA
Alt. setpoint (Digital input 1)	DI	DIN1 CN12:1	NO	Toggle setpoint (function for digital input 1) Signal activated by short circuiting to ground. 3.3VDC, max 3.3mA, 1k◈. 2 Not galvanic isolated.
Forced_start (Digital input 2)	DI	DIN2 CN12:1	NO	Start a forced start (function for digital input 2) Signal activated by short circuiting to ground. 3.3VDC, max 3.3mA, 1k◈. 2 Not galvanic isolated.
(Reset Password)	DI	DIN3 CN12:4	NO	Resets passwords when short circuiting to ground for more than 3 seconds. 3.3VDC, max 3.3mA, 1k◈. Not galvanic isolated.
Tamb Ambient temperature	T	Temp2 CN5:2		Ambient temperature Lodam NTC sensor Measurement range: -40°C to 130°C Accuracy: • ffl1°C in the range -10°C to 60°C • ffl3°C in the range -40°C to -10 °C • ffl3°C in the range +60°C to 130°C 2 terminals per input • Signal • Gnd
Troom Room temperature	T	Temp3 CN5:4		Room (coldstore) temperature Lodam NTC sensor Measurement range: -60°C to 100°C Accuracy: • ffl1°C in the range -30°C to 60°C • ffl3°C in the range -60°C to -30 °C • ffl3°C in the range +60°C to 100°C 2 terminals per input • Signal • Gnd
Tdis Tdis Discharge temperature	T	Temp4 CN5:5		Discharge temperature Lodam NTC sensor Measurement range: -40°C to 130°C Accuracy: • ffl1°C in the range -10°C to 60°C • ffl3°C in the range -40°C to -10 °C • ffl3°C in the range +60°C to 130°C 2 terminals per input • Signal • Gnd

I/O list, LMC340i Condensing Unit controller - Dual compressor configuration				
Name	Type	Pin	Logic	Description
Tsuc Suction line temperature	T	Temp8 CN6:2		Suction line temperature Lodam NTC sensor Measurement range: -60ºC to 100ºC Accuracy: • ffl1ºC in the range -30ºC to 60ºC • ffl3ºC in the range -60ºC to -30 ºC • ffl3ºC in the range +60ºC to 100ºC 2 terminals per input • Signal • Gnd
Ext. Setadj External setpoint adjust-ment	T	vTemp10 CN6:5		External setpoint adjustment. A 10 kΩ 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 Suction pressure	AI	A1 CN11:2		Suction pressure For use with Sensata 2CP5-49 200 psia (absolute) 0 – 5V
Pdis Discharge pressure	AI	A2 CN11:5		Discharge pressure For use with Sensata 2CP5-47 500 psig (rel.) 0 – 5V
Fan speed 0-10V	AO	Anout0 CN4:1		Fan speed for condenser fan controller 0 – 10V, 10mA Not galvanic isolated.
FI Speed	AO	Anout1 CN4:2		Compressor capacity – for test purposes 0 – 10V (0 – 100%) 0 – 10V, 5mA Not galvanic isolated.
CPR1-CAP	AO	Anout2 CN4:4		Compressor 1 capacity 0 – 10V, 5mA Not galvanic isolated.
CPR2-CAP	AO	Anout3 CN4:5		Compressor 2 capacity 0 – 10V, 5mA Not galvanic isolated.
FI-Com	S	Data1+ CN7:2 Data1- CN7:3 GND CN6:8 (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 • Data+ (A1) • Data- (/B1)
Display (LUP200)	S	Data2+ CN7:4 Data2- CN7:5 GND CN7:6 (RS485)		RS 485 cable for display communication (LUP200) Half duplex, max. 100m twisted pair cable, 2 * 120Ω termination. Receiver impedance >= 12kΩ • +12V (I-limit approx. 100mA) • GND • Data2+ (A2) • Data2- (/B2)
Ethernet	S	Ethernet CN31		10/100 Mbit TIA/EIA 568
Modbus External master controller	S	Data+ CN32:3 Data2- CN32:2 GND CN32:1 (RS485)		RS 485 cable for Modbus communication with external controller Half duplex, max. 100m twisted pair cable, 2 * 120Ω termination. Receiver impedance >= 12kΩ • +12V (I-limit approx. 100mA) • GND • Data+ (A) • Data- (/B)
Fan control power	P	12PWR CN2:1 GND CN2:2		Power for fan controller 12V, max 500 mA.
CPR1	DO	RE1OUT CN14:8	NO	Relay for compressor 1 ON/OFF Max 10A@250VAC/10A@30VDC
LLV Liquid line valve	DO	RE2OUT CN14:6	NO	Relay for solenoid valve in liquid line / Signal that oil return function is active Max 10A@250VAC/10A@30VDC

