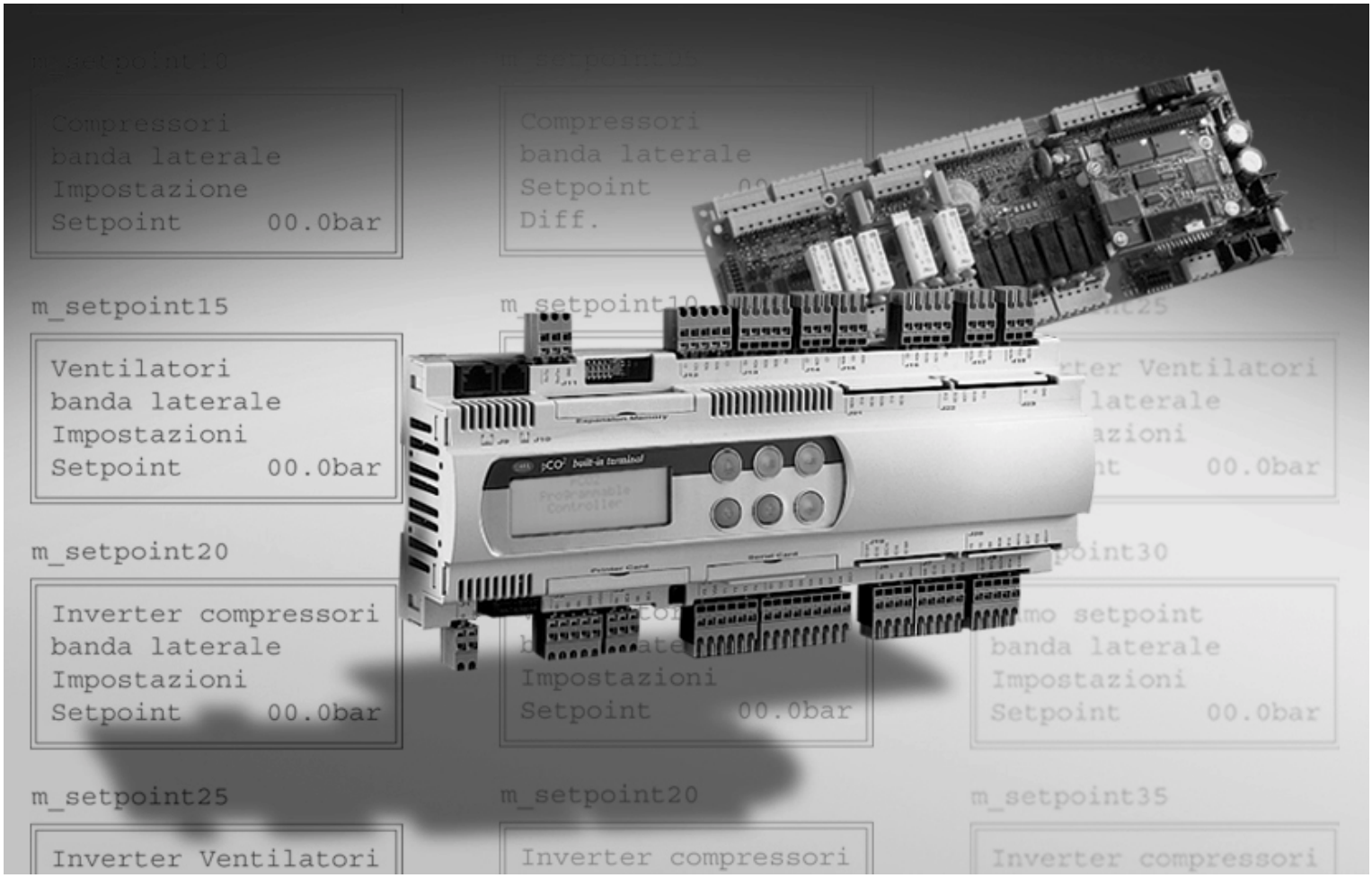
pCO² Standard Application



Pack Control
Code: FLSTDMFC0A
Version 1.2's manual

LEGGI E CONSERVA QUESTE ISTRUZIONI
READ AND SAVE THESE INSTRUCTIONS

CAREL
Technology & Evolution

We wish to save you time and money!
We can assure you that the thorough reading of this manual will guarantee correct installation and safe use of the product described.

IMPORTANT WARNINGS

BEFORE INSTALLING OR HANDLING THE APPLIANCE PLEASE CAREFULLY READ AND FOLLOW THE INSTRUCTIONS DESCRIBED IN THIS MANUAL.

The appliance that this software is dedicated to has been developed to operate risk-free and for a specific purpose, as long as:

- all the conditions specified and described in the installation and operation manual for the device in question are heeded.
- the installation, programming, operation and maintenance of the software are carried out according to the instructions contained in this manual and by qualified personnel;

All other uses and modifications made to the device that are not authorised by the manufacturer are considered incorrect. Liability for injury or damage caused by the incorrect use of the device lies exclusively with the user.

CONTENTS

1 THE PROGRAM

1.1 Main new features in version 1.2 release date 10/02/03

- The number of fan stages has been increased from 5 to 16.
- Program compatible with the pCO1 platform.
- The compressors can also be controlled with NTC temperature probes.
- Suction and discharge pressure saved together with the events in the alarm log.
- GSM modem management for remote connections and sending SMS (text) messages upon each alarm event.
- Control of the efficiency and the electrical consumption of the system.
- Indication of the electronic valve installed, with signal to the supervisor.
- Extended choice of refrigerants (for pressure – temperature conversion).
- Management of a transducer able to measure refrigerant leaks into the environment, with corresponding alarm threshold.
- Increased number of languages available: Italian, English, French, German, Spanish.
- New high discharge pressure alarm prevent function.

1.2 Main characteristics

The FLSTDMFC0A "Refrigeration system" application software for pCO² / pCO1 allows the management of a refrigeration system, with the following characteristics:

- display and control of the values measured; by external or built-in LCD terminal;
- system control with pressure probes or NTC pressure probes;
- management, according to the number of outputs available, of up to six compressors, each with up to three capacity-control steps (for a total of four outputs per compressor), and up to sixteen condensing fan steps;
- alarm management and consequent saving in the alarm log;
- availability of three levels of access to the screens;
- modification of the fundamental operating parameters (set point, differentials, alarm thresholds, time settings);
- programming of the time bands (variation of the set point according to time bands);
- multi-language management
- connection to a supervisor/telemaintenance serial line.
- send SMS (text) messages to cellular telephones.

The program features some screens for setting the operating values, and others for configuring the unit, all of which are password-protected.

1.3 Starting the unit

1.3.1 Selecting the language for displaying the screens

The application software allows the language of the user interface to be changed at power on. The first screen, after the initial self-test, displays the current language, which can be changed by pressing ENTER.
If no button is pressed, after a few seconds the main screen M0 is displayed (without changing the language).

1.3.2 Initialising the parameters in the permanent memory

The first time that the pCO² is used the data in the permanent memory should be initialised to prevent the use of incorrect for the required control functions.
For this reason, the first time the pCO² is used, the program automatically initialises all the parameters.
To perform the same procedure at any other time, follow these steps:

1. Turn the pCO² on; after a certain time in which the check routine is run, the pCO² will display the main screen, M0. During the first installation IGNORE the alarms, as these may be the result of incorrect data in the permanent memory.
2. Press the MENU + PROG buttons to display the password setting screen. This screen prevents access to the configuration branch by unauthorised persons.
3. Enter the password (default 1234), and press ENTER to confirm.
4. Move to the last row: "INITIALISATION ->", and press ENTER.
5. Press the UP button. The screen V3 will be displayed.
6. Select the configuration model required;
7. Press ENTER and UP, the text "PLEASE WAIT" will be displayed for a few seconds; this mode deletes the permanent memory and enters the default values defined by Carel.

The default values differ depending on the type of board used.
If some standard values are not correct for the required application, the user can always change them by accessing the screen or from the supervisor, making the unit customisable according to the specific application.
The fundamental parameters to be checked are:

- the number of devices and their configuration;
- the language used;
- the control parameters (Set Point, time settings, alarm thresholds, etc.).

