Program for pCO¹ pCO² and pCOC

Modular Standard HP Chiller 1/4 compressors for Carel driver

Manual version 1.0 – 07 July 2003

Program code: FLSTDmMC0E

LEGGI E CONSERVA QUESTE ISTRUZIONI
READ AND SAVE THESE INSTRUCTIONS

CAREL
Technology & Evolution

LEGGI E CONSERVA QUESTE ISTRUZIONI

READ AND SAVE THESE INSTRUCTIONS

Do we want you to save you time and money?

We can assure you that reading this manual to the full will ensure correct installation and safe use of the product described here.

IMPORTANT WARNINGS

BEFORE INSTALLING OR CARRYING OUT ANY JOBS ON THE APPLIANCE, CAREFULLY READ AND FOLLOW THE INSTRUCTIONS IN THIS MANUAL.

The appliance to which this software is dedicated was built to operate without risks for the intended purposes, providing:

- software installation, programming, operational control and maintenance must be carried out by qualified personnel according to the instructions in this manual;
- all the conditions prescribed and contained in the installation and use manual of the application in question are observed.

All uses other than this use and the making of modifications, not expressly authorised by the manufacturer, are considered improper.
The user shall be exclusively responsible for injuries and damage caused through improper use.

INDEX

1 APPLICATIONS AND FUNCTIONS PERFORMED BY THE SOFTWARE

Type of control unit
air /water chiller only
air /water chiller + freecooling
air /water total recovery
air / water chiller + heat pump

Maximum number of compressors
Max. 1 compressor with a maximum of 3 capacity controls per pCO board
Max. 2 compressor with a maximum of 1 capacity control per pCO board

Types of compressors
Semi-hermetic compressors with 1 capacity control
Semi-hermetic compressors with 3 capacity controls

Compressor duty call rotation
Rotation of all compressors with FIFO logic

Management of electronic expansion valve (EXV)
Management of following electronic valves

- Alco (EX5, EX6, EX7, EX8)
- Sporlan (SEI 0.5, SEI 1, SEI 2, SEI 3.5, SEI 6, SEI 8,5, SEH 100, SEH 175, SEH 250)
- Danfoss (ETS50, ETS100)
- Carel EVD200
- Custom valve

Type of defrosting
Overall defrosting of all pCO units connected to network: Independent/simultaneous/separate
Local defrosting of individual pCO units: separate/simultaneous

Safety devices for all refrigerating circuits
High pressure (pressure switch)
Low pressure (pressure switch)
Oil differential pressure switch
Compressor thermal cutout
Thermal cutout for condensation fan

System Safety devices
A Serious alarm input (shuts down entire unit), available on both MASTER and SLAVE units
A flow-switch input (shuts down entire unit), available on both MASTER and SLAVE units
An input for the pump thermal cutout (shuts down entire unit)
ON/OFF remote input without alarm signalling

Type of control
Proportional or proportional + integral control on the evaporator input probe
Neutral band control on the evaporator output probe (compressor enabled according to band and time)

Condensation
Condensation can be performed according to temperature or pressure
Fans managed in ON/OFF mode or with a 0/10V modulating signal

Other functions
Alarms logging
Built-in terminal management (on pCO² only)
Management of ratiometric probes for pressure control (on pCO^1 only)
EVD driver for piloting the EXV valve.
Multilingual management.

Accessories
Supervision with serial card RS485 (CARE1 or MODBUS protocol)

2 THE USER TERMINAL

The specified terminal has an LCD display (4 lines over 20 columns) and can be of two types: on board a built-in card with only 6 keys or external (connected by telephone cable) with 15 keys. All operations possible with the program can be carried out with both types. With the user terminal you can view the unit's operating conditions at all times and modify parameters. The terminal can be disconnected from the basic card - in fact it need not be present at all.

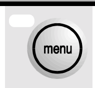
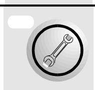
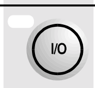
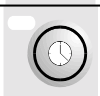
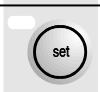
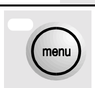
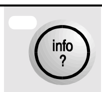
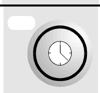
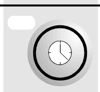
2.1.1 BELOW-KEY LEDS

Three LEDs are located under the rubber keys of the EXTERNAL terminal, and four under the keys of the Built-in card. They respectively indicate the following:

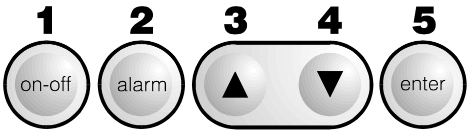
ON/OFF key (External display)	When green the LED indicates that the unit is ON; it flashes in OFF status from the supervisor or remote digital input
ENTER key (External display)	Yellow LED: the instrument is correctly powered
ALARM key (common)	Red LED: alarms are present
ENTER key (Built-in display)	Yellow LED: see ON/OFF Key (external display)
PROG key (Built-in display)	Green LED: you are in a branch of screens, other than the Menu
ESC key (Built-in display)	Green LED: you are in the Menu screens branch

2.1.2 EXTERNAL DISPLAY

`How to use the keys on the external terminal`

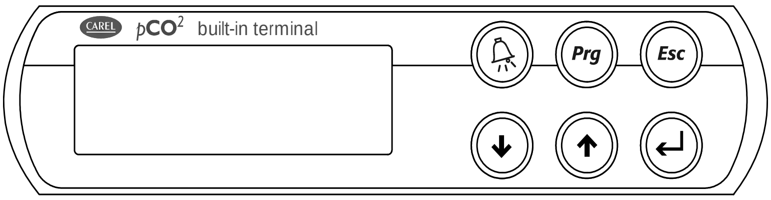
	Key	Description
	MENU	if pressed in all loops except Costr., you return to the main screen of the Menu (MU) branch if pressed in the Constructor loops, you return to the screen selected by the constructor the Menu branch displays the status of the unit and the reading of the control probes
	SERVICING	sends you to the first screen of the Maintenance loop (A0) the maintenance loop makes it possible to check the state of the devices and probes, and to maintain and adjust them, and to run the Manual procedure
	PRINTER	temporary display of the pLAN address of the displayed card
	INPUTS AND OUTPUTS	sends you to the first screen of the I/O loop (I0) the I/O loop displays the state of the digital and analogue inputs and outputs
	CLOCK	sends you to the first screen of the Clock loop (K0) the clock loop is used for displaying / programming time and date
	SET POINT	sends you to the screen for setting the temperature set-point (SU) the loop also displays and sets the winter operation set-point and the recovery set-point, if enabled
	PROGRAM	sends you to the screen for inputting the user password (PU) the user loop is used for displaying / programming the unit's parameters
 + 	MENU+PROG	sends you to the screen for inputting the constructor password (ZU) the constructor loop enables configuration of type of unit and selection of connected devices and enabled functions.
	INFO	if pressed in the shared terminal, it switches the displayed card
	RED	with the unit OFF, it enables winter operation in machine configurations 4 and 5.
	BLUE	with the unit OFF, it enables summer operation in machine configurations 4 and 5.

How to use the silicone rubber keys:



1. **ON/OFF** key: for switching the unit on and off.
2. **ALARM** key: to view the alarms on the display, cancel them and silence the alarm buzzer
3. **UP ARROW** has two functions: 1 it scrolls through the previous screens of the same branch when the cursor is in home position; 2 it increases the value of a settings field, when the cursor is over that field; if a selection field is involved, if you press the arrow key, the previous associated text is shown
4. **DOWN ARROW** has two functions: 1 it scrolls through the next screens of the same branch when the cursor is in home position; 2 it reduces the value of a settings field, when the cursor is over that field; if a selection field is involved, if you press the arrow key, the next associated text is shown
5. **ENTER** key this is used for moving the cursor between the home position and the settings or selection fields, and for saving the values of the set parameters after the cursor has exited the settings fields.

2.1.3 BUILT-IN DISPLAY



ALARM	PROG	ESC
UP	DOWN	ENTER

For advice on using keys Alarm, Up Arrow, Down Arrow, and Enter in the Built-in terminal, see the external terminal

PRG + ENTER: keys: temporary display of the pLAN address of the displayed card.

POWER-UP: as there is no ON/OFF key, the unit is powered up or down by simultaneously pressing the Esc+Enter keys for 20s, after which a screen appears in which the operation is performed with the Enter key.

MASK LOOP: as there are no keys which directly put in the screen loop, press the Prog key to show the loop list. Then use the arrow keys to locate in line with the selected loop and then press Enter to access it.

3 PLAN MANAGEMENT AMONG SCREENS

The pLAN network identifies a physical connection between the cards (pCO1 pCO2 or pCOC) and the external terminals.
pLAN=**p**.CO **L**.ocal **A**.rea **N**.etwork.. The purpose of the pLAN network connection between the cards is to exchange variables among the cards with a logic decided by the program, in order to make the cards work together functionally.
The variables exchanged among the cards have already been established by the program, and likewise their direction of origin and destination. Therefore, the user does not have to set them, but has only make the electrical connections.

3.1 HOW TO ASSIGN THE PLAN ADDRESSES

The pLAN addresses are set with binary logic, changing the position of a group of dip-switches located at the back of the external terminals, on the pCO2 cards (see figure below) and inside the drivers of the electronic valves, with all the devices powered down. In pCO1, the address is numeric and is assigned in a different way from an external terminal.

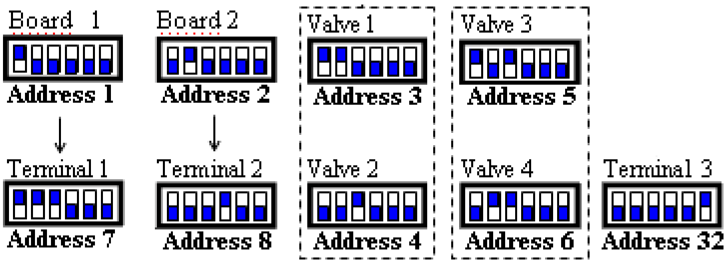
3.1.1 pCO1 ADDRESSING

Here is a description of the operations necessary for addressing pLAN from the pCO1 cards.

1. Power down the pCO1 card and connect an external terminal to the pLAN "0" address.
2. Power up the pCO1 card, by holding down the Alarm + Up keys until a screen appears
3. When the screen is shown, perform the indicated operations, i.e. insert the numeric (1,2,3…) pLAn address with the Up and Down keys and then confirm by pressing Enter.
4. Power down the pCO1 card.
5. If necessary, assign the correct pLAN address to the external terminal if specified.
6. Power up the pCO1 card.

3.1.2 ADDRESSING PCO2, EXTERNAL TERMINALS AND VALVE DRIVERS

The following are the addresses to be set on the pCO2 cards, external terminals and valve drivers. If you are using the pCO1 cards, consult the previous paragraph for the cards only, whereas the following information *does* apply to the terminals and drivers.



The main Menu screen indicated on the terminals shows the address of the connected card in the bottom left-hand corner. With the ind.32 terminal, all the cards can be controlled without any need for other terminals or in addition to them. In fact, the program enables ind.32 (address 32) terminal to access the parameters of all the connected cards, one at a time. To change over from one card to another, just press the info key.,
In all the other screens of the program, you can find out the address of the connected card by pressing the printer key.

4 INSTALLING DEFAULT VALUES

When you have checked the connections between the cards and terminals, power up the pCO card/s*.When the machine is powered up, the software automatically installs the default values selected by CAREL for all the chiller and driver configuration parameters.
This section tells you how to reset default values to return to the initial conditions. Therefore, this operation need not be carried out at the first power-up.
The following procedure is used for resetting all the in-plant configuration parameters selected by CAREL:

ATTENTION! this procedure irreversibly cancels any programming done by the user

As resetting the default values is an operation that concerns each pCO* card, if there are two cards, repeat the operation for the second card. The procedure is identical for both cards.
These are the steps:

- simultaneously press the "menu" and "prog" keys of the LCD terminal (when pressed, both the LED above the "menu" key and the LED above the "prog" key should light up).
- Input the password using the "arrow" keys and press Enter: in this way, you enter the "constructor" configuration :

```
+--------------------+
¦Constructor         ¦
¦Input password   ¦
¦                    ¦
¦              0000  ¦
+--------------------+
```

- press the up arrow key four times to rapidly reach the default values installation screen:

```
+--------------------+
¦Installing default  ¦
¦values              ¦
¦                    ¦
¦Please wait...      ¦
+--------------------+
```

- press the "enter" key to position the cursor above the letter "N", and take it to "S" with the arrow keys. The "please wait…" words appear immediately. They disappear after a few seconds. the default values have now been fully installed.

5 SELECTING THE LANGUAGE

When the unit is powered up, a screen appears by default, where you can select the language to be used (Italian/English).
This screen stays active for 30 seconds. When this time has elapsed, the program automatically changes over to the main menu (M0 screen)
This function can be disabled. How to disable it:

1. Go to the Program (P0 screen) branch
2. Type in the correct password.
3. Press the down arrow unit you reach the screen with reference "Pa"
4. Select "N" under item "Show language screen".

In any case, you can change the language in use at any time. To do this, go to the first screen of the "I/O" key (ref.10).

6 LIST OF INPUTS/OUTPUTS

Inputs and outputs are listed below based on unit type.

AIR/WATER UNIT WITH MAX. 4 SEMIHERMETIC COMPRESSORS (1 CAPACITY STAGE PER COMPRESSOR)

6.1 CHILLER-ONLY UNIT - MACHINE TYPE “0”

6.1.1 DIGITAL INPUTS

	Chiller-only unit **MACHINE TYPE “0”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)
2	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)
3	Remote On/Off		Remote On/Off		Remote On/Off	
4	Pump thermal cutout		Pump thermal cutout		Pump thermal cutout	
5	Low pressure 1 pressure-switch	Low pressure 3 pressure-switch	Low pressure 1 pressure-switch	Low pressure 3 pressure-switch	Low pressure 1 pressure-switch	Low pressure 3 pressure-switch
6	Oil differential 1	Oil differential 3	Oil differential 1	Oil differential 3	Oil differential 1	Oil differential 3
7	Fan 1 thermal cutout	Fan 3 thermal cutout	Fan 1 thermal cutout	Fan 3 thermal cutout	Fan 1 thermal cutout	Fan 3 thermal cutout
8	Low pressure 2 pressure-switch	Low pressure 4 pressure-switch	Low pressure 2 pressure-switch	Low pressure 4 pressure-switch	Low pressure 2 pressure-switch	Low pressure 4 pressure-switch
9	Oil differential 2	Oil differential 4	Oil differential 2	Oil differential 4	Oil differential 2	Oil differential 4
10	Fan 2 thermal cutout	Fan 4 thermal cutout	Fan 2 thermal cutout	Fan 4 thermal cutout	Fan 2 thermal cutout	Fan 4 thermal cutout
11	High pressure 1 pressure-switch/ compressor 1 thermal cutout	High pressure 3 pressure-switch/ compressor 3 thermal cutout	High pressure 1 pressure-switch/ compressor 1 thermal cutout	High pressure 3 pressure-switch/ compressor 3 thermal cutout	High pressure 1 pressure-switch/ compressor 1 thermal cutout	High pressure 3 pressure-switch/ compressor 3 thermal cutout
12	High pressure 2 pressure-switch/ compressor 2 thermal cutout	High pressure 4 pressure-switch/ compressor 4 thermal cutout	High pressure 2 pressure-switch/ compressor 2 thermal cutout	High pressure 4 pressure-switch/ compressor 4 thermal cutout	High pressure 2 pressure-switch/ compressor 2 thermal cutout	High pressure 4 pressure-switch/ compressor 4 thermal cutout

6.1.2 ANALOGUE INPUTS

	Chiller-only unit **MACHINE TYPE “0”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 condenser temperature	Circuit 3 condenser temperature	Outside set-point		Water inlet temperature	
2	Circuit 2 condenser temperature	Circuit 4 condenser temperature			Water outlet temp.1	Water outlet temp.2
3			Circuit 1 high pressure transducer	Circuit 3 high pressure transducer	Circuit 1 condenser temperature	Circuit 3 condenser temperature
4	Water inlet temperature		Circuit 2 high pressure transducer	Circuit 4 high pressure transducer	Circuit 2 condenser temperature	Circuit 4 condenser temperature
5	Water outlet temp.1	Water outlet temp.2	Water inlet temperature		Outside set point	
6	Outside set-point		Water outlet temp.1	Water outlet temp.2		
7	Circuit 1 high pressure transducer	Circuit 3 high pressure transducer	Circuit 1 condenser temperature	Circuit 3 condenser temperature	Circuit 1 high pressure transducer	Circuit 3 high pressure transducer
8	Circuit 2 high pressure transducer	Circuit 4 high pressure transducer	Circuit 2 condenser temperature	Circuit 4 condenser temperature	Circuit 2 high pressure transducer	Circuit 4 high pressure transducer

6.1.3 DIGITAL OUTPUTS

	Chiller-only unit **MACHINE TYPE “0”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circulation pump		Circulation pump		Circulation pump	
2	Comp. 1 winding A	Comp. 3 winding A	Comp. 1 winding A	Comp. 3 winding A	Comp. 1 winding A	Comp. 3 winding A
3	Comp. 1 winding B	Comp. 3 winding B	Comp. 1 winding B	Comp. 3 winding B	Comp. 1 winding B	Comp. 3 winding B
4	Circuit 1 liquid solenoid	Circuit 3 liquid solenoid	Circuit 1 liquid solenoid	Circuit 3 liquid solenoid	Circuit 1 liquid solenoid	Circuit 3 liquid solenoid
5	Comp. 1 capacity control	Comp. 3 capacity control	Comp. 1 capacity control	Comp. 3 capacity control	Comp. 1 capacity control	Comp. 3 capacity control
6	Comp. 2 winding A	Comp. 4 winding A	Comp. 2 winding A	Comp. 4 winding A	Comp. 2 winding A	Comp. 4 winding A
7	Comp. 2 winding B	Comp. 4 winding B	Comp. 2 winding B	Comp. 4 winding B	Comp. 2 winding B	Comp. 4 winding B
8	Circuit 2 liquid solenoid	Circuit 4 liquid solenoid	Circuit 2 liquid solenoid	Circuit 4 liquid solenoid	Circuit 2 liquid solenoid	Circuit 4 liquid solenoid
9	Comp. 2 capacity control	Comp. 4 capacity control	Comp. 2 capacity control	Comp. 4 capacity control	Comp. 2 capacity control	Comp. 4 capacity control
10	Antifreeze heater 1	Antifreeze heater 2	Antifreeze heater 1	Antifreeze heater 2	Antifreeze heater 1	Antifreeze heater 2
11	General alarm	General alarm	General alarm	General alarm	General alarm	General alarm
12	Circuit 1 fan	Circuit 3 fan	Circuit 1 fan	Circuit 3 fan	Circuit 1 fan	Circuit 3 fan
13	Circuit 2 fan	Circuit 4 fan	Circuit 2 fan	Circuit 4 fan	Circuit 2 fan	Circuit 4 fan

6.1.4 ANALOGUE OUTPUTS

	Chiller-only unit **MACHINE TYPE "0"**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 fan speed control	Circuit 3 fan speed control	Circuit 1 fan speed control	Circuit 3 fan speed control	Circuit 1 fan speed control	Circuit 3 fan speed control
2	Circuit 2 fan speed control	Circuit 4 fan speed control	Circuit 2 fan speed control	Circuit 4 fan speed control	Circuit 2 fan speed control	Circuit 4 fan speed control