I/O list, LMC340i Condensing Unit controller - Dual compressor configuration				
Name	Type	Pin	Logic	Description
CPR2	DO	RE3OUT CN14:4	NO	Relay for compressor 2 ON/OFF Max 10A@250VAC/10A@30VDC
Unloader 1 (3)	DO	RE4OUT CN14:2	NO	Relay for unloader capacity regulation CPR 1 Max 10A@250VAC/10@30VDC
BMS Alarm	DO	RE5OUT-NO CN13:3	NC	Relay for alarm for external system Max 10A@250VAC/10@30VDC
Mfan1	DO	RE6OUT CN22:2	NO	Relay for fan motor 1 ON/OFF Max 10A@250VAC/5A@30VDC
Mfan2	DO	RE7OUT CN22:4	NO	Relay for fan motor 2 ON/OFF Max 10A@250VAC/5A@30VDC
Unloader 2 (3)	DO	RE9OUT CN22:8	NO	Relay for unloader capacity regulation CPR 2 Max 10A@250VAC/10@30VDC
Power supply	P	AC CN2:1/2	–	Power supply for the LMC340i 12 – 24 VAC / 15 – 30 VDC; 4 – 15 VA

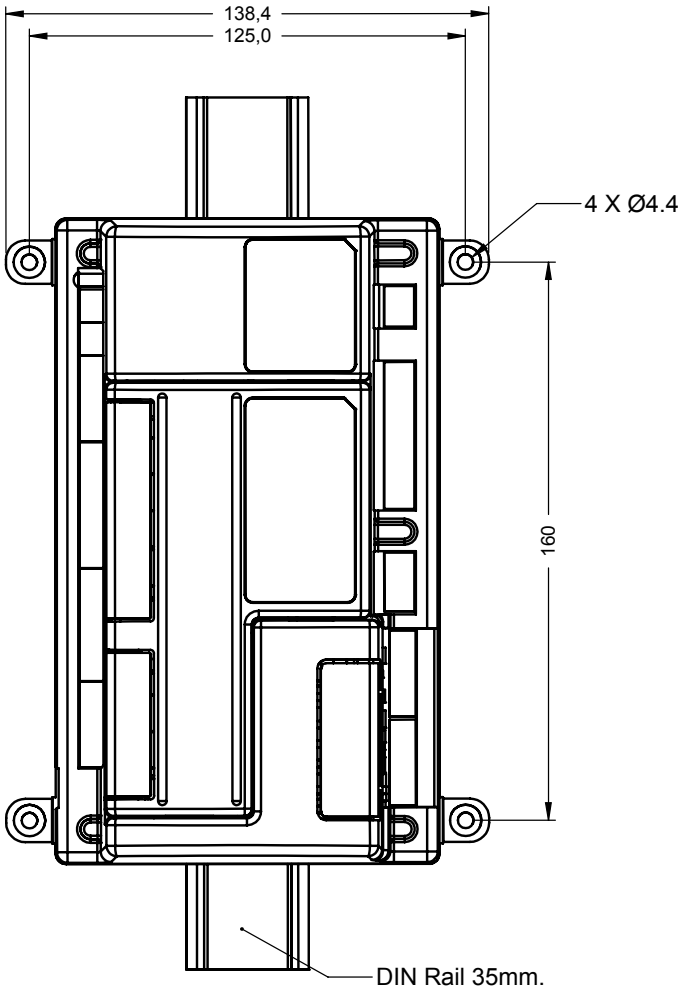
Note 1: Power to the compressor must be cut off by external safety chain when high pressure switch is activated!