All the data set is stored in permanent memory, to prevent it being lost when the unit is not powered. Using the program WINLOAD, the permanent memory can be read and saved to file for subsequent programming. In this way, different configurations can be modified, read and saved for different models of unit using one board.

1.3.3 Hardware keys, PCO200KEY0 for pCO2 / PCO100KEY0

The hardware keys can be used instead of a computer to download the application software to the pCO2 board.

1.3.4 Downloading the program from the hardware key

Connect the key to the pCO2 – pCO1 and proceed as described below:

1. Switch off the pCO2 – pCO1 and remove the "expansion memory" cover with a screwdriver
2. Position the selector on the key towards the key symbol  .
3. Insert the key in the corresponding slot.
4. Press Up and Down at the same time and switch the board on.
5. Check that the red LED on the key comes on .
6. Wait until the copy message on the LCD disappears, then release the buttons and confirm by pressing Enter; the data transfer operation takes around 10 seconds.
7. Switch off the pCO2 – pCO1, remove the key, replace the cover and switch the board on again.

The board will now work with the program transferred from the key.

1.3.5 Downloading the program from a computer

Obtain the kit code PC485KIT00 and the WinLOAD 32 program, and proceed as follows:

1. Connect the black converter (RS232/RS485) to the power supply using the transformer supplied in the kit, then connect the transformer to the mains.
2. Connect the converter to a free serial port on the computer using the serial cable supplied in the kit.
3. Connect the converter to connector J10 on the pCO2 – pCO1 using a telephone cable (code S90CONN00*).
4. Start the WinLOAD32 program on the computer with the board off.
5. Enter in the "COMM" field the number of the serial port used on the PC (1 for COM1, 2 for COM2).
6. Enter the value "0" in the "pCO² ADD" field.
7. Switch the board on.
8. Wait 15 seconds until the text "OFF LINE" becomes "ON LINE" in the bottom left of the WinLOAD32 screen, or until the yellow LED near the dipswitch on the board flashes; at this point, enter the actual value of the pLAN address of the board in the "pCO² ADD" field (for stand alone applications pCO² ADD =0).
9. In the WinLOAD32 program select "Upload" folder and the "Application" sub-folder.
10. Select the path with the source files of the application software.
11. Press CTRL, then click all of the IUP and BLB/BIN files, then release CTRL.
12. Click the "UPLOAD" button to start the file transfer procedure. This will last between around 1 and 5 minutes.
13. Wait until the text box shows "Upload OK".
14. Disconnect the telephone cable between the board and the converter, connect the external display if envisaged, then switch the board on and off again.

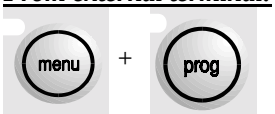
1.3.6 Basic configuration

According to the board used (SMALL, MEDIUM, or LARGE) and the number of inputs per compressor (screen C3), the number of compressors set can vary from 1 to 6, with between 1 and 3 capacity-control steps, for a total of 4 outputs per compressor, and between 1 and 16 fan steps. In addition, the compressors and the fans can be configured for phase-cutting speed controllers or inverters.
The program checks the type of board (SMALL, MEDIUM or LARGE) that it is working with, and makes the inputs and outputs that can actually be used available.
For the pCO1 controllers, check that the dipswitches used on the board for the configuration of the type of analogue inputs are positioned correctly; for more information, please read the pCO1 manual.

Number of compressors and fans

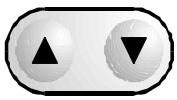
The first step involves accessing the screen C4 "CONFIGURATION" to set the number of compressors, fans and capacity-control steps to be managed and monitored.

From external terminal:



→ ENTER MANUFACTURER PASSWORD 

Go to CONFIGURATION then press 

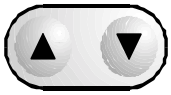
Use UP and DOWN  to scroll the screens until reaching C4

The number of compressors to be controlled, managed by the intake probe, can be set by directly by the user (screen C4), keeping in mind the number of relay outputs available according to the model: 8 outputs for the Small; 13 outputs for the Medium; 18 outputs for the Large.
The pCO², depending on the board used, can manage from a minimum of 1 compressor to a maximum of 6, all with the same capacity, as well as the possibility to rotate operation. The number of condenser fans available ranges from 1 to 16, and can be set directly by the user (screen C4), with the possibility of rotating operation. After having set/modified the number of controlled devices on screen C4 (compressors, fans, capacity-control steps), it is recommended to update the configuration parameters for the outputs E0,E1,..,E9,Ea,Eb.

Output logic

After having accessed screen C4, press 

once to return back one level

Devices
Input positions
OUTPUT POSITIONS → } use  to place the cursor on OUTPUT POSITIONS and press 

Associate the relays to the devices managed based on the selected configuration (C4).
[The system will automatically search for the first free position in the digital outputs; otherwise the user can scroll the list using the UP - DOWN buttons]

The user can decide which relays to use for the various devices (e.g. first a compressor then a capacity-control step then a fan and so on), also see manufacturer branch, unit configuration E, without needing to modify the electrical system and in any case freely deciding upon the use of the outputs.
Once having completed this operation, proceed to the configuration of the digital inputs:

NOTE: To configure the pCO2 from the built-in terminal follow the procedure described, using the corresponding buttons.

Input logic

To go back one level, press MENU once.

Devices
INPUT POSITIONS → } then 

Output positions

Associate the digital inputs to the previously configured devices so as to set the safety functions and the anomalous operation alarms.

The user can decide if the inputs are normally closed (when an alarm is present the contact is open) or normally open (when an alarm is present the contact is closed) (screen G0).
In addition the type of compressor safety devices connected to the inputs can be defined; the possible choices are as follows:

A. general: one safety device only per compressor, not delayed with manual reset
B. thermal overload + oil differential: one input dedicated to the thermal overload, not delayed with manual reset, and one input dedicated to the oil differential, delayed with manual reset
C. thermal overload + high/low pressure switch: one thermal overload input, immediate with manual reset, while the pressure switch is immediate with reset set on the screen G2
D. thermal overload + oil differential + high/low pressure switch: includes all three types of alarm

The user can decide which inputs to use for the various safety devices.
Example:
If input 6 is used for the compressor thermal overload switch, simply go to the screen D0, move to the row “Thermal comp.1 ID:00”and choose number 6 from the possible free inputs.
NOTE: the software does not allow two devices to be connected to the same input. To reverse two devices, a free input needs to be used (also see branch D, CONFIGURATION section).

Language selection.

The user can set the display language in two ways. The first is at power on, by pressing ENTER; this function can be disabled by setting the parameter on screen V3.
The second is to change the language without re-starting the controller. To do this, from the main screen M0 press PROG (for the built in terminal, press PROG and go to the row “USER: →” and then press ENTER), then enter the password (default 0); Screen P1 is displayed, press ENTER until the desired language is displayed.
Currently the software manages five languages (Italian, English, French, German and Spanish).

Unit On-Off.

There are various ways to activate or deactivate the controller and the management of the various devices with related alarms (in order of priority):

1. from the alarms: the screen Pe can be used to select if a faulty probe alarm is to turn the unit off or not
2. from the supervisor: the screen Pe is used to enable shut-down from the supervisor
3. from digital input (if configured, C8) in addition to the screen G1, the logic can be selected
4. from the keypad : if enabled on the screen B1, pressing the ON-OFF button turns the unit on or off. For built-in terminals, to switch the unit on-off simply go to the main screen M1 (M_MAIN_MENU) and press the UP button, then select whether to switch the unit on or off
5. from screen B1: the unit can be turned off or on

1.4 The supervisor network

The pCO^2 system allows connection to the main supervisory systems, using interface boards and suitable protocols.
In this application program, the following data is exchanged with the supervisor:

- display of the status of the inputs / outputs,
- the status of the enabled devices,
- any alarms present and active
- the enabling of the devices, various functions, etc.

Furthermore, a number of parameters can be modified, such as: set point, differential, time settings, unit status, alarm reset, etc.
Also see the paragraph Variables used in communication with the supervisor.

