ESIE07-03

Service Manual

EWAD-AJ
EWYD-AJ
EWAD-BZ
EWYD-BZ

Air-cooled units with R134a refrigerant

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1 Introduction

1.1 About This Manual

Target group

This service manual is intended for and should only be used by qualified engineers.

Purpose of this manual

This service manual contains all the information you need to carry out the necessary repair and maintenance tasks.

Different lines

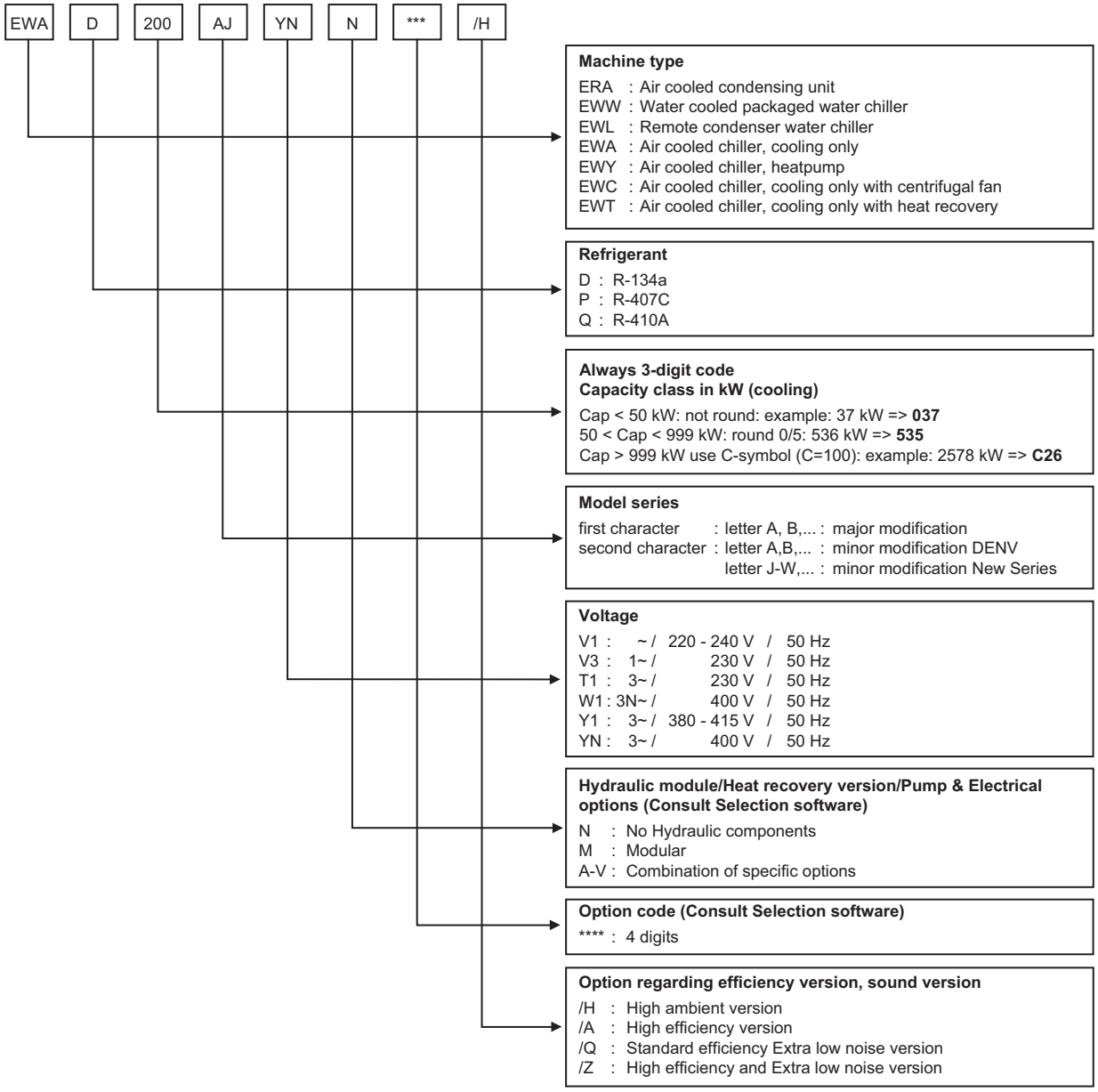
- EWAD-AJ
  Cooling only units without compressor inverter
  2 circuits
- EWAD-BZ
  Cooling only units with compressor inverter
  2 circuits
- EWYD-AJ
  Heat pump units with compressor inverter
  2 circuits
- EWYD-BZ
  Heat pump units with compressor inverter
  2 or 3 circuits

Before starting up the unit

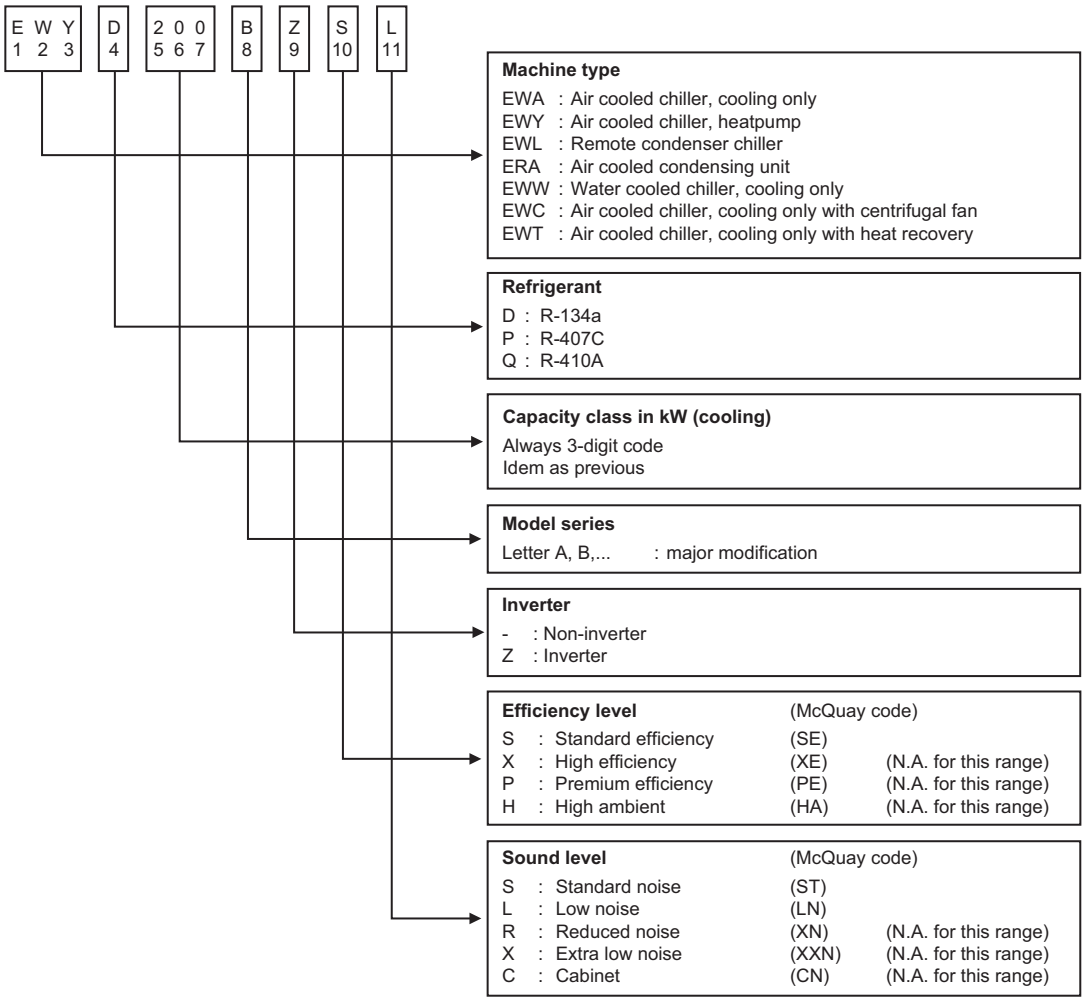
Before starting up the unit for the first time, make sure it has been properly installed. See installation manual.

1.2 Nomenclatures

EWAD-AJ &
EWYD-AJ



EWAD-BZ &
EWYD-BZ



Part 1
System Outline

Introduction

This part contains an outline of all the relevant elements in the EWAD-AJ, EWYD-AJ, EWAD-BZ and EWYD-BZ units.

What is in this part?

- Technical specifications
  See data book
- Electrical specifications
  See data book
- Outlook drawings
  Due to the fact that not one unit is the same, it is not possible to provide the dimensional drawings for all units in a manual.
  However, for every serial number, there is a dimensional drawing available on http://passdoor.mcquay.it
- Capacity tables
  See data book
- Heat recovery ratings
  See data book
- Sound levels
  See data book
- Piping diagram
  See installation operation manual
- Wiring diagram
  Due to the fact that not one unit is the same, it is not possible to provide the wiring diagram for all units in a manual.
  However, for every serial number, there is a unique wiring diagram available on http://passdoor.mcquay.it
  Every unit is also shipped with a wiring diagram in the switchbox.
  The field wiring connections can be found on the last page of the wiring diagram.
- System architecture
  See control panel operating manual
- Correction factors
  See data book
- Operation range
  See installation operation manual
- Water heat exchangers pressure drops
  See installation operation manual and data book
- Pump curves
  See installation operation manual

Part 2
Functional Description

Introduction

This part gives more detailed information on the functions and controls of the unit. This information is used as background information for troubleshooting. An extensive overview of the functioning of the controller is also given in this part. Knowledge of the controller is essential to gather information prior to servicing and troubleshooting.

What is in this part?

This part contains the following chapters:

1 The Digital Controller Menus

1.1 What Is in This Chapter?

Introduction

This chapter gives more detailed information about the controller and the software. Understanding these functions is vital when diagnosing a malfunction, which is related to system architecture or software.

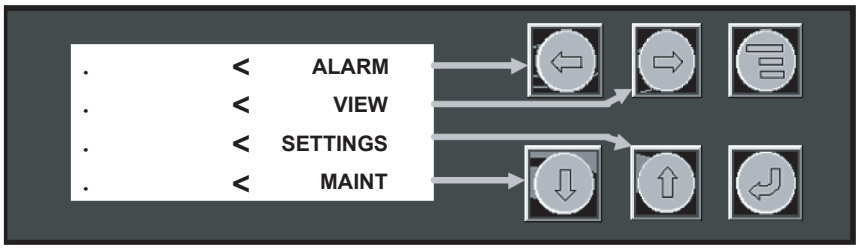
Overview

This chapter contains the following topics:

1.2 Main Menu

Introduction

The digital controller consist of a display panel with 4 lines and a keypad at the right-hand side of the display (see example below).



Display panel

The following screen shows the main menu of the controller.

```
                    <                    A L A R M
                    <                      V I E W
                    <          S E T T I N G S
                    <                    M A I N T
```

Keypad

Use the Up/Down and the Left/Right arrow keys to access the submenu's of the current screen:

Press ...		To access the ...
	Left arrow key	First menu (e.g. Alarm)
	Right arrow key	Second menu (e.g. View)
	Up arrow key	Third menu (e.g. Settings)
	Down arrow key	Fourth menu (e.g. Maint)

Use the Enter and Exit arrow key to:

Press ...		To ...
	Enter arrow key	Edit the current screen.
	Exit arrow key	Exit the current menu and to go back to the previous.

Menu structure

- main menu
  - → alarm
    - → active
    - → log
  - → view
    - → unit
      - → status
      - → water
      - → evap
    - → compressor
      - → comp. #1
      - → comp. #2
      - → comp. #3 (only 3-circuit units)
    - → I/O
      - → main board
      - → expansion boards
  - → settings
    - → unit
      - → configuration
      - → setpoint
      - → condensation
        - → condensation (only EWYD)
        - → evaporation (only EWYD)
      - → valve driver (only with electronic expansion valve)
    - → compressor
    - → user
      - → setpoints
      - → time schedule
      - → FSM schedule
      - → clock
    - → alarms
  - → maintenance
    - → view
    - → settings

1.3 Alarm Menu

Main screen of the Alarm menu

In the Main menu of the controller, press the **Left** arrow key to access the Alarm menu.

As a result the following screen appears.

The Alarm menu contains two submenu's:

Topic	See page
1.3.1–Active Menu	2–7
1.3.2–LOG Menu	2–8

1.3.1 Active Menu

Accessing Alarm menu > Active

In the Alarm menu, press the **Left** arrow key to access the Active menu. The Active menu indicates the current fault. When multiple faults are active, use up and down to scroll between them.

When there is no alarm active, the following screen appears.

```
No alarm
detected
```

If there is an alarm active, the Left arrow key lights up red (function as an alarm button) and the current alarm message appears on the display (see example below).

```
AL:203                          U:1
      High pressure
    Switch alarm #2
```

Resetting an alarm

To reset an alarm, press the alarm button (Left arrow key lighting up red) during approximately 3 seconds.

Note: It is only possible to reset an alarm if the cause of the alarm is restored/repaired. For example, it is only possible to reset a flow alarm when the flow is back.

1.3.2 LOG Menu

Accessing Alarm menu > LOG

In the Alarm menu, press the **Right** arrow key to access the LOG menu. The LOG menu allows you to see the last 10 alarms that occurred.

To browse through the last 10 alarms use the Up/Down arrow keys.

For each alarm the following information is displayed:

- Time and date.
- Alarm message.

Examples:

```
30/01/08                    16:30
Prepurge #1 Timeout
```

```
30/01/08                    16:40
High Press. Switch #
2
```

Consulting details

To consult the detailed running conditions when the alarm occurred, proceed as follows:

1 Press the Right arrow key at a certain alarm in the LOG.
As a result the detailed running conditions are displayed.

```
In.Wat.T.      013.0°C
Out Wat.T.     008.3°C
```

2 Scroll through the running conditions using the Up/Down arrow keys.
Below an example of successive screens when using the Down arrow key.

```
Compressor #1
Suct.Pres      002.0bar
Disc.Pres      010.1bar
Oil Pres       009.7bar
```

```
Compressor #1
Evap.Temp      012.2°C
Suct.Temp      002.3°C
```

```
Compressor  #1
Cond.Temp    042.2°C
Disc.Temp    062.3°C
```

```
Compressor  #1
EXV Steps      0000
Comp. Load       025%
```

```
Compressor  #2
Suct.Pres    001.9bar
Disc.Pres    010.5bar
Oil Pres     010.0bar
```

```
Compressor  #2
Evap.Temp    011.2°C
Suct.Temp    002.1°C
```

```
Compressor  #2
Cond.Temp    043.2°C
Disc.Temp    061.3°C
```

```
Compressor  #2
EXV Steps      0863
Comp. Load       045%
```

```
Compressor  #3
Suct.Pres    001.9bar
Disc.Pres    010.5bar
Oil Pres     010.0bar
```

```
Compressor  #3
Evap.Temp    011.2°C
Suct.Temp    002.1°C
```

```
Compressor  #3
Cond.Temp    043.2°C
Disc.Temp    061.3°C
```

```
Compressor #3
EXV Steps      0863
Comp. Load      045 %
```

3 Press the Enter key, to exit the LOG menu.

1.4 View Menu

Main screen of the View menu

In the Main menu of the controller, press the **Right** arrow key to access the View menu.

As a result the following screen appears.

The View menu contains three submenu's:

Topic	See page
1.4.1–Unit Menu	2–12
1.4.2–Compressor Menu	2–18
1.4.3–I/O Menu	2–22

1.4.1 Unit Menu

Accessing View menu > Unit

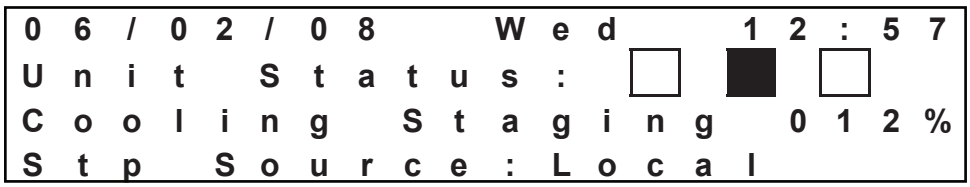
In the View menu, press the **Left** arrow key to access the Unit menu.

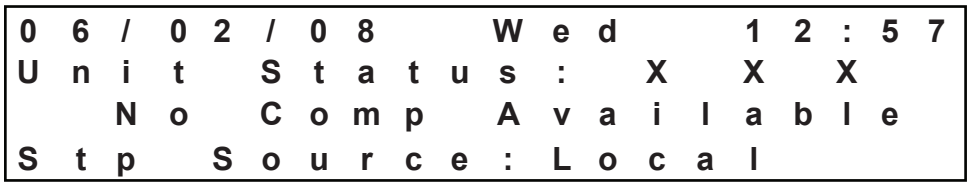
Status menu

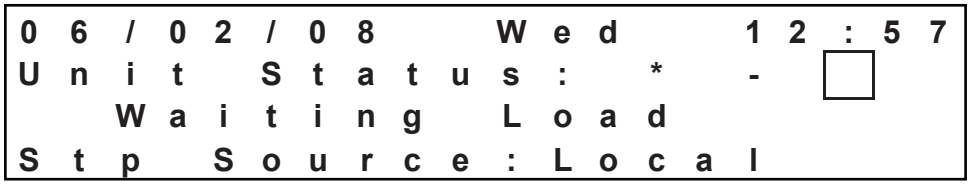
In the Unit menu, press the **Left** arrow key to access the Status menu.

Note: Alternatively, press the Enter arrow key in any menu, in which the < symbol appears in the screen (e.g. the Main menu).

As a result one of the following screens can appear.







The following information is displayed:

- Date and Time,
- Unit Status,
- Information,
- Setpoint Source.

Date and Time

For example: 06/02/08 Wed 12:57

Unit Status

□	The compressor is off, but ready to start. This can be because there is no load or the cycle timers are still running.
■	The compressor is running.
X	The compressor is not available. This can be because it's manually switched off or in an alarm condition.
*	The circuit is in defrost.
-	The compressor is running with low discharge superheat.

Information

■ Cooling staging 80%	The unit is in cooling mode. The total capacity of the unit is 80%. This capacity is the average of the compressor capacities (for example 60% and 100%).
■ Heating staging 120%	The unit is in heating mode. The total capacity of the unit is 120%. This capacity is the average of the compressor capacities (for example 100% and 140%). EWYD-AJ or EWYD-BZ units have a maximum capacity of 150% (90 Hz) thanks to the overboost functionality.
■ Off Alarm	The unit is switched off due to an active alarm.
■ Off Rem Com	The unit is switched off by BMS, CSC or EKDSSP.
■ Off Time Schedule	The unit is switched off due to the time schedule (see "Time Schedule menu" on page 2–60).
■ Off Remote Sw	The unit is switched off by remote switch (digital input 17 of the controller, field wiring inputs 58 and 59).
■ PwrLoss Enter Start	Only when "Restart after power failure" = N and at first start.
■ Off Amb. Lockout	The unit is switched off by the ambient lockout function (see step 5 of the procedure "Scrolling through the setpoints menu" on page 2–54).
■ Waiting Flow	Before starting a compressor, the unit is waiting for flow in the evaporator. There should be 20 sec of flow during the first 30 sec after switching on the unit.
■ Waiting Load	The unit is off and waiting for load. This is when the water temperature is more than the setpoint + start-up ΔT.
■ No comp Available	The unit is off, because none of the compressors are available. The compressors are switched off by switch (Q1, Q2 and Q3) or in the software (see step 6 of the procedure "Scrolling through the status menu" on page 2–14) or are in oil heating.
■ FSM Operation	The unit is working in Fan Silent Mode (see "FSM (Fan silent Mode) Schedule menu" on page 2–61). The speed of the fans is reduced for more silent operation.
■ Off Local Sw	The unit is switched off by local switch (Q0 on the switchbox).
■ Off Cool/Heat Switch	The unit is switched off after a switch between cooling mode and heating mode (only for EWYD-AJ units).

Setpoint Source

- Softload
- Stp source: Local
- Stp source: Double
- Stp source: 4-20 mA (setpoint override)
- Stp source: OAT reset ambient temperature
- Stp source: set reset (evaporator delta T)
- Stp source: Ice (ice mode)
- Glycol (glycol mode cooling)
- Stp source: CSC Comm

Scrolling through the status menu

To scroll through the Status menu, use the Up/Down arrow keys. Below the successive screens that appear when using the Down arrow key.

1 Press the Down arrow key.
The actual setpoint is shown.
Note: EWYD-AJ or EWYD-BZ units in heating mode show the heating setpoint here.

```
Actual Setpoint
Cooling          007.0°C
```

```
Actual Setpoint

Heating          045.0°C
```

2 Press the Down arrow key.
The following screen appears.

```
      Unit Limiting
demand limit      000%
run current       000Amp
limit             000Amp
```

- Demand limiting — The capacity of the unit is limited with a 4-20 mA signal (expansion board 4 required).
- Running current — If the unit is equipped with a current measuring system.
- Current limit — Max current that is determined by the 4-20 mA input.

3 Press the Down arrow key.
Multiple units can be controlled with the option EKCSCIII or EKDSSP (max 6 units).

```
Csc communication
          Online
Heartbeat          OnL
CSC On/Off
```

- Heartbeat — Blinks when communication is active.
- Online — On when communication between the CSC or EKDSSP and the unit is OK.
- CSC On/Off — Shows the status of the CSC or EKDSSP.

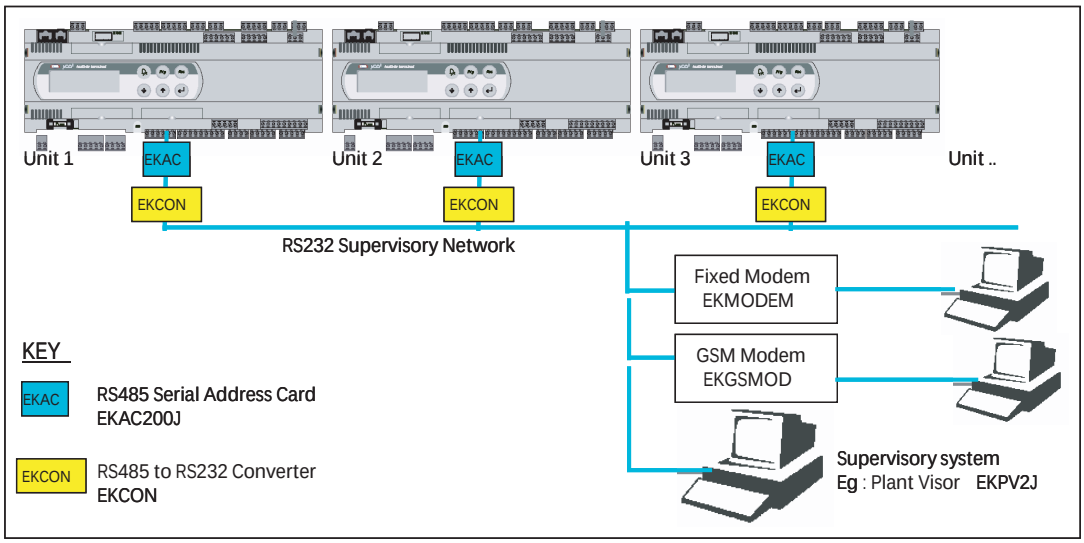
4 Press the Down arrow key.
The modem status is shown.

```
Modem Status

DISCONNECTED
```

A fixed or GSM modem can be used to monitor up to 32 chillers from a distance.
For both the fixed modem (EKMODEM) and GSM modem (EKGSMOD), a RS485 serial address card (EKAC200J) and a RS485 to RS232 converter (EKCON) should be used.
With this configuration, it's also possible to connect to Plant Visor (EKPV2J).

Note: this screen is only visible with the option EKMODEM, EKGSMOD or EKPV2J.



5 Press the Down arrow key.
The following screen is visible when the softload function is enabled.

```
Softload              On
Max Stage             060%
Rem. Time             007min
Max Time              020min
```

- Softload — On / Off
- Maximum stage — During the softload, the total unit capacity is limited to 60%.
- Remaining time — The softload is still active for another 7 minutes.
- Maximum time — The softload limits the unit in the first 20 min of operation.

6 Press the Down arrow key.
The compressor state can be set to AUTO, MANUAL or OFF.
In MANUAL mode, the capacity of the compressor can be changed.
Note: Manager password is required (02001).

```
Compressor #1

State              AUTO
comp.#1 load       000%
```

```
Compressor #2
NManual Load       +  -
State              MANUAL
comp.#2 load       000%
```

```
Compressor #3

State              OFF
comp.#3 load       000%
```

7 Press the Down arrow key.
The version and creation date of the bios and boot on the controller are displayed.

```
Bios Version          003.87
Bios Date          04/03/08
Boot Version          003.01
Boot Date          15/04/02
```

Water menu

In the Unit menu, press the **Right** arrow key to access the Water menu.

As a result the following screen appears.

```
  Water Temperatures
Ent Evap      016.4°C
LVG Evap      011.7°C
```

- Entering evaporator water sensor = analog input 9 (NTC).
- Leaving evaporator water sensor = analog input 10 (NTC).

Note: If the full heat recovery option is selected, the following screen will be visible.

```
Heat Rec. water
Ent Cond      042.2°C
Leav Cond     046.7°C
```

- Entering heat recovery water sensor = analog input 3 on expansion board 2 (NTC).
- Leaving heat recovery water sensor = analog input 4 on expansion board 2 (NTC).

EVAP menu

In the Unit menu, press the **Up** arrow key to access the EVAP menu.

As a result the following screen appears.

```
View Evaporator (01)
Circuit #1
Suct SH     = 006.5°C
Approach    = 003.2°C
```

Use the Up/Down arrow key to see the suction superheat and evaporator approach for each circuit.

```
View Evaporator (02)
Circuit #2
Suct SH     = 006.9°C
Approach    = 003.9°C
```

Note:

- Approach = evaporator refrigerant temperature - outlet water temperature.
- Suct SH (Suction superheat) is only displayed on units with electronic expansion valve.

1.4.2 Compressor Menu

Accessing View menu > Compressor

In the View menu, press the **Right** arrow key to access the Compressor menu.

To scroll between the different compressors, use the left/right arrow key.

2

```
Comp. # 01                    H
Status: Off Ready
```

```
Comp. # 02                    C
Status: Ready
```

```
Comp. # 03
Status: Auto 100%
```

Compressor status

■ Ready	The compressor is ready to start
■ Off Ready	
■ Off Alarm	The compressor is off due to an alarm
■ Off Switch	The compressor is off by switch Q1 or Q2
■ Auto xx%	The compressor is running in automatic mode at xx%
■ Manual xx%	The compressor is running in manual mode at xx%
■ Oil Heating	The compressor is off and in oil heating state (see step 7 of the procedure "Changing the factory unit configuration settings" on page 2–34)
■ Recycle Time	The compressor is off and in recycle timer (see the procedure "Scrolling through the compressor menu" on page 2–49)
■ Manual Off	The compressor is switched off manually in the software
■ Prepurge	
■ Pumping Down	
■ Downloading	
■ Starting	The compressor is starting.
■ Low Disch SH	The compressor is running with too low discharge superheat.
■ Defrost	The compressor is in defrost (reverse cycle in heating mode)

- Max VFD Load — The compressor is limited because the inverter absorbed current is too high. The signal comes in digital input 3 (circuit 1) or 4 (circuit 2) on EWYD-AJ units.
- Off Rem SV — The compressor is off by supervisor.

Scrolling through the Compressor menu

To scroll through the Compressor menu, use the Up/Down arrow keys. Below the successive screens that appear when using the Down arrow key.

1 Press the Down arrow key.
The following screen appears.

```
Inverter #1

Frequency          60 Hz
Current           122 A
```

- Frequency — This is the actual frequency of the inverter driven compressor. This value is not measured, but is an analog output on the controller to the inverter.

  Nominal frequency is 60 Hz (100%). Maximum frequency is 90 Hz (150%) in overboost.
- Current — The absorbed current by the inverters.

2 Press the Down arrow key.
The following screen appears.

```
Evap Press    001.6 barg
Evap Temp     -002.5 °C
Cond Press    009.4 barg
Cond Temp     040.8 °C
```

- Evaporator pressure — The pressure of the refrigerant in the evaporator, measured by a transducer.
- Evaporator temperature — The saturated temperature of the refrigerant in the evaporator.
- Condenser pressure — The pressure of the refrigerant in the condenser, measured by a transducer.
- Condenser temperature — The saturated temperature of the refrigerant in the condenser.

3 Press the Down arrow key.
The following screen appears.

```
Suction Temp  004.4 °C
Suct SupHeat  006.9 °C
Disc SupHeat  021.2 °C
Valve Position  1234
```

- Suction temperature — The temperature of the refrigerant at the suction side of the compressor. This value is measured via the driver of the electronic expansion valve.

2

- Suction superheat — The superheat at the suction side of the compressor. This is the suction temperature - evaporator saturated temperature.
- Discharge superheat — The superheat at the discharge side of the compressor. This is the discharge temperature - condenser saturated temperature.
- Valve position — The position of the electronic expansion valve (only visible on units with an electronic expansion valve).

4 Press the Down arrow key.
The following screen appears.

```
Oil Press      010.0bar
Disch. T.    0056.7°C
```

- Oil pressure — The pressure of the oil, measured by a transducer behind the oil filter.
- Discharge temperature — The refrigerant temperature at the discharge side of the compressor. This is also the oil temperature measured in the oil separator.

5 Press the Down arrow key.
The following screen appears.

```
Staging UP
Staging Down
Staging Fixed
Compressor Off
```

- Staging up — The compressor is increasing capacity.
- Staging down — The compressor is decreasing capacity.
- Staging fixed — The compressor is maintaining the same capacity.
- Compressor off — The compressor is off.

6 Press the Down arrow key.
The following screen appears.

```
Compressor
Hour counter 000010
Number of
starts           00006
```

- Compressor hour counter — The amount of running hours of the compressor.
- Number of starts — The amount of starts of the compressor.

7 Press the Down arrow key.
The following screen appears.

```
Last comp. start
06/02/08          15:41
Last comp. stop
06/02/08          15:58
```

- Last compressor start The time and date of the last start of the compressor.
- Last compressor stop The time and date of the last stop of the compressor.

8 Press the Down arrow key.
The following screen appears.

```
EXV Driver State
Batt. resist.     000.0
Batt. Voltage     00.0
```

- Battery resistance
- Battery voltage

1.4.3 I/O Menu

Accessing View menu > I/O

In the View menu, press the **Up** arrow key to access the I/O menu.

In the I/O menu, all the analog and digital inputs and outputs of the main controller and of the expansion boards are visible.

2

The first screen shows the digital inputs and outputs of the main controller.

```
Digital inputs
C C C C C C C C C O O O O O O O O O
Digital outputs
O O O O O O O O O C C C C C C C C C
```

The C's and O's correspond to the 18 digital inputs and outputs.

Have a look on the wiring diagram to see what is connected to the digital inputs and outputs.

Scrolling through the I/O menu

To scroll through the I/O menu, use the Up/Down arrow keys. Below the successive screens that appears when using the Down arrow key.

1 Press the Down arrow key.
The following screen appears.

```
Analog Inputs:

B1: Oil Pr1      010.3 bar
B2: Oil Pr2      010.7 bar
```

- B1: Oil pressure 1 — Oil pressure of circuit 1. This is the condensing pressure - the pressure drop over the oil filter.
  The sensor is 4-20 mA.
- B2: Oil pressure 2 — Oil pressure of circuit 2. This is the condensing pressure - the pressure drop over the oil filter.
  The sensor is 4-20 mA.

2 Press the Down arrow key.
The following screen appears.

```
Analog Inputs:
B3: Low Pr.1     001.4 bar
B4: Disch.T1     068.2 °C
B5: Disch.T2     072.1 °C
```

- B3: Low pressure 1 — The low (evaporator) pressure of circuit 1.
  The sensor is 4-20 mA.
  On units with an electronic expansion valve, the low pressure is measured via the driver of the electronic expansion valve. In this case, the value is not displayed here.
- B4: Discharge temperature 1 — The compressor discharge temperature of circuit 1.
  The sensor is PT1000.

- B5: Discharge temperature 2 — The compressor discharge temperature of circuit 2. The sensor is PT1000.

3 Press the Down arrow key.
The following screen appears.

```
Analog Inputs:
B6: Cond Pr1  010.8bar
B7: Cond Pr2  011.3bar
B8: Low pr.2  001.2bar
```

- B6: Condenser pressure 1 — The discharge pressure of circuit 1. The sensor is 4-20 mA.
- B7: Condenser pressure 2 — The discharge pressure of circuit 2. The sensor is 4-20 mA.
- B8: Low pressure 2 — The low (evaporator) pressure of circuit 2. The sensor is 4-20 mA. On units with an electronic expansion valve, the low pressure is measured via the driver of the electronic expansion valve. In this case, the value is not displayed here.
- or B8: Outside ambient temperature — NTC sensor. Only for 3-circuit units.

4 Press the Down arrow key.
The following screen appears.

```
Analog Inputs:
B9: In Wtr    014.2°C
B10: Out Wtr  009.3°C
```

- B9: Inlet water — The evaporator inlet water temperature. The sensor is NTC.
- B10: Outlet water — The evaporator outlet water temperature. The sensor is NTC.

5 Press the Down arrow key.
The following screen appears.

```
Analog Outputs

Y1:                 00.0V
Y2:                 00.0V
```

- Y1 — Output for compressor 1 inverter. Signal from 0-10 V DC.
- Y2 — Output for compressor 2 inverter. Signal from 0-10 V DC.

6 Press the Down arrow key.
The following screen appears.

```
Analog Outputs

Y3:                          00.0V
Y4:                          00.0V
```

- Y3 — Output for fan inverter or phase cut module of circuit 1. Signal from 0-10 V DC.
- Y4 — Output for fan inverter or phase cut module of circuit 2. Signal from 0-10 V DC.

7 Press the Down arrow key.
The following screen appears.

```
Analog Outputs

Y5:                          00.0V
Y6:                          00.0V
```

Y5 and Y6 are not used.

8 Press the Down arrow key.
The following screen appears.

```
Driver Firmware
        Version
   H.W.       000
   S.W.       000
```

This screen shows the hardware (H.W.) and software (S.W.) version of the drivers of the electronic expansion valves.

Accessing the I/O menu of the expansion boards

As mentioned before, the first screen of the I/O menu shows the digital inputs and outputs of the main controller (pCO2) (see "Accessing View menu > I/O" on page 2–22).

```
Digital inputs
C C C C C C C C C O O O O O O O O O
Digital outputs
O O O O O O O O O C C C C C C C C C
```

Press the Left or Right arrow key to access the I/O menu of the expansion boards.

Below the successive screens (inputs and outputs of the 4 expansion boards) that appears when using the Right arrow key.

Economizer board:

```
          I / O  Exp  A
DO1: Comp  al  #1      N
DO2: Comp  al  #2      N
DO3: Economizer 1      N
```

Inverter or heat recovery board:

```
          I / O  exp  B
B1: OAT           007.8°C
B2:
B3: Curr.#1       015A
```

Pump board:

```
          I / O  exp  C
DI1: 1  Pump  Alarm    N
DI2: 2  Pump  Alarm    N
DI3: 1  HR  Pump  AL   N
```

Limiting board:

```
          I / O  Exp  D
B1: STP  Overr.  03.7mA
B2: DMD. Limit   00.4mA
B4: CURR. Limit  07.2mA
```

Expansion Board A: Economizer

```
          I / O  Exp  A
DO1: Comp  al  #1      N
DO2: Comp  al  #2      N
DO3: Economizer 1      N
```

- DO1 — A digital output to indicate a circuit 1 alarm.
- DO2 — A digital output to indicate a circuit 2 alarm.
- DO3 — This digital output controls the economizer on circuit 1.

```
          I / O  Exp  A
DO4:  Economizer 2  N
```

- DO4: Economizer 2 — This digital output controls the economizer on circuit 2.

2

Expansion Board B: Heat Recovery or Inverter

Expansion Board B can be configured to control Full Heat Recovery or compressor Inverters.

Note: Full Heat Recovery and Inverter driven compressors can't be combined.

- Heat Recovery:

```
          I / O  exp  B
B 1 : O A T          0 0 7 . 8 ° C
B 2 :
B 3 : E n t   H R W  0 3 8 . 7 ° C
```

- B1: Outside Ambient Temperature — NTC sensor.
- B2 — Not used.
- B3: Entering heat recovery water sensor — NTC sensor.

```
          I / O  exp  B
B 4 : L e a  H R W  0 4 3 . 4 ° C
D I 3 : H R  S w i t c h    O
D I 4 : H R  f l . s w      C
```

- B4: Leaving heat recovery water sensor — NTC sensor.
- DI3: Heat recovery switch — Controlls full heat recovery operation.
- DI4: Heat recovery flow switch — The flow switch inside the heat recovery system.

```
              I / O  Exp  B
D O 1 : 4 W  v a l v e  H R # 1  N
D O 2 : 4 W  v a l v e  H R # 2  N
D O 3 : 4 W  v a l v e  H R # 3  N
```

- DO1: 4-way valve heat recovery circuit 1 — Controls the heat recovery 4-way valve of circuit 1.
- DO2: 4-way valve heat recovery circuit 2 — Controls the heat recovery 4-way valve of circuit 2.
- DO3: 4-way valve heat recovery circuit 3 — Not used.

```
          I/O Exp B
DO4:4W valve HR#4 N
AO1:HR Valve      00.0V
```

- DO4: 4-way valve heat recovery circuit 4 — Not used.
- AO1: Heat recovery 3-way valve — 0-10 V DC signal to control a 3-way valve in the heat recovery circuit. This to ensure a minimum water temperature in the heat recovery condenser.

- Inverter:

```
          I/O exp B
B1:OAT          007.8°C
B2:
B3:Curr.#1      015A
```

- B1: Outside Ambient Temperature — NTC Sensor (only for 2-circuit units).
- B1: Current inverter 3 — The absorbed current, measured by the inverter of compressor 3.

  0-5 V signal from inverter 3 to expansion board 2 (only for 3-circuit units).
- B3: Current inverter 1 — The absorbed current, measured by the inverter of compressor 1.

  0-5 V signal from inverter 1 to expansion board 2.

```
          I/O exp B
B4:Curr.#2      017A
DI1:H/C Switch  H
DI2:Ovboost     N
```

- B4: Current inverter 2 — The absorbed current, measured by the inverter of compressor 2.

  0-5 V signal from inverter 2 to expansion board 2.
- DI1: Heating / Cooling switch — Connected to Q8 on the switch box. This allows users to change between heating and cooling mode (only for 2-circuit units).
- DI1: Max VFD 3 — Limitation signal from the VFD (Variable Frequency Driver = Inverter) of circuit 3. This indicates that the inverter is absorbing too much current. The controller will then decrease the compressor capacity to lower the absorbed current (only for 3-circuit units).
- DI2: Overboost — Allows the inverters to boost the compressors up to 90 Hz in any condition.

  Note: It is not allowed to enable this digital input. Contact Daikin Europe FQS for more information.

```
          I / O  exp  B

DI3: Max VFD 1          C
DI4: Max VFD 2          C
```

- DI3: Max VFD 1 — Limitation signal from the VFD (Variable Frequency Driver = Inverter) of circuit 1. This indicates that the inverter is absorbing too much current. The controller will then decrease the compressor capacity to lower the absorbed current.
- DI4: Max VFD 2 — Limitation signal from the VFD (Variable Frequency Driver = Inverter) of circuit 2. This indicates that the inverter is absorbing too much current. The controller will then decrease the compressor capacity to lower the absorbed current.

```
            I / O  Exp  B
DO1: 4W valve #1        Y
DO2:                    N
DO3: 4W valve #2        Y
```

- DO1: 4-way valve circuit 1 — Digital output to control the 4-way valve of circuit 1 to change between heating or cooling mode.
- DO2: Coil drain pan heaters — Digital output to enable/disable the drain pan heaters for the coil. Only for EWYD models with Nordic kit.
- DO3: 4-way valve circuit 2 — Digital output to control the 4-way valve of circuit 2 to change between heating or cooling mode.

```
            I / O  Exp  B
DO4: S.Liq inj #2       N
AO1:                 00.0V
```

- DO4: 4-way valve circuit 3 — Digital output to control the 4-way valve of circuit 3 to change between heating or cooling mode (only for 3-circuit units).
- AO1 — Not used.

Expansion Board C: Water pump control

```
          I/O exp C
DI1:1  Pump Alarm   N
DI2:2  Pump Alarm   N
DI3:1  HR Pump AL   N
```

- DI1: Pump 1 alarm — Pump 1 thermal protection.
- DI2: Pump 2 alarm — Pump 2 thermal protection (only on units with 2 pumps).
- DI3: Heat recovery pump 1 alarm — Heat recovery pump 1 thermal protection.

```
          I/O exp C
DI4:2  HR Pump AL   N
DO1:2  Water Pump   N
DO3:1  HR Pump      N
```

- DI4: Heat recovery pump 2 alarm — Heat recovery pump 2 thermal protection.
- DO1: Water pump 2 — Digital output that controls the 2nd pump (1st pump is controlled by digital output 12 of the main controller).
- DO3: Heat recovery pump 1 — Controls the primary heat recovery pump.

```
          I/O exp C
DO4:2  HR Pump      N
```

- DO4: Heat recovery pump 2 — Controls the secondary heat recovery pump.

Expansion Board D: current & demand limiting and additional fan steps

```
I/O Exp D
B1:STP Overr. 03.7mA
B2:DMD.Limit  00.4mA
B4:CURR.Limit 07.2mA
```

- B1: Setpoint override — 4-20 mA signal to overwrite the setpoint.
  Function: see procedure "Scrolling through the setpoints menu" on page 2–54.
- B2: Demand limiting — 4-20 mA signal to limit the capacity of the unit.
  Function: see procedure "Scrolling through the setpoints menu" on page 2–54.
- B4: Current limit — 4-20 mA signal that indicates the unit absorbed current (measured by a current transformer inside the unit on 1 phase of the main power line).
  Function: see procedure "Scrolling through the setpoints menu" on page 2–54.

```
I/O Exp D
DI1:Unit lim.EN N
DI2:EXT Alarm   N
```

- DI1: Enable unit limiting — To enable the demand or current limitation.
  Function: see procedure "Scrolling through the setpoints menu" on page 2–54.
- DI2: External alarm — When this function is enabled, the unit will switch off if this contact is closed.

```
I/O Exp D
DO1:4 Fan step #1 N
DO2:5 Fan step #1 N
DO3:4 Fan step #2 N
```

- DO1: Fan step 4 of circuit 1 — 4th fan step of circuit 1 (fan step 1, 2 and 3 are controlled by the main controller).
  Function: see "Condensation" on page 2–41.
- DO2: Fan step 5 of circuit 1 — 5th fan step of circuit 1 (fan step 1, 2 and 3 are controlled by the main controller).
  Function: see "Condensation" on page 2–41.
- DO3: Fan step 4 of circuit 2 — 4th fan step of circuit 2 (fan step 1, 2 and 3 are controlled by the main controller).
  Function: see "Condensation" on page 2–41.

```
I / O  E x p  D
D O 4 : 5  F a n  s t e p  # 2  N
```

- DO4: Fan step 5 of circuit 2 — 5th fan step of circuit 2 (fan step 1, 2 and 3 are controlled by the main controller).

  Function: see "Condensation" on page 2–41.

1.5 Settings Menu

Main screen of the Settings menu

In the Main menu of the controller, press the **Up** arrow key to access the Settings menu.

As a result the following screen appears.

```
                    <                    U N I T
                    <   C O M P R E S S O R
                    <                    U S E R
                    <              A L A R M S
```

The Settings menu contains four submenu's:

Topic	See page
1.5.1–Unit Menu	2–33
1.5.2–Compressor Menu	2–49
1.5.3–User Menu	2–54
1.5.4–Alarms Menu	2–63

1.5.1 Unit Menu

Accessing Settings menu > Unit

In the Settings menu, press the **Left** arrow key to access the Unit menu.

```
< CONFIGURATION
< SETPOINT
< CONDENSATION
< VALVE DRIVER
```

Configuration menu

In the Unit menu, press the **Left** arrow key to access the Configuration menu. The Configuration menu allows you to change some factory unit configuration settings.

As a result the following screen appears.

```
Expansion Valve
Electronic
Gas Type
R134a
```

- Expansion valve — Thermostatic or electronic
- Gas type — R134a

2

Changing the factory unit configuration settings

To change the factory unit configuration settings, scroll through the Configuration menu using the Up/Down arrow keys. Below the successive screens that appears when using the Down arrow key.

1 Press the Down arrow key.
The following screen appears.

```
Unit Config
N. of comp. s        2
N. of evaporator 1
N. of Pumps          1
```

Fill out the following fields:

- Number of compressors — Select the number of compressors.
- Number of evaporators — Select the number of evaporators (not refrigerant circuits, actual number of evaporators).
- Number of pumps — Select the number of unit pumps (not heat recovery pumps).

2 Press the Down arrow key.
The following screen appears.

```
Pump management
Type          On / Off
```

Fill out the following field:

- Type of pump control — On/Off pumps.

3 Press the Down arrow key.
The following screen appears.

```
Condensation
Fans number:
Circuit #1   :   2
Circuit #2   :   2
```

Fill out the following field for each circuit:

- Number of fans — Select actual number of fans

4 Press the Down arrow key.
The range of the low pressure transducer is shown (analog input 3 for circuit 1 and analog input 8 for circuit 2).
Note: this screen is only shown on units equipped with thermostatic expansion valves.

```
Low Press Transd
limits
Min.          -00.5bar
Max.          007.0bar
```

5 Press the Down arrow key.
The range of the inverter absorbed current is shown. The current is measured by the inverter. The expansion board 2 controller receives a 0-5 V DC from the inverter.