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.

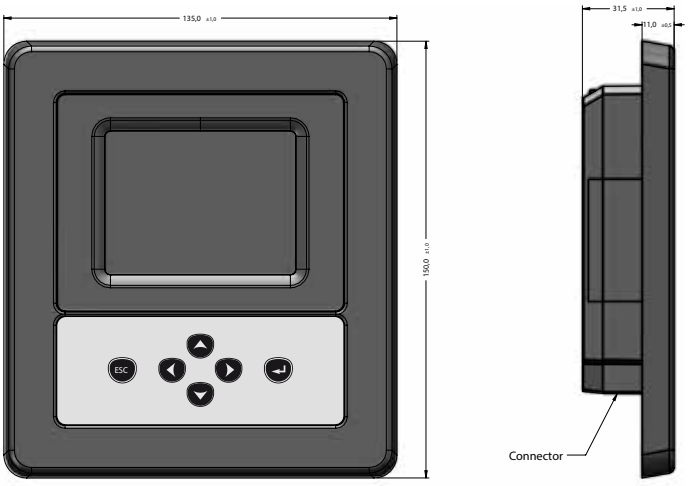
Note 3: The unloader(s) cannot be used together with an inverter configuration.

14. Drawings

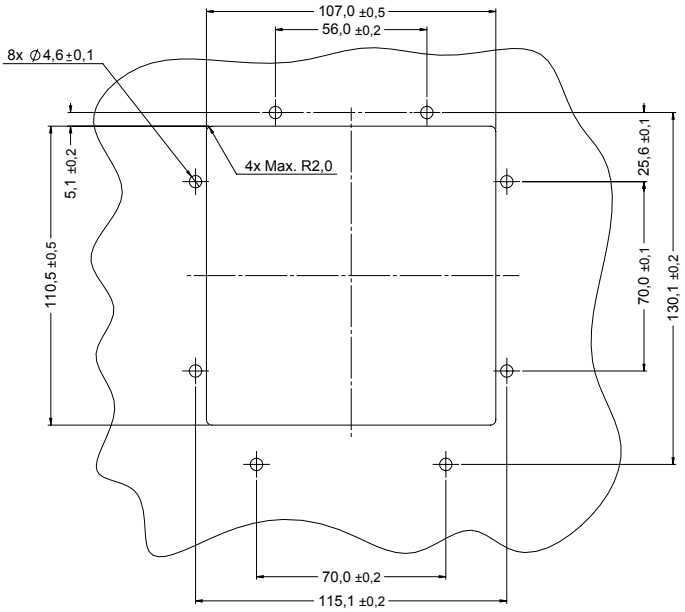
All dimensions in mm. LMC300 Mounting dimensions.



LUP200



Panel cutout



15. Standards

15.1. The product is designed according to the following directives

2006/95/EC Low Voltage Directive (LVD)

2004/108/EC Electromagnetic Compatibility (EMC)

2002/95/EC RoHS Compliance

15.2. The product is tested according to the following 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)

16. 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 at 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.

12) Several temperatures shows -100 ºC in the display menu. The model code is still set to None. The controller needs a model code for configuration of the inputs and outputs.