6.2 CHILLER-ONLY UNIT WITH FREECOOLING – MACHINE TYPE "1"

6.2.1 DIGITAL INPUTS

	Chiller-only unit with freecooling **MACHINE TYPE "1"**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)
2	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)
3	Remote On/Off		Remote On/Off		Remote On/Off	
4	Pump thermal cutout		Pump thermal cutout		Pump thermal cutout	
5	Low pressure 1 pressure-switch	Low pressure 3 pressure-switch	Low pressure 1 pressure-switch	Low pressure 3 pressure-switch	Low pressure 1 pressure-switch	Low pressure 3 pressure-switch
6	Oil differential 1	Oil differential 3	Oil differential 1	Oil differential 3	Oil differential 1	Oil differential 3
7	Fan 1 thermal cutout	Fan 3 thermal cutout	Fan 1 thermal cutout	Fan 3 thermal cutout	Fan 1 thermal cutout	Fan 3 thermal cutout
8	Low pressure 2 pressure-switch	Low pressure 4 pressure-switch	Low pressure 2 pressure-switch	Low pressure 4 pressure-switch	Low pressure 2 pressure-switch	Low pressure 4 pressure-switch
9	Oil differential 2	Oil differential 4	Oil differential 2	Oil differential 4	Oil differential 2	Oil differential 4
10	Fan 2 thermal cutout	Fan 4 thermal cutout	Fan 2 thermal cutout	Fan 4 thermal cutout	Fan 2 thermal cutout	Fan 4 thermal cutout
11	High pressure 1 pressure-switch/ compressor 1 thermal cutout	High pressure 3 pressure-switch/ compressor 3 thermal cutout	High pressure 1 pressure-switch/ compressor 1 thermal cutout	High pressure 3 pressure-switch/ compressor 3 thermal cutout	High pressure 1 pressure-switch/ compressor 1 thermal cutout	High pressure 3 pressure-switch/ compressor 3 thermal cutout
12	High pressure 2 pressure-switch/ compressor 2 thermal cutout	High pressure 4 pressure-switch/ compressor 4 thermal cutout	High pressure 2 pressure-switch/ compressor 2 thermal cutout	High pressure 4 pressure-switch/ compressor 4 thermal cutout	High pressure 2 pressure-switch/ compressor 2 thermal cutout	High pressure 4 pressure-switch/ compressor 4 thermal cutout

6.2.2 ANALOGUE INPUTS

	Chiller-only unit with freecooling **MACHINE TYPE "1"**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 condenser temperature	Circuit 3 condenser temperature	Outside temperature		Water inlet temperature	
2	Circuit 2 condenser temperature	Circuit 4 condenser temperature	Freecooling temperature		Water outlet temp.1	Water outlet temp.2
3	Freecooling temperature		Circuit 1 high pressure transducer	Circuit 3 high pressure transducer	Circuit 1 condenser temperature	Circuit 3 condenser temperature
4	Water inlet temperature		Circuit 2 high pressure transducer	Circuit 4 high pressure transducer	Circuit 2 condenser temperature	Circuit 4 condenser temperature
5	Water outlet temp.1	Water outlet temp.2	Water inlet temperature		Outside temperature	
6	Outside temperature		Water outlet temp.1	Water outlet temp.2	Freecooling temperature	
7	Circuit 1 high pressure transducer	Circuit 3 high pressure transducer	Circuit 1 condenser temperature	Circuit 3 condenser temperature	Circuit 1 high pressure transducer	Circuit 3 high pressure transducer
8	Circuit 2 high pressure transducer	Circuit 4 high pressure transducer	Circuit 2 condenser temperature	Circuit 4 condenser temperature	Circuit 2 high pressure transducer	Circuit 4 high pressure transducer

6.2.3 DIGITAL OUTPUTS

	Chiller-only unit with freecooling **MACHINE TYPE "1"**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circulation pump		Circulation pump		Circulation pump	
2	Comp. 1 winding A	Comp. 3 winding A	Comp. 1 winding A	Comp. 3 winding A	Comp. 1 winding A	Comp. 3 winding A
3	Comp. 1 winding B	Comp. 3 winding B	Comp. 1 winding B	Comp. 3 winding B	Comp. 1 winding B	Comp. 3 winding B
4	Circuit 1 liquid solenoid	Circuit 3 liquid solenoid	Circuit 1 liquid solenoid	Circuit 3 liquid solenoid	Circuit 1 liquid solenoid	Circuit 3 liquid solenoid
5	Comp. 1 capacity control	Comp. 3 capacity control	Comp. 1 capacity control	Comp. 3 capacity control	Comp. 1 capacity control	Comp. 3 capacity control
6	Comp. 2 winding A	Comp. 4 winding A	Comp. 2 winding A	Comp. 4 winding A	Comp. 2 winding A	Comp. 4 winding A
7	Comp. 2 winding B	Comp. 4 winding B	Comp. 2 winding B	Comp. 4 winding B	Comp. 2 winding B	Comp. 4 winding B
8	Circuit 2 liquid solenoid	Circuit 4 liquid solenoid	Circuit 2 liquid solenoid	Circuit 4 liquid solenoid	Circuit 2 liquid solenoid	Circuit 4 liquid solenoid
9	Comp. 2 capacity control	Comp. 4 capacity control	Comp. 2 capacity control	Comp. 4 capacity control	Comp. 2 capacity control	Comp. 4 capacity control
10	Circuit 2 fan	Antifreeze heater 2	Circuit 2 fan	Antifreeze heater 2	Circuit 2 fan	Antifreeze heater 2
11	General alarm	General alarm	General alarm	General alarm	General alarm	General alarm
12	Circuit 1 fan	Circuit 3 fan	Circuit 1 fan	Circuit 3 fan	Circuit 1 fan	Circuit 3 fan
13	Freecooling On/Off	Circuit 4 fan	Freecooling On/Off	Circuit 4 fan	Freecooling On/Off	Circuit 4 fan

6.2.4 ANALOGUE OUTPUTS

N.	Chiller-only unit with freecooling **MACHINE TYPE "1"**					
	pCO2 MEDIUM		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 fan speed control	Circuit 3 fan speed control	Circuit 1 fan speed control	Circuit 3 fan speed control	Circuit 1 fan speed control	Circuit 3 fan speed control
2	Freecooling modulating valve	Circuit 4 fan speed control	Freecooling modulating valve	Circuit 4 fan speed control	Freecooling modulating valve	Circuit 4 fan speed control

AIR/WATER UNIT WITH MAX. 2 SEMIHERMETIC COMPRESSORS (UP TO 3 CAPACITY STAGES PER COMPRESSOR)

6.3 CHILLER-ONLY UNIT – MACHINE TYPE "2"

6.3.1 DIGITAL INPUTS

N.	Chiller-only unit **MACHINE TYPE "2"**					
	pCO2 MEDIUM		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)
2	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)
3	Remote On/Off		Remote On/Off		Remote On/Off	
4	Pump thermal cutout		Pump thermal cutout		Pump thermal cutout	
5	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch
6	Oil differential 1	Oil differential 2	Oil differential 1	Oil differential 2	Oil differential 1	Oil differential 2
7	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout
8	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout
9	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout
10						
11	High pressure 1 pressure-switch	High pressure 2 pressure-switch	High pressure 1 pressure-switch	High pressure 2 pressure-switch	High pressure 1 pressure-switch	High pressure 2 pressure-switch
12	Comp. 1 thermal cutout	Comp. 2 thermal cutout	Comp. 1 thermal cutout	Comp. 2 thermal cutout	Comp. 1 thermal cutout	Comp. 2 thermal cutout

6.3.2 ANALOGUE INPUTS

N.	Chiller-only unit **MACHINE TYPE "2"**					
	pCO2 MEDIUM		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 condenser temperature	Circuit 2 condenser temperature	Outside set-point		Water inlet temperature	
2					Water outlet temp.1	Water outlet temp.2
3			Circuit 1 high pressure transducer	Circuit 2 high pressure transducer	Circuit 1 condenser temperature	Circuit 2 condenser temperature
4	Water inlet temperature					
5	Water outlet temp.1	Water outlet temp.2	Water inlet temperature		Outside set-point	
6	Outside set-point		Water outlet temp.1	Water outlet temp.2		
7	Circuit 1 high pressure transducer	Circuit 2 high pressure transducer	Circuit 1 condenser temperature	Circuit 2 condenser temperature	Circuit 1 high pressure transducer	Circuit 2 high pressure transducer
8						

6.3.3 DIGITAL OUTPUTS

N.	Chiller-only unit **MACHINE TYPE "2"**					
	pCO2 MEDIUM		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circulation pump		Circulation pump		Circulation pump	
2	Comp. 1 winding A	Comp. 2 winding A	Comp. 1 winding A	Comp. 2 winding A	Comp. 1 winding A	Comp. 2 winding A
3	Comp. 1 winding B	Comp. 2 winding B	Comp. 1 winding B	Comp. 2 winding B	Comp. 1 winding B	Comp. 2 winding B
4	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid
5	Circuit 1 fan 3	Circuit 2 fan 3	Circuit 1 fan 3	Circuit 2 fan 3	Circuit 1 fan 3	Circuit 2 fan 3
6	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1
7	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2
8	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3
9	Circuit 1 fan 2	Circuit 2 fan 2	Circuit 1 fan 2	Circuit 2 fan 2	Circuit 1 fan 2	Circuit 2 fan 2
10	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater
11	General alarm	General alarm	General alarm	General alarm	General alarm	General alarm
12	Circuit 1 fan 1	Circuit 2 fan 1	Circuit 1 fan 1	Circuit 2 fan 1	Circuit 1 fan 1	Circuit 2 fan 1
13						

6.3.4 ANALOGUE OUTPUTS

N.	Chiller-only unit **MACHINE TYPE "2"**					
	pCO2 MEDIUM		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 fan speed control	Circuit 2 fan speed control	Circuit 1 fan speed control	Circuit 2 fan speed control	Circuit 1 fan speed control	Circuit 2 fan speed control
2						

6.4 CHILLER-ONLY UNIT WITH FREECOOLING – MACHINE TYPE "3"

6.4.1 DIGITAL INPUTS

	Chiller-only unit with freecooling **MACHINE TYPE "3"**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)
2	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)
3	Remote On/Off		Remote On/Off		Remote On/Off	
4	Pump thermal cutout		Pump thermal cutout		Pump thermal cutout	
5	Low pressure 2 pressure-switch 1	Low pressure 2 pressure-switch	Low pressure 2 pressure-switch 1	Low pressure 2 pressure-switch 2	Low pressure 2 pressure-switch 1	Low pressure 2 pressure-switch 2
6	Oil differential 1	Oil differential 2	Oil differential 1	Oil differential 2	Oil differential 1	Oil differential 2
7	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout
8	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout
9	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout
10						
11	High pressure 1 pressure-switch	High pressure 2 pressure-switch	High pressure 1 pressure-switch	High pressure 2 pressure-switch	High pressure 1 pressure-switch	High pressure 2 pressure-switch
12	Comp. 1 thermal cutout	Comp. 2 thermal cutout	Comp. 1 thermal cutout	Comp. 2 thermal cutout	Comp. 1 thermal cutout	Comp. 2 thermal cutout

6.4.2 ANALOGUE INPUTS

	Chiller-only unit with freecooling **MACHINE TYPE "3"**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 condenser temperature	Circuit 2 condenser temperature	Outside set-point		Water inlet temperature	
2	Outside temperature		Freecooling temperature		Water outlet temp.1	Water outlet temp.2
3	Freecooling temperature		Circuit 1 high pressure transducer	Circuit 2 high pressure transducer	Circuit 1 condenser temperature	Circuit 2 condenser temperature
4	Water inlet temperature				Outside temperature	
5	Water outlet temp.1	Water outlet temp.2	Water inlet temperature		Outside set-point	
6	Outside set-point		Water outlet temp.1	Water outlet temp.2	Freecooling temperature	
7	Circuit 1 high pressure transducer	Circuit 2 high pressure transducer	Circuit 1 condenser temperature	Circuit 2 condenser temperature	Circuit 1 high pressure transducer	Circuit 2 high pressure transducer
8			Outside temperature			

6.4.3 DIGITAL OUTPUTS

	Chiller-only unit with freecooling **MACHINE TYPE "3"**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circulation pump		Circulation pump		Circulation pump	
2	Comp. 1 winding A	Comp. 2 winding A	Comp. 1 winding A	Comp. 2 winding A	Comp. 1 winding A	Comp. 2 winding A
3	Comp. 1 winding B	Comp. 2 winding B	Comp. 1 winding B	Comp. 2 winding B	Comp. 1 winding B	Comp. 2 winding B
4	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid
5	Circuit 1 fan 3	Circuit 2 fan 3	Circuit 1 fan 3	Circuit 2 fan 3	Circuit 1 fan 3	Circuit 2 fan 3
6	Comp. 1 capacity stage 1	Comp. 1 capacity stage 2	Comp. 1 capacity stage 1	Comp. 1 capacity stage 2	Comp. 1 capacity stage 1	Comp. 1 capacity stage 2
7	Comp. 2 capacity stage 1	Comp. 2 capacity stage 2	Comp. 2 capacity stage 1	Comp. 2 capacity stage 2	Comp. 2 capacity stage 1	Comp. 2 capacity stage 2
8	Comp. 3 capacity stage 1	Comp. 3 capacity stage 2	Comp. 3 capacity stage 1	Comp. 3 capacity stage 2	Comp. 3 capacity stage 1	Comp. 3 capacity stage 2
9	Circuit 1 fan 2	Circuit 2 fan 2	Circuit 1 fan 2	Circuit 2 fan 2	Circuit 1 fan 2	Circuit 2 fan 2
10	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater
11	General alarm	General alarm	General alarm	General alarm	General alarm	General alarm
12	Circuit 1 fan 1	Circuit 1 fan 2	Circuit 1 fan 1	Circuit 1 fan 2	Circuit 1 fan 1	Circuit 1 fan 2
13	Freecooling On/Off		Freecooling On/Off		Freecooling On/Off	

6.4.4 ANALOGUE OUTPUTS

	Chiller-only unit with freecooling **MACHINE TYPE "3"**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 fan speed control	Circuit 2 fan speed control	Circuit 1 fan speed control	Circuit 2 fan speed control	Circuit 1 fan speed control	Circuit 2 fan speed control
2	Freecooling modulating valve		Freecooling modulating valve		Freecooling modulating valve	

6.5 CHILLER UNIT WITH HEAT PUMP – MACHINE TYPE “4”

6.5.1 DIGITAL INPUTS

	Chiller unit with heat pump **MACHINE TYPE “4”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)
2	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)
3	Remote On/Off		Remote On/Off		Remote On/Off	
4	Cooling/heating selector		Cooling/heating selector		Cooling/heating selector	
5	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch
6	Oil differential 1	Oil differential 2	Oil differential 1	Oil differential 2	Oil differential 1	Oil differential 2
7	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout
8	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout
9	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout
10	Pump thermal cutout		Pump thermal cutout		Pump thermal cutout	
11	High pressure 1 pressure-switch	High pressure 2 pressure-switch	High pressure 1 pressure-switch	High pressure 2 pressure-switch	High pressure 1 pressure-switch	High pressure 2 pressure-switch
12	Comp. 1 thermal cutout	Comp. 2 thermal cutout	Comp. 1 thermal cutout	Comp. 2 thermal cutout	Comp. 1 thermal cutout	Comp. 2 thermal cutout

6.5.2 ANALOGUE INPUTS

	Chiller unit with heat pump **MACHINE TYPE “4”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circ. 1 condenser temperature	Circ. 2 condenser temperature	Outside set point		Water inlet temperature	
2					Water outlet temp.1	Water outlet temp.2
3			Circuit 1 high pressure transducer	Circuit 2 high pressure transducer	Circ. 1 condenser temperature	Circ. 2 condenser temperature
4	Water inlet temperature					
5	Water outlet temp.1	Water outlet temp.2	Water inlet temperature		Outside set-point	
6	Outside set-point		Water outlet temp.1	Water outlet temp.2		
7	Circuit 1 high pressure transducer	Circuit 2 high pressure transducer	Circ. 1 condenser temperature	Circ. 2 condenser temperature	Circuit 1 high pressure transducer	Circuit 2 high pressure transducer
8						

6.5.3 DIGITAL OUTPUTS

	Chiller unit with heat pump **MACHINE TYPE “4”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circulation pump		Circulation pump		Circulation pump	
2	Comp. 1 winding A	Comp. 2 winding A	Comp. 1 winding A	Comp. 2 winding A	Comp. 1 winding A	Comp. 2 winding A
3	Comp. 1 winding B	Comp. 2 winding B	Comp. 1 winding B	Comp. 2 winding B	Comp. 1 winding B	Comp. 2 winding B
4	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid
5	Circuit 1 4-way valve	Circuit 2 4-way valve	Circuit 1 4-way valve	Circuit 2 4-way valve	Circuit 1 4-way valve	Circuit 2 4-way valve
6	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1
7	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2
8	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3
9	Circuit 1 fan 2	Circuit 2 fan 2	Circuit 1 fan 2	Circuit 2 fan 2	Circuit 1 fan 2	Circuit 2 fan 2
10	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater
11	General alarm	General alarm	General alarm	General alarm	General alarm	General alarm
12	Circuit 1 fan 1	Circuit 2 fan 1	Circuit 1 fan 1	Circuit 2 fan 1	Circuit 1 fan 1	Circuit 2 fan 1
13	Circuit 1 fan 3	Circuit 2 fan 3	Circuit 1 fan 3	Circuit 2 fan 3	Circuit 1 fan 3	Circuit 2 fan 3

6.5.4 ANALOGUE OUTPUTS

	Chiller unit with heat pump **MACHINE TYPE “4”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 fan speed control	Circuit 2 fan speed control	Circuit 1 fan speed control	Circuit 2 fan speed control	Circuit 1 fan speed control	Circuit 2 fan speed control
2						

6.6 CHILLER UNIT WITH HEAT PUMP AND TOTAL RECOVERY – MACHINE TYPE “5”

6.6.1 DIGITAL INPUTS

	Chiller with heat pump and total recovery **MACHINE TYPE “5”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)	Serious alarm	Serious alarm (enablable)
2	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)	Evaporator flow-switch	Evaporator flow-switch (enablable)
3	Remote On/Off		Remote On/Off		Remote On/Off	
4	Cooling/heating selector		Cooling/heating selector		Cooling/heating selector	
5	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch	Low pressure 1 pressure-switch	Low pressure 2 pressure-switch
6	Oil differential 1	Oil differential 2	Oil differential 1	Oil differential 2	Oil differential 1	Oil differential 2
7	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout	Fan 1 thermal cutout
8	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout	Fan 2 thermal cutout
9	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout	Fan 3 thermal cutout
10	Pump thermal cutout		Pump thermal cutout		Pump thermal cutout	
11	High pressure 1 pressure-switch	High pressure 2 pressure-switch	High pressure 1 pressure-switch	High pressure 2 pressure-switch	High pressure 1 pressure-switch	High pressure 2 pressure-switch
12	Comp. 1 thermal cutout	Comp. 2 thermal cutout	Comp. 1 thermal cutout	Comp. 2 thermal cutout	Comp. 1 thermal cutout	Comp. 2 thermal cutout

