

Application program for pCO², pCO¹, pCO^c and pCO^{xs}



Standard Rooftop 1/2 compressors

Manual version: 1.1 dated 06/05/04

Program code: **FLSTDMRT0E**

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**READ AND SAVE
THESE INSTRUCTIONS**

CAREL
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We want to save you time and money

We can assure you that reading this manual from start to finish will guarantee you correct installation and safe use of the product described herein.

IMPORTANT WARNINGS



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

The device this software refers to was built to operate risk free for the intended purposes, providing:

- all conditions prescribed and contained in the installation and operating manual of the equipment in question are observed.
- the software is installed, programmed, run and maintained by qualified personnel according to the instructions in this manual.

Any other use, and the making of modifications not expressly authorized by the manufacturer, are considered improper.

The user shall be exclusively responsible for injuries and damage caused through improper use.

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1. Introduction

The "Standard rooftop" application program is compatible with pCO², pCO¹ medium, pCO^C, and pCO^{xs} boards.

It manages a rooftop air-conditioning unit comprising two compressors (1 on pCO^{xs}), an external damper and a heating valve.

Up to 16 boards can be connected in pLAN with addresses from 1 to 16 in addition to a shared terminal with the address 32. Each board manages a rooftop unit independently and can be controlled by the terminal. To change the board controlled on the display, there are 2 possible procedures depending on the terminal connected:

- 1) 15-key terminal: press the INFO key to switch to the next available unit;
- 2) 6-key terminal: select the SELECT UNIT option from the main menu and press ENTER. Every time you now press the ENTER key, you switch to the next available unit.

Room air can be controlled based on both temperature and humidity values (not managed by pCO^{xs}). There are a number of energy-saving features:

- summer freecooling,
- winter freecooling,
- winter freeheating,
- digital inputs for enabling compressors (pCO² large only),
- digital inputs for enabling heating elements (pCO² large only).

The first three features operate dampers, controlling the flow of external air entering the room when external temperature or enthalpy conditions are favourable.

For heating purposes, two auxiliary heating elements are fitted, which can be controlled via user parameters.

A sensor can be connected to monitor delivery temperature. Control consists in a minimum limit that closes the external damper and switches off the compressors (feature selectable via manufacturer parameters).

The board manages the rooftop unit's main alarms, such as: antifreeze, generic interlock, dirty filters and all cooling unit alarms, such as: compressor thermal overload, high- and low-pressure pressure switch.

1.1. Initializing the application program

The application program, the first time the controller is switched on, initializes the parameters automatically following the standard configuration described in the list of parameters table. This is so that incorrect data are not used for control purposes.

To override this procedure at any time, you must proceed as follows (this operation must be performed only if the unit has been deprogrammed):

switch on the board, wait for the internal checks to run and screen M0 to appear. When installing for the first time, DISREGARD alarms as they may be the result of incorrect data in the permanent memory.

Terminal with 15-key keypad

1. Press the MENU + PROG keys: this calls up the logon screen for the manufacturer loop.
2. Enter the password correctly then press ENTER to confirm.
3. Position the cursor on the "INITIALIZATION" line and press ENTER.
4. Press the UP key. Screen V1 comes up.
5. Press ENTER - the display reads "RUNNING....." for a few seconds - this deletes the permanent memory and enters CAREL's chosen factory settings.

This stage lasts a few seconds and ends when the display reads "DONE".

Terminal with 6-key keypad or built-in version

1. Press the PRG key - this calls up the main menu.
2. Select MANUFACTURER and press ENTER
3. Position the cursor on the "INITIALIZATION" line and press ENTER.
4. Press the UP key. Screen V1 comes up.
5. Press ENTER - the display reads "RUNNING....." for a few seconds - this deletes the permanent memory and enters CAREL's chosen factory settings.

This stage lasts a few seconds and ends when the display reads "DONE".

If any of the standard values are not correct for the desired use, you can replace them with others better suited to the unit's actual configuration, thus tailoring the application program to the equipment to be controlled.

2. Inputs/Outputs description

2.1.1. Digital inputs

N°	pCO ²	pCO ¹	pCO ^C	pCO ^{ss}
ID1	Antifreeze protection	Antifreeze protection	Antifreeze protection	Antifreeze protection
ID2	Clogged filter alarm	Clogged filter alarm	Clogged filter alarm	Clogged filter alarm
ID3	Summer/Winter selector	Summer/Winter selector	Summer/Winter selector	Main fan therm.cutout/generic interlock
ID4	Main fan therm.cutout/generic interlock	Main fan therm.cutout/generic interlock	Main fan therm.cutout/generic interlock	Compressor thermal cutout/High-pressure pressure switch
ID5	Remote start/stop command	Remote start/stop command	Remote start/stop command	Heaters thermal cutout
ID6	Heater 1 thermal cutout	Heater 1 thermal cutout	Heaters thermal cutout	Low-pressure pressure switch
ID7	Low-pressure pressure switch circuit 1	Low-pressure pressure switch circuit 1	Low-pressure pressure switch circuit 1	
ID8	Compressor thermal cutout circuit 1	Compressor thermal cutout circuit 1	Compressor thermal cutout circuit 1	
ID9	Low-pressure pressure switch circuit 2	Low-pressure pressure switch circuit 2	Low-pressure pressure switch circuit 2	
ID10	Compressor thermal cutout circuit 2	Compressor thermal cutout circuit 2	Compressor thermal cutout circuit 2	
ID11	Heater 2 thermal cutout	Heater 2 thermal cutout	High-pressure pressure switch circuit 1	
ID12	Flow-switch	Flow-switch	High-pressure pressure switch circuit 2	
ID13	High-pressure pressure switch circuit 1	High-pressure pressure switch circuit 1		
ID14	High-pressure pressure switch circuit 2	High-pressure pressure switch circuit 2		
ID15	Cooling power 1 reduction (pCO ² large)			
ID16	Cooling power 2 reduction (pCO ² large)			
ID17	Heating power 1 reduction (pCO ² large)			
ID18	Heating power 2 reduction (pCO ² large)			

2.1.2. Analogue inputs

N°	pCO ²	pCO ¹	pCO ^C	pCO ^{ss}
B1	Room air relative humidity	Recirculated air relative humidity	Room air temperature	Room air temperature
B2	External air relative humidity	External air relative humidity	External air temperature	External air temperature
B3	Condensing defrost temperature/pressure circuit 1	Condensing defrost temperature/pressure circuit 1	Delivery temperature	Delivery temperature
B4	Delivery temperature	Condensing defrost temperature/pressure circuit 2		Condensing defrost temperature/pressure
B5	Room air temperature	Room air temperature	Recirculated air relative humidity	
B6	Condensing defrost temperature/pressure circuit 2	External air temperature	External air relative humidity	
B7	External air temperature	Delivery temperature	Condensing defrost temperature/pressure circuit 1	
B8			Condensing defrost temperature/pressure circuit 2	

2.1.3. Digital outputs

N°	pCO ²	pCO ¹	pCO ^C	pCO ^{xs}
NO1	Compressor 1 contactor	Compressor 1 contactor	Main fan	Main fan
NO2	Condenser fan circuit 1	Condenser fan circuit 1	Compressor 1 contactor	Compressor contactor
NO3	Compressor 1 capacity control	Compressor 1 capacity control	Condenser fan circuit 1	Heater
NO4	Compressor 2 contactor	Compressor 2 contactor	Compressor 2 contactor	General alarm
NO5	Condenser fan circuit 2	Condenser fan circuit 2	Condenser fan circuit 2	Cycle reversing solenoid valve
NO6	Compressor 2 capacity control	Compressor 2 capacity control	Heater 2/Compressor 1 capacity control	
NO7	Main fan	Main fan	Heater 2/Compressor 2 capacity control	
NO8	General alarm	General alarm	Cycle reversing solenoid valve circuit 1	
NO9	Heater 1	Heater 1	Cycle reversing solenoid valve circuit 2	
NO10	Heater 2	Heater 2	Humidifier command	
NO11	Humidifier command	Humidifier command	General alarm	
NO12	Cycle reversing solenoid valve circuit 1	Cycle reversing solenoid valve circuit 1		
NO13	Cycle reversing solenoid valve circuit 2	Cycle reversing solenoid valve circuit 2		

2.1.4. Analogue outputs

N°	pCO ²	pCO ¹	pCO ^C	pCO ^{xs}
Y1	External air damper	External air damper	External air damper	External air damper
Y2	Heating valve	Heating valve	Heating valve	Heating valve
Y3	Fan 1 control	Fan 1 control	Fan 1 control	Fan control
Y4	Fan 2 control	Fan 2 control	Fan 2 control	

3. Room air temperature control

Room temperature is regulated via the activation of connected devices (compressors, heating elements, valves and dampers). The user can enter two set points, one for summer mode and one for winter mode. For starting and stopping compressors, two types of control have been devised:

- Proportional control (P)
- Proportional + integral control (P+I).

3.1. Summer/Winter Switching

Inputs Employed:

- Room air temperature sensor
- Summer/Winter switch

Parameters Employed:

- Summer control set point (S0).
- Winter control set point (S1).
- Summer/winter switching type select (C4)

Description of Operation:

You can switch from summer mode to winter mode (or vice versa) in any of the following ways:

- 1) from the board's front panel with the summer and winter keys (15-key terminal) or via the Summer/Winter screen called up from the main menu;
- 2) remote triggering via digital input;
- 3) automatically, based on room air temperature.

The method is selected on screen C4, which is password protected (manufacturer password needed).

Control panel Mode:

- 15-key terminal: to switch to the desired operating mode, simply press the relevant key: red key for winter mode; blue key for summer mode;
- 6-key terminal: PRG key to enter the main menu - select Summer/Winter and press ENTER: in this screen, every time you press the ENTER key, you toggle between summer and winter.

Digital input Mode:

contact open: summer mode
contact closed: winter mode.

Automatic Mode:

the unit switches from summer mode to winter mode or vice versa depending on room air temperature.

$T_{Amb} > \text{Summer set point} \Rightarrow \text{Summer mode.}$

$T_{Amb} < \text{Winter set point} \Rightarrow \text{Winter mode.}$

3.2. Unit ON/OFF

Inputs employed:

- Remote ON/OFF digital input (not available on pCO^{xs}).

Parameters Employed:

- Automatic restart after power failure enable (Pg);
- Weekly time bands enable (K6);
- Remote ON/OFF enable (Pg) (not available on pCO^{xs}).

Description of Operation:

The unit can be switched on or off in the following ways:

- from the panel using the ON/OFF key (15-key terminal) or via the screen called up from the main menu with the UNIT ON/OFF option (6-key terminal);
- by remote ON/OFF Digital Input;
- by weekly unit switch on/off Time Bands;
- by Supervisor (where connected).

3.2.1. Keying ON/OFF:

1. 15-key terminal: you can switch the unit on or off by pressing the rubber on-off key on the front panel.
2. 6-key terminal: select UNIT ON/OFF from the main menu and press ENTER: every time you press the ENTER key while in this screen, you toggle between switching the unit on and off.

If the unit is switched off via the panel, none of the other on and off procedures can be used to switch it back on.

If the unit is off, all unit functions and its various controls are disabled.

3.2.2. Remote ON/OFF: (Not an option on pCO^{XS} board)

The unit comes on if the following conditions are encountered:

- if the unit is turned on via the panel;
- if the digital input contact is closed.

The unit switches off if one of the following conditions is encountered:

- if the unit is turned off via the panel;
- if the digital input contact is open.

3.2.3. ON/OFF based on time band

The unit comes on if the following conditions are encountered:

- if the unit is turned on via the panel;
- if the unit has a clock card fitted;
- if operation is enabled by the time band.

The unit switches off if one of the following conditions is encountered:

- if the unit is turned off via the panel;
- if operation is not enabled by the time band.

IMPORTANT: if both the remote ON/OFF and time band procedures are active at the same time, the unit only comes on if operation is enabled by both.

3.2.4. ON/OFF by Supervisor (and GSM)

The digital variable with address 63 is used to switch the unit on and off.

Integer variable address 1: unit status display only.

3.3. Compressor control

Regulates the compressor on and off command.

Inputs Employed:

- room temperature sensor.

Parameters Employed:

- summer control set point S0;
- winter control set point S1;
- summer control band P4;
- winter control band P4;
- summer control dead zone P4;
- number of compressors selected C5;
- Heat Pump enable C0;
- prop. / prop. + integr control select G0;
- integration time G0;
- compressor 1 enable (P1);
- compressor 2 enable (P2).

Description of operation:

the compressor on and off command is a function of room air temperature.

If disabled in the user password-protected screen (P1), said compressor will not work.