17. Alarm system and trouble shooting

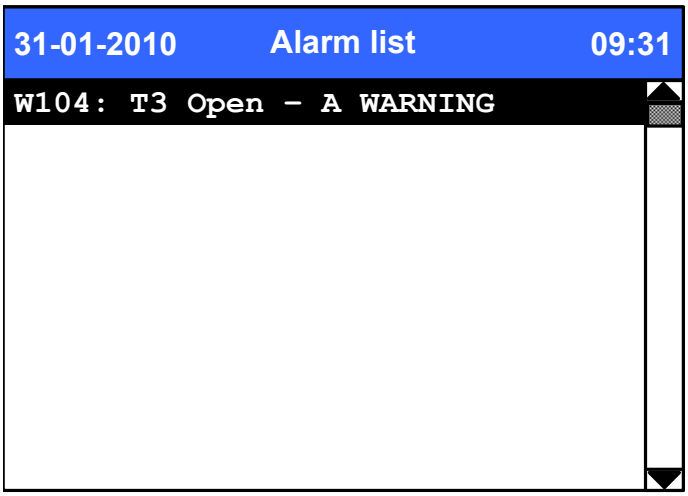
The LMC340i controller is equipped with a failure and alarm diagnoses system. There are three alarm levels: Warning, Alarm and Critical. A warning does not stop the unit but affects its temperature control precision. An alarm will stop the unit and it will restart after the restart delay.

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 cannot be acknowledged before the connection has been fixed.

Up to 16 alarms at the same time can be shown



17.1. Alarm list and trouble shooting

Failure code	Cause	Troubleshooting
Requesting data	Communication between display and controller faulty or interrupted.	Check cable and connector LMC340i: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 LMC340i: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 LMC340i: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 LMC340i:CN5:4/9. 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 LMC340i:CN5:1/6. Check resistance of sensor according to table: NTC temperature/resistance table
W114/ W115	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.
C122/ C123	Circuit of low pressure transmitter open or short circuit	Check cables and connector LMC340i:CN11:1/2/3. Replace low pressure transmitter
W124/ W125	Circuit of high pressure transmitter open or short circuit	Check cables and connector LMC340i:CN11:4/5/6. Replace high pressure transmitter
Frequency inverter (FI)		
C500	No BUS communication to FI	Check data cable and connector LMC340i:CN6:/8 and LMC340i:CN7:2/3. Check power supply of FI. Replace data cable or FI if necessary.
C501	FC local control	The FI is set I local control mode. Use a hand terminal to change the setting to remote control.
C502	FC EEPROM error	The FI is defect
C503	FC stator error	The wiring between the FI and the compressor motor is wrong. Wire correct.
C504	FC AnalogRef 1 error	Signal level to the FI analogue input 1 is faulty
C505	FC AnalogRef 2 error	Signal level to the FI analogue input 2 is faulty
C506	FC AnalogRef31 error	Signal level to the FI analogue input 3 is faulty
C507	FC Serial communication Error	Check the communication cable from LMC340i:CN6:8, CN7:2 and CN7:3 to the FI. The Serial port of the FI is defect.
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.

Failure code	Cause	Troubleshooting
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.
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.
C520	FC over speed	FI speed is above setpoint. Check compressor valves, a broken valve can give this alarm
C521	FI Auto tune Error	After replacement of a FI the auto tune failed. Check wiring to the compressor motor.
C564	FI Brake Resistor	The temperature in the F3 FI is too high. Power off for 5 min and see if it settles. Check refrigerant charge as this is used for FI cooling.
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.
Operation		
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.
C611	To, suction temperature activated repeatedly	The capacity of the compressor is too high or too small expansion valve.
C620	Dual pressure switch active	High or low pressure fault, check fans and expansion valves. 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 the defrost interval.