- 0 V = minimum absorbed current
- 5 V = maximum absorbed current

These values depend on the type of compressor (see parameter list).

```
Absorbed current
probe limits Inv.#1
Min. 000.0A
Max. 230.0A
```

```
Absorbed current
probe limits Inv.#2
Min. 000.0A
Max. 300.0A
```

6 Press the Down arrow key.
The following screen appears.

```
Condensation
Control var. PRES.
Type SPEEDTR
```

Fill out the following fields:

- Control variable
  - Pressure: the fan control depends on the condensing pressure.
  - PR (pressure ratio): the fan control depends on the ratio between the evaporating pressure and the condensing pressure (not used).
  - None: external fan control (not used).
- Type
  - Fantroll: all fans are on/off.
  - Speedtroll: one (or two) phase cut or inverter controlled fan(s) and the rest on/off.
  - VSD: all fans are phase or inverter cut controlled.
  - Fan modulation: step control with phase cut or inverter controlled fans.

7 Press the Down arrow key.
The following screen appears and allows you to enable or disable the oil heating control.

```
Enable Oil Heating
control Y
```

When oil heating is enabled, the start-up of compressors will not be allowed if the following formula is not met: Disch Temp - Temp (oil press) > 5°C

- Disch Temp — Discharge temperature (= actual oil temperature).
- Temp (oil press) — The refrigerant saturated temperature at the oil pressure.

8 Press the Down arrow key.
The unit will restart automatically after a switch between cooling and heating (only for EWYD units).

```
Autorestart After
Cool/Heat Switch
300 s
```

9 Press the Down arrow key.
On the first start-up and when selecting default values, the RS485 network (J23 connection to the expansion boards) is scanned for 30 seconds.
The network can be refreshed by changing N to Y (technical password required).

```
RS485 net

time check 030
Refresh N
```

10 Press the Down arrow key.
The configuration screen of the expansion board appears.

```
Exp.Board #2 conf.
Heat Pump
Compressor load
control: Inverter
```

Fill out the following fields:

- Expansion board #2 configuration
  - Chiller only.
  - Heat pump (only for EWYD units).
  - Heat recovery (only full heat recovery, not partial heat recovery).
- Compressor load control
  - Solenoid (standard with oil pressure).
  - Inverter (for units with inverter controlled compressors).

11 Press the Down arrow key.
The following screen appears and allows you to enable or disable the economizer.

```
Economizer

Enabled Y
```

The economizer is enabled when the compressor capacity reaches 90% and disabled again on 75%. When the discharge temperature reaches 80°C, the economizer is disabled. It will only start again, when the discharge temperature is 80°C - 5°C = 75°C (and when the compressor capacity is 90% or more).

```
Econ.Thres.080.0°C
Econ.Diff. 05.0°C
Econ. ON 90 %
Econ. OFF 75 %
```

12 Press the Down arrow key.
The following screen appears.

```
2nd HR Pump enabling
Not present
```

Select Present if the unit is equipped with two full heat recovery pumps.

13 Press the Down arrow key.
The following screen appears.

```
HR circuit select.
C #1 Y C #2 N
C #3 N C #4 N
Recovery type: Total
```

Select the circuits that are equipped with full heat recovery.

14 Press the Down arrow key.
The following screen appears and allows you to enable or disable the autorestart after power failure.

```
Autorestart after
power failure Y
```

When enabled, the unit will automatically restart after a power failure.

15 Press the Down arrow key.
The following screen appears.

```
Switch Off unit
on External Alarm
N
```

When enabled, the unit will be switched off on external alarm (see field wiring connections).

16 Press the Down arrow key.
The following screen allows you to put all parameters back to the default values. After this, use the parameter list to set all settings correct.

```
Reset all parameters
to default values
N
```

17 Press the Down arrow key.

The following screen allows you to change the technical password.

Note: It is recommended to leave the technical password as standard.

```
Password Technician
```

2

Setpoint menu

In the Unit menu, press the **Right** arrow key to access the Setpoint menu. The Setpoint menu allows you to change setpoint regulation configuration.

Scrolling through the setpoint menu

To scroll through the Setpoint menu, use the Up/Down arrow keys. Below the successive screens that appears when using the Down arrow key.

1 Press the Down arrow key.

The derivation parameter of the PID setpoint control is shown.

```
Temp. Regulation
Der. Time      060s
```

2 Press the Down arrow key.

```
Liquid Line Close
Time (Prepurge)
Cooling          010s
Heating          010s
```

On units with thermostatic expansion valves, the liquid line solenoid valve closes for a certain amount of time to empty the evaporator on start-up (= prepurge).

On units with electronic expansion valves, the expansion valve closes.

3 Press the Down arrow key.

```
Downloading time
                 010s
```

The time to download (= go to minimum capacity) the compressor when commanded to switch off. During this time, the unload valve will be enabled.

4 Press the Down arrow key.

```
Pump down config.
Enable             Y
Max time       120s
Min Press   01.0barg
```

When pumpdown (= to put all refrigerant in the condenser when powered off) is enabled, it can take up to 120 sec, except if the evaporator pressure gets below 1,0 bar.

5 Press the Down arrow key.

```
Pumpdown regime
VSD speed 45.0%
```

On units with inverter driven compressors, the pumpdown is executed at 45% of 90 Hz = 40,5 Hz.

6 Press the Down arrow key.

```
Main pump OFF
Delay 180s
```

When the unit is switched off, the pump runs for another 180 sec to prevent freeze up in the evaporator.

7 Press the Down arrow key.

```
LI.Disc stp085.0°C
LI.Disc Dif010.0°C
LI.Suct stp035.0°C
LI.Suct dif005.0°C
```

Liquid injection (to cool down the compressor) is enabled when the discharge temperature reaches 85°C, and disabled again when the discharge is 85°C - 10°C = 75°C.

On EWYD units, liquid injection is also enabled when the suction temperature reaches 35°C and disabled again when the suction is 35°C - 5°C = 30°C.

8 Press the Down arrow key.

```
Low Ambient Param.
Cond.T thr 005.0°C
L.Amb.Timer 120sec
```

If the condensing saturated temperature is lower than 5,0°C, the compressor starts and stays at minimum capacity for the first 120 sec.

When the evaporator pressure is equal or bigger than the evaporator pressure stage down setpoint, the low ambient start is successful.

When the evaporator pressure is still lower than the evaporator pressure stage down setpoint after 120 sec, the compressor is stopped.

Three low ambient start-ups are done automatically before an alarm appears.

9 Press the Down arrow key.

```
Defrost parameters
Startup T 00180s
Defr. Int. 01800s
Defr. Param. 10°C
```

The defrost formula (Suction temperature < 0,7 x Ambient - 10°C) has to be respected for 180 sec before a defrost starts. Before the logic looks at this formula and timer, the values of the suction superheat, ambient temperature and suction temperature need to be respected (see next screen).

The minimum time between 2 defrost of the same circuit is 1800 sec (= 30 min).

Defrost parameter: Suction temperature < 0,7 x Ambient - 10°C. 10°C is the design approach

value of the coil.

10 Press the Down arrow key.

```
Defrost parameters
Ssh THR      010.0°C
AMB T THR    020.0°C
Suct T THR   000.0°C
```

Before the defrost formula (Suction temperature < 0,7 x Ambient - 10°C) is checked, the suction superheat needs to be less than 10,0°C, the ambient temperature needs to be less than 20,0°C and the suction temperature needs to be less than 0,0°C.

11 Press the Down arrow key.

```
Defrost parameters
LWT fail T    012.0°C
Cool Mode time600s
HP limit     0014.0bar
```

A defrost is stopped:

- OR when the evaporator leaving water drops below 12,0°C.
- OR after 600 sec.
- OR when the condensing pressure is 14,0 bar (not during the first 60 sec, see next screen).

12 Press the Down arrow key.

```
Defrost parameters
Cooling mode
Regime speed  60.0%
Min Endurance   60s
```

The speed of a compressor in defrost (cooling) mode is 60,0% of 90 Hz = 54 Hz.

When the condensing pressure reaches 14,0 bar (see previous screen), half of the fans will start. They will stop again at 10,5 bar condensing pressure. During 60 sec, the fans can start and stop. After this, the defrost will terminate because the high pressure limit is reached (no alarm).

13 Press the Down arrow key.

```
Defrost parameters
Compressor pause
Starting        060s
Ending          180s
```

Before a defrost starts, the compressor waits 60 sec. After a defrost, it waits 180 sec.

14 Press the Down arrow key.

```
Heat Rec. Param
Deadband      02.0°C
Stage time     045s
Cond.T thr   030.0°C
```

The heat recovery will operate in a 2,0°C deadband around the setpoint.

The 45 sec stage timer is between heat recovery steps (circuits).

Heat recovery will only be enabled when the condensing saturated temperature is 30,0°C or more.

15 Press the Down arrow key.

```
HR interstage
pause
Time              02 min
```

Before a heat recovery step is removed or added, the controller waits 2 min.

16 Press the Down arrow key.

```
HR bypass valve

Min Temp      040.0°C
Max Temp      030.0°C
```

Analog output 1 (0 - 10 V) of expansion board 2 is to regulate a 3-way valve in the heat recovery circuit to ensure a minimum temperature in the heat recovery circuit.

- 0 V = 40°C. The 3-way valve will not bypass when the temperature is 40°C or more.
- 10 V = 30°C. The 3-way valve will completely bypass all heat recovery water to build up temperature.

Between 30°C and 40°C, the bypass is linear 0 - 10 V.

Condensation menu

In the Unit menu, press the **Up** arrow key to access the Condensation menu. The Condensation menu allows you to change the fan settings.

As a result the following screen appears.

```
              < CONDENSATION
              < EVAPORATION
```

The condensation menu is divided into two submenu's, Condensation and Evaporation. Both submenu's are discussed in detail below.

Note: the Evaporation menu is only visible in EWYD units.

Condensation

In the Condensation menu, press the **Left** arrow key to access the Condensation submenu.

As a result the following screen appears.

```
Condensation
Setpoint      040.0°C
```

The setpoint for the condensing saturated temperature is 40,0°C.

2

To scroll further through the Condensation submenu, use the Up/Down arrow keys. Below the successive screens that appears when using the Down arrow key.

```
Fantroll  SetPs

StageUP  Err.    10.0°C
stageDW  Err.    10.0°C
```

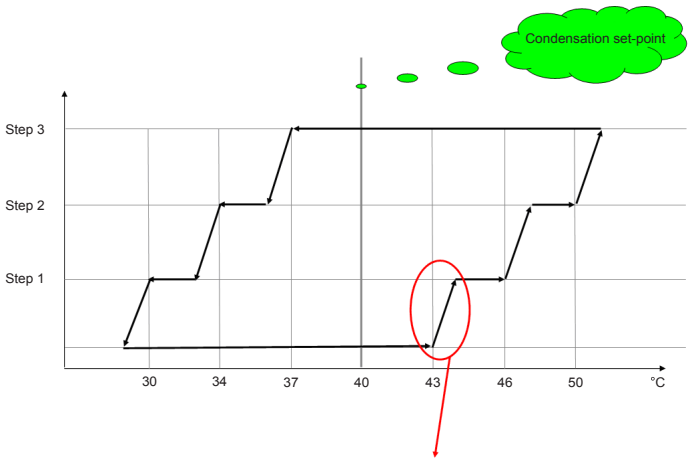
A fan stage-up will be done when the stage-up setpoint (see next screens) and the stage-up error of 10°C x sec is reached (see graphs).

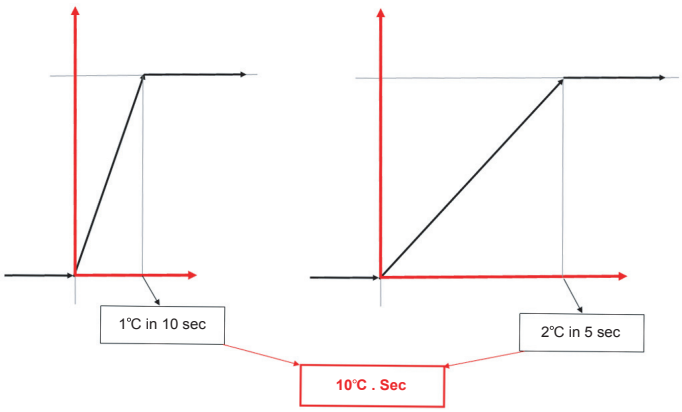
```
Fantroll  SetPs
Dead band  n.  1
Stage  Up      003.0°C
Stage  Down    010.0°C
```

```
Fantroll  SetPs
Dead band  n.  2
Stage  Up      006.0°C
Stage  Down    006.0°C
```

```
Fantroll  SetPs
Dead band  n.  3
Stage  Up      010.0°C
Stage  Down    003.0°C
```

Depending on the amount of fan steps (contactors), different stage up and stage down parameters have to be set. These values are listed in the parameter lists.





Example:

The condensing pressure builds up from 20°C to 42°C.

At 43°C, the stage-up error is checked.

When the temperature rises another 2°C in 5 seconds (= 10°C x sec), so to 45°C, the first fan step is activated.

```
VSD config.
Max. speed          10.0V
Min. speed          00.0V
Speed up time         01s
```

When the unit is equipped with phase cut or inverter controlled fans, the controller sends a 0-10 V signal to the phase cut or inverter devices.

The maximum speed of 10 V corresponds to a fan frequency of 50 Hz.

Note: low noise versions use a maximum speed of 6 V.

The minimum speed should be set to at least 1,5 V. Lower values may damage the fan motor, because there is not enough torque to run it.

Speed up time = 1 sec. This function puts the phase cut or inverter controlled fan(s) at maximum speed for 1 sec to ensure the fan is starting. This to protect the fan against burn out of the fan motor (when the fan is off and the controller gives a signal to run at very low speed, the fan may not be able to start and can burn out).

```
Cond. Regulation    VSD

Reg. Band        020.0°C
Neut. Band       001.0°C
```

Phase cut controlled fans regulate in a 20,0°C regulation band around the condensation setpoint with a neutral band of 1,0°C.

```
Cond. Regulation    VSD
Int. Time           150s
Der. Time           001s
```

These are the PID parameters of the phase cut controlled fan regulation.

2

Evaporation

In the Condensation menu, press the **Right** arrow key to access the Evaporation submenu.

As a result the following screen appears.

```
Evaporation
Setpoint      010.0°C
```

Note: EWYD units in heating mode have an evaporation setpoint to regulate the evaporating pressure.

```
Fantroll SetPs

StageUP Err.     10.0°C
stageDW Err.     10.0°C
```

```
Fantroll SetPs
Dead band n.  1
Stage Up      006.0°C
Stage Down    004.0°C
```

```
Fantroll SetPs
Dead band n.  2
Stage Up      008.0°C
Stage Down    003.0°C
```

```
Fantroll SetPs
Dead band n.  3
Stage Up      010.0°C
Stage Down    002.0°C
```

```
VSD config.
Max.speed        10.0V
Min.speed        00.0V
Speed up time    01s
```

```
Evap. Regulation VSD

Reg.Band      010.0°C
Neut.Band     001.0°C
```

```
Evap. Regulation VSD
Int. Time       150s
Der. Time       001s
```

The fan step regulation for the evaporation setpoint is similar to the condensation regulation.

Valve Driver menu

In the Unit menu, press the **Down** arrow key to access the Valve Driver menu. The Valve Driver menu allows you to change the settings of the electronic expansion valve.

Consulting the Valve Driver menu

To scroll further through the Valve Driver menu, use the Up/Down arrow keys. Below the successive screens that appears when using the Down arrow key.


```
E X V   S e t t i n g s
P r e O p e n i n g      0 3 5 %
```

This is the first opening for the electronic expansion valve after the initial closing time (pre-purge).

```
E X V   S e t t i n g   # 1 / # 2 / # 3

N O   W A R N I N G S
```

Possible warnings for the electronic expansion valves are displayed here.

```
E X V   S e t t i n g   # 1 / # 2 / # 3
A c t .   P o s i t i o n   0 0 0 0
M a n .   P o s i t i o n   0 5 0 0
E n . E X V   M a n        A U T O
```

- Actual position — The actual position of the electronic expansion valve.
- Manual position — A manual chosen position of the electronic expansion valve.
- Enable EXV manual — When changing AUTO into MAN, the electronic expansion valve goes to the position asked in "Manual position".

```
E X V   S e t t i n g
V a l v e   t y p e
C U S T O M
```

To set the type of electronic expansion valve. Most EWYD units have the Danfoss ETS 100 B expansion valve. For this valve, “Custom” valve type has to be selected.

2

```
EXV Setting
Opening EXTRAs Y
Closing EXTRAs Y
Time EXTRAs 0000s
```

```
EXV Setting
Cooling
SSH setp 006.0°C
Dead zone 00.0°C
```

The suction superheat setpoint in cooling mode.

```
EXV Setting
Heating
SSH setp #1 009.5°C
SSH setp #2 009.5°C
```

The suction superheat setpoint in heating mode.

```
EXV Setting Cool
Prop. factor 80.0
Int. factor 030s
Diff. factor 00.5s
```

The PID parameters for the electronic expansion valve in cooling mode.

```
EXV Setting Heat
Prop. factor 50.0
Int. factor 010s
Diff. factor 02.5s
```

The PID parameters for the electronic expansion valve in heating mode.

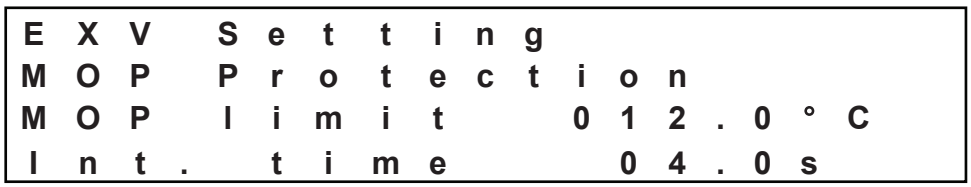
```
EXV Setting
Low SHeat Protect.
Low limit -002.0°C
Int. time 00.0s
```

Protection for the suction superheat. It can't drop below the low limit for the integral time.

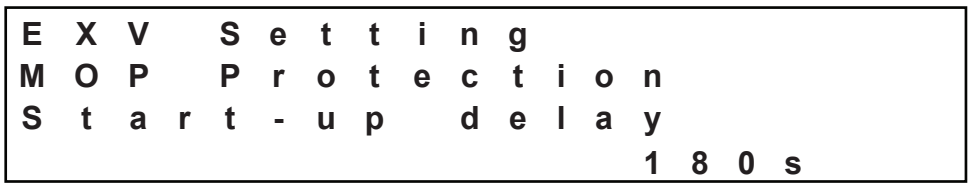
```
EXV Setting
LOP Protection
LOP limit -030.0°C
Int. time 00.0s
```

When the evaporator saturated temperature gets below the LOP limit for a certain amount of time, the electronic expansion valve will open to increase the evaporator pressure.

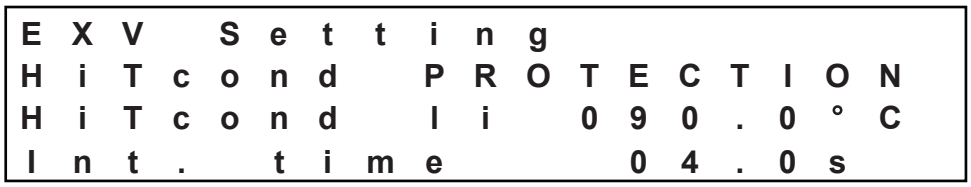
Note: the protection will only work if the suction superheat is above the low suction superheat limit.

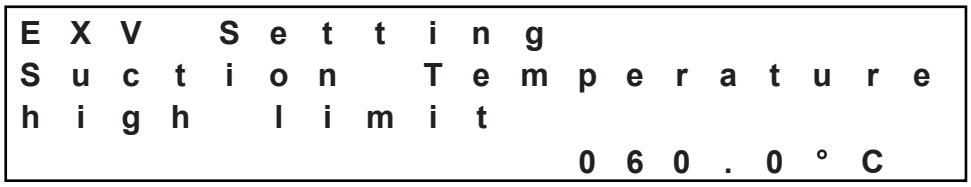


When the evaporator saturated temperature gets above the MOP limit for a certain amount of time, the electronic expansion valve will close to decrease the evaporator pressure.

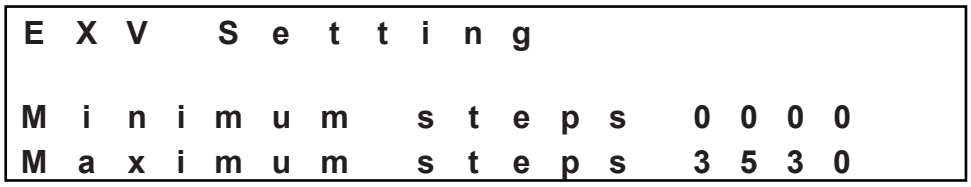


On start-up, the controller doesn't check for MOP protection during the start-up delay.

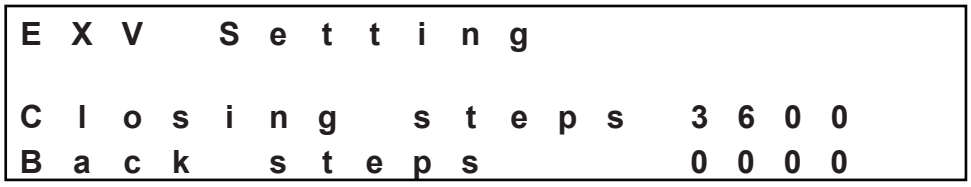




When the suction temperature goes above a certain value, the expansion valve will increase its opening.



The electronic expansion valves minimum and maximum opening.



When the electronic expansion valve is commanded to close completely (when compressor switches off), it closes 3600 steps.

2

```
EXV Setting

Phase curr. 0140mA
Still curr. 0075mA
```

- Phase current — The current needed to move the step motor of the electronic expansion valve.
- Still current — The current needed to keep the step motor of the electronic expansion valve in place.

```
EXV Setting

Step rate 120Hz
Duty-cycle 070%
```

- Step rate — The amount of steps that the electronic expansion valve can make per second.
- Duty-cycle — The electronic expansion valve will go to a value in “1/(duty-cycle)” times.

  For example with a duty-cycle of 70%, the electronic expansion valve will go to a value in 1,43 times.

```
EXV Setting #1/#2/#3
Press. probe
Min val -000.5barg
Max val 007.0barg
```

The limit values for the low pressure sensors that are connected to the drivers of the electronic expansion valves.

```
EXV Setting #1/#2/#3

BATTERY PRESENT Y
PLAN PRESENT N
```

An indication if the battery is present for the electronic expansion valve and if the pLAN network is operating.

1.5.2 Compressor Menu

Accessing Settings menu > Compressor

In the Settings menu, press the **Right** arrow key to access the Compressor menu.

As a result the following screen appears.

```
Min T same comp.
starts          0600s
Min T diff. comps
starts          0120s
```

- The minimum time between starts of the same compressor.
- The minimum time between starts of different compressors.

Scrolling through the compressor menu

To scroll through the Compressor menu, use the Up/Down arrow keys. Below the successive screens that appears when using the Down arrow key.

1 Press the Down arrow key.
The minimum time that the compressor has to be ON and OFF is shown.
Note: when an alarm occurs, the compressor is switched off, even if the "min time comp. on" timer is not expired.

```
Min Time comp.
ON              0030s
Min Time comp.
OFF             0180s
```

2 Press the Down arrow key.
The interstage time is displayed.

```
Interstage time
                0120s
```

This is a delay timer that needs to be expired before an additional compressor can start.

3 Press the Down arrow key.
The following screen appears.

```
Low pressure
Hold T.       -004.0°C
Down T.       -008.0°C
Down delay      020s
```

- Hold temperature — When the evaporator saturated temperature reaches this value, the compressor will hold its capacity (no longer load up).
- Down temperature — When the evaporator saturated temperature reaches this value, the compressor will decrease its capacity (unload).
- Down delay — Before actually decreasing capacity (unloading) when the "down temperature" is reached, the controller will wait for the down delay.

4 Press the Down arrow key.
The following screen appears.

```
High pressure
Hold T.        060.0°C
Down T.        065.0°C
```

- Hold temperature — When the condenser saturated temperature reaches this value, the compressor will hold its capacity (no longer load up).
- Down temperature — When the condenser saturated temperature reaches this value, the compressor will decrease its capacity (unload).

5 Press the Down arrow key.
The minimum speed of an inverter driven compressor is displayed (e.g. 33% of 90 Hz = 30 Hz).

```
Compressor min.
speed          33.0%
```

6 Press the Down arrow key.
The nominal speed of an inverter driven compressor is displayed. (e.g. 67% of 90 Hz = 60 Hz).
Note: 100% compressor capacity means that the speed is 60 Hz.

```
Inverter nominal
speed
Summer  67.0%
Winter  67.0%
```

7 Press the Down arrow key.
The following screen appears.

```
Compressor FLA max
(OAT < 40°C)
Comp. #1       105.0A
Comp. #2       140.0A
```

When the ambient temperature is lower than 40°C, the compressor inverter current is limited. This value depends on the size of compressor and inverter. See the parameter list for the correct values.

8 Press the Down arrow key.
The following screen appears.

```
FLA amb.temp comp.
factor  95.0%
```

When the ambient temperature is more than 40°C, the compressor inverter current is limited to 95% of the FLA max value (see screen step 7).

9 Press the Down arrow key.
The following screen appears.

```
Stage hold diff. %
to start reloading
Diff.          10.0%
```

When the current gets to the FLA max value, the compressor will hold its capacity (no longer load up). The current has to drop 10% before the compressor can reload.

10 Press the Down arrow key.
The following screen appears.

```
Stage down % offset
FLA min.
Compressor #1    5.0%
Compressor #2    5.0%
```

When the current gets to the FLA max value + the offset (5%), the compressor will decrease its capacity (unload).

11 Press the Down arrow key.
The following screen appears.

```
Dis.SH THR 001.0°C
disch SH T     030sec
```

When the compressor starts with too low discharge superheat, the compressor will operate at minimum capacity. As soon as the discharge superheat gets above 1,0°C for 30 sec, the compressor can start uploading.

12 Press the Down arrow key.
The following screen appears.

```
N Load Pulse      06
N Unload Pulse    09
```

- Number of load pulses — The number of compressor steps from minimum capacity to maximum capacity.
- Number of unload pulses — The number of compressor steps from maximum capacity to minimum capacity.

13 Press the Down arrow key.
The following screen appears.

```
Load/Unload speed
variation perc.
Load      2.0%
Unload    2.0%
```

Inverter controlled compressors change capacity with steps of 2,0%, which is 1,8 Hz.
Minimum capacity is 33%, nominal is 100% and maximum is 150%.
So there are about 34 steps from minimum to nominal capacity and 25 from nominal to maximum.

14 Press the Down arrow key.
The following screen appears.

```
Loading
Pulse time      00.1s
Min pulse per.030s
Max pulse per.150s
```

To load a compressor, the loading solenoid valve is energized for 0,1 sec (pulse time). When the compressor is loading up, the time between 2 pulses is between 30 sec and 150 sec.
The length of the pulse time has to be calibrated at commissioning using a current clamp.

15 Press the Down arrow key.
The following screen appears.

```
Unloading
Pulse time      01.0s
Min pulse per.001s
Max pulse per.150s
```

To unload a compressor, the unloading solenoid valve is energized for 1,0 sec (pulse time). When the compressor is loading down, the time between 2 pulses is between 1 sec and 150 sec.
The length of the pulse time has to be calibrated at commissioning using a current clamp.

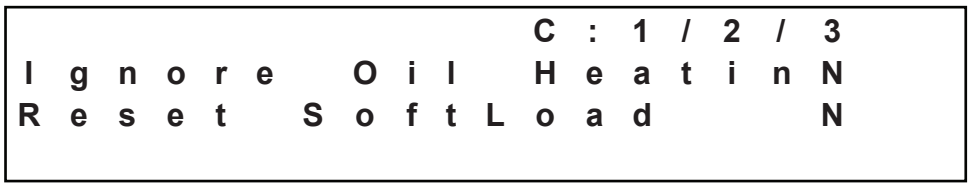
16 Press the Down arrow key.
The following screen appears.

```
1st Pulse duration

Loading         01.0s
Unloading       00.8s
```

To ensure the capacity sliding valve is moving, the first pulse during loading or unloading is energized longer.
Together with the loading and unloading pulse time, the first pulse duration has to be calibrated at commissioning using a current clamp.

17 Press the Down arrow key.
The following screen appears.



When compressor 1 is in oil heating, this can be ignored for 1 start-up.
When the unit is in softload, this can be ignored for 1 start-up.

1.5.3 User Menu

Accessing Settings menu > User

In the Settings menu, press the **Up** arrow key to access the User menu.

```
                    <      Setpoints
                    <  Time  Sched.
                    <   FSM  Sched.
                    <          Clock
```

Setpoints menu

In the User menu, press the **Left** arrow key to access the Setpoints menu.

As a result the following screen appears.

```
Cooling setpoint
                    007.0°C
Heating setpoint
                    0045.0°C
```

Choose the cooling and heating setpoint.

Note: the heating setpoint is only applicable for EWYD units.

Scrolling through the setpoints menu

To scroll through the Setpoints menu, use the Up/Down arrow keys. Below the successive screens that appear when using the Down arrow key.

1 Press the Down arrow key.
The following screen appears.

```
Enable Double
setpoint       Y
```

Enable or Disable the double setpoint. For more information, see the wiring diagrams for the digital input connection.
When double setpoint is enabled, other setpoints are used. The following screen appears when pressing the Down arrow key.

```
Cooling double
setpoint      012.0°C
Heating double
setpoint      050.0°C
```

When the digital input is open, the basic setpoint is used.
When the input is closed, the double setpoint is used.

2 Press the Down arrow key.
The following screen appears.

```
Lvg Water Temp.
setpoint reset

                    NONE
```

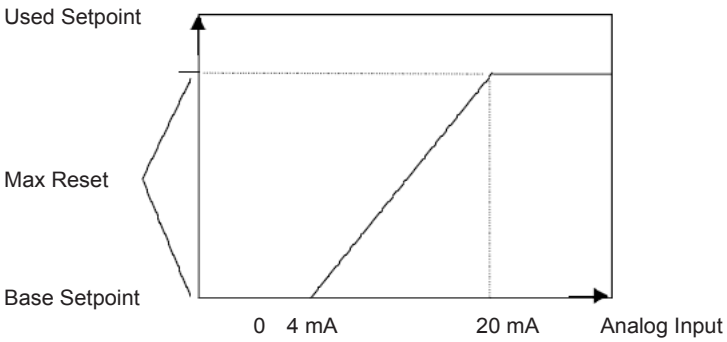
Choose one of the following Leaving water temperature settings

- None (default setting) — Outlet water control.
- Return — Inlet water control.
- 4-20 mA — Setpoint depending on 4-20 mA input (expansion board 4).
- OAT — Setpoint depending on ambient temperature.

- If **4-20 mA** is selected, the following screen appears when pressing the Down arrow key:

```
ChLWT Setpoint
Override Limits
Setp. Diff.
                  003.0°C
```

Setpoint difference = max reset value on below graph.

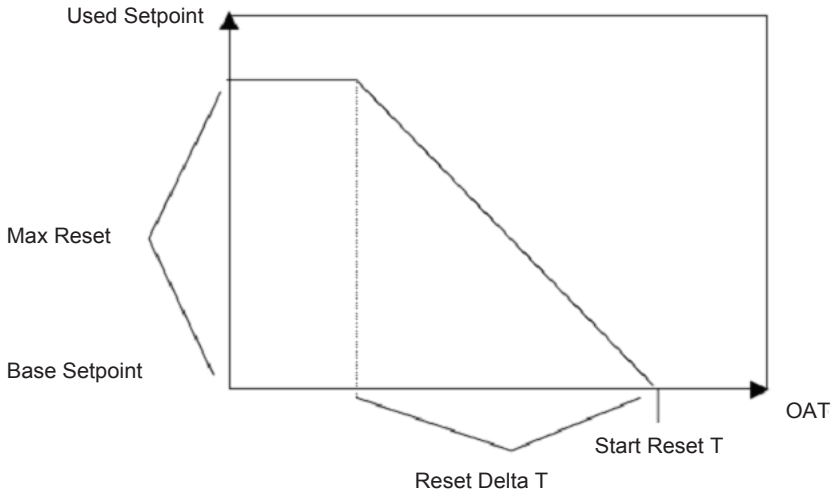



```
HotLWT Setpoint
Override Limits
Minimum          040.0°C
Maximum          050.0°C
```

Note: only for EWYD units.
Minimum (40,0°C) = 4 mA
Maximum (50,0°C) = 20 mA

- If **OAT** is selected, the following screen appears when pressing the Down arrow key.

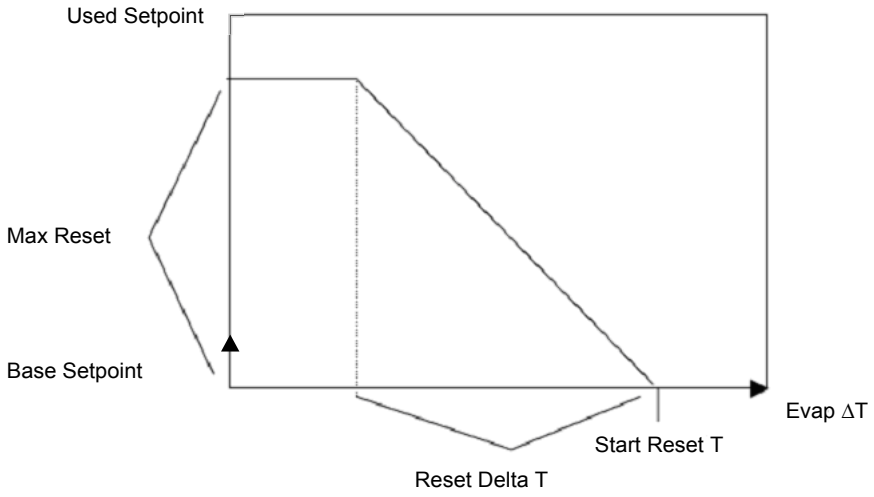
```
OAT ChLWT Reset
Max reset        003.0°C
Reset DT         008.0°C
Start Reset 035.0°C
```



■ If **Return** is selected, the following screen appears when pressing the Down arrow key:

```
ChLWT Return Reset
Start Dt      003.0°C
Max reset     003.0°C
```

The base setpoint is modified on the base of evaporator ΔT and of a max reset value, of a value of OAT to start reset and a value of OAT to apply max reset, as shown in figure below.



3 Press the Down arrow key.
The outlet setpoint for total heat recovery is displayed.

```
Heat Recovery

Setpoint      0050.0°C
```

4 Press the Down arrow key.
The type of working mode is displayed.

```
Working mode
      Cooling
```

There are three possible workings modes:

- Cooling (normal mode)
- Glycol (low leaving water operation)
- Ice (ice mode: the compressor is not allowed to unload, but is stopped using a step procedure)

The table below lists some temperature values/ranges for the 4 modes:

	Cooling	**Glycol**	**Ice**	**Heating**
Setpoint range	4,4°C - 15,5°C	-6,7°C - 15,5°C	-6,7°C - 15,5°C	40°C - 50°C
Freeze alarm	2°C	-10°C	-10°C	
Freeze prevent	3°C	-9°C	-9°C	

5 Press the Down arrow key.
When softload is enabled, the unit will not load more capacity than the maximum stage (50%) during the maximum time (20 min).

```
Enable Softload      Y
Maxstage          050 %
MaxTime           020 min
```

When softload is running, the minutes count down in the main screen.

```
06/02/08    Wed    12:57
Unit Status:  □  ■
Cooling Staging    012%
Soft Load          019 min
```

6 Press the Down arrow key.
The following screen appears.

```
En. Amb. Lockout
                      Y
Setpoint          005.0°C
Diff              001.0°C
```

When ambient lockout is enabled, it stops the unit when the setpoint is reached. When the ambient is more than the setpoint + difference, the unit can start again.

7 Press the Down arrow key.
The following screen appears.

```
Enable Demand Lim
                Y
```

Expansion board 4 can control a demand limit to the unit. This has to be enabled here + with digital input 1 on the expansion board.

8 Press the Down arrow key.
The following screen appears.

```
Enabling Supervisor
Demand Limiting  Y
Type: Unit
```

Supervisory demand limiting can be enabled on unit or circuit.

9 Press the Down arrow key.
The following screen appears.

```
Current Limit set
4mA              000A
20mA             400A
Max Curr.        300A
```

When current measuring system is installed (+ expansion board 4), the current of the unit can be limited to a maximum value.

10 Press the Down arrow key.
The following screen appears.

```
Compressor
sequencing
AUTO
```

Normally the compressor with the least amount of running hours starts first. The start-up procedure can be set to manual. Then you can choose which compressor has to start first, second and third.

```
Set comp. stage
C #1  1st  C #2  2nd
C #3  3rd  C #4  4th
```

11 Press the Down arrow key.
The following screen appears.

```
Heat Recovery pump
sequencing
AUTO
```

When 2 heat recovery pumps are installed, the one with the least amount of running hours will start first. This procedure can be set to manual. Then you can choose which pump has to start first and which has to start as last.

```
Set HR Pumps stage
(manual sequencing)
P #1 1st      P #2 2nd
```

12 Press the Down arrow key.
The following screen appears.

```
Protocol: BACNET
Superv. Com. Speed
9600 (RS485 ONLY)
Identif. No.: 001
```

- Protocol: BACNET / MODSHZ / LONWORKS / MODBUS / REMOTE / LOCAL
- Speed: 1200 (RS485 / RS422) / 2400 (RS485 / RS422) / 4800 (RS485 / RS422) / 9600 (RS485 only) / 19200 (RS485 only)
- Identification number: 1-200

13 Press the Down arrow key.
The following screen appears.

```
Supervisory remote
on / off              N
Supervisory Remote
Cool / Heat           N
```

This allows the BMS system to switch on/off the unit and select cooling or heating (the Q8 cool/heat switch on the switch box is then bypassed).

14 Press the Down arrow key.
The following screen appears.

```
Modem connection

Password          0152
```

When a modem is connected, enter password 0152 to enable the connection.

15 Press the Down arrow key.
The following screen allows you to choose between SI-units (°C, bar, ...) or PI-units (°F, psi, ...).

```
Interface Units
          SI
Supervisory Units
          SI
```

16 Press the Down arrow key.
The following screen allows you to choose a language.

```
Choose Language:

     ENGLISH
```

17 Press the Down arrow key.
The following screen allows you to change the operator password, which is standard set to 00100.

```
    Password Operator
Old:   00000
New:   00000
Save changes?    N
```

Time Schedule menu

In the Settings menu, press the **Right** arrow key to access the Time Schedule menu.

As a result the Enable time scheduling screen appears.

```
Enable time
Scheduling
                        Y
```

If you select **Yes**, you have the posibility to:

- Program the start/stop function of the unit.

```
                Start   Stop
Mo-Fr           00:00   23:59
Sat             00:00   23:59
Sun             00:00   23:59
```

- Program holidays.

```
              Holidays      (1)
00/00      00/00      00/00
00/00      00/00      00/00
00/00      00/00      00/00
```

```
                Holidays      (2)
00/00        00/00        00/00
00/00        00/00        00/00
00/00        00/00        00/00
```


FSM (Fan silent Mode) Schedule menu

In the Settings menu, press the **Up** arrow key to access the FSM menu.

As a result the Fan Silent Mode screen appears.

```
Fan Silent Mode     Y

Max Inv. Out. 06.0 V
```

If you select **Yes**, you have the possibility to program the weekly Fan Silent Mode (see examples below).

```
  FSM Monday-Friday
            Start      Stop
1st         00:00      06:00
2nd         18:00      23:59
```

```
        FSM Saturday
            Start      Stop
1st         00:00      06:00
2nd         14:00      23:59
```

```
          FSM Sunday
            Start      Stop
1st         00:00      23:59
2nd         00:00      00:00
```

```
FSM Force On Days(1)
00/00        00/00        00/00
00/00        00/00        00/00
00/00        00/00        00/00
```

```
FSM Force On Days(2)
00/00        00/00        00/00
00/00        00/00        00/00
00/00        00/00        00/00
```

Clock menu

In the Settings menu, press the **Down** arrow key to access the Clock menu.

As a result the Clock configuration screen appears.

```
Clock config.
Time              18:51
Date           24/03/08
WeekDay           2
```

1.5.4 Alarms Menu

Accessing Settings menu > Alarms

In the Settings menu, press the **Down** arrow key to access the Alarms menu.

As a result the following screen appears.

```
Antifreeze alarm

Setpoint          02.0°C
Diff.             01.4°C
```

When the evaporator leaving water temperature reaches 2,0°C, the antifreeze alarm is activated. It is only possible to reset this alarm when the temperature is 1,4°C above this setpoint (3,4°C).

1 Press the Down arrow key.
The following screen appears.

```
Freeze prevent

Setpoint          03.0°C
Diff.             01.0°C
```

To prevent an antifreeze alarm, the compressors will download capacity when the evaporator leaving water temperature reaches 3,0°C. The compressors can only start uploading again when the temperature is 1,0°C above this setpoint (4,0°C).

2 Press the Down arrow key.
The following screen appears.

```
Oil level Switch

En. Alarm              N
Run delay            010s
```

Note: this function is not active.

3 Press the Down arrow key.
The following screen appears.

```
Oil low pressure
alarm delays
Startup delay        300s
Run delay            090s
```

This function compares the evaporator pressure with the oil pressure. The minimum difference depends on the compressor load.

Compressor load	Activation
Minimum load	(LP X 1.1) + 1 bar
Maximum load	(LP X 1.5) + 1 bar
Intermediate load	Interpolated value

On startup, there is a delay of 300 sec before the pressures are checked.
When running, there is a delay of 90 sec.

4 Press the Down arrow key.
The following screen appears.

```
Saturated disch.
Temperature alarm
Setpoint      068.5°C
Diff.         012.0°C
```

When the saturated discharge temperature (condensing temperature) reaches 68,5°C, the circuit will trip in alarm. It's only possible to reset the alarm when the temperature drops to 68,5°C - 12,0°C = 56,5°C.

5 Press the Down arrow key.
The following screen appears.

```
Saturated suction
Temp alarm cool mode
Setpoint    -008.0°C
Diff.         002.0°C
```

When the saturated suction temperature (evaporating temperature) reaches -8,0°C in cooling mode, the circuit will trip in low pressure alarm. It's only possible to reset the alarm when the temperature goes up to -8,0°C + 2,0°C = -6,0°C.

6 Press the Down arrow key.
The following screen appears.

```
Saturated suction
Temp alarm heat mode
Setpoint    -032.0°C
Diff.         000.0°C
```

Note: the heating mode is only applicable for EWYD units.
When the saturated suction temperature (evaporating temperature) reaches -32,0°C in heating mode, the circuit will trip in low pressure alarm. It's only possible to reset the alarm when the temperature goes up to -32,0°C + 0,0°C = -32,0°C.

7 Press the Down arrow key.
The following screen appears.

```
Saturated suction
Temp alarm delays
Starting        120s
Running         040s
```

When the compressor is starting, the saturated suction temperature (low pressure) alarm is bypassed for 120 sec.
When the compressor is running, the saturated suction temperature (low pressure) alarm is only activated when the saturated temperature drops below the setpoint for 40 sec.

8 Press the Down arrow key.
The following screen appears.

```
High Discharge
Temperature Alarm
Setpoint      110.0°C
```

When the compressor discharge temperature reaches 110,0°C, the circuit trips in high discharge temperature alarm.

9 Press the Down arrow key.
The following screen appears.

```
Press Ratio al
Thresholds
@  25%              1.4
@  100%             1.8
```

Pressure ratio = ratio between the low pressure and high pressure (absolute pressure).
Example: at 25% capacity, the low pressure is 2,0 bar on the controller (relative pressure). The absolute low pressure is then 3,0 bar. The absolute high pressure needs to be 3,0 x 1,4 = 4,2 bar (relative 3,2 bar).

10 Press the Down arrow key.
The following screen appears.

```
   Oil Press Diff

Alarm Setp    002.5bar
```

The oil pressure is measured behind the oil filter inside the compressor. If the condensing pressure - oil pressure = 2,5 bar or more, the unit trips in high oil pressure difference alarm.

11 Press the Down arrow key.
The following screen appears.

```
Select PVM or GPF
alarm type: Unit
```

PVM (phase voltage monitor) or GPF (ground protection failure) is always set on Unit. The voltage monitor looks at the voltage (360 V - 440 V) and the phase sequence.

12 Press the Down arrow key.
The following screen appears.

```
Evap. Flow Switch
alarm delays
Startup delay 020s
Run delay     005s
```

When the unit starts, there has to be 20 sec of flow during the first 30 sec of pump operation. When the unit is running, the flow switch has to be open for 5 sec before the unit trips in flow alarm.

13 Press the Down Arrow key.
The following screen appears.

```
HR high water
temp. alarm
Threshold      050.0°C
```

When the leaving water of the total heat recovery reaches 50,0°C, the unit will trip in alarm.

14 Press the Down arrow key.
The following screen appears.

```
HR Flow switch
alarm delays
Startup delay  020s
Running delay  005s
```

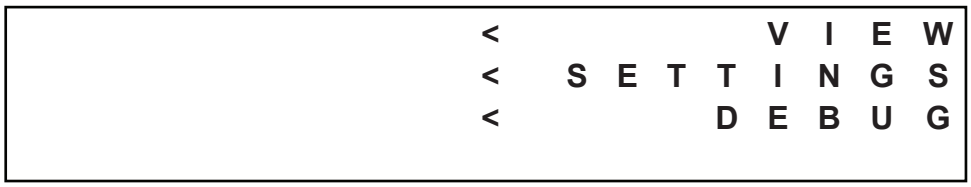
When the total heat recovery starts, there has to be 20 sec of flow during the first 30 sec of pump operation. When the heat recovery is running, the flow switch has to be open for 5 sec before the circuit trips in alarm and the following screen appears.

1.6 Maintenance Menu

Main screen of the Maintenance menu

In the Main menu of the controller, press the **Down** arrow key to access the Maintenance menu.

As a result the following screen appears.