6.6.2 ANALOGUE INPUTS

	Chiller with heat pump and total recovery **MACHINE TYPE “5”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circ. 1 condenser temperature	Circ. 2 condenser temperature	Outside set-point		Water inlet temperature	
2	Recovery boiler inlet temperature		Recovery boiler outlet temperature		Water outlet temp.1	Water outlet temp.2
3	Recovery boiler outlet temperature		Circuit 1 high pressure transducer	Circuit 2 high pressure transducer	Circ. 2 condenser temperature 1	Circ. 2 condenser temperature 2
4	Water inlet temperature				Recovery boiler inlet temperature	
5	Water outlet temp.1	Water outlet temp.2	Water inlet temperature		Outside set-point	
6	Outside set-point		Water outlet temp.1	Water outlet temp.2	Recovery boiler outlet temperature	
7	Circuit 1 high pressure transducer	Circuit 2 high pressure transducer	Circ. 2 condenser temperature 1	Circ. 2 condenser temperature 2	Circuit 1 high pressure transducer	Circuit 2 high pressure transducer
8			Recovery boiler inlet temperature			

6.6.3 DIGITAL OUTPUTS

	Chiller with heat pump and total recovery **MACHINE TYPE “5”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circulation pump		Circulation pump		Circulation pump	
2	Comp. 1 winding A	Comp. 2 winding A	Comp. 1 winding A	Comp. 2 winding A	Comp. 1 winding A	Comp. 2 winding A
3	Comp. 1 winding B	Comp. 2 winding B	Comp. 1 winding B	Comp. 2 winding B	Comp. 1 winding B	Comp. 2 winding B
4	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid	Circuit 1 liquid solenoid	Circuit 2 liquid solenoid
5	Valve A		Valve A		Valve A	
6	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1	Comp. 1 capacity stage 1	Comp. 2 capacity stage 1
7	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2	Comp. 1 capacity stage 2	Comp. 2 capacity stage 2
8	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3	Comp. 1 capacity stage 3	Comp. 2 capacity stage 3
9	Valve B		Valve B		Valve B	
10	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater	Antifreeze heater
11	General alarm	General alarm	General alarm	General alarm	General alarm	General alarm
12	Circuit 1 fan 1	Circuit 2 fan 1	Circuit 1 fan 1	Circuit 2 fan 1	Circuit 1 fan 1	Circuit 2 fan 1
13	Valve C		Valve C		Valve C	

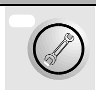
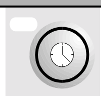
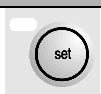
6.6.4 ANALOGUE OUTPUTS

	Chiller with heat pump and total recovery **MACHINE TYPE “5”**					
N.	**pCO2 MEDIUM**		**pCO1 MEDIUM**		**pCOC MEDIUM**	
	Master	**Slave**	Master	Slave	Master	Slave
1	Circuit 1 fan speed control	Circuit 2 fan speed control	Circuit 1 fan speed control	Circuit 2 fan speed control	Circuit 1 fan speed control	Circuit 2 fan speed control
2						

7 LIST OF PARAMETERS

The table below describes program parameters along with the following additional information: screen code (screens have a code in the top right corner) to make identifying the parameter easier (screen), factory setting, upper and lower limits of the range within which values can be edited, unit of measurement, and an empty column for recording the desired value.
To find the parameter you are interested in on the terminal's display, proceed as follows:

- Locate the parameter in the table below and the code of the screen it appears on
- Using the list of screens (coming section) and screen code, call up the screen on the terminal

DESCRIPTION OF PARAMETER	MASK	MASTER SLAVE	FACTORY VALUE	USER VALUE	RANGE	MEASUREMENT UNIT
						
Password inputting	A3	M / S	1234		0 to 9999	
Duty hours thresholds for main pump	A4	M	10		0 to 999	hours x 1000
Reset duty hours thresholds for main pump	A4	M	N.		N/Y	
Duty hours thresholds for compressor 1	A5	N/Y	10		0 to 999	hours x 1000
Reset duty hours for compressor 1	A5	M / S	N		N / S	
Operating hours thresholds for compressor 2	A6	M / S	10		0 to 999	hours x 1000
Reset duty hours for compressor 2	A6	M / S	N		N / S	
Adjustment of probe B1	A7	M / S	0		-9.9 to 9.9	
Adjustment of probe B2	A7	M / S	0		-9.9 to 9.9	
Adjustment of probe B3	A7	M / S	0		-9.9 to 9.9	
Adjustment of probe B4	A7	M / S	0		-9.9 to 9.9	
Adjustment of probe B5	A8	M / S	0		-9.9 to 9.9	
Adjustment of probe B6	A8	M / S	0		-9.9 to 9.9	
Adjustment of probe B7	A8	M / S	0		-9.9 to 9.9	
Adjustment of probe B8	A8	M / S	0		-9.9 to 9.9	
Enable compressor 1	A9	M	S		N/Y	
Enable compressor 2	A9	M	S		N/Y	
Enable compressor 3	A9	M	S		N / Y	
Enable compressor 4	A9	M	S		N / Y	
Cancel alarm log	Aa	M / S	N		N / Y	
Adjustment mode for Driver 1 valve	Ab	M/S	Automatic		Aut-Man	
Number of steps for manual opening of Driver 1 valve	Ab	M/S	0		0 to 9999	Steps
Adjustment mode for Driver 2 valve	Ac	M/S	Automatic		Aut-Man	
Number of steps for manual opening of Driver 2 valve	Ac	M/S	0		0 to 9999	Steps
Manual release of Driver 1 at start-up	Ad	M/S	No		No-Yes	
Manual release of Driver 2 at start-up	Ae	M/S	No		No-Yes	
Inputting of new Maintenance password	Af	M/S	1234		0 to 9999	
						
Hour setting	KO	M/S	current hour		0 to 23	Hours
Minute setting	KO	M/S	current minutes		0 to 59	minutes
Day setting	KO	M/S	current day		1 to 31	
Month setting	KO	M/S	current month		1 to 12	
Year setting	KO	M/S	current year		0 to 99	
						
Summer set-point	S1	M/S	12.0		see P1	°C
Winter set-point	S1	M/S	45.0		see P2	°C
Recovery priority	S2	M/S	Evap.		Evap.Recov.	
Recovery set-point	S2	M/S	45,0		-99.9 to 99.9	°C
Recovery differential	S2	M/S	3,0		0.0 to 99.9	°C

						
User password inputting	P0	M/S	1234		0 to 9999	
Minimum limit of summer set-point	P1	M	7.0		-99.9 / 99.9	°C
Minimum limit of summer set-point	P1	M	17.0		-99.9 / 99.9	°C
Minimum limit of winter set-point	P2	M	40.0		-99.9 / 99.9	°C
Minimum limit of winter set-point	P2	M	50.0		-99.9 / 99.9	°C
Selection of control probe	P3	M	Input		Input / Output	
Control at output - delayed power up	P4	M/S	20		0 to 9999	seconds
Control at output - delayed power down	P4	M/S	10		0 to 9999	seconds
Control at output - summer forced power down	P5	M/S	10.0		-99.9 / 99.9	°C
Control at output - winter forced power down	P5	M/S	47.0		-99.9 / 99.9	°C
Control with probe at evaporator input	P6	M	Prop.		Prop./Prop+Int.	
Integration time	P6	M	0 to 9999		600	seconds
Enable outside set-point	P7	M	N.		N/Y	
Outside set-point minimum value	P7	M	0.0		-99.9 / 99.9	°C
Outside set-point maximum value	P7	M	5.0		-99.9 / 99.9	°C
Control band	P8	M	3.0		0 to 99.9	°C
Delayed power up between pump and compressors	P9	M	5		0 to 999	seconds
Delayed power down of main pump	P9	M	5		0 to 999	seconds
Enable language screen start-up	Pa	M	N.		N/Y	
Enable remote On/Off	Pa	M	N.		N/Y	
Enable summer / winter selection from digital input	Pa	M	N.		N/Y	
Enable On/Off from supervisor	Pb	M			N/Y	
Enable summer / winter selection from supervisor	Pb	M			N/Y	
Delta freecooling	Pc	M/S	2.0		0 to 99.9	°C
Freecooling differential	Pc	M/S	3.0		-99.9 / 99.9	°C
Defrosting starts	Pd	M	2.0		-99.9 / 99.9	°C/bar
Defrosting ends	Pd	M	12.0		-99.9 / 99.9	°C/bar
Delayed defrosting start	Pe	M/S	1800		0 to 32000	seconds
Maximum defrosting time	Pe	M/S	300		0 to 32000	seconds
Card identification number for supervision network	Pf	M/S	1		0 to 200	
Card communication speed for supervision network	Pf	M/S	19200		1200 to 19200	bps
Selection of communication serial network	Pf	M/S	Carel		Carel / Modbus	
New user password inputting	Pj	M/S	1234		0 to 9999	
 + 						
Constructor password inputting	Z0	M/S	1234		0 to 9999	
Unit configuration	C0	M/S	4		0 to 5	
Total number of compressors	C0	M/S	1		1 to 4	
Number of local compressors	C0	M/S	1		1 to 2	
Number of capacity stages per compressor	C0	M/S	3		0 to 3	
Enable local power down from flow-switch alarm	C1	S	S		N/Y	
Enable probe B1	C2	M/S	Y (if pCO2) N (if pCO1) N (if pCOC)		N/Y	
Enable probe B2	C2	M/S	N.		N/Y	
Enable probe B3	C2	M/S	N.		N/Y	
Enable probe B4	C2	M/S	Y (if pCO2) N (if pCO1) N (if pCOC)		N/Y	
Enable probe B5	C2	M/S	Y (if pCO2) N (if pCO1) N (if pCOC)		N/Y	
Enable probe B6	C2	M/S	N.		N/Y	
Enable probe B7	C2	M/S	N.		N/Y	
Enable probe B8	C2	M/S	N.		N/Y	
Pressure probes minimum limit	C3	M/S	00,0		-99.9 to 99.9	bar
Pressure probes maximum limit	C3	M/S	30,0		-99.9 to 99.9	bar
Probe type for outside set-point	C4	M	4-20 mA		0-20 mA / 4-20 mA 0-1 V / 0-10 V	
Number of drivers present	C5	M/S	1		1 to 2	
Part winding time	C6	M/S	1000		5 to 1000	msec
Enable compressor rotation	C6	M/S	S		N/Y	
Enable clock card	C7	M/S	N.		N/Y	
Enable pump - down	C8	M/S	N.		N/Y	
Minimum pump - down time	C8	M/S	60		0 to 999	seconds
Delay between capacity controls	C9	M	1		0 to 99	seconds
Capacity controls logic	C9	M	N.C.		N.C / N.A.	

Compressor minimum ON time	Ca	M	60		0 to 9999	seconds
Compressor minimum OFF time	Ca	M	360		0 to 9999	seconds
Minimum time between power ups of different compressors	Cb	M	10		0 to 9999	seconds
Minimum time between power ups of same compressor	Cb	M	450		0 to 9999	seconds
Type of condensation control	Cc		Pressure		No / Pressure Temperature	
Type of condensation management	Cc	M/S	Inverter		Inverter / Steps	
Type of condensation	Cd	M/S	Single		Single / Double	
Number of fans per condenser	Cd	M/S	1		1 to 3	
Condensation set-point	Ce	M/S	14,0		-999.9 to 999.9	bar/ °C
Condensation differential	Ce	M/S	2,0		-999.9 to 999.9	bar/ °C
Inverter maximum speed	Cf	M/S	10,0		0.0 to 10.0	V
Inverter maximum speed	Cf	M/S	0,0		0.0 to 10.0	V
Minimum ON time	Cf	M/S	0		0 to 999	seconds
Enable prevent	Cg	M/S	S		N/Y	
Type of control probe	Cg	M/S	Pressure		Pressure /Temperature	
Prevent set-point	Cg	M/S	20,0		-99.9 to 99.9	bar/ °C
Prevent differential	Cg	M/S	2,0		-99.9 to 99.9	bar/ °C
Set-point for high pressure alarm from transducer	Ch	M/S	21,0		-99.9 to 99.9	bar
High pressure alarm differential from transducer	Ch	M/S	2,0		-99.9 to 99.9	bar
Delayed start due to low pressure alarm	Ci	M/S	40		0 to 999	seconds
Delayed steady state operation due to low pressure alarm	Ci	M/S	0		0 to 999	seconds
Delayed start due to oil differential alarm	Cj	M/S	120		0 to 999	seconds
Delayed steady state operation due to oil differential alarm	Cj	M/S	10		0 to 999	seconds
Antifreeze alarm set-point	Ck	M/S	3,0		-99.9 to 99.9	°C
Antifreeze alarm set-point	Ck	M/S	1,0		-99.9 to 99.9	°C
Type of antifreeze alarm reset	Cl	M/S	Manual		Manual /Autom	
Delay antifreeze alarm	Cl	M/S	0		0 to 999	minutes
Antifreeze heater set point	Cm	M/S	5,0		-99.9 to 99.9	°C
Antifreeze heater differential	Cm	M/S	1,0		-99.9 to 99.9	°C
Delayed start due to evaporator flow-switch alarm	Cn	M/S	15		0 to 999	seconds
Delayed steady state operation due to evaporator flow-switch alarm	Cn	M/S	3		0 to 999	seconds
Delayed start due to condenser flow-switch alarm	Co	M/S	15		0 to 999	seconds
Delayed steady state operation due to condenser flow-switch alarm	Co	M/S	3		0 to 999	seconds
Modulating valve configuration	Cp	M	0-10 V		0-10 V / On-Off	
Cycle reversing valve configuration	Cq	M/S	N.O.		N.C / N.A.	
Defrosting probe configuration	Cr	M/S	Temperature		Temperature Pressure switch	
Type of overall defrosting	Cr	M/S	Simultaneous		Simultaneous Separate Independent	
Type of local defrosting	Cr	M/S	Simultaneous		Simultaneous Separate	
Installation of default values	Cs	M/S	N.		N/Y	
Input new Constructor password	Ct	M/S	1234		0 to 9999	
Input new constructor-driver password	Cu	M/S	1234		0 to 9999	
CAREL EXV DRIVERS						
Driver 1 valve type	F0	M/S	Custom		0-11 (see page 8)	
Enable driver 1 battery	F0	M/S	N.		N/Y	
Percentage relationship between Refrigerating power and Driver 1 power	F1	M/S	60		0 to 100	%
Driver 2 valve type	F2	M/S	Custom		0-11 (see page 8)	
Enable driver 2 battery	F2	M/S	N.		N/Y	
Percentage relationship between Refrigerating power and Driver C2 power	F3	M/S	60		0 to 100	%
Driver 1 superheat set-point during chiller operation	F4	M/S	6,0		2.0 to 50.0	°C
Driver 1 dead band during chiller operation	F4	M/S	0		0 to 9.9	°C
Driver 1 superheat set-point during heat pump operation	F5	M/S	6,0		2.0 to 50.0	°C
Driver 1 dead band during heat pump operation	F5	M/S	0		0 to 9.9	°C
Driver 1 superheat set-point during defrost. operation	F6	M/S	6,0		2.0 to 50.0	°C
Driver 1 dead band during defrost. operation	F6	M/S	0		0 to 9.9	°C
Driver 2 superheat set-point during chiller operation	F7	M/S	6,0		2.0 to 50.0	°C
Driver 2 dead band during chiller operation	F7	M/S	0		0 to 9.9	°C
Driver 2 superheat set-point during heat pump operation	F8	M/S	6,0		2.0 to 50.0	°C
Driver 2 dead band during heat pump operation	F8	M/S	0		0 to 9.9	°C

Driver 2 superheat set-point during defrost. operation	F9	M/S	6,0		2.0 to 50.0	°C
Driver 2 dead band during defrost. operation	F9	M/S	0		0 to 9.9	°C
Driver 2 superheat set-point during chiller operation	Fa	M/S	2,5		0.0 to 99.9	
Driver 1 integral time during chiller operation	Fa	M/S	25		0 to 999	seconds
Driver 1 derivative time during chiller operation	Fa	M/S	2,0		0.0 to 99.9	seconds
Driver 1 proportional gain during heat pump operation	Fb	M/S	2,5		0.0 to 99.9	
Driver 1 integral time during heat pump operation	Fb	M/S	25		0 to 999	seconds
Driver 1 derivative time during heat pump operation	Fb	M/S	2,0		0.0 to 99.9	seconds
Driver 2 proportional gain during defrost. operation	Fc	M/S	2,5		0.0 to 99.9	
Driver 1 integral time during defrost. operation	Fc	M/S	25		0 to 999	seconds
Driver 1 derivative time during defrost. operation	Fc	M/S	2,0		0.0 to 99.9	seconds
Driver 2 proportional gain during chiller operation	Fd	M/S	2,5		0.0 to 99.9	
Driver 2 integral time during chiller operation	Fd	M/S	25		0 to 999	seconds
Driver 2 derivative time during chiller operation	Fd	M/S	2,0		0.0 to 99.9	seconds
Driver 2 proportional gain during heat pump operation	Fe	M/S	2,5		0.0 to 99.9	
Driver 2 integral time during heat pump operation	Fe	M/S	25		0 to 999	seconds
Driver 2 derivative time during heat pump operation	Fe	M/S	2,0		0.0 to 99.9	seconds
Driver 2 proportional gain during defrost. operation	Ff	M/S	2,5		0.0 to 99.9	
Driver 2 integral time during defrost. operation	Ff	M/S	25		0 to 999	seconds
Driver 2 derivative time during defrost. operation	Ff	M/S	2,0		0.0 to 99.9	seconds
Threshold for protection of low super heat driver 1 during chiller operation	Fg	M/S	4,0		-4.0 to 10.0	°C
Integral time for protection of low super heat driver 1 during chiller operation	Fg	M/S	1,0		0 to 25.5	seconds
Threshold for protection of low super heat driver 1 heat pump operation	Fh	M/S	4,0		-4.0 to 10.0	°C
Threshold integral time for protection of low super heat driver 1 heat pump operation	Fh	M/S	1,0		0 to 25.5	seconds
Threshold for protection of low super heat driver 1 during defrost. operation	Fi	M/S	4,0		-4.0 to 10.0	°C
Integral time for protection of low super heat driver 1 during defrost operation	Fi	M/S	1,0		0 to 25.5	seconds
Threshold for protection of low super heat driver 2 during chiller operation	Fj	M/S	4,0		-4.0 to 10.0	°C
Threshold integral time for protection of low super heat driver 2 heat pump operation	Fj	M/S	1,0		0 to 25.5	seconds
Threshold for protection of low super heat driver 2 heat pump operation	Fk	M/S	4,0		-4.0 to 10.0	°C
Threshold integral time for protection of low super heat driver 2 heat pump operation	Fk	M/S	1,0		0 to 25.5	seconds
Threshold for protection of low super heat driver 2 during defrost. operation	Fl	M/S	4,0		-4.0 to 10.0	°C
Threshold integral time for protection of low super heat driver 2 defrost. operation	Fl	M/S	1,0		0 to 25.5	seconds
Threshold for LOP protection during chiller operation	Fm	M/S	-40,0		-70.0 to 50.0	°C
Integral time of threshold for LOP protection during chiller operation	Fm	M/S	4,0		0 to 25.5	seconds
Threshold for LOP protection during heat pump operation	Fn	M/S	-40,0		-70.0 to 50.0	°C
Integral time of threshold for LOP protection during heat pump operation	Fn	M/S	4,0		0 to 25.5	seconds
Threshold for LOP protection during defrost. operation	Fo	M/S	-40,0		-70.0 to 50.0	°C
Integral time of threshold for LOP protection during defrost. operation	Fo	M/S	4,0		0 to 25.5	seconds
Delayed start MOP protection during chiller operation	Fp	M/S	30		0 to 500	seconds
Threshold for MOP protection during chiller operation	Fp	M/S	40,0		-50.0 to 99.9	°C
Integral time of threshold for MOP protection during chiller operation	Fp	M/S	4,0		0 to 25.5	seconds
Delayed start MOP protection during heat pump operation	Fq	M/S	30		0 to 500	seconds
Threshold for MOP protection during heat pump operation	Fq	M/S	40,0		-50.0 to 99.9	°C
Integral time of MOP protection during heat pump operation	Fq	M/S	4,0		0 to 25.5	seconds
Delayed start MOP protection during chiller operation	Fr	M/S	30		0 to 500	seconds
Threshold for MOP protection during chiller operation	Fr	M/S	40,0		-50.0 to 99.9	°C
Integral time of threshold for MOP protection during chiller operation	Fr	M/S	4,0		0 to 25.5	seconds