3.3.1. Operation with 1 Compressor

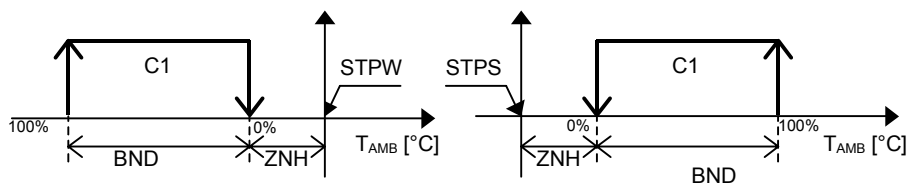


Figure 3.3.1

3.3.2. Operation with 2 Compressors

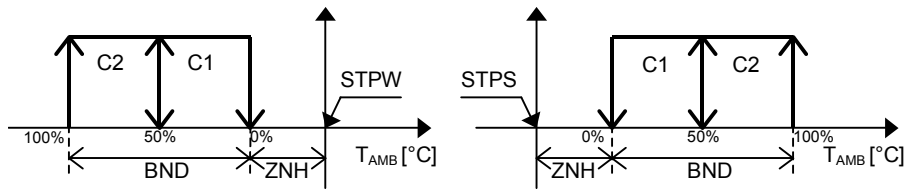


Figure 3.3.2

3.3.3. Operation with 2 Compressors + 1 Capacity control selected

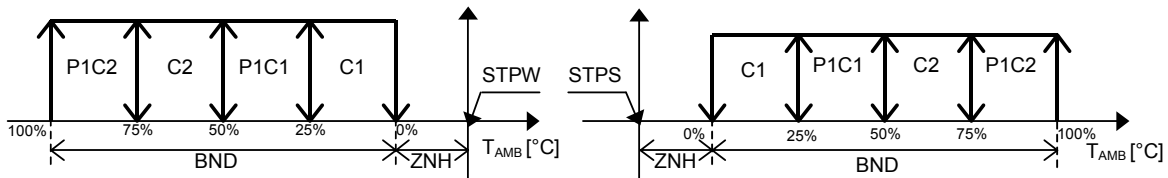


Figure 3.3.3

- STPW Winter set point [°C]
- STPS Summer set point [°C]
- ZNH Neutral/2 zone [°C]
- BND Control band [°C]
- TAMB Room (ambient) temperature [°C]

3.3.4. Proportional or Proportional + Integral mode

Proportional:

Once an ideal work point (set point) has been established for room air temperature, the action taken by the controller to bring the system as near to the ideal work point as possible will be proportional to the system's distance from said work point. Once a proportional band has been established around the set point, the controller will produce the most limited action at the set point whilst controller performance will increase as the value controlled deviates more and more from it, to the point of saturation on reaching the controller's upper and lower limits, where it will be working at full capacity.

Proportional + Integral:

In addition to the action described for the proportional control, the proportional + integral control adds the concept of "time" to the control action. The characteristic parameter is the time constant whose value, expressed in seconds, characterizes the P+I response speed (short time high speed). Extremely useful to overcome deadlock situations (set point never reached) typical in proportional-only control. Typical time constant is 600 seconds.

3.4. Compressor rotation

An option for selecting automatic rotation so that both compressors work the same number of hours and are started-stopped the same number of times.

Devices Employed:

- Compressor no.1 contactor.
- Compressor no.2 contactor.

Parameters Employed:

- Number of compressors selected (C5).
- Compressor rotation enable (T2).

Description of operation:

This feature is enabled in password-protected screen T2 (manufacturer password needed). Rotation follows FIFO logic, i.e. the first compressor to switch on will be the first to switch off.

When a compressor is switched on, the following conditions are observed:

- the compressor that has been off longest is switched on;
- the first compressor to switch on is the first to switch off;
- a compressor will only switch back on once all the other compressors have started since it last switched on.

3.5. Compressor Timing

Compressor timings control anti-circuit cycle times, startup delays after main fan start and delay after a power failure.

Devices Employed:

- Compressor no.1 contactor.
- Compressor no.2 contactor.

Parameters Employed:

- Minimum compressor off-time (T0).
- Minimum compressor on-time (T0).
- Time between starts by a single compressor (T1).
- Time between starts by different compressors (T1).
- Compressor start delay after main fan start (T3).

Description of operation:

- Compressor start delay time after main fan start: the compressor can be switched on if said time has elapsed since the main fan started.
- Minimum compressor off-time: makes sure that the compressor, once switched off, stays off for said time before being switched back on.
- Minimum compressor on-time: this time makes sure that the compressor, once switched on, stays on for said time before being switched off again (if an alarm is activated, the compressor is switched off regardless, even if the above-mentioned time has not elapsed).
- Time between starts by a single compressor: this time makes sure, once a compressor is started, that said time elapses before the same compressor can be started again (limits demand peaks per hour).
- Time between starts by different compressors: this time makes sure that said time elapses before different compressors can switch on (eliminates current demand peaks).

3.6. Defrosting

Inputs Employed:

- Defrost no.1 sensor.
- Defrost no.2 sensor.

Devices Employed:

- Cycle reversing solenoid valve no.1.
- Cycle reversing solenoid valve no.2.
- Compressor no.1
- Compressor no.2.

Parameters Employed:

- Defrost sensor type (G3).
- Defrost start set point (G4).
- Defrost end set point (G4).
- Defrost start delay (Pf).
- Maximum defrost time (Pf).
- Switch-off time for compressors entering and exiting defrost mode (T4)
- Main fan switch-off (G5).
- Simultaneous circuit defrost (G5).
- Simultaneous Defrost stop mode select (G6).

There are two defrosting modes.

3.6.1. Non-simultaneous defrosting

The 2 circuits will never be defrosted at the same time. If both request defrosting, one circuit will be defrosted first whilst the other is kept waiting. A circuit will enter defrost mode provided the following conditions are met:

- the unit is in winter mode;
- the defrost temperature sensor reading must be less than the "defrost start set point" (G4) for a cumulative time equivalent to "defrost delay time" (Pf);
- compressors must be on.

Defrosting can end in two ways:

- determined by temperature, if the defrost temperature sensor reading is higher than the "defrost end set point" (G4);
- determined by maximum time, if the defrost temperature sensor fails to reach the defrost end set point by the "maximum defrost time" (Pf).

3.6.2. Simultaneous defrosting

This can be split into:

- simultaneous defrosting with simultaneous end
- simultaneous defrosting with non-simultaneous end

In both cases, the defrosting status of the 2 circuits depends on the sensor detecting the lower temperature.

Defrost stopping is instead different for each case.

If defrosting is set to end simultaneously, defrosting will end in both circuits the moment both sensors detect temperatures over the defrost end set point. Otherwise, if defrosting is set not to end simultaneously, defrosting will end separately in each circuit when the relevant sensor detects a temperature over the defrost end set point.

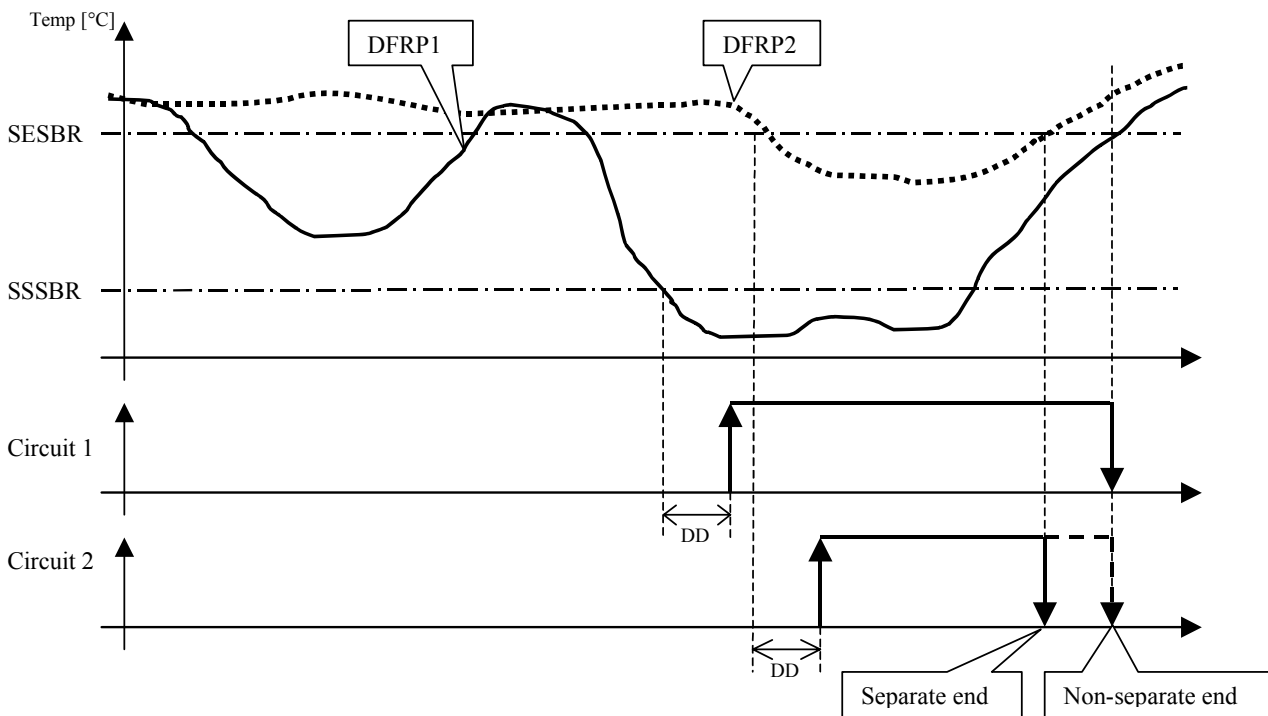


Figure 3.6.1

DFRP1	Circuit 1 defrost sensor [°C]
DFRP2	Circuit 2 defrost sensor [°C]
SESBR	End-of-defrost threshold [°C]
SSSBR	Start-of-defrost threshold [°C]
DD	Defrost delay [s]

The end of simultaneous defrosting can be determined by maximum time if the defrost temperature sensor fails to reach the defrost end set point by the "maximum defrost time" (Pf).

In both control modes, you can set a switch-off time for compressors when entering and exiting defrost mode.

This time allows cycle reversing with compressors switched off.

As soon as the defrost command is given, the compressors are switched off and after a few seconds the cooling cycle is reversed - compressors will stay off for the time set.

If the time set is zero seconds, the compressor switch-off feature is automatically disabled.

NB.: there is an option for switching off the main fan while defrosting takes place (G5).

3.7. Cycle reversing solenoid valves

Devices Employed:

- Cycle reversing solenoid valve no. 1
- Cycle reversing solenoid valve no. 2

Parameters Employed:

- Cycle reversing valve logic

There is an option on screen C6 for selecting the operating logic of the cycle reversing 4-way valves.

There is an option for selecting the operating logic, choosing between NC (Normally Closed) and NO (Normally Open).

3.8. Main Fan

Inputs Employed:

- Main Fan thermal cutout/interlock digital input.

Devices Employed:

- Main fan.

Parameters Employed:

- Main fan Switch-off delay (T3).
- Fan switch-off during defrost (G5).

The main fan is the first device to switch on once the unit has been turned on. Once the unit has been turned off, the main fan will stay on for a user-settable time (see screen T3).

You can force the main fan to switch off during the following stages:

- defrosting stage, by selecting the relevant parameter in the screen (G5);
- during the weekly time bands' OFF stage, by selecting the relevant parameters in the clock screens (K2).

The main fan can be started by the digital output test procedure (screen Ai) if there are no alarms to inhibit it.

3.9. Condenser fans

Inputs Employed:

- Condensing/defrost 1 temperature sensor.
- Condensing/defrost 2 temperature sensor.

Devices Employed:

- Condenser fan no.1.
- Condenser fan no.2.

Parameters Employed:

- Condensing/defrost 1 sensor enable (Ca).
- Condensing/defrost 2 sensor enable (Cc).
- Condensing dependent on compressor (G8).
- Fans condensing set point (G9).
- Fans condensing differential (G9).
- Inverter speed limits (Ga).
- Minimum on-time (Ga).
- Prevent enable (Gb).
- Prevent set point (Gb).
- Prevent differential (Gb).
- Prevent output delay (Gc).
- Coupled operation of Fans (Gd).

Description of operation:

If defrost/condensing sensors have not been enabled, fans will work as follows:

- Compressor ON => Fan ON
- Compressor OFF => Fan OFF
- Defrost ON => Fan OFF

If condensing/defrost sensors have been enabled, fans may also come on based on a condensing temperature, a set point and a differential (they can be set in password-protected screens G8/G8 - you will need the manufacturer password) depending on whether the condensing dependent on compressor option has been enabled or not.

Two operating modes have been devised:

- coupled mode;
- standalone mode.

3.9.1. Standalone mode

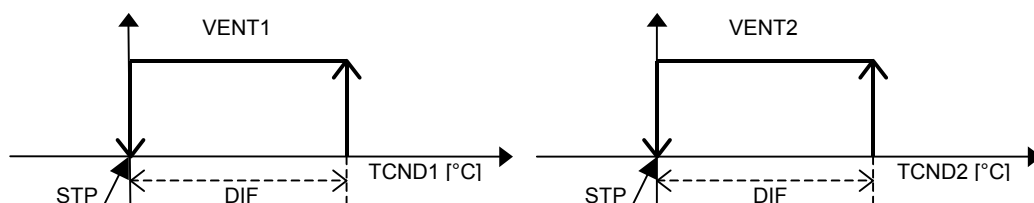


Figure 3.9.1

3.9.2. Coupled mode

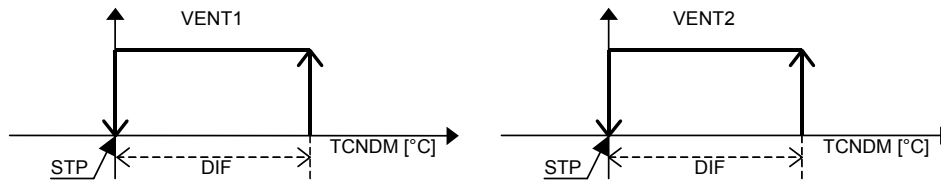


Figure 3.9.2

STP	Condensing set point [°C]
DIF	Condensing differential [°C]
TCND1	Condensing temperature 1 [°C]
TCND2	Condensing temperature 2 [°C]
TCNDM	Maximum condensing temperature [°C]

Condenser fans 1 and 2 are controlled by whichever of the two condensing temperatures is highest. The condenser fan control uses 2 digital outputs (as described above) for boards pCO², pCO¹, pCO^C, and 2 analogue outputs - PWM for pCO¹ and 0...10V for pCO² (for pCO^{XS}, only one PWM analogue output is featured for condensing). Analogue control works just like digital control. Above the set point+differential, the output takes on the maximum value whilst when below the set point, it adopts the minimum value. Within this band, it controls the speed of the fans. The fan control also has a prevent feature with parameters that can be set in screens Gb and Gc.