The Maintenance menu contains three submenu's:

Topic	See page
1.6.1–View Menu	2–68
1.6.2–Settings Menu	2–72
1.6.3–Debug Menu	2–81

1.6.1 View Menu

Accessing Maintenance menu > View

In the Maintenance menu, press the **Left** arrow key to access the View menu.

```
Hour counter
Pump Evap.          000007
Second Pump         000007
```

This screen allows you to see the running hours of the primary and secondary pump, if present.

Scrolling through the View menu

To scroll through the View menu, use the Up/Down arrow keys. Below the successive screens that appear when using the Down arrow key.

1 Press the Down arrow key to consult the parameters of the PID thermostat control.

```
Cooling PID Errors
Prop.  014.7   °C
Der.   000.0   °C/min
```

```
Cool. PID Act.      1000
Proportional        1000
Derivative          0000
```

```
Cooling Reg.
Disable stop          N
Increase stop         N
```

```
Heating PID Errors
Prop.  007.7   °C
Der.   000.0   °C/min
```

```
Heat. PID Act.      1000
Proportional        1000
Derivative          0000
```

```
Heating Regulation
Disable stop          N
Increase stop         N
```

```
Global PID request
Load                    N
Unload                  N
Standby                 N
```

2 Press the Down arrow key.
The following screen appears.

```
        Available Board

X          ■          ■          X
                X                 X
```

The connected expansion boards.
In this example, expansion board 2 and 3 are present on the main pCO2 controller.

3 Press the Down arrow key 4 times to consult the following 4 successive compressor screens.

```
Compressor 1/2/3   Hold
LPN      HPN       AmpN
HRN      VFDN      DSHN
HWN      NTWN
```

```
Compresso 1/2/3 Unload
LPN      HPN       AmpN
FRN
HWN      NTWN
```

When xxN becomes xxY, the compressor is holding or decreasing capacity, because of a limitation with the:

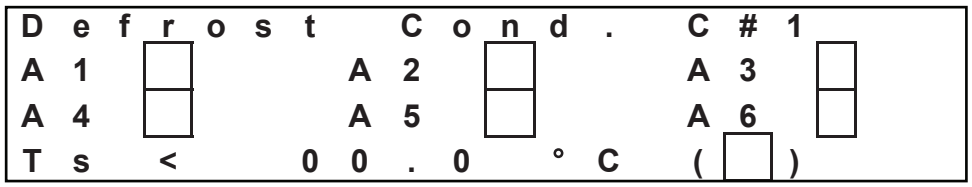
- LP: Low pressure
- HP: High pressure
- Amp: Current
- HR: Heat recovery
- VFD: Variable frequency driver (compressor inverter)
- DSH: Discharge superheat
- HW: Hot water
- NTW: Network
- FR: Freeze prevention

4 Press the Down arrow key.
The following screen appears.

```
Num. Defrost cycle
Circ. 1:  004
Circ. 2:  007
Circ. 3:  005
```

This shows the number of defrost cycles per circuit.

5 Press the Down arrow key.
The following screen appears.

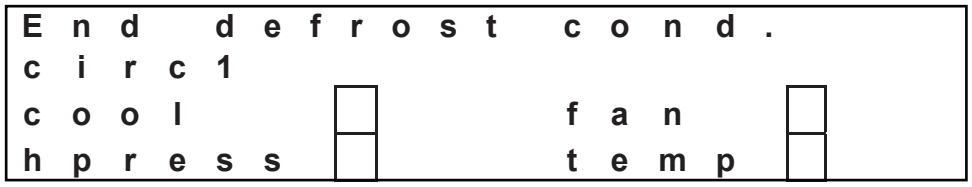


The defrost conditions of circuit 1

- A1 suct < 0,7 x OAT - 10°C is true for 180 sec
- A2 OAT < 20°C, suct < 0°C and SSH < 10°C
- A3 timer since compressor start
- A4 defrost interstage timer (1800 sec)
- A5 defrost not finished
- A6 defrost enabled
- Ts < xx°C suct < 0,7 x OAT - 10°C is true

When all these conditions are true, defrost will start.
Note: It is also possible to call a manual defrost.

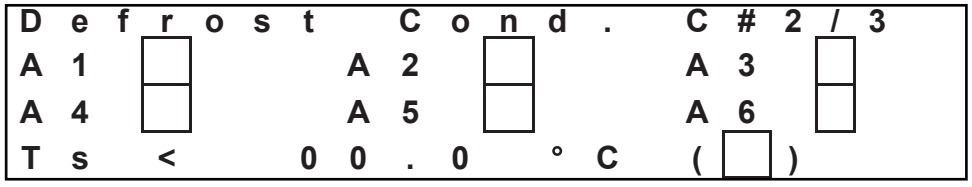
6 Press the Down arrow key.
The following screen appears.



The defrost end condition:

- cool: maximum time has exceeded (default 600 sec)
- fan: not used
- hpress: defrost ends in HP condition (default 14 bar)
- temp: defrost ends due to too low leaving water temperature (default 12°C)

7 Press the Down arrow key.
The defrost conditions of circuit 2 and 3 appear.



For more information refer to the defrost conditions of circuit 1.

8 Press the Down arrow key.
The end defrost conditions of circuit 2 and 3 appears.

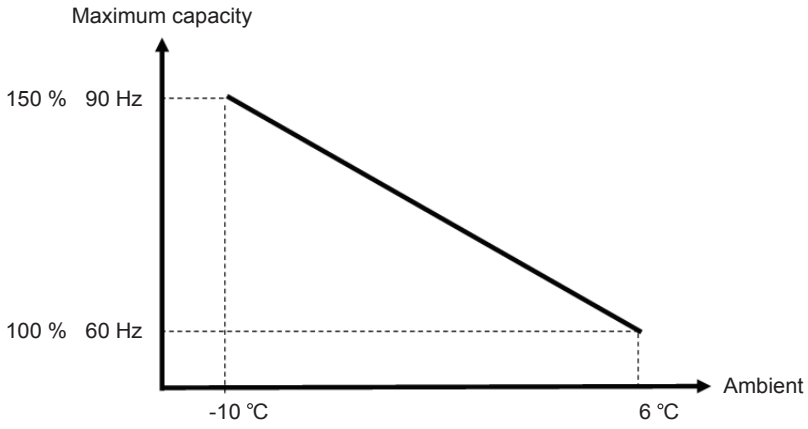
```
End defrost cond.
circ2/3
cool      [ ]   fan    [ ]
hpress    [ ]   temp   [ ]
```

For more information refer to the end defrost conditions of circuit 1 (see step 6).

9 Press the Down arrow key.
The following screen appears.

```
Inverter overboost
Overboost                [ ]
Overb. by Tamb           [ ]
Max Capacity        125 %
```

- Overboost — When digital input 2 of expansion board 2 is closed.
- Overboost by ambient temperature in cooling — Overboost is enabled depending on ambient temperature (> 35°C in cooling mode).
- In heating mode, overboost is automatically enabled, depending on ambient temperature:



1.6.2 Settings Menu

Accessing Maintenance menu > Settings

In the Maintenance menu, press the **Right** arrow key to access the Settings menu.

```
Evap.Pump h.Count.
Thresh.    010x1000
Reset             N
Adjust       000007
```

- The Threshold value shows the amount of running hours where a maintenance alarm is triggered. The default value is 010 x 1000. So after 10 000 running hours, an evaporator pump maintenance alarm will come up.
- By changing the Reset from N to Y, the evaporator pump hour counter is reset to 0.
- In Adjust, the evaporator pump hour counter can be manually adjusted.

Scrolling through the Settings menu

To scroll through the Settings menu, use the Up/Down arrow keys. Below the successive screens that appear when using the Down arrow key.

1 Press the Down arrow key.
The following screen appears.

```
Second.Pump h.Count.
Thresh.    010x1000
Reset             N
Adjust       000007
```

Second evaporator pump (if present) hour counter alarm threshold, reset and adjustment.

2 Press the Down arrow key.
The following screen appears.

```
Comp.#1 h.Count
Threshold  010x1000
Reset             N
Adjust       000007
```

- The Threshold value shows the amount of running hours where a maintenance alarm is triggered. The default value is 010 x 1000. So after 10 000 running hours, a compressor #1 maintenance alarm will come up.
- By changing the Reset from N to Y, the compressor #1 hour counter is reset to 0.
- In Adjust, the compressor #1 hour counter can be manually adjusted.

3 Press the Down arrow key.
The following screen appears.

```
Comp.#1 starts
Reset             N
Adjust        00014
```

The compressor #1 number of starts can be adjusted and reset to 0.

4 Press the Down arrow key.
The following screen appears.

```
Comp.#2 h.Count
Threshold 010x1000
Reset N
Adjust 000007
```

Compressor #2 maintenance alarm threshold, reset of hour counter and adjust of hour counter. Similar like compressor #1.

5 Press the Down arrow key.
The following screen appears.

```
Comp.#2 starts
Reset N
Adjust 00014
```

The compressor #2 number of starts can be adjusted and reset to 0.

6 Press the Down arrow key.
The following screen appears.

```
Comp.#3 h.Count
Threshold 010x1000
Reset N
Adjust 000007
```

Compressor #3 maintenance alarm threshold, reset of hour counter and adjust of hour counter. Similar like compressor #1.

7 Press the Down arrow key.
The following screen appears.

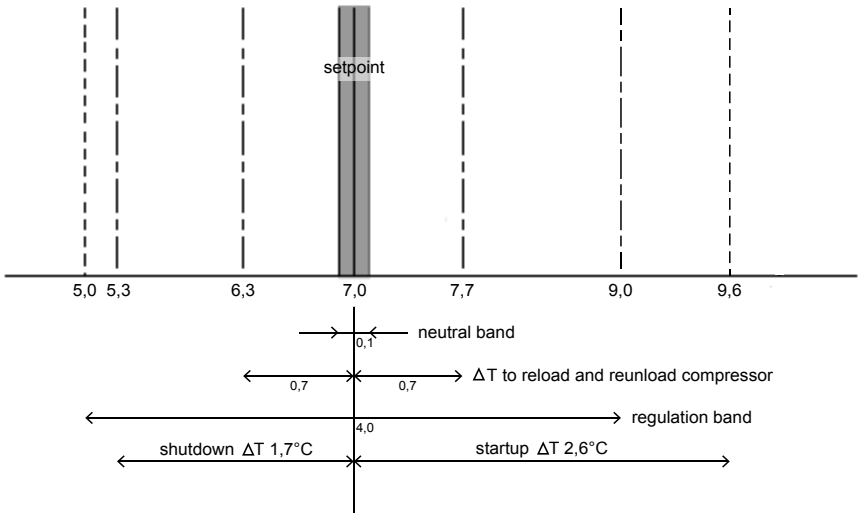
```
Comp.#3 starts
Reset N
Adjust 00014
```

The compressor #3 number of starts can be adjusted and reset to 0.

8 Press the Down arrow key.
The following screen appears.

```
Regul. band 004.0°C
Neutr. band 000.1°C
Max Pull Down Rate
          00.7°C/min
```

- The Regulation band is the area around the setpoint where the PID control is active.
- The Neutral band is the area around the setpoint where there is no regulation, except if the PID control would require it.
- The Maximum pull down rate is a limitation how fast the leaving water temperature can drop per minute.
  If the leaving water temperature decreases faster, the compressors will hold or even unload their capacity.



9 Press the Down arrow key.
The following screen appears.

```
   M a x   P u l l   U p   R a t e
                              0 1 . 2 ° C
S t a r t u p   D T   0 0 2 . 6 ° C
S h u t d n   D T     0 0 1 . 7 ° C
```

- The Maximum pull up rate is a limitation how fast the leaving water temperature can rise up per minute (in heating mode).
  If the leaving water temperature increases faster, the compressors will hold or even unload their capacity.
- The Startup DT is the difference with the setpoint where the unit can start.
  For example, if the setpoint is 7,0°C and the Startup DT is 2,6°C, the unit will only start at 9,6°C or more.
- The Shutdown DT is the difference with the setpoint where the unit will stop.
  For example, if the setpoint is 7,0°C and the Shutdown DT is 1,7°C, the unit will stop at 5,3°C or less.

10 Press the Down arrow key.
The following screen appears.

```
H i g h   C h L W T   s t a r t
L W T                 0 2 5 . 0 ° C
M a x C o m p . S t a g e   0 7 0 %
```

The unit will limit the maximum compressor capacity to 70% when the leaving water temperature is more than 25°C (not in heating mode).

11 Press the Down arrow key.
The following screen appears.

```
M i n   E v a p   D T   0 1 . 0 ° C
M a x   T i m e         1 5 m i n
```

The unit will switch off when the evaporator delta T is less than 1,0°C for 15 min.

12 Press the Down arrow key.
The following screen appears.

```
Load for Comps
Min Load          025%
Full Load         100%
En Slide Valve      N
```

Not used.

13 Press the Down arrow key.
The following screen appears.

```
ChLW Temperature
setpoint limits
Low              004.0°C
High             015.0°C
```

These are the limits for the cooling setpoint.
They will automatically change with the current working mode, but can also be changed manually.
Note: these limits should not be changed outside the unit's operating range.

14 Press the Down arrow key.
The following screen appears.

```
HotLW Temperature
setpoint limits
Low              040.0°C
High             050.0°C
```

These are the limits for the heating setpoint.
These can be changed manually.
Note: these limits should not be changed outside the unit's operating range.

15 Press the Down arrow key.
The following screen appears.

```
Probes enable
B1:Y B2:Y B3:Y B4:Y
B5:Y B6:Y B7:Y B8:Y
B9:Y B10:Y
```

Here the analogue inputs of the main controller can be manually enabled or disabled.
Note: these are automatically changed depending on the unit's configuration. See the wiring diagram for the corresponding inputs.

16 Press the Down arrow key.
The following screens appear.

```
Exp probes enable 1
B101:N      B102:N
B103:N      B104:N
B201:Y      B202:N
```

```
   Exp probes enable
B203:N          B204:N
B301:N          B302:N
```

```
   Exp probes enable
B401:N          B402:N
B404:N
```

Here the analogue inputs of the expansion boards can be manually enabled or disabled.

Note: these are automatically changed depending on the unit's configuration. See the wiring diagram for the corresponding inputs.

17 Press the Down arrow key.

The following screens appear.

```
Exp.Dig.Input Enable
DI103:N         DI104:N
DI201:N         DI202:N
DI301:N         DI302:N
```

```
Exp.Dig.Input Enable
DI303:N         DI304:N
DI401:N         DI402:N
DI403:N         DI404:N
```

Here the digital inputs of the expansion boards can be manually enabled or disabled.

Note: these are automatically changed depending on the unit's configuration. See the wiring diagram for the corresponding inputs.

18 Press the Down arrow key.

The following screens appear.

```
Inputs Probes offset
B1:  0.0        B2:  0.0
B3:  0.0        B4:  0.0
B5:  0.0
```

```
Inputs Probes offset
B6:  0.0        B7:  0.0
B8:  0.0        B9:  0.0
B10:  0.0
```

Here offsets can be given to the analogue inputs of the main pCO2 controller.

This can be done when certain pressure or temperature sensors deviate.

Range: -9,9 until +9,9.

19 Press the Down arrow key.
The following screens appear.

```
Expansion A
Probe offset

B103: 0.0   B104: 0.0
```

```
Expansion B
Probe offset
B201: 0.0   B202: 0.0
B203: 0.0   B204: 0.0
```

```
Expansion C
Probe offset
B301: 0.0   B302: 0.0
```

```
Expansion D
Probe offset
B401: 0.0   B402: 0.0
            B404: 0.0
```

Here offsets can be given to the analogue inputs of the expansion boards.
This can be done when certain pressure or temperature sensors deviate.
Range: -9,9 until +9,9.

20 Press the Down arrow key.
The following screen appears.

```
DT to reload and
reunload comp

            000.7°C
```

Loading:
When an additional compressor is required to start and the leaving water temperature is between the setpoint (for example 7,0°C) and this DT to reload and reunload compressor (setpoint 7,0°C + 0,7°C = 7,7°C), the already running compressor(s) will first unload before an additional compressor will start.

Unloading:
When a compressor is required to stop if multiple compressors are running and the leaving water temperature is between the setpoint (for example 7,0°C) and this DT to reload and reunload compressor (setpoint 7,0°C - 0,7°C = 6,3°C), the other compressor(s) that will stay on will first upload before the compressor that was required to stop will actually stop.

This DT to reload and reunload compressor is used to avoid big changes in capacity when the leaving water temperature is close to the setpoint.

21 Press the Down arrow key.
The following screen appears.

```
Reset alarm
buffer                    N
```

Here the alarm log can be cleared.

22 Press the Down arrow key.
The following screen appears.

```
Defrost forcing
Circ.1: No force
Circ.2: No force
Circ.3: No force
```

Here a manual defrost can be forced.

- Force cool will do a normal defrost by reversing the cycle.
- Force fan will put all fans at maximum speed (not recommended).

23 Press the Down arrow key.
The following screen appears.

```
Defrost cycles
counter reset: N
```

This resets the defrost cycles counter in the maintenance → view menu.

24 Press the Down arrow key.
The following screen appears.

```
Supervisor auto.
comp. selection
Enabling      N
Delay      030s
```

When this function is enabled, integer index 32 (modbus 40161 or LON integer value “nviCompSelect”) is automatically switching between the available circuits.

The BMS variable list only contains the information of 1 particular circuit. By changing this integer value to the corresponding circuit (1, 2 or 3), the information of that circuit becomes available.

25 Press the Down arrow key.
The following screens appear.

```
HR Pump h.Count.
Thresh.      010x1000
Reset             N
Adjust       000007
```

```
HR Pump2 h.Count.
Thresh.      010x1000
Reset              N
Adjust        000007
```

- The Threshold value shows the amount of running hours where a maintenance alarm is triggered. The default value is 010 x 1000. So after 10 000 running hours, a heat recovery pump #1 or #2 maintenance alarm will come up.
- By changing the Reset from N to Y, the heat recovery pump #1 or #2 hour counter is reset to 0.
- In Adjust, the heat recovery pump #1 or #2 hour counter can be manually adjusted.

26 Press the Down arrow key.
The following screen appears.

```
Inverter Forced
Speed #1/2/3
Enabling N
Compr. #1/2/3 000.0%
```

Here the speed of the inverter compressors can manually be changed.
To do this, Enabling has to be set to Y.
Then, the speed of Compr. #1, 2 or 3 can be changed.

27 Press the Down arrow key.
The following screen appears.

```
Communication
        Supervisor
On Comm. Loss
        LOCAL
```

Communication:

- Supervisor: for BMS systems (Modbus, Bacnet and LON).
- CSC: for CSCIII or EKDSSP sequencing panel.

On communication loss (only for CSC):

- Local: switch to local control when the communication is lost between the unit and the CSC system.
- Alarm: stop with a communication alarm when the communication is lost between the unit and the CSC system.

28 Press the Down arrow key.
The following screen appears.

```
CSC safety setp.
Activate      N
Cooling    07.0°C
Heating    45.0°C
```

When the CSC safety setpoint is activated (Y), the unit switches to an adjustable setpoint when communication is lost with the CSC system.
There is an adjustable setpoint for Cooling (default 7,0°C) and for Heating (default 45,0°C) mode.

29 Press the Down arrow key.
The following screen appears.

```
     Password Manager
Old:   02001
New:   00000
Save changes?     N
```

This allows you to change the Manager password.
It is recommended to leave the Manager password as standard (02001).

1.6.3 Debug Menu

Note The Debug menu is beyond the scope of this service manual and will not be discussed.

2 Functional Control

2.1 What Is in This Chapter?

Introduction

This chapter gives more detailed information on the functions and controls of the unit.

Overview

This chapter contains the following topics:

2.2 Control Possibilities

Overview

- Local control
- Remote control
- Network control
- Time schedule

Explanation

The control allows different ways to enable/disable the unit:

- Local control : by using the QO switch that is mounted on the switchbox.
  When QO is off, there is “Off Local Sw” on the status screen.
- Remote control : by using a field supplied switch that is connected to the “ON-OFF Remote” digital input (see field wiring connections on the wiring diagram).
  When the remote switch is off, “Off Remote Sw” is displayed on the status screen.
- Network control : a supervisory (BMS) or CSC system may send an On/Off signal.
  “Off Rem. Comm.” is then displayed on the status screen.
- Time schedule : a timetable allows to program a weekly schedule. Several holidays can be included.

2.3 Operating Modes

Overview

- Cooling mode
- Cooling / Glycol mode
- Ice operation
- Heating
- Cooling + Heat recovery
- Cooling / Glycol + Heat recovery
- Ice + Heat recovery

Explanation

MODE	SETPOINT RANGE (°C)	Freeze up prevention (°C)	Freeze up protection (°C)
Cooling	+ 4,0 / + 15,0	+ 3°C	+ 2°C
Cooling / Glycol	– 8,0 / + 15,0	– 9	– 10
Ice	– 8,0 / + 15,0	– 9	– 10
Heating	+ 35 / + 55	+ 3°C	+ 2°C
Cooling / Heat recovery	+ 4,0 / + 15,0	+ 3°C	+ 2°C
Cooling / Glycol / Heat recovery	– 8,0 / + 15,0	– 9	– 10
Ice / Heat recovery	– 8,0 / + 15,0	– 9	– 10

The setpoint range can also be manually adjusted in the maintenance, settings menu. The freeze up prevention and protection can be adjusted in the settings, alarms menu.

A sufficient amount of glycol has to be used if water temperatures below 4°C are required or possible.

2.4 Set-point Management

Overview

- Local set-point control
- Double set-point control
- Set-point controlled by external input
  - 4 – 20 mA
  - Floating set-point (on ambient temperature)
  - Inlet water control
  - Set-point controlled by BMS system

Explanation

The control is able to manage the evaporator leaving water temperature on the base of several inputs:

- Local set-point : selected from the controller.
- Double set-point : when this is enabled, a second setpoint can be set in the controller. To activate this second setpoint, the “Double setpoint” input has to be closed. See field wiring connection on the wiring diagram.

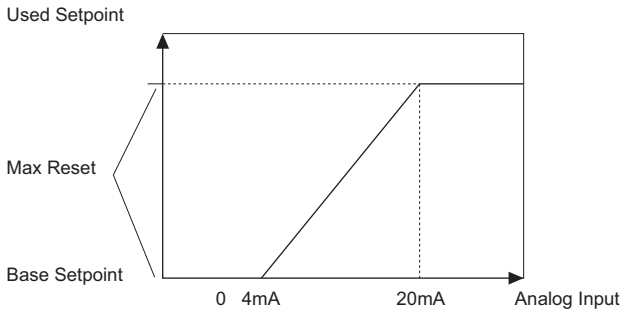
Set-point reset methods

The following set-point reset methods are available to modify the local or double set-point:

- None : outlet control.
- 4-20 mA : base set-point is modified on the base of a user analog input.
- OAT : base set-point is modified on the base of outside ambient temperature (if ambient sensor is installed).
- Inlet : base set-point is modified on the base of evaporator entering temperature.
- Network : the set-point is determined by a BMS or CSC system.

4-20 mA set-point control

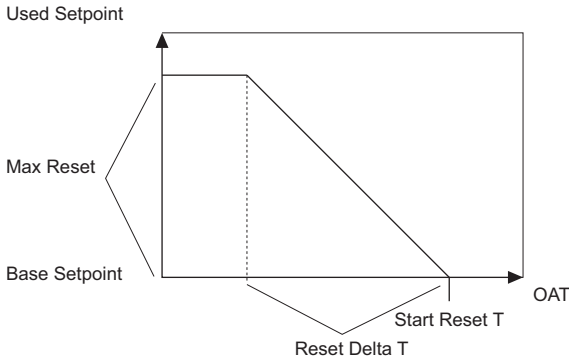
Through an external signal 4-20 mA, it is possible to change the value of the local set-point within the minimum and maximum set limits.



See field wiring connection on the wiring diagram.

Floating set-point

This function is called OAT setpoint reset. A reduction of the external temperature corresponds to an increase in the set-point. This system allows energy saving when the external temperature goes down under the projected value.



To enable the OAT set-point override, an ambient sensor is required. The base set-point is modified on the basis of an outside ambient temperature, a reset temperature start, a max reset value, a value of OAT to start reset and a value of OAT to apply max reset.

Example:

Maximum reset : 5°C

Reset DT : 10°C

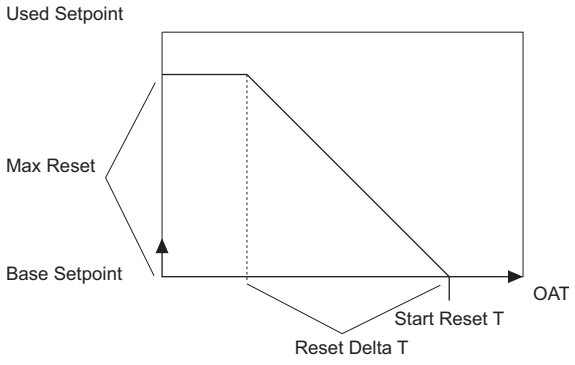
Start reset : 35°C

So when the ambient is 35°C or more, the base setpoint is used (for example 7,0°C).

And when the ambient is 25°C or less, the setpoint will be 7,0°C + 5,0°C = 12,0°C.

Return reset

The base setpoint is modified on the base of evaporator ΔT and of a max reset value.



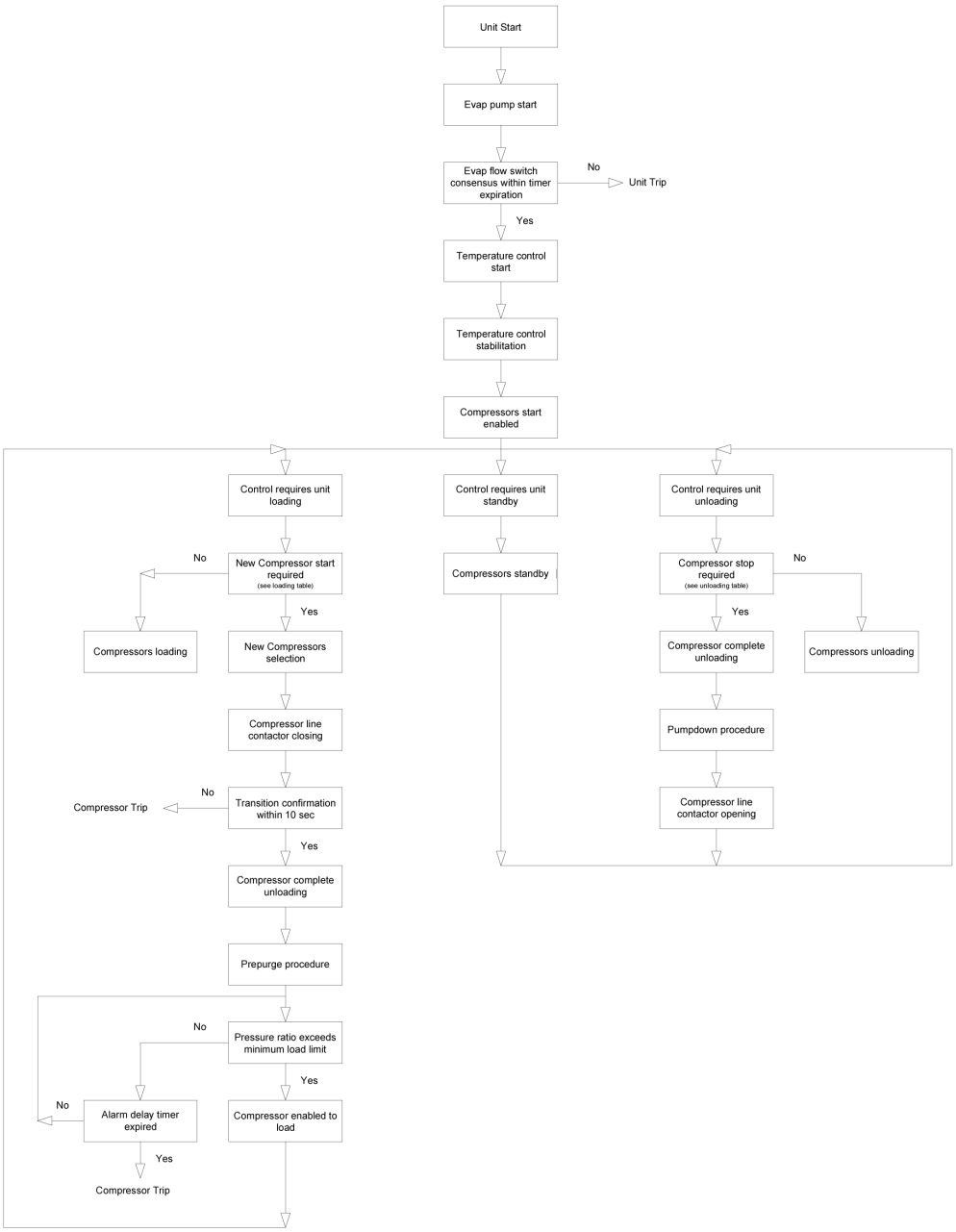
2.5 Unit Start Sequence

Overview

This chapter contains the following topics:

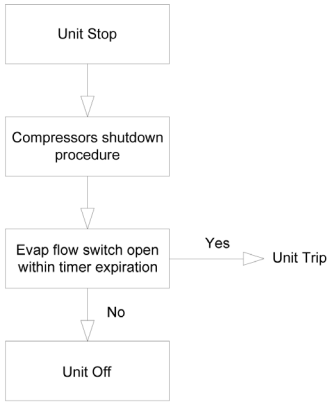
2.5.1 Unit Starting Sequence Flow Charts

Standard unit start-up flowchart

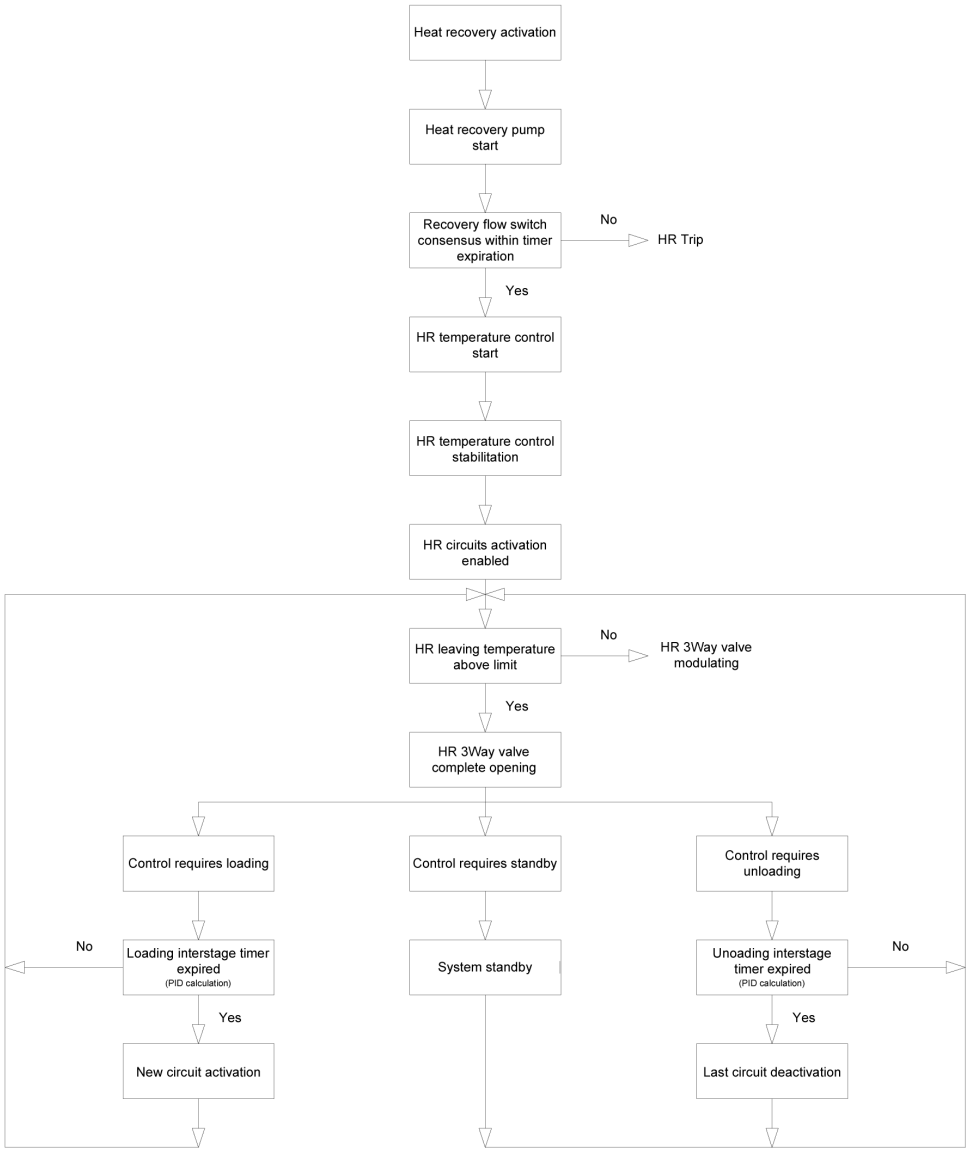


2

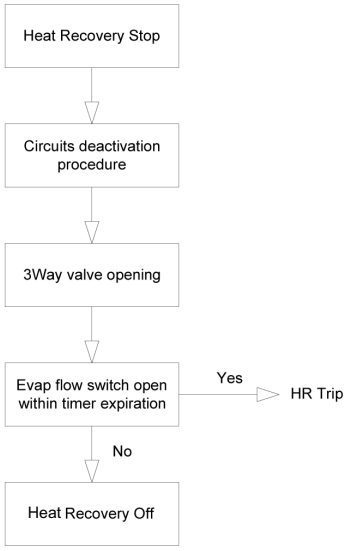
Standard unit shut-down flowchart



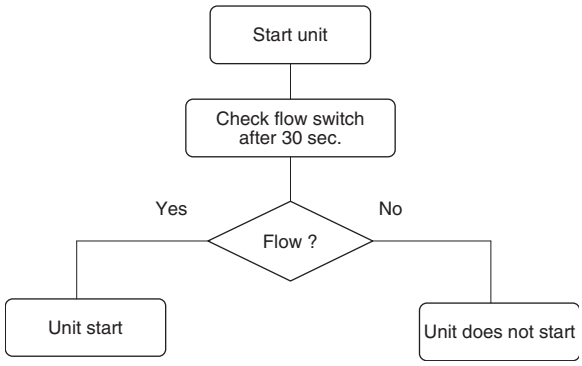
Heat recovery unit start-up flowchart



Heat recovery unit shut-down flowchart



2.5.2 Water Pump Operation



- The second pump is optional.
- When 2 pumps are installed, the pump with the lowest running hours will start.
- It is possible to program the sequence.

2.5.3 Oil Heating

Explanation

Oil heating is required to separate the refrigerant and the oil when the compressor is off. Hot oil will have adequate viscosity and the compressor will be able to start with discharge superheat.

The start-up of compressors will not be allowed if the following formula is not respected:

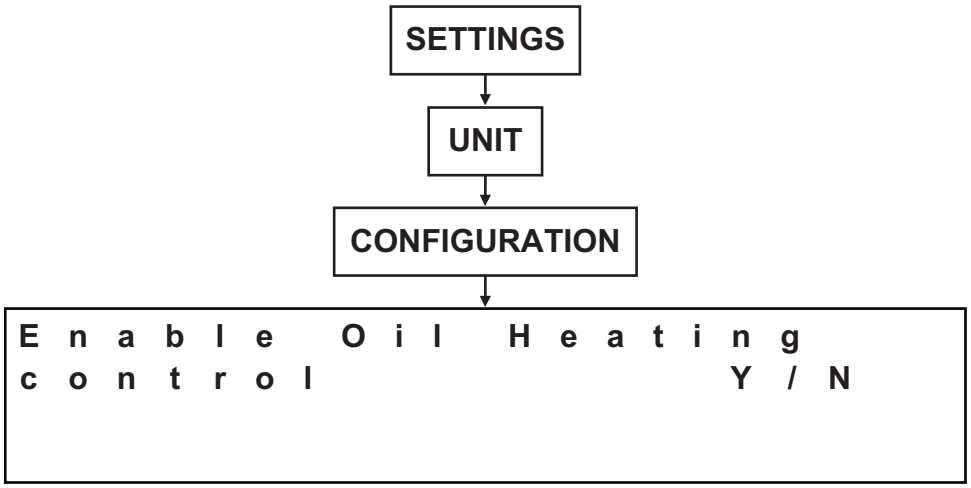
Discharge Temperature – TOilPress > 5°C

Where:

Discharge Temperature is the compressor discharge temperature (corresponding to oil temperature).

TOilPress is the refrigerant saturated temperature at the oil pressure.

Programming oil heating



2.5.4 Pre-purge Operation

Explanation

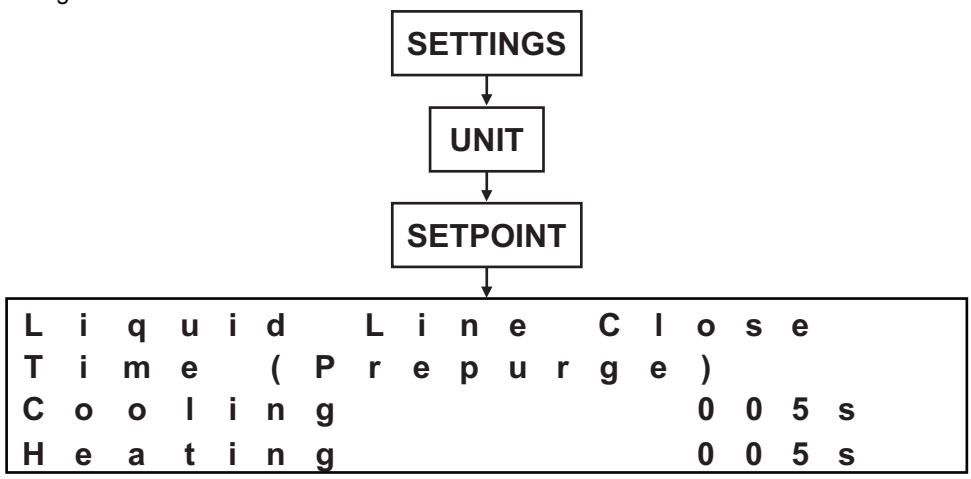
When the compressor starts, the expansion valve (or liquid line solenoid valve) stays closed for some seconds.

After this, the electronic expansion valve goes to a programmable pre-opening.

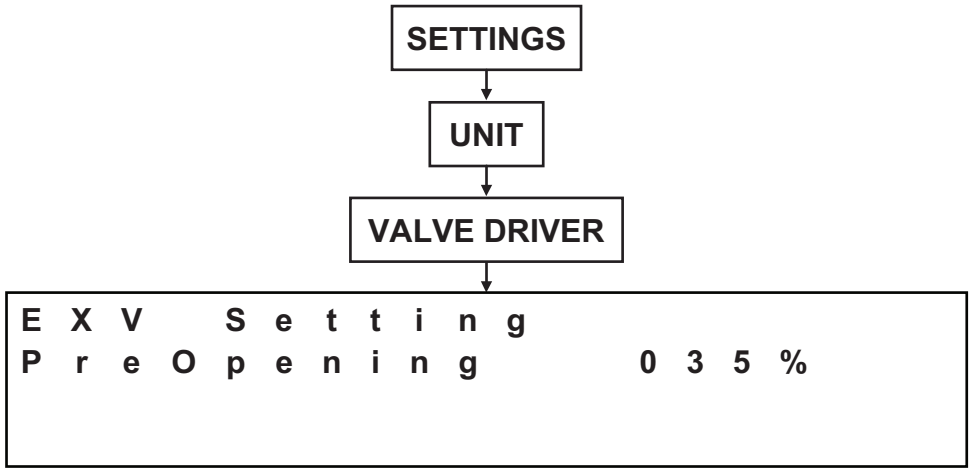
2

Programming

- Closing time:



- Pre-opening:



2.6 Compressor Management Control

Overview

This chapter contains the following topics:

2.6.1 Overview and Explanation

Overview

- Automatic control
- Manual control

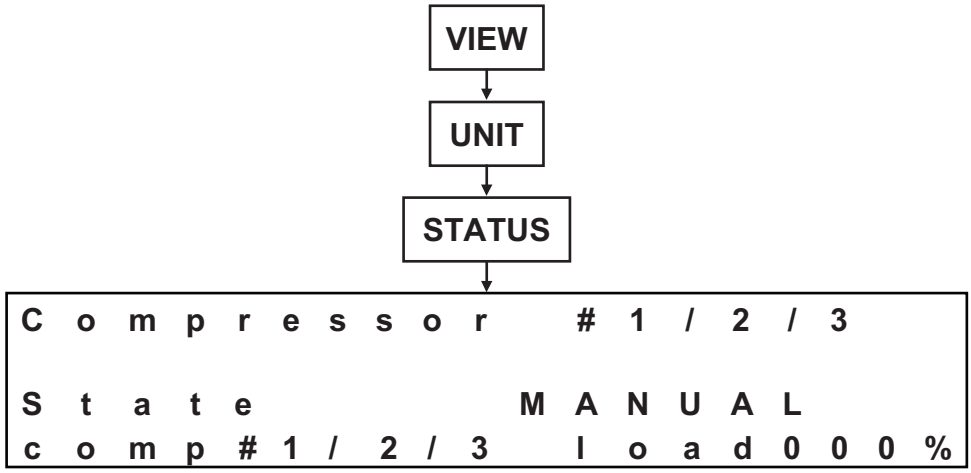
Explanation

- Automatic control : The compressor start/stop and its capacity are automatically managed by the software to allow the set-point control.
- Manual control : The compressor is started by the operator and its capacity is managed by the operator's programming the controller. In this case the compressor will not be used by the software to allow the set-point control.

  Manual control is automatically switched to Automatic control if any safety action is required on the compressor (safety stand-by or unloading or safety shutdown). In this case the compressor remains in Automatic and must be re-switched to Manual by the operator if required.

  Compressors in manual mode are automatically switched to automatic mode during shutdown.

Programming



2.6.2 Definitions and Programming

Number of load pulses (non-inverter compressor)

Quantity of pulses required to load from 25 to 100%.

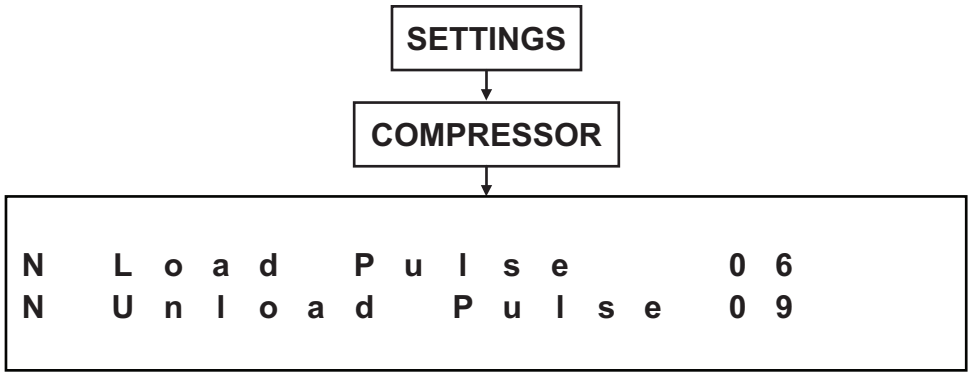
The default quantity of pulses is 6 for the Frame 3100 series compressors and 12 for the Frame 3200 series compressors.

Number of unload pulses (non-inverter compressor)

Quantity of pulses required to unload from 100 to 25%.

The default quantity of pulses is 9 for the Frame 3100 series compressors and 12 for the Frame 3200 series compressors.

Programming



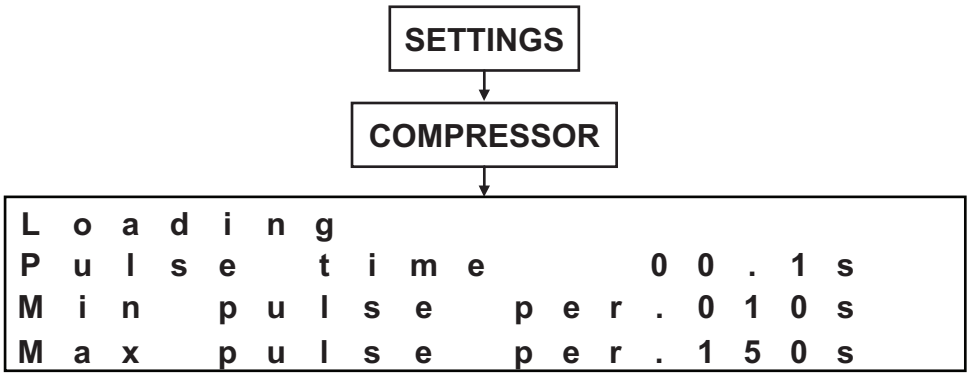
Loading (non-inverter compressor)

The pulse time setting determines how long the loading solenoid valve is energized at each individual pulse. The minimum and maximum pulse period are the time limits between individual pulses.

When the water temperature is far above the setpoint, the minimum pulse period is used.

When the water temperature is a little bit above the setpoint, the maximum pulse period is used.

Programming



Unloading (non-inverter compressor)

The pulse time setting determines how long the unloading solenoid valve is energized at each individual pulse. The minimum and maximum pulse period are the time limits between individual pulses.

When the water temperature is far below the setpoint, the minimum pulse period is used.

When the water temperature is a little bit below the setpoint, the maximum pulse period is used.