1.4.1 Serial cards.

For connection to the supervisory systems, the pCO² is designed to support the main and most common communication standards. As a result, connection cards are available for the following standards:

- optically-isolated RS485 serial card for pCO² PCO2004850
- RS232 modem serial card, not optically-isolated, for pCO² PCO200MDM0

The user may, depending on requirements, decide whether to install the card or not. The card allows connection to a supervisory system for the transmission of all the parameters set in the pCO².
In addition, an external GATEWAY is available for communication with the BACNET protocol.

1.4.2 Communication protocols.

The pCO² line supports and integrates two communication protocols, CAREL PLANT VISOR, MODBUS and GSM MODEM.
As well as installing the card, for the correct operation the identification number of the pCO² needs to be set and the card needs to be enabled (V0 and V1), and the communication protocol used needs to be selected.
Each pCO² must have its address defined so that:

- **there are no** other devices with the same address on the same serial line
- the addresses of pCO²s on the same serial line must be set in progressive order, starting from no. 1

For further information, refer to the corresponding manual or contact CAREL.

1.5 Meaning of the pCO² inputs / outputs.

This table summarises the inputs - outputs and provides a short description of each.
As the inputs and outputs of the software are completely configurable, the physical connection of the inputs and outputs changes according to which devices are configured; also see the tables on the different configurations that can be set.
In addition, the input/output branch displays what devices are configured and how they are connected.
When using a pCO1 controller, check that the dipswitches used on the board for the configuration of the type of analogue inputs are positioned correctly; for further information refer to the pCO1 installation manual.

Code	Description
B1	Suction pressure / temperature probe
B2	Discharge pressure / temperature probe
B3	Room temperature probe (opt.)
B4	Input configured by software
B5	Input configured by software
B6	Outside temperature probe (opt.)
B7	Generic temperature probe (opt.)
B8	
B9	Input configured by software
B10	Input configured by software

Table 1.1 Analogue inputs.

Code	Description
Y1	Fan controller
Y2	Compressor controller
Y3	
Y4	

Table 1.2 Analogue outputs.

The digital inputs and outputs can be completely configured from the terminal.

2 MAIN SETTINGS

2.1 Dead zone

This setting determines a zone around the set point in which no device is activated or deactivated, as a consequence minimising rapid changes in the system pressure and thus stabilising its behaviour.
The devices are activated when the measured value exceeds the limit to the right (measured value greater than SP + DZN, see Figure 1).
The number of devices to be activated varies according to the time elapsed in this situation. At set intervals, the software increases the load by one step. The controller checks the parameter (T0), used to measure the minimum time to remain in the zone for requesting the activation of a further step.
Similarly, the devices are stopped when the measured value falls below the dead zone (measured value less than the set point), and remains there for a period equal to the time between device stop requests (T0); in this case, the first device stops immediately, while the others wait the delay time between stops.
Also see the paragraph on **Time settings**.
If the next device that should start is off due to a time setting, then the start of another device will be requested, respecting the delay between starts for the devices.

1. Device stop zone
2. Dead zone
3. Device start zone
4. DZN compressor and fan dead zone differential (S8)
5. RP suction pressure read
6. SP Set Point: compressors (S2); fans (S1)

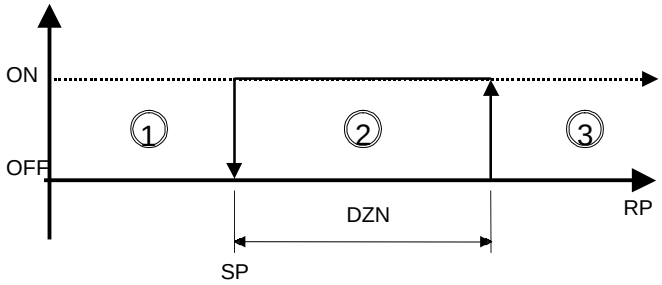


Figure 2.1.1

2.2 Proportional band

Proportional band control calculates, based on the parameters (SP, DF and the number of devices set), the various points of activation and deactivation of the devices, so as the various starts and stops are positioned proportionally within the controlled differential.
The example shows the activation of the steps for a system with 4 stages. For each step, by setting the parameters listed above, each individual step has a differential equal to SP + DF/No. steps, for the first, SP + 2 *DF/No. steps for the second, up to SP + DF for the last step.

1. SP Set Point: compressors (S2); fans (S1)
2. DF Differential: compressors and fans (S8)
3. RP Pressure read

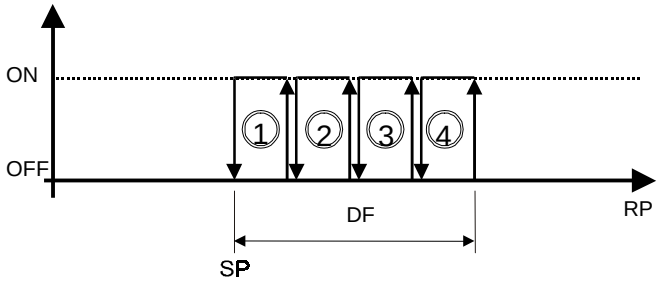


Figure 2.1.1.1

2.3 Compressor management

The compressors can be managed with inverter control or as simple ON-OFF stages
Inputs Used:

- Suction pressure probe (B1)
- Digital inputs dedicated to the compressor safety devices (ID x)

Devices used:
Various digital outputs that depend on the configuration used;
Parameters used for the control:

- compressor set point
- compressor differential
- minimum compressor set point limit
- maximum compressor set point limit
- number of compressors and capacity-control steps
- compressors times
- type of rotation
- type of control

2.3.1 Compressor management, without inverter
Can be configured with or without capacity-control
Parameters used for ON OFF control:
number of capacity-control steps
capacity-control step times
compressor times
Description of dead zone or proportional band operation.
The compressors are managed by the unit based on Set Point and a differential, which can be set on the screen (S1) and on the value read by the intake probe.
In the default configuration, dead zone control is activated - as set on the screen (G5) - with FIFO rotation (G5), respecting the various time settings (see the corresponding paragraph).
For a description of dead zone or proportional band operation, please see the following paragraph.

2.3.2 Compressor management with inverter
If the control is configured with an inverter, no capacity-control can be used
Parameters used for inverter control:
- enable inverter
- inverter set point
- inverter step
- minimum compressor inverter opening

Operating description:
The compressor inverter can be activated on the screen (C5), if no capacity-control steps are configured on screen C4.
A lower limit can be set for the inverter (G9).
The inverter is managed as follows:

case 1 - dead zone control
The inverter is set on the first compressor, which will always be the first on and the last off.
The control requires the setting of a differential (DZNI) for the control of the inverter (screen S6) from the inverter Set Point (SP) and the amount to increase the value by each second.
The output of the inverter of compressor no. 1 starts increasing when the reading of the intake probe exceeds the inverter Set Point + the differential. A decrease occurs when the reading of the intake probe is below the value of the Set Point.
In the zones between the SP and SP + DZNI, the output of the inverter is not changed. The output of the inverter is increased/decreased every second, by the value defined as the inverter step (screen S6)
Caution: when the compressor inverter is enabled and is controlled outside of the dead zone, the compressors are started in the following way:
- compressor 1, which is managed by the inverter, is activated as soon as there is a start request;
- if the request remains, the output of compressor 1 inverter is increased;
- if the request is still present, and the output of the inverter reaches 10 Volts, the other compressors are requested, one at a time, with rotation (if selected) and respecting the time settings.

For deactivation , the following occurs:
- the output of the inverter is decreased;
- when the output of the inverter reaches 0 Volt, the other compressors stop, one at a time, respecting the time settings and rotation;
- the last compressor to stop is no. 1.