Threshold for condensation high temperature protection during chiller operation	Fs	M/S	75,0		0 to 99.9	°C
Integral time of threshold for condensation high temperature protection during chiller operation	Fs	M/S	4,0		0 to 25.5	seconds
Threshold for condensation high temperature protection during heat pump operation	Ft	M/S	75,0		0 to 99.9	°C
Integral time of threshold for condensation high temperature protection during heat pump operation	Ft	M/S	4,0		0 to 25.5	seconds
Threshold for condensation high temperature protection during defrost. operation	Fu	M/S	75,0		0 to 99.9	°C
Integral time of threshold for condensation high temperature protection during defrost operation	Fu	M/S	4,0		0 to 25.5	seconds
Threshold for intake high temperature during chiller operation	Fv	M/S	30,0		0 to 100.0	°C
Threshold for intake high temperature during heat pump operation	Fw	M/S	30,0		0 to 100.0	°C
Threshold for intake high temperature during defrost. operation	Fx	M/S	30,0		0 to 100.0	°C
Type of refrigerant	Fy	M/S	R407c		R22 / R134a / R404a R407c / R410a / R507c R290 / R600 / R600a R717R / 744	
CustomValve: minimum steps	Fz	M/S	0		0 to 8100	
CustomValve: maximum steps	Fz	M/S	1600		0 to 8100	
CustomValve: closing steps	FA	M/S	3600		0 to 8100	
CustomValve: return steps	FA	M/S	0		0 to 8100	
CustomValve: enable extra step at opening	FB	M/S	N.		N/Y	
CustomValve: enable extra step at closure	FB	M/S	N.		N/Y	
CustomValve: current operating	FC	M/S	250		0 to 1000	mA
CustomValve: current stopped	FC	M/S	100		0 to 1000	mA
CustomValve: frequency	FD	M/S	100		32 to 330	Hertz
CustomValve: duty cycle	FD	M/S	50		0 to 100	%
Minimum value of evaporat. pressure probe	FE	M/S	-0,5		-9.9 to 10.0	Bar
Maximum value of evaporat. pressure probe	FE	M/S	7,0		3.5 to 200.0	Bar
Delay super heat low alarm	FF	M/S	0		0 to 3600	seconds
Delay high temperature intake alarm	FF	M/S	0		0 to 3600	seconds
Delay LOP alarm	FG	M/S	0		0 to 3600	seconds
Delay MOP alarm	FG	M/S	0		0 to 3600	seconds
Input new constructor-driver password	FH	M/S	1234		0 to 9999	
		M/S				

8 SCREENS

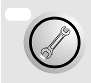
Screens can be divided into 5 categories:

- **USER** screens, not password protected: they appear in all loops except "**prog**" and "**menu+prog**" and show probe values, alarms, hours of operation of the devices, time and date, and can be used to set temperature and humidity set points and for clock set-up. They are marked with the "⓿" symbol in the parameters table below.
- password-protected **USER** screens (password 1234, editable): called up by pressing the "**prog**" key, via these screens you can set the main functions (times, set points, differentials) of connected devices. Screens referring to functions that are not available are not displayed. They are marked with the "❶" symbol in the parameters table below.
- password-protected **MAINTENANCE** screens (password 1234, editable): called up by pressing the **"maintenance"** key. Via these screens you can monitor devices, set connected probes, edit hours of operation and manage devices in manual mode. They are marked with the "❷" symbol in the parameters table below.
- password-protected **MANUFACTURER** screens (password 1234, editable): called up by pressing key combination "**menu+prog**" - via these screens you can configure the air-conditioner and enable main functions, as well as choosing connected devices. They are marked with the "❸" symbol in the parameters table below.

8.1 LIST OF SCREENS

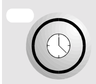
Screens appearing on the display are listed below. The table's columns represent screen loops, and the first screen (A0, B0…) is the one that appears when you press the relevant key. You can then use the arrow keys to scroll through the others. The codes (Ax, Bx, Cx…) appear in the top right corner of the screens, making them easier to identify. The meaning of the symbols ⓿, ❶… is explained in the section above. The PSW symbol indicates screens where you are required to enter passwords.

⓪	M0



⓪	A0
⓪	A1
⓪	A2
⓪	A3
PSW	A4
②	A7
②	A8
②	A9
②	Aa
②	Ab
②	Ac
②	Ad
②	Ae
②	Af

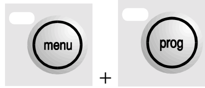
⓪	I0
⓪	I1
⓪	I2
⓪	I3
⓪	I4
⓪	I5
⓪	I6
⓪	I7
⓪	I8
⓪	I9
⓪	Ia
⓪	Ib
⓪	Ic
⓪	Id
⓪	Ie
⓪	If
⓪	Ig
⓪	Ih



⓪	K0

⓪	S0
⓪	S1
⓪	S2

PSW	P0
①	P1
①	P2
①	P3
①	P4
①	P5
①	P6
①	P7
①	P8
①	P9
①	Pa
①	Pb
①	Pc
①	Pd
①	Pe
①	Pf
①	Pg



	PSW	Z0
CONFIGURATION →	③	C0
	③	C1
	③	C2
	③	C3
	③	C4
	③	C5
	③	C6
	③	C7
	③	C8
	③	C9
	③	Ca
	③	Cb
	③	Cc
		.....
	③	Cs
	③	Ct
PSW FOR EEV DRIVER →	③	Cu
	③	F0
	③	F1
	③	F2
	③	F3
	③	F4
	③	F5
	③	F6
	③	F7
	③	F8
	③	F9
	③	Fa
	③	Fb
	③	Fc
		.....
	③	Fu
	③	Fv
	③	Fw
	③	Fx
	③	Fy
	③	Fz
	③	FA
	③	FB
	③	FC
	③	FD
	③	FE
	③	FF
	③	FG
	③	FH

9 CONTROL

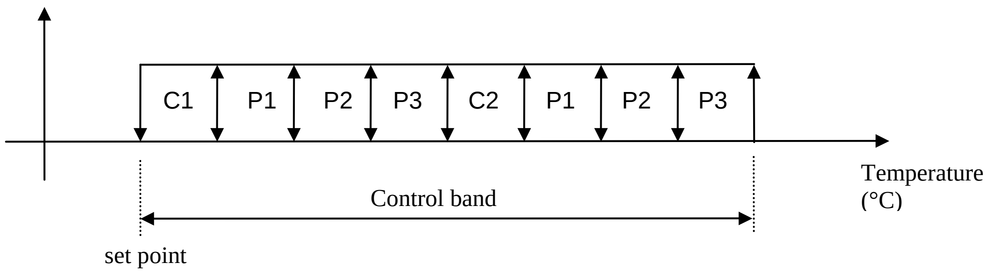
9.1 INLET TEMPERATURE CONTROL

9.1.1 INLETS USED
- Inlet temperature

9.1.2 OUTLETS USED
- All compressors and the relevant capacity controls

9.1.3 PARAMETERS USED
- Control set point
- Proportional band for control at inlet.
- Type of control (proportional or proportional + integral)
- Integration time (if the proportional + integral control is enabled)
- Type of unit
- Total number of compressors
- Number of capacity controls

Example: a control diagram for machines with a max. of 2 semi-hermetic compressors with a max. of three capacity controls



C1 → compressor 1
P1 → capacity control 1
P2 → capacity control 2
P3 → capacity control 3

C2 → compressor 2
P1 → capacity control 1
P2 → capacity control 2
P3 → capacity control 3

All network compressors will be positioned proportionally in the band.

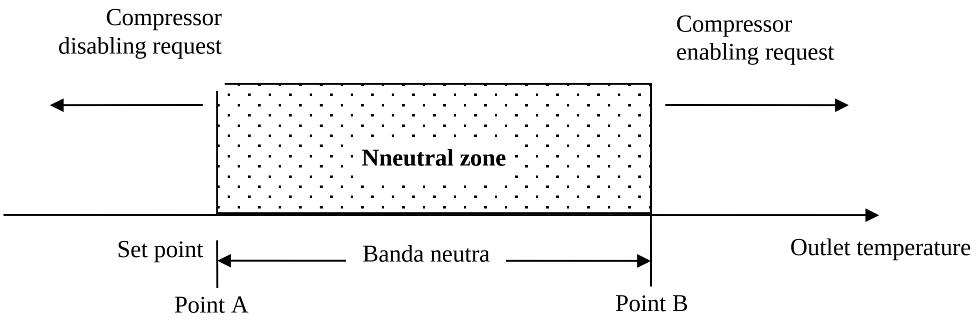
9.2 TEMPERATURE CONTROL AT OUTLETS

9.2.1 INLETS USED
- Outlet temperature

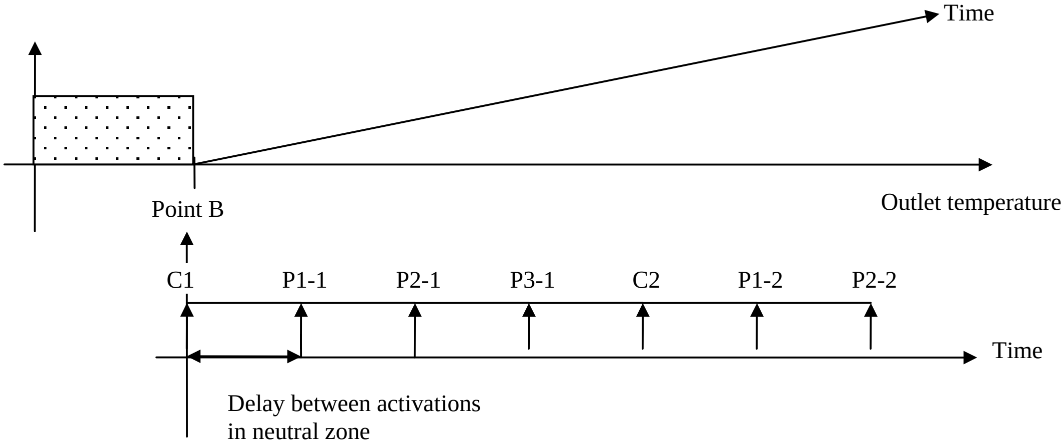
9.2.2 OUTLETS USED
- All compressors and capacity controls

9.2.3 PARAMETERS USED
- Control set point
- Neutral band for control. at outlet
- Step activation time
- Step disabling time
- Minimum limit of temperature at outlet (powers down all compressors without observing the disabling time)
- Maximum limit of temperature at outlet (powers down all compressors without observing the disabling time)

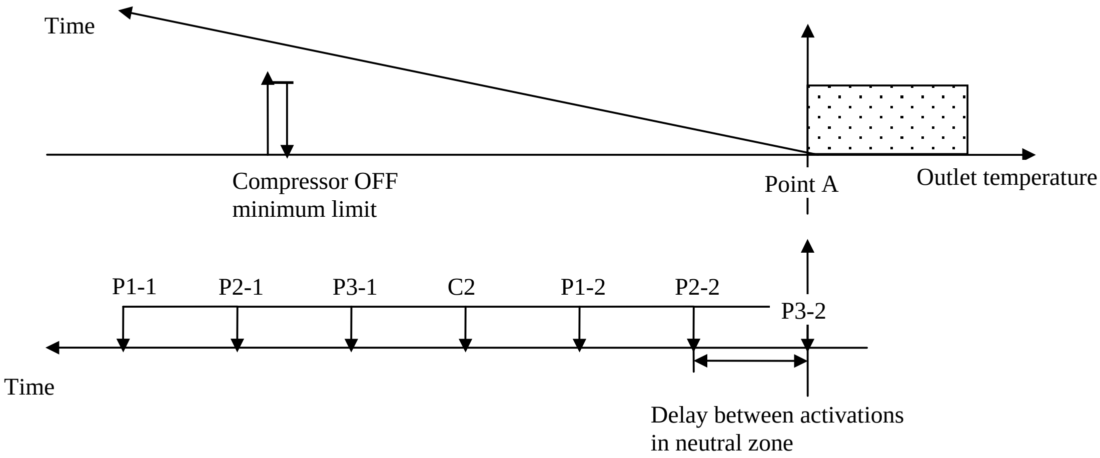
Diagram of temperature control at outlet:



As long as the temperature remains inside the neutral zone, no compressor is enabled or disabled (outlet temperature between point A and point B).
Compressor enabling request (outlet temperature higher at point B):



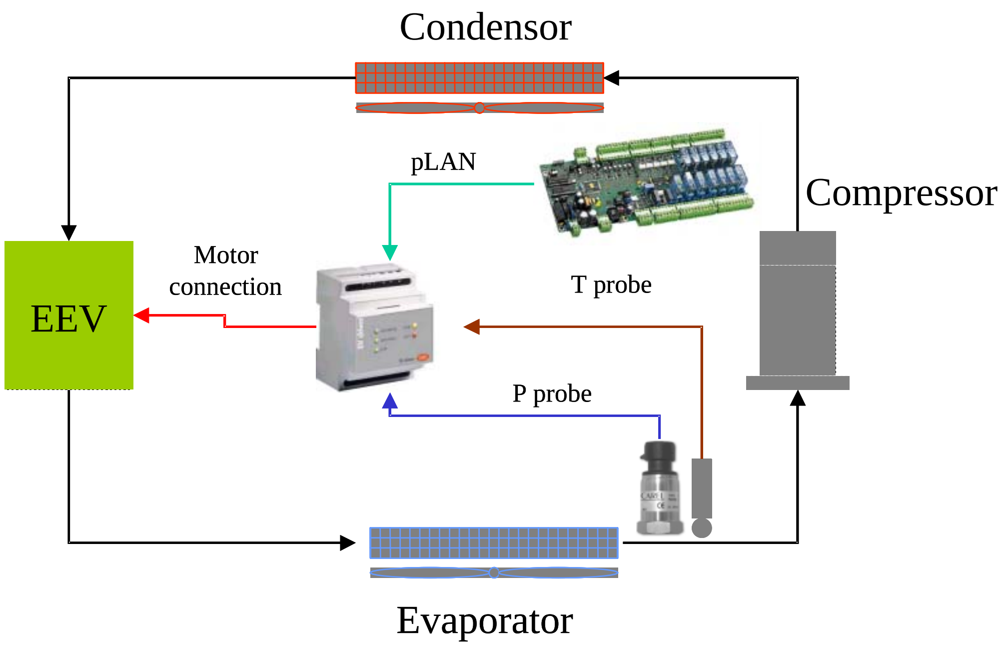
As long as the temperature is higher at point B, the compressors are activated with a delay between activations equal to parameter "delay between activations in neutral zone":
Disabling active devices:



As long as the temperature is lower at point A, the compressors are activated with a delay between activations equal to parameter "delay between power-downs in neutral zone":
If the temperature falls below the minimum limit, the compressors are forcibly powered down if the times were not satisfied (this control is introduced to prevent the unit entering antifreeze alarm status).

10 ELECTRONIC EXPANSION VALVE

The EV Driver module for piloting the electronic expansion valves (EEV) for the pLAN network, makes it possible to control intake superheating to enable the refrigerating unit to operate more efficiently and with greater versatility.
We say efficiently, because by improving and stabilising the flow of refrigerant to the evaporator, we increases the system's overall performance, while guaranteeing safety (low pressure pressure switch less frequently tripped, fewer returns of liquid refrigerant to the compressor,…). Furthermore, if the EEV is correctly sized, use of condensation pressure (or evaporation pressure,) either floating or at low set-point, considerably increases the system's efficiency, while ensuring lower energy consumption and greater refrigerating yield.
It is versatile, because the electronic expansion valve makes it possible to serve refrigerating units with a lower refrigerating capacity and in operating conditions which may differ considerably from each other.
Using an expansion valve entails the installation not only of the EVDriver and the expansion valve itself, but also of a temperature sensor and a pressure transducer, both located on the refrigerating side at the end of the evaporator (on the compressor's intake pipe). Consult the following diagram for a better understanding of the system's typical lay-out.



The basic principle of the new control algorithm is to reach the superheating set-point quickly.
In this light, these are the priorities to be considered for optimal control of the refrigerating system: obtaining a high, constant refrigerating yield rather than very low, stable superheating.
The heart of the control is a PID control with settable coefficients for superheating.

These are the additional controls:

	LOW	(Low superheating with integral time and adjustable threshold)
	LOP	(Low evaporation pressure, operating in transients only, with integral time and adjustable threshold)
	MOP	(High evaporation pressure with integral time and adjustable threshold)
	HiTcond	(High condensation pressure, enablable only with the condensation pressure probe read by pCO, with integral time and adjustable threshold)

The parameters table describes the control parameters with thresholds and default values. The table below explains the meaning of the VALVE TYPE parameter (see screens F1- F2):

PARAMETER VALUE	TYPE OF CORRESPONDING VALVE
0	Alco EX5 – EX6
1	Alco EX7
2	Alco EX8
3	Sporlan SEI 0.5 - 11
4	Sporlan SEi 25
5	Sporlan SEI 50 – SHE 250
6	Danfoss ETS 50
7	Danfoss ETS 100
8	---
9	Carel E2V**P
10	Carel E2V**A
11	Custom (other type of valve)

10.1 DRIVER PARAMETERS

In this section, we shall explain the essential parameters of greatest interest for setting up the driver.
The screen code (see chap. "PARAMETERS LIST") is used (in brackets) to describe these parameters, in order to help you find the appropriate parameter.
Each pCO* card manages a maximum of two drivers. As they have the same configuration, this section illustrates the first driver's configuration only.

10.1.1 Valve Type and battery presence (F0)

The type of valve and battery presence are set on this first screen. These are the possible valves:

- Alco (EX5, EX6, EX7, EX8)
- Sporlan (SEI 0.5, SEI 1, SEI 2, SEI 3.5, SEI 6, SEI 8,5, SEH 100, SEH 175, SEH 250)
- Danfoss (ETS50, ETS100)
- Carel EVD200
- Custom valve (if none of the valves described above are the one used by the user).