3.10. Temperature-based freecooling and freeheating control

With the unit working in FREECOOLING or FREEHEATING mode, external air can be exploited when its temperature conditions are favourable with respect to the temperature of the room air. The unit's winter/summer freecooling or winter freeheating mode will be selected via a password-protected parameter (C1) (manufacturer password needed).

Inputs Employed:

- External Air Temperature Sensor.
- Room Air Temperature Sensor.

Devices Employed:

- External Damper 0...10 V.

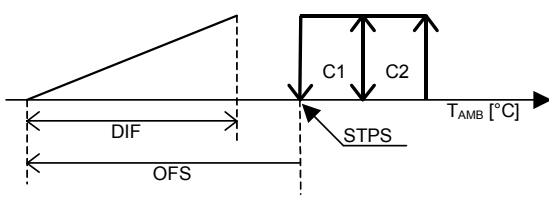
Parameters Employed:

- Temperature-based Freecooling/Freeheating Differential (P7).
- Enthalpy-based Freecooling/Freeheating Differential (P8).
- Summer freecooling offset (P9).
- Summer freecooling modulation differential (P9).
- Winter Freeheating offset (Pa).
- Winter Freeheating modulation differential (Pa).
- Temperature Control set point (S0, S1).
- Temperature Control Band (P4).
- Damper minimum opening (Pb).

3.10.1. Summer freecooling

The opening of the external damper is controlled by room air temperature as illustrated in the following figure provided the following conditions are met:

- the unit is in summer mode;
- the external temperature sensor is enabled in password-protected screen C8 (manufacturer password needed);
- the summer freecooling feature is enabled in password-protected screen C1 (manufacturer password needed);
- (external temperature) < (room temperature - freecooling differential P7);
- room temperature > summer set point + offset (see figure).



STPS	Summer set point [°C]
DIF	Freecooling differential [°C]
OFS	Summer freecooling offset [°C]
T _{AMB}	Room (ambient) temperature [°C]

Figure 3.10.1

If a positive offset is set, freecooling can be made to start after the set point.

3.10.2. Winter freeheating

The opening of the external damper is controlled by room air temperature as illustrated in the figure below provided the following conditions are met:

- the unit is in winter mode;
- the external temperature sensor is enabled in password-protected screen C8 (manufacturer password needed);
- the winter freeheating feature is enabled in password-protected screen C1 (manufacturer password needed);
- $(\text{external temperature} - \text{room temperature}) > (\text{freeheating differential P7});$
- $\text{room temperature} < \text{winter set point} + \text{offset}$ (see figure).

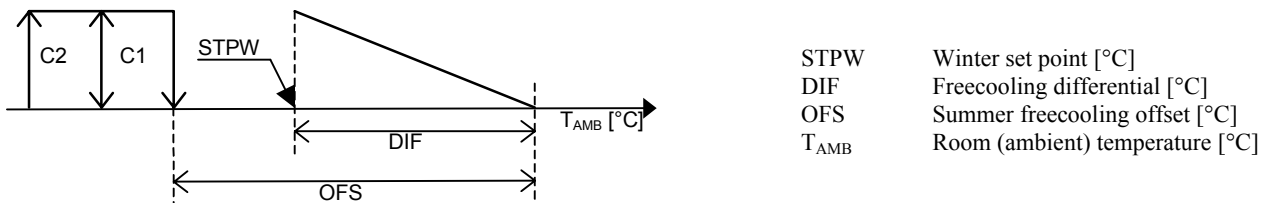


Figure 3.10.2

"Offset" and "differential" parameters for controlling damper opening are set in user password-protected screen Pa.

For freeheating to be enabled, the "external temperature – room temperature > freeheating differential" condition must be met. The damper is open 100% when room temperature is lower than the "(Set point + Offset-differential)" point. Modulation starts, from 100% to 0%, when room temperature increases from the "(Set point + Offset)-differential" point to the "Set point + offset" point. When temperature is over "Set point - offset", the damper is fully closed. If a negative offset is set, freeheating can be made to start before the set point.

3.10.3. Winter freecooling

Winter freecooling is useful in shopping centres during operation in winter, where overcrowding inevitably causes temperature to exceed the set point, meaning the place needs cooling as opposed to heating. Therefore, for the job of cooling, external conditions are exploited, which are almost always favourable for this purpose in winter.

The opening of the external damper is controlled by room air temperature as illustrated in the figure below provided the following conditions are met:

- the unit is in winter mode;
- the external temperature sensor is enabled in password-protected screen C8 (manufacturer password needed);
- the winter freecooling feature is enabled in password-protected screen C1 (manufacturer password needed);
- $(\text{external temperature}) < (\text{room temperature} - \text{freecooling differential}).$
-

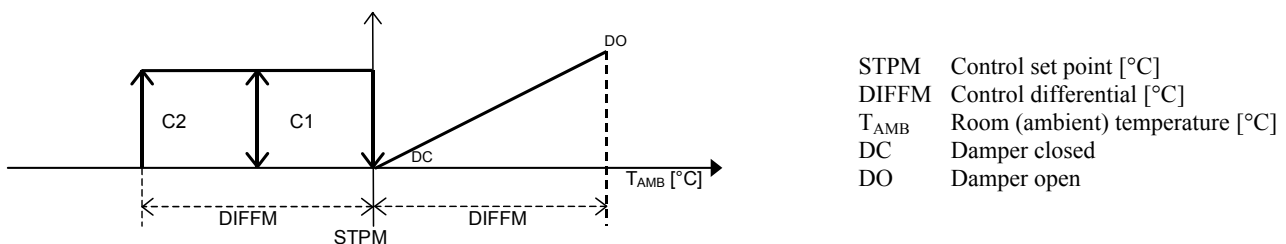


Figure 3.10.3

The set point and differential (also considered the dead zone/2) are the ones relating to winter mode.

In SUMMER FREECOOLING and WINTER FREEHEATING situations, the normally closed external damper starts to mix external air with room air in an attempt to move the work point as near as possible to the set point, hence turning off as many devices as possible switched on for cooling or possibly heating purposes.

The ideal condition would be when the desired temperature or enthalpy is reached just by modulating the damper.

There is an option on screen Pb for selecting minimum damper opening in case the unit is on.

If in winter mode and the "winter damper start" parameter (Pb) equals "closed", the damper stays fully closed on startup or after a power failure until control temperature reaches the control set point. If said parameter is set to "normal", the above-mentioned function is not carried out.

Bear in mind the delivery limit. This overrides damper modulation, forcing it to close.

3.11. Heating valve Control

Control of a 0/10V modulating valve.

Inputs Employed:

- Room temperature sensor.

Devices Involved:

- Heating valve.

Parameters Employed:

- Heating Valve enable (C6).
- Valve open temperature offset (Pm).
- Valve closed temperature differential (Pm).

Description of operation: The heating valve is controlled by room temperature as illustrated in the figure below provided the following conditions are met:

- the unit is in winter mode;
- heating valve control is enabled in password-protected screen C4 (manufacturer password needed).

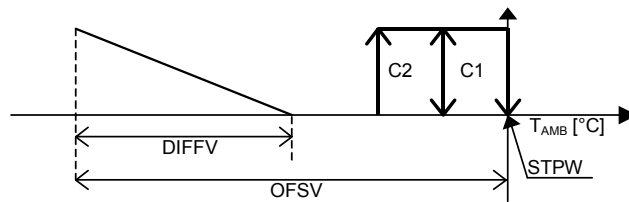


Figure 3.11.1

STPW	Winter set point [°C]
DIFFV	Heating valve control differential [°C]
T _{AMB}	Room (ambient) temperature [°C]
OFSV	Valve open temperature offset [°C]

3.12. Delivery temperature minimum limit

The delivery temperature minimum limit protects the room against sudden drops in temperature.

Inputs Employed:

- Delivery Temperature Sensor (NTC –PT1000 for pCO² only).

Devices Involved:

- Compressor 1.
- Compressor 2.
- External damper.

Parameters Employed:

- Delivery Sensor enable (C9).
- Set point (Pc).
- Differential (Pc).

Winter mode

- when delivery temperature drops below the delivery set point:

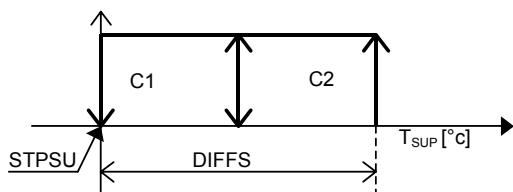
- the external air damper is forced to close;
- the heating valve is forced to open.

When delivery temperature starts to increase to the point of exceeding the delivery set point + (differential), then both the external damper and heating valve revert to normal operating mode (the minimum limit on delivery during winter mode does not interact with compressor operation).

Summer mode

- when delivery temperature drops below the delivery set point:

- the external air damper is forced to close
- Compressors are gradually switched off as illustrated in the figure below:



STPSU	Delivery set point [°C]
DIFFS	Delivery differential [°C]
T _{SUP}	Delivery temperature [°C]

Figure 3.12.1

3.13. Auxiliary heating elements

The auxiliary heating elements operate when the heat pump or heating valve fail to heat room air sufficiently. They can only be configured as an alternative to compressor capacity controls in the case of pCO^C (using the same outputs), and are not selectable in the case of pCO^{xs}.

Inputs Employed:

- Room air temperature.

Devices Involved:

- Heater no. 1.
- Heater no. 2.

Parameters Employed:

- Number of heaters set (C4).
- Heater control offset (Pi).
- Heater control differential (Pi).
- Temperature control set point (S0/S1).
- Heater 1 enable (P2).
- Heater 2 enable (P2).

Description of operation

Auxiliary heating elements are controlled by room air temperature as illustrated in the figure below provided the following conditions are met:

- the unit is in winter mode;
- more than 0 heaters are set in password-protected screen C4 (manufacturer password needed);
- heating elements 1 and 2 are enabled with the heater 1 and 2 enable option in user password-protected screen P2.

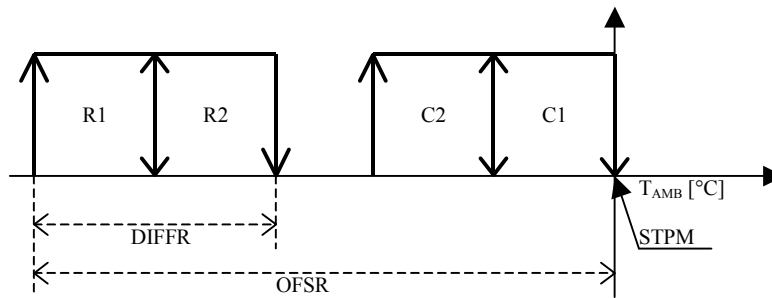


Figure 3.13.1

STPM	Control set point [°C]
OFSR	Heater control offset [°C]
DIFFR	Heater control differential [°C]
T _{AMB}	Room (ambient) temperature [°C]

3.14. Set point compensation

Set point compensation allows you to save energy when external temperature values are particularly unfavourable considering the demands of the room to be controlled. Compensation varies the control set point according to external temperature.

Inputs Employed:

- External air temperature sensor.

Devices Involved:

- Compressor no.1
- Compressor no.2.

Parameters Employed:

- Compensation enable (C4).
- External temperature winter compensation set point (Pe).
- External temperature winter compensation band (Pe).
- Maximum winter compensation (Pe).
- External temperature summer compensation set point (Pd).
- External temperature summer compensation band (Pd).
- Maximum summer compensation (Pd).

Description of operation

Set point compensation differs between winter mode and summer mode in terms of the type of action and the parameters employed.

Summer Compensation

Summer set point compensation is enabled when the following conditions are encountered:

- the unit is in summer mode;
- compensation is enabled in password-protected screen C4 (manufacturer password needed).

Summer compensation adds a value, "delta", to the selected set point. This value depends on external temperature (the value increases as external temperature rises).

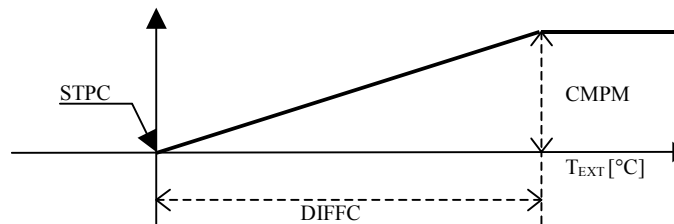


Figure 3.14.1

STPC	Compensation set point [°C]
CPM	Maximum compensation [°C]
DIFFC	Compensation differential [°C]
T _{EXT}	External temperature [°C]

Winter Compensation

Winter set point compensation is enabled when the following conditions are encountered:

- the unit is in winter mode;
- compensation is enabled in password-protected screen C4 (manufacturer password needed).