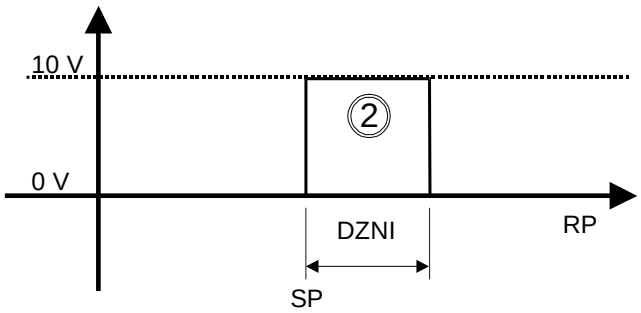


Figure 2.2.2.1

case 2 - proportional band control
The control requires the setting of a set point and a differential (screens S3 and S9). When the value measured by the intake probe is less than or equal to the value of the inverter set point, the output of the inverter is 0 Volt. As the value measured by probe B1 moves away from the set point, the analogue output is increased in proportion to the deviation, until reaching 10 Volts, when the value measured is greater than or equal to the inverter set point + differential.

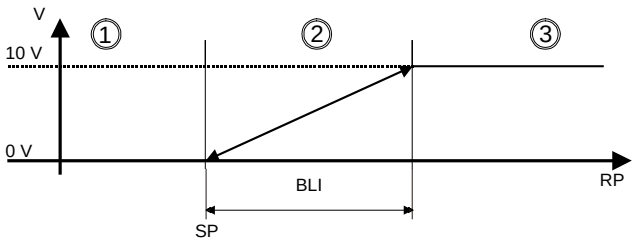


Figure 2.2.2.2

2.3.3 Capacity-control parameters

The capacity-control steps are a function of the compressors generally used to balance the working loads between the compressors. This is not valid for single cylinder compressors.
For multi-cylinder compressors, on the other hand, applying the capacity-control steps distributes a percentage of the load inside the compressor (depending on requirements) to each cylinder.
This allows a reduction in energy consumption and the repeated ON/OFF of the compressors, thus optimising the operation and life of the compressors.

Number of capacity-control steps
Manufacturer branch, configuration, screen C4
One, two or three capacity control steps can be selected, with a maximum of 4 relays per compressor.
This parameter is displayed only if there is at least one free output per configured compressor, and if the "Compressor Inverter" functions have not been enabled at the same time.

Capacity-control step logic
Manufacturer branch, general parameters, screen G8
If capacity-control steps are used, this parameter selects the operating logic for the outputs dedicated to the capacity-control steps (normally energised or normally de-energised).

Compressor start mode with capacity-control steps
Manufacturer branch, general parameters, screen G7
If the parameter is set to **CppCppCpp** the software gives the precedence to the complete start of each compressor; while if set to **CCCppppppp** the software will first switch on all the compressors and then act on the capacity-control steps

Compressor stop mode with capacity-control steps
Manufacturer branch, general parameters, screen G7
If set to **pppppppCCC**, when the compressors are being stopped, first all the capacity-control steps are deactivated and then the corresponding compressors are stopped. This procedure is useful when wanting to limit the number of compressor stops and starts, and consequently extend the compressor working life.
If **ppCppCppC** is set, when the compressors are being stopped, priority goes to the complete stop of the individual compressor. so as to more frequently alternate which compressors are on (obviously only with FIFO rotation).

2.3.4 Compressor and fan rotation

This is a fundamental function used to balance the operating hours of the devices in the refrigeration system.
It avoids wear and reduces maintenance on a specific device, by distributing operation evenly to the other devices configured.
Manufacturer branch, general parameters, screens M G5… Gc
Rotation can be DISABLED (number 1 is always turned on first, then 2 etc., while the highest number compressor always stops first), or FIFO rotation can be selected (the first on is the first off.)
These screens are also used to select the type of compressor and fan control: dead zone (see **Dead zone**) or proportional band control (see **Proportional band**) can be selected.

2.3.5 Type of compressor control

Manufacturer branch, general parameters, screen G6
Can be proportional or proportional plus integral (only in proportional band):

- Proportional control
  Based on the set point entered (screen S1), a proportional band is calculated, the width of which is equal to the differential set (screen S9).
  The positions of the control stages of the devices are calculated within this band, according to the number of compressors configured and any capacity-control steps.
- Proportional and integral control
  Proportional plus integral control uses the same parameters as for just proportional, calculating the device activation steps according to the set point, differential, and the integration time set (screen G6)
  The integration action is doubled if the conditions do not vary after the set time.

Number of compressors forced on with probe 1 fault
Manufacturer branch, general parameters, screen Gb.
If the probe 1 failure or not connected alarm is activated, this parameter indicates the minimum number of compressors forced on.

2.3.6 Compressor time settings

The following is a list of all the time parameters used for compressor management.

Time between start requests (dead zone)
Manufacturer branch, general parameters, screen T0
These parameters set the time between the successive start requests for the devices managed by the probes. Present only for dead zone control.

Time between stop requests (dead zone and proportional band in the event of the prevent function)
Manufacturer branch, general parameters, screen T1
These parameters set the time between the successive stop requests for the devices managed by probes 1 and 2. Present only for dead zone control or in the event of the prevent function.

Minimum compressor ON time.
Manufacturer branch, general parameters, screen T2
Sets the minimum time (in seconds) the compressors stay on, that is, once activated, must remain on for the time set by this parameter.

Minimum compressor OFF time.
Manufacturer branch, general parameters, screen T2
Sets the minimum time the compressors stay off. The devices are not started again if the minimum time selected has not elapsed since the last stop.

Minimum time between starts of different compressors (proportional band)
Manufacturer branch, general parameters, screen T3
Represents the minimum time that must elapse between the start of one device and the next. This parameter allows simultaneous starts to be avoided

Minimum time between starts of the same compressor
Manufacturer branch, general parameters, screen T4
Sets the minimum time that must elapse between two starts of the same device, irrespective of the measured value and the set point. This parameter limits the number of starts per hour. If, for example, the maximum allowable number of starts per hour is 10, to guarantee this limit simply set a value of 360 seconds.

Minimum time between capacity-control step activation for the same compressor
Manufacturer branch, general parameters, screen T5
Sets the minimum time that must elapse between the activation of two capacity-control steps or between the start of the compressor and its capacity control steps. The parameter is present only if capacity-control steps have been selected (M_MANUF325 manufacturer branch). This is a safety parameter if rotation with dead zone operation has been selected, as in fact the minimum time between requests also includes the time between the activation of two capacity-control steps or alternatively between the start of the compressor and its capacity-control steps.

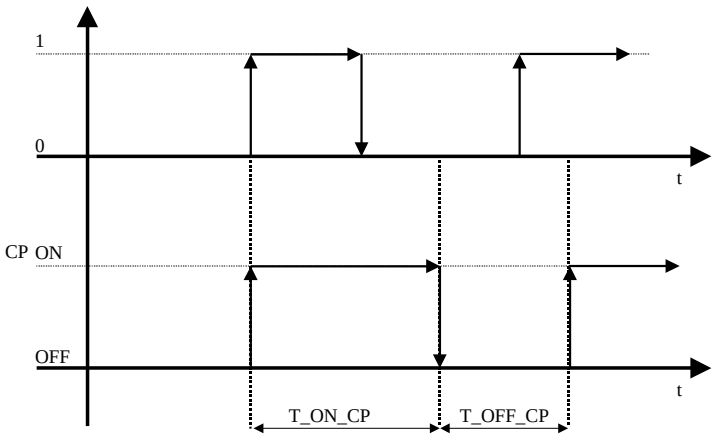


Figure 2.2.4.1

2.4 Fan management

The fans can be managed with inverter control or as simple ON-OFF stages

Inputs Used:

- Discharge pressure probe
- Digital inputs dedicated to the fan safety devices

Devices used:

Various digital outputs that depend on the configuration used

Parameters used for the control:

- Fan set point
- Fan differential
- Minimum fan set point limit
- Maximum fan set point
- number of fans
- fan times
- type of rotation
- type of control

2.4.1 Fan management without inverter

The fans are managed by the unit based on Set Point and a differential, which can be set on the screen (S1) and on the value read by the outlet probe.
In the default configuration, **proportional band** control is activated, which can be set on the screen (Gc) with FIFO rotation (Gc), respecting the various time settings.