10.1.2 EEV circ. percentage ratio (F1)

This indicates the ratio, as a percentage, between the maximum refrigerating capacity of the circuit controlled by the EVDriver and the capacity obtainable through maximum opening of the expansion valve, *under the same operating conditions.* Operating conditions are all the system variables which influence the refrigerating yield of both the system and the valve (condensation temperature, subcooling, superheating, loss of load,….)

10.1.3 Super-heat set-point in mode CH/HP/DF (F4/F5/F6)

Set-point for superheating control. <u>We advise you not to use values below 3°C</u>
Superheating control dead band. Control is not enabled for temperatures in the range *Sheat Set – SH Dead band and Sheat Set + SH Dead band*
For example, a dead band value of 1°C, with a set-point of 5°C, means that superheating can vary from 4°C and 6°C without the control attempting to change it. The algorithm resumes controlling outside that range. <u>We advise you not to use values of over 2°C</u>
Attention: Suffix -CH means that these parameters are used for chiller operation. These parameters must be configured also for heat pump and defrosting operation.

10.1.4 PID parameters in operation CH/HP/DF (F4/F5/F6)

Constants used for PID control of the EVDriver. The respectively represent the following:

- Proportional gain
- Integrating time constant
- Derivative time constant

In this case too, the three types of operation must be configured.

10.1.5 Low super-heat threshold for operation CH/HP/DF (F4/F5/F6)

The low superheating threshold and relevant integral constant for activating the low superheating protection. This protection usually leads to the closing of the electronic valve.If the integral constant is zero, the protection is disabled.
In this case too, the three types of operation must be configured.

10.1.6 LOP threshold in operation CH/HP/DF (F4/F5/F6)

The low intake pressure threshold and relevant integral constant for activating LOP protection. This protection usually leads to the opening of the electronic valve. If the integral constant is zero, the protection is disabled.
In this case too, the three types of operation must be configured.

10.1.7 MOP threshold in operation CH/HP/DF (F4/F5/F6)

The high intake pressure threshold and relevant integral constant for activating MOP protection. This protection usually leads to the closing of the electronic valve. If the integral constant is zero, the protection is disabled.
In this case too, the three types of operation must be configured.

10.1.8 High condensation temperature threshold in operation CH/HP/DF (F4/F5/F6)

The high condensation pressure threshold and relevant integral constant for activating the protection. This protection usually leads to the closing of the electronic valve. If the integral constant is zero, the protection is disabled.
In this case too, the three types of operation must be configured.

10.1.9 Refrigerant (Fy)

Type of refrigerant used in the unit:

10.1.10 Configuration of the evaporation pressure probe (FE)

This screen is used for setting the minimum and maximum values of the refrigerant pressure probe range at the outlet of the evaporator connected to the driver.

10.2 SPECIAL FUNCTION "IGNORE"

```
+--------------------+
|State of driver 1 Ad|
|                    |
|Valve not shut      |
|Ignore? N           |
+--------------------+
```

There are three alarm conditions which prevent the driver from performing normal control (one of these is shown above):
- an open valve → during the last blackout, the valve was not shut completely
- battery charge → the battery is not operating correctly or it is discharged or disconnected
- EEPROM restart → malfunctioning EEPROM

When one of these conditions is active, the following alarm appears:

```
+--------------------+
|AL074               |
|D1:Wait due to error|
|eeprom/batt.rechg.or|
|open valve          |
+--------------------+
```

With the "Ignore" function, these alarms can be ignored to enable the driver to control the valve (otherwise the driver would keep the valve shut).

ATTENTION! cancelling the alarms means ignoring them, and, therefore, we advise you to carefully check that the system is not damaged, is not malfunctioning or does not become unreliable (e.g.: if "recharge battery" is signalled, this probably means that the battery is not charged or not connected, etc. In the event of a blackout, this may not allow the valve to close. The valve would therefore stay shut even when the system restarts.

If none of the three above alarms is present, the screen changes over to the next screen:

```
+--------------------+
¦State of driver 1 Ad¦
¦                    ¦
¦No fault            ¦
¦                    ¦
+--------------------+
```

11 COMPRESSOR ROTATION

The call rotation of the compressors is such that the number of hours and the number of starts-stops of different compressors are equal. Rotation follows the FIFO Logic (First in first out), i.e. the first compressor to be activated is the first to be disabled. This behaviour may lead, at the initial stage, to considerable differences in the operating hours of the compressors, however, the hours are very similar to each other in steady state.
Rotation occurs only among the compressors and not among the capacity controls.

11.1 ROTATION-FREE MANAGEMENT

- Power-up sequence: C1,C2,C3,C4
- Power-down sequence: C4,C3,C2,C1

11.2 MANAGEMENT WITH FIFO ROTATION (FIRST IN FIRST OUT)

- Power-up sequence: C1,C2,C3,C4
- Power-down sequence: C1,C2,C3,C4

12 CONDENSATION CONTROL

12.1 OPERATING MODES

- ON/OFF linked to compressor operation (without pressure transducers)
- ON/OFF or modulating linked to reading by the pressure transducer (if the high pressure transducers were enabled)
- ON/OFF or modulating linked to reading by the battery 1 and 2 temperature probes (if the battery temperature probes were enabled)

12.1.1 INPUTS USED

- high pressure probe C1
- high pressure probe C2
- battery temperature probe C1
- battery temperature probe C2

12.1.2 OUTPUTS USED

- Fan 1
- Fan 2
- Fan 3
- Speed control for fans C1 AOUT 1
- Speed control for fans C2 AOUT 2

12.1.3 PARAMETERS USED

- Selection of condensation control None /pressure/temperature
- Type of condensation battery (Single/Separate)
- Condensation set-point
- Condensation band
- Number of fans per battery
- Enable prevent function
- Prevent threshold
- Prevent differential
- Output voltage for inverter minimum speed
- Output voltage for inverter maximum speed
- Inverter speed-up time

12.2 ON/OFF CONDENSATION LINKED TO OPERATION OF COMPRESSOR

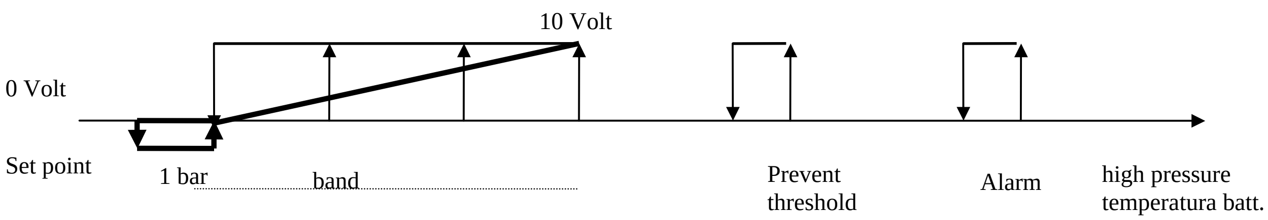
With this type of condensation, fan operation will solely depend on compressor operation:
Compressor OFF = fan OFF
Compressor ON = fan ON

12.3 ON/OFF CONDENSATION LINKED TO PRESSURE OR TEMPERATURE SENSOR

With this type of condensation, fan operation depends on compressor operation and on the value read by the pressure or temperature sensors according to a set-point or to a band. When the pressure/temperature is lower than or equal to the set-point, all fans are OFF, but when the pressure/temperature rises to set-point + band, all fans are ON.
You may select condensation with a single or separate battery: with single battery condensation, the fans are commanded by the highest pressure/temperature; with separate battery condensation, every pressure/temperature sensor commands its fan.

12.4 MODULATING CONDENSATION LINKED TO PRESSURE OR TEMPERATURE SENSOR

With this type of condensation, the fans will be controlled through a 0/10 V analogue output, in proportion to demand by the pressure/temperature sensors. In this case too, you may select single battery or separate batteries condensation. The control is according to the same methods described above. If the lower limit of the ramp is greater than 0 V, there will not be a proportional straight line, but, as in the first section of the graph, it will be below the set-point-diff. by one step.



12.5 PREVENT FUNCTION

This function can be selected under the constructor password, and is used to prevent circuits shutting down due to high pressure.
With the compressor ON, when this threshold is reached, the compressor is capacity-control forced until pressure drops below the set-point - differential (both can be set). With the compressor OFF when this threshold is reached, compressor forcing is replaced by forced power up of the fans.

13 DEFROSTING CONTROL FOR WATER/AIR MACHINE

13.1.1 *INPUTS USED*
- Battery 1 temperature (can be used as a pressure switch)
- Battery 2 temperature (can be used as a pressure switch)
- Input for defrosting pressure switch 1
- Input for defrosting pressure switch 2

13.1.2 *PARAMETERS USED*
- Inputs used for defrosting
- Type of overall defrosting (simultaneous / separate)
- Type of local defrosting (simultaneous / separate)
- Defrosting start set-point
- Defrosting stop set-point
- Defrosting maximum delay time
- Maximum defrosting time

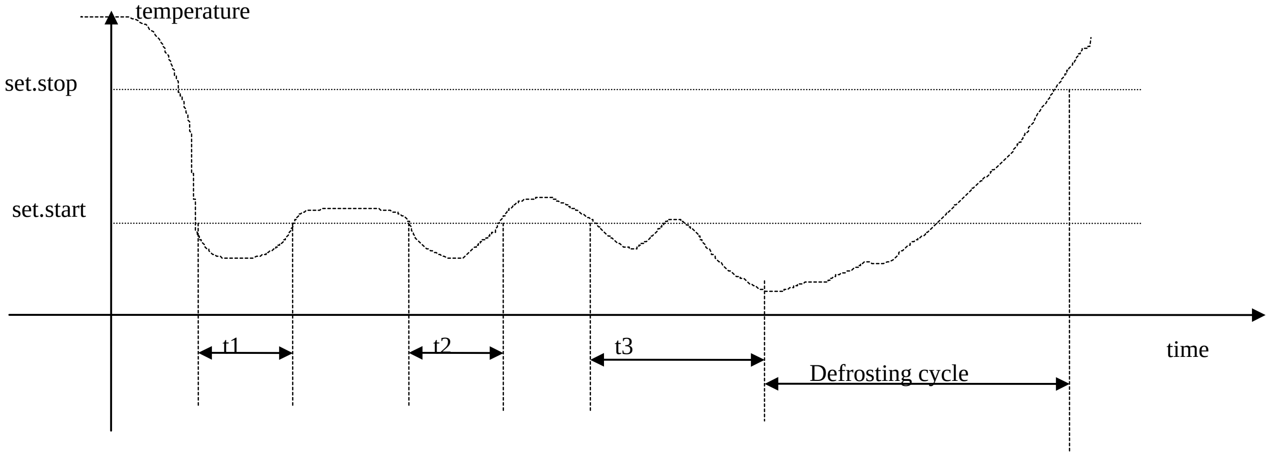
13.1.3 *OUTPUTS USED*
- Compressor 1
- Compressor 2
- Compressor 3
- Compressor 4
- Cycle reversing solenoid-valve 1
- Cycle reversing solenoid-valve 2
- Circuit No.1 fan
- Circuit No.2 fan

13.2 DEFROSTING TYPE 1
overall simultaneous / local simultaneous
Only one circuit has to request entering the defrosting cycle for all circuits to forcibly enter defrosting. Circuits which do not need to defrost (temperature above defrosting stop set-point) stop and wait. As soon as all circuits finish defrosting, the compressors may redstart on heat pump operation.

13.3 DEFROSTING TYPE 2
overall separate / local simultaneous
With this type of defrosting, there is a separate defrosting among the different pCO units, and a simultaneous defrosting inside the pCO Unit.
The first pCO unit requesting to defrost enters defrosting (simultaneous defrosting inside the unit). Even if they request defrosting, the other units continue waiting (still operating on the heat pump) unit the first unit finishes defrosting. When the first unit finishes, the next unit needing to defrost enters defrosting (simultaneous inside the unit) and the others continue waiting.

13.4 DEFROSTING TYPE 3
overall separate / local separate
With this type of defrosting, each refrigerating circuit enters defrosting separately. The first circuit requesting to defrost enters defrosting, whereas, the others, even if they request defrosting, continue waiting until the first has finished defrosting. When it has finished, the next circuit needing to defrost enters defrosting and the others continue to wait.

Defrosting a circuit with time/temperature control



If the battery temperature/pressure remains below the defrosting start set-point for a cumulative time equal to defrosting delay time, the circuit in question enters a defrosting cycle.

- the system's refrigerating capacity reaches maximum value
- the refrigerating circuit is reversed with the 4-way valve
- the fan in question is switched OFF (if pressure probes are installed, the fan can come into operation at a certain threshold to prevent the circuit entering high pressure)

The circuit leaves the defrosting cycle due to temperature/pressure (if battery temperature exceeds the defrosting stop set-point) or due to maximum time if the defrosting cycle exceeds the set maximum time threshold.

Defrosting a circuit with time/pressure switches control:
control is exactly the same, with the difference that the status of the pressure switches is counted rather than temperature/pressure.

The fans are usually OFF during the defrosting cycle. They are activated only if the pressure probes were enabled and pressure exceeds the prevent threshold - in this way the unit is prevented from going into high pressure alarm status.

14 CONTROLLING UNIT RECOVERY

14.1.1 *INPUTS USED*

- Water T at evaporator input B1
- Water T at evaporator output B2
- Water T at recovery input
- Water T at recovery output

14.1.2 *OUTPUTS USED*

- Valve A
- Valve B
- Valve C

14.1.3 *PARAMETERS USED*

- Recovery/use priority
- Recovery set-point
- Recovery band

14.2 RECOVERY PRIORITY

14.2.1 *SUMMER OPERATION*

With the use temperature controller dissatisfied and the recovery temperature controller satisfied , the machine is in ***chiller only*** operating mode. The compressors are controlled by the evaporator water temperature.
With the use temperature controller dissatisfied and the recovery temperature controller dissatisfied , the machine is in ***chiller + recovery*** operating mode. The compressors are controlled by the recovery water temperature.
With the use temperature controller satisfied and the recovery temperature controller satisfied, the machine is in ***recovery only*** operating mode. The compressors are controlled by the recovery water temperature.

14.2.2 *WINTER OPERATION*

With the use temperature controller satisfied and the recovery temperature controller satisfied , the machine is in ***heat pump*** operating mode. The compressors are controlled by the evaporator water temperature.
With the use temperature controller dissatisfied and the recovery temperature controller dissatisfied , the machine is in ***recovery only*** operating mode. The compressors are controlled by the recovery water temperature.
With the use temperature controller satisfied and the recovery temperature controller dissatisfied , the machine is in ***recovery only*** operating mode. The compressors are controlled by the recovery water temperature.
If the unit requests defrosting, the machine is in ***defrosting*** operating mode.

14.3 USE PRIORITY

14.3.1 *SUMMER OPERATION*

With the use temperature controller dissatisfied and the recovery temperature controller satisfied, the machine is in ***chiller only*** operating mode. The compressors are controlled by the evaporator water temperature.
With the use temperature controller dissatisfied and the recovery temperature controller dissatisfied , the machine is in ***chiller + recovery*** operating mode. The compressors are controlled by the evaporator water temperature.
With the use temperature controller satisfied and the recovery temperature controller satisfied , the machine is in ***recovery only*** operating mode. The compressors are controlled by the recovery water temperature.

14.3.2 *WINTER OPERATION*

With the use temperature controller satisfied and the recovery temperature controller satisfied , the machine is in ***heat pump*** operating mode. The compressors are controlled by the evaporator water temperature.
With the use temperature controller dissatisfied and the recovery temperature controller dissatisfied , the machine is in ***heat pump*** operating mode. The compressors are controlled by the evaporator water temperature.
With the use temperature controller satisfied and the recovery temperature controller dissatisfied , the machine is in ***recovery only*** operating mode. The compressors are controlled by the recovery water temperature.
If the unit requests defrosting, the machine is in ***defrosting*** operating mode.
The condensation fans are ON in all operating modes with the exception of chiller + recovery and defrosting.
The different operating modes are selected by the control by means of three relays according to the following table.

Summer operation	valve A (recovery)	Valve B (use)	Valve C (summer/winter)
Chiller only	*OFF*	*ON*	*OFF*
Chiller + recovery	*ON*	*ON*	*OFF*
Recovery only	*ON*	*OFF*	*OFF*

Winter operation	valve A (recovery)	Valve B (use)	Valve C (summer/winter)
Heat pump	*OFF*	*ON*	*ON*
Recovery only	*ON*	*OFF*	*ON*
Defrosting	*OFF*	*OFF*	*ON*

15 Free Cooling Control

<u>Inputs used</u>

- Water temperature at evaporator outlet
- Water temperature at inlet of Free Cooling battery
- Outside air temperature

<u>Parameters used</u>

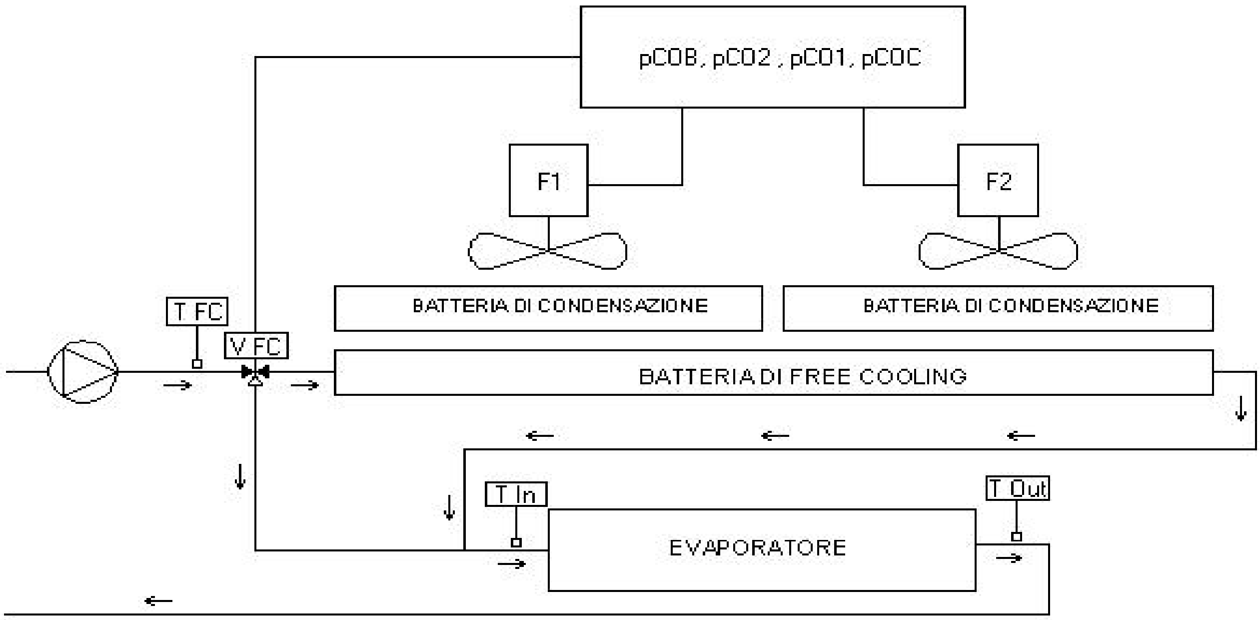
- Type of unit
- Number of units
- Type of condensation
- Number of fans
- Free Cooling valve type
- Free Cooling type control
- Integration time
- Control set-point
- Control set point offset
- Minimum Free Cooling Delta
- Maximum Free Cooling Delta
- Free Cooling Control differential
- Maximum threshold for Free Cooling valve opening
- Minimum threshold for condensation speed controller
- Free Cooling antifreeze threshold
- Compressor activation delay

<u>Outputs used</u>

- Condensation fans
- Condensation fans speed controller
- Free Cooling ON/OFF valve
- Free Cooling 3-way valve

15.1.1 Description of operation

Free Cooling control makes it possible to exploit the temperature conditions of external air to facilitate cooling use water.
To this end, an heat exchanger is supplied. If necessary, a certain quantity of water is returned to this heat exchanger by the system, deviated via an appropriately commanded valve.
The favourable conditions of outside air cause the water to cool beforehand, and, therefore activation of the cooling devices is delayed.
Free Cooling is available in the air/water unit in the internal Free Cooling mode only. i.e. with the Free Cooling battery housed inside the machine near the condensation battery/ies, with which its shares control of the condensation fan/s.