2

Programming

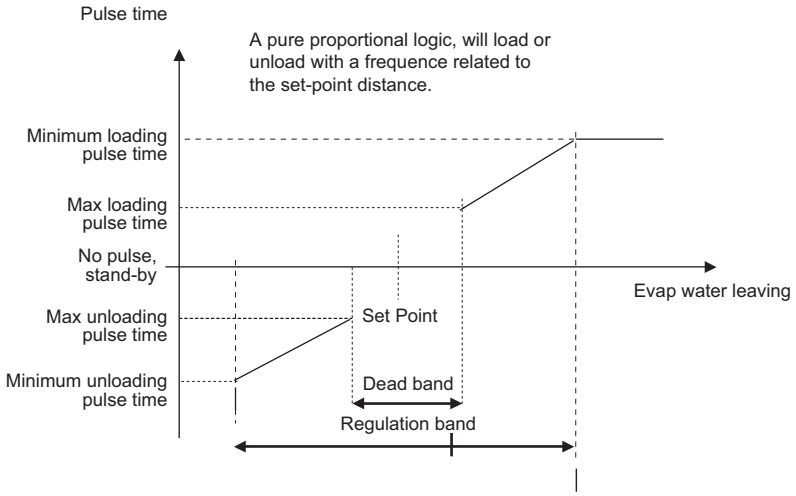
SETTINGS

COMPRESSOR

```
Unloading
Pulse time          00.3s
Min pulse per.001s
Max pulse per.150s
```

Note:

- At maximum compressor capacity, the loading solenoid valve is permanently energized.
- At minimum compressor capacity, the unloading solenoid valve is permanently energized.



First pulse duration (non-inverter compressor)

The first pulse will be longer to make sure that the slide vane starts moving.

- Loading: 1 sec.
- Unloading: 0,8 sec.

Programming

SETTINGS

COMPRESSOR

```
1st Pulse duration

Loading             01.0s
Unloading           00.8s
```

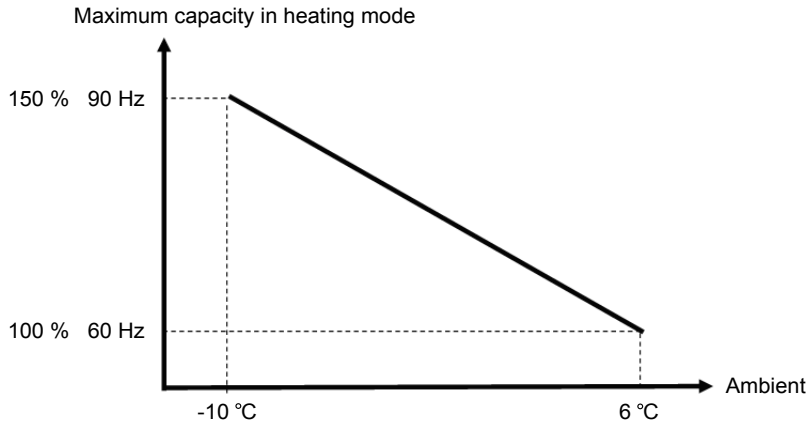
Loading and unloading (inverter compressor)

Inverter compressors have the oil capacity control system blocked: the loading solenoid valve stays energized.

The compressor capacity is regulated with the speed of the screw.

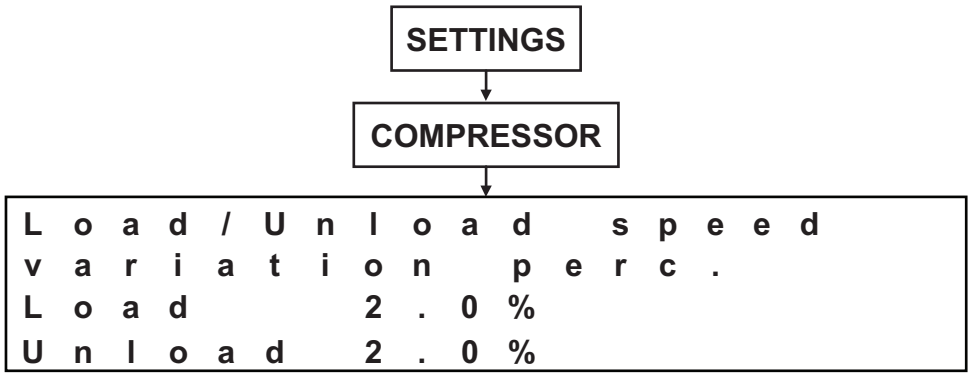
The nominal speed is 60 Hz (100%).

The maximum speed is 90 Hz (150%) in overboost. This is automatically enabled in heating: below 6°C (max 100%) until -10°C (max 150%) the maximum compressor capacity is linearly increased. In cooling mode overboost is enabled above 35°C ambient temperature.



The speed of the inverter can be changed in steps of 2% from 90 Hz, so steps of 1,8 Hz.

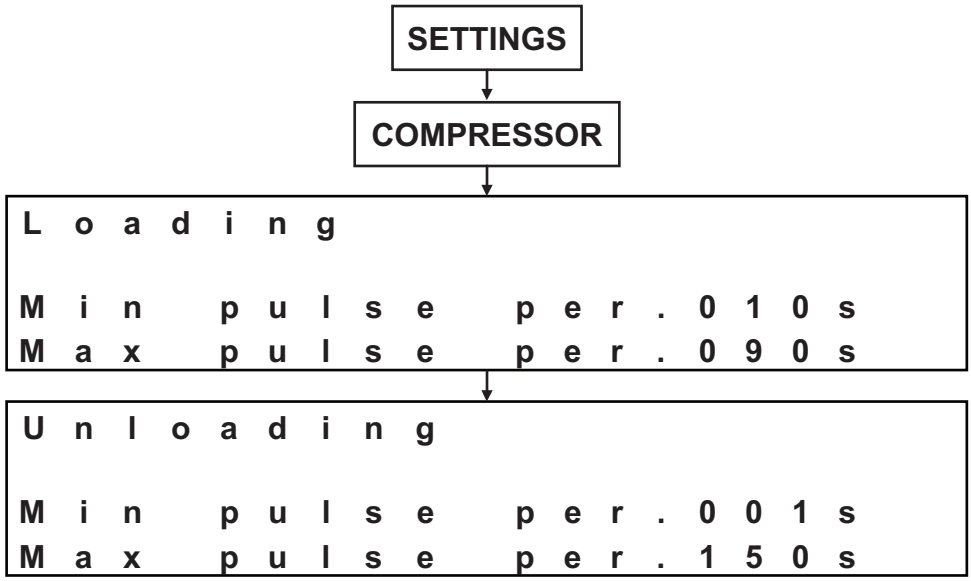
Programming



Pulse period (inverter compressor)

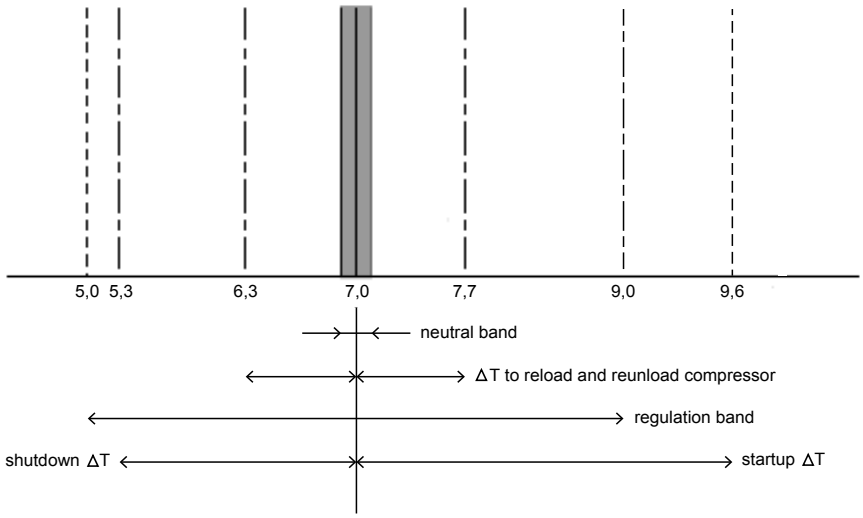
The minimum and maximum pulse period are the time limits between individual steps (similar as non-inverter compressor).

Programming



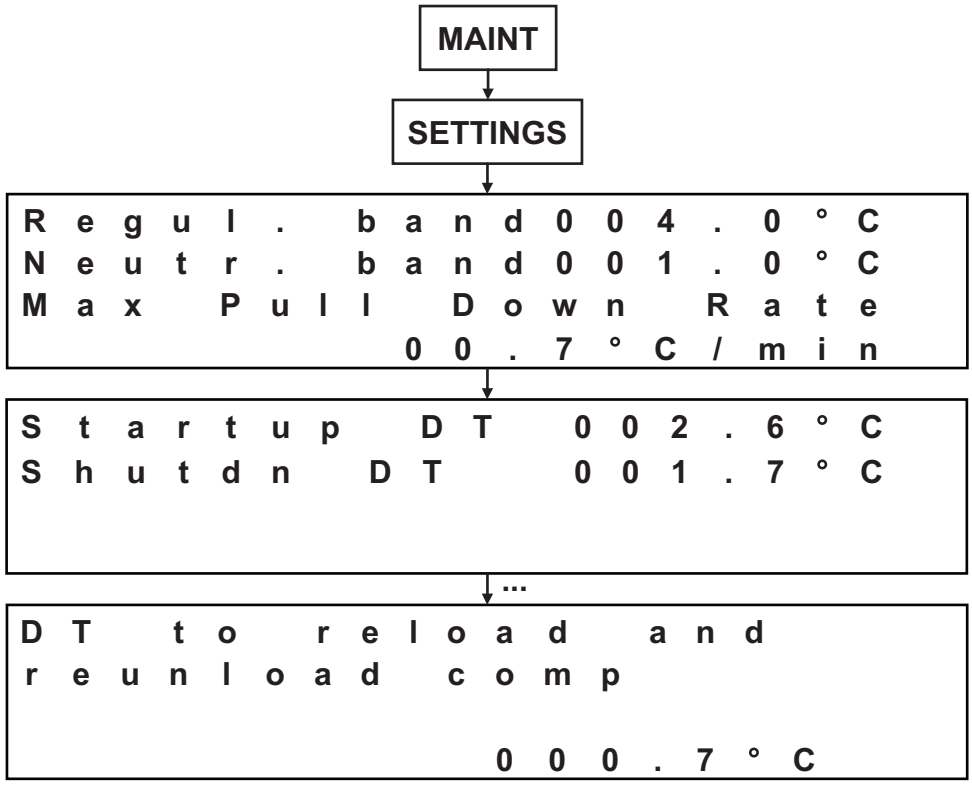
2.6.3 Compressor Load Evaluation

Water temperature control



- Neutral band:
  This is the area around the setpoint where the capacity stays fixed. No load or unload commands are given.
- ΔT to reload and reunload compressor:
  - Loading
    When an additional compressor is required to start and the leaving water temperature is between the setpoint (for example 7,0°C) and this DT to reload and reunload compressor (setpoint 7,0°C + 0,7°C = 7,7°C), the already running compressor(s) will first unload before an additional compressor will start.
  - Unloading
    When a compressor is required to stop if multiple compressors are running and the leaving water temperature is between the setpoint (for example 7,0°C) and this DT to reload and reunload compressor (setpoint 7,0°C - 0,7°C = 6,3°C), the other compressor(s) that will stay on will first upload before the compressor that was required to stop will actually stop.
    This DT to reload and reunload compressor is used to avoid big changes in capacity when the leaving water temperature is close to the setpoint.
- Regulation band:
  This is the area where the PID control is active.
- Startup ΔT:
  Above this temperature, a first compressor can start.
- Shutdown ΔT:
  Below this temperature, all compressors will stop.

Programming



2.6.4 Maximum Pull Down Rate

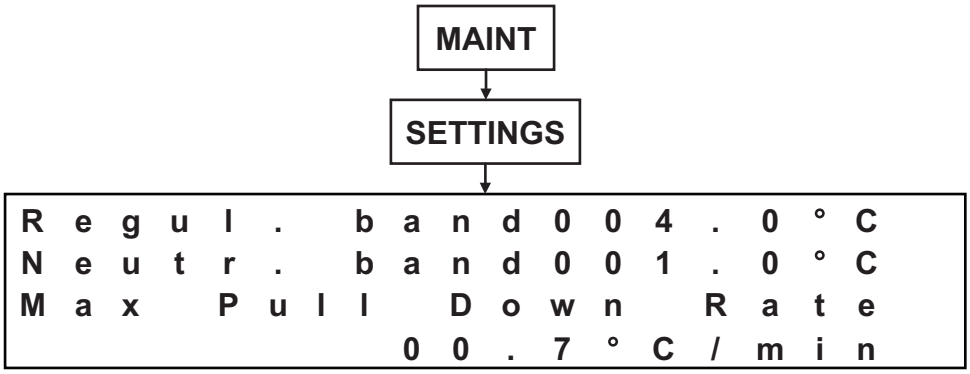
Overview

- Water temperature can only drop a certain °C per minute. (Example: 0.7°C/minute)
- If decrease in water temperature is higher, the compressor will limit capacity.

Explanation

In addition to the specialized PID controller, a max pull-down-rate is introduced in the control; this means that if the controlled temperature is approaching the set-point with a rate greater than a set value, any loading action is inhibited, even if required by the PID algorithm. This makes the control slower but allows to avoid oscillations around set-point.

Programming



2.6.5 Compressor Timers

Overview

- Minimum time between 2 starts of the same compressor
- Minimum time between starts of different compressors
- Minimum time a compressor has to operate
- Minimum time a compressor needs to be off

Minimum time between 2 starts of the same compressor

The compressor is allowed to start 6 times per hour. More starts per hour will reduce compressor life.

Minimum time between starts of different compressors

To avoid big and fast changes in capacity, there is a minimum time of 120 sec between starts of different compressors.

Minimum time a compressor has to operate

The minimum time a compressor has to run is 30 sec. Unless an alarm occurs, the compressor cannot be stopped if this timer is not expired.

Minimum time a compressor needs to be off

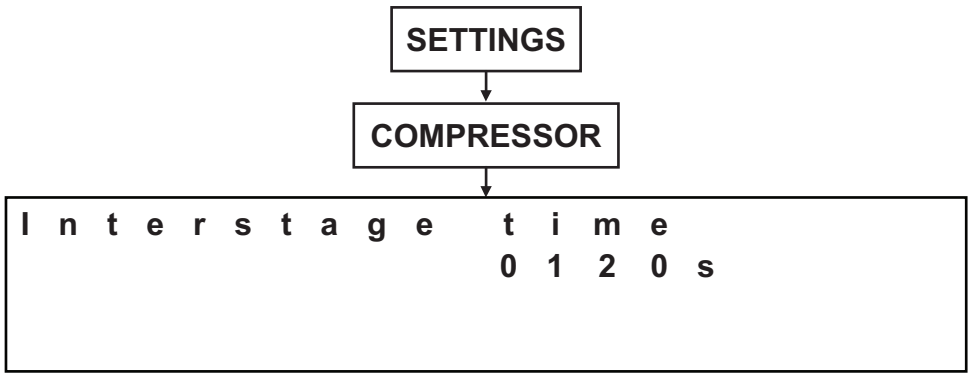
The minimum time a compressor has to stay off is 180 sec. The compressor cannot be started if this timer is not expired.

2.6.6 Interstage Timer

Explanation

The interstage timer is only active in the positive part of the regulation band. If the setpoint is 7,0°C and the regulation band is 4,0°C, the interstage timer will be active between 7,0°C and 9,0°C. In this area, the controller will wait 120 sec (default value) before to start an additional compressor. This is to avoid undershooting the setpoint.

Programming



2.6.7 Compressor Rotation Management

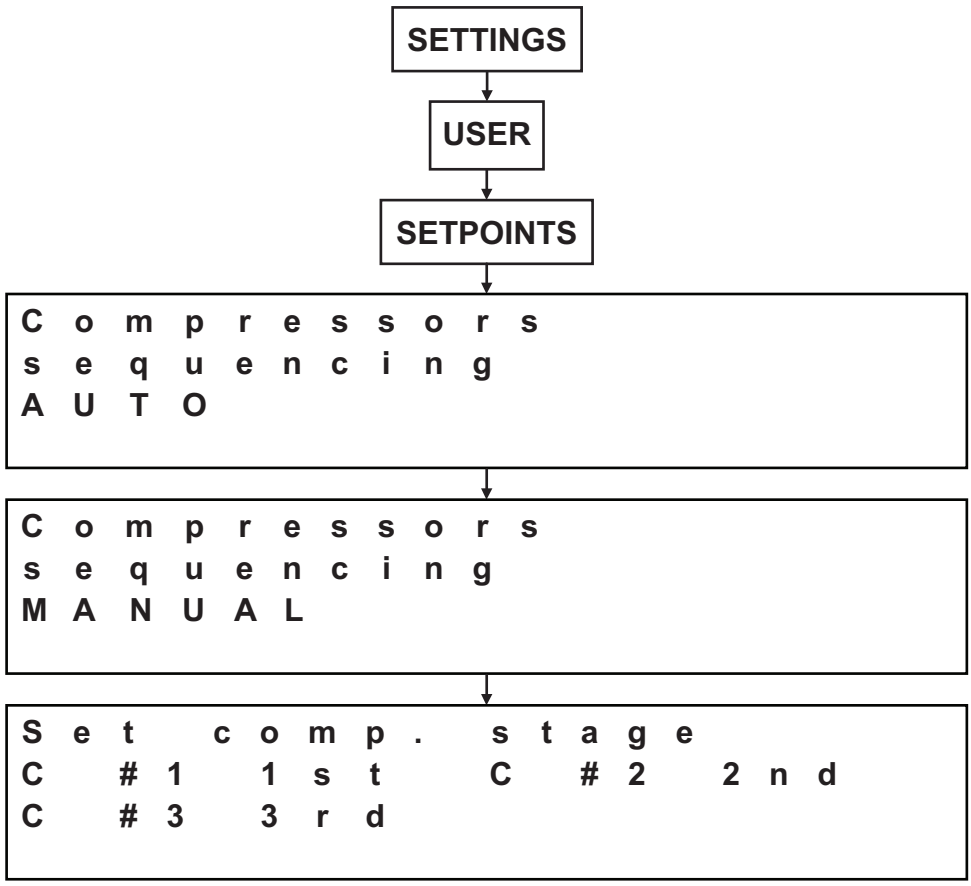
Overview

This decides the starting sequence of the compressors (which one will start first).

There are two possibilities:

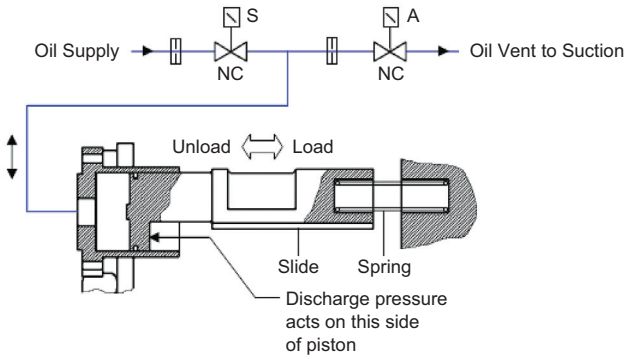
- Automatic rotation: the compressor with the least amount of running hours will start first.
- Manual rotation: the starting sequence can be set manually.

Programming



2.7 Compressor Capacity Control

Capacity control using oil pressure (non-inverter compressors)



HSS 3100 and 3200 series compressors are provided with infinitely variable capacity control as standard.

Since the compressor utilizes fixed intake and discharge ports instead of valves, the overall compression ratio is determined by the configuration of these ports. The degree of compression is governed by the ratio between the flute volume when it is sealed off by the star tooth at the beginning of the compression process, to that immediately before the discharge port is uncovered. This is known as the built-in volume ratio (VR) and is an important characteristic of all fixed-port compressors.

In order to achieve maximum efficiency, the pressure within the flute volume at the end of the compression process should equal the pressure in the discharge line at the instant the flute volume opens to discharge.

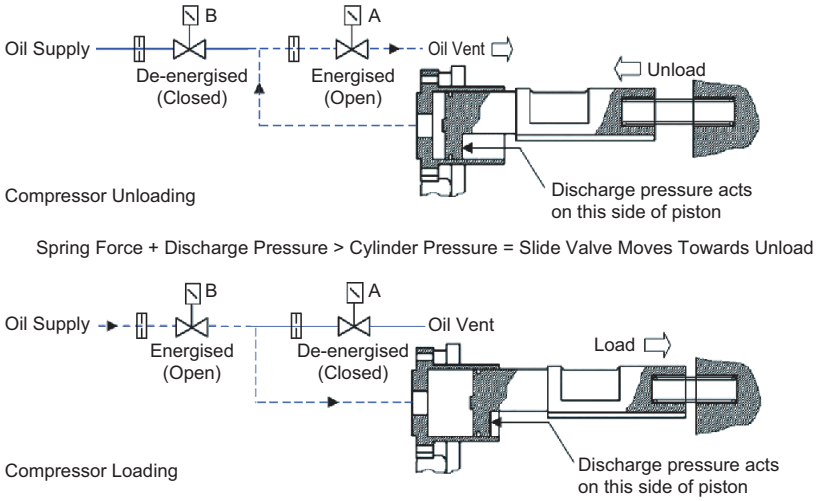
Should these conditions not prevail, either over-compression or undercompression will occur, both of which result in internal losses. Although in no way detrimental to the compressor, inefficient compression will increase power consumption.

The slide valve is housed in a semicircular slot in the wall of the annular ring which encloses the main rotor. As the slide valve travels axially from the full load position it uncovers a port, which vents part of the gas trapped in the main rotor flute back to suction, before compression can begin.

When the flute has passed beyond the port, compression commences with a reduced volume of gas. However, a simple bypass arrangement without any further refinement would produce an undesirable fall in the effective volume ratio which in turn causes under compression and inefficient part load operation. To overcome this problem, the slide valve is shaped so that it delays the opening of the discharge port at the same time as the bypass slot is created.

2

Loading / unloading compressor



One end of the slide valve is machined to form a hydraulic piston, housed inside a cylinder and mounted internally at the discharge end of the compressor. The other end of the slide incorporates a spring.

Variation in compressor pumping capacity is achieved by altering the forces acting on the slide valve/piston assembly.

Internal drillings communicate pressurized oil to the capacity control cylinder and vent the oil from the cylinder. The flow of oil is controlled by two separate solenoid valves, A and B; the solenoids are normally closed (NC), energize to open.

While the compressor is running, the position of the slide valve is controlled by the pressure in the capacity control cylinder. Oil pressure which is introduced into the cylinder acts on a larger area of the piston. This will result in a force which is greater than the pressure applied by the discharge pressure and spring, thereby moving the slide to load.

If the cylinder is vented to suction, the force applied by the discharge pressure and spring will be greater and the side will move to unload. If the compressor is stopped at part load, the slide valve will return to minimum load by the spring only if the pressure in the cylinder is vented to the casing pressure, unload solenoid valve energized (opened). When the compressor starts, the unload solenoid should remain open until there is a requirement to load.

Two solenoid valves A and B control the venting from and the oil flow to the capacity control cylinder.

Inverter capacity control

Heat pump and certain cooling only units are equipped with inverter controlled compressors. Here the capacity control is done by altering the speed (frequency) of the screw.

The controller or expansion board sends out a 0 - 10 V signal to the inverter. This then adjusts the speed (frequency) of the screw up to 90 Hz. The nominal speed is 60 Hz.

Inverter operating principle

The VFD (also known as an “inverter“) is an electronic power device designed to vary the speed of rotation of induction motors.

The motors revolve at a practically fixed rpm speed which depends only on the frequency of the power supply (***f***) and on the number of poles (***p***), as per the following formula:

$$rpm = \frac{f \bullet 60}{p}$$

(In fact, for the motor to produce torque, the rotation speed, known as the speed of synchronism, must be slightly less than that calculated above.)

To vary the speed of rotation of an induction motor, the supply frequency of the same therefore needs to vary.

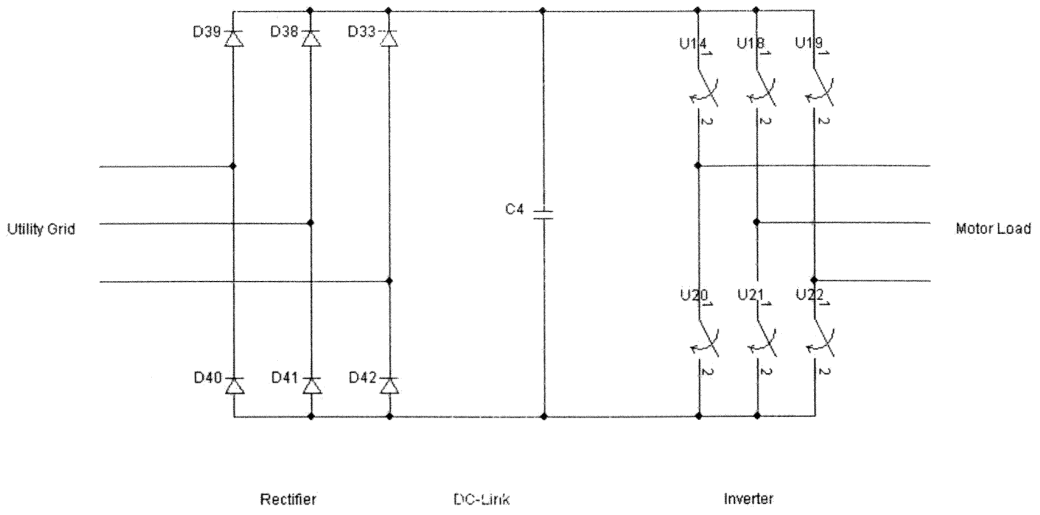
The VFD does this, starting with a fixed grid frequency (50 Hz for European power grid, 60 Hz for the US) operating in three steps:

- Step 1 involves a rectifier to transform the alternating current into direct current, which is typically achieved using a diode rectifier bridge (leading solutions use bridges with SCR).
- Step 2 involves charging the capacitors (direct current bus, also known as a DC-Link).
- Step 3 involves the reconstruction of the alternating current (a genuine inverter) by means of a transistor bridge (normally IGBT) with variable voltage and frequency values, set by the control system. The voltage is in fact the result of a high-frequency PWM modulation (in the range of a few kHz) from which the fundamental variable frequency component is taken (typically 0-100 Hz).

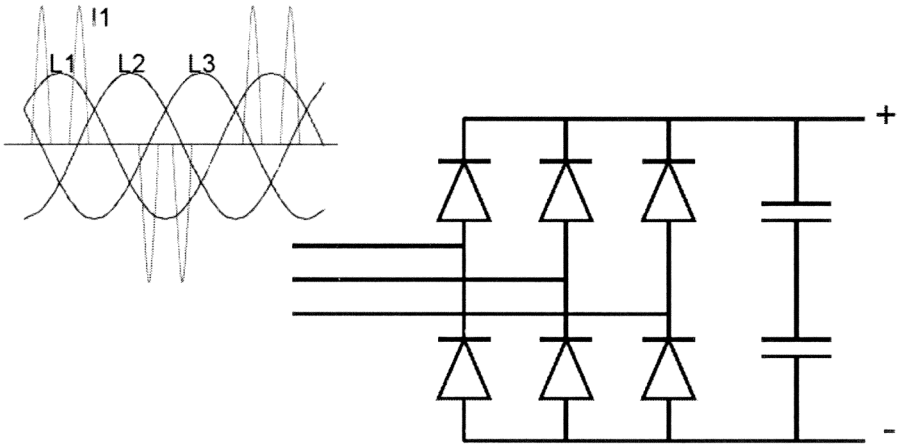
Problem with harmonics

The rectifier bridge of a VFD requires current from the grid that is not purely sinusoidal. Indeed, due to the presence of diodes, which are non-linear components, the current absorbed by a rectifier bridge has a higher frequency than the frequency of the power grid. Such components are known as harmonics: in the case of a power supply at 50 Hz, the component at 50 Hz is defined as the fundamental harmonic, while the second harmonic is the component at 100 Hz, the third harmonic is the component at 150 Hz, and so on. (In the case of a power supply at 60 Hz, the fundamental component is that at 60 Hz, the second that at 120 Hz, the third is that at 180 Hz, and so on.)

Typical diagram of an inverter



Harmonics



Since the rectifier bridge sees before it a direct current stage, the current taken is practically in phase with the voltage.

However, the formula below no longer applies

$P_{act} = \sqrt{3} \cdot V \cdot I \cdot \cos\varphi$

because the harmonic components in excess of the fundamental harmonic do not contribute to the active power. Several values therefore need to be defined:

Displacement Power Factor
DPF = cosφ

Power Factor (total power)

$$PF = \frac{I_1}{I} \bullet DPF$$

The Power Factor takes into account both phase displacement as well as harmonic content, expressed as a ratio of the fundamental component I_1 to the current and the overall effective value. It actually expresses which part of the input current is converted into active power. It is worth mentioning that in the absence of an inverter or electronic devices in general, the DPF and PF are the same.

Moreover, many electricity boards only take into account the DPF, since the harmonic content is not measured, but only the absorption of active and reactive power.

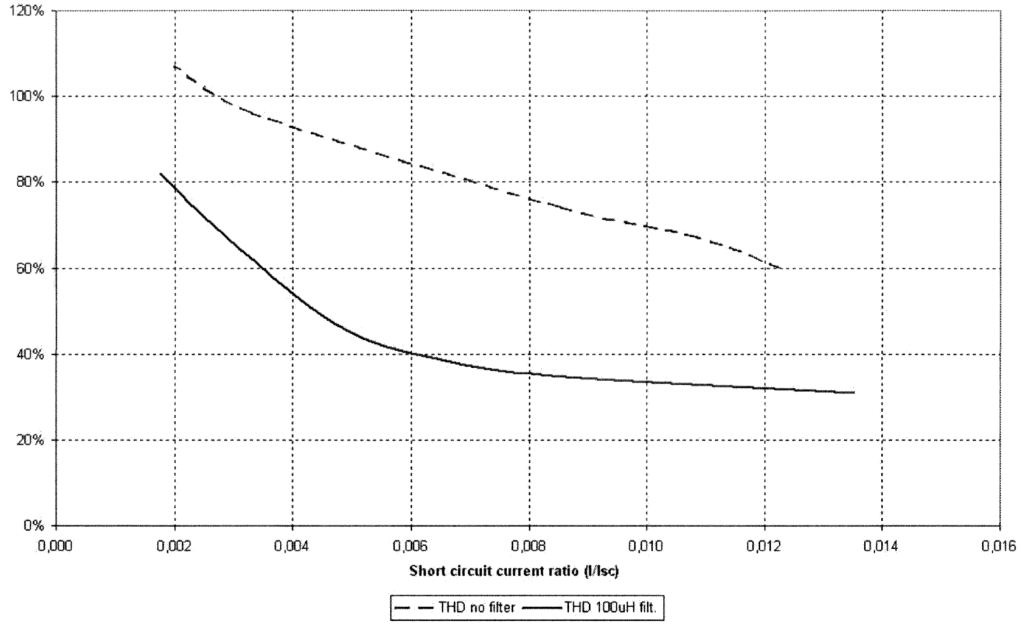
Another measuring index for the harmonics in the grid is provided by the harmonic distortion coefficient THD_i (Total Harmonic Distortion):

$$THD_i = \sqrt{\frac{I^2 - {I_1}^2}{{I_1}^2}}$$

In a VFD without remedial devices, harmonic distortion can reach values of more than 100% (i.e. the harmonic components can, all together, reach more than the fundamental component).

To reduce the harmonic content of the current (and so the THD), the units illustrated in this manual are equipped with line inductance. Since the harmonic content depends on the ratio of the current required by the VFD to the short-circuit current in the wiring point, for a given plant, the THD varies according to the machine absorption. For example, below graph illustrates the value of the THD with or without a filter inductance, for different values of the ratio of VFD current to the short-circuit current in the wiring point.

Harmonic content with and without line inductance

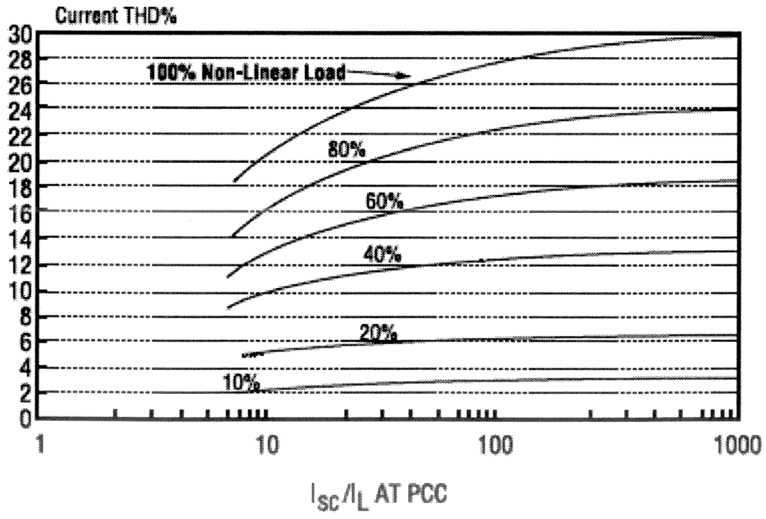


It must however be mentioned that the harmonic distortion drops in value if other utilities are connected at the connection point (PCC): the greater the weight of these utilities, the smaller the current distortion will be. Below graph illustrates the total harmonic distortion in the point where the unit is wired to the grid, according to the ratio between the short circuit current in the connection point (I_{sc}) and the current drawn by the unit (I_L) and the percentage power absorbed by the unit compared to the total power supplied by the grid at the connection point.

Notice how the harmonic distortion at the connection point can feature very low values (below 5%) when the short circuit current is less than 20 times the unit current and this makes up a percentage of no more than 20% of the total load of the grid.

In any case, the harmonic distortion introduced by the unit must be evaluated in relation to the specific application, subject to a detailed analysis of the entire grid and of the loads powered.

Harmonic content varying according to the percentage of non-linear loads



2.8 Compressor Stopping Sequence

Overview

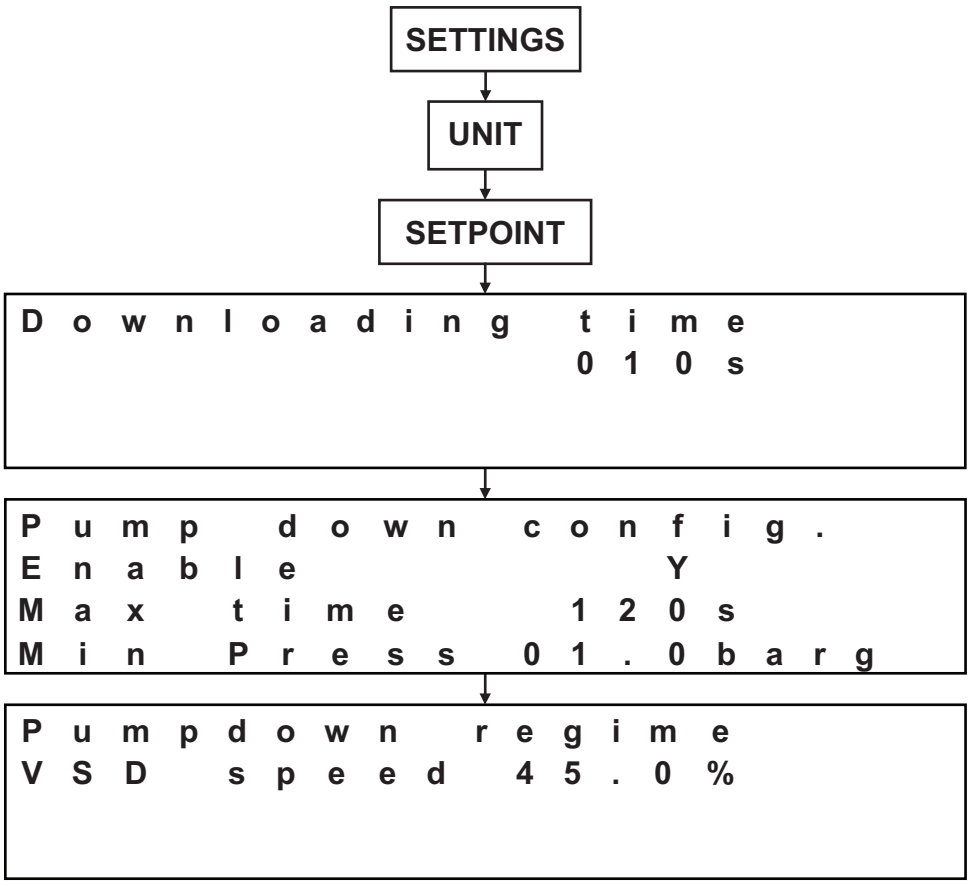
This chapter contains the following topics:

2.8.1 Pump Down Control

Explanation

Every time before the compressor stops, it downloads to minimum capacity (oil capacity control) or goes to the pump down regime speed (inverter compressors). This is done during the downloading time. After that, the liquid line solenoid valve or the electronic expansion valve is closed to perform a pump down.

Programming



2.9 Fan Control Management

Overview

This chapter contains the following topics:

2.9.1 Cooling Mode

Overview

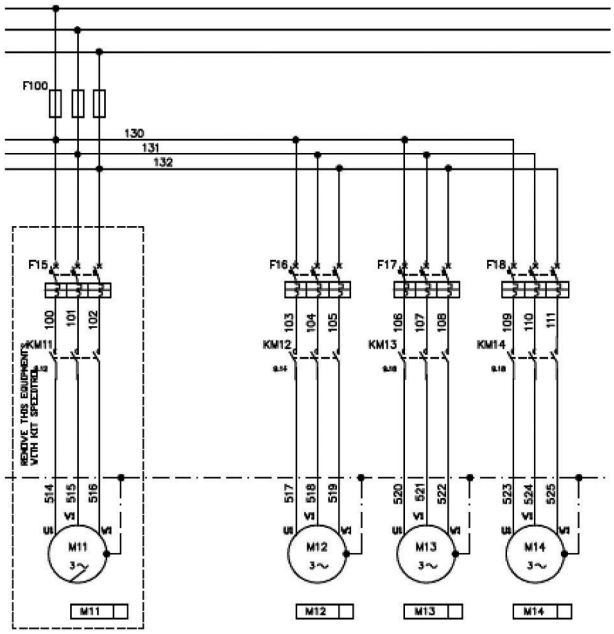
- Fan Troll
- Variable Speed Drive (VSD)
- Speed Troll

Explanation

- Fan Troll : All fans are ON/OFF fans. There are no variable speed drives.
- Variable Speed Drive (VSD) : All fans are driven by variable speed drives. These can be inverters or phase cut modules.
- Speed Troll : The first fan or the 2 first fans per circuit is/are driven by variable speed drives. The rest of the fans are ON/OFF fans.

Fan Troll

ON/OFF fans.



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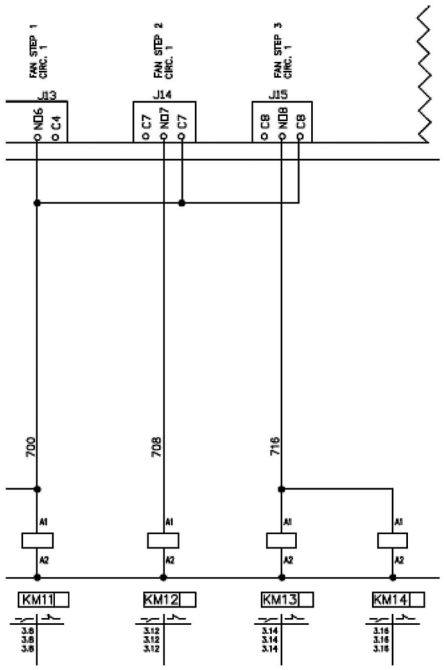
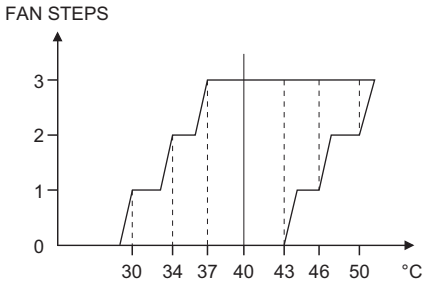
Each of the fan contactors is controlled with a digital output.



Fan Troll



A condensation setpoint can be chosen (default 40°C). This is the starting point for the dead bands of the ON/OFF fans and the regulation band of the VSD fans.

Dead bands of the ON/OFF fans have a stage up parameter and a stage down parameter. When the saturated condensing temperature is above the condensation setpoint + the stage up parameter, a next fan step can be added. When the saturated condensing temperature is below the condensation setpoint - the stage down parameter, a fan step can be stopped.

When a stage up is reached, an accumulator starts counting. This one has to reach 10°C x sec (default value) before the next fan step is actually started. This function is used to avoid hunting or unnecessary staging in the fans.

When a stage down is reached, the function is similar.

The amount of fan steps can be selected in the controller.

VSD/Speed Troll

VSD fans are all driven by variable speed drives. Speed Troll means the first fan or the 2 first fans is/are driven by variable speed drives.

Any variable speed drive (phase cut or inverter) is controlled through a 0-10 V output from the controller.

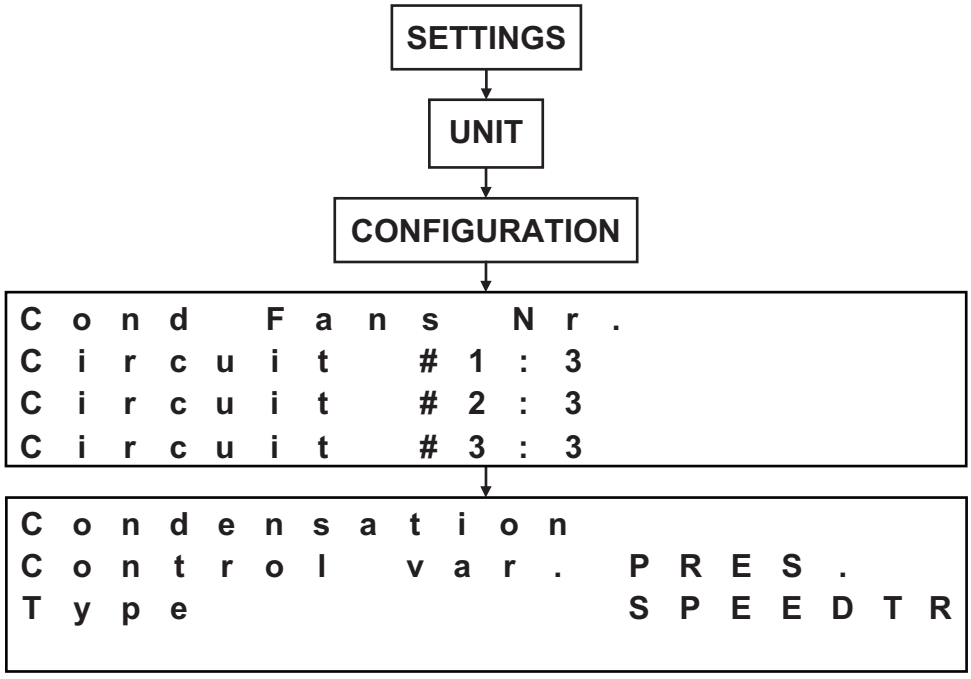
The minimum speed should be at least set to 1 V or more. Lower speeds than 1 V could stall the fan motor and cause overheating. The maximum speed is set to 10 V for all units except low noise versions. There the maximum speed can be reduced. However, low fan noise operation can't be used when the ambient temperature doesn't allow it.

To avoid damage on fan motors, the VSD puts the fans at maximum speed during the first second(s) of operation. This is the 'speed up time'. If this is set at 2 sec (default value), the fan will start at maximum speed (10 V) for 2 sec and then start regulating between the minimum and the maximum speed.

Other parameters for VSD fans are:

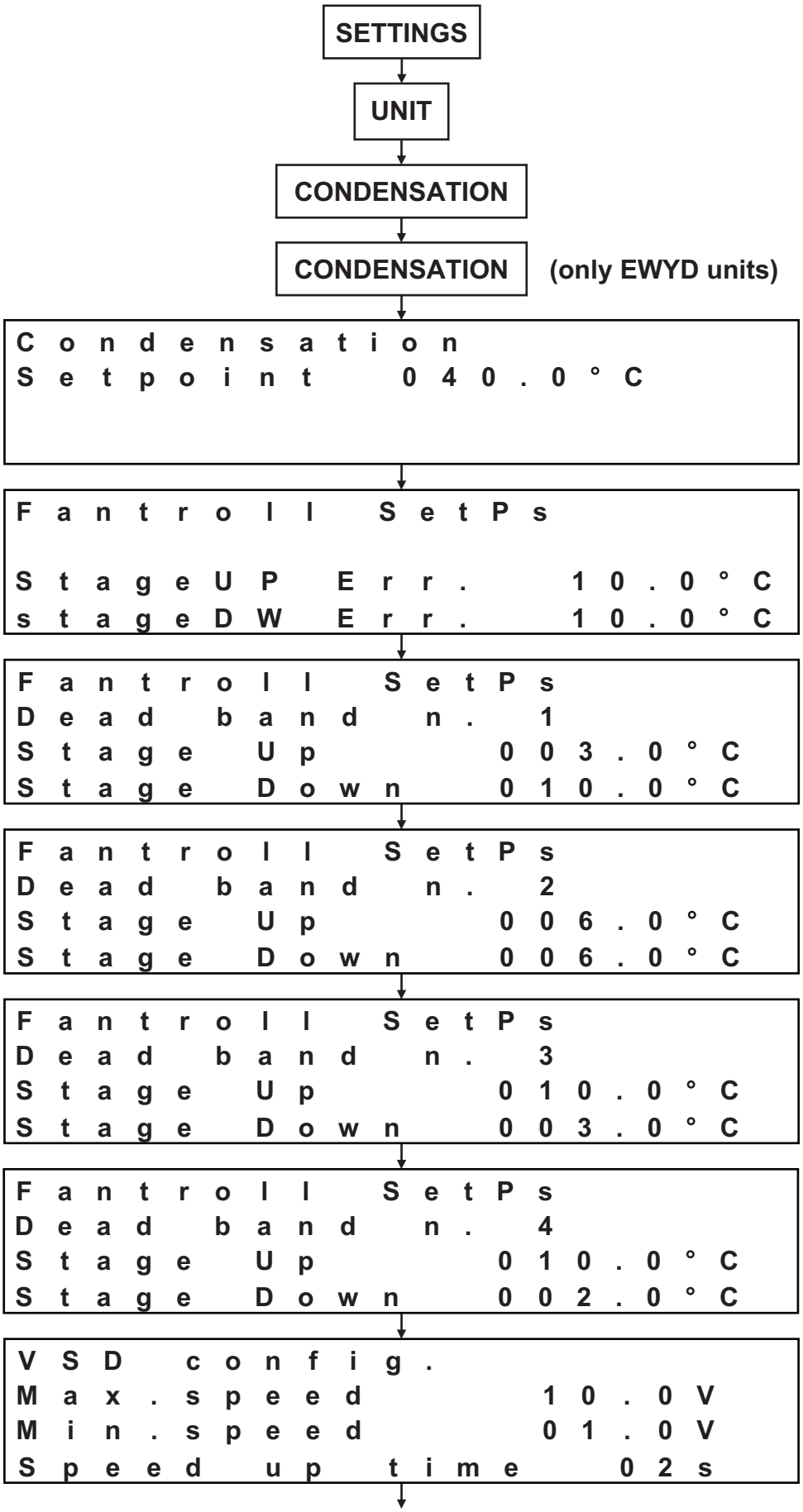
- regulation band around the condensation setpoint
  This is the area where the VSD fan(s) regulate between minimum and maximum speed.
- neutral band around the condensation setpoint
  This is a small area where the VSD fan(s) stay at the same speed.
- integral time and derivative time
  PID parameters.