2.4.2 Fan management with inverter

Parameters used:

- Fan inverter set point
- Fan inverter differential

The fan inverter can be set on the screen (C5). A minimum value can be set for the inverter (G9)
The management of the inverter depends on the type of control performed:
case 1 - dead zone control
The control requires a deviation to be set (S4) from the Set Point and the amount to increase the value by each second.
Operation in this case is similar to the compressor inverter.
case 2 - proportional band control
When the value measured by probe 2 is lower than the value of the inverter Set Point (screen S4), the output of the inverter is 0 Volt. As the value measured by probe 2 moves away from the inverter set point, the analogue output is increased in proportion to the deviation, until reaching 10 Volts, when the value measured is greater than or equal to the inverter set point + inverter differential.

2.4.3 Fan parameters

Fan rotation
Manufacturer branch, general parameters, screen Gc
Rotation can be DISABLED (number 1 is always turned on first, then 2 etc., while the highest number fan always stops first), or FIFO rotation can be selected (the first on is the first off.)
Fan control
Manufacturer branch, general parameters, screen Gc
Dead zone (see **Dead zone**) or proportional band control (see **Proportional band**) can be selected.
Number of fans forced on with probe 2 fault
Manufacturer branch, general parameters, screen Gd
If the probe 2 failure or not connected alarm is activated, this parameter indicates the minimum number of fans forced on.

2.4.4 Fan time settings

Time between start requests (dead zone)
Manufacturer branch, general parameters, screen T6
These parameters set the time between the successive start requests for the devices managed by the probes. Present only for dead zone control.
Time between stop requests (dead zone)
Manufacturer branch, general parameters, screen T6
These parameters set the time between the successive stop requests for the devices managed by the probes. Present only for dead zone control.
Minimum time between starts of different fans
Manufacturer branch, general parameters, screen T7
Represents the minimum time that must elapse between the start of one device and the next. This parameter allows simultaneous starts to be avoided.

3 SPECIAL FUNCTIONS

3.1 Compressor time bands

Clock branch, screens K1, K2 and K3
Programmable time bands have been included, allowing the variation of the Set Point. Pressing the CLOCK button accesses the branch for programming the time bands. Once time band control has been enabled, the start time in hour and minutes of the time band and the corresponding Set Point must be set (K2, K3). This Set Point will be referred to by the control when the current time coincides with that of the time band, and will remain the point of reference for the system until the following time band starts.
For example, assuming time bands with the following values, the results below can be obtained :

HOURS/MINUTES	SET POINT	RESULT
06:00	0.9 bars	from 06:00 to 07:00 the Set Point will be 0.9 bars
07:00	1 bar	from 07:00 to 10:00 the Set Point will be 1 bar
10:00	1.1 bars	from 10:00 to 17:00 the Set Point will be 1.1 bars
17:00	0.8 bars	from 17:00 to 6:00 the Set Point will be 0.8 bars

Table 3.1 Example of time band configuration

Four time bands can be set, and in the case where one or more are not used, it is important to attribute these the same values as the previous band so as to not compromise the correct operation of the control.

3.2 Force devices

The individual devices can be activated manually without the time settings, rotation and irrespective of the values measured by the probes. The only support to the control in manual operation is the alarm management. The manual activation of the inverter devices forces the corresponding analogue outputs to the set value.
The manual procedure can be activated only if the unit is OFF; therefore, the parameters are not enabled if the unit is ON. In any case, the procedure finishes automatically after 5 minutes. See MAINT branch button.

3.3 Auxiliary probe management

The software can manage, as well as the inlet and outlet probes, three auxiliary NTC display-only probes; these are enabled on the screen e. The three probes are:
B3 ambient temperature probe, read only or configurable for consumption control
B6 outside temperature probe, used with the electronic expansion valve. Medium and Large boards only
B7 general temperature probe (the name can be set). Medium and Large boards only. Refrigerant leak probe as default.

Once enabled, the value of these probes can be seen in the I/O branch
Note: if the intake probe is connected to B7, the general temperature probe cannot be enabled.

3.4 Energy consumption control function

To be able to monitor and manage energy consumption, the ambient probe must be disabled on screen B3.
Reading and display of the instant power, screen Ac, from external current transformer through current input, screen Cf, in kW, to one decimal.
The daily consumption is calculated in kWh to one decimal, starting from a time set by parameter. The monthly consumption is calculated in MWh to two decimals, over a set period of time. The annual consumption is calculated in MWh to two decimals, over a set period of time. The consumption for the current and previous periods are shown, screen To Ad and Ae.
Screen Af displays the TOTAL consumption in MWh to two decimals.
The screens Ag and Ah displays two further consumption totals for set time bands, in kWh.
The user can enter two start and end count times, and the C-day consumption (corresponding to the period between the start and end) and the C-night consumption (period between end and start) can then be displayed.
For example, if the start time is set to 07.00 and the end time to 20.00, the C-day consumption is the band between the start and end. At the end time, the C-night count starts and the C-day value is saved.
The following day, at the start time: C-night ends, C-day is reset and the new C-day count starts. The same is true in reverse for C-night
The consumption is displayed for the current band and for the same band on the previous day.

3.5 Calculate estimated efficiency function

The application is able to estimate the efficiency that would be achieved for the same system operating with a thermostatic expansion valve (TXV). The user needs to set four parameters:
TeVirt: System evaporation temperature for operation with TXV (screen Pi)
DEff Te: Efficiency of the system at the evaporation °C (modifications not recommended, preset at 3%, screen Pi)
TcVirt: System condensing temperature for operation with TXV (screen Pj)
DEff Tc: Efficiency of the system at the condensing °C (modifications not recommended, preset at 2%, screen Pj)
The software automatically calculates the estimate of the increase in efficiency (screen A7).
As well as the instant value, the daytime (DEff%-day), night-time (DEff%-night), daily, monthly and annual averages are displayed (screens A8, A9, Aa, Ab).

3.6 Using the GSM modem

Carefully read and follow the instructions described in the manual **GSM MODEM protocol for pCO2**, before installing or working on the appliance with a GSM modem.
The pCO2 standard programmable controller for refrigeration systems manages the new pCO^2/GSM protocol, which allows the use of a GSM modem to send and receive SMS (text) messages across a GSM network for signalling and resetting active alarms.
A pCO2-pCO1 can be thus connected to a remote supervisor even when a land line is not available. All the properties of the pCO^2/Modem protocol are valid, which allows the pCO2-pCO1 peripherals to communicate with a remote supervisor using the standard Carel protocol.
Setting the protocol to *GSM modem* in screen V1 enables screens Ai, B3, B4 and a parameter B2, for sending a test message. Screen Ai can be accessed to check the status of the GSM modem and the value in percentage of the GSM network signal strength. Screen B3 can be used to set the telephone number of the GSM cellular phone that should receive the text message, the password (for remote supervisor or receiving text messages) and the number of attempts. In screen B4, the first two rows are the "event description" for the alarm log, the third and fourth rows are fields that the user can use to enter the desired text message.
Upon each alarm event, the controller sends, to the cellular phone number set on screen B3, an SMS (text) message containing the alarm log screen and the message entered in screen B4.

Receiving an SMS message
The new protocol also allows a GSM telephone to be used to set the individual variables of the pCO^2 via SMS messages. For example, special commands can be sent to reset an alarm or change the value of a set point

WARNINGS
The messages must be sent from a cellular telephone, not via the internet.
The variables involved are those in the supervisor variable database
The messages sent must use the following format:

.pCO2.PWD.Type1.Index1.Value1.… … … … .TypeN.IndexN.ValueN& with N<=11

where:

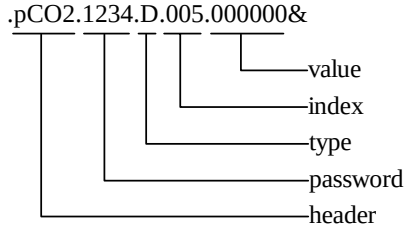
PCO2 = Message header.
PWD = Access password; this must be 4 ASCII characters and coincide with the remote access password. If the password is 0001, PWD will be '0001'.
Type*i* = Type of i-th variable to be set; this may be either 'A', 'I' or 'D', respectively Analogue, Integer or Digital variable.
Index*i* = Index of the i-th variable to be set; this must be made up of **3** consecutive numbers from '0' to '9'.
If, for example, the index of the variable is 132, Index will be '132'.
Value*i* = Value to be set for the i-th variable; this must always be made up of **6** characters, the first being the sign, and the others the numbers from '0' to '9'.
If, for example, the value of the variable is 12, Value will be '000012' or alternatively '+00012'.
If, on the other hand, the value of the variable is –243, Value will be '-00243'.
For analogue variables, the value sent is the effective value of the variable multiplied by 10. For example, the value '-00243' corresponds to –24.3.
For digital variables, the possible values are '000000' or alternatively '000001'.