BATTERIA DI CONDENSAZIONE	=	*CONDENSATION BATTERY*
BATTERIA DI FREE COOLING	=	*FREE COOLING BATTERY*
EVAPORATORE	=	*EVAPORATOR*

15.2 Free Cooling activation condition

The entire Free Cooling procedure is based on a relationship between the temperature value measured by the external temperature probe, and the temperature value measured by the temperature probe located at the input of the Free Cooling battery and the set Free Cooling delta.

External T. ≤ Free Cooling Input T. – Free Cooling Delta

If this condition occurs, the control manages Free Cooling, enabling /disabling the dedicated devices.

15.3 Free Cooling Thermostat

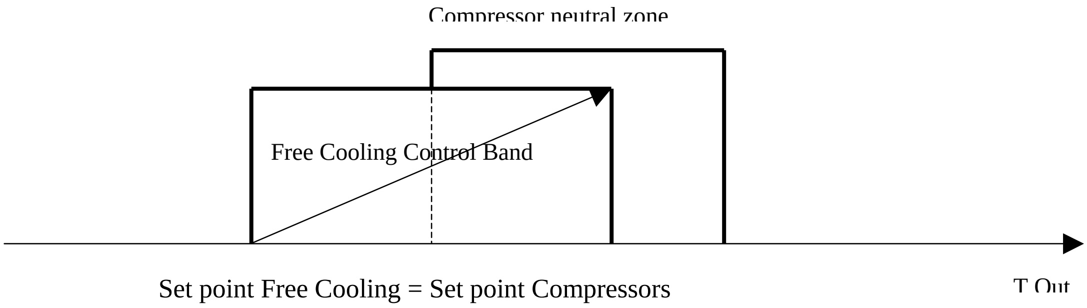
Free Cooling control exploits the calculated control set-point values (taking into account any compensation) and the set Free Cooling control differential.
The control is based on the water temperature measured by the probe located at the evaporator outlet, considering the effective supply of cold of the Free Cooling exchanger according to the different external temperature conditions.
Two different control modes can be selected: proportional, proportional + integral - the integration constant must be set in the latter case.

The set-point for thermostatic control of Free Cooling will be determined according to the nominal value of the temperature of the water you wish the unit to produce.
According to the type of control adopted for compressor control (input - output), and as the temperature references are different, two distinct control graphs must be identified.

In machines controlled output with a neutral zone, the Free Cooling control set-point will correspond to the control set-point of the compressors.

Free Cooling Set-point = Compressors set point

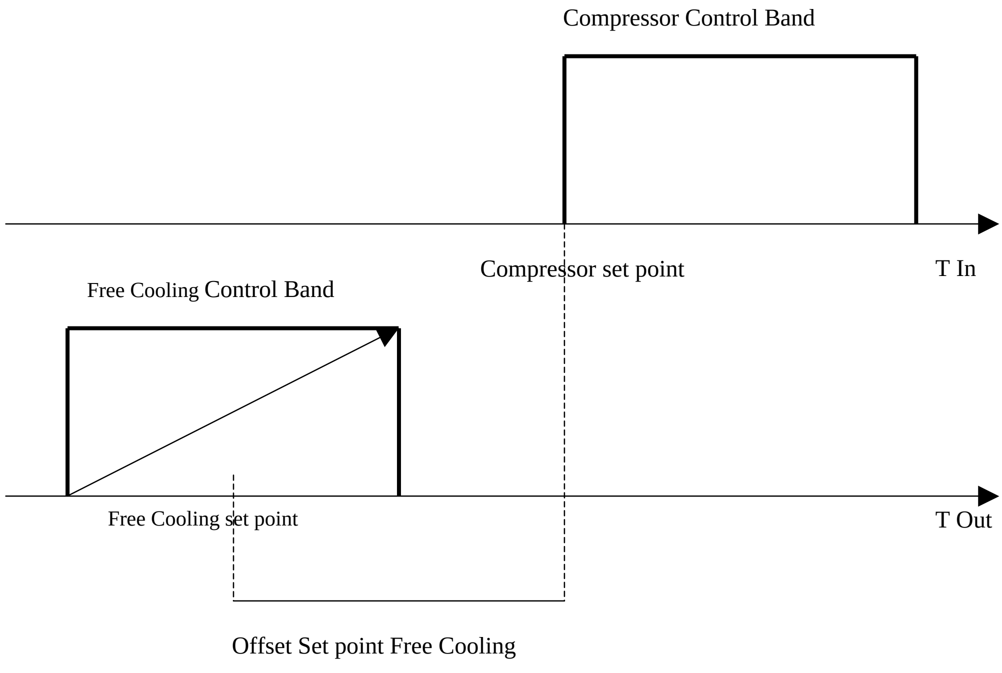
The proportional control band will be equally distributed at the sides of the set-point.



In machines controlled at output with a lateral proportional band, the Free Cooling control set-point takes into account an offset with respect to the control set-point of the compressors to compensate for the presence of the evaporating battery.

Free Cooling Set-point = Compressors - Offset Set point

The proportional control band will be equally distributed at the sides of the set-point.



In the Free Cooling control band, the activation thresholds for dedicated devices (e.g. valves and fans or speed variators) will be calculated in different ways according to the type of selection.

As the fans and/or speed variators are shared by Free Cooling control and condensation control, if one or more compressors in a given refrigerating circuit is/are enabled, priority will be given to condensation control to protect the circuit itself.

The Free Cooling valve will, in any event, be maintained fully open to provide as high as possible a thermal yield even at minimum ventilating capacity.

To optimise Free Cooling performance during the machine start transients and in steady state operating situations, a by-pas time is applied for thermostatic control of the compressors.
The purpose of this time is to delay the activation of the compressors in order to give Free Cooling sufficient time to reach the steady state conditions and take the machine's yield to nominal value. Only after this time has elapsed, and with the main thermostat dissatisfied, the compressors are commanded to operate. If time is set to 0, the function will be disabled.

While the unit is operating, the same parameter is used by Free Cooling control to reassess the machine's working conditions according to the value measured by the external temperature probe.
A further temperature delta should be set. This identifies a second threshold below which the yield of the Free Cooling battery is so high that it can fully satisfy the system's thermal load solely through combined operation of valve and fans.

If the compressors are ON, the external temperature falls below "maximum delta" set according to the following relation:

External T. ≤ Free Cooling Input T. – Free Cooling "Maximum Delta"

and this condition continues for a continuous time period equal to the set by-pass time for the compressors. When this time has elapsed, the compressors will be commanded to OFF followed by a changeover to pure Free Cooling operation to satisfy load requirements with minimum use of energy.
When the by-pass time for thermostatic control of the compressors has again elapsed, the requests will be re-assessed.

An antifreeze threshold is specified . It is based on the temperature value of external air to protect the heat exchanger when operating in a cold environment.
If the temperature of external air is lower than the set threshold, the valve controlling water flow inside the Free Cooling exchanger will be commanded to open, and the main circulation pump will be enabled (if OFF). This pump moves the fluid and prevents the interior of the exchanger from freezing.

If the valve is a 0-10V type, the degree of opening will depend on the unit's operating status.

- with the machine OFF, opening to 100% of capacity will be commanded
- with the machine ON, opening to 10% of capacity will be commanded

If the valve is of the ON/OFF type, it will always open to maximum value irrespective of the unit's operating mode.
The entire procedure will finish as soon as the external air temperature reaches a fixed hysteresis of 1.0°C with respect to the set threshold.

15.4 Free Cooling disabling conditions

There are two main causes of the closure of the Free Cooling valve: the first depends on the external temperature conditions, and the second on thermostatic demand.

The Free Cooling valve will close if the Free Cooling conditions stop.

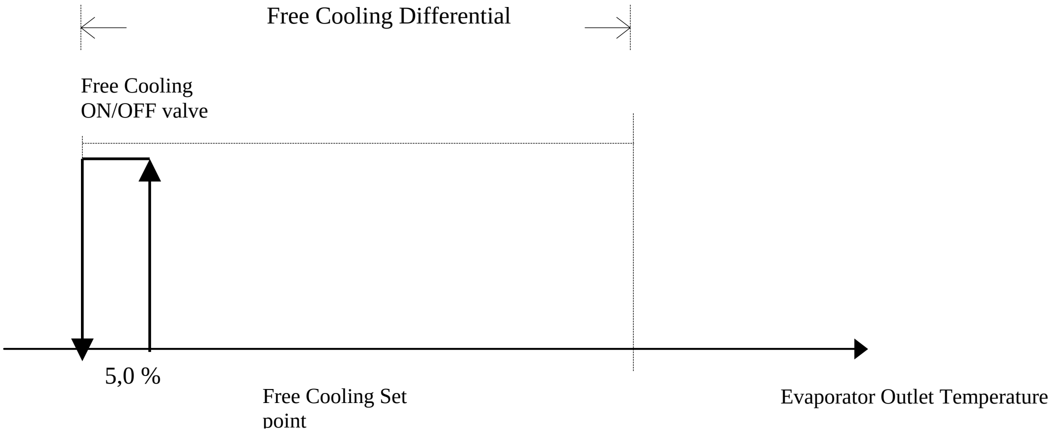
External T. ≤ Free Cooling Input T. – (Free Cooling Delta) + 1.5°C

The Free Cooling valve will close if the Free Cooling thermostat is satisfied.

For system safety, the reading of the water temperature probe a the evaporator outlet will be checked. According to the set thresholds, the following will be processed: an antifreeze pre-alarm, which will enable any post-heating heaters and totally disable the Free Cooling devices; and an antifreeze alarm which will totally disable the unit.
Other system safety devices : serious alarm from digital input, circulation pump thermal cutout, failed control probe, failed antifreeze control probe, evaporator flow-switch alarm, phase monitor alarm. These safety device will totally disabled the unit, and, therefore, stop the Free Cooling control.

Free Cooling ON/OFF valve

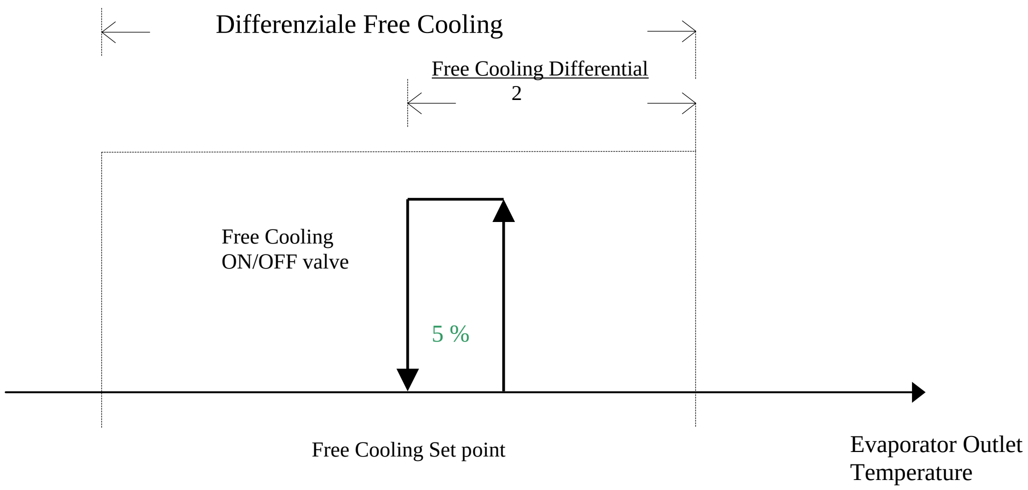
15.4.1 Proportional setting



If temperature conditions favour Free Cooling control, the Free Cooling ON/OFF valve will be activated as soon as temperature exceeds the activation threshold of the individual step, identified by a temperature value of:

Control Set-point - Free Cooling Differential +5.0% Free Cooling Differential
The step amplitude is fixed at 5.0% of the set Free Cooling control differential.

15.4.2 Proportional + integral control



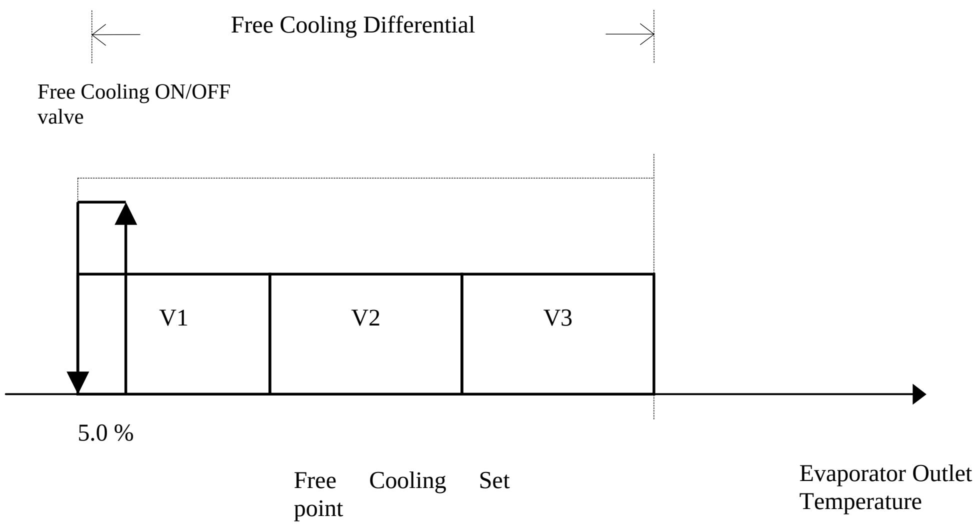
If temperature conditions favour Free Cooling control, the Free Cooling ON/OFF valve will be activated as soon as temperature exceeds the activation threshold of the individual step, identified by a temperature value of:

Control Set-point + 5.0% Free Cooling Differential

The step amplitude is fixed at 5.0% of the Free Cooling control differential.

15.5 Free Cooling ON/OFF valve with stepped condensation

15.5.1 Proportional control



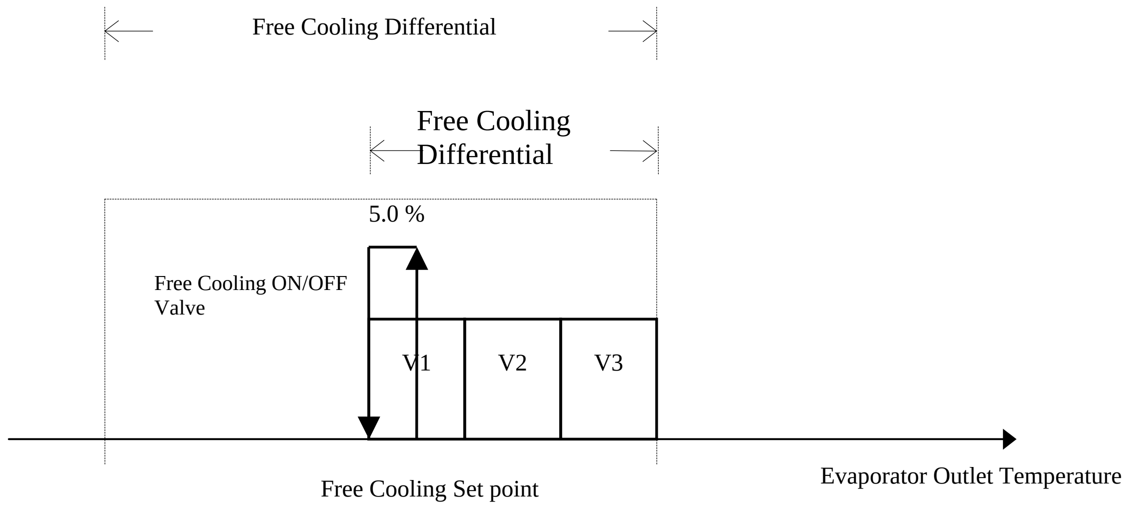
Here is an example of Free Cooling control with ON/OFF valve and three condensation steps.

The ON/OFF valve activation step will, in any case, be positioned in the first part of the control differential and will have an amplitude of 5.0% of the said differential.
The activation steps of the condensation fans will be positioned proportionally inside the Free Cooling control differential.
To calculate the amplitude of each step, use the following relation:

$$\text{Step amplitude} = \frac{\text{Free Cooling Differential}}{\text{(Number of Master fans X number of cards)}}$$

It is assumed that all the circuits controlled by the pCO cards making up the system are equivalent and that the number of controlled devices is the same.

15.5.2 Proportional + integral control



Here is an example of Free Cooling control with ON/OFF valve and three condensation steps.

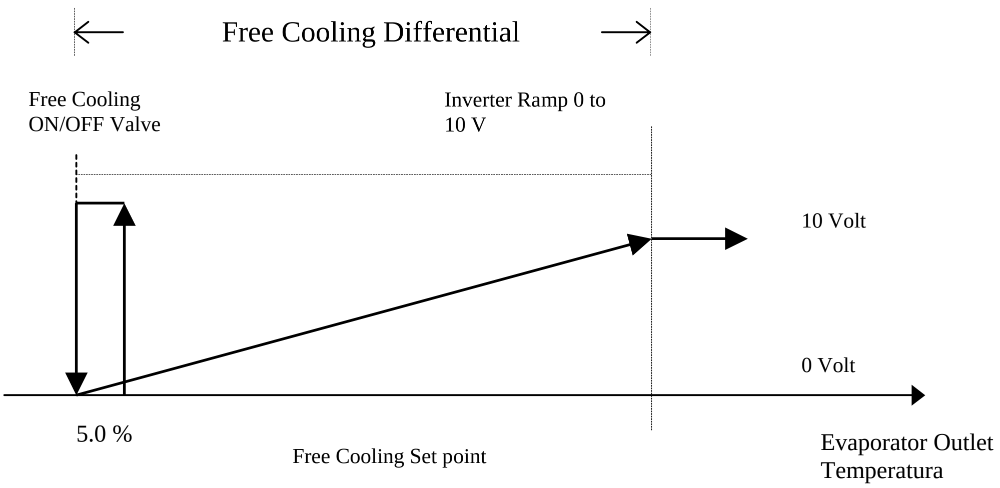
The devices, whether they are valve or fans, will be activated in the second half of the control differential through the effect of the integrating control. Their activation will be tied to the set integrating constant: the slower it is, the greater the value attributed to the specific parameter.
The amplitude of the valve control step will be 5.50% of the said control differential.
The amplitude of the fan control steps will be calculated according to the following relation:

$$\text{Step amplitude} = \frac{\text{Free Cooling Differential}}{\text{(Number of Master fans X number of cards)}}$$

It is assumed that all the circuits controlled by the pCO cards making up the system are equivalent and that the number of controlled devices is the same.