Winter compensation subtracts a value, "delta", from the selected set point. This value depends on external temperature (the value increases as external temperature drops).

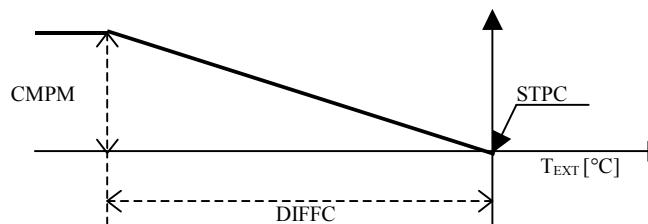


Figure 3.14.2

STPC	Compensation set point [°C]
CPM	Maximum compensation [°C]
DIFFC	Compensation differential [°C]
T _{EXT}	External temperature [°C]

4. Room air humidity control

4.1. Dehumidifying

Feature not available on pCO^{XS}. Dehumidifying action is produced by switching on the compressors.

Inputs Employed:

- Room Humidity.

Devices Employed:

- Compressor no.1
- Compressor no.2.

Parameters Employed:

- Humidity feature enable (C0).
- Summer Humidity set point (S2).
- Summer Humidity control band (P6).
- Humidity dead zone (P6).
- Number of compressors for Dehum (G7).

Description of operation

Dehumidifying is enabled provided the following conditions are met:

- the unit is in summer mode;
- humidity control must be enabled in password-protected screen C0 (manufacturer password needed);
- the number of compressors associated with the dehumidifying demand is greater than or equal to 1 (you can set 1 or 2 compressors in user password-protected screen G7).

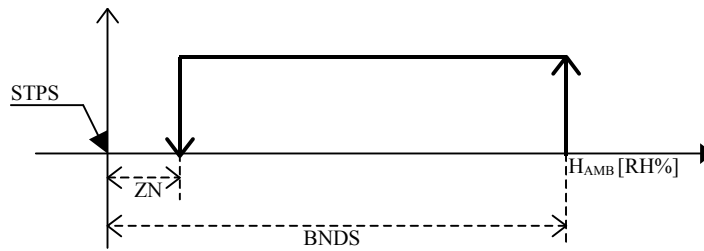


Figure 4.1.1

STPS	Summer humidity set point [RH%]
ZN	Dead zone [RH%]
BNDS	Summer humidity control band [RH%]
H _{AMB}	Room (ambient) humidity [RH%]

For compressors to be activated by the dehumidifying demand, room temperature must have reached the control set point as illustrated in the figure below:

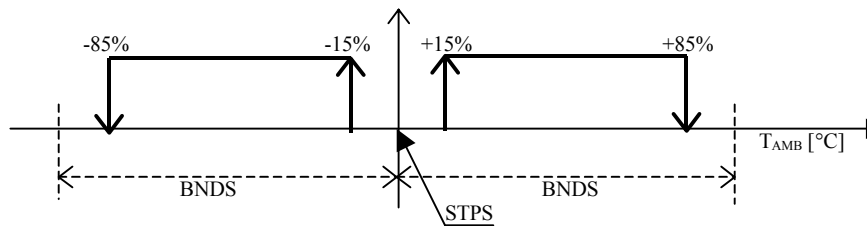


Figure 4.1.2

STPS	Summer set point [°C]
BNDS	Summer humidity control band [°C]
T _{AMB}	Room (ambient) temperature [°C]

When room temperature is within the band's +/-15% range, compressors can be switched on/off for dehumidifying. If room temperature deviates from the set point to the extent that it goes beyond the band's +/-85% point, compressors cannot be switched on for dehumidifying until temperature falls within the band's +/-15% range again.

NB: if two compressors have been selected for the dehumidifying stage, they will be switched on and off by the same dehumidifying step.

4.2. Humidifying

Feature not available on pCO^{XS}. Humidification is regulated by means of the on/off control provided through a digital output since the control of all the humidifier's values - such as current demand, level, steam production and alarms - is handled by the controller on the actual humidifier.

Inputs Employed:

- Room Humidity.

Devices Employed:

- Humidity Relay.

Parameters Employed:

- Humidity feature enable (C0).
- Summer Humidity set point (S1).
- Winter Humidity set point (S1).
- Summer Humidity control band (P6).
- Winter Humidity control band (P6).
- Humidity dead zone (P6).

Description of operation:

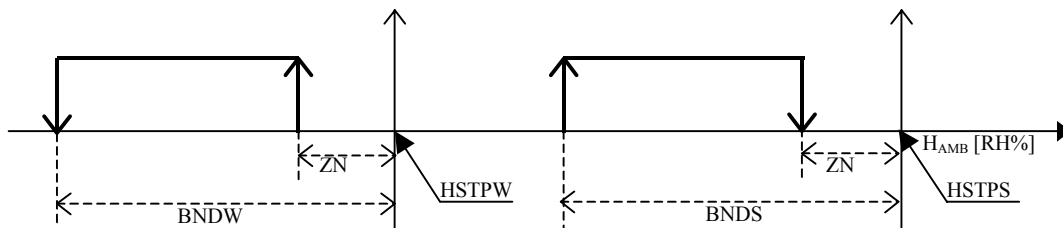


Figure 4.2.1

HSTPS	Summer humidity set point [RH%]
HSTPW	Winter humidity set point [RH%]
BNDS	Summer humidity control band [RH%]
BNDW	Winter humidity control band [RH%]
ZN	Humidity neutral zone [RH%]
H _A MB	Room (ambient) humidity [RH%]

4.3. Enthalpy-based freecooling and freeheating control

The enthalpy-based freecooling and freeheating control feature manages external damper opening based on internal and external enthalpy conditions.

Inputs Employed:

- Room temperature sensor.
- External temperature sensor.
- Room humidity sensor.
- External humidity sensor.

Devices Employed:

- External damper (analogue output no.1).

Parameters Employed:

- Summer freecooling enable (C1).
- Winter freeheating enable (C1).
- Humidity feature enable (C0).
- Enthalpy-based freecooling and freeheating enable (G1).
- Active temperature control set point.
- Active humidity set point.
- Enthalpy differential (P8).

Description of operation

Enthalpy-based freecooling and freeheating control is enabled provided the following conditions are met:

- the Humidity feature is enabled in password-protected screen C0 (manufacturer password needed);
- the summer freecooling and winter freeheating features are enabled in password-protected screen C1 (manufacturer password needed);
- the enthalpy-based control is enabled in password-protected screen G1 (manufacturer password needed).

With room temperature and recirculating humidity, the controller calculates recirculating enthalpy (I5); with external temperature and external humidity, the controller calculates external enthalpy (I5); and with the temperature control set point and Humidity control set point, it calculates the enthalpy set point. The aim of the control feature is to keep recirculating enthalpy as near as possible to the Enthalpy set point.

The following conditions may occur:

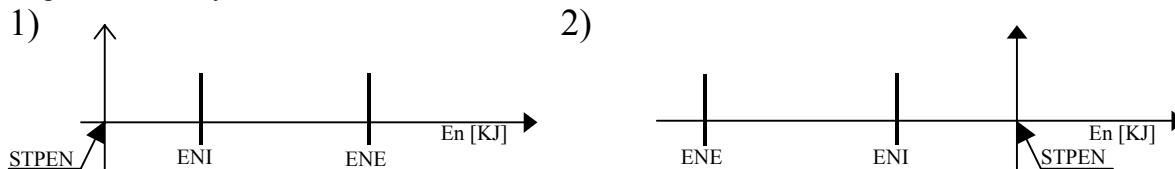


Figure 4.3.1

Opening the external damper will not be a suitable response in either of the conditions illustrated above (1, 2) since internal enthalpy is nearer to the enthalpy set point than external enthalpy.

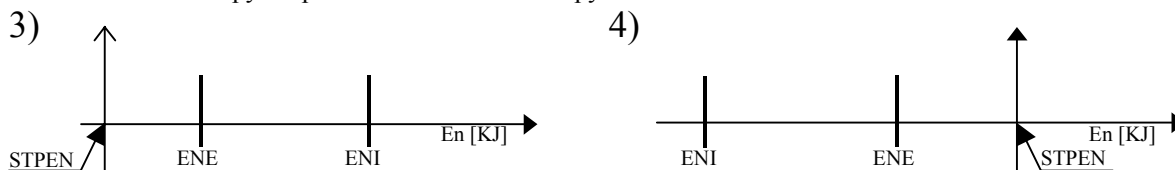


Figure 4.3.2

Opening the damper will be a suitable response in either of the conditions illustrated above (3, 4) since external enthalpy is nearer to the enthalpy set point than internal enthalpy.

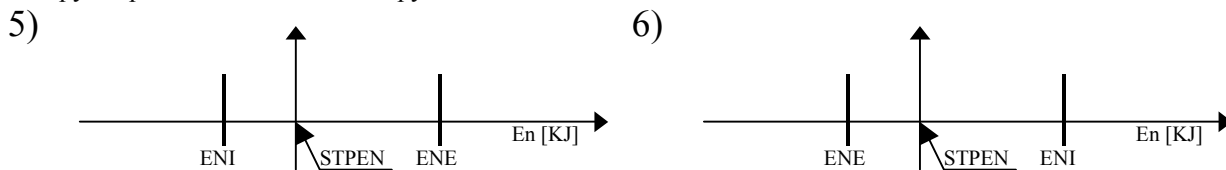


Figure 4.3.3

STPENS	Enthalpy set point [KJ]
ENI	Internal enthalpy [KJ]
ENE	External enthalpy [KJ]

In case number 5 illustrated above, internal enthalpy is nearer to the enthalpy set point than external enthalpy. However, in this case, opening the damper is a suitable response because, with the mixing of the two enthalpies (internal and external), internal enthalpy will nonetheless near the enthalpy set point.

In case number 6 illustrated above, external enthalpy is nearer to the enthalpy set point than internal enthalpy. Consequently, opening the damper is a suitable response because, with the mixing of room air and external air, internal enthalpy will nonetheless near the enthalpy set point.

Should any of the cases illustrated above (3, 4, 5, 6) occur, damper opening will depend on internal enthalpy as show in the figure below:

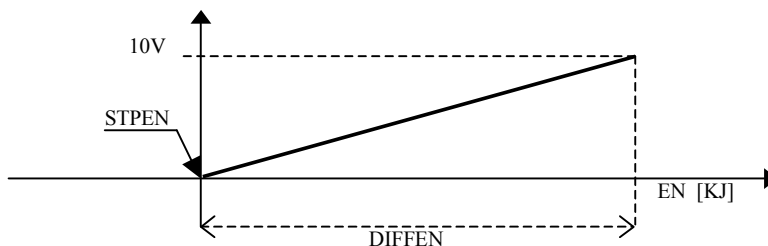


Figure 4.3.4

STPEN	Enthalpy set point [KJ]
DIFFEN	Enthalpy differential [KJ]
EN	Room enthalpy [KJ]

5. Energy saving

The energy-saving feature (a feature of pCO² large only) involves 4 digital inputs, which are responsible for switching off the compressors or heating elements.

Inputs Employed:

- Cooling power 1 decrease digital input.
- Cooling power 2 decrease digital input.
- Heating power 1 decrease digital input.
- Heating power 2 decrease digital input.

Devices Employed:

- Compressor 1.
- Compressor 2.
- Heater 1.
- Heater 2.

Parameters Employed:

- Cooling power 1 decrease enable (C2).
- Cooling power 2 decrease enable (C2).
- Cooling NC/NO contact.
- Heating power 1 decrease enable (C3).
- Heating power 2 decrease enable (C3).
- Heating NC/NO contact.

The cooling power decrease inputs operate by switching off the compressors whilst heating power decrease inputs operate by switching off the heating elements.

6. Alarm Management

When an Alarm is triggered, action is taken on devices, where this option is provided for, and the siren, LED, remote relay and relevant screen are all activated at the same time.

To view the alarm triggered, simply press the Alarm key - you can then use the UP/DOWN keys to scroll through the list and view other alarms that might have been triggered. To reset Alarms in the log, you must call up the alarm screens and press the ALARM key again.