N represents the number of variables to be set in a single SMS message. The maximum number, so as to not exceed the threshold of 160 characters per message, is 11.

WARNINGS

- The SMS message must not contain spaces.
- The message starts with a dot.
- The fields in the message are separated by dots.
- The message ends with the character '&', not preceded by a dot.

EXAMPLES
To reset the digital variable with index 5 on a pCO^2 with password = 1234, the SMS message would be as follows:



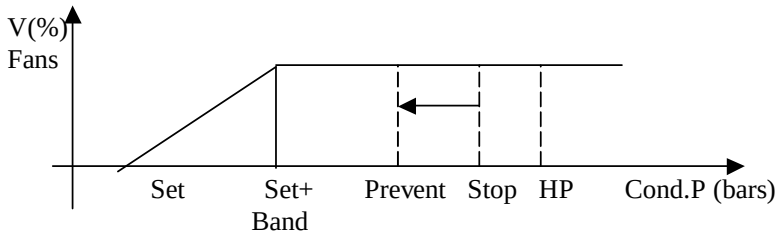
To set the analogue variable with index 1 to the value -22.4 with an SMS message, the message must be as follows:
pCO2.1234.A.001.-00224&.

3.7 Electronic valve management

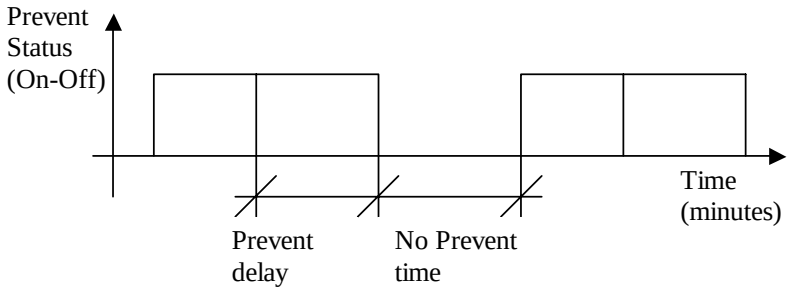
When enabling the special parameter in screen C9, the pCO^2 standard application is able to send a signal to the supervisor system to tell it that the system is working with an electronic valve.

3.8 Prevent high discharge pressure (G3)

In order to prevent the activation of the HP pressure switch (total shut-down of the compressors, with manual reset), a prevention function can be enabled by setting a pre-alarm threshold; this function does not stop the unit completely, while an event is logged at each start and end of the prevention status.
The high pressure prevent function can be activated/deactivated on the corresponding screen G3 (which also includes the set point setting), and is available for any type of configuration, irrespective of the active cooling capacity of the unit.
Inside the Prevent zone the cooling capacity is reduced, and the activation of any compressors is ignored.
As soon as the condensing pressure falls below the Prevent threshold, for a set time (see screen P9, prevent time 1; default 5 minutes) any compressor start requests are ignored. The following method is used to avoid frequent activation of the Prevent function: if the time between the end of the first Prevent action, plus the corresponding 5 minute delay, and the start of the next Prevent action is less than a set time (see screen P9, prevent time 2; default 60s) the "Excessive prevent frequency" alarm is activated, and an event is logged. The "Excessive prevent frequency" alarm is reset automatically, if, within a set time (see screen P9, prevent time 3; default 30 minutes), the Prevent function will not start. This alarm can also be reset manually by the operator, even if the set time (30 minutes) has not yet elapsed.



Set:	Fan operation set point
Set+Band:	Activation point for all the fans
Prevent:	Start prevent set point
Stop:	High discharger pressure alarm threshold, measured by the corresponding probe
HP:	Pressure switch threshold



To enable the Prevent function on screen G3 (manufacturer branch), set ENABLE; the field with the set point will be displayed for entering the discharge pressure.
Screen P9 (user branch) can be used to set the 3 times for the Prevent function.
Prevent Time 1: expressed in minutes, this is the time that starts immediately after the end of the prevent conditions have been verified, in which no compressors are activated.
Prevent Time 2: expressed in seconds, this starts at the end of a prevent action, after the delay time 1; if within this time a subsequent prevent condition occurs, the excessive prevent frequency alarm will be activated.
Prevent Time 3: expressed in minutes, this is the time in which, if the excessive prevent frequency alarm is active, no new prevent actions can be started; the alarm is deactivated automatically.

4 ALARM MANAGEMENT

The unit checks all the procedures of the individual alarms: action, delays, resets and corresponding signals.
When an alarm is activated, it acts on the devices, if enabled, and simultaneously activates: the LED, the buzzer (on the external terminal), the corresponding screen and the corresponding event recording.
To monitor the active alarm simply press the ALARM button, and use the UP/DOWN buttons to scroll any other active alarms. To reset the relay and delete the alarms in the memory, first display the alarm screen and then press the ALARM button again.
The alarm from digital input arises when there is no voltage at the corresponding terminal if the parameter "input logic" is configured as normally closed. Manufacturer branch, general parameters, screen G0.

Table 4.1 Alarms managed by the controller

code	alarm description	action performed	reset auto/man	delay	NOTES
AL:011	thermal overload Klixon/generic compressor 1	OFF comp.1	manual	no	
AL:012	thermal overload Klixon/generic compressor 2	OFF comp.2	manual	no	
AL:013	thermal overload Klixon /generic compressor 3	OFF comp.3	manual	no	
AL:014	thermal overload Klixon /generic compressor 4	OFF comp.4	manual	no	
AL:015	thermal overload Klixon /generic compressor 5	OFF comp.5	manual	no	
AL:016	thermal overload Klixon /generic compressor 6	OFF comp.6	manual	no	
AL:021	high/low pressure switch comp.1	OFF comp.1	manual	no	
AL:022	high/low pressure switch comp.2	OFF comp.2	manual	no	
AL:023	high/low pressure switch comp.3	OFF comp.3	manual	no	
AL:024	high/low pressure switch comp.4	OFF comp.4	manual	no	
AL:025	high/low pressure switch comp.5	OFF comp.5	manual	no	
AL:026	high/low pressure switch comp.6	OFF comp.6	manual	no	
AL:031	oil differential comp.1	OFF comp.1	manual	can be set	
AL:032	oil differential comp.2	OFF comp.2	manual	can be set	display only
AL:033	oil differential comp.3	OFF comp.3	manual	can be set	display only
AL:034	oil differential comp.4	OFF comp.4	manual	can be set	display only
AL:035	oil differential comp.5	OFF comp.5	manual	can be set	display only
AL:036	oil differential comp.6	OFF comp.6	manual	can be set	display only
AL:041	low liquid level alarm	/	manual	can be set	display only
AL:042	Suction pressure switch	/	manual		
AL:043	Max low pressure switch activation alarm	/	manual		
AL:044	General high pressure switch	OFF Comp.			
AL:051	maintenance comp. 1	/	manual	no	
AL:052	maintenance comp. 2	/	manual	no	
AL:053	maintenance comp. 3	/	manual	no	display only
AL:054	maintenance comp. 4	/	manual	no	display only
AL:055	maintenance comp. 5	/	manual	no	
AL:056	maintenance comp. 6	/	manual	no	
AL:061	low discharge pressure pre-alarm	all fans OFF	automatic	no	
AL:062	high discharge pressure pre-alarm	all fans ON	automatic	can be set	
AL:063	low suction pressure pre-alarm	all comp. OFF	automatic	can be set	
AL:064	high suction pressure pre-alarm	all comp. ON	automatic	can be set	
AL:065	Suction probe broken alarm	set no. comps. ON	manual	no	
AL:066	Discharge probe broken alarm	set no. fans ON	manual	no	
AL:067	Probe B3 broken or not connected alarm	/	manual	no	
AL:068	Probe B6 broken or not connected alarm	/	manual	no	
AL:069	Probe B7 broken or not connected alarm	/	manual	no	
AL:071	Configuration alarm, exceeded no. of digital inputs	/	automatic	no	
AL:072	Configuration alarm, exceeded no. of devices	/	automatic	no	
AL:073	Clock card broken or flat battery	disable time bands	manual	no	
AL:081	Fan 1 thermal overload	OFF fan 1	manual	no	
AL:082	Fan 2 thermal overload	OFF fan 2	manual	no	
AL:083	Fan 3 thermal overload	OFF fan 3	manual	no	
AL:084	Fan 4 thermal overload	OFF fan 4	manual	no	
AL:085	Fan 5 thermal overload	OFF fan 5	manual	no	
AL:086	Fan 6 thermal overload	OFF fan 6	manual	no	
AL:087	Fan 7 thermal overload	OFF fan 7	manual	no	
AL:088	Fan 8 thermal overload	OFF fan 8	manual	no	
AL:089	Fan 9 thermal overload	OFF fan 9	manual	no	
AL:090	Fan 10 thermal overload	OFF fan 10	manual	no	
AL:091	Fan 11 thermal overload	OFF fan 11	manual	no	
AL:092	Fan 12 thermal overload	OFF fan 12	manual	no	
AL:093	Fan 13 thermal overload	OFF fan 13	manual	no	
AL:094	Fan 14 thermal overload	OFF fan 14	manual	no	
AL:095	Fan 15 thermal overload	OFF fan 15	manual	no	