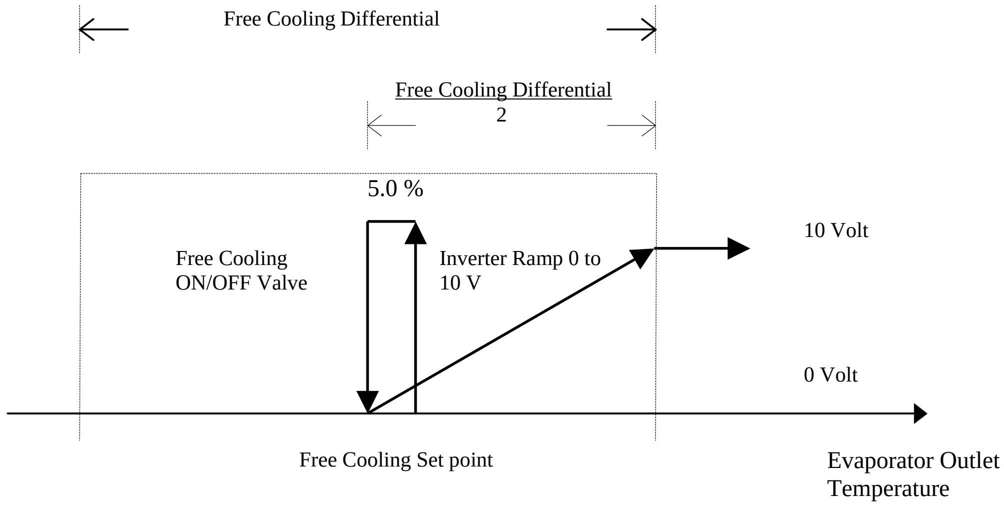
15.6 Free Cooling ON/OFF valve with inverter controlled condensation

15.6.1 Proportional control



The ON/OFF valve activation step will, in any case, be positioned in the first part of the control differential and will have an amplitude of 5.0% of the said differential.
The proportional ramp for piloting the analogue control output of the condensation inverter will be calculated on the entire control differential.
If necessary, Value 0-10 Volt can be further limited downward according to the minimum output voltage value set on the screen.
All proportional outputs relating to the different units of the system will be piloted in parallel

15.6.2 Proportional + integral control



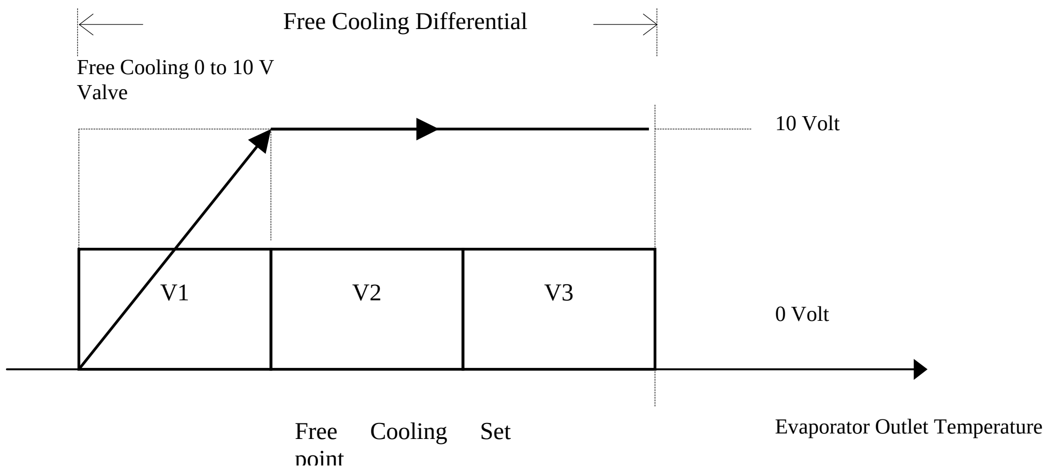
The devices, whether they are valve or fans, will be activated in the second half of the control differential through the effect of the integrating control. Their activation will be tied to the set integrating constant: the slower it is, the greater the value attributed to the specific parameter.
The amplitude of the valve control step will be 5.50% of the said control differential.
All proportional outputs relating to the different units of the system will be piloted in parallel

15.7 0-10 Volt Free Cooling ON/OFF valve

The Free Cooling valve is proportionally commanded in a different way depending on whether condensation control is in steps or by inverter.
The control diagrams of the two different situations are shown below.

15.8 0-10 Volt Free Cooling ON/OFF valve with stepped condensation

15.8.1 Proportional control

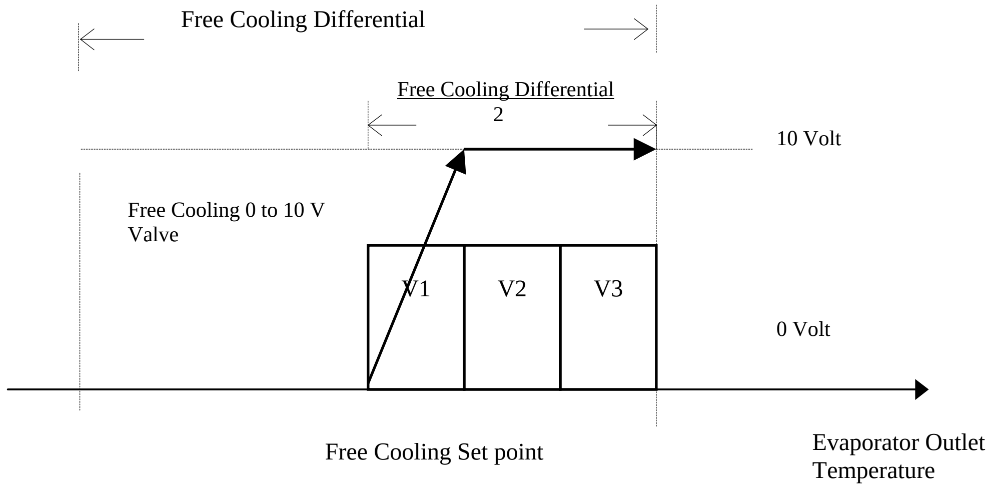


The proportional control ramp of the Free Cooling valve will be calculated inside the first activation step of the condensation fans. In this way, when the first fan is enabled, the valve will be completely open, and, therefore, water flow in the Free Cooling exchanger will be at maximum level.
The activation steps of the condensation fans will be positioned proportionally inside the Free Cooling control differential.
To calculate the amplitude of each step, use the following relation:

$$\text{Step amplitude} = \frac{\text{Free Cooling Differential}}{\text{(Number of Master fans X number of cards)}}$$

It is assumed that all the circuits controlled by the pCO cards making up the system are equivalent and that the number of controlled devices is the same.

15.8.2 Proportional + integral control



The devices, whether they are valve or fans, will be activated in the second half of the control differential through the effect of the integrating control. Their activation will be tied to the set integrating constant: the slower it is, the greater the value attributed to the specific parameter.
The proportional control ramp of the Free Cooling valve will be calculated inside the first activation step of the fans. In this way, when the first fan is enabled, the valve will be completely open, and, therefore, water flow in the Free Cooling exchanger will be at maximum level.
The activation steps of the fans will be positioned proportionally inside the Free Cooling control differential.

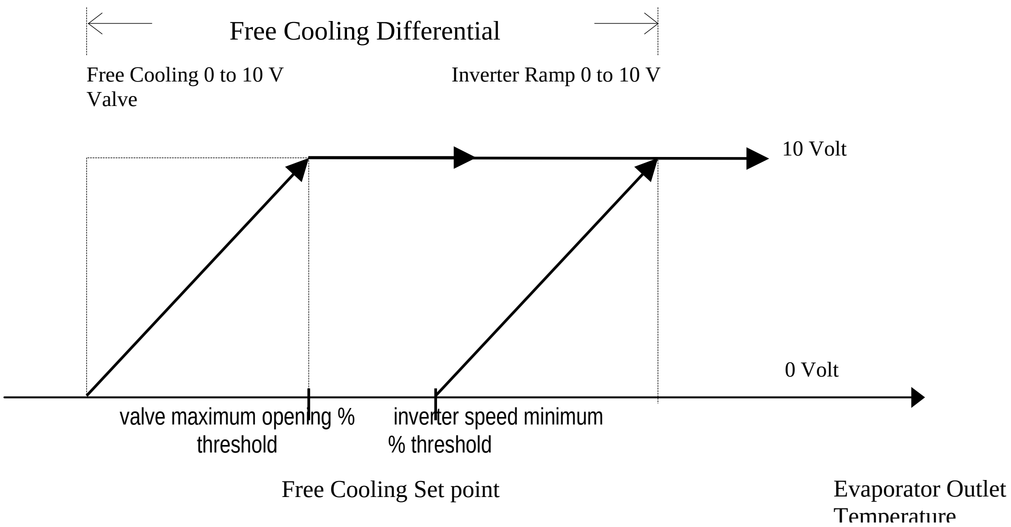
To calculate the amplitude of each step, use the following relation:

$$\text{Step amplitude} = \frac{\text{Free Cooling Differential}}{\text{(Number of Master fans X number of cards)}}$$

It is assumed that all the circuits controlled by the pCO cards making up the system are equivalent and that the number of controlled devices is the same.

15.9 0-10 Volt Free Cooling valve with inverter controlled condensation

15.9.1 Proportional control



The control proportional ramp of the Free Cooling valve will be calculated inside the area determined by the thresholds:
Control Set-point -Free Cooling Differential/2
Control Set-point -Free Cooling Differential/2 + valve maximum opening % Threshold

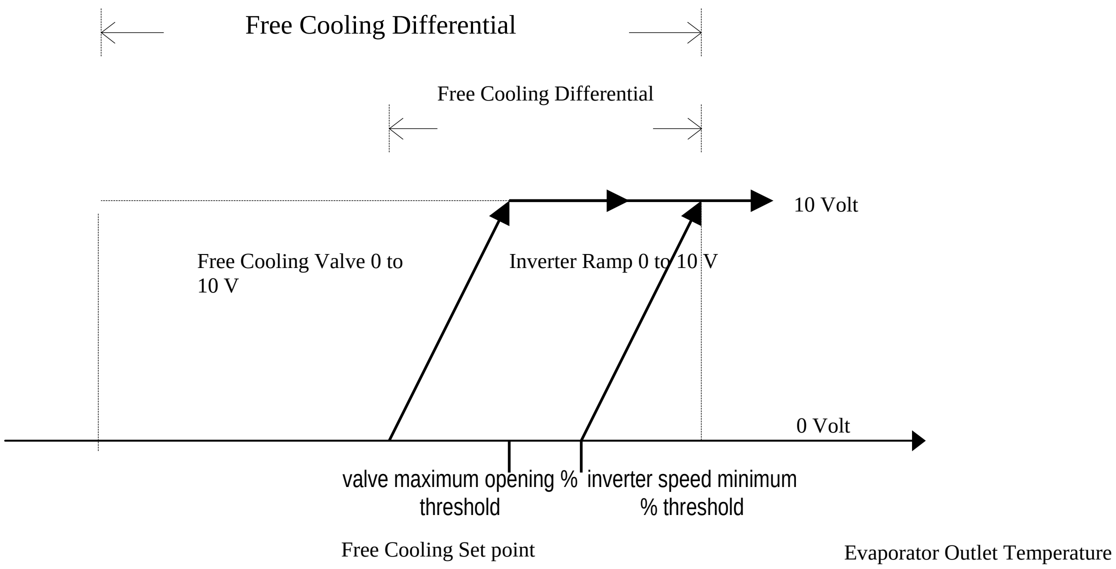
The control proportional ramp of the condensation inverter will be calculated inside the area determined by the thresholds:
Control Set-point -Free Cooling Differential/2 + inverter speed minimum % Threshold
Control Set-point + Free Cooling Differential/2

The start/end points of the two control ramps can be modified at the user's discretion by varying the value of the thresholds (see graph) as a percentage of the value of the set Free Cooling differential.
For the Free Cooling valve, the setting field ranges from 25 to 100% of the differential.
For the condensation inverter, the setting field ranges from 0 to 75% of the differential.

Example

Control set point	12.0ºC
Free Cooling Differential	4.0ºC
Free Cooling valve % threshold	40%
Condensation inverter % threshold:	80%
Proportional area for control of Free Cooling valve =	10.0 to 11.6 ºC
Control Set-point - Free Cooling Differential/2 =	10.0ºC
Maximum % threshold for valve opening =	1.6ºC
Proportional area for control of condensation inverter =	13.2 to 16.0 ºC
Control Set-point - Free Cooling Differential/2 =	10.0ºC
Control Set-point - Free Cooling Differential/2 + inverter speed minimum % Threshold =	13.2ºC

15.9.2 Proportional + integral control



The devices, whether they are valve or fans, will be activated in the second half of the control differential through the effect of the integrating control. Their activation will be tied to the set integrating constant: the slower it is, the greater the value attributed to the specific parameter.

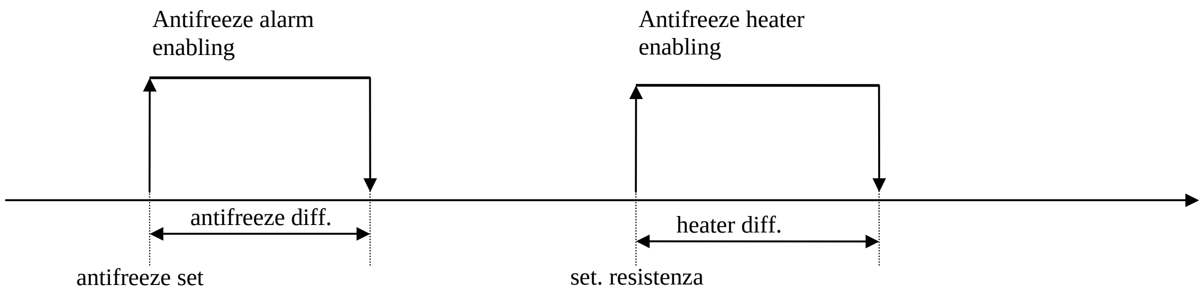
16 ANTIFREEZE CONTROL

16.1.1 *INPUTS USED*
- Temperature probe at Outlet

16.1.2 *PARAMETERS USED*
- enable probe at outlet
- antifreeze heater set point
- antifreeze heater differential
- antifreeze alarm set-point
- antifreeze alarm differential

16.1.3 *OUTPUTS USED*
- antifreeze heater

Every pCO unit is able to manage antifreeze control providing the temperature probe at outlet is connected and enabled.



Antifreeze control is always enabled, even if the machine is OFF, both in summer and winter operating modes.

Note: the antifreeze alarm on any pCO unit shuts down the entire machine.

17 ALARMS

17.1 General description

Alarms are divided into three categories:

- Warning-only alarms (only warning on display and buzzer, warning on display, buzzer, alarm relay)
- Circuit alarms (only disable relevant circuit, warning on display, buzzer, alarm relay)
- Serious alarm (disables whole system, warning on display, buzzer, alarm relay)

17.1.1 *WARNING-ONLY ALARMS*

- Unit maintenance alarm
- Compressor maintenance alarm
- Clock card faulty or disconnected alarm
- Unit disconnected from network alarm
- Driver alarms: high pressure on driver, superheating and valve not closed last time the unit switched off (“valve not closed during switch-off”)

17.1.2 *CIRCUIT ALARMS*

- High pressure/pressure switch alarm immediate compressor shut-down, with manual reset
- Low pressure alarm delayed at compressor start, immediate in steady state, with manual reset
- Compressor thermal overload alarm immediate compressor shut-down, with manual reset
- Oil differential alarm delayed on acquisition, with manual reset
- Fan thermal overload alarm immediate fan shut-down, with manual reset
- Driver alarm - probe error shut-down of compressor(s) on relevant circuit
- Driver alarm - motor error shut-down of compressor(s) on relevant circuit
- Driver alarm - EEPROM error shut-down of compressor(s) on relevant circuit
- Driver alarm - battery malfunct. shut-down of compressor(s) on relevant circuit (enablable)
- Driver alarm - low pressure shut-down of compressor(s) on relevant circuit (enablable and delayable)

17.1.3 *SERIOUS ALARMS*

- no water flow alarm digital input delayed at start and in steady state
- evaporator antifreeze alarm generated by evaporator outlet probe, with set point and differential for reset, reset manually
- serious alarm from digital input immediate unit shut-down, with manual reset

Alarms are reset by pressing the alarm key twice.
<u>None of the driver alarms are serious ones.</u>

17.2 ALARM LOGGING

The alarm log can store the standard chiller’s operating state when alarms are generated or at particular times. Each set of data stored is an event that can be viewed by selecting it from the list of logged events. The log proves useful when troubleshooting because a “snapshot” is taken of the system when the alarm occurs, which can later be used to help determine possible causes and how to remedy the trouble.
There are two kinds of log in the program, the STANDARD log and ADVANCED log.

17.2.1 STANDARD LOG

The pCO* boards’ considerable buffer space means events can be saved in the STANDARD log, which is always available on the various boards. If there is no clock card (optional extra on pCO1 and pCOC, built-in feature on pCO2), the STANDARD log just gives the alarm code.
The maximum number of events that can be logged is 100. Once the hundredth alarm is reached, i.e. the last available slot in the memory is taken, the oldest alarm (00) is erased as it is overwritten with the next alarm, and so on for subsequent events. Logged events cannot be deleted by the user unless installing factory settings. The STANDARD log screen can be called up by pressing the MAINTENANCE key, and looks like this:

```
+--------------------+
¦Alarms Log        A2¦
¦Event number      00¦
¦Alarm Code       000¦
¦Date  00:00 00/00/00¦
+--------------------+
```

For each alarm, the following data are stored relating to the standard chiller at the time of the alarm:

- alarm code
- time
- date
- chronological event number (0-99)

The chronological event number indicates the “seniority” of the event with respect to the 100 available storage slots. The alarm with number 00 is the first to occur after the STANDARD logs are enabled, and hence the oldest.
If you move the cursor onto the chronological number, you can run through the alarm log, from 0 to 99, using the arrow keys.
For instance, if you are on position 00, pressing the down arrow will not take you anywhere.
If 15 alarms have been logged, for instance, and you are on position 014, pressing the up arrow will not take you anywhere.