Failure code	Cause	Troubleshooting
C625	Liquid in suction line	Check injection regulators on the evaporator. Check the defrost interval.
W626	Liquid in discharge line	Check injection regulators on the evaporator. Check the defrost interval.
C627	Liquid in discharge line	Check injection regulators on the evaporator. Check the defrost interval.
C628	Multiple liquid discharge line	Check injection regulators on the evaporators or adjust settings for detection of multiple times liquid in the discharge line
C629	Multiple liquid suction line	Check injection regulators on the evaporators or adjust settings for detection of multiple times liquid in the suction line
Controller		
W905	Failure in the data base of the controller	Note all changed settings and perform a factory reset in the Installer.Service section. Update LMC340i controller software. Replace LMC340i controller if necessary.
W907	Failure of the LM340 controllers real time clock	Replace the LMC340i 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 LMC340i controller if necessary.
W909	No model code	Some temperatures will also show -100 °C. Open the factory menu and set the correct compressor control mode in the Model Code field.
W998	Test version	The software in the controller is a test version. Update the LMC340i controller software to a released version
W999	The unit is in manual mode	Change mode from Manual to On in User.Mode

17.2. Alarm parameters

Together with the alarm up to 4 parameters are also stored according to the table below.

Alarm no.	Parameter 2	Parameter 3	Parameter 4	Parameter 5
Sensor alarms				
100-125	Lower alarm activation limit	Upper alarm activation limit	Actual value	-
FC alarms				
500-599	FC Speed	FC Current	FC Temp	FC Voltage
Operation alarms				
600-605	Psuc	Tsuc	Pdis	Tdis
606	Temperature setpoint	Actual temperature	External reference	-
607	-	-	-	-
608	Psuc	Tsuc	Pdis	Tdis
609	Psuc	Pdis	Tdis	TC
610	Psuc	Pdis	Tdis	Ifc
611	Psuc	Pdis	Tdis	T0
620	Psuc	Tsuc	Pdis	Tdis
621	Psuc	Tsuc	Pdis	Tdis
622	Psuc	Tsuc	Pdis	Tdis
623	Psuc	Tsuc	Pdis	Tdis
Internal alarms				
624-629	T0	Tsuc	TC	Tdis
904-909	-	-	-	-
998-999	-	-	-	-

17.3. Events in the datalog

The controller stores the following configuration changes in the datalog.

Event no.	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
0: Power-Up	SW ver. 1	SW ver. 2	SW ver. 3	SW ver. 3	-
1: Main switch change	New value	Old Value	-	-	-
2: Control mode change	New value	Old Value	-	-	-
3: Database reset	Project code	Model code	Refrigerant	-	-
4: Model code change	New value	Old Value	-	-	-
5: System reset	SW ver. 1	SW ver. 2	SW ver. 3	SW ver. 3	-
6: Compressor mode change	New value	Old Value	-	-	-
7: Fan mode change	New value	Old Value	-	-	-
8: Psuc emergency mode	New value	Old Value	-	-	-
9: Tset change	New value	Old Value	-	-	-

18. Emergency operation

18.1. Frequency inverter

The LMC340i 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 LMC340i controller must be changed to enable. On/Off operation. In **Installer.Service.No-FI emergency mode** the default No must be changed to **Yes.**

18.2. Fan controller

In case of fan controller malfunction or operation without a 0 – 100% fan speed controller, the LMC340i 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.

19. Expansion options

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

20. 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.

21. Firmware update

Firmware update is done from Lodams Multi Tool, LMT. This will update the software in the LMC340i controller and the LUP200 display if necessary.