code	alarm description	action performed	reset auto/man	delay	NOTES
AL:011	thermal overload Klixon/generic compressor 1	OFF comp.1	manual	no	
AL:012	thermal overload Klixon/generic compressor 2	OFF comp.2	manual	no	
AL:013	thermal overload Klixon /generic compressor 3	OFF comp.3	manual	no	
AL:014	thermal overload Klixon /generic compressor 4	OFF comp.4	manual	no	
AL:015	thermal overload Klixon /generic compressor 5	OFF comp.5	manual	no	
AL:016	thermal overload Klixon /generic compressor 6	OFF comp.6	manual	no	
AL:021	high/low pressure switch comp.1	OFF comp.1	manual	no	
AL:022	high/low pressure switch comp.2	OFF comp.2	manual	no	
AL:023	high/low pressure switch comp.3	OFF comp.3	manual	no	
AL:024	high/low pressure switch comp.4	OFF comp.4	manual	no	
AL:025	high/low pressure switch comp.5	OFF comp.5	manual	no	
AL:026	high/low pressure switch comp.6	OFF comp.6	manual	no	
AL:031	oil differential comp.1	OFF comp.1	manual	can be set	
AL:032	oil differential comp.2	OFF comp.2	manual	can be set	display only
AL:033	oil differential comp.3	OFF comp.3	manual	can be set	display only
AL:034	oil differential comp.4	OFF comp.4	manual	can be set	display only
AL:035	oil differential comp.5	OFF comp.5	manual	can be set	display only
AL:036	oil differential comp.6	OFF comp.6	manual	can be set	display only
AL:041	low liquid level alarm	/	manual	can be set	display only
AL:096	Fan 16 thermal overload	OFF fan 16	manual	no	
AL:097	Refrigerant gas leak into the environment	/	manual		
AL:098	Prevent in progress	OFF compressors	automatic	no	
AL:099	Compressors off due to prevent	OFF compressors	manual	no	
AL:097	Excessive prevent frequency	/	automatic	no	

4.1 Alarms with automatic reset

When one or more automatic reset alarms are detected, these are signalled by:

- red LED below the ALARM button on;
- buzzer active (with external terminal) ;
- the alarm relay changes status (the logic can be set in the manufacturer branch, general parameters, screen G4), if enabled (manufacturer branch, unit configuration screen C6).

Pressing the ALARM button silences the buzzer and displays the alarm codes.
If the cause of the alarms is resolved, the devices that have shut-down will restart normal operation, and the status of the signal devices changes as follows:

- the alarm relay changes status;
- the buzzer, if not silenced by pressing the ALARM button, stops;
- the red LED below the ALARM button flashes.

If, in this situation, new alarms are activated, the initial situation will return.
The **red LED flashing** informs the user that there have been active alarms during the day and that the causes have now passed. To display the codes of the alarms that were activated, simply go to the alarm log (press the MENU or PROG button for the Built-In terminal, alarm log branch).

4.2 Alarms with manual reset

When one or more manual reset alarms are detected, these are signalled by:

- red LED below the ALARM button on;
- buzzer active (with external terminal) ;
- the alarm relay changes status.

Pressing the ALARM button silences the buzzer and displays the screens of the activated alarms.
If the cause of the alarms is resolved, the red LED stays on to inform the user that alarms have been activated during the day, and to press the ALARM button to reset this situation. In this situation, the alarm relay remains in an alarm condition.
If, in this situation, new alarms are activated, the initial situation will return.
The devices remain off until the user deletes the alarm messages.
The messages are deleted by pressing the ALARM button when the alarm messages are displayed. If the causes no longer exist, the status of the signal devices changes as follows:

- the alarm relay changes status (switches according to the set logic);
- the buzzer, if not silenced by pressing the ALARM button, stops;
- the red LED below the ALARM button goes off.

If, on the other hand, the cause of the alarms is still present, the initial situation will return.

4.3 Semiautomatic alarms

The low pressure switch alarm is a semiautomatic alarm. It acts as an alarm with automatic reset, however if it is activated at least 5 times within a set time (default 10 minutes), it becomes an alarm that must be reset manually.

4.4 Alarm relay

The user may decide whether to configure the alarm relay simply by enabling it (C6) and entering the relay to assign to the alarm (Eb).
If enabled, a delay time can be set (screen P5) between the activation of an alarm and the change in the status of the signal relay.
If the time is set to 0, the activation of the alarm relay is immediate.

4.5 Alarm log

To display the alarm log: press the PRINT button, or enter the Built in terminal by pressing the PROG button twice on the terminal, scroll the rows of the submenus until reaching the alarm log branch and press ENTER.
All the activated alarms, attempts to reset them from the keypad, and black outs are automatically saved in the alarm log. A maximum of 300 events can be saved, all of which can be displayed on the “Alarm log” screen. The type of alarm, the time and date of the alarm and the number of events saved so far, as well as a progressive index number, are all indicated on the screen. When accessing the screen, the last active alarm is displayed. The UP and DOWN buttons can be used to check the previous alarms. Once the maximum number of alarms has been saved, the new events replace the oldest ones. The alarm log can be deleted from screen B2 in the maintenance branch (password-protected). Installing the default values also resets the log.

5 USER INTERFACE

The loop of screens is divided into 4 categories.

USER screens, not password-protected: these screens are in all the branches, except for "**prog**" and "**menu+prog**" and show the values read by the probes, the alarms, the operating hours of the devices, the time and the date, and can be used to set the temperature set point and the clock. They are indicated by the symbol "❶" in the following table of parameters.

USER screens, password-protected (0000, modifiable): these are accessed by pressing "**prog**", and are used to set the main functions (times, set points, differentials) for the devices connected; the screens that refer to functions that are not available are not displayed. They are indicated by the symbol "❶" in the following table of parameters.

SERVICE screens, password-protected (0000, modifiable): these are accessed by pressing "**maint**" and are used to run periodical checks on the devices, calibrate the probes connected, modify the operating hours and manually operate the devices. They are indicated by the symbol "❷" in the following table of parameters.

MANUFACTURER screens, password-protected (1234, modifiable): these are accessed by pressing "**menu+prog**" and are used to configure the system, enable the main functions and select the devices connected. They are indicated by the symbol "❸" in the following table of parameters.