Table 6.1 Alarms

Code	Alarm description	Action	Reset	Delay	Notes
AL01	Compressor 1 thermal cutout	Circuit 1 OFF	Manual	No	
AL02	Compressor 2 thermal cutout	Circuit 2 OFF	Manual	No	
AL03	Compressor 1 HP	Circuit 1 OFF	Manual	No	
AL04	Compressor 2 HP	Circuit 2 OFF	Manual	No	
AL05	Antifreeze alarm	Circuits OFF (summer only)	Automatic	2 s	
AL06	High room temperature	/	Manual	Settable	
AL07	Low room temperature	/	Manual	Settable	
AL08	Compressor 1 LP Summer	/	Manual	Settable*	
AL09	Compressor 2 LP Summer	/	Manual	Settable*	
AL10	Compressor 1 LP Winter	/	Automatic	Settable*	
AL11	Compressor 2 LP Winter	/	Automatic	Settable*	
AL12	Compressor 1 maintenance	/	Manual	No	View only
AL13	Compressor 2 maintenance	/	Manual	No	View only
AL14	Unit maintenance	/	Manual	No	View only
AL15	Main fan thermal cutout	Total OFF	Manual	No	Switches off unit
AL16	Filter dirty	/	Manual	5 s	View only
AL17	Heaters thermal cutout	Heaters OFF	Manual	No	View only***
AL18	Flow-switch	/	Manual	No	
AL19	Clock broken or no clock	/	Manual	No	View only
AL20	Set point E below Set point I.	/	Manual	No	View only
AL21	B1 sensor fail	Total OFF	Manual	60 s	View only**
AL22	B2 sensor fail	/	Manual	60 s	View only
AL23	B6 sensor fail	/	Manual	60 s	View only
AL24	B7 sensor fail	/	Manual	60 s	View only
AL25	B4 sensor fail	/	Manual	60 s	View only
AL26	B3 sensor fail	/	Manual	60 s	View only
AL27	B8 sensor fail	/	Manual	60 s	View only
AL28	B5 sensor fail	/	Manual	60 s	View only**
AL29	Heater 1 thermal cutout	Heater 1 OFF	Manual	No	View only***
AL30	Heater 2 thermal cutout	Heater 2 OFF	Manual	No	View only***

* with delay from compressor startup
 ** if said sensor is the room temperature device, the unit is switched off
 *** alarm 17 is only given if you are using a pCO^C board, otherwise it will be given separately for the 2 heaters with alarm 29 and 30

6.1. Summer/winter circuit 1/2 low pressure alarm

The low pressure alarm is managed in a different way depending on the circuit and operating mode (summer or winter).

In summer, the alarm is disregarded for a settable time (T2) from the compressor's startup. In winter, it works in the same way as in summer, except during defrosting when the alarm is disabled.

6.2. Summer set point below winter set point alarm

This alarm is only enabled when the summer/winter automatic switching option (C4) is enabled.

The software checks to make sure the summer set point is always higher than the winter one, generating a view-only alarm.

6.3. Alarm log

The log is only available if the board has a clock card fitted.

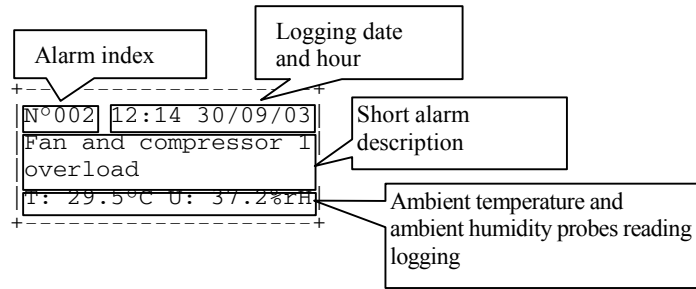


Figure 6.3.1

All alarms are logged. Pressing the PRINTER key displays the last event and the UP/DOWN keys can be used to scroll up and down the list of alarms logged. The number of events in the top left corner increases every time there is a new alarm. The maximum number of events that can be logged is 150. Once the logging limit is reached, new events overwrite the older ones. The alarm log can be cleared completely via screen Af in the password-protected part of the servicing loop. The log is erased during the default installation procedure.

6.4. Alarm-warning SMS

If a GSM modem is connected to the board, the unit also offers the option of sending an alarm-warning SMS. The SMS is sent the moment the alarm is triggered.

7. Servicing

7.1. Compressor and unit hour-meter control

Manages the compressor maintenance and unit maintenance alarm.

Parameters Employed:

- Unit maintenance alarm Hours threshold (A6)
- Unit Hour-meter reset (A9)
- Compressor maintenance alarm Hours threshold (A7, A8)
- Compressor No.1 and No.2 Hour-meter reset (Aa)

Description of Operation

The controller counts the running hours of these devices: Compressor 1, 2 and Unit.

When the hour-meter of the individual device reaches the set alarm threshold, the maintenance alarm relating to the relevant device is activated. The maintenance alarm is a warning-only alarm.

7.2. Sensor settings

Manages setting and type of sensors connected.

Inputs Employed:

- Room air temperature.
- External air temperature.
- Condensing/defrosting no.1 air temperature.
- Condensing/defrosting no.2 air temperature.
- Room air relative humidity.
- External air relative humidity.
- Delivery air temperature.

Parameters Employed:

- Room air temp. sensor setting (Ab).
- External air temp. sensor setting (Ac).
- Delivery air temp. sensor setting (Ab).
- Cond./defrost 1 air temp. sensor setting (Ae).
- Cond./defrost 2 air temp. sensor setting (Ae).
- Recirculating humidity sensor setting (Ad).
- External humidity sensor setting (Ad).

Description of operation

Sensor settings are made by setting an offset for each sensor.

The set parameter is added to the value detected by the relevant sensor.

7.3. Input/Output test

This Input/Output test feature is used to run a quick check on analogue inputs and digital outputs.

Inputs Employed:

- All analogue inputs

Devices Employed:

- All digital outputs

Parameters Employed:

- Consult state of analogue inputs in mV (Ag, Ah).
- Closing/opening of all output relays (Ai, Aj).

Description of operation

To check analogue inputs and digital outputs, the unit must be switched off.

Screen Ag, Ah displays analogue inputs exactly as they are detected directly by the controller without any setting or conversion.

Via screen Ai and Aj, you can activate and deactivate output relays manually.

8. Time bands

This feature is only available if the board has a clock card fitted.

There are two kinds of time bands:

- Weekly time bands
- Daily time bands

8.1. Weekly time bands

Weekly time bands control the unit's switching on and off during the week, determining either the ON or OFF state for each single day.

Parameters Employed:

- Weekly time bands enable (K6).
- Unit running Monday...Sunday (K7).

Weekly time bands are enabled if the weekly time bands ON/OFF feature is enabled in screen K6, which belongs to the group of clock screens.

For each day of the week, a parameter is set that controls the unit's switching on and off.

Each day at midnight, the pCO will check whether the variable relating to that day is set to ON or OFF and will switch the unit on or off accordingly.

Example:

- Weekly time bands feature enabled
- Unit running on Monday = ON
- Unit running on Tuesday = ON
- Unit running on Wednesday = ON
- Unit running on Thursday = ON
- Unit running on Friday = OFF
- Unit running on Saturday = OFF
- Unit running on Sunday = OFF

With this setup, the unit will be ON from 00:00 on Monday until 23:59 Thursday evening; it will stay OFF from 00:00 on Friday until 23:59 Sunday evening.

8.2. Daily time bands

The daily time bands manage the control set point and switching on of the main fan, consequently causing all the unit's devices to switch off.

Parameters Employed:

- Daily time bands enable (K2).
- Main fan switch-off in out-of-band zone (K2)
- Daily time band start (K3)
- Daily time band end (K3)
- Summer Inside band set point (K4)
- Summer Outside band set point (K4)
- Winter Inside band set point (K5)
- Winter Outside band set point (K5)

Description of Operation:








Daily time bands are enabled if the daily time bands feature is enabled (screen K2, which belongs to the group of clock screens). By setting the band start time and band end time (in hours and minutes) in screen K3, 2 time bands are automatically determined: an "inside band" and an "outside band". For each of these two bands, you can enter two set points, one for summer mode and one for winter mode. With the daily time bands enabled, the active set points for control become the "inside time band" set point or "outside time band" set point depending on whether the current time falls within the inside band or outside band. You can select main fan switch-off during the "outside time band".

9. User Interface

The application program's user interface includes screens that can be viewed without restriction and others that, for security purposes, are password protected. Hence screens are split into different security levels:

- Screens not password protected: they appear in all loops except MANUFACTURER and USER and show sensor values, alarms, hours of operation of the various devices, time, date, and can be used to enter set points and for clock setup. They are marked with the "1" symbol in the table below.
- Password-protected sub-screens (marked in the table with the "2" symbol): in SERVICING and CLOCK loops, there are unrestricted screens not protected by passwords followed by a logon screen for access to the other screens. Via these screens you can check devices at regular intervals, set connected sensors, edit hours of operation, manage devices in manual mode and set time bands.
- Password-protected screens (marked in the table with the "3" symbol): these are the MANUFACTURER and USER loops - via these screens you can configure the unit, enable main features, and choose connected devices.

The table's columns represent screen groups: the first screen (A0, S0...) is the one that appears when you press the relevant key (or, when using a 6-key display, it is called up from the main menu). 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 distinguish. The PSW symbol indicates screens where you are required to enter passwords.

						
① M0	① A0	① I0	① K0	① S0	PSW P0	PSW Z0
① M1	① A1	① I1	PSW K1	① S1	③ P1	Z1
① M2	① A2	① I2	② K2		③ P2	CONF. → ③ C0
① M3	① A3	① I3	② K3		③ P3	③ C1
① M4	① A4	① I4	② K4		③ P4	③ C2
	PSW A5	① I5	② K5		③ P5	③ C3
	② A6	① I6	② K6		③ P6	③ C4
	② A7	① I7	② K7		③ P7	③ C5
	② A8	① I8	② K8		③ P8	③ C6
	② A9	① I9			③ P9	③ C7
	② Aa	① Ia	② K8		③ Pa	③ C8
	② Ab	① Ib			③ Pb	③ C9
	② Ac	① Ic			③ Pc	③ Ca
	② Ad	① Id			③ Pd	③ Cb
	② Ae	① Ie			③ Pe	③ Cc
	② Af				③ Pf	③ Cd
	② Ag				③ Pg	③ Ce
	② Ah				③ Ph	③ Cf
	② Ai				③ Pi	③ Cg
	② Aj				③ Pj	③ Ch
	② Ak				③ Pk	PARAM. → ③ G0
					③ Pl	③ G0
					③ Pm	③ G1
					③ Pn	③ G2
					③ Po	③ G3
					③ Pp	③ G4
					③ Pq	③ G5
					③ Pr	③ G6
					③ Ps	③ G7
						③ G9
						③ Ga
						③ Gb
						③ Gc
						③ Gd
						TIMES → ③ T0
						③ T1
						③ T2
						③ T3
						③ T4
						③ T5
						INITIAL. → ③ V0
						③ V1

9.1. Keypad

The board features a terminal, which the operator uses to perform certain actions:

15-key terminal

- ON/OFF: switches the unit on and off. The unit must have been switched on with this key for any control, check or action to be carried out. (See ON/OFF control).
- ALARM: pressing this key calls up the first active alarm screen and at the same time switches off the buzzer. Pressing the key again resets the active alarm or alarms. Various alarm screens can be viewed by pressing UP/DOWN. If no alarms are reported, pressing this key skips to the NO ACTIVE ALARM screen. (See Alarm management).
- UP/DOWN: these keys are dual purpose:
 - use to scroll screen loops when the cursor is in the top left corner
 - use to increase/decrease parameters or change their values when the cursor is positioned on said values.
- ENTER: in the value setup screens, the first time the key is pressed, the cursor moves onto the first parameter on the screen. When pressed again, you confirm the set value and move the cursor to the next parameter. From the last parameter, the cursor will return to the top left position (cursor on 0.0 on display).
- WINT. (red): Winter mode
- SUM. (blue): Summer mode
- INFO: changes the unit displayed on the terminal, switching to the next one available

6-key keypad

- ALARM: pressing this key calls up the first active alarm screen and at the same time switches off the buzzer. Pressing the key again resets the active alarm or alarms. Various alarm screens can be viewed by pressing UP/DOWN. If no alarms are reported, pressing this key skips to the NO ACTIVE ALARM screen (see Alarm management).
- ESC exits a loop and goes back to the previous menu.
- PRG from the initial screen, provides access to the main menu so that you can perform programming procedures.
- UP/DOWN: these keys are dual purpose:
 - use to scroll screen loops when the cursor is in the top left corner;
 - use to increase/decrease parameters or change their values when the cursor is positioned on said values.
- ENTER: in the value setup screens, the first time the key is pressed, the cursor moves onto the first parameter on the screen. When pressed again, you confirm the set value and move the cursor to the next parameter. From the last parameter, the cursor will return to the top left position (cursor on 0.0 on display).

9.2. LEDs

In the 15-key terminal, each key is associated with a green LED, which lights when the associated key is pressed and indicates which group of screens the user is in.

A further three LEDs are located under the rubber keys, indicating respectively:

1. Alarm key indicates peripheral unit alarm status;
2. ON/OFF key if lit, confirms that the unit is on;
3. Enter key indicates that the unit is correctly powered.

6-key terminals, on the other hand, only feature the alarm key, which indicates the alarm condition, and the prog key, which tells the user that he is entering the unit's configurations. 2 minutes after the last key is pressed, the application automatically calls up the main screen and switches off the display's LEDs and backlighting.

9.3. Display

The display used is a PGD 4-line x 20-character LCD model.

The liquid crystal display gives the values of controlled parameters, the selected set points, alarm thresholds and, in general, all information relating to controlled variables in the specified formats. Special messages are also displayed whenever an alarm situation occurs. This type of display can also show images (the key in password screens, the hazard symbol in alarm screens etc.) and display a line twice its normal size.

You can move around the screen using the terminal's keys as described below:

- if the cursor is positioned in the top left corner (Home), you can press the UP/DOWN keys to call up the following screens associated with the selected loop;

- if a screen features fields for setting values, pressing the ENTER key moves the cursor onto these fields.

Once you have reached the value setting field, the value can be edited, within the prescribed range, by pressing the UP/DOWN keys.