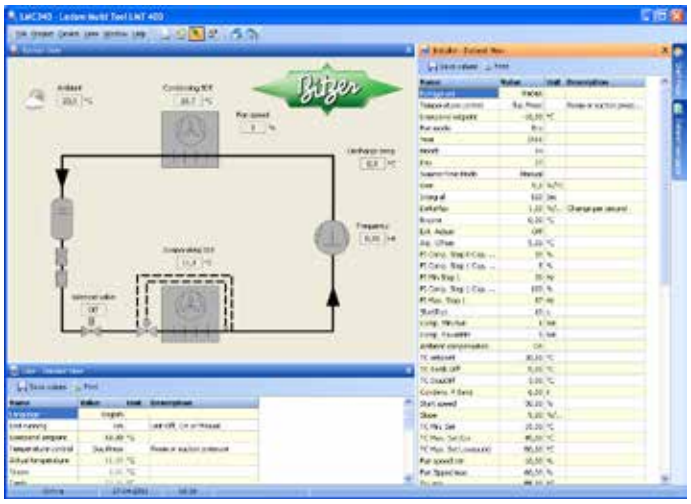
If the firmware in the LOM320 Ethernet board should be updated, this can be done using a USB memory stick in one of its 2 USB type A connectors or via a firmware update on its webpage.

22. Downloading the datalog from the controller

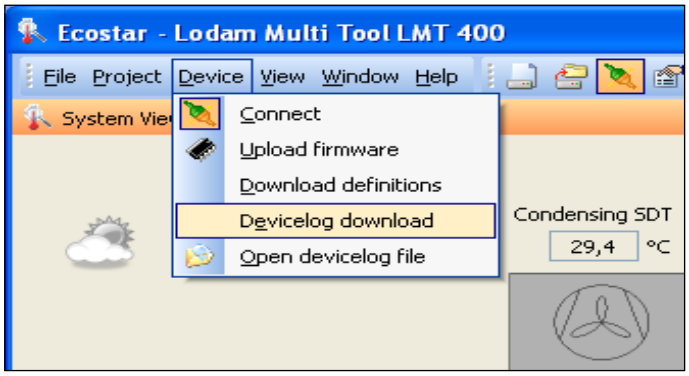
For service purposes the LMC340i is equipped with a datalog where data is stored in non-volatile memory.

The datalog is extracted with LMT – Lodams Multi Tool. The tool connects to the controller and retrieves the datalog from the controller.

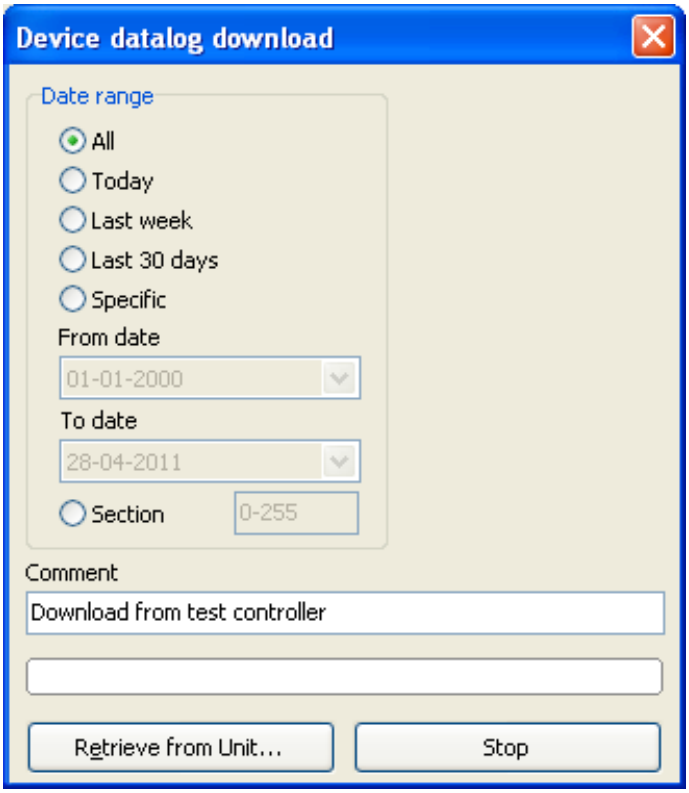
Main menu from LMT:



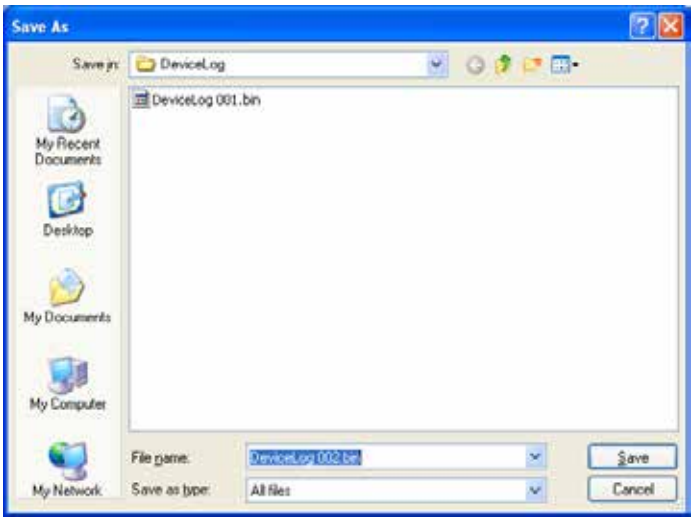
Select the Devicelog download in the Device menu:



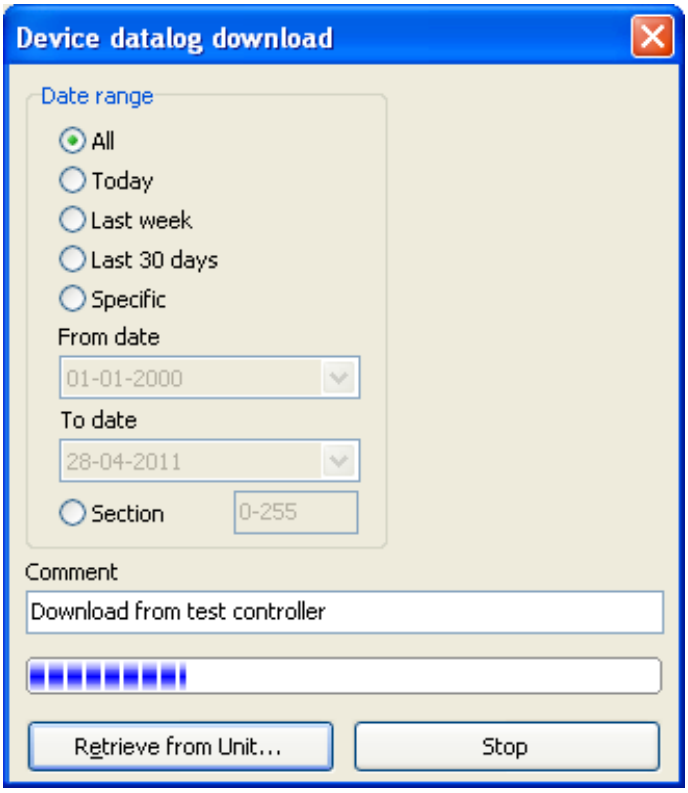
On the following menu the time range can be selected and a comment for the datalog can be added. Click Retrieve from Unit... to start the download.



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

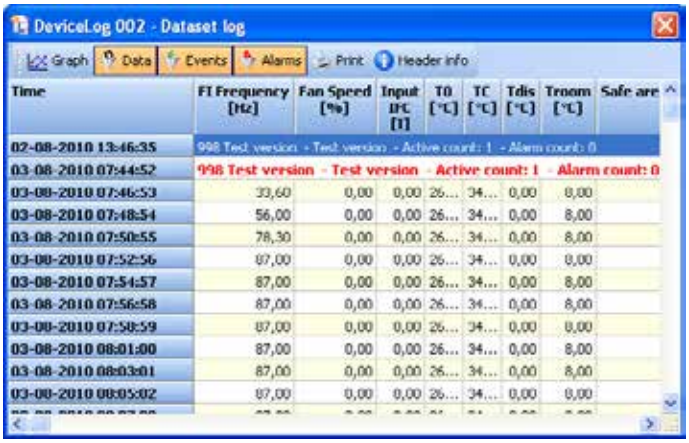


After clicking the Save button, the download starts.