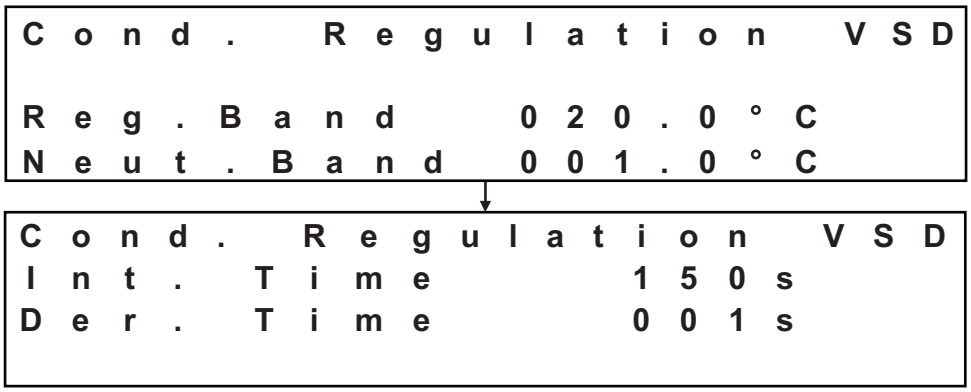
Programming



Note: the control variable always has to be set on Pressure. Pressure ratio control should never be used.

2


SETTINGS
UNIT
CONDENSATION
CONDENSATION
(only EWYD units)
Condensation
Setpoint 040.0 °C
Fantroll SetPs
StageUP Err. 10.0 °C
stageDW Err. 10.0 °C
Fantroll SetPs
Dead band n. 1
Stage Up 003.0 °C
Stage Down 010.0 °C
Fantroll SetPs
Dead band n. 2
Stage Up 006.0 °C
Stage Down 006.0 °C
Fantroll SetPs
Dead band n. 3
Stage Up 010.0 °C
Stage Down 003.0 °C
Fantroll SetPs
Dead band n. 4
Stage Up 010.0 °C
Stage Down 002.0 °C
VSD config.
Max. speed 10.0V
Min. speed 01.0V
Speed up time 02s


Cond. Regulation VSD
Reg. Band 020.0°C
Neut. Band 001.0°C
Cond. Regulation VSD
Int. Time 150s
Der. Time 001s

2

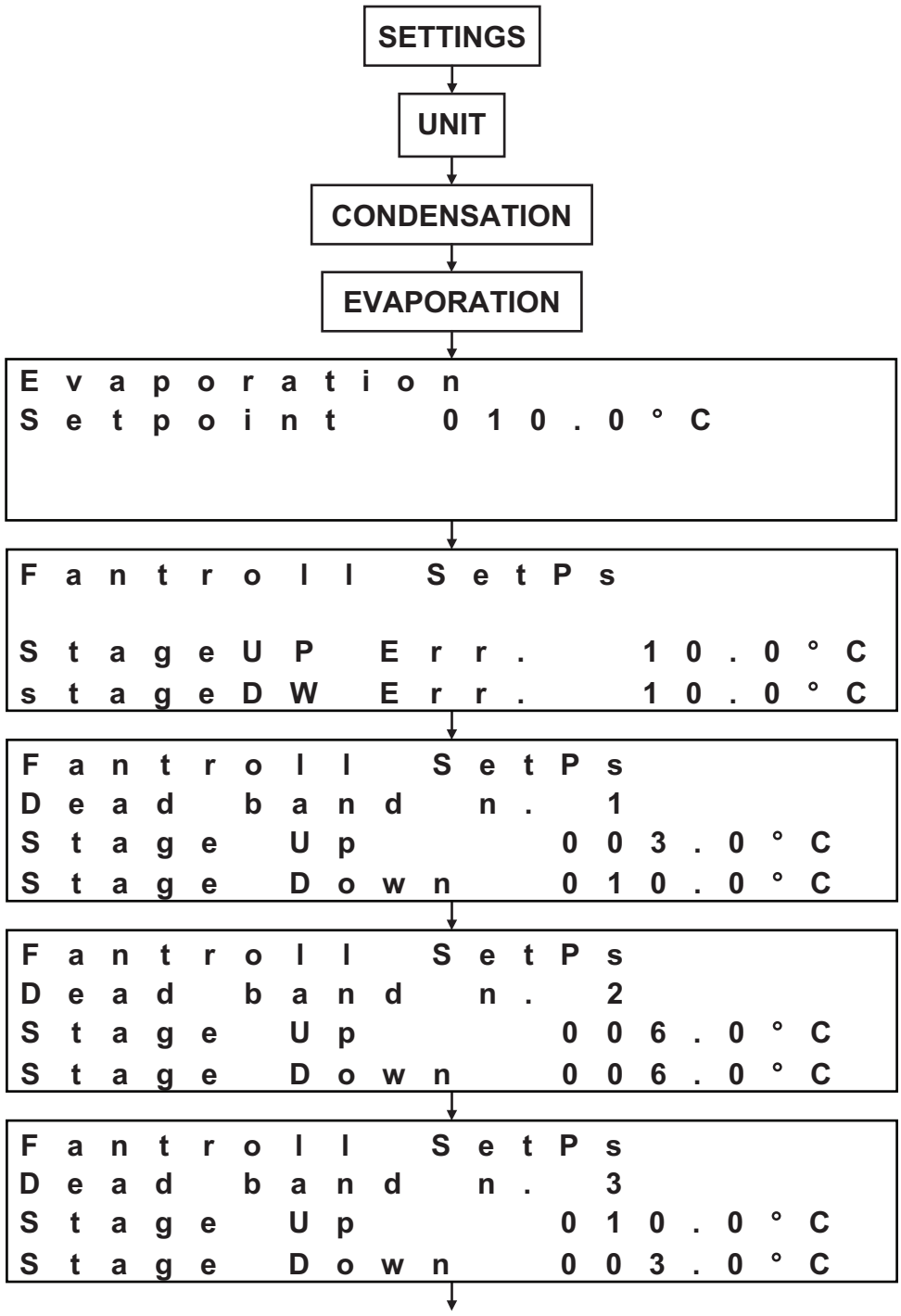
2.9.2 Heating Mode

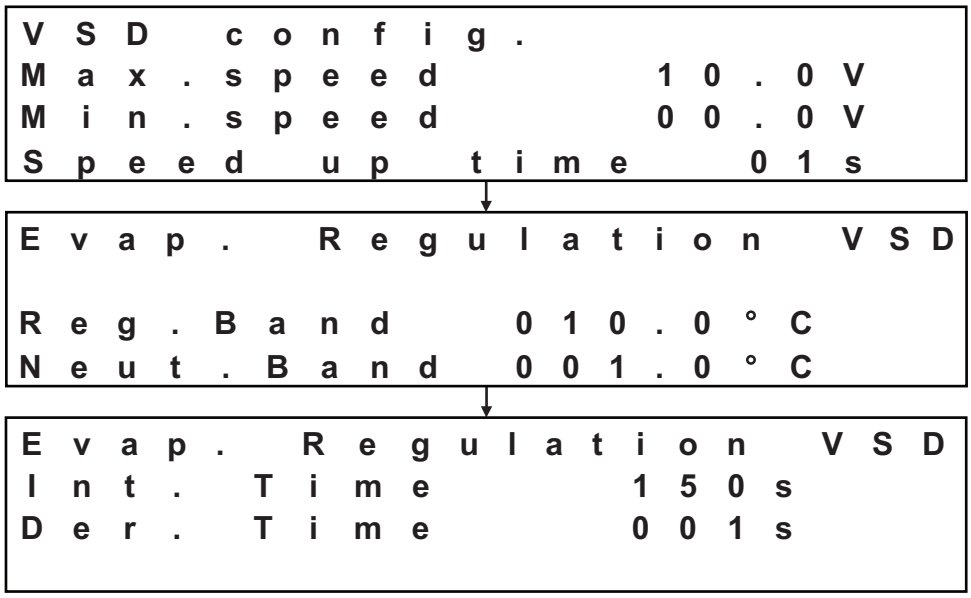
Explanation

In heating mode, the fan control management is similar as in cooling mode. An evaporation setpoint is used instead of a condensation setpoint. The unit will try to maintain a certain evaporation temperature (default 10°C). Both ON/OFF fans and VSD fans can be used.

2

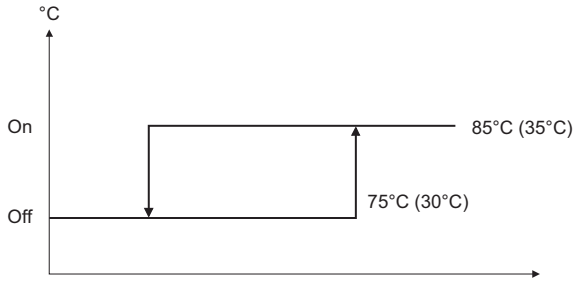
Programming




VSD config.
Max. speed 10.0V
Min. speed 00.0V
Speed up time 01s
Evap. Regulation VSD
Reg. Band 010.0°C
Neut. Band 001.0°C
Evap. Regulation VSD
Int. Time 150s
Der. Time 001s

2.10 Liquid Injection

Explanation

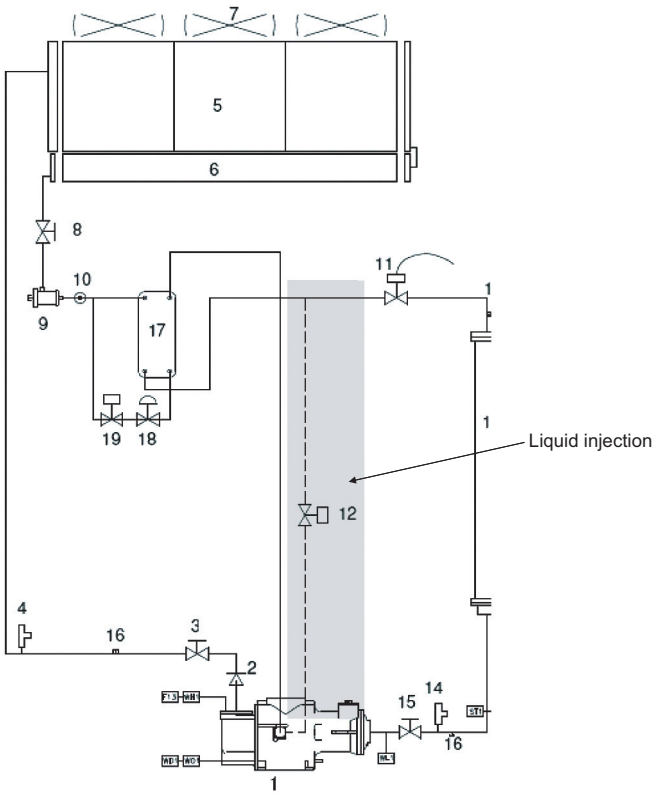


To avoid possible overheating of the compressor, a liquid injection is activated when the discharge temperature becomes higher than 85°C or if the suction temperature becomes higher than 35°C.

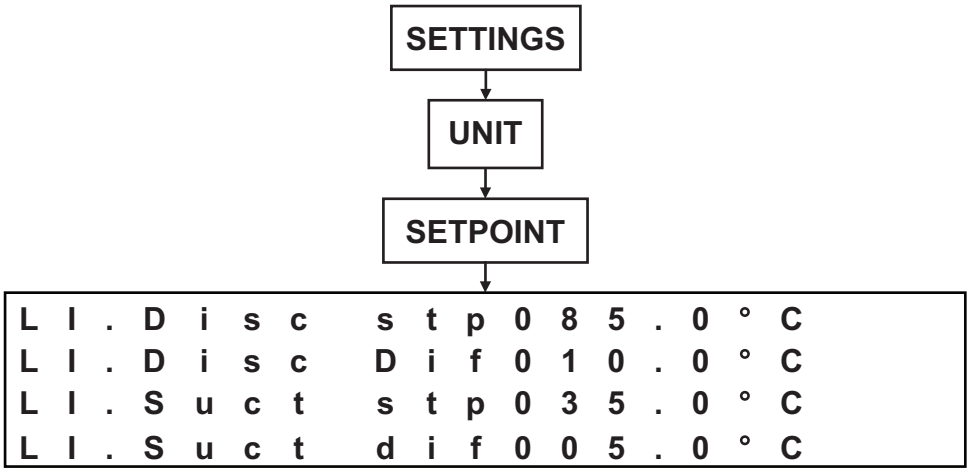
This control is reset when the discharge temperature becomes 10°C lower or when the suction temperature becomes 5°C lower.

These values can be changed in the controller. It is not recommended to change these settings.

Position of the liquid injection valve



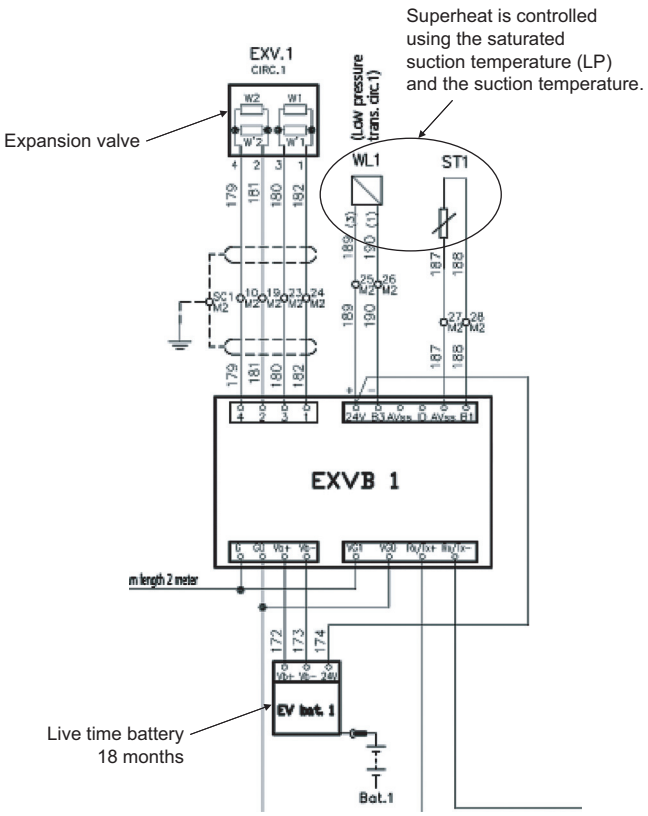
Programming



2

2.11 Electronic Expansion Valve Control

EEV valve control



The Electronic expansion valve (EEV) circuit is build up of the following parts:

1 Expansion valve

2 Suction temperature sensor

3 Low pressure sensor

4 EEV driver

5 Battery charger

6 Battery

Driver EVD200 with Electronic EXV

The driver has the following functions:

1 Opening or closing the expansion valve.

2 To maintain the pre-programmed suction superheat.

3 To avoid that the low pressure will drop below a certain value.

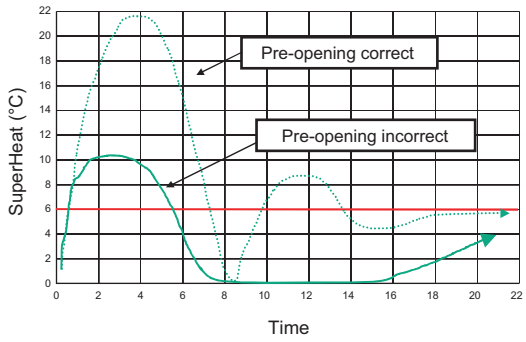
4 To avoid that the low pressure will rise above a certain value.

Parameters

- Pre-opening valve
- Type of valve
- Type of refrigerant
- Superheat Set-Point and Dead Band
- Proportional, Integral time and Derivative time
- Low Superheat protection
- LOP Protection
- MOP Protection
- High suction temperature
- Low pressure sensor temperature
- Hardware configuration (battery and plan)

Pre-opening valve

A set percentage value of the valve at the compressor start up.



- An excessive pre-opening can cause liquid return from the suction to the compressor (use default value).
- A small pre-opening can cause the compressor to trip for low pressure (use default value).

Valve and refrigerant type

Those values that are set in the factory must not modified:

An incorrect valve selection can cause:

- Step motor ERROR (the motor can be damaged by high current)
- Valve not opening or closing
- Valve to move in the opposite direction
- The circuit to stop for low or high pressure after start up

An incorrect refrigerant selection can cause:

- Wrong Suction Super Heat
- Incorrect suction pressure value (transducer range difference)

2

Driver EXV status LED

Under normal conditions, the five (5) LEDs indicate:

- POWER (yellow): Remains On in presence of supply. Remains Off in case of battery operation.
- OPEN (green): Flashing during the valve opening. On when valve is fully open.
- CLOSE (green): Flashing during the valve closing. On when valve is fully closed.
- Alarm (red): On or flashing in case of hardware alarm.
- pLAN (green): On during the normal working of pLAN.

In presence of critical alarm situations, the combination of LED On identifies the alarm as shown in the next page.

Driver EXV LED meaning alarm

Alarms that stops the system	**PRIORITY**	**LED OPEN**	**LED CLOSE**	**LED POWER**	**LED ALARM**
Eeprom reading error	7	Off	Off	On	Flashing
Valve open in case of lack of supply	6	Flashing	Flashing	On	Flashing
At start up, wait for battery loading (parameter...)	5	Off	On	Flashing	Flashing
Other alarms	**PRIORITY**	**LED OPEN**	**LED CLOSE**	**LED POWER**	**LED ERROR**
Motor connection error	4	Flashing	Flashing	On	On
Probe error	3	Off	Flashing	On	On
Eeprom writing error	2	-	-	On	On
Battery error	1	-	-	Flashing	On

pLAN	**LED pLAN**
Connection OK	On
Driver connection or address error = 0	Off
The pCO Master doesn't answer	Flashing

LOP protection

Is activated when...		The Valve
The saturated suction temperature is below the LOP limit	→	The valve will open to increase the suction pressure

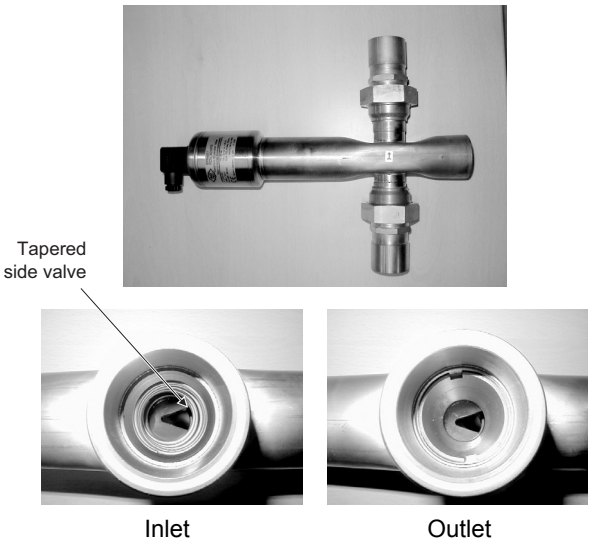
Warning: The protection will only work if the suction SH is away from the limit for low SH. (It could flood the evaporator!)

MOP protection

Is activated when...		The Valve
The saturated suction temperature is above the MOP limit	→	The valve will close to decrease the saturated suction temperature

Warning: This protection will only work if the temperature is below the maximum limit. (The closing of the valve can increase the saturated temperature).

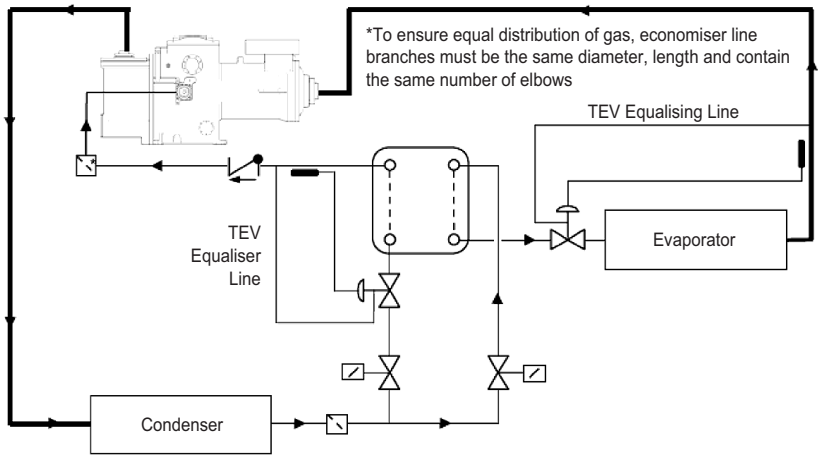
Electronic expansion valve



2.12 Economizer

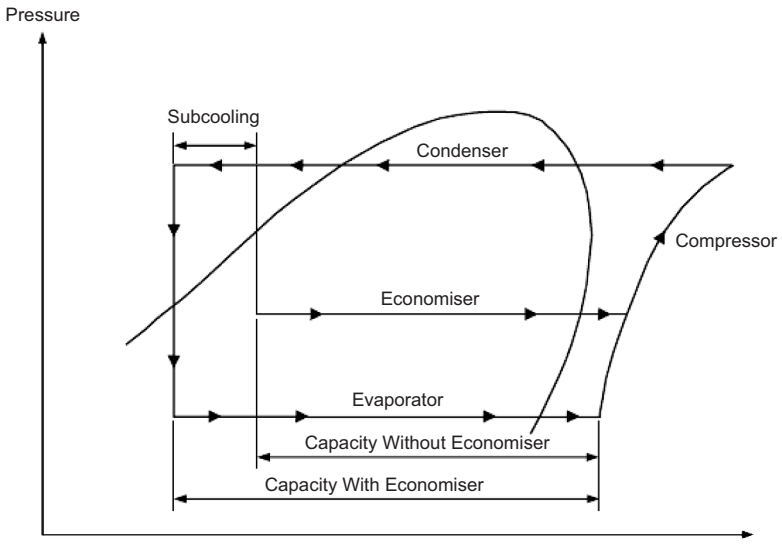
Typical single compressor application

Principal



The compressor is provided with an economizer. This enables an additional charge of gas to be handled by the compressor, over and above that which is normally pumped. It is, in effect, a form of supercharging which has the net result of increasing refrigerating capacity by a significantly greater percentage than power consumption, hence improving the coefficient of performance (COP) of the compressor.

Economizer cycle on pressure/ Enthalpy (p-h) diagram



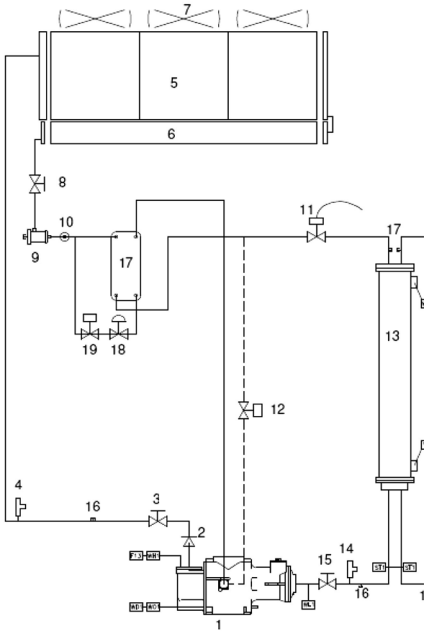
The economizer principle is illustrated on a pressure/enthalpy (p-h) diagram.

Suction gas is drawn into the main rotor flutes, these are sealed off in sequence by the star rotor teeth and compression begins. An extra charge of gas now enters the sealed flute through a port in the casing enclosing the main rotor. This gas supply is taken from an intermediate source at a slightly higher pressure than that prevailing in the flute at the instant the gas is introduced, hence the gas is induced to enter the flute.

The original and additional charges of gas are then compressed and discharged in the normal way. The full load pumping capacity of the compressor at suction conditions is not affected by the additional flow through the economizer connection. Typical for all screw compressors, as the compressor unloads, the pressure at the economizer port falls towards suction pressure and the additional capacity and improved efficiency economizer system is no longer available.

As a guide to this effect, approximately half of the improvement due to using an economizer system will be lost by the time the compressor unloads to 90% capacity, and falls to zero at around 70% capacity.

Piping layout economizer



1. Single-screw compressor
2. No-return valve
3. Compressor delivery tap
4. High-pressure safety valve (24.5 bars)
5. Condenser battery
6. Built-in undercooling section
7. Axial ventilator
8. Liquid line isolating tap
9. Dehydration filter
10. Liquid and humidity indicator
11. Electronic expansion valve
12. Liquid injection solenoid valve
13. Direct expansion evaporator
14. Low-pressure safety valve (15.5 bars)
15. Compressor intake tap
16. Loading joint with valve
17. Economizer
18. Economizer expansion valve
19. Economizer solenoid valve

ST1-2. Intake temperature sensor
WL1-2. Low-pressure transducer (-0.5:7.0 bars)
WO1-2. Oil pressure transducer (0.0:30.0 bars)
WH1-2. High-pressure transducer (0.0:30.0 bars)
WD1-2. Discharge temperature sensor/Oil
F13. High-pressure switch (21.5 bars)
WIE. Water input temperature sensor
WOE. Water output temperature sensor

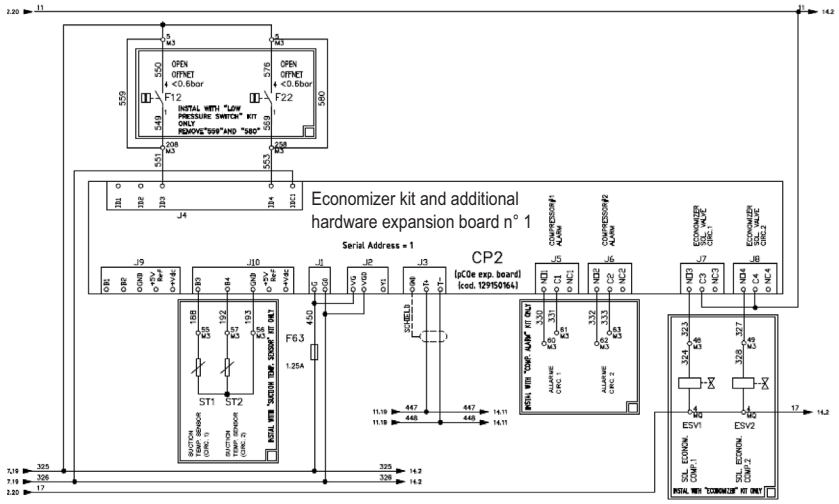
pCOe expansion # 1 - additional hardware & economizer

To have this function an additional expansion board is required. This board will control the 2 economizer valves:

- Digital Output 3 controls the economizer of circuit 1.
- Digital Output 4 controls the economizer of circuit 2.

2

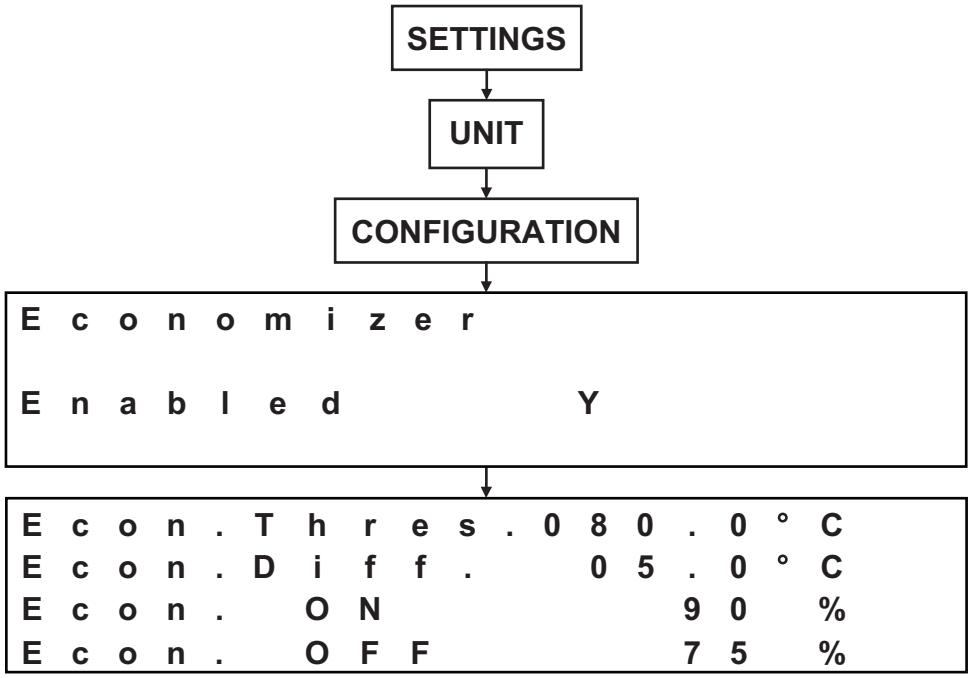
Wiring economizer kit and additional hardware



Economizer conditions

- Installation of expansion board
- Address of expansion board: 1
- Economizer activated if compressor capacity = 90%
- Economizer switch OFF if compressor capacity = 75%
- Precaution
  - Economizer switch OFF if HP saturated > 65°C
  - Economizer can switch ON again if HP saturated < 65°C
  - Economizer switches OFF if discharge temperature > 80°C
  - Economizer can switch ON again if discharge temperature < 75°C
- Above setting can be programmed in the controller

Programming



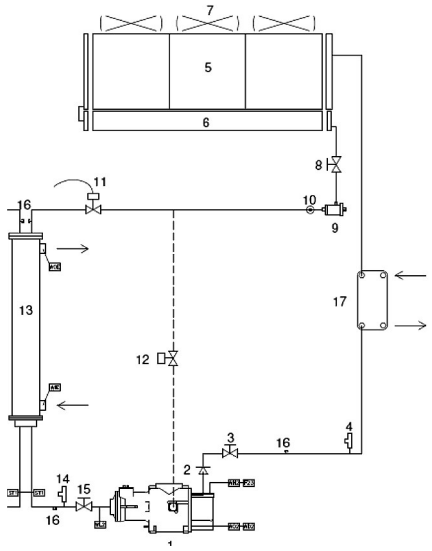
2

2.13 Heat Recovery

pCOe expansion # 2 – heat recovery

Analog Input				Digital Input	
Ch.	Description	Type		Ch.	Description
B1	Ambient temperature sensor			D11	Heat Recovery switch
B2	SPARE			D12	Heat Recovery Flow switch
B3	Entering HR water sensor	NTC		D13	SPARE
B4	Leaving HR water sensor	NTC		D14	SPARE

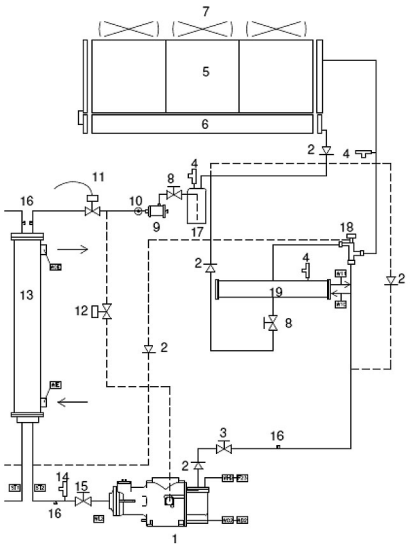
Partial heat recovery



1. Single-screw compressor
2. No-return valve
3. Compressor delivery tap
4. High-pressure safety valve (24.5 bars)
5. Condenser battery
6. Built-in undercooling section
7. Axial ventilator
8. Liquid line isolating tap
9. Dehydration filter
10. Liquid and humidity indicator
11. Thermostatic expansion valve
12. Liquid injection solenoid valve
13. Direct expansion evaporator
14. Low-pressure safety valve (15.5 bars)
15. Compressor intake tap
16. Loading joint with valve
17. Partial recovery exchanger (*)

ST1-2. Intake temperature sensor
WL1-2. Low-pressure transducer (-0.5:7.0 bars)
WO1-2. Oil pressure transducer (0.0:30.0 bars)
WH1-2. High-pressure transducer (0.0:30.0 bars)
WD1-2. Discharge temperature sensor/Oil
F13. High-pressure switch (21.5 bars)
WIE. Water input temperature sensor
WOE. Water output temperature sensor

Full heat recovery



1. Single-screw compressor
2. No-return valve
3. Compressor delivery tap
4. High-pressure safety valve (24.5 bars)
5. Condenser battery
6. Built-in undercooling section
7. Axial ventilator
8. Liquid line isolating tap
9. Dehydration filter
10. Liquid and humidity indicator
11. Thermostatic expansion valve
12. Liquid injection solenoid valve
13. Direct expansion evaporator
14. Low-pressure safety valve (15.5 bars)
15. Compressor intake tap
16. Loading joint with valve
17. Liquid receiver
18. Recovery cycle three-way switch valve
19. Recovery exchanger

WL1-2. Low-pressure transducer (-0.5:7.0 bars)
WO1-2. Oil pressure transducer (0.0:30.0 bars)
WH1-2. High-pressure transducer (0.0:30.0 bars)
WD1-2. Temperature discharge sensor/Oil
F13. High-pressure switch (21.5 bars)
WIE. Water input temperature sensor
WOE. Water output temperature sensor
W10. Recovery water input temp. sensor (*)
W11. Recovery water output temp. sensor (*)

When heat recovery is activated the control activates or deactivates recovery circuits with a step logic.

In particular a next heat recovery stage is activated (a new heat recovery circuit is inserted) if the heat recovery leaving water temperature remains below the set-point by an amount greater than an adjustable regulation band for a timer greater than an adjustable value (heat recovery interstage).

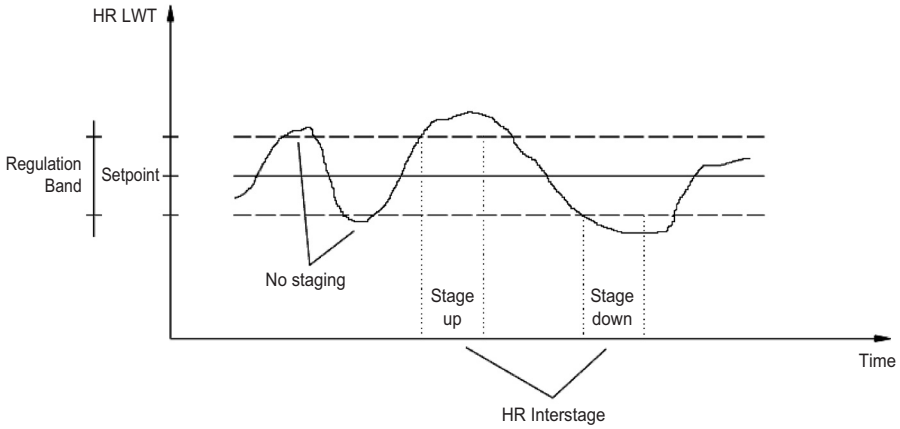
In the same manner a heat recovery stage is deactivated (a heat recovery circuit is removed) if the heat recovery leaving water temperature remains above the set-point by an amount greater than an adjustable dead regulation band for a timer greater than the previous defined value. A high temperature alarm set-point is active in the recovery loop; it will disable recovery circuits.

A three-way valve is used to increase recovery water temperature at start-up; a proportional control is used to establish valve position; at low temperature the valve will re-circulate recovery water, while at temperature increasing the valve will bypass a portion of the flow.

Partial heat recovery is not controlled by the unit. There is no ON/OFF switch, no temperature sensors, no 3-way valve, no flow switch, ...

2

Heat recovery operation



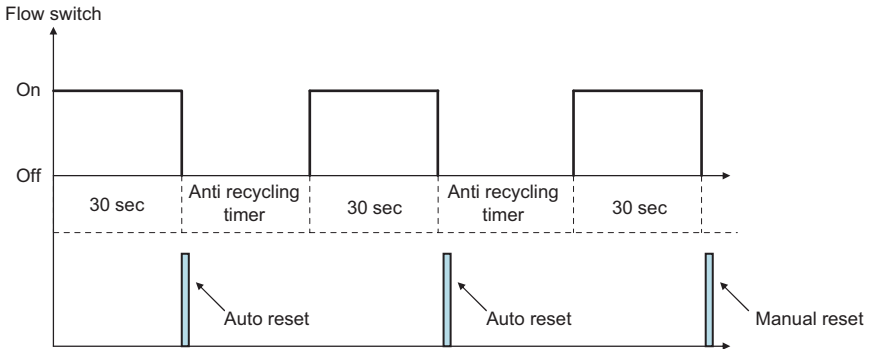
- Heat recovery dead band: Area where the capacity of the compressor remains the same.
- Stage timer: Time between 2 capacity step increases or decreases.
- Condensing threshold time: When changing from water to air-cooled condenser and the saturated discharge temperature is below 30°C, the compressor will not load up to avoid liquid pumping.
- HR inter-stage timer:
  - If temperature is higher than the upper limit of the dead band for a time longer than the inter-stage time, the unit returns to the cooling mode.
  - If temperature is lower than the lower limit of the dead band for a time longer than the inter-stage time, the unit switch on the second compressor.
- HR Bypass valve Min. Time:
  - If the water temperature is 40°C the 3-way valve is 100% open.
  - If the water temperature is 30°C the 3-way valve is 100% closed.
- The valve has proportional control with a signal of 0 to 10 V.

Heat recovery operation conditions

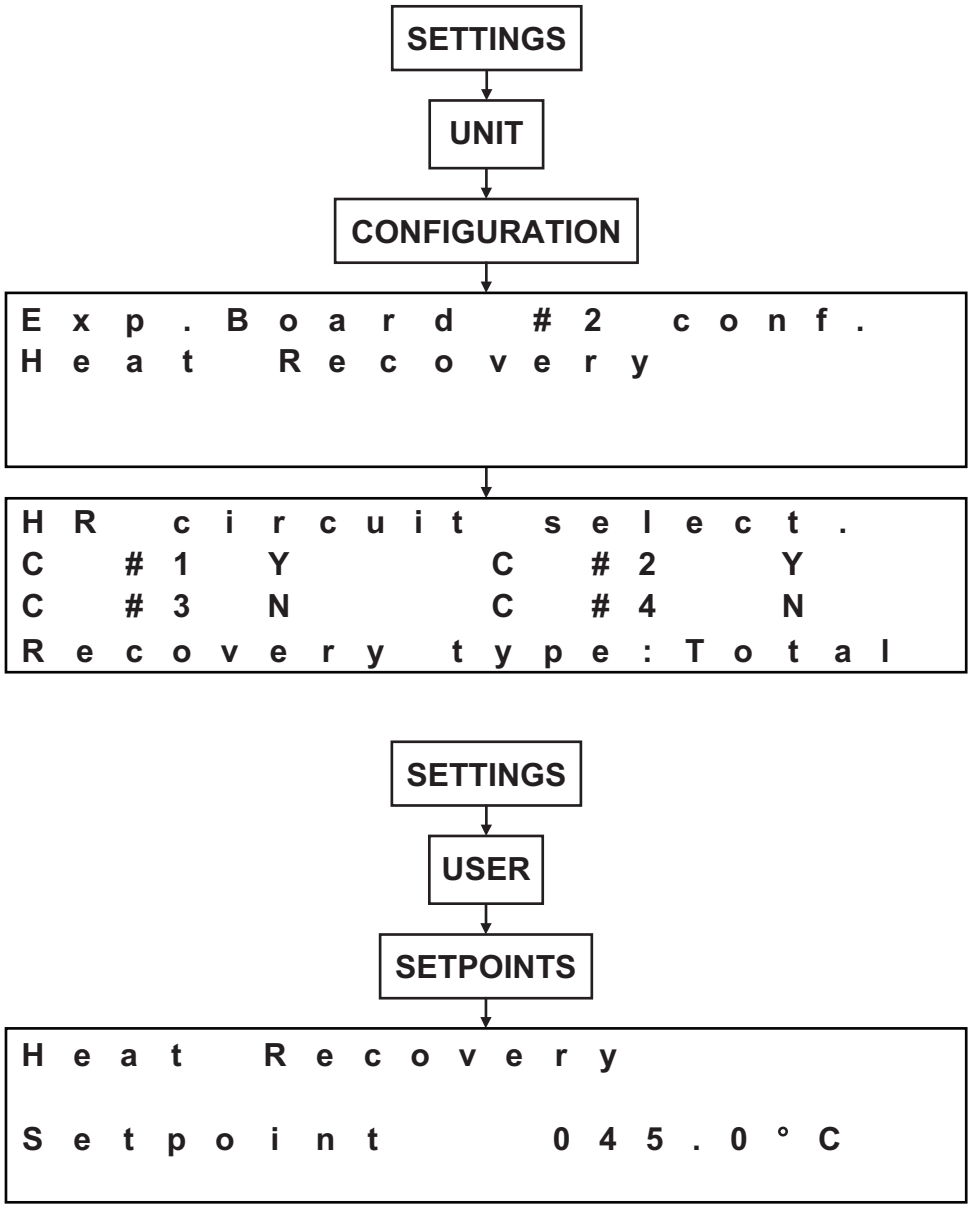
- Installation of expansion board
- Address of expansion board: 2
- Possible to select full recovery
- Settings to be programmed in the controller:
  - Dead band
  - Stage timer
  - Set-point leaving water condenser
  - Heat recovery inter-stage timer
  - Heat recovery bypass valve minimum temperature
  - Heat recovery bypass valve maximum temperature

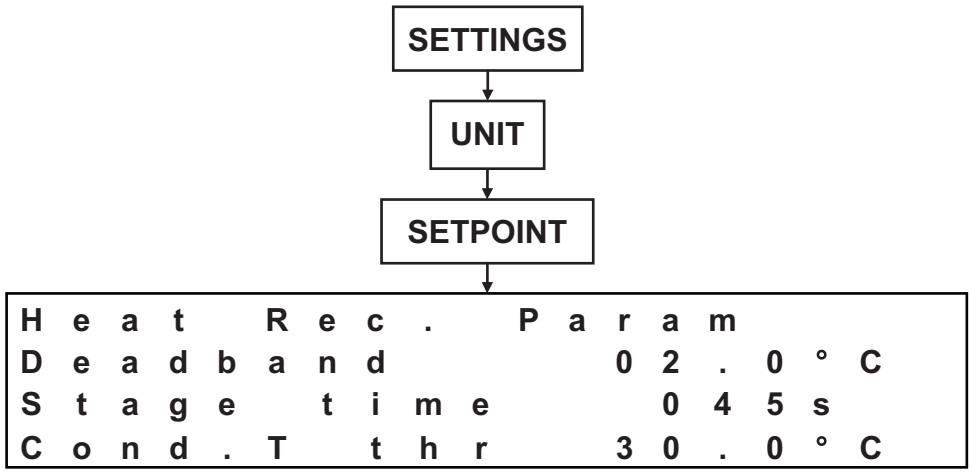
Flow switch problem during operation

- Failure if flow is not within specification
- Same function if unit is switched OFF (no)



Programming




SETTINGS
UNIT
SETPOINT
Heat Rec. Param
Deadband 02.0°C
Stage time 045s
Cond.T thr 30.0°C

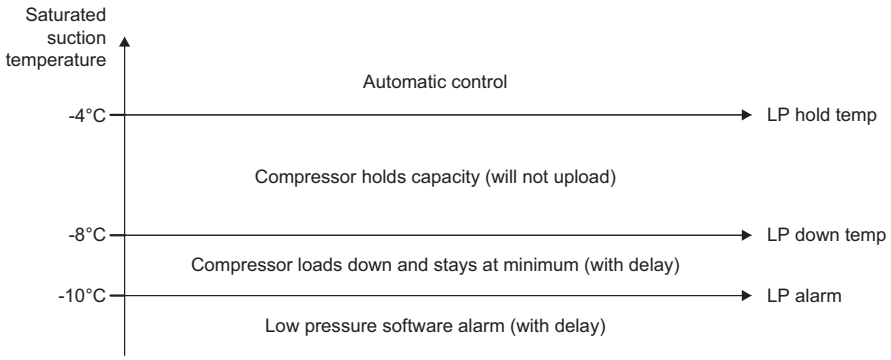
2.14 Limitation

Overview

- Low pressure
- High pressure
- Compressor inverter absorbed current
- Oil heating
- Low discharge superheat
- Low water temperature
- High water temperature

Low pressure

Cooling mode

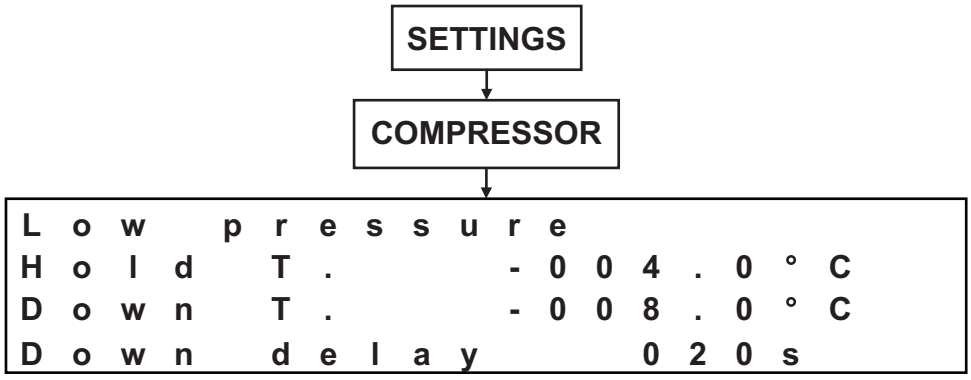


Note: there is no mechanical low pressure switch.