Once you have set the desired value, you must press the ENTER key again to store it in the memory.

If you are on a list menu, you can use the UP/DOWN keys to run through the various options, and the ENTER key to select them. This type of menu is found in the MANUFACTURER loop. If the display installed is a 6-key model, a main list menu will appear via which you can access the application's various features quickly.

10. List of parameters

This table contains the list of all parameters appearing in the screens, with the relevant description.

Parameter: string as it appears in the screen;

Type: (R) read, (R/W) read/write

P.: position of screen in the application, screen index;

Description: brief description of the parameter;

U/M: unit of measurement of value in question;

Range: range of values that parameter can be given;

Default: parameter's factory setting

Notes: column left blank for user to make notes.

Depending on setup, some screens might not be displayed when running the cursor between the various loops.

Table 10.1 List of parameters

Parameter	Type	P.	Description	U/M	Range	Default	Notes
Q0 main list menu (for 6-key keypads)							
MAINTENANCE LOG INPUTS/OUTPUTS CLOCK SET POINT USER MANUFACTURER UNIT ON/OFF SUMMER/WINTER UNIT SELECT	R	Q0	Using UP & DOWN keys, you can move the cursor onto the desired string and then press ENTER to enter the various loops				
M0,1,...,6 main menu loop MENU key							
HH:MM dd/mm/yy	R	M0	Displays hours, minutes, day, month and year				
Room T.	R	M0	Temperature of room to be controlled	°C			
External T.	R	M1	External temperature, only if there is no humidity management	°C			
Room H.	R	M1	Room humidity, only if humidity management is enabled	%rH	Screen Cd		
Active temperature set point	R	M2	Active temperature set point	°C			
Unit in	R	M3	Indicates whether current operating mode is winter or summer: 0: WINTER; 1: SUMMER		0.1		
Time band	R	M3	Filled-in box (!) means time bands are enabled; empty box (?) means time bands are not enabled		!/?		
Dehumid	R	M3	Indicates whether the dehumidifying feature is activated		!/?		
Set point compens.	R	M4	Indicates whether the set point compensation feature is activated		!/?		
Defrost	R	M4	Indicates whether the defrost feature is activated		!/?		
Freecooling	R	M4	Indicates whether the freecooling feature is activated		!/?		
Freeheating	R	M4	Indicates whether the freeheating feature is activated		!/?		
I0,1,...,9,a,b input output loop I/O key							
Temperature sensors: Room	R	I0	Displays value of the room temperature sensor	°C			
External	R	I0	Displays value of the external temperature sensor	°C			
Delivery Temperature Sensor	R	I1	Displays value of the delivery temperature sensor	°C			
Humidity sensors: Recirculat.	R	I2	Displays value of the room humidity sensor	%	Screen Cd		
External	R	I2	Displays value of the external humidity sensor	%	Screen Cf		
Sensors: Defrost 1	R	I3	Displays value of defrost 1 sensor		Screen C9	Screen Ca	
Defrost 2	R	I3	Displays value of defrost 2 sensor		Screen Cb	Screen Cc	
Sensor: Condens. 1	R	I4	Displays value of condensing temperature 1 sensor	°C		Screen Ca	
Condens. 2	R	I4	Displays value of condensing temperature 2 sensor	°C		Screen Cc	
Enthalpy: Internal	R	I5	Displays calculation of internal enthalpy	kcal/kg			
External	R	I5	Displays calculation of external enthalpy	kcal/kg			
Enthalpy set point	R	I6	Displays the enthalpy set point calculated	kcal/kg			
Digital inputs 1: :7	R	I7	Status of digital inputs 1,2,..,7 (C: closed; O: open)		O/C		
4: :10	R	I7	Status of digital inputs 4,5,..,10 (C: closed; O: open)		O/C		
13: :16	R	I8	Status of digital inputs 10,11,..,16 (C: closed; O: open)		O/C		
Compressor 1	R	I9	Status of compressor 1 (ON; OFF)		ON / OFF		
Compressor 2	R	I9	Status of compressor 2 only if enabled (ON; OFF)		ON / OFF		
Heater 1	R	I9	Status of heating element 1 only if enabled (ON; OFF)		ON / OFF		
Heater 2	R	I9	Status of heating element 2 only if enabled (ON; OFF)		ON / OFF		

Parameter	Type	P.	Description	U/M	Range	Default	Notes
Cycle 1 Rev.Sol.	R	Ia	Status of cycle reversing solenoid valve 1 only if enabled (ON; OFF)		ON / OFF		
Cycle 2 Rev.Sol.	R	Ia	Status of cycle reversing solenoid valve 2 only if enabled (ON; OFF)		ON / OFF		
Cond.Fan 1	R	Ia	Condenser fan 1 (ON; OFF)		ON / OFF		
Cond.Fan 2	R	Ia	Condenser fan 2 only if compressor 2 is enabled (ON; OFF)		ON / OFF		
Main Fan	R	Ib	Status of main fan (ON; OFF)		ON / OFF		
Humidifier	R	Ib	Status of humidifier only if enabled (ON; OFF)		ON / OFF		
Comp.1 Cap.ctrl 1	R	Ib	Status of compressor 2 capacity control 1 only if enabled (ON; OFF)		ON / OFF		
Comp.2 Cap.ctrl 1	R	Ib	Status of compressor 1 capacity control 1 only if enabled (ON; OFF)		ON / OFF		
Ext.damper	R	Ic	External damper opening status	%			
Heat.Valve	R	Ic	Heating valve opening status	%			
Fan 1 status	R	Id	Indicates status of fan 1. This can be displayed either as a percentage or in graphic format using a bar with 20 divisions.		0...100		
Fan 2 status	R	Id	Indicates status of fan 2. This can be displayed either as a percentage or in graphic format using a bar with 20 divisions.		0...100		
Modem status	R	Ie	Modem status: Modem standby, Initialization, Searching for GSM network, Modem standby, Modem alarm condition, Initializ. error, Enabled PIN err., No GSM network found, SMS saturation, Sending SMS, Modem connected, Modem calling				
GSM range	R	Ie	Quality of GSM reception				
Time to next call	R	Ie	Time after which the modem will make a new call attempt				

S0,S1 set point loop SET key

Summer Temp.set point	R	S0	Temperature set point during summer mode	°C	Screen P3	25.0	
Winter Temp.set point	R	S1	Temperature set point during winter mode	°C	Screen P3	21.0	
Summer Humidity set point	R/W	S2	This screen is only enabled if humidity control is enabled; summer humidity set point setting	%	Screen P5	50.0	
Winter Humidity set point	R/W	S3	This screen is only enabled if humidity control is enabled; winter humidity set point setting	%	Screen P5	50.0	

P0,P1,...,9,a,b,...s user loop PROG key

User Password	R/W	P0	User loop logon screen		0...9999		
Compressor 1 enable	R/W	P1	Enable operation of compressor number 1				
Compressor 2 enable	R/W	P1	Enable operation of compressor number 2				
Heater 1 enable	R/W	P2	Enable operation of heating element number 1				
Heater 2 enable	R/W	P2	Enable operation of heating element number 2				
Temperature Set point Limit: Maximum	R/W	P3	Temperature set point maximum limit	°C	-99.9...99.9	35.0	
Minimum	R/W	P3	Temperature set point minimum limit	°C	-99.9...99.9	5.0	
Temp.ctrl. band: Summer	R/W	P4	Summer temperature control differential	°C	0...15.0	3.0	
Winter	R/W	P4	Winter temperature control differential	°C	0...15.0	3.0	
Dead zone	R/W	P4	Temperature control dead zone	°C	0...3.0		
Humidity Set point Limit: Maximum	R/W	P5	Humidity set point maximum limit	%	-99.9...99.9	85.0	
Minimum	R/W	P5	Humidity set point minimum limit	%	-99.9...99.9	25.0	
Humid.ctrl. band: Summer	R/W	P6	Summer humidity control band	%	0...20.0	5.0	
Winter	R/W	P6	Winter humidity control band	%	0...20.0	5.0	
Dead zone	R/W	P6	Humidity control dead zone	%	0...5.0		
Temperature-based Free Cool/Heating Differential	R/W	P7	Screen displayed only if freecooling features are activated. Temperature differential for entering freecooling and freeheating mode	°C	-99.9...99.9	3.0	
Enthalpy-based Free Cool/Heating Differential	R/W	P8	Screen displayed only if freecooling and enthalpy features are activated. Enthalpy differential for controlling damper opening	kcal/kg	-999.9...999.9		
Freecool Damper (summer set point): Offset	R/W	P9	Displayed only if summer freecooling is activated. Parameters for adjusting external damper during summer freecooling. Offset with respect to summer set point - ramp start point	°C	-99.9...99.9	-2.0	

Parameter	Type	P.	Description	U/M	Range	Default	Notes
Differ.	R/W	P9	Differential with respect to offset - defines end of ramp	°C	-99.9...99.9	2.0	
Freeheat Damper (winter set point): Offset	R/W	Pa	Displayed only if winter freecooling is activated. Parameters for adjusting external damper during winter freeheating. Offset with respect to winter set point - ramp start point	°C	-99.9...99.9	2.0	
Differ.	R/W	Pa	Differential with respect to offset - defines end of ramp	°C	-99.9...99.9	2.0	
Ext. Damper Minimum Opening	R/W	Pb	Minimum opening of external damper even when full closing is requested	%	0...99	25	
Winter Damper Start	R/W	Pb	During startup or after a power failure, the external damper stays fully closed at 0V until the temperature control set point is reached (only when in winter mode) 0: NORMAL; 1: CLOSED		0.1	0	
Delivery temperature minimum limit: Set point	R/W	Pc	Displayed only if delivery sensor is enabled; set point setting	°C	-99.9...99.9	15.0	
Different.	R/W	Pc	Differential setting	°C	-99.9...99.9	3.0	
Summer compens.: External T.	R/W	Pd	Parameters for compensation in summer mode; external temperature set point beyond which compensation starts	°C	-99.9...99.9	30.0	
Different.	R/W	Pd	Compensation band determining the set point variation range	°C	-99.9...99.9	5.0	
Max Comp.	R/W	Pd	Maximum permissible compensation	°C	0...99.9	5.0	
Winter compens.: External T.	R/W	Pe	Parameters for compensation in winter mode; external temperature set point beyond which compensation starts	°C	-99.9...99.9	0	
Different.	R/W	Pe	Compensation band determining the set point variation range	°C	-99.9...99.9	5.0	
Max Comp.	R/W	Pe	Maximum permissible compensation	°C	0...99.9	5.0	
Defrost Start del.	R/W	Pf	Only displayed if heat pump feature is activated. Temperature must remain below the initial set point for this time for defrosting to start	minutes	0...999	30	
Maximum time	R/W	Pf	If defrosting is not ended by temperature within this time, it is stopped	minutes	0...999	5	
Enable: ON after blackout	R/W	Pg	For enabling automatic restart after a power failure		Y/N	Y	
Digital inp. OFF	R/W	Pg	For enabling unit switch-off by digital input		Y/N		
Supervisor OFF	R/W	Pg	For enabling unit switch-off by supervisor system		Y/N		
Flow-switch enable	R/W	Ph	Enables/Disables flow-switch				
Heaters (winter set point): Offset	R/W	Pi	Only enabled if heating elements are enabled. Offset with respect to winter set point	°C	-99.9...99.9	-2.0	
Differ.	R/W	Pi	Differential with respect to offset	°C	-99.9...99.9	2.0	
Summer Recirc.Temp H/L threshold: High	R/W	Pj	Room temperature high alarm threshold in summer	°C	-99.9...99.9	32.0	
Low	R/W	Pj	Room temperature low alarm threshold in summer	°C	-99.9...99.9	20.0	
Winter Recirc.Temp H/L threshold: High	R/W	Pk	Room temperature high alarm threshold in winter	°C	-99.9...99.9	26.0	
Low	R/W	Pk	Room temperature low alarm threshold in winter	°C	-99.9...99.9	17.0	
Recirc. Temp. High/Low Alarm Delay	R/W	Pl	High/low room temperature alarm delay	minutes	0...999	30	
Heating Valve Ctrl. (Winter Set point): Offset	R/W	Pm	Parameters for heating valve control. Offset with respect to winter set point	°C	-99.9...99.9	-2.0	
Differ.	R/W	Pm	Differential with respect to offset	°C	-99.9...99.9	2.0	
Supervisor speed	R/W	Pn	Setting of baud rate for communication with supervisor system 1200 (RS485-RS422); 2400 (RS485-RS422); 4800 (RS485-RS422); 9600 (RS485 only); 19200 (RS485 only)	bps	0,1,2,3,4		
ID No.	R/W	Pn	Identification number of unit in a supervision network		1...200	1	
Protocol	R/W	Pn	Type of protocol used (CAREL, Modbus®, LON, RS232, GSM)				
Number rings	R/W	Po	Number of call rings (modem only)				
Total phonebook numbers	R/W	Po	Total of numbers stored for sending SMS				
Telephone number	R/W	Po	Telephone number to send SMS to				
Password	R/W	Po	Password for sending SMS to pCO				
Number rings	R/W	Pp	Number of rings to be made (external modem only)				
Modem type	R/W	Pp	Modem type: tone or pulse				
Text on SMS	R/W	Pq	Customizable string sent together with the alarm SMS messages				