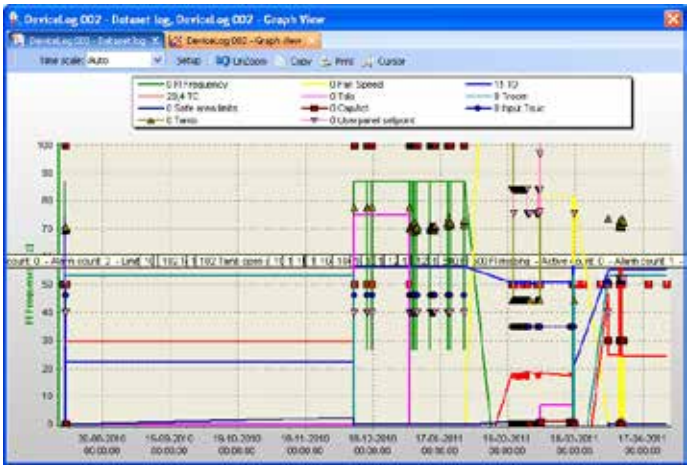


And finishes with:

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



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



See section Datalogger for information about the data in the datalog.

23. NTC tempera-ture/resistance table

The relation between the temperature and measured resistance in the NTC sensor is listed in the following table where resistance is in Ω (Ohm) and temperature in ºC. This can be used in case of trouble shooting of the equipment.

At least one of the terminals of the temperature sensor must be un-mounted to make a correct measurement with a multi meter.

To make the table more compact the listed temperatures are in steps of 2ºC, i.e. 0ºC, +2ºC, +4ºC, +6ºC and +8ºC in one row.

Temp. [ºC]	Temp. [Ohm]	Temp.+ 2K [Ohm]	Temp.+ 4K [Ohm]	Temp.+ 6K [Ohm]	Temp.+ 8K [Ohm]
ºC	+ 0 ºC	+ 2 ºC	+ 4 ºC	+ 6 ºC	+ 8 ºC
-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

24. NTC temperature/voltage table

Using a normal multi meter the temperature reading of a NTC sensor can be controlled by measuring the voltage between the two terminals when the controller is powered up and the NTC temperature sensor is connected.

The measured voltage can be converted to an approx. temperature using the tables in this section. This can be used in case of trouble shooting of the equipment.

For Tamb, Tcoldstore 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	3,01	2,973	2,932	2,887	2,839
-30	2,786	2,73	2,67	2,606	2,539
-20	2,468	2,393	2,316	2,236	2,154
-10	2,071	1,986	1,9	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	0,19	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	0,09	0,084	0,08	0,075	0,071
100	0,067	0,063	0,06	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 Tamb the voltage can be measured on the LMC300 controller between the terminals CN5:2 and CN5:3.

For Tcoldstore the voltage can be measured on the LMC300 controller between the terminals CN5:4 and CN5:9.

For Tsuc the voltage can be measured on the LMC300 controller between the terminals CN6:2 and CN6:3.

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	3,24	3,233	3,224	3,214	3,204
-20	3,192	3,18	3,166	3,15	3,133
-10	3,115	3,095	3,074	3,05	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	2,56	2,508	2,454	2,398
30	2,341	2,282	2,223	2,162	2,1
40	2,037	1,975	1,912	1,848	1,785
50	1,723	1,66	1,599	1,538	1,478
60	1,42	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	0,72	0,686	0,654	0,623	0,594
100	0,566	0,539	0,502	0,49	0,467
110	0,445	0,424	0,404	0,385	0,367
120	0,35	0,334	0,319	0,299	0,282

For Tdis the voltage can be measured on the LMC300 controller between the terminals CN5:5 and CN5:6.

25. Index

26. Notes

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