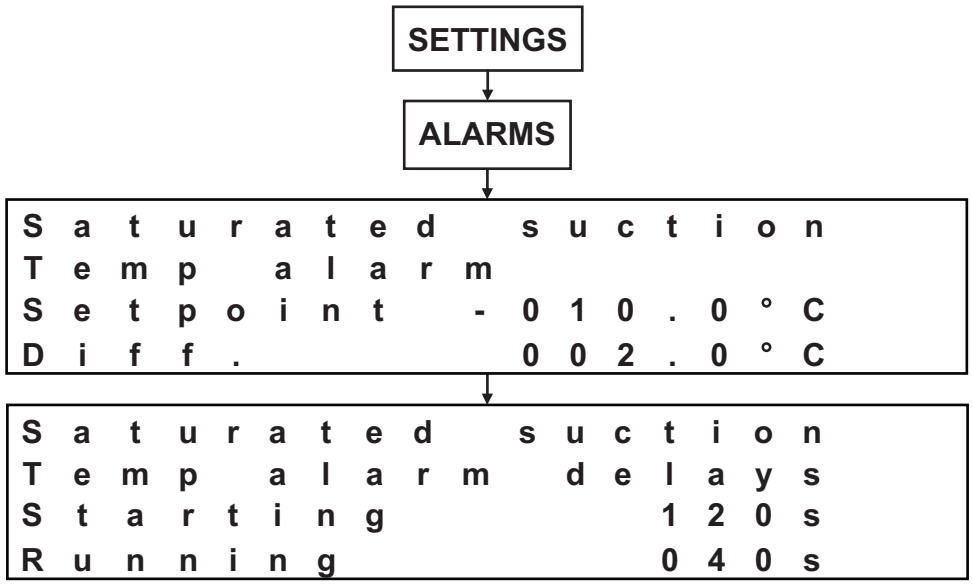
Delays:

- The LP down temp uses a delay of 20 sec before it starts unloading the compressor.
- The LP alarm is bypassed during the first 120 sec after compressor starts.
- The LP alarm uses a delay of 40 sec during normal running before the circuit stops in alarm.

Programming



2

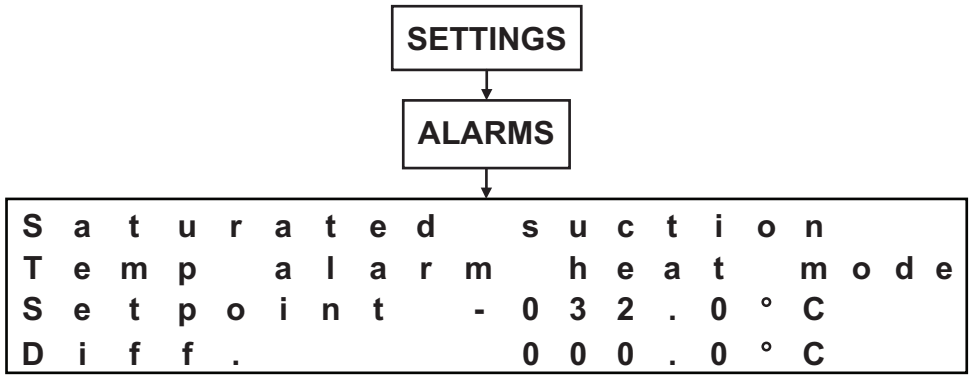


Explanation

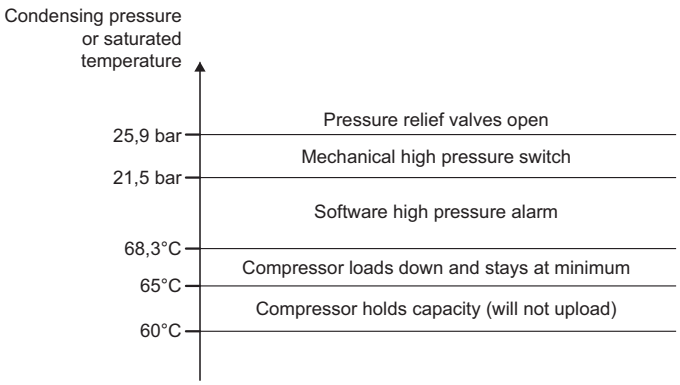
Heating mode

In heating mode there are no settings for hold or down. When a certain saturated suction temperature (default -32°C) is reached, the unit will go in defrost operation.

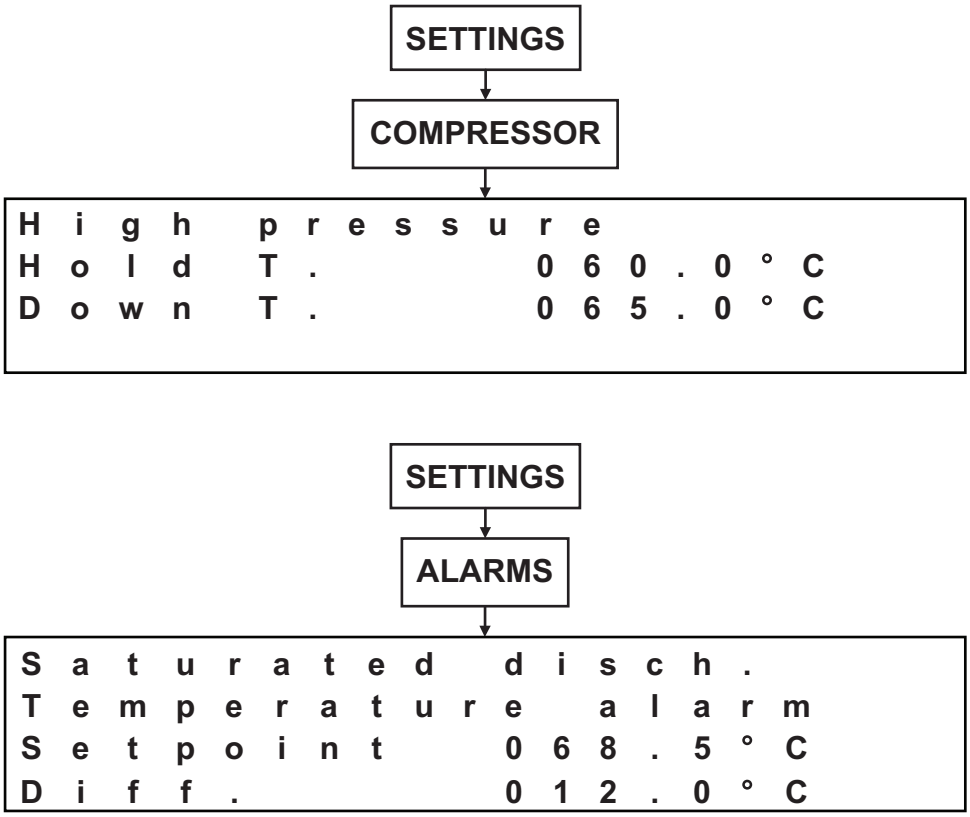
Programming



High pressure



Programming



Compressor inverter absorbed current

When the ambient temperature is lower than 40°C, the compressor inverters are limited to a certain absorbed current value:

- 105 A for 3118 and 3120 compressors.
- 140 A for 3121 and 3122 compressors.
- 170 A for 3123 compressors.

When the ambient temperature is higher than 40°C, the compressor inverters are limited to 95% of these values (105 A, 140 A or 170 A).

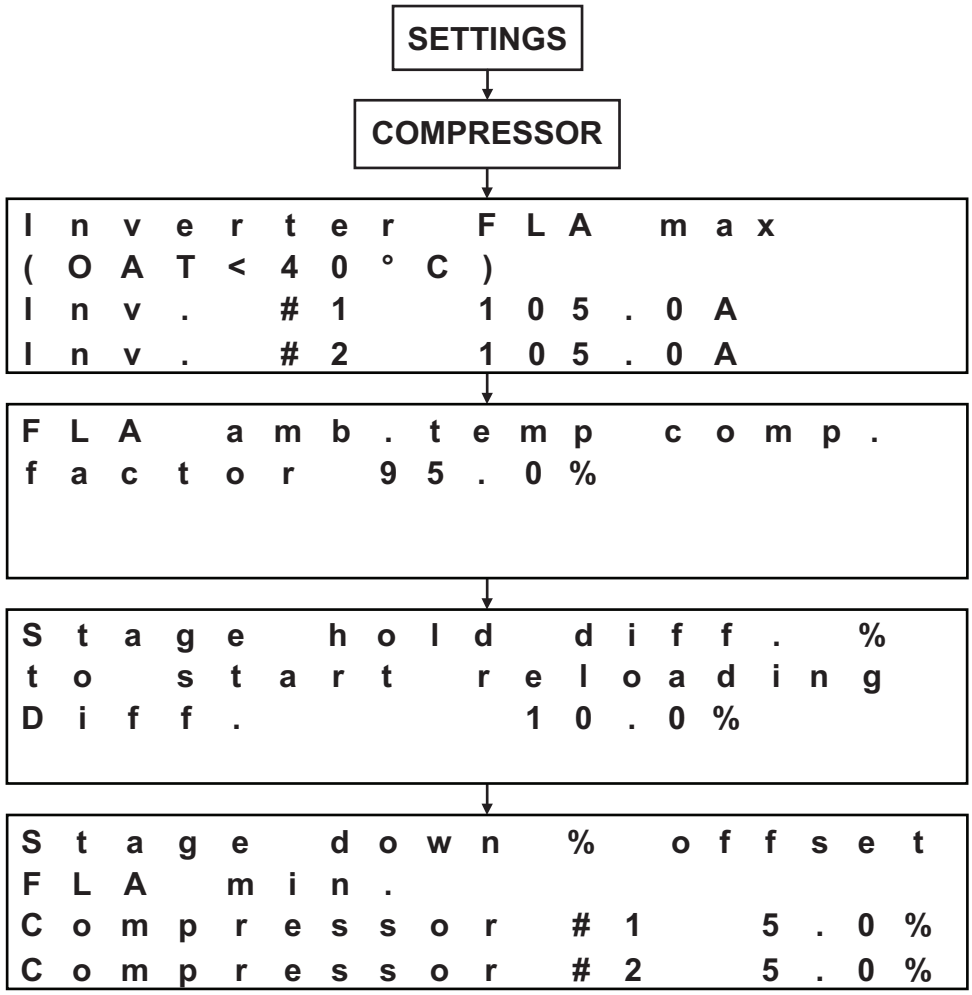
When the maximum current value is reached, the compressor will hold its capacity. The current then has to drop 10% before the compressor can reload again.

When the maximum current value +5% is reached, the compressor will start unloading.

When the inverters are limiting by themselves, they close the “maximum VFD load” input on the controller. This will also limit the compressor capacity.

2

Programming

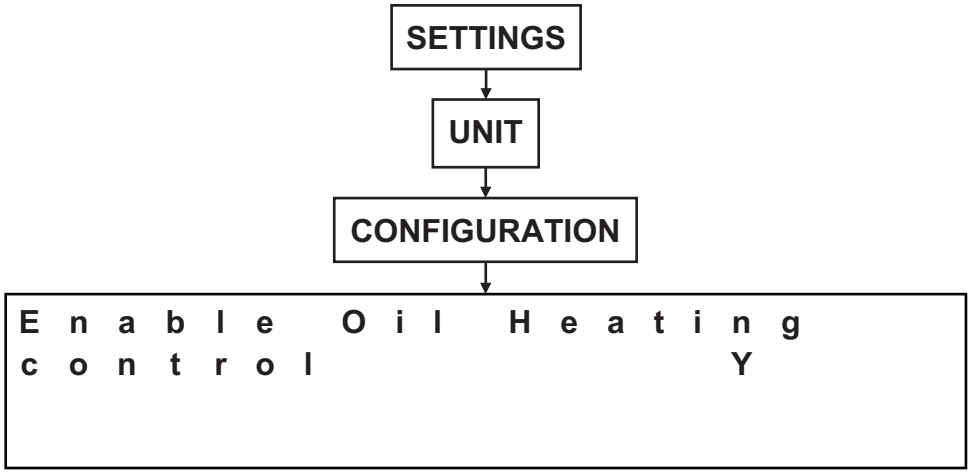


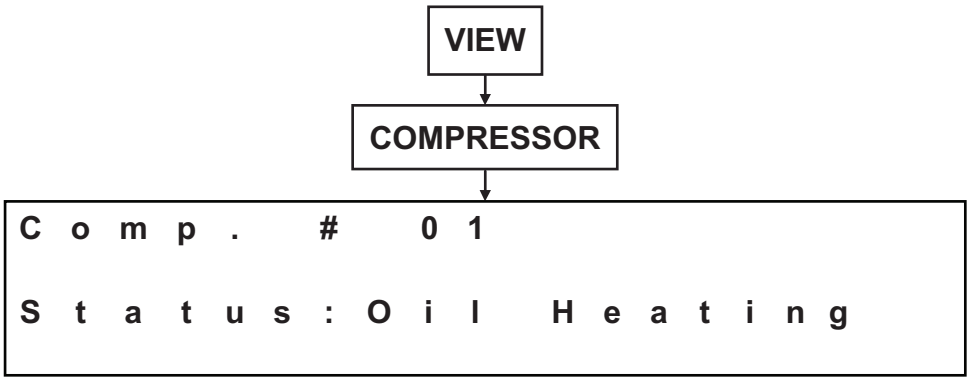
Oil heating

The compressor can't start if the discharge temperature - T oil pressure < 5°C. When this is active, "oil heating" is shown in the compressor status screen.

When the compressor is off, the oil is heated with a crankcase heater. When the compressor is on, the heater is not active.

Programming

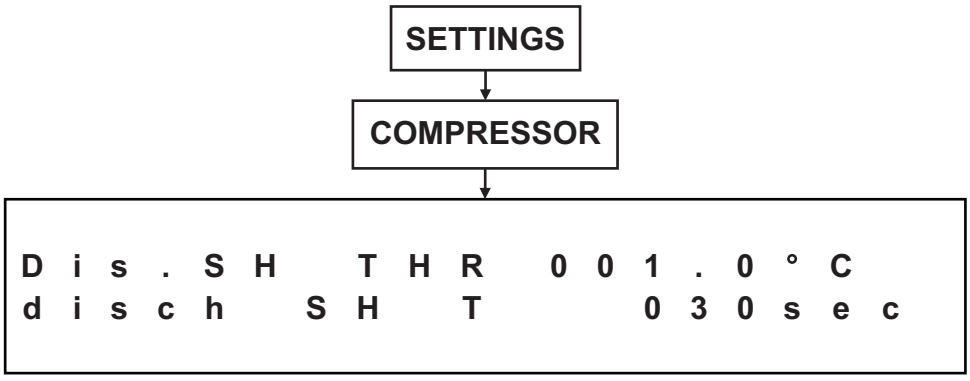




Low discharge superheat

If the compressor discharge superheat is less than 1°C during the first 30 sec of operation, the circuit will go into low discharge superheat operation. This means the compressor will stay at minimum capacity until the discharge superheat reaches 10°C.

Programming



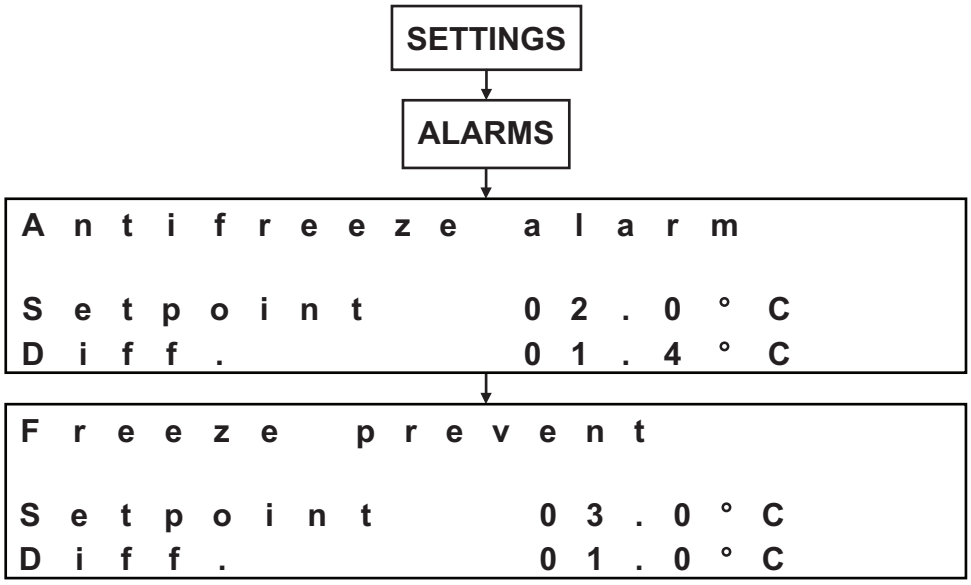
Low water temperature

If the leaving water temperature reaches the Freeze prevent temperature, the compressors will start unloading to prevent an antifreeze alarm. When the temperature goes back up above the Freeze prevent setpoint + the differential, the compressors can start uploading again.

If the temperature drops further down to the Antifreeze alarm setpoint, the unit will stop immediately in alarm. This alarm can only be reset when the water temperature rises up above the Antifreeze alarm + the differential.

2

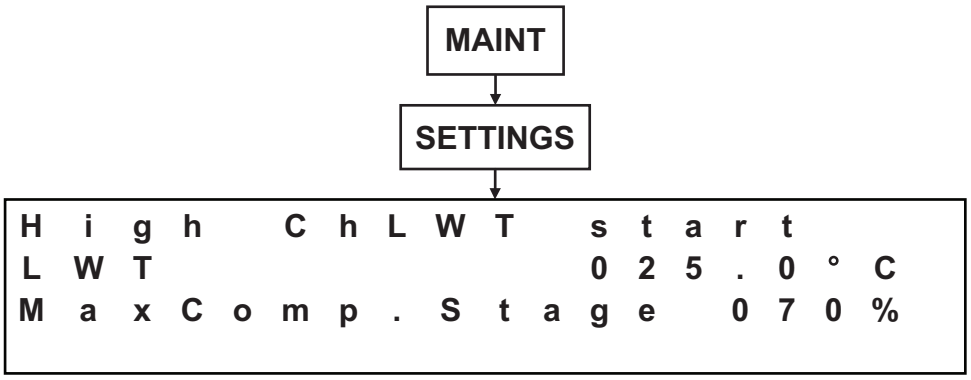
Programming



High water temperature

When the leaving water temperature exceeds a certain value, the unit will limit the maximum compressor stage. This feature avoids overheating of the compressors.

Programming



2.15 Defrost

Explanation

In heat pump units a defrost procedure is started when the evaporator coil begins to ice up. The circuit will reverse the cycle from heating to cooling mode. Multiple compressors will not execute the defrost procedure at the same time. If required, a manual defrost can always be started.

Defrost start condition

A defrost is possible if following things are true:
1. Suction superheat is lower than 10°C.
2. Ambient temperature is lower than 20°C.
3. Suction temperature is lower than 0°C.

When above 3 conditions are true, the following formula needs to be true for 180 sec. After this, the defrost is started.

Suction temperature < 0,7 x Ambient temperature - Defrost parameter.

The Defrost parameter is the adjustable coil design approach (default 10°C).

Between 2 defrosts of the same circuit, there is a minimum time of 1800 sec (adjustable value).

Defrost operation

During defrost the compressor is kept at 54 Hz. The other circuit(s) can boost up to compensate the loss in heating capacity.

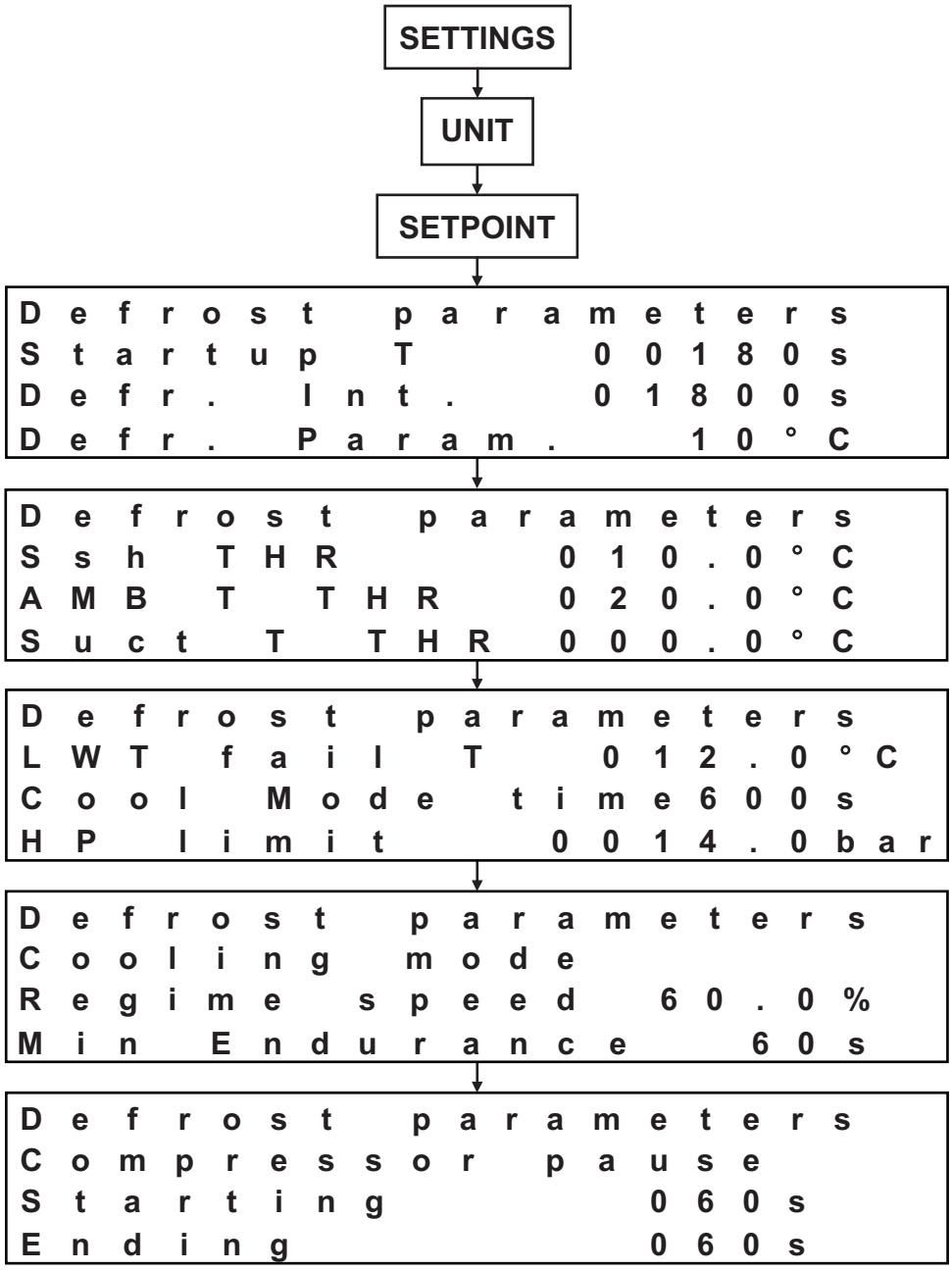
Before and after the defrost, the compressor is stopped for 60 sec to change the 4-way valve.

Defrost stop condition

The defrost will stop if any of below conditions are true:
1. The leaving water temperature drops below 12°C.
2. The defrost is active for 600 sec.
3. The coil HP limit is reached (default stop condition).

The HP limit function is set to 14,0 bar (default value). Once 14,0 bar is reached, 2 fans are started to let the condensing pressure drop. Once it has dropped below 10,0 bar, the fans are stopped again. Then the pressure goes up again up to 14,0 bar where again 2 fans are started until the pressure drops down again to 10,0 bar. This fan cycling is maintained during a minimum endurance time (default 60 sec).

Programming



Part 3
Troubleshooting

Introduction

When a problem occurs, all possible faults have to be checked. This chapter gives a general idea of where to look for faults. Furthermore the general procedure for electrical circuit repair are explained.

What is in this part?

This part contains the following chapters:

1 Overview of Fault Indications and Safeties

1.1 What Is in This Chapter?

Overview

Faults can be unit related or circuit related. Unit alarms will stop the complete unit. Circuit alarms will only stop the involved circuit.

List of faults

1.2 001: PVM or GPF Alarm

Error code:	001: PVM or GPF Alarm
Purpose:	▪ Protect any 3-phase motor (compressor or fan) from running with missing or reverse phase. ▪ Protect against too low or too high voltage or voltage unbalance.
Applicable models:	▪ All
Detection method:	▪ Phase voltage monitor
Error condition:	▪ Voltage too low ▪ Voltage too high ▪ Voltage unbalance ▪ Missing phase ▪ Reverse phase

Possible causes	Corrective action
Power supply issues	Check power supply

Reset:	The error is automatically reset when the power supply is ok again.

1.3 003: Freeze Alarm

Error code:	003: Freeze alarm
Purpose:	▪ Prevent evaporator freezing
Applicable models:	▪ All
Detection method:	▪ Water outlet or inlet sensor
Error condition:	▪ Water temperature lower than Antifreeze alarm setting

Possible causes	Corrective action
Water flow too low.	Increase the water flow (target delta T between 3°C and 8°C).
Inlet temperature to the evaporator is too low.	Increase the inlet water temperature.
Flow switch is not working or no water flow.	Check the flow switch and the water pump.
Blocked water filter.	Clean the water filter.
Reset:	After water temperature rises, above the Differential value, this safety can be reset manually.

1.4 007: Evaporator Pump Maintenance

Error code:	007: Evaporator pump maintenance	
Purpose:	▪ Indicate certain pump running hours	
Applicable models:	▪ All	
Detection method:	▪ Hour counter in software	
Error condition:	▪ Setting (default 010 x 1000 hours)	
Possible causes		Corrective action
Pump may need maintenance		Perform a maintenance on the pump
Reset:	By resetting the pump operating hours or adjusting the pump maintenance hours.	

3

1.5 007: Second Pump Maintenance

Error code:	007: Second pump maintenance	
Purpose:	▪ Indicate certain pump running hours	
Applicable models:	▪ All	
Detection method:	▪ Hour counter in software	
Error condition:	▪ Setting (default 010 x 1000 hours)	
Possible causes		Corrective action
Pump may need maintenance		Perform a maintenance on the pump
Reset:	By resetting the pump operating hours or adjusting the pump maintenance hours.	

3

1.6 009: External Alarm

Error code:	009: External alarm	
Purpose:	▪ Stop on external alarm	
Applicable models:	▪ All	
Detection method:	▪ Digital input (field wiring)	
Error condition:	▪ External alarm condition	
Possible causes		Corrective action
External alarm		Reset external alarm condition
Reset:	Manual reset required after external alarm is ok again.	

1.7 010: Unit N. 2 is Offline

Error code:	010: Unit n. 2 is offline
Purpose:	▪ Indicate communication error or controller malfunction
Applicable models:	▪ 3-circuit EWYD units
Detection method:	▪ Communication between controllers
Error condition:	▪ Loss of communication between controllers

Possible causes	Corrective action
Loose communication wire	Check communication wiring
Broken second controller	Change second pCO2 controller

Reset:	Automatic reset when communication is re-established.

1.8 011: Evaporator Flow Alarm

Error code:	011: Evaporator flow alarm
Purpose:	▪ Prevent evaporator freezing
Applicable models:	▪ All
Detection method:	▪ Flow switch
Error condition:	▪ Flow switch open for 5 sec

Possible causes	Corrective action
Bad wiring contact in flow switch	Check wiring in flow switch
Blocked water filter	Clean water filter
Broken pump	Check / Replace pump
Closed water valve	Check water valves
Air in the water circuit	Purge water circuit

Reset:	3 automatic resets per day, 4th alarm in the same day requires manual reset.

1.9 012: B9 Probe Fault or Not Connected

Error code:	012: B9 probe fault or not connected
Purpose:	▪ Detect inlet temperature sensor malfunction
Applicable models:	▪ All
Detection method:	▪ Measure resistance of inlet temperature sensor
Error condition:	▪ Open or closed contact or out of range sensor

Possible causes	Corrective action
Bad contact in the wiring	Check wiring
Broken temperature sensor	Replace temperature sensor
Broken input on controller	Replace controller

Reset:	Automatic reset when temperature sensor is ok again.

1.10 013: B10 Probe Fault or Not Connected

Error code:	013: B10 probe fault or not connected
Purpose:	▪ Detect outlet temperature sensor malfunction
Applicable models:	▪ All
Detection method:	▪ Measure resistance of outlet temperature sensor
Error condition:	▪ Open or closed contact or out of range sensor

Possible causes	Corrective action
Bad contact in the wiring	Check wiring
Broken temperature sensor	Replace temperature sensor
Broken input on controller	Replace controller

Reset:	Automatic reset when temperature sensor is ok again.

1.11 101: Compressor # Overload

Error code:	101: Compressor # overload
Purpose:	▪ Protect compressor
Applicable models:	▪ All
Detection method:	▪ PTC sensor in compressor windings or compressor inverter
Error condition:	▪ Too high temperature inside compressor or inverter

Possible causes	Corrective action
Lack of refrigerant	Check refrigerant charge
Liquid injection doesn't work	Check liquid injection
Inverter alarm	Check inverter display

Reset:	Manual reset required

1.12 102: Low Pressure Ratio Alarm

Error code:	102: Low pressure ratio alarm #
Purpose:	▪ Detect compressor or 4-way valve problem
Applicable models:	▪ All
Detection method:	▪ Evaporating pressure transducer and condensing pressure transducer (calculation in absolute pressure)
Error condition:	▪ 1,1 (25% C/O & H/P), 1,8 (100% C/O) or 1,3 (100% H/P)

Possible causes	Corrective action
Not enough difference between LP and HP	Ensure unit is working within operating range
4-way valve does not change over	Check 4-way valve and replace if necessary
Compressor not pumping	Check compressor

Reset:	Manual reset required

1.13 103: High Pressure Switch Alarm

Error code:	103: High pressure switch alarm #
Purpose:	▪ Protect components from too high pressure
Applicable models:	▪ All
Detection method:	▪ 2 high pressure switches per compressor
Error condition:	▪ 21,5 bar high pressure

Possible causes	Corrective action
Condenser fan(s) not working in cooling mode	Check fans + their overcurrent protection
No flow in heating mode	Check flow
Overcharged with refrigerant	Check refrigerant charge
Non-condensable parts in the refrigerant	Check refrigerant

Reset:	Manual reset in the controller + reset the high pressure switch via the blue button on it

1.14 104: High Pressure Alarm

Error code:	104: High pressure alarm #
Purpose:	▪ Protect components from too high pressure
Applicable models:	▪ All
Detection method:	▪ Condensing pressure transducer
Error condition:	▪ 68,5°C saturated condensing temperature

Possible causes	Corrective action
Condenser fan(s) not working in cooling mode	Check fans + their overcurrent protection
No flow in heating mode	Check flow
Overcharged with refrigerant	Check refrigerant charge
Non-condensable parts in the refrigerant	Check refrigerant

Reset:	Manual reset in the controller

1.15 106: Low Pressure Alarm

Error code:	106: Low pressure alarm #
Purpose:	▪ Protect the compressor from too low suction pressure & protect the evaporator against freeze-up
Applicable models:	▪ All
Detection method:	▪ Evaporating pressure transducer (there is no low pressure switch)
Error condition:	▪ Default -10°C saturated evaporating temperature in cooling mode (can be modified, for example for glycol application). ▪ Default -32°C saturated evaporating temperature in heating mode (the unit will go into defrost in this condition).

Possible causes	Corrective action
Too low water flow	Check water flow (pump, filter, water valves…)
Refrigerant shortage	Check for leaks and check refrigerant charge
Fan malfunction (heating mode)	Check the fans (overcurrent protections)
Blocked coil (ice in heating mode)	Manually defrost the circuit
Wrong measuring outlet water temperature sensor	Check outlet water temperature sensor

Reset:	Manual reset in the controller

1.16 107: High Discharge Temperature

Error code:	107: High discharge temperature #
Purpose:	▪ Prevent compressor overheating (damage)
Applicable models:	▪ All
Detection method:	▪ Discharge (oil) temperature sensor
Error condition:	▪ 110°C discharge temperature

Possible causes	Corrective action
Lack of refrigerant	Check refrigerant charge (& check for leaks)
Low evaporating temperature	Check operating range

Reset:	Manual reset in the controller

1.17 108: Compressor # Maintenance

Error code:	108: Compressor # maintenance
Purpose:	▪ Indicate certain compressor running hours
Applicable models:	▪ All
Detection method:	▪ Hour counter in software
Error condition:	▪ Setting (default 010 x 1000 hours)

Possible causes	Corrective action
Compressor may need maintenance	Perform a maintenance on the compressor (see installation, operation and maintenance manual for a maintenance guideline).

Reset:	By adjusting the compressor maintenance hours (to for example 020 x 1000 hours).

1.18 109: B1 Probe Fault or Not Connected Oil Pressure

Error code:	109: B1 probe fault or not connected oil pressure #
Purpose:	▪ Detect oil pressure transducer malfunction
Applicable models:	▪ All
Detection method:	▪ Measure resistance of oil pressure transducer
Error condition:	▪ Open or closed contact or out of range sensor

Possible causes	Corrective action
Bad contact in wiring	Check wiring
Broken oil pressure transducer	Replace oil pressure transducer
Broken input on controller	Replace controller

Reset:	Possible when oil pressure transducer is ok again.

1.19 110: B3 Probe Fault or Not Connected Low Pressure

Error code:	110: B3 probe fault or not connected low pressure #
Purpose:	▪ Detect low pressure transducer malfunction
Applicable models:	▪ Only on units with thermostatic expansion valves
Detection method:	▪ Measure resistance of oil pressure transducer
Error condition:	▪ Open or closed contact or out of range sensor

Possible causes	Corrective action
Bad contact in wiring	Check wiring
Broken oil pressure transducer	Replace oil pressure transducer
Broken input on controller	Replace controller

Reset:	Possible when low pressure transducer is ok again.

1.20 111: B4 Probe Fault or Not Connected Disch. Temp.

Error code:	111: B4 probe fault or not connected Disch. temp. #
Purpose:	▪ Detect discharge temperature sensor malfunction
Applicable models:	▪ All
Detection method:	▪ Measure resistance of oil pressure transducer
Error condition:	▪ Open or closed contact or out of range sensor

Possible causes	Corrective action
Bad contact in wiring	Check wiring
Broken oil pressure transducer	Replace oil pressure transducer
Broken input on controller	Replace controller

Reset:	Possible when discharge temperature sensor is ok again.

1.21 112: B6 Probe Fault or Not Connected Disch. Press.

Error code:	112: B6 probe fault or not connected Disch. Press #
Purpose:	▪ Detect discharge pressure transducer malfunction
Applicable models:	▪ All
Detection method:	▪ Measure resistance of oil pressure transducer
Error condition:	▪ Open or closed contact or out of range sensor

Possible causes	Corrective action
Bad contact in wiring	Check wiring
Broken oil pressure transducer	Replace oil pressure transducer
Broken input on controller	Replace controller
Reset:	Possible when discharge pressure transducer is ok again.

3

1.22 113: Transition Alarm Comp.

Error code:	113: Transition Alarm comp #	
Purpose:	▪ Detect faults on compressor starting system	
Applicable models:	▪ All (star/delta, softstarter, inverter starter or inverter compressors)	
Detection method:	▪ Digital input reporting successful compressor start	
Error condition:	▪ Digital input still open 14 sec after compressor start	
Possible causes		Corrective action
Bad contact		Check wiring to the digital input
Start contactor		Check / replace star contactor
Delta contactor		Check / replace delta contactor
Softstarter		Check softstarter (error code on softstarter)
Inverter		Check inverter (error code on inverter)
Reset:	Possible when compressor starting system is ok again.	

1.23 114: Low Oil Pressure

Error code:	114: Low Oil Pressure #
Purpose:	▪ Assure compressor oil lubrication
Applicable models:	▪ All
Detection method:	▪ Software calculation between evaporating pressure and oil pressure
Error condition:	▪ Oil press < (evap press x 1,1) + 1 bar at min capacity ▪ Oil press < (evap press x 1,5) + 1 bar at max capacity ▪ Start-up delay = 300 sec (default value) ▪ Run delay = 90 sec (default value)

Possible causes	Corrective action
Compressor not running	Check compressor (wiring, fuses, compression…)
Not enough pressure difference (for example hot water in the evaporator in cold ambient conditions before start)	Make sure unit runs within envelope
Very low ambient temperatures	Make sure unit runs within envelope and protect unit from direct cold wind

Reset:	Needed to restart the compressor

1.24 115: High Oil Pressure Difference

Error code:	115: High oil Pressure difference #
Purpose:	▪ Assure compressor oil lubrication
Applicable models:	▪ All
Detection method:	▪ Software calculation between the oil pressure and discharge pressure
Error condition:	▪ Discharge pressure – oil pressure > 250 kPa (default value)

Possible causes	Corrective action
Oil filter clogged	Replace oil filter
Oil pressure transducer measuring wrong	Check oil pressure transducer
Discharge pressure transducer measuring wrong	Check discharge pressure transducer

Reset:	Possible to reset when the discharge pressure – oil pressure < 250 kPa again

1.25 117: Low Discharge Superheat Alarm

Error code:	117: Low Discharge Superheat Alarm #
Purpose:	▪ Prevent compressor running cold
Applicable models:	▪ All
Detection method:	▪ Software calculation between discharge temperature and saturated discharge pressure
Error condition:	▪ Discharge temperature – saturated discharge pressure < 10°C for 30 min

Possible causes	Corrective action
Suction temperature sensor reading wrong	Check suction temperature sensor
Discharge temperature sensor reading wrong	Check discharge temperature sensor
Discharge pressure transducer reading wrong	Check discharge pressure transducer
Suction pressure transducer reading wrong	Check suction pressure transducer
Wrong expansion valve operation	Check expansion valve

Reset:	Necessary to restart compressor

1.26 D11: EXV Driver # Probe Fault

Error code:	D11: EXV Driver # Probe Fault
Purpose:	▪ Detect suction temperature sensor of suction pressure transducer
Applicable models:	▪ All units with electronic expansion valves
Detection method:	▪ Measure resistance of sensor/transducer input
Error condition:	▪ Open or closed contact or out of range sensor/transducer

Possible causes	Corrective action
Bad contact in the wiring	Check wiring
Suction temperature sensor broken or out of range	Check/replace suction temperature sensor
Suction pressure transducer broken or out of range	Check/replace suction pressure transducer

Reset:	When suction temperature sensor or suction pressure transducer is ok again.

1.27 D12: EXV # Step Motor Error

Error code:	D12: EXV # Step motor error	
Purpose:	▪ Prevent wrong expansion valve operation	
Applicable models:	▪ All units with electronic expansion valves	
Detection method:	▪ Measure expansion valve connection	
Error condition:	▪ Step motor not responding	
Possible causes		Corrective action
Faulty expansion valve		Check/replace expansion valve
Bad contact in the wiring		Check wiring between driver and expansion valve
Reset:	Manual reset possible when step motor (expansion valve) is ok again.	

3

1.28 D13: EXV Driver # Eeprom Error

Error code:	D13: EXV Driver # Eeprom error
Purpose:	▪ Prevent wrong expansion valve operation
Applicable models:	▪ All units with electronic expansion valves
Detection method:	▪ Check EXV driver operation
Error condition:	▪ Communication with driver ok, but not responding

Possible causes	Corrective action
Faulty expansion valve driver	Replace expansion valve driver

Reset:	Possible when expansion valve driver is ok again.

1.29 D14: EXV Driver # Battery Error

Error code:	D14: EXV Driver # Battery error
Purpose:	▪ Assure that EXV can close when power supply fails
Applicable models:	▪ All units with electronic expansion valves
Detection method:	▪ Measure resistance and voltage of the battery
Error condition:	▪ Resistance too high or voltage too low

Possible causes	Corrective action
Battery not fully charged after long power off	Wait until battery is charged
Battery faulty	Replace battery
Battery fuse blown	Replace battery fuse
Battery charger broken	Replace battery charger

Reset:	Reset possible when battery resistance and voltage are within range again.

1.30 D15: EXV Not Closed During Power OFF

Error code:	D15: EXV not closed during power OFF #	
Purpose:	▪ Prevent compressor to start with liquid	
Applicable models:	▪ All units with electronic expansion valves	
Detection method:	▪ Check EXV opening when power is restored	
Error condition:	▪ EXV is still partly open when power is restored	
Possible causes		Corrective action
EXV battery not working		Check/replace EXV battery
EXV blocked / not responding		Check expansion valve
Reset:	Any liquid refrigerant in the evaporator should be recovered to the condenser (water flow must be ensured at all time during this operation) to avoid the compressor to start with liquid. The error can always be reset manually.	

3

1.31 D16: Driver # Offline

Error code:	D16: Driver # Offline
Purpose:	▪ Detect communication loss between controller and expansion valve driver
Applicable models:	▪ All units with electronic expansion valves
Detection method:	▪ Check communication between controller and expansion valve driver
Error condition:	▪ No communication between controller and expansion valve driver

Possible causes	Corrective action
Bad contact in communication wiring	Check communication wiring between modules
Expansion valve driver broken	Replace expansion valve driver

Reset:	Error can be reset when communication between the controller and the expansion valve driver is restored.

1.32 E01/E02/E03/E04: Probe Alarm

Error code:	E01/E02/E03/E04: Probe alarm	
Purpose:	▪ Detect sensor/transducer/4-20mA input fault on the expansion boards	
Applicable models:	▪ All	
Detection method:	▪ Measure resistance of sensor/transducer/4-20mA	
Error condition:	▪ Open or closed contact or out of range sensor	
Possible causes		Corrective action
Bad contact in wiring		Check wiring
Broken sensor/transducer/4-20mA input		Replace sensor/transducer/4-20mA input
Reset:	Possible when the sensor/transducer/4-20mA input is ok again.	

3

1.33 EXP A/B/C/D Offline

Error code:	EXP A/B/C/D offline
Purpose:	▪ Detect communication loss between main controller and expansion board(s)
Applicable models:	▪ All
Detection method:	▪ Check communication between main controller and expansion board(s)
Error condition:	▪ No communication between main controller and expansion board(s)

Possible causes	Corrective action
Communication fault between modules	Refresh the RS485 network (settings => unit => configuration)
Bad contact in communication wiring	Check communication wiring between modules
Expansion board broken	Replace expansion board

Reset:	Possible when the communication between the main controller and the expansion board(s) is ok again.

Part 4
Service Procedures

Introduction

This part contains service procedures that are needed when changing certain parts. They are also useful to check the settings of these parts, like inverters.

The last procedures are recommendations in case of a frozen evaporator.

What is in this part?

This part contains the following chapters:

1 Procedure for Controller Changing

To change the pCO² Controller, proceed as follows:

Step	Action
1	Switch off the power supply to the chiller.
2	Remove the old pCO² controller.
3	Place the new pCO² controller in the same way as the old pCO² controller.
4	Change the pCO² controller dipswitches to the right address.
5	Upload the software (see procedure for controller programming). It's recommended to only connect the power supply to the controller during this operation. Certainly disconnect any communication cable (like J11 and J23).
6	Connect everything again to the pCO² controller and switch it on.
7	Confirm the first start up to reset all parameters to default settings. If this is not displayed on the first start up, go to Settings → Unit → Configuration and put Reset all parameters to default values on Y.
8	Insert the correct parameters using the parameter list (see extranet) and adapt them to the site conditions if needed.

2 Procedure for Controller Programming

2.1 What Is in This Chapter?

Overview

This chapter contains the following topics:

4

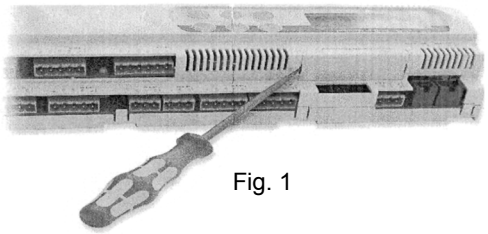
2.2 Copy from the Software Key to pCO²

- Switch off the pCO^2 and remove the "expansion memory" cover with a screwdriver (see "Copy from pCO² to the Software Key" on page 4–6/Fig. 1).
- Set the key selector on  .
- Insert the key in the corresponding pin connector as shown (see "Copy from pCO² to the Software Key" on page 4–6/Fig. 2).
- Press simultaneously the buttons UP and DOWN then supply power to the pCO^2.
- Check the LED on the key is on (red color ).
- Wait until the request of copying appears on the LCD display, then release the buttons and confirm by pressing ENTER.
- The data transfer operation takes about 50 sec using the 1 MB key and 100 sec using the 2 MB one. The display will show a progressive series of numbers.
- Once copied the application program starts, then switch off the pCO^2, remove the key, put the cover in its place and switch on the pCO^2 again.
- Now the pCO^2 works with the program transferred by the key.

2.3 Copy from pCO² to the Software Key

- Switch off the pCO^2 and remove the "expansion memory" cover with a screwdriver (see Fig. 1).
- Set the key selector on  .
- Insert the key in the corresponding pin connector as shown (see Fig. 2).
- Press simultaneously the buttons UP and DOWN then supply the pCO^2.
- Check the LED on the key is on (green color ).
- Wait until the request of copying appears on the LCD display, then release the buttons and confirm by pressing ENTER.
- If the application includes a password to protect the software, use the UP and DOWN buttons on the terminal to enter the correct password. Then press enter.
- The data transfer operation takes about 50 sec using the 1 MB key and 100 sec using the 2 MB one. The display will show a progressive series of numbers.
- Once copied the application program starts, then switch off the pCO^2, remove the key, put the cover in its place and switch on the pCO^2 again.
- Now the key has the program transferred by the pCO^2.