Parameter	Type	P.	Description	U/M	Range	Default	Notes
Display language screen at switch-on	R/W	Pr	For enabling language option screen every time the unit is switched on				
New user password	R/W	Ps	Option for setting new user password		0...9999		
K0,K1,...,8 clock loop CLOCK key							
Clock time	R/W	K0	Current time setup, in hours and minutes	hh:mm	0...24; 0...59		
date	R/W	K0	Current date setup	dd/mm/yy	1...31/1...12/0...99		
Clock password	R/W	K1	Clock loop logon screen		0...9999		
Daily time bands enable	R/W	K2	For enabling daily time bands with varying set points		Y/N		
Main fan OFF	R/W	K2	For enabling main fan switch-off by time bands		Y/N		
Daily time band: Start	R/W	K3	Setting of time band start in hours and minutes	hh:mm	0...24; 0...59		
End	R/W	K3	Setting of time band end in hours and minutes	hh:mm	0...24; 0...59		
Summer mode time bands: Inside set point	R/W	K4	Setting of summer control inside set point for time band	°C	-99.9...99.9		
Outside set point	R/W	K4	Setting of summer control outside set point for time band	°C	-99.9...99.9		
Winter mode time bands: Inside set point	R/W	K5	Setting of winter control inside set point for time band	°C	-99.9...99.9		
Outside set point	R/W	K5	Setting of winter control outside set point for time band	°C	-99.9...99.9		
Unit OFF by weekly time band enable	R/W	K6	For enabling weekly time bands with unit's switching off		Y/N		
Time bands Mon	R/W	K7	Enabling of weekly time bands for Monday		Y/N		
Tues	R/W	K7	Enabling of weekly time bands for Tuesday		Y/N		
Wed	R/W	K7	Enabling of weekly time bands for Wednesday		Y/N		
Thur	R/W	K7	Enabling of weekly time bands for Thursday		Y/N		
Fri	R/W	K7	Enabling of weekly time bands for Friday		Y/N		
Sat	R/W	K7	Enabling of weekly time bands for Saturday		Y/N		
Sun	R/W	K7	Enabling of weekly time bands for Sunday		Y/N		
Enter new password	R/W	K8	Option for setting new clock password		0...9999		
A0,A1,...,9,a,b...servicing loop SERV key							
PCO STD ROOFTOP CAREL SpA Cod.:FLSTDMRT0A Ver.:1.0 12/12/02		A0	Displays code, version and date of application program				
Language:	R/W	A0	Language option		Italian/English		
Bios:x.xx Date bios:dd/mm/yy Boot:x.xx Date Boot:dd/mm/yy		A1	Indicates version and date of application program's Boot and Bios				
pCO Board Installed Board: pCOxx Type: sssss		A2	Indicates the type of board installed (pCO ² , pCO ¹ ...) and size of board (small, medium and large)				
Unit Operation	R	A3	Indicates hours of operation of unit	h	0...999999		
Operation: Compressor1	R	A4	Indicates hours of operation of compressor 1	h	0...999999		
Compressor2	R	A4	Indicates hours of operation of compressor 2	h	0...999999		
Maintenance password	R/W	A5	Servicing loop logon screen		0...9999		
Unit running hours threshold	R/W	A6	Setting of running hours threshold for unit	h	0...999000	20000	
Compressor1 running hours threshold	R/W	A7	Setting of running hours threshold for compressor 1	h	0...999000	10000	
Compressor2 running hours threshold	R/W	A8	Setting of running hours threshold for compressor 2	h	0...999000	10000	
Unit hour-meter reset	R/W	A9	Unit hour-meter reset		Y/N		
Compressors hour-meter reset: 1	R/W	Aa	Compressor 1 hour-meter reset		Y/N		
2	R/W	Aa	Compressor 2 hour-meter reset		Y/N		
Temperature sensors setting: Room	R/W	Ab	Room temperature sensor setting. The set value is added algebraically to the value detected by the sensor. The sensor reading is on the right	°C	-9.9...9.9		
Deliv.	R/W	Ab	Delivery temperature sensor setting	°C	-9.9...9.9		
Ext. temperature sensor setting	R/W	Ac	External temperature sensor setting	°C	-9.9...9.9		
Humidity sensors setting: Room	R/W	Ad	Room humidity sensor setting	%	-9.9...9.9		
Ext.	R/W	Ad	External humidity sensor setting	%	-9.9...9.9		

Parameter	Type	P.	Description	U/M	Range	Default	Notes
Defrost sensors setting: Defrost 1	R/W	Ae	Defrost 1 sensor setting	°C	-9.9...9.9		
Defrost 2	R/W	Ae	Defrost 2 sensor setting	°C	-9.9...9.9		
Alarm log delete	R/W	Af	Enables you to delete the log of stored alarms		Y/N		
AIn. (mv) Test 1	R/W	Ag	Displays AIn 1 atom outputs		-9999...9999		
2	R/W	Ag	Displays AIn 2 atom outputs		-9999...9999		
3	R/W	Ag	Displays AIn 3 atom outputs		-9999...9999		
4	R/W	Ag	Displays AIn 4 atom outputs		-9999...9999		
5	R/W	Ag	Displays AIn 5 atom outputs		-9999...9999		
6	R/W	Ag	Displays AIn 6 atom outputs		-9999...9999		
AIn. (mv) Test 7	R/W	Ah	Displays AIn 7 atom outputs		-9999...9999		
8	R/W	Ah	Displays AIn 8 atom outputs		-9999...9999		
Dout Test Main Fan	R/W	Ai	Manual test of main fan operation		Y/N		
Compress. 1	R/W	Ai	Manual test of compressor 1 operation		Y/N		
Compress. 2	R/W	Ai	Manual test of compressor 2 operation		Y/N		
Dout Test Cycle Rev.Sol 1	R/W	Aji	Manual test of cycle reversing solenoid valve 1 operation		Y/N		
Cycle Rev.Sol 2	R/W	Aj	Manual test of cycle reversing solenoid valve 2 operation		Y/N		
Enter new password	R/W	Ak	Option for setting new servicing password		0...9999		

Z0,Z1 manufacturer loop MENU-PROG key

Manufacturer password	R/W	Z0	Manufacturer loop logon screen		0...9999		
Configuration Parameters Times Initialization	R	Z1	Manufacturer parameters are split into four parts. Using the UP & DOWN keys, you can move the cursor onto the desired string and then press ENTER to run through the parameters				

C0,C1,...,9,a,b,..i manufacturer loop CONFIGURATION submenu

Humidity Management	R/W	C0	For enabling humidity management		Y/N		
Heat Pump	R/W	C0	For enabling unit operation in heat pump mode		Y/N		
Summ. Freecooling	R/W	C1	For enabling summer freecooling		Y/N	N	
Wint. Freeheating	R/W	C1	For enabling winter freeheating		Y/N	N	
Wint. Freecooling	R/W	C1	For enabling winter freecooling		Y/N	N	
Cooling Steps 1 enable:	R/W	C2	For enabling energy saving, switching off first compressor		Y/N		
Cooling Steps 2 enable:	R/W	C2	For enabling energy saving, switching off second compressor		Y/N		
Contacts logic:	R/W	C2	Digital inputs' contacts logic for cooling energy saving		NC/NO		
Heating Steps 1 enable:	R/W	C3	For enabling energy saving, switching off first heating element		Y/N		
Heating Steps 2 enable:	R/W	C3	For enabling energy saving, switching off second heating element		Y/N		
Contacts logic:	R/W	C3	Digital inputs' contacts logic for heating energy saving		NC/NO		
Num.Heaters	R/W	C4	Number of heating elements (0,1,2)	Heater	0,1,2	0	
Set point Compensation	R/W	C4	For enabling set point compensation		Y/N	N	
Summ/Wint select	R/W	C4	Summer/winter switching type (pan;rem;aut)		0, 1, 2		
Number compressors	R/W	C5	Number of compressors managed (-----; 1 Compres.; 2 Compres.; 2 Comp. +1 Capacity ctrl)	Comp.	0, 1, 2, 3		
Heating Valve	R/W	C6	For enabling heating valve		Y/N		
Cycle reversing valve logic	R/W	C6	Cycle reversing valve logic 0: NC; 1:NO		0,1		
Room temperature sensor Type	R/W	C7	Setting of type of room sensor (NTC, PT1000)		0,1		
External temperature sensor enable Type	R/W	C8	For enabling external temperature sensor		Y/N		
Delivery temperature sensor enable Type	R/W	C8	Setting of type of external sensor (NTC, PT1000)		0, 1, 2, 3, 4		
Delivery temperature sensor enable Type	R/W	C9	For enabling delivery temperature sensor		Y/N		
Defrost 1 sensor enable Type	R/W	C9	Setting of type of delivery sensor (NTC, PT1000)		0,1		
Defrost 1 sensor enable Type	R/W	Ca	For enabling defrost 1 sensor		Y/N		
Defrost 1 sensor enable Type	R/W	Ca	Setting of defrost 1 sensor (NTC, 0...1 V, 0...10 V, 4...20 mA, 0...20 mA)		0...5		
Defrost 1 sensor limits	R/W	Cb	Setting of minimum limit of defrost 1 sensor	Screen C9	-99.9...99.9		

Parameter	Type	P.	Description	U/M	Range	Default	Notes
Min							
Max	R/W	Cb	Setting of maximum limit of defrost 1 sensor	Screen C9	-999.9...999.9		
Defrost 2 sensor enable	R/W	Cc	For enabling defrost 2 sensor		Y/N		
Type	R/W	Cc	Setting of defrost 1 sensor (NTC, 0...1 V, 0...10 V, 4...20 mA, 0...20 mA)		0...5		
Defrost 2 sensor limits							
Min	R/W	Cd	Setting of minimum limit of defrost 2 sensor	Screen Ca	-99.9...99.9		
Max	R/W	Cd	Setting of maximum limit of defrost 2 sensor	Screen Ca	-999.9...999.9		
Room humidity sensor enable	R/W	Ce	For enabling room humidity sensor		Y/N		
Type	R/W	Ce	Setting of type of room humidity sensor (0...1 V, 0...10 V, 4...20 mA, 0...20 mA)		0...5		
Room humidity sensor limits							
Min	R/W	Cf	Setting of minimum limit of room humidity sensor	%rH	-99.9...99.9	10.0	
Max	R/W	Cf	Setting of maximum limit of room humidity sensor	%rH	-999.9...999.9	90.0	
External humidity sensor enable	R/W	Cg	For enabling external humidity sensor		Y/N		
Type	R/W	Cg	Setting of type of external humidity sensor (0...1 V, 0...10 V, 4...20 mA, 0...20 mA)		0...5		
External humidity sensor limits							
Min	R/W	Ch	Setting of minimum limit of external humidity sensor	%rH	-99.9...99.9	10.0	
Max	R/W	Ch	Setting of maximum limit of external humidity sensor	%rH	-999.9...999.9	90.0	

G0,G1,...,9 manufacturer loop PARAMETERS submenu

Temperature control	R/W	G0	Type of temperature control (P; P+I)		0,1		
Integrat. time in P+I control:	R/W	G0	Integration time during P+I control	s	0...999		
Summ.freecooling and wint.freeheating based on:	R/W	G1	Control mode option: temperature- or enthalpy-based (TEMPERATURE; ENTHALPY)		0,1		
Unit altitude for calculating enthalpy	R/W	G2	Setting of altitude of place where unit works for the purpose of calculating enthalpy	m	0...2000		
Sensor used for defrost	R/W	G3	Setting of type of sensor used during defrosting (TEMPERATURE/PRESSURE)			Pressure	
Defrost set point Start	R/W	G4	Setting of defrost start set point		-99.9...99.9	-2.0	
End	R/W	G4	Setting of defrost end set point		-99.9...99.9	14.0	
Main Fan OFF during Defrost	R/W	G5	For enabling main fan switch-off during defrosting		Y/N		
Simultaneous Circuit Defrost	R/W	G5	For enabling simultaneous-type circuit defrosting		Y/N		
Simult.defrost End of defrost with lowest temp.sensor?	R/W	G6	Enabling in case of simultaneous defrosting with lowest temperature sensor		Y/N		
No.compressors for dehumid	R/W	G7	Setting of number of compressors enabled during dehumidifying stage	Comps.	0, 1, 2		
Condensing dependent on compressor	R/W	G8	Establishes whether condensing must be CompressorON=CondensingON CompressorOFF=CondensingOFF or if it must be controlled autonomously			Dependent	
Condenser fan: Set point	R/W	G9	Setting of condenser fans set point on condensing temperatures		0...99.9	16 bar	
Different.	R/W	G9	Setting of differential based on previous set point		0...99.9	3 bar	
Inverter speed: Max	R/W	Ga	Maximum speed (expressed as a voltage) the inverter will reach	V	0...10	10 V	
Min	R/W	Ga	Minimum speed (expressed as a voltage) the inverter will reach	V	0...10	0 V	
Minimum ON-time	R/W	Ga	Minimum time for which condensing must stay ON	s	0...999	0	
Prevent enable	R/W	Gb	For enabling or disabling the prevent feature during condensing			Enabled	
Prevent set point	R/W	Gb	Prevent feature set point		-99.9...99.9	20	
Prevent differential	R/W	Gb	Prevent feature differential		0...99.9	2	
Prevent output delay	R/W	Gc	Prevent output delay	s	0...999	0	
Coupled Condenser fans?	R/W	Gd	For enabling coupled operation of condenser fans		Y/N		

T0,T1,...,5 manufacturer loop TIMES submenu

Min compressor OFF time	R/W	T0	Minimum compressor off-time	s	0...9999	180	
Min compressor ON time	R/W	T0	Minimum compressor on-time	s	0...9999	60	
Time between ON single compr.	R/W	T1	Time between starts by a single compressor	s	0...9999	360	

Parameter	Type	P.	Description	U/M	Range	Default	Notes
Time between ON diff. compr.	R/W	T1	Time between starts by different compressors	s	0...9999	10	
Low pressure delay	R/W	T2	Setting of low pressure alarm delay	s	0...9999	120	
Rotation enable	R/W	T2	For enabling compressor rotation		Y/N	1	
Flow-switch alarm delay: Start	R/W	T3	Flow-switch alarm generation delay on startup	s	0...99		
Steady state	R/W	T3	Flow-switch alarm generation delay in steady state	s	0...99		
Delay at Main Fan OFF	R/W	T4	Setting of delay at main fan switch-off	s	0...999	20	
Start delay Compressor	R/W	T4	Setting of delay on compressor startup	s	0...999	60	
Start/end defrost Forced compressor OFF	R/W	T5	Setting of forced compressor switch-off time at start and end of defrosting	s	0...999		
V0,V1,...,2 manufacturer loop INITIALIZATION submenu							
New manufacturer password	R/W	V0	For setting a new manufacturer password		0...9999		
Press ENTER to install default values	R/W	V1	In this screen, if you press the ENTER key, the default values are installed				

11. Variables for supervision

The unit can be interfaced with a local or remote supervision/remote-servicing system.