17.2.2 ADVANCED LOG

Events are logged on the 1MB or 2MB memory expansion module, which is a permanent appendix to the board. Advantages and features are listed below:

- Event-based log: a typical event-based log is the alarm log. When an alarm occurs, the alarm generated is stored along with significant data (temperatures, pressures, set points etc.).
- Time-based log: a typical event[*sic! probably* time]-based log is the temperatures/pressure log. Temperature and pressure values are stored at regular intervals.
- Log log: this is the log of the last alarms/temperatures/pressures stored before a serious alarm. Unlike data stored in the event- and time-based logs, these data are not overwritten when the memory is full.
- You have the option of choosing the values to be saved at any time as well as the method used to save them. Using the "WinLOAD" utility program, you can define the values to be saved and the method used to save them with the aid of a practical Wizard. WinLOAD does not need application software files as it can procure all the information required directly from the pCO1 – pCO2 board's resident application software.
- 1MB of dedicated FLASH memory. With this system, data are saved to the 1MB FLASH memory included in the memory expansion module (code PCO200MEM0). By way of example, 1MB of memory can hold 5,000 alarm events with 5 values for each alarm, and 6 months of recording 2 values - for instance, temperature and pressure - saved every 5 minutes.
- Option of defining up to 7 different log configurations. Usually, each controller will have one alarm log and one log for control values (temperature/humidity/pressure) configured, in addition to a number of "log logs".
- Stored data can be consulted either via the (separate or built-in) LCD terminal or via a connected PC.
- "Black box" operating mode. The memory expansion module containing the logs can be removed from the controlled unit's pCO^2 and inserted in another pCO^2, via which the stored data can be consulted. The host pCO^2 does not need to contain the same software as the original.
- Stored data reliability. Data are saved to a FLASH memory that does not need batteries, which are liable to run down. If previously stored data are not compatible with new software following an upgrade, all data are erased (you are prompted to confirm first).

17.3 ALARM TABLE

Code	Alarm description	OFF Compressors	OFF Fans	OFF Pump	OFF System	Reset Aut/Man	Delay	Enablements
	CHILLER							
AL01	Serious alarm	*	*	*	*	man	no	enablable from both master and slave
AL02	Antifreeze alarm	*	*		*	settable	no	you can select from manual and automatic resetting
AL03	Evaporator Pump thermal cutout	*	*	*	*	man	no	
AL04	Condenser Pump thermal cutout	*	*	*	*	man	no	
AL05	Evaporator flow-switch	*	*		*	man	settable	enablable from both master and slave
AL06	Condenser flow-switch	*	*		*	man	settable	
AL10	Low pressure pressure-switch 1	*Circuit 1				man	settable	
AL11	Low pressure pressure-switch 2	*Circuit 2				man	settable	
AL12	High pressure pressure-switch 1	*Circuit 1				man	no	
AL13	High pressure pressure-switch 2	*Circuit 2				man	no	
AL14	Oil differential pressure switch 1	*Circuit 1				man	settable	
AL15	Oil differential pressure switch 2	*Circuit 2				man	settable	
AL16	Comp. 1 thermal cutout	*Comp. 1				man	no	
AL17	Comp. 2 thermal cutout	*Comp. 2				man	no	
AL20	Fan 1 thermal cutout		*			man	no	
AL21	Fan 2 thermal cutout		*			man	no	
AL22	Fan 3 thermal cutout		*			man	no	
AL23	High pressure Transducer 1	*Circuit 1	*			man	no	
AL24	High pressure Transducer 2	*Circuit 2	*			man	no	
AL30	B1 probe failed	*	*	*	*	auto.	60 sec.	
AL31	B2 probe failed	*	*	*	*	auto.	60 sec.	
AL32	B3 probe failed					auto.	60 sec.	
AL33	B4 probe failed					auto.	60 sec.	
AL34	B5 probe failed					auto.	60 sec.	
AL35	B6 probe failed					auto.	60 sec.	
AL36	B7 probe failed					auto.	60 sec.	
AL37	B8 probe failed					auto.	60 sec.	
AL40	Pump Maintenance					man		
AL41	Comp. 1 maintenance					man..		
AL42	Comp. 2 maintenance					man.		
AL50	Unit 1 offline					auto.	30 sec.	
AL51	Unit 2 offline					auto.	30 sec.	
AL54	Evaporator thermal cutout					man.		
AL55	32k clock card failed					man.		
	DRIVER 1							
AL56	Driver1 - probe Error	*Circuit				man.		
AL57	Driver1 - EEPROM Error	* Circuit				man.		
AL58	Driver1 - EEV Motor Error	*Circuit				man.		
AL59	Driver1 - Battery Error	*Circuit				man.		
AL60	Driver1 - Evaporation high pressure					man	Settable	
AL61	Driver1 - Evaporation low pressure (LOP)					man	Settable	
AL62	Driver1 - Low Super-Heat	*Circuit				man	Settable	
AL63	Driver1 - Valve not shut during power-down	*Circuit				man.		
AL64	Driver1 - Intake high temperature					man	Settable	
AL74	Time-out for non-shut valve, EEPROM or battery not charging driver 1	*Circuit				man.		
AL76	Driver 1 offline	*Circuit				man.	30 sec.	
	DRIVER 2							
AL65	Driver2 - Probe Error	*Circuit				man.		
AL66	Driver2 - EEPROM Error	*Circuit				man.		
AL67	Driver2 - EEV Motor Error	*Circuit				man.		
AL68	Driver2 - Battery Error	*Circuit				man.		
AL69	Driver2 - Evaporation high pressure (MOP)					man	Settable	
AL70	Driver2 - Evaporation low pressure (LOP)					man	Settable	
AL71	Driver2 - Low Super-Heat	*Circuit				man	Settable	
AL72	Driver2 - Valve not shut at power-down	*Circuit				man.		
AL73	Driver2 - Intake high temperature					man	Settable	
AL75	Time-out for non-shut valve, EEPROM or battery not charging driver 2	*Circuit				man		
AL77	Driver 2 offline	*Circuit				man.	30 sec.	

17.4 SHORT SUMMARY OF ALARMS COMING FROM DRIVER

- probe error (temperature and/or pressure probe malfunctioning or failed)
- stepper motor error (valve motor connections fault)
- EEPROM error (EEPROM reading or writing malfunction)
- battery error (battery malfunction)
- high pressure on EXV driver (operating pressure has exceeded max. MOP threshold)
- high pressure on EXV driver (operating pressure has exceeded max. LOP threshold)
- superheat low alarm (overheating alarm)
- valve not closed during switch-off (valve not fully closed after last blackout)
- high intake temperature alarm (operating temperature has exceeded max. threshold)

standby due to EEPROM error/battery recharge or open valve

18 SUPERVISOR

pCO1, pCO2 and pCOC can be connected to a local supervision PC, and to the most common BMSs (Modbus and Bacnet) To use the listed functions, you must insert the optional RS485 card or Gateway card (instruments interpreting the different communication protocols).

Follow the list of variables managed by the supervisor.

18.1 DIGITAL VARIABLES

Flow	Type	Index	Description
OUT	D	1	Unit On/Off Powers up all connected units on the master. On every single slave unit, it works as an activation "enabler".
OUT	D	10	Digital output 1
OUT	D	11	Digital output 2
OUT	D	12	Digital output 3
OUT	D	13	Digital output 4
OUT	D	14	Digital output 5
OUT	D	15	Digital output 6
OUT	D	16	Digital output 7
OUT	D	17	Digital output 8
OUT	D	18	Digital output 9
OUT	D	19	Digital output 10
OUT	D	20	Digital output 11
OUT	D	21	Digital output 12
OUT	D	22	Digital output 13
OUT	D	28	Indicates if the unit is a MASTER
OUT	D	29	Indicates if the unit is a SLAVE
OUT	D	40	Main Pump (or main Fan)
OUT	D	41	Condenser Pump
IN/OUT	D	42	On/Off from Supervisor
IN/OUT	D	44	Selection of chiller/HP mode from supervisor
OUT	D	46	Free Cooling enable according to configuration
OUT	D	47	Air/air unit selected : 0=Main_Fun, 1=Main_Pump
OUT	D	48	Water/water unit selected : enable condenser pump.
OUT	D	49	Digital Input for selecting chiller / HP Mode
OUT	D	50	Enable digital Input for selecting chiller / HP Mode
OUT	D	51	Operating modes: 0=Chiller, 1= heat pump
IN/OUT	D	53	Selection of condenser type : 0= single, 1=double
IN/OUT	D	56	Select inverter or stepped operating mode : 0 = inverter, 1 = stepped
OUT	D	57	Selected operating mode: 1 = inverter, 0 = stepped
IN/OUT	D	58	Selection of freecooling type valve : On/Off
OUT	D	59	Selection of freecooling type valve : 0 / 10V
IN/OUT	D	60	Selection of capacity controls logic : 0= normally closed, 1=normally open
IN/OUT	D	61	Selection of 4-way valve logic : 0= normally closed, 1=normally open
IN/OUT	D	30	Enable probe B1
IN/OUT	D	31	Enable probe B2
IN/OUT	D	32	Enable probe B3
IN/OUT	D	33	Enable probe B4
IN/OUT	D	34	Enable probe B5
IN/OUT	D	35	Enable probe B6
IN/OUT	D	36	Enable probe B7
IN/OUT	D	37	Enable probe B8
OUT	D	70	General alarm
OUT	D	71	Antifreeze alarm
OUT	D	72	Comp. 1 thermal cutout
OUT	D	73	Comp. 2 thermal cutout
OUT	D	74	Comp. 3 thermal cutout
OUT	D	75	Comp. 4 thermal cutout
OUT	D	76	Condenser flow-switch alarm
OUT	D	77	Evaporator flow-switch alarm

Flow	Type	Index	Description
OUT	D	78	Circuit 1 high pressure alarm (pressure switch)
OUT	D	79	Circuit 2 high pressure alarm (pressure switch)
OUT	D	80	Circuit 1 oil differential alarm
OUT	D	81	Circuit 2 oil differential alarm
OUT	D	82	Circuit 1 low pressure alarm
OUT	D	83	Circuit 2 low pressure alarm
OUT	D	84	Transducer 1 high pressure alarm
OUT	D	85	Transducer 2 high pressure alarm
OUT	D	86	Serious alarm from digital input
OUT	D	87	Thermal cutout alarm for condensation fan 1
OUT	D	88	Thermal cutout alarm for condensation fan 2
OUT	D	89	Thermal cutout alarm for condensation fan 3
OUT	D	90	Main fan thermal cutout alarm
OUT	D	91	Condenser pump thermal cutout alarm
OUT	D	92	Evaporator pump thermal cutout alarm
OUT	D	93	Alarm: unit 1 disconnected
OUT	D	94	Alarm: unit 2 disconnected
OUT	D	97	Alarm: B1 probe failed or disconnected
OUT	D	98	Alarm: B2 probe failed or disconnected
OUT	D	99	Alarm: B3 probe failed or disconnected
OUT	D	100	Alarm: B4 probe failed or disconnected
OUT	D	101	Alarm: B5 probe failed or disconnected
OUT	D	102	Alarm: B6 probe failed or disconnected
OUT	D	103	Alarm: B7 probe failed or disconnected
OUT	D	104	Alarm: B8 probe failed or disconnected
OUT	D	105	Alarm: main pump or main fan maintenance
OUT	D	106	Compressor 1 maintenance alarm
OUT	D	107	Compressor 2 maintenance alarm
OUT	D	110	Alarm: 32K clock card failed or disconnected
OUT	D	111	Device 1 (compressor or capacity control) status. If it is a capacity control, status is irrespective of selected logic (NO/NC).
OUT	D	112	Device 2 (compressor or capacity control) status. If it is a capacity control, status is irrespective of selected logic (NO/NC).
OUT	D	113	Device 3 (compressor or capacity control) status. If it is a capacity control, status is irrespective of selected logic (NO/NC).
OUT	D	114	Device 4 (compressor or capacity control) status. If it is a capacity control, status is irrespective of selected logic (NO/NC).
OUT		115	Defrosting not finished from pressure switch/es
OUT		116	Machine not water/water
OUT		117	Recovery enabled
OUT		118	Outside set-point disabled
OUT		119	Unit in heat pump operating mode
OUT		132	Unit not ON
OUT		155	Driver 2 enabled (present)
OUT		156	Compressors of circuit 1 disabled due to alarm/s originating from driver (or from drivers) controlled by circuit 1.
OUT		157	Compressors of circuit 2 disabled due to alarm/s originating from driver (or from drivers) controlled by circuit 2.
IN/OUT		124	Enable compressor 1
IN/OUT		125	Enable compressor 2
IN/OUT		126	Enable compressor 3
IN/OUT		127	Enable compressor 4
OUT	D	133	DRIVER 1 alarm - probes failed or disconnected
OUT	D	134	DRIVER 1 alarm - stepped motor failed or disconnected
OUT	D	135	DRIVER 1 alarm - EEPROM malfunctioning
OUT	D	136	DRIVER 1 alarm - Battery failed or disconnected
OUT	D	137	DRIVER 1 alarm - high pressure
OUT	D	138	DRIVER 1 alarm - low pressure
OUT	D	139	DRIVER 1 alarm - low super-heat

Flow	Type	Index	Description
OUT	D	140	DRIVE 1 alarm - valve not shut (after last shut-down)
OUT	D	141	DRIVER 1 alarm - high intake pressure
OUT	D	142	DRIVER 1 alarm - time-out due to EEPROM error/battery recharge or open valve
OUT	D	144	DRIVER 2 alarm - probes failed or disconnected
OUT	D	145	DRIVER 2 alarm - stepped motor failed or disconnected
OUT	D	146	DRIVER 2 alarm - EEPROM malfunctioning
OUT	D	147	DRIVER 2 alarm - Battery failed or disconnected
OUT	D	148	DRIVER 2 alarm - high pressure
OUT	D	149	DRIVER 2 alarm - low pressure
OUT	D	150	DRIVER 2 alarm - low super-heat
OUT	D	151	DRIVE 2 alarm - valve not shut (after last shut-down)
OUT	D	152	DRIVER 2 alarm - high intake pressure
OUT	D	153	DRIVER 2 alarm - time-out due to EEPROM error/battery recharge or open valve

18.2 ANALOGUE VARIABLES

Flow	Type	Index	Description
OUT	A	1	Analogue input 1
OUT	A	2	Analogue input 2
OUT	A	3	Analogue input 3
OUT	A	4	Analogue input 4
OUT	A	5	Analogue input 5
OUT	A	6	Analogue input 6
OUT	A	7	Analogue input 7
OUT	A	8	Analogue input 8
OUT	A	9	Analogue output 1
OUT	A	10	Analogue output 2
IN/OUT	A	11	Summer set-point (evaporator set-point)
IN/OUT	A	12	Winter set-point (condenser set-point)
IN/OUT	A	13	Condensation set-point
OUT	A	14	Current set-point
IN/OUT	A	15	Control band
IN/OUT	A	16	Temperature delta for enabling freecooling
IN/OUT	A	17	Temperature differential for controlling fans in freecooling mode
IN/OUT	A	18	Start of defrosting threshold
IN/OUT	A	19	End of defrosting threshold
OUT	A	20	Summer set-point lower limit
OUT	A	21	Summer set-point upper limit
OUT	A	22	Winter set-point lower limit
OUT	A	23	Winter set-point upper limit
IN/OUT	A	24	Recovery control set point
IN/OUT	A	25	Recovery control band
IN/OUT	A	26	Condensation differential
OUT	A	27	Current value of super-heat driver 1
OUT	A	28	Evaporated saturated gas temperature, driver 1 (calculated on evaporation pressure)
OUT	A	29	Superheat probe temperature reading, driver 1
OUT	A	30	Evaporation pressure probe reading, driver 1
OUT	A	31	Value of driver 1 condensation temperature (if the condensation pressure probe is configured)
OUT	A	32	Current value of super-heat driver 2
OUT	A	33	Saturated temperature of driver 2 evaporation (calculated with evaporation pressure)
OUT	A	34	Superheat probe temperature reading, driver 2
OUT	A	35	Evaporation pressure probe reading, driver 2
OUT	A	36	Value of driver 2 condensation temperature (if the condensation pressure probe is configured)
OUT	A	37	Set-point of super-heat driver 1
OUT	A	38	Set-point of super-heat driver 2

18.3 ENTIRE VARIABLES

Flow	Type	Index	Description
OUT	I	1	STEFA supervisor
OUT	I	2	STEFA supervisor
OUT	I	3	STEFA supervisor
OUT	I	4	STEFA supervisor
OUT	I	5	STEFA supervisor
OUT	I	6	STEFA supervisor
OUT	I	7	STEFA supervisor
OUT	I	8	STEFA supervisor
OUT	I	9	STEFA supervisor
OUT	I	10	Compressors remote control
OUT	I	11	Recovery modes: 1 = recovery only 2 = chiller 3 = chiller + recovery 4 = defrosting 5 = recovery only 6 = heat pump
OUT	I	12	Machine status : 0= Unit enabled 1 = shut down by alarm 2 = shut down by supervisor 3 = shut down by hour bands 4 = shut down by digital input (DIN3) 5 = shut down by local element (terminal keyboard) 6 = manual operating mode
IN/OUT	I	13	Fan control by : 0 = nothing 1 = pressure 2 = temperature
OUT	I	20	Count of main pump duty hours (high number word)
OUT	I	21	Count of main pump duty hours (low number word)
OUT	I	22	Count of compressor 1 duty hours (high word)
OUT	I	23	Count of compressor 1 duty hours (low number word)
OUT	I	24	Count of compressor 2 duty hours (high number word)
OUT	I	25	Count of compressor 2 duty hours (low number word)
OUT	I	26	Count of compressor 3 duty hours (high number word)
OUT	I	27	Count of compressor 3 duty hours (low number word)
OUT	I	28	Count of compressor 4 duty hours (high number word)
OUT	I	29	Count of compressor 4 duty hours (low number word)
OUT	I	30	Configuration of output devices for all units : 0 = CCCC 1 = CPCP 2 = CPPP [C = compressor ; P = capacity control]
IN/OUT	I	31	Selection of machine type : 0 - 23 (see manual)
OUT	I	32	Type of circuit (physical) = 0 = water / air 1 = air / air 2 = water / water
IN/OUT	I	33	Total number of compressor on machine
IN/OUT	I	34	Number of compressors per unit (equal for all units)
IN/OUT	I	35	Number of capacity controls per unit (equal for all units)
IN/OUT	I	36	Number of condensation fans (1-3 for single condenser, 1-2 for double condenser)
OUT	I	37	Circuit 1 inverter speed
OUT	I	38	Circuit 2 inverter speed

Flow	Type	Index	Description
OUT	I	39	Opening of freecooling valve :
OUT	I	40	Analogue output 1
OUT	I	41	Analogue output 2
IN/OUT	I	42	Type of defrosting
IN/OUT	I	43	Defrosting delay time
IN/OUT	I	44	Maximum defrosting time
OUT	I	46	Serial address for communication to BMS network
IN/OUT	I	51	Driver 1 - Ignores "wait for re-initialisation…" alarms and continues with control
IN/OUT	I	52	Driver 2 - Ignores "wait for re-initialisation…" alarms and continues with control
OUT	I	54	Driver 1 valve position
OUT	I	55	Diver 1 battery status
OUT	I	56	Remaining capacity of driver 1 battery
OUT	I	57	Circuit 1 refrigerating capacity (as a percentage)
OUT	I	60	Driver 2 valve position
OUT	I	61	Diver 2 battery status
OUT	I	62	Remaining capacity of driver 2 battery
OUT	I	63	Circuit 2 refrigerating capacity (as a percentage)
OUT	I	70	Type of fault at driver 1 start-up
OUT	I	71	Type of fault at driver 2 start-up
OUT	I	72	Type of refrigerant
OUT	I	73	Type of driver 1 electronic valve
OUT	I	74	Type of driver 2 electronic valve

FLOW				TYPE	
IN	Supervisor	→	pCO	D:	Digital
OUT	Supervisor	←	pCO	I:	Entire
IN/OUT	Supervisor	←→	pCO	A:	Analogue

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