Fig. 1



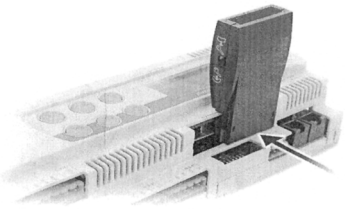
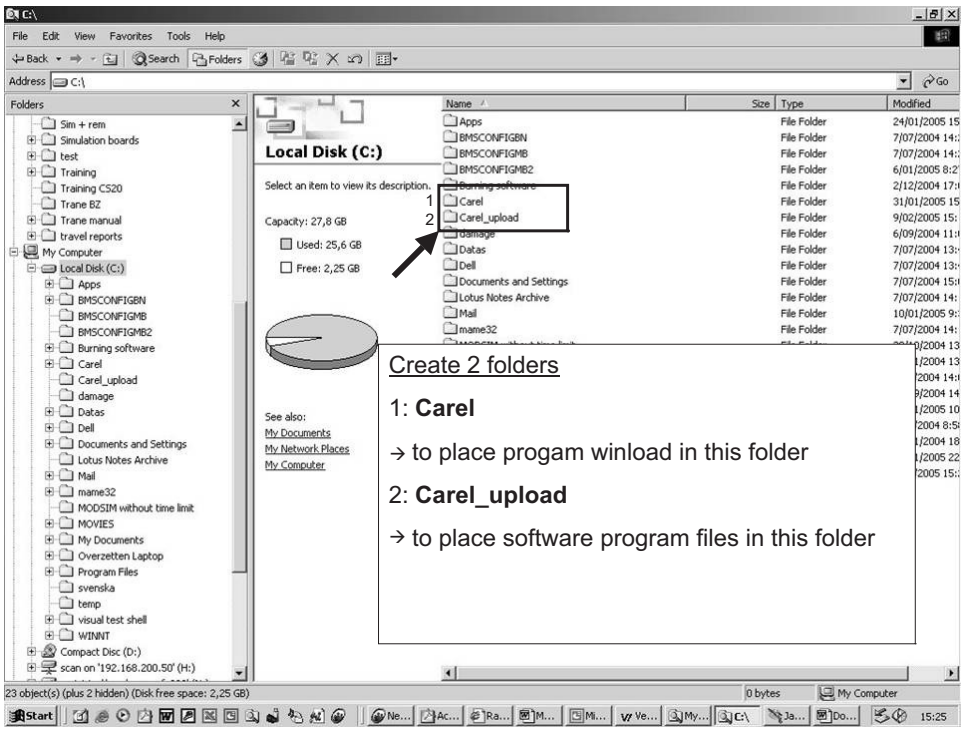
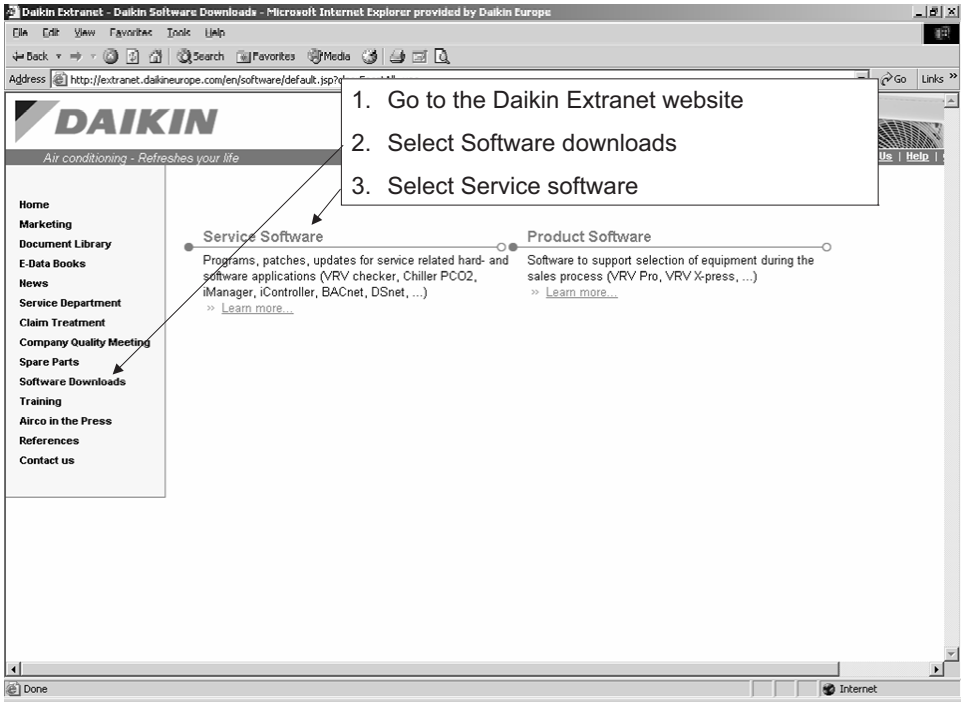
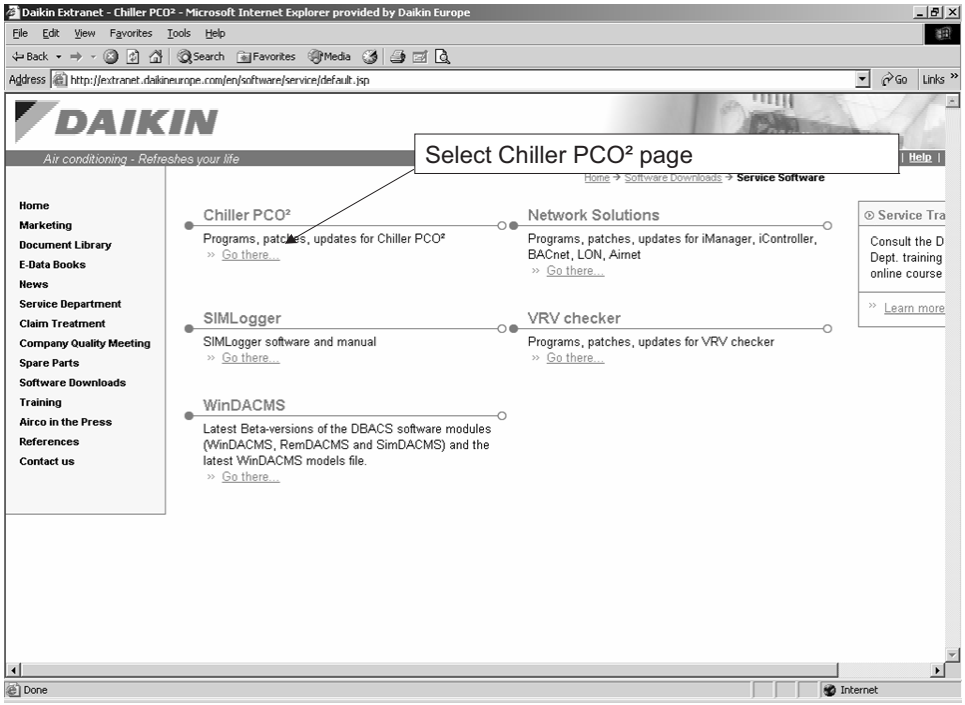
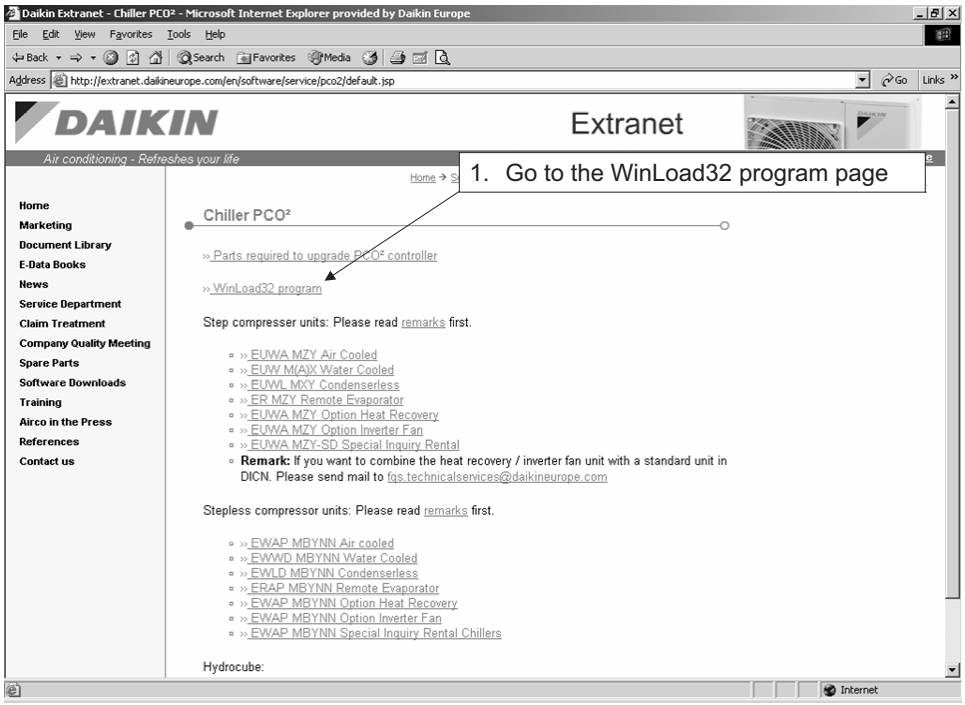
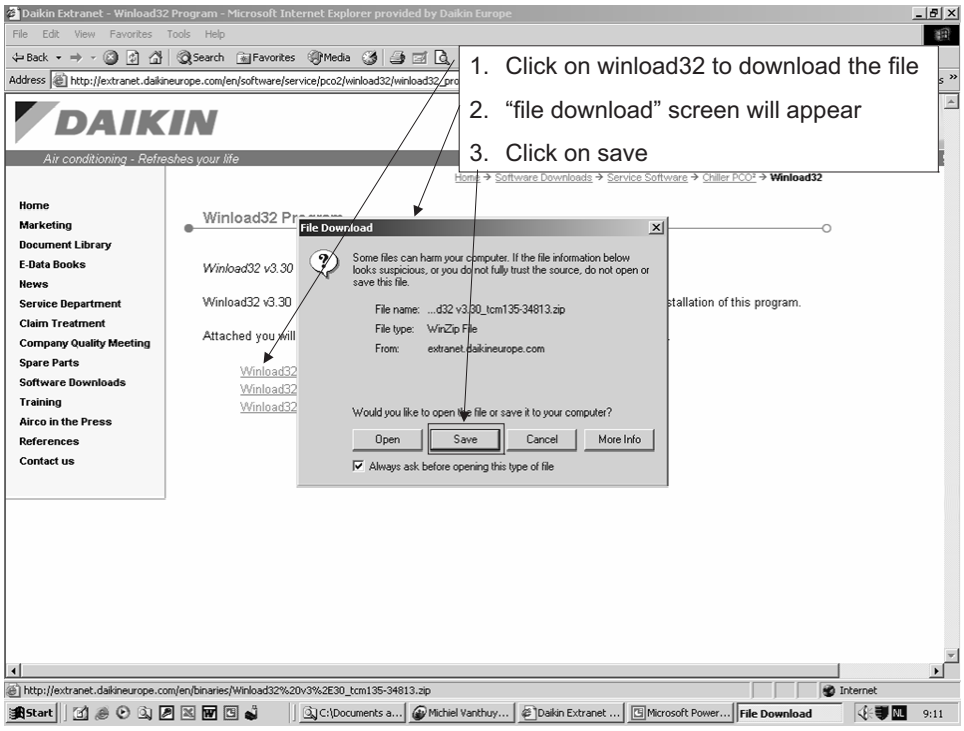
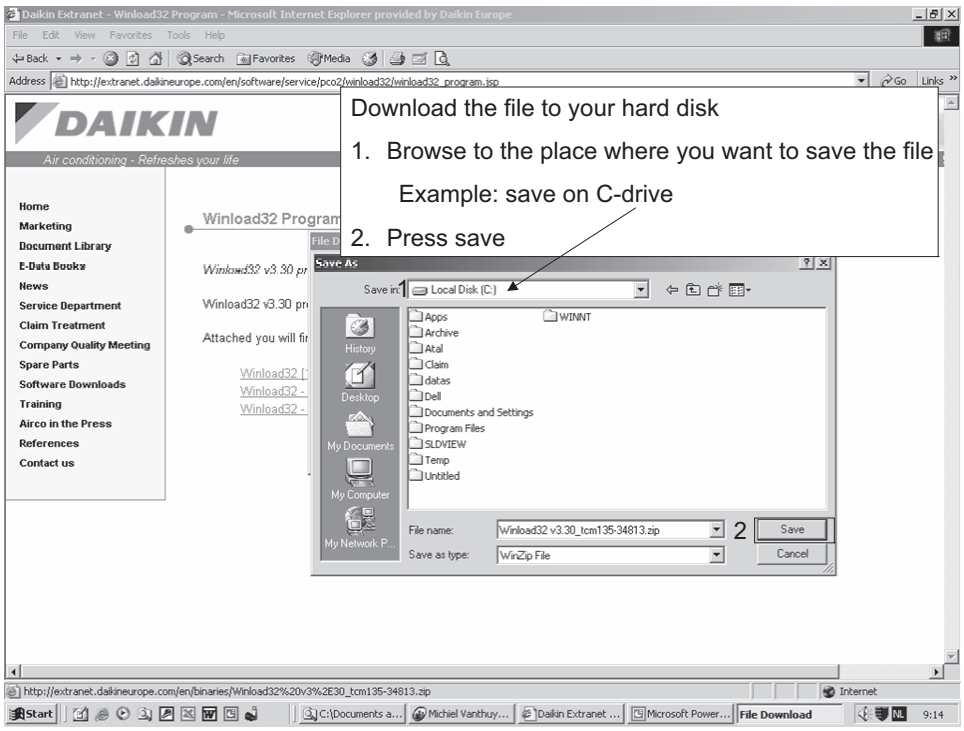


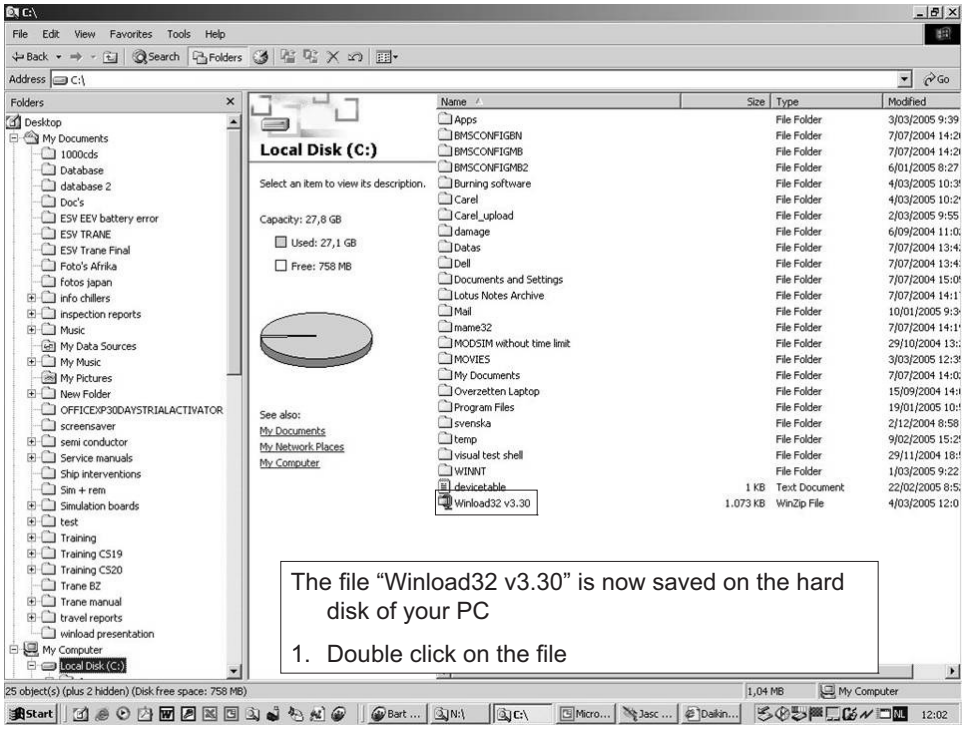
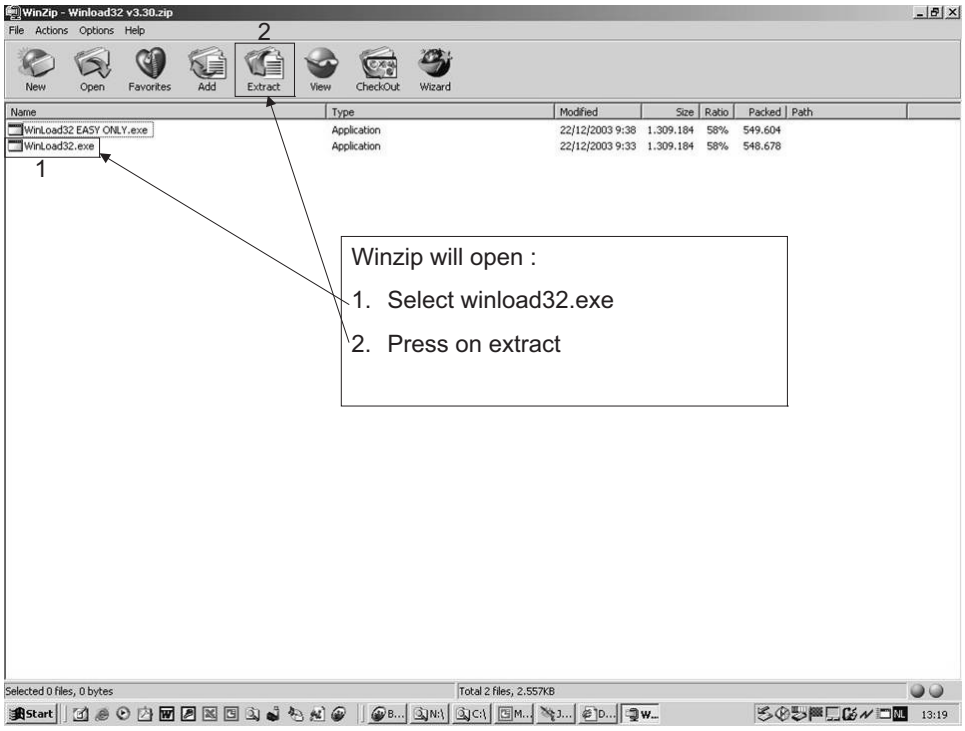
Fig. 2

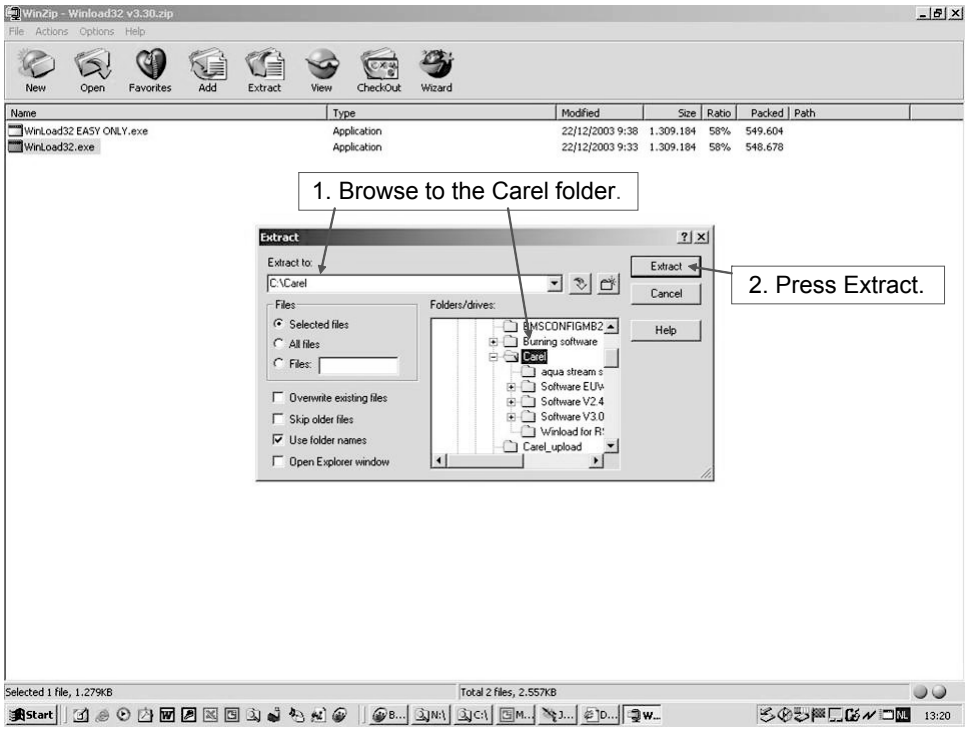
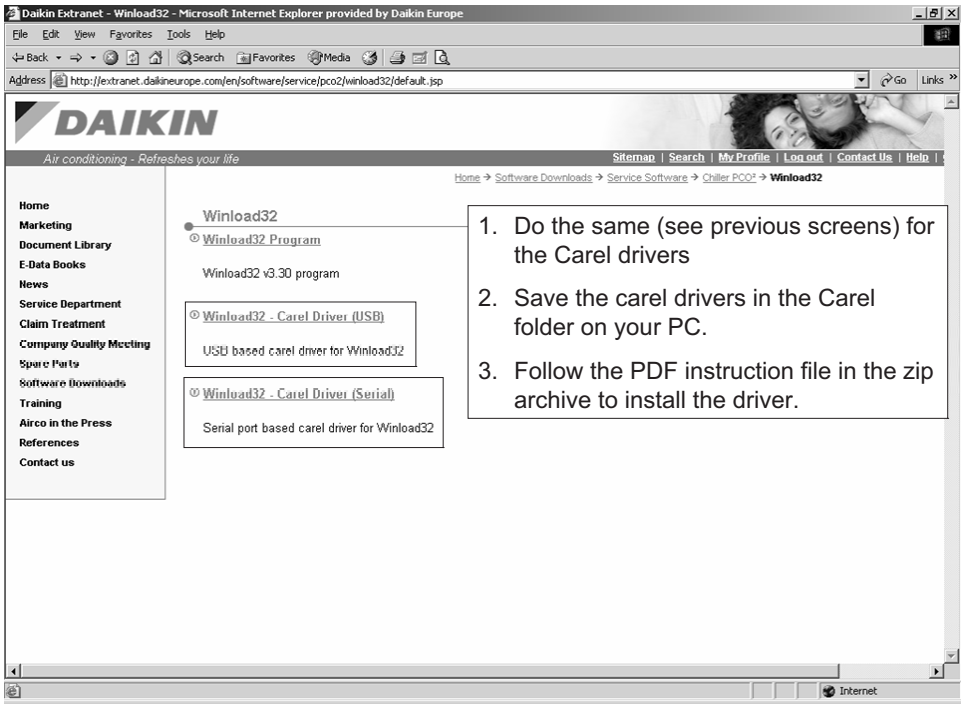
2.4 Installation of Winload32 on the PC and Programming a Controller

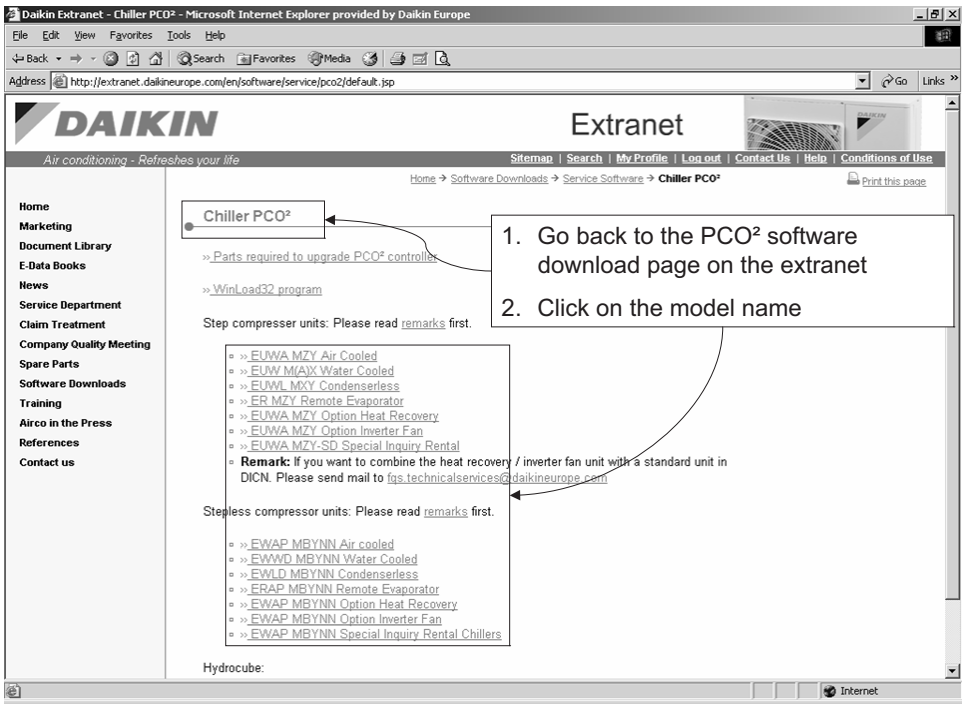
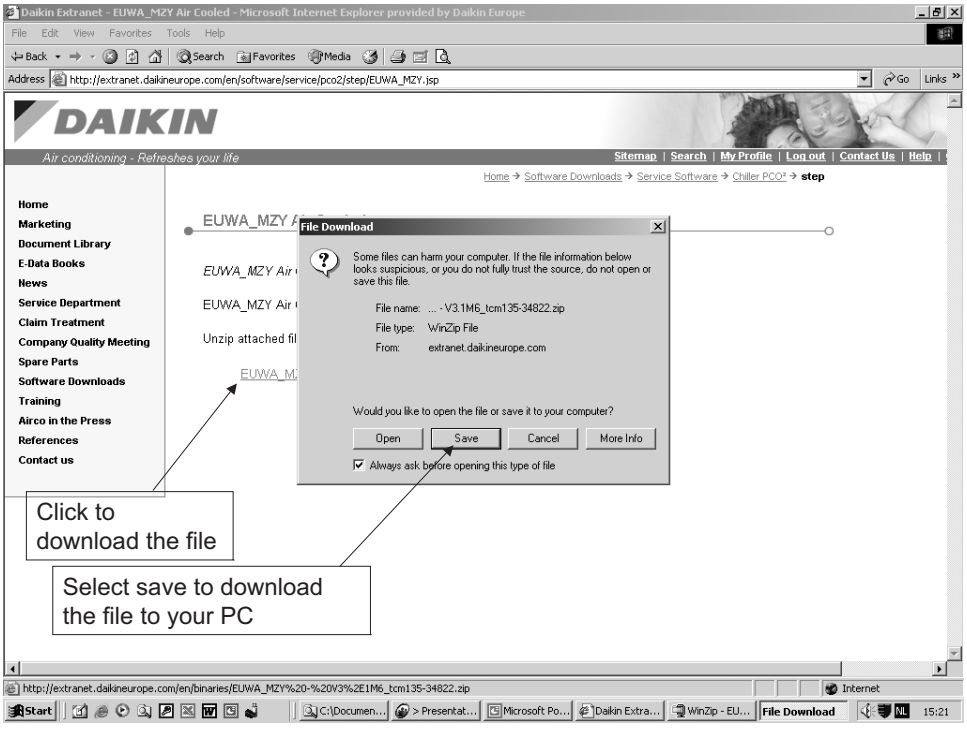
Step	Action
1	
2	

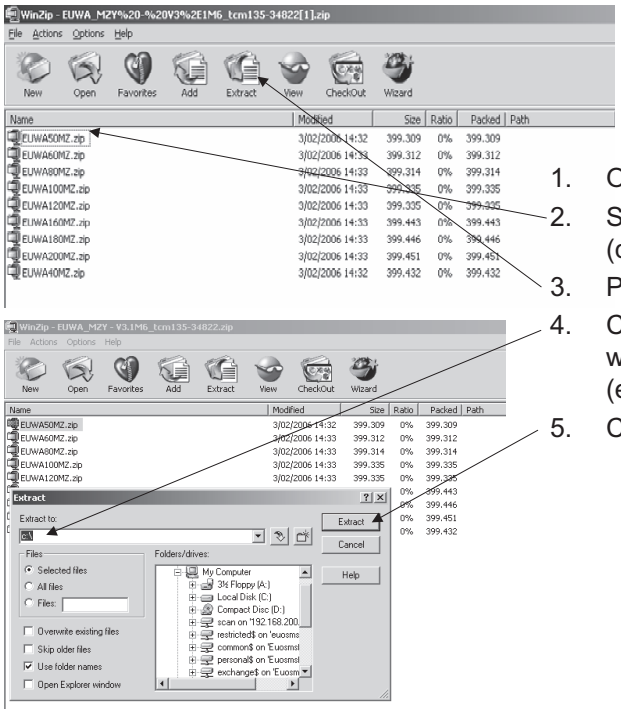
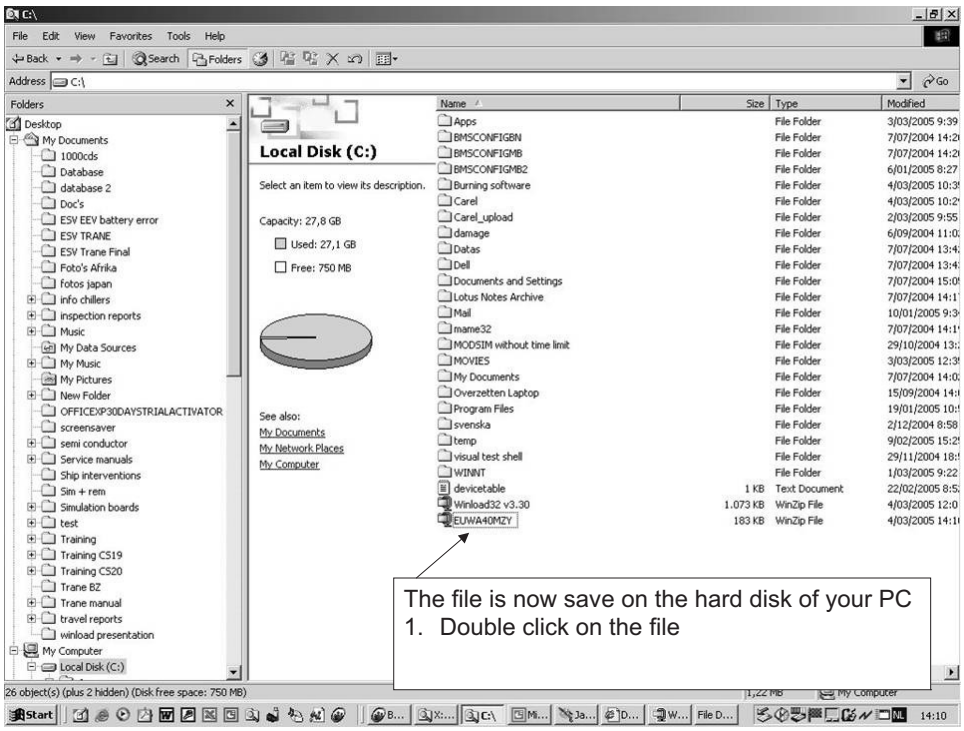
Step	Action
3	
4	

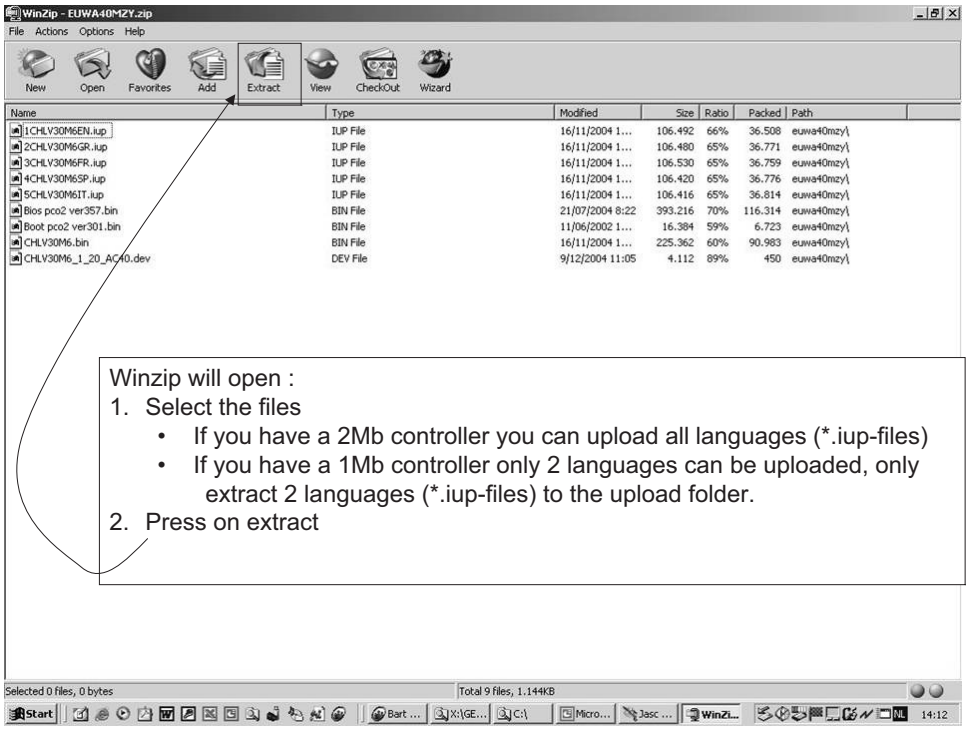
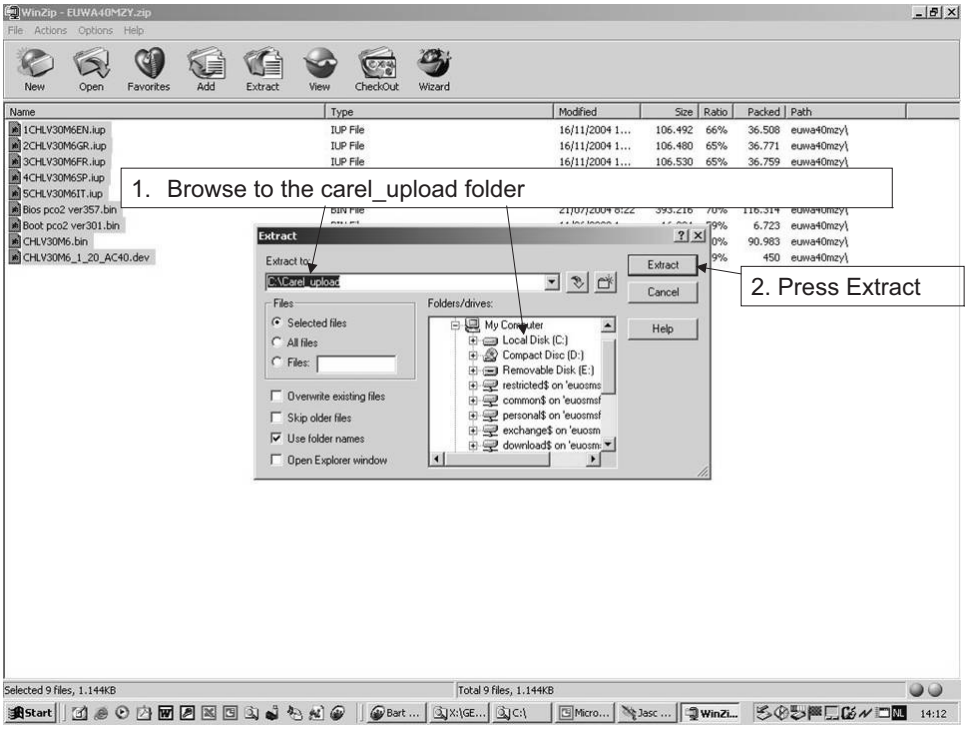
Step	Action
5	
6	

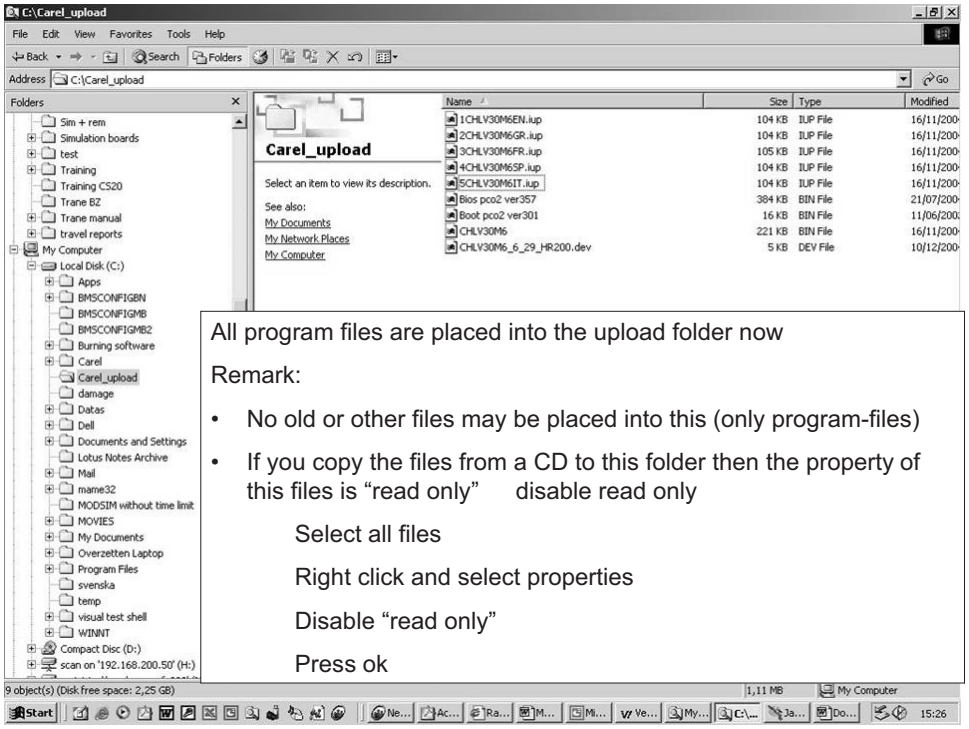
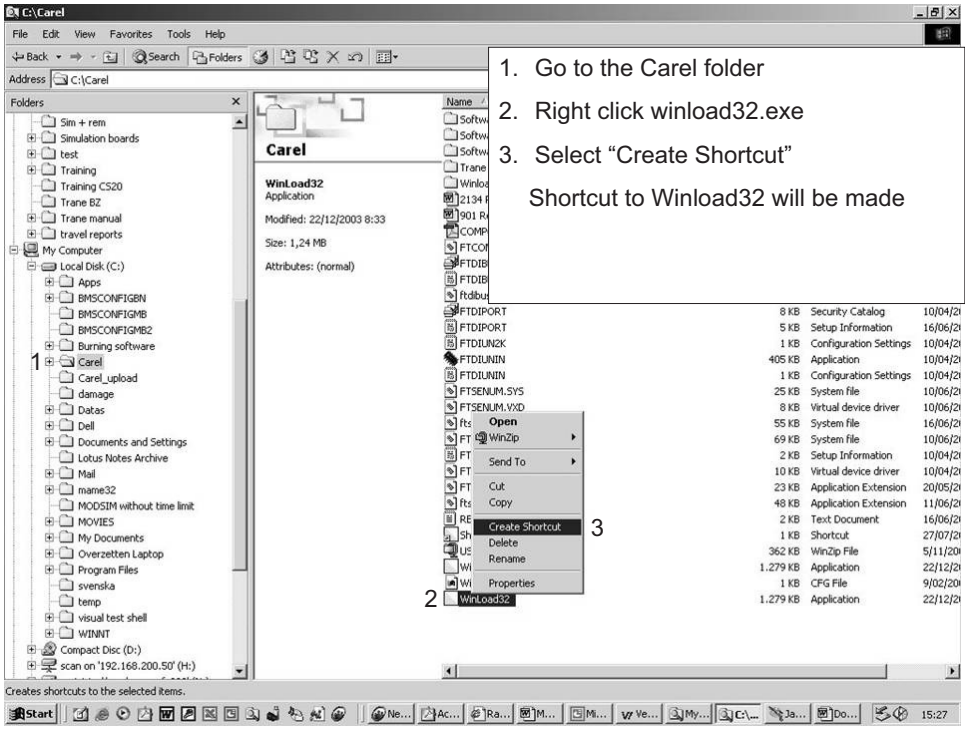
Step	Action
7	
8	

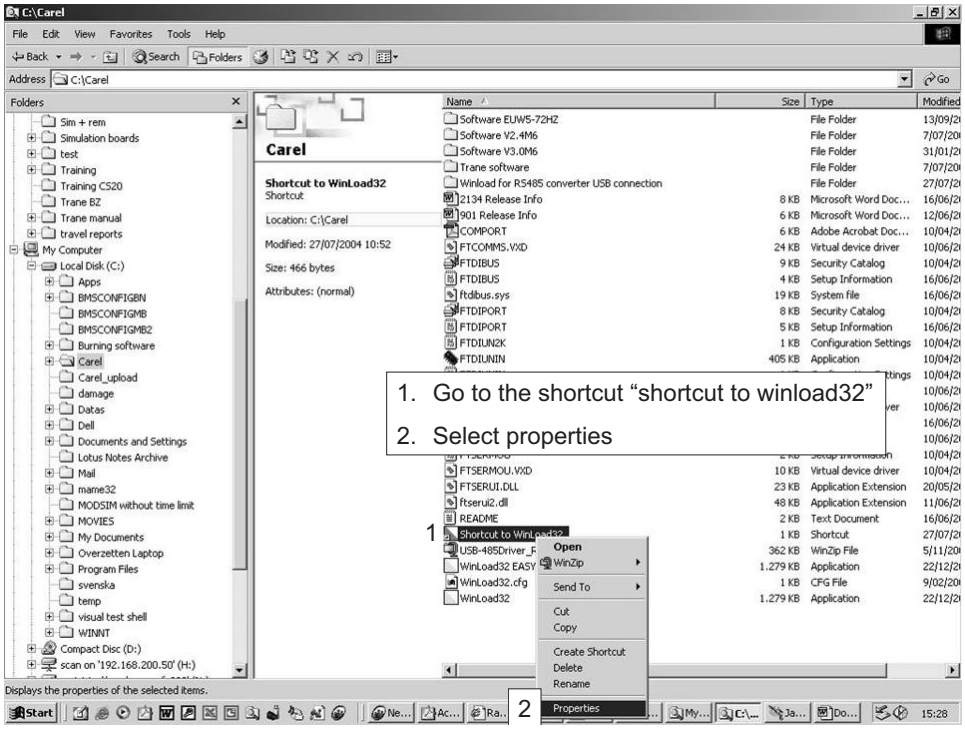
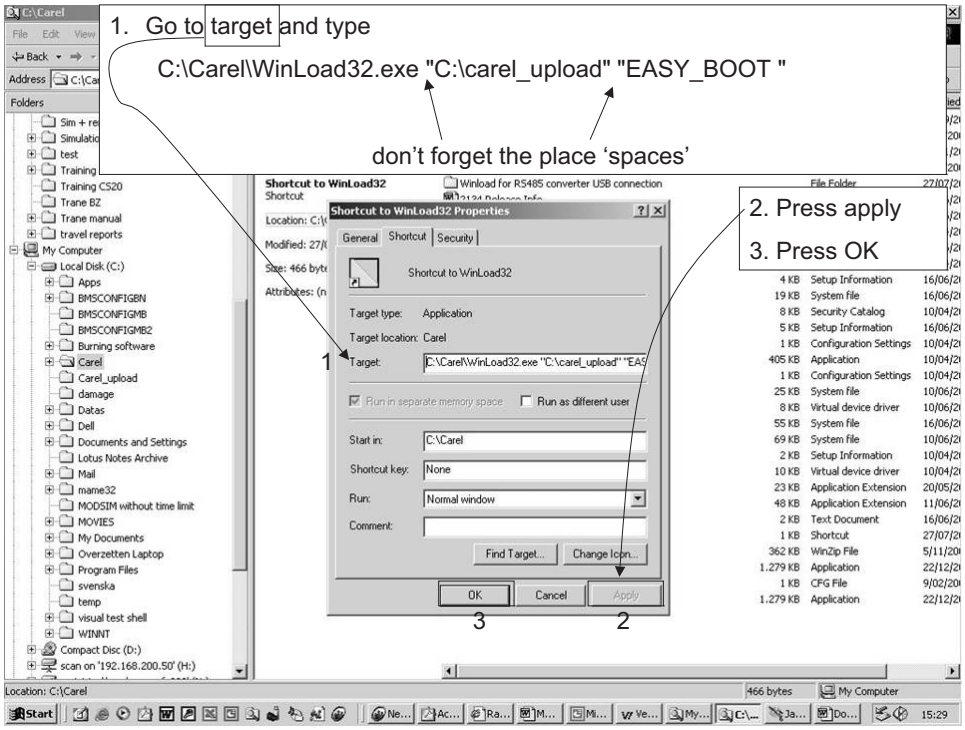
Step	Action
9	
10	