The columns in the table below represent the loop of screens, with the first screen (A0, S0…) being the one displayed when pressing the corresponding button, after which the arrow buttons can be used to scroll to the others. The codes (Ax, Bx, Cx…) are displayed in the top right corner of the screens, making them easy to identify. The meaning of the symbols ❶, ❶… is explained in the previous paragraph. The symbol PSW indicates that the screens are password protected.

menu		I/O		set	prog	menu + prog		
⓪ M0	⓪ A0	⓪ I0	⓪ K0	⓪ S0	**PSW** P0	**PSW** C0		
⓪ M1	⓪ A1	⓪ I1	⓪ K1	⓪ S1	① P1	④ C1		
⓪ M2	⓪ A2	⓪ I2	⓪ K2	⓪ S2	① P2	CONF. →	DISP.	IN / OUT
⓪ M3	⓪ A3	⓪ I3	⓪ K3	⓪ S3	① P3		③ C3	③ D0 / ③ E0
⓪ M4	⓪ A4	⓪ I4	⓪ K4	⓪ S4	① P4		③ C4	③ D1 / ③ E1
⓪ M5	⓪ A5	⓪ I5		**PSW** S5	① P5		③ C5	③ D2 / ③ E2
	⓪ A6	⓪ I6		① S6	① P6		③ C6	③ D3 / ③ E3
	⓪ A7	⓪ I7		① S7	① P7		③ C7	③ D4 / ③ E4
	⓪ A8	⓪ I8		① S8	① P8		③ C8	③ D5 / ③ E5
	⓪ A9	⓪ I9		① S9	① P9		③ C9	③ D6 / ③ E6
	⓪ Aa	⓪ Ia		① Sa	① Pa		③ Ca	③ D7 / ③ E7
	⓪ Ab	⓪ Ib			① Pb		③ Cb	③ D8 / ③ E8
	⓪ Ac	⓪ Ic			① Pc		③ Cc	③ D9 / ③ E9
	⓪ Ad	⓪ Id			① Pb		③ Cd	③ Da / ③ Ea
	⓪ Ae	⓪ Ie			① Pe		③ Ce	③ Db / ③ Eb
	⓪ Af	⓪ If			① Pf		③ Cf	③ Dc
	⓪ Ag	⓪ Ig			① Pg		③ Cg	③ Dd
	⓪ Ah	⓪ Ih			① Ph		③ Ch	
	⓪ Ai	⓪ Ii			① Pi	PARAM. →	③ G0	
	PSW B0	⓪ Il			① Pj		③ G1	
	② B1	⓪ Im			① Pk		③ G2	
	② B2						③ G3	
	② B3						③ G4	
	② B4						③ G5	
	② B5						③ G6	
	② B6						③ G7	
	② B7						③ G8	
	② B8						③ G9	
	② B9						③ Ga	
	② Ba						③ Gb	
	② Bb						③ Gc	
	② Bc						③ Gd	
	② Bd					TIMES→	③ T0	
	② Be						③ T1	
	② Bf						③ T2	
	② Bg						③ T3	
	② Bh						③ T4	
	② Bi						③ T5	
	② Bj						③ T6	
	② Bk						③ T7	
	② Bl					INITIAL. →	③ V0	
	② Bm						③ V1	
	② Bn						③ V2	
	② Bo						③ V3	
	② Bp							
	② Bq							
	② Br							
	② Bs							

5.1 Display

The display used is an LCD, with 4 rows x 20 columns.
The values and operating information are presented in the form of successive screens.
The user can move around the screens using the buttons on the terminal, described as follows:

```
x Row0
Home Row1
 Row2
 Row3
```

If the cursor is positioned in the top left corner (Home) pressing the UP/DOWN buttons accesses the successive screens in the selected branch.
If the screen includes fields to be set, then pressing the ENTER button moves the cursor to these fields.
Inside the setting fields, the values can be modified, within the limits envisaged, by pressing the UP/DOWN buttons.
Once the value required has been set, press the ENTER button to save it

5.2 LEDs under the buttons

Three LEDs are located under the rubber buttons, and indicate respectively:

ON/OFF button	green LED - indicates that the instrument is on and in operation. On the built-in terminal, the ENTER button lights up.
ALARM button	red LED - indicates the presence of an alarm situation; when flashing, the alarm condition is no longer present.
ENTER button	yellow LED - on the external terminal indicates that the instrument is correctly powered green LED - on the built-in terminal, indicates that the instrument is on and in operation.

5.3 Extetnal keypad

Layout of the buttons on the pCO external terminal:

MENU	MAINT.	PRINT	I/O	CLOCK	SET	PROG	
VERSION	**HEAT**	**COOL**	**ON/OFF**	**ALARM**	**UP**	**DOWN**	**ENTER**

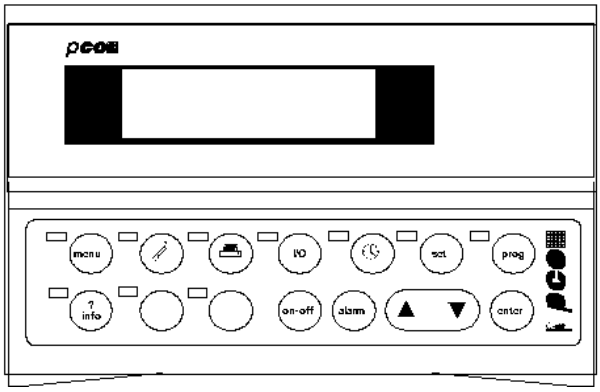


Table 5.1 Buttons on the external terminal

Button	**Description**
MENU	Pressed once returns to the main screen (M_mean_menu) Pressed again goes to the screens for accessing the various branches (m_menu_1)
MAINT	displays the values corresponding to the maintenance of the devices (operating hours of the devices and reset hour counter, accesses the manual operation procedure)
PRINTER	displays the alarm log
I/O	displays the status of the digital and analogue inputs and outputs and the input-output configuration
CLOCK	displays/sets the clock and of the time bands
SET	sets the Set Point and differentials
PROG	sets the various operating parameters (thresholds, delays etc.)
MENU+PROG	pressing these buttons at the same time accesses the unit's configuration
INFO	displays the version of the software application and other information on the unit

Table 3.3.1.1

External silicon rubber buttons.

1. **ON/OFF** button: switches the unit on and off. The green LED on the button indicates if the unit is on; if the LED is off the unit is OFF
2. **ALARM** button: used to display the alarms, to perform manual resets and to silence the buzzer. If the button is lit (red) at least one alarm has been activated; if the LED is flashing, an alarm with automatic reset has passed.
3. The **UP ARROW** has two functions:
   - Scroll the various screens when the cursor is in the top left of the display
   - If the cursor is inside a numeric field, the button increases or decreases the corresponding value. If the field is a selection, pressing the button displays the available options (not back-lit);
4. The **DOWN ARROW**: see the UP arrow
5. **ENTER** button: used to move the cursor around the screens and to save the values of the set parameters. The button is constantly back-lit (yellow), to indicate that the power is on.

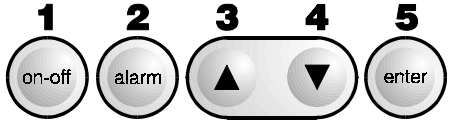


Fig. 3.3.1.1

5.4 Built-in terminal

Layout of the buttons on the keypad for the version with built-in display:

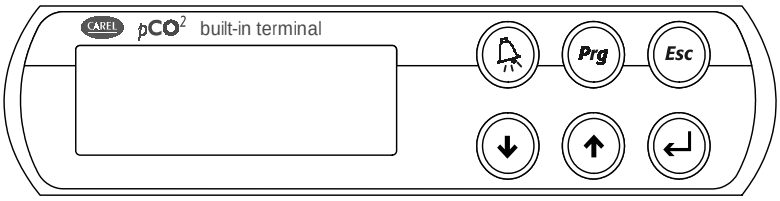


Table 5.2 Layout of the buttons on the built in terminal

ALARM	**