Board accessories include an optional card for serial communication through RS-422 or RS-485 interface, supplied separately.

If serial communication values (such as serial address and baud rate) are correctly set, the parameters transmitted by the unit will be as featured in the following table.

11.1.1. Key

A Analogue variable

D Digital variable

I Integer variable

IN Input variable

OUT Output variable

IN/OUT Input/output variable

pCOx ← Supervisor

pCOx → Supervisor

pCOx ↔ Supervisor

Type	Address	Direction	Description
D	1	IN	Digital Input 1
D	2	IN	Digital Input 2
D	3	IN	Digital Input 3
D	4	IN	Digital Input 4
D	5	IN	Digital Input 5
D	6	IN	Digital Input 6
D	7	IN	Digital Input 7
D	8	IN	Digital Input 8
D	9	IN	Digital Input 9
D	10	IN	Digital Input 10
D	11	IN	Digital Input 11
D	12	IN	Digital Input 12
D	13	IN	Digital Input 13
D	14	IN	Digital Input 14
D	15	IN	Digital Input 15
D	16	IN	Digital Input 16
D	17	IN	Digital Input 17
D	18	IN	Digital Input 18
D	21	IN	Digital Output 1
D	22	IN	Digital Output 2
D	23	IN	Digital Output 3
D	24	IN	Digital Output 4
D	25	IN	Digital Output 5
D	26	IN	Digital Output 6
D	27	IN	Digital Output 7
D	28	IN	Digital Output 8
D	29	IN	Digital Output 9
D	30	IN	Digital Output 10
D	31	IN	Digital Output 11
D	32	IN	Digital Output 12
D	33	IN	Digital Output 13
D	62	IN	Unit ON
D	60	IN	Total alarm
D	64	IN	Compressor 1 thermal overload alarm
D	65	IN	Compressor 2 thermal overload alarm
D	66	IN	Circuit no.1 HP pressure switch alarm
D	67	IN	Circuit no.2 HP pressure switch alarm
D	68	IN	Antifreeze alarm
D	69	IN	Alarm: Room air temperature over high threshold
D	70	IN	Alarm: Room air temperature under low threshold
D	71	IN	Circuit no.1 LP pressure switch alarm
D	72	IN	Circuit no.2 LP pressure switch alarm
D	73	IN	Compressor 1 maintenance alarm
D	74	IN	Compressor 2 maintenance alarm
D	75	IN	Unit hours alarm
D	76	IN	Main fan generic interlock alarm
D	77	IN	Clogged filter alarm
D	78	IN	Heater 1 and 2 thermal overload alarm
D	79	IN	Flow-switch alarm
D	80	IN	Clock fail alarm
D	81	IN	Summer < Winter set point alarm
D	82	IN	B1 sensor fail alarm
D	83	IN	B2 sensor fail alarm
D	84	IN	B6 sensor fail alarm
D	85	IN	B7 sensor fail alarm

Type	Address	Direction	Description
D	86	IN	B4 sensor fail alarm
D	87	IN	B3 sensor fail alarm
D	88	IN	B8 sensor fail alarm
D	89	IN	B5 sensor fail alarm
D	122	IN	Heater 1 thermal overload alarm
D	123	IN	Heater 2 thermal overload alarm
D	56	IN/OUT	Alarm reset by supervisor
D	63	IN/OUT	ON/OFF by supervisor
D	90	IN/OUT	Operation as heat pump enable
D	91	IN/OUT	Humidity feature enable
D	92	IN/OUT	Delivery sensor enable
D	93	IN/OUT	Enthalpy-based freecooling control enable
D	94	IN/OUT	Summer freecooling enable
D	95	IN/OUT	Winter freeheating enable
D	96	IN/OUT	Damper opening on startup option
D	97	IN/OUT	Compensation enable
D	98	IN/OUT	Main fan switch-off during defrost enable
D	99	IN/OUT	Simultaneous defrost enable
D	100	IN/OUT	Automatic restart enable
D	101	IN/OUT	Remote start-stop enable
D	102	IN/OUT	Daily time bands enable
D	103	IN/OUT	Winter freecooling enable
D	104	IN/OUT	Type of control (Proportional or Prop. + Integr.)
D	105	IN/OUT	Compressor rotation enable
D	106	IN/OUT	Weekly time bands: Running on Sunday
D	107	IN/OUT	Weekly time bands: Running on Monday
D	108	IN/OUT	Weekly time bands: Running on Tuesday
D	109	IN/OUT	Weekly time bands: Running on Wednesday
D	110	IN/OUT	Weekly time bands: Running on Thursday
D	111	IN/OUT	Weekly time bands: Running on Friday
D	112	IN/OUT	Weekly time bands: Running on Saturday
D	113	IN/OUT	Fans in coupled mode enable
D	114	IN/OUT	External temperature sensor enable
D	115	IN/OUT	External humidity sensor enable
D	116	IN/OUT	Condens./Defrost 1 sensor enable
D	117	IN/OUT	Condens./Defrost 2 sensor enable
D	118	IN/OUT	Clock "Hours" change enable
D	119	IN/OUT	Clock "minutes" change enable
D	120	IN/OUT	Clock "day" change enable
D	121	IN/OUT	Clock "month" change enable
D	124	IN/OUT	Prevent enable
D	125	IN/OUT	Condensing dependent on compressor (N/Y).
D	126	IN/OUT	Flow-switch enable
D	127	IN/OUT	Cooling power 1 limitation enable
D	128	IN/OUT	Cooling power 2 limitation enable
D	129	IN/OUT	Heating power 1 limitation enable
D	130	IN/OUT	Heating power 2 limitation enable
I	1	IN	Unit status
I	10	IN	Room air temperature sensor configuration
I	11	IN	External air temperature sensor configuration
I	12	IN	Delivery temperature sensor configuration
I	13	IN	Circuit 1 condensing/defrost temperature sensor configuration
I	14	IN	Circuit 2 condensing/defrost temperature sensor configuration
I	15	IN	Room air relative humidity sensor configuration
I	16	IN	External air relative humidity sensor configuration
I	20	IN/OUT	High and low recirculating temperature alarm delay (minutes)
I	21	IN/OUT	Low pressure alarm delay
I	22	IN/OUT	Number of compressors for dehumid
I	23	IN/OUT	Main fan switch-off delay
I	24	IN/OUT	Compressor start delay
I	26	IN/OUT	Minimum compressor off-time
I	27	IN/OUT	Minimum time between starts by single compressor
I	28	IN/OUT	Flow-switch alarm delay on startup
I	29	IN/OUT	Flow-switch alarm delay in steady state
I	30	IN/OUT	Minimum condensing ON time
I	31	IN/OUT	Prevent output delay
I	36	IN/OUT	Time between starts by different compressors
I	37	IN/OUT	Minimum compressor on-time
I	38	IN/OUT	Defrost start delay time (minutes)
I	39	IN/OUT	Maximum defrosting time (minutes)
I	40	IN/OUT	Damper minimum opening percentage
I	41	IN/OUT	Unit running hours alarm threshold (x1000)
I	42	IN/OUT	Running hours threshold for compressor 1 (x1000)

Type	Address	Direction	Description
I	43	IN/OUT	Running hours threshold for compressor 2 (x1000)
I	44	IN/OUT	Number heaters
I	45	IN/OUT	Integration time for Prop.+ Intergr. control
I	46	IN/OUT	Daily band 1 Hour
I	47	IN/OUT	Daily band 2 Hour
I	48	IN/OUT	Daily band 1 Minutes
I	49	IN/OUT	Daily band 2 Minutes
I	50	IN/OUT	Time and date setup: Editable minutes
I	51	IN/OUT	Time and date setup: Editable hours
I	52	IN/OUT	Time and date setup: Editable day
I	53	IN/OUT	Time and date setup: Editable month
I	54	IN/OUT	Time and date setup: Editable year
I	55	IN/OUT	Low pressure alarm delay
I	56	IN	Compressor 1 running hours high part
I	57	IN	Compressor 1 running hours low part
I	58	IN	Compressor 2 running hours high part
I	59	IN	Compressor 2 running hours low part
I	60	IN	Unit running hours high part
I	61	IN	Unit running hours low part
I	70	IN	External air damper
I	71	IN	Heating valve
I	72	IN	Fan 1 speed
I	73	IN	Fan 2 speed
A	1	IN	Room air temperature
A	2	IN	External air temperature
A	3	IN	Delivery temperature
A	4	IN	Defrost 1 temperature
A	5	IN	Defrost 2 temperature
A	6	IN	External humidity
A	7	IN	Room humidity
A	10	IN	Active set point
A	11	IN	Active control band
A	15	IN/OUT	Summer temperature set point
A	16	IN/OUT	Winter temperature set point
A	17	IN/OUT	Summer humidity set point
A	18	IN/OUT	Winter humidity set point
A	19	IN/OUT	Temperature set point upper limit
A	20	IN/OUT	Temperature set point lower limit
A	21	IN/OUT	Summer temperature control band
A	22	IN/OUT	Winter temperature control band
A	23	IN/OUT	Humidity set point upper limit
A	24	IN/OUT	Humidity set point lower limit
A	25	IN/OUT	Summer humidity control band
A	26	IN/OUT	Winter humidity control band
A	27	IN/OUT	Freecooling/freeheating temperature differential
A	28	IN/OUT	Freecooling offset (summer set point)
A	29	IN/OUT	Freecooling differential
A	30	IN/OUT	Freeheating offset (winter set point)
A	31	IN/OUT	Freeheating differential
A	32	IN/OUT	Delivery temperature minimum limit set point
A	33	IN/OUT	Delivery temperature minimum limit differential
A	34	IN/OUT	Summer compensation set point
A	35	IN/OUT	Summer compensation differential
A	36	IN/OUT	Summer maximum compensation
A	37	IN/OUT	Winter compensation set point
A	38	IN/OUT	Winter compensation differential
A	39	IN/OUT	Winter maximum compensation
A	40	IN/OUT	Defrost start set point
A	41	IN/OUT	Defrost end set point
A	42	IN/OUT	Condensing set point
A	43	IN/OUT	Condensing differential
A	44	IN/OUT	Maximum fan speed
A	45	IN/OUT	Minimum fan speed
A	46	IN/OUT	Prevent set point
A	47	IN/OUT	Prevent differential
A	58	IN/OUT	Temperature dead zone
A	59	IN/OUT	Humidity dead zone
A	60	IN/OUT	Summer temperature high threshold
A	61	IN/OUT	Summer temperature low threshold
A	62	IN/OUT	Winter temperature high threshold
A	63	IN/OUT	Winter temperature low threshold
A	64	IN/OUT	Room air sensor setting
A	65	IN/OUT	External air sensor setting

Type	Address	Direction	Description
A	66	IN/OUT	Delivery sensor setting
A	67	IN/OUT	Defrost 1 sensor setting
A	68	IN/OUT	Defrost 2 sensor setting
A	69	IN/OUT	Heaters offset
A	70	IN/OUT	Heaters differential
A	71	IN/OUT	Room humidity sensor setting
A	72	IN/OUT	External humidity sensor setting
A	73	IN/OUT	Time bands winter outside set point
A	74	IN/OUT	Time bands summer outside set point
A	75	IN/OUT	Time bands winter inside set point
A	76	IN/OUT	Time bands summer inside set point
A	77	IN/OUT	Heating valve offset
A	78	IN/OUT	Heating valve differential
A	86	IN	External enthalpy
A	87	IN	Internal enthalpy
A	88	IN	Enthalpy set point

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Tecnologia ed Evoluzione

CAREL S.p.A.
Via dell'Industria, 11 - 35020 Brugine -
Padova (Italy)
Tel. (+39) 049.9716611 Fax (+39) 049.9716600
<http://www.carel.com> - email: carel@carel.com

Agency:

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