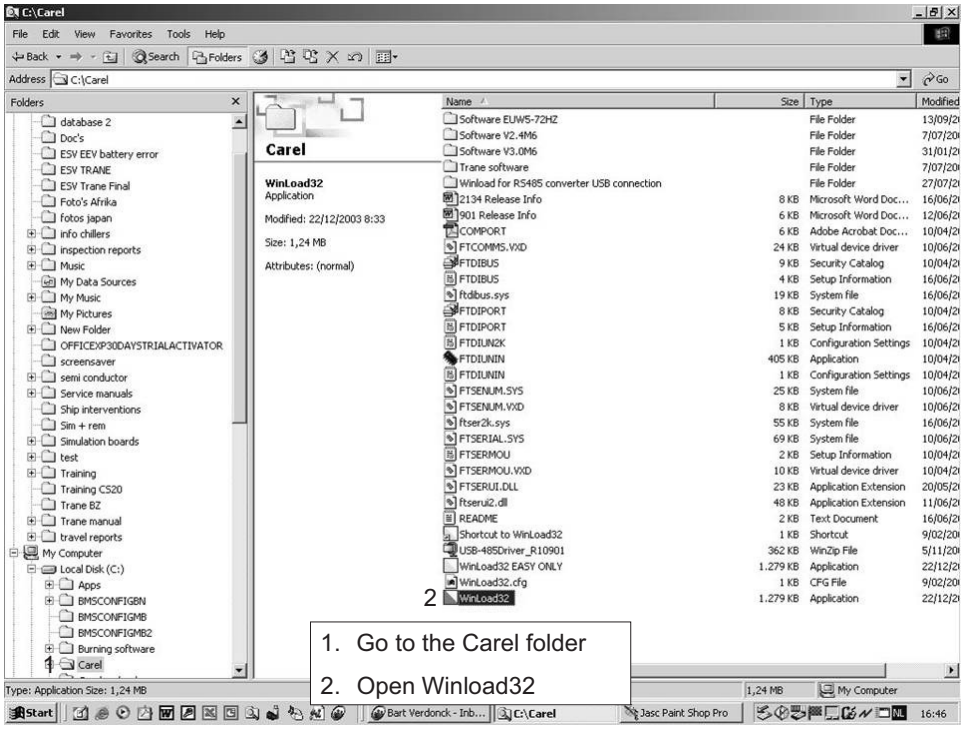
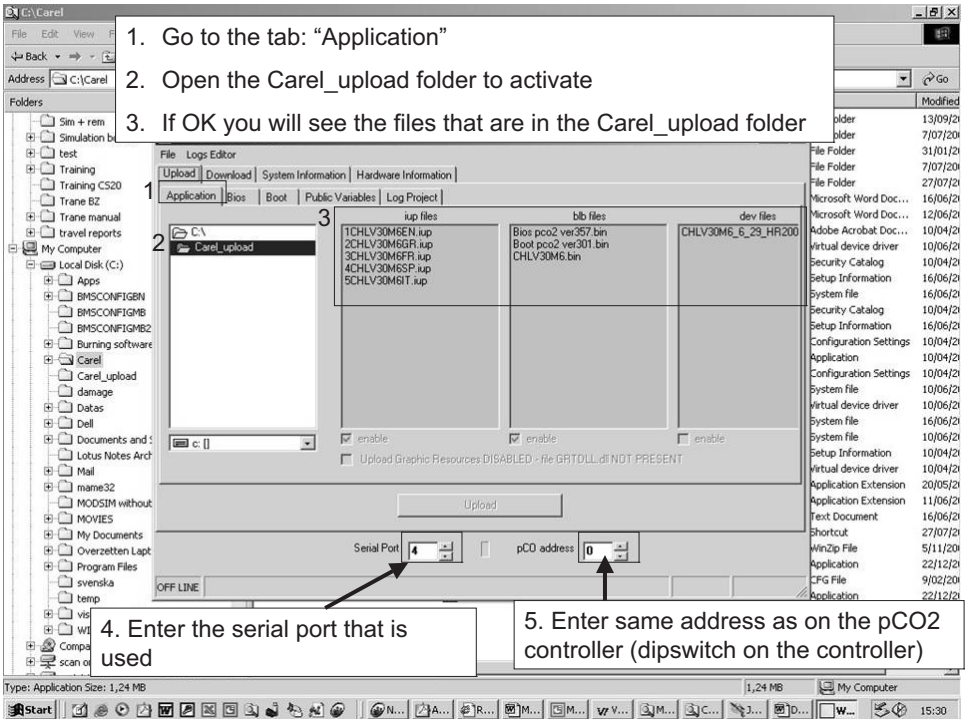
Step	Action
11	
12	

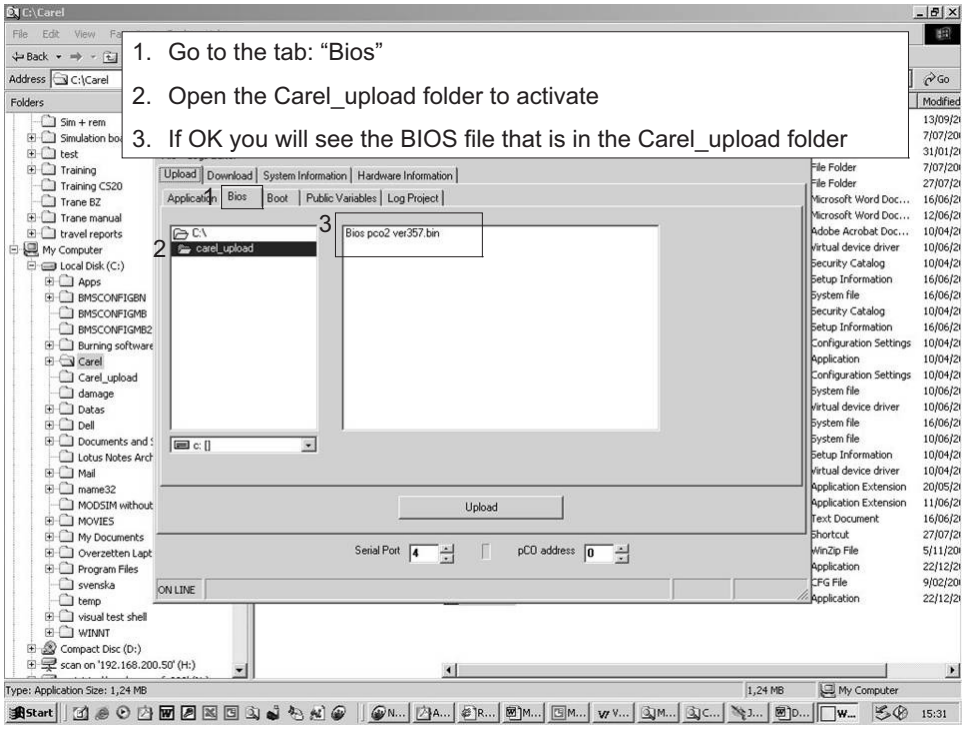
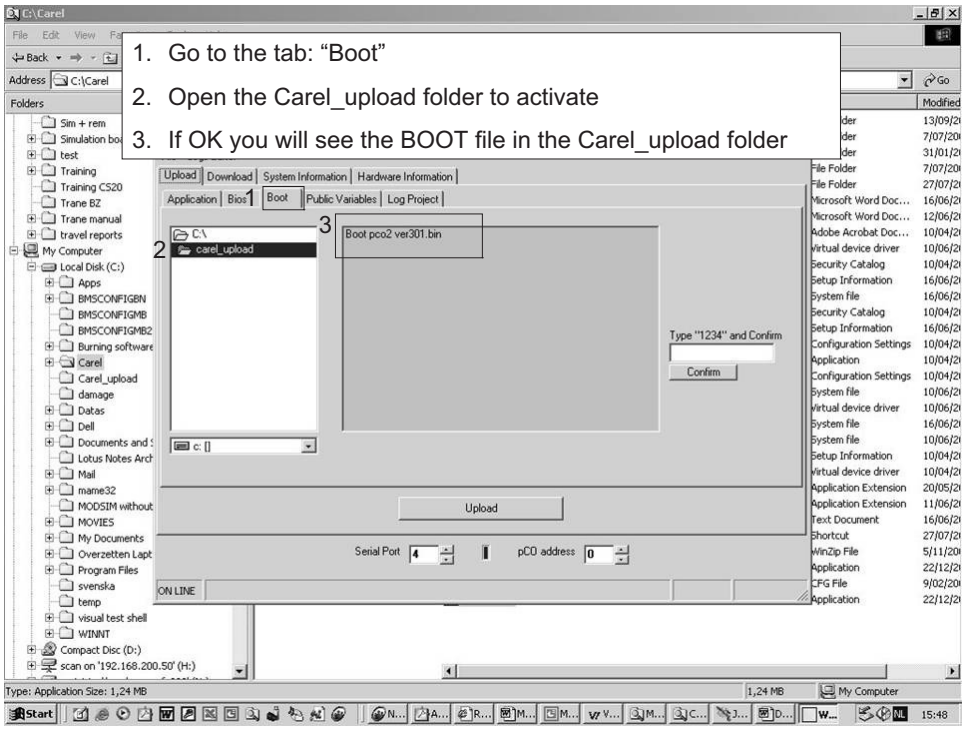
Step	Action
13	 1. Open the saved zip file 2. Select the file for the unit (capacity) 3. Press extract 4. Choose a location where you want to save the file (example: C-drive) 5. Click extract
14	 The file is now save on the hard disk of your PC 1. Double click on the file

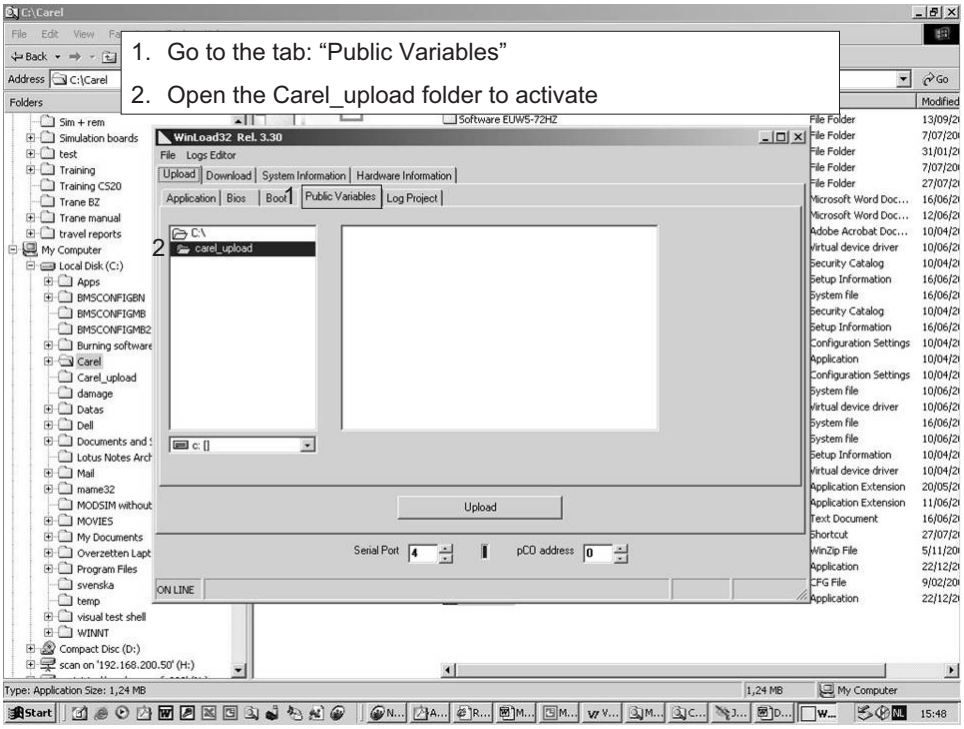
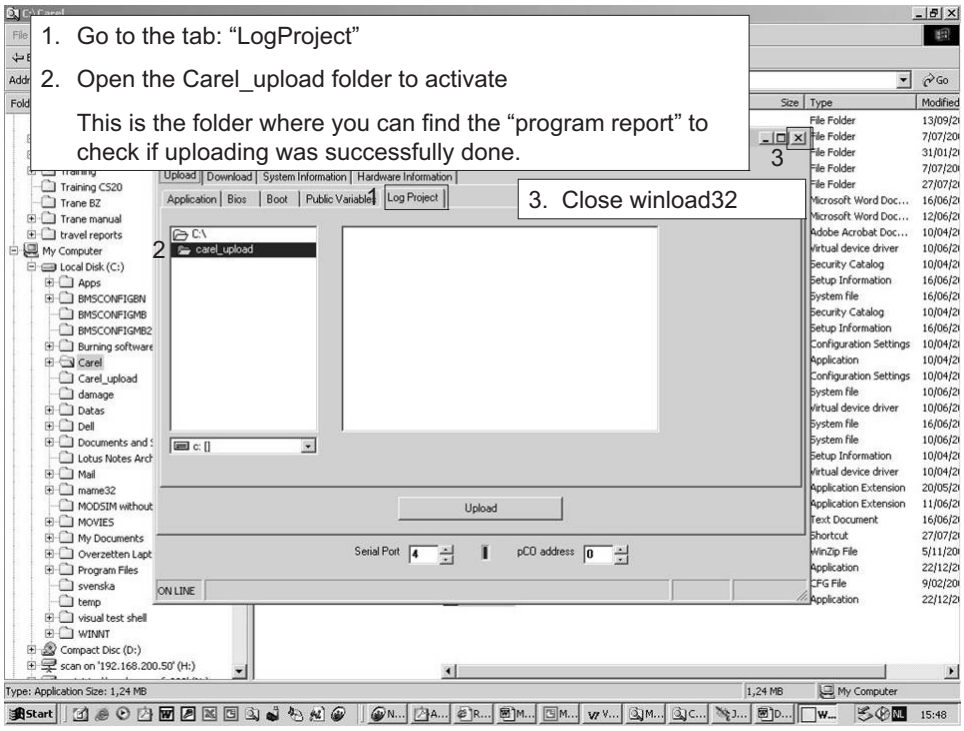
Step	Action
15	
16	

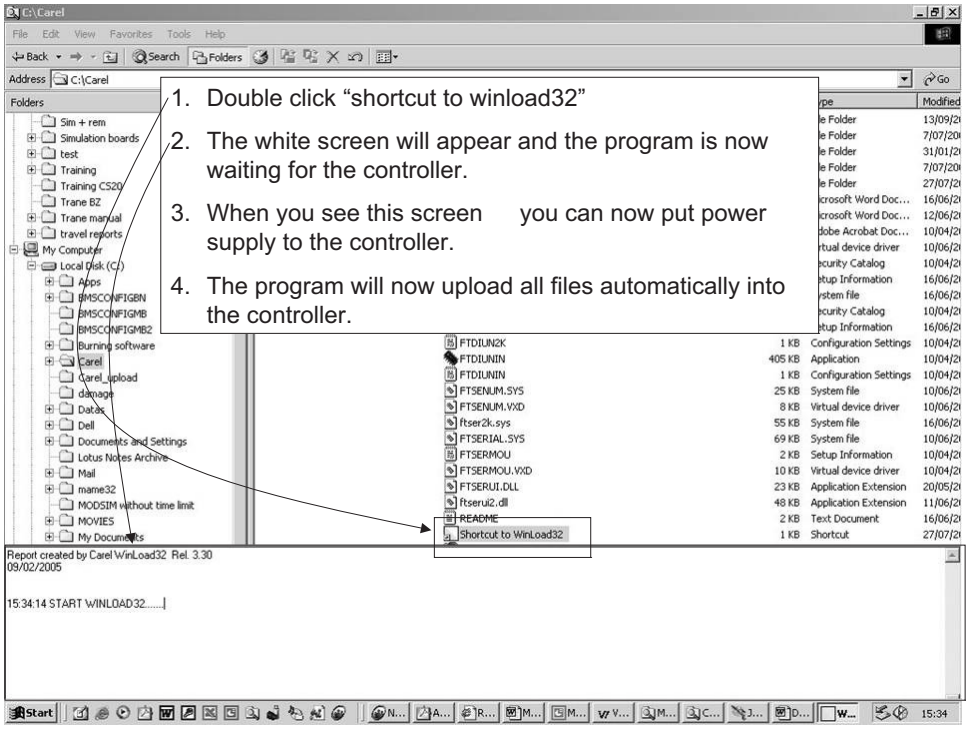
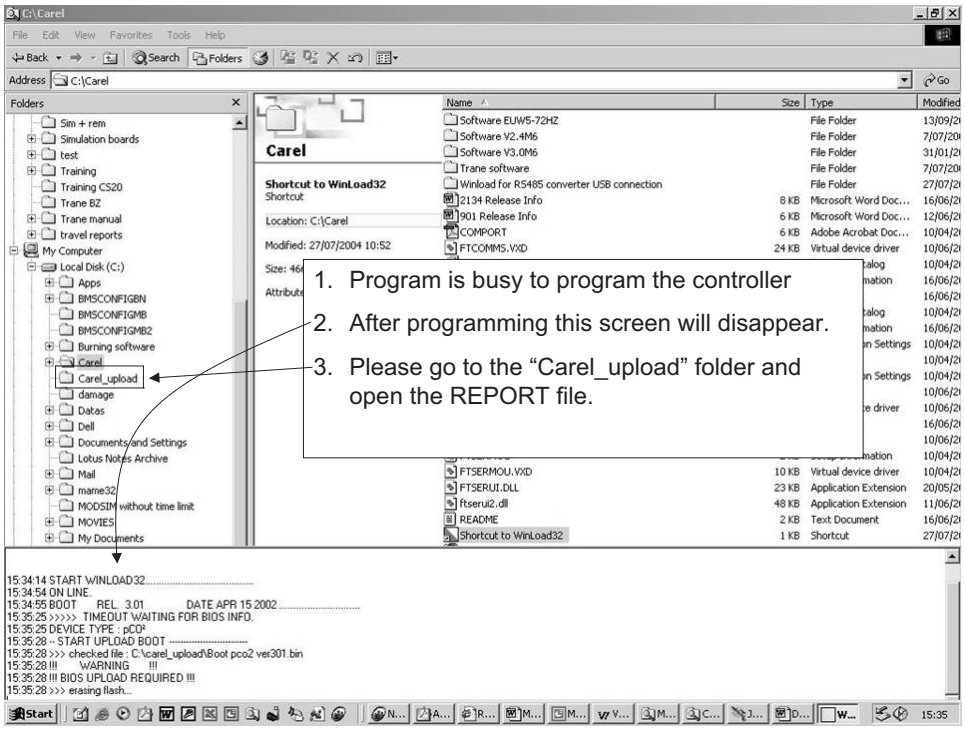
Step	Action
17	
18	

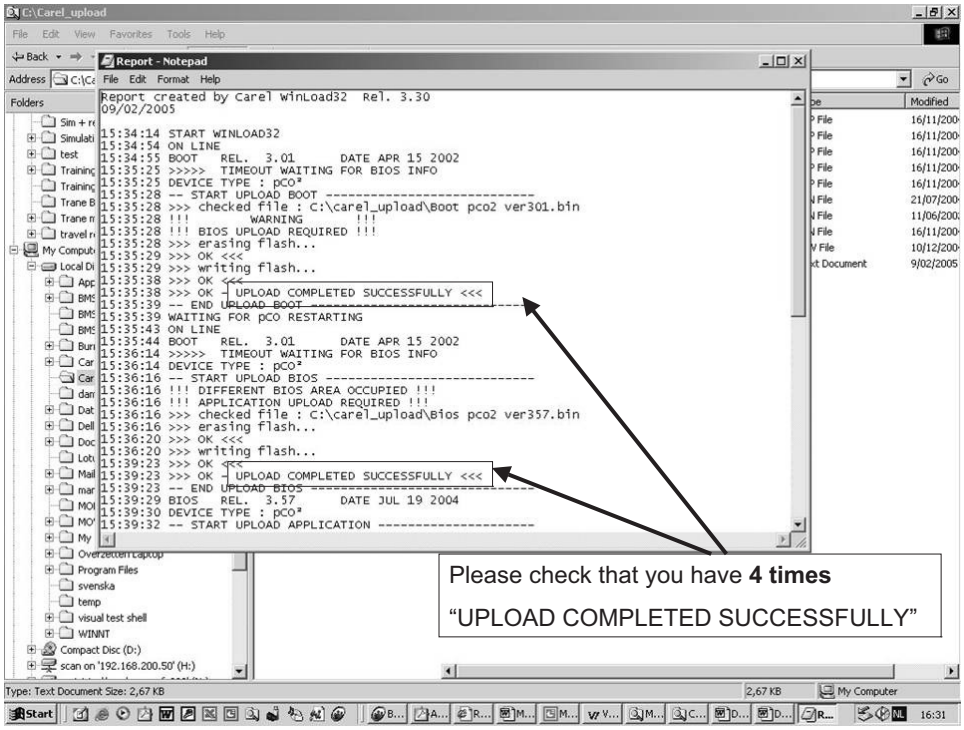
Step	Action
19	
20	

Step	Action
21	
22	

Step	Action
23	
24	

Step	Action
25	
26	

Step	Action
27	
28	

Step	Action
29	

2.5 Copy Software from WinLoad32 to the Software Key

Optional: Carel RS Converter (software Winload + drivers: are available on intranet).

- Switch off the pCO^2 and remove the "expansion memory" cover with a screwdriver (see "Copy from pCO² to the Software Key" on page 4–6/Fig. 1).
- Set the key selector on (from key to pCO^2).
- Insert the key in the corresponding pin connector as shown (see "Copy from pCO² to the Software Key" on page 4–6/Fig. 2).
- Prepare the connection for downloading the program for WinLoad32 (see also previous chapter).
- Supply power to the pCO^2 (check the red LED on the key is on).
- Make the upload.
- Once finished, switch off the pCO^2, remove the key and put the cover in its place.
- Now the key has the program transferred from WinLoad32.

3 Procedure for Expansion Board Changing

To change the pCO^2 expansion board, proceed as follows:

Step	Action
1	Switch off the power supply to the chiller.
2	Remove the old expansion board.
3	Place the new expansion board in the same way as the old expansion board.
4	Check if the dipswitch address is the same as the old one.
5	Switch on the power to the chiller.
6	Go to Settings → Unit → Configuration and refresh the RS485 net to detect the connected expansion boards.

4 Procedure for EEV Driver Changing

To change the expansion valve driver, proceed as follows:

Step	Action
1	Switch off the power supply.
2	Remove the old EV driver.
3	Place the new EV driver in the same way as the old EV driver.
4	Change the EV driver dipswitches to the right address.

5 Procedure for Fan Inverter Changing

To change a fan inverter, proceed as follows:

Step	Action
1	Switch off the power supply.
2	Remove the old fan inverter.
3	Place the new fan inverter in the same way as the old fan inverter.
4	Set the dipswitches (if applicable) and insert the correct settings (see below).

Settings for the KEB combivert

Press Button	Display	Notes
Func	CP1	
Stop ↓	CP0	
Func	CP_on	
Start ↑ until display shows 440	440	Password
Enter	noP	
Func	Ru.3.	
Enter	Ru.3.	Dot flashing under u
Start ↑ until display shows 0.oP.0.	0.oP.0.	
Enter (x 2)	0.oP.0.	Dot flashing under last 0
Start ↑ until display shows 0.oP.10.	0.oP.10.	Dot flashing under 10
Func	70.000	Open Parameter max. freq.
Stop ↓ until display shows 50.000	50.000	Set Max. Frequency
Func	0.oP.10.	Close Parameter
Start ↑ until display shows 0.uF.0.	0.uF.0.	
Enter (x 2)	0.uF.0.	Dot flashing under last 0
Start ↑ until display shows 0.uF.11.	0.uF.11.	Dot flashing under 10
Func	2	Open Parameter Switching Frequency
Stop ↓ until display shows 8	8	Set Switching Frequency at 8 kHz
Func	0.uF.11.	Close Parameter
Enter (x 2)	0.uF.11.	
Start ↑ until display shows Ud.1.	Ud.1.	
Func	APPL	
Start ↑ until display shows 200	200	Password for saving parameters
Enter	noP	Inverter Ready

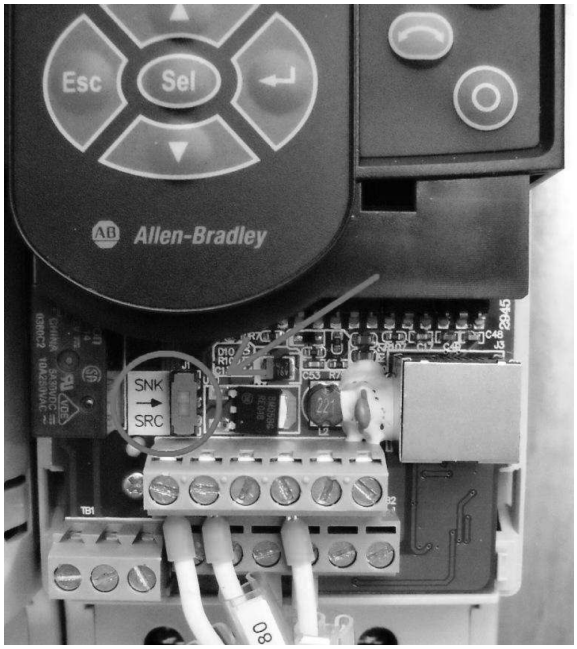
Settings for the Allen-Bradley (Rockwell) Powerflex

Parameter	Description	Default	Set
P101	Motor name plate voltage	460 V	400 V
P102	Motor name plate frequency	60 Hz	50 Hz
P103	Motor overload current	4.2 A (1.5 kW) 8.7 A (3.7 kW)	(*) (**)
P104	Min. output frequency	0 Hz	0 Hz
P105	Max. output frequency	60 Hz	50 Hz
P106	Start signal source	0	3
P107	Stop mode	0	1
P108	Speed reference	0	2
P109	Acceleration time	10 sec	10 sec
P110	Deceleration time	10 sec	10 sec
P111	Motor overload retention	0	0
P112	Reset to defaults	0	0
A433	Start at power-up	0	1
A434	Reverse disable	0	1
A435	Flying start enable	0	0
A437	Slip Hertz @ FLA	2 Hz	0 Hz
A442	Current limit	6.3 A (1.5 kW) 13 A (3.7 kW)	7.5 A 13.5 A
A444	Motor overload select	0	1
A446	PWM frequency	4 kHz	4 kHz
A448	Instantaneous current trip	0	8 A 16 A
A451	Auto restart tries	0	1
A452	Auto restart delay	01.0 sec	5.0 sec
A453	Boost select	7	1

(*)(**) The ampere value depends on the model of fan installed on the unit. Refer to the table below for the fan model mounted in each related outdoor unit model.

Fan models		
	(*) 1 fan per inverter	(**) 2 fans per inverter
MCDK800-6P	4.1 A	8.2 A
MCDK800-8P	2.8 A	5.6 A
EBMPAD800	2.8 A	5.6 A
FZ710F000 high speed	2.8 A	5.6 A
FZ710F000 low speed	1.6 A	3.2 A

Note: Set the dipswitch on the board in “SNK” position as in below picture.



6 Procedure for Compressor Inverter Changing

To change a compressor inverter, proceed as follows:

Step	Action
1	Switch off the power supply.
2	Remove the old compressor inverter.
3	Place the new compressor inverter in the same way as the old compressor inverter.
4	Insert the correct settings (see below).

Instructions to program "Combivert" KEB Inverter (type 22FSG11RY000)

Insert the keypad and power up the device with 400 V AC taking care of the disconnection of X2A connector. The keypad will turn on and will show the "noP" status. The keypad has 4 buttons listed in the following. In the following the step by step procedure to change the inverter programming.

n°	On the display (begin)	Push button	On the display (end)	Note
1	noP	Func	CP1	CP parameter
2	CP1	Stop	CP0	CP parameter
3	CP0	Func	CP_on	Disclose parameter
4	CP_on	Start up to	440	Password
5	440	Enter	noP	Enter password
6	noP	Func	Ru.3	The dot blinks below **3**
7	Ru.3	Enter	Ru.3	The dot blinks below **u**
8	Ru.3	Start up to	0.**oP**.0	Parameter type changed
9	0.**oP**.0	2 x Enter	0.oP.**0.**	The dot blinks below **0**
10	0.oP.**0.**	Start up to	0.oP.10	
11	0.oP.10	Func	70.000	Disclose maximum frequency
12	70.000	Start up to	90.000	Change maximum frequency
13	90.000	Func	0.oP.**10.**	Close parameter
14	0.oP.**10.**	Start	0.oP.**11.**	Changed parameter
15	0.oP.**11.**	Func	=For	Parameter disclosure
16	=For	Start	0.0000	Set Max. freq. Rev=0
17	0.0000	Func	0.oP.**11.**	Close parameter
18	0.oP.**11.**	Start up to	0.oP.**28.**	Change parameter
19	0.oP.**28.**	Func	5.00	Disclose parameter
20	5.00	Start up to	7.00	Sets **Acc ramp** to 7 sec
21	7.00	Func	0.oP.**28.**	Close parameter
22	0.oP.**28.**	Start up to	0.oP.**30.**	Change parameter
23	0.oP.**30.**	Func	5.00	Disclose parameter
24	5.00	Start up to	7.00	Sets **Dec ramp** to 7 sec
25	7.00	Func	0.oP.**30.**	Close parameter
26	0.oP.**30.**	Enter	0.**oP.**30.	Dot blinks below **oP.**
27	0.**oP.**30.	Start	**Pn.**0.	Parameter type changed
28	**Pn.**0.	Enter	Pn.**0.**	Dot blinks below **0.**

29	Pn.**0.**	Start up to	0.Pn.**20.**	Change parameter
30	0.Pn.**20.**	Func	OFF	Disclose parameter
31	OFF	Stop up tp	100	Sets % of stall current
32	100	Func	0.Pn.**20.**	Close parameter
33	0.Pn.**20.**	Enter	0.**Pn.**20.	Dot blinks below **Pn**
34	0.**Pn.**20.	Start up to	0.**uF.**0.	Change parameter
35	0.**uF.**0.	2 x Enter	0.uF.**0.**	Dot blinks below **0.**
36	0.uF.**0.**	Start	0.uF.**1.**	Change parameter
37	0.uF.**1.**	Func	5,7	Disclose parameter
38	5,7	Stop up to	1.3	Boost changed
39	1.3	Func	0.uF.**1.**	Close parameter
40	0.uF.**1.**	Start up to	1.uF.**10.**	Change parameter
41	1.uF.**10.**	Func	0	Disclose parameter
42	0	Start up to	3	Sets overmodulation
43	3	Func	0.uF.**10.**	Close parameter
44	0.uF.**10.**	Start	0.uF.**11.**	Change parameter
45	0.uF.**11.**	Func	4	Disclose parameter
46	4	Stop up to	2.	Sets switching frequency
47	2.	Enter	2	Parameter entered (dot disappear)
48	2	Func	0.uF.**11.**	Close parameter
49	0.uF.**11.**	Enter	0.**uF.**11.	Dot blinks below **F**
50	0.**uF.**11.	Start up to	**An.**0	Parameter type changed (Analog. Param.)
51	**An.**0	Enter	An.0.	Dot blinks below **0.**
52	An.0.	Start up to	An.**4.**	Analog Input 1
53	An.**4.**	Func	0.2	Disclose parameter
54	0.2	Start up to	10.0	Sets % of input clamp voltage
55	10.0	Func	An.**4.**	Close parameter
56	An.**4.**	Start fino a	0.An.**38.**	Change parameter
57	0.An.**38.**	Func	1.00	Disclose parameter
58	1.00	Stop up to	0.50	Sets current gain @ 5V=200%
59	0.50	Func	0.An.**38.**	Close parameter
60	0.An.**38.**	Enter	0.**An.**38.	Dot blink below **An.**
61	0.**An.**38.	Stop up to	**Ud.**1	Parameter type changed
62	**Ud.**1	Func	APPL	Disclose parameter
63	APPL	Start up to	200	Enter Cp parameters password
64	200	Enter	noP	

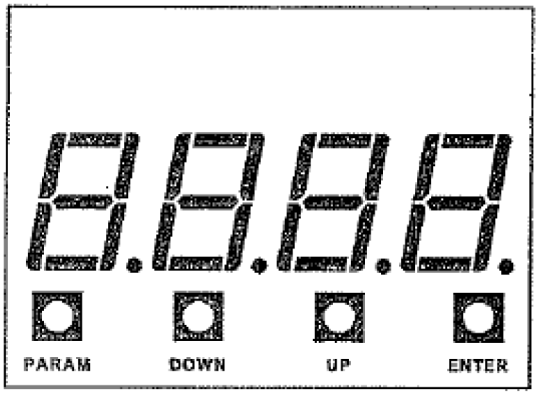
Note: Additionally check if parameter CP32=48 (could be that default is 27).

7 Procedure for Soft Starter Changing

To change a soft starter, proceed as follows:

Step	Action
1	Switch off the power supply.
2	Remove the old soft starter.
3	Place the new soft starter in the same way as the old one.
4	Insert the correct settings (see below).

Setting the Benshaw soft starter



Upper figure shows the LED display of the Benshaw Soft-Starter with the four buttons to navigate through the menu.

In order to set parameters, press PARAM to enter the menu and then, for each parameter to be set:

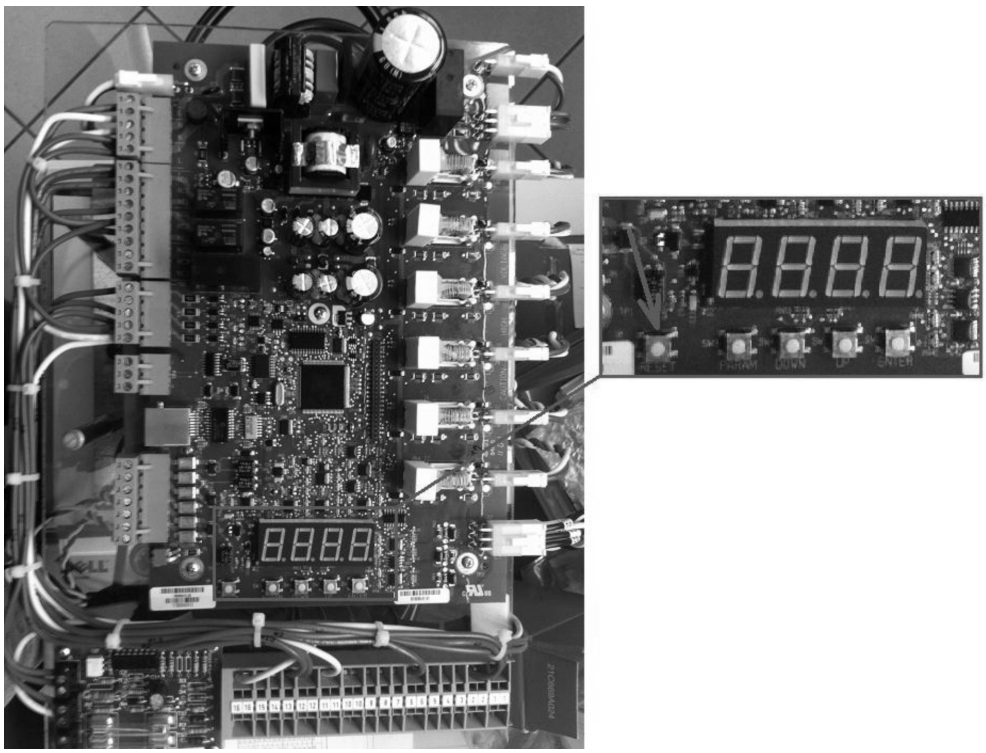
1 Navigate with UP and DOWN buttons to reach desired parameter.

2 Press ENTER to show the present value of selected parameter.

3 Press UP and DOWN to change value.

4 Press ENTER to store the new value or PARAM to abandon the change.

Important notice



Following settings apply on new version of Benshaw Soft-Starters, equipped with MX-2 board (see picture above). This kind of board is different from the old model and is recognizable because has pre-wired connectors on both sides of the board and reset button on the same line of the four others (arrow of small picture on the right).

Air Cooled/EWAD units with FRAME 3100 compressor Refrigerant: R134a Soft-Starter connection: Inside Delta						
N°	Parameters	Compressor model				
		3118	3120	3121	3122	3123
P1	Motor FLA	**80**	**96**	**107**	**121**	**145**
P2	Motor RLA	**80**	**96**	**107**	**121**	**145**
P3	Motor Service Factor	**1.05**	**1.05**	**1.05**	**1.05**	**1.05**
P4	Motor Overload Class	Class 10	Class 10	Class 10	Class 10	Class 10
P5	Initial Motor Current	225%	225%	225%	225%	225%
P6	Max Motor Current	300%	300%	300%	300%	300%
P7	Ramp Time	7 sec	7 sec	7 sec	7 sec	7 sec
P8	UTS Time	10 sec	10 sec	10 sec	10 sec	10 sec
P9	Default Meter Display	**1**	**1**	**1**	**1**	**1**
P10	Overcurrent Level	140%	140%	140%	140%	140%
P11	Overcurrent Delay Time	2 sec	2 sec	2 sec	2 sec	2 sec
P12	Rate RMS Voltage	400	400	400	400	400
P13	Over Voltage Trip Level	10%	10%	10%	10%	10%
P14	Under Voltage Trip Level	10%	10%	10%	10%	10%
P15	Under/Over Voltage Delay Time	1.0	1.0	1.0	1.0	1.0
P16	Current Imbalance Trip Level	**15%**	**15%**	**15%**	**15%**	**15%**
P17	Ground Fault Trip Level	Off	Off	Off	Off	Off
P18	Auto Fault Reset Delay Time	60	60	60	60	60
P19	CT Ratio (x:1)	**864**	**864**	**864**	**864**	**864**
P20	Control Source	tEr	tEr	tEr	tEr	tEr
P21	Modbus Address	1	1	1	1	1
P22	Modbus Baud Rate	19.2	19.2	19.2	19.2	19.2
P23	Modbus Timeout	3	3	3	3	3
P24	Analog Input Trip Type	OFF	OFF	OFF	OFF	OFF
P25	Analog Input Trip Level	50%	50%	50%	50%	50%
P26	Analog Input Trip Time	0.1	0.1	0.1	0.1	0.1
P28	Analog Output Span	100	100	100	100	100
P29	Analog Output Offset	0	0	0	0	0
P30	Rated kW	43	43	60	60	60
P31	Passcode	**-**	**-**	**-**	**-**	**-**
H18	Starter Type	**-**	**-**	**-**	**-**	**-**
P32	Fault Log	**-**	**-**	**-**	**-**	**-**

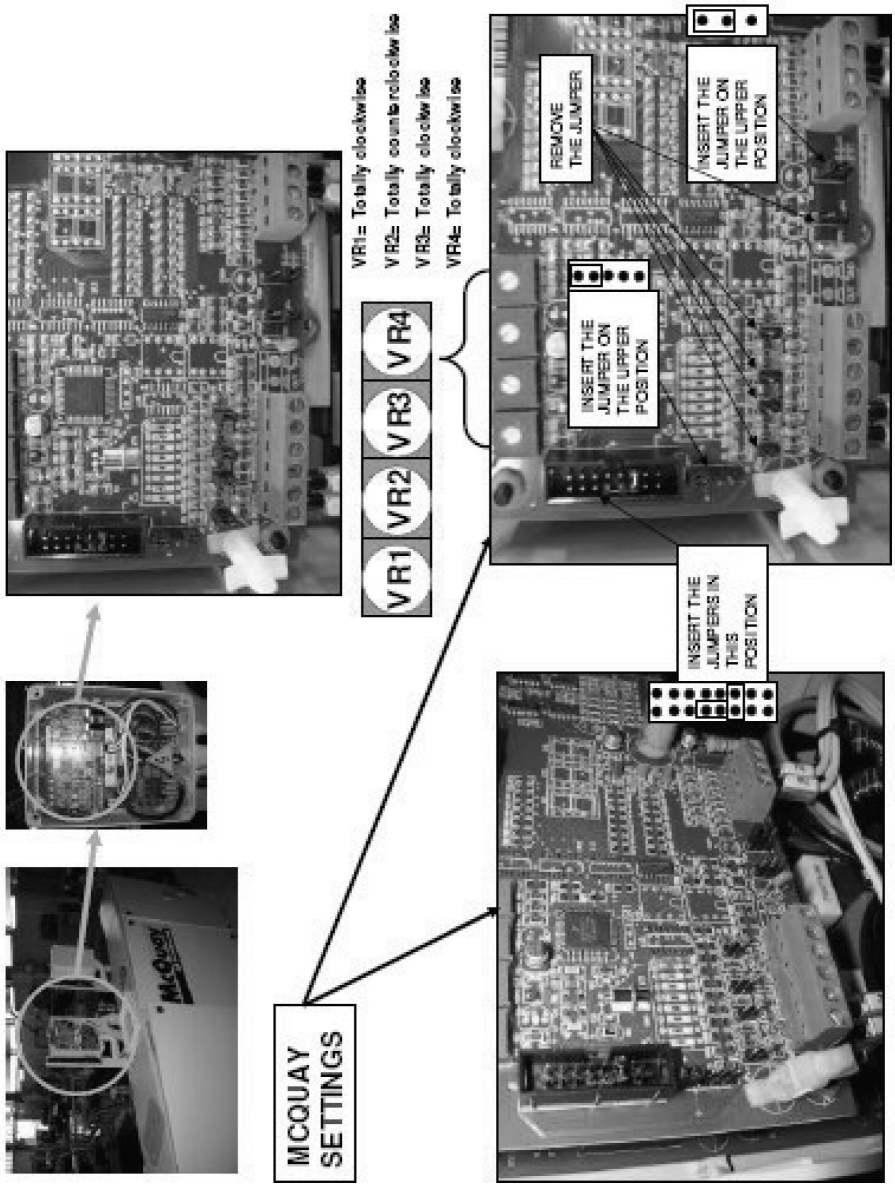
Air Cooled/EWAD with FRAME 3200 compressor Refrigerant: R134a Soft-Starter connection: Inside Delta					
N°	Parameters	Compressor model			
		3216 (HSA167)	3218 (HSA179)	3220 (HSA197)	3221 (HSA203)
P1	Motor FLA	**112**	**134**	**161**	**182**
P2	Motor RLA	**112**	**134**	**161**	**182**
P3	Motor Service Factor	**1.05**	**1.05**	**1.05**	**1.05**
P4	Motor Overload Class	Class 10	Class 10	Class 10	Class 10
P5	Initial Motor Current	225%	225%	225%	225%
P6	Max Motor Current	300%	300%	300%	300%
P7	Ramp Time	7 sec	7 sec	7 sec	7 sec
P8	UTS Time	10 sec	10 sec	10 sec	10 sec
P9	Default Meter Display	**1**	**1**	**1**	**1**
P10	Overcurrent Level	140%	140%	140%	140%
P11	Overcurrent Delay Time	2 sec	2 sec	2 sec	2 sec
P12	Rate RMS Voltage	400	400	400	400
P13	Over Voltage Trip Level	10%	10%	10%	10%
P14	Under Voltage Trip Level	10%	10%	10%	10%
P15	Under/Over Voltage Delay Time	1.0	1.0	1.0	1.0
P16	Current Imbalance Trip Level	**15%**	**15%**	**15%**	**15%**
P17	Ground Fault Trip Level	Off	Off	Off	Off
P18	Auto Fault Reset Delay Time	60	60	60	60
P19	CT Ratio (x:1)	**864**	**864**	**864**	**864**
P20	Control Source	tEr	tEr	tEr	tEr
P21	Modbus Address	1	1	1	1
P22	Modbus Baud Rate	19.2	19.2	19.2	19.2
P23	Modbus Timeout	3	3	3	3
P24	Analog Input Trip Type	OFF	OFF	OFF	OFF
P25	Analog Input Trip Level	50%	50%	50%	50%
P26	Analog Input Trip Time	0.1	0.1	0.1	0.1
P28	Analog Output Span	100	100	100	100
P29	Analog Output Offset	0	0	0	0
P30	Rated kW	82	82	82	82
P31	Passcode	**-**	**-**	**-**	**-**
H18	Starter Type	**-**	**-**	**-**	**-**
P32	Fault Log	**-**	**-**	**-**	**-**

8 Procedure for Fan Phase Cut Module Changing

To change a fan phase cut module, proceed as follows:

Step	Action
1	Switch off the power supply.
2	Remove the old fan phase cut module.
3	Place the new fan phase cut module in the same way as the old one.
4	Set the dipswitches and potentiometers correct (see below).

Settings



9 Procedure to Protect Compressor in Case of Frozen Evaporator

If water is detected in the compressor after an evaporator damage, the following procedure should be executed within the first days.

1 Supply the compressor crank case heater.

2 Insulate the compressor from the rest of the refrigerant circuit. If there is no suction valve available on the compressor, use a plate to close the suction of the compressor.

3 Open the oil plugs on the discharge and suction side to drain the oil and the water out of the compressor.

4 Blow dry nitrogen through the compressor using the service ports on the HP and LP side of the compressor.

5 Close the drain plugs and vacuum the compressor for a few hours while the crank case heater is on.

6 If the vacuum oil becomes coloured (milky colour) replace the vacuum oil.

7 Repeat step 6 each time the vacuum oil becomes milky.

8 After 4 hours break the vacuum using step 3.

9 Repeat step 5 till step 7 until the oil of the vacuum pump stays clear.

10 If the vacuum oil remains clear fill the compressor with the necessary compressor oil.

11 Charge the compressor with nitrogen.

10 Procedure to Clear the Refrigerant Circuit in Case of Frozen Evaporators

If water is detected in the refrigerant circuit after an evaporator damage, the following procedure should be executed to clear the system.

Step	Action
1	Inspection and cleaning of compressor. Vacuum and heat-up the compressor to remove moisture. Fill with oil and N_2.
2	Cleaning & drying refrigerant circuit. Cleaning components: ■ Expansion valve body. ■ Liquid line solenoid valve. ■ Suction and liquid line. Replace components: ■ Expansion valve element ■ Sight glass ■ Drier filter element by high density filter ■ Compressor oil Actions: ■ Drill a hole in the bottom of the condenser headers to remove water. ■ Braze the drilled holes. ■ Draw the rags through the suction and liquid line. ■ Blow **dry** N_2 through all the pipes. ■ Drain compressor oil. ■ Vacuum the whole installation: Check on a regular basis the condition of the oil of the vacuum pump. If the vacuum oil becomes milky, it should be replaced by new vacuum oil. The crankcase heater must be activated. It is advisable to connect a second heater tape at the suction of the compressor. ■ Stop the vacuum and purge with dry nitrogen. ■ Restart the vacuum of the installation; check after a couple of hours the condition of the vacuum oil. If OK the unit can be recharged. ■ Charge the unit with R134a/407C. ■ Start the unit & re-commissioning. ■ After 24 hours replace HD filter by new HD filter & replace compressor oil. ■ Check oil contamination with measuring kit. ■ After 48 hours replace HD filter by normal filter drier + check sight glass and pressures.
3	Find the cause of this evaporator breakdown and take the necessary actions to prevent recurrence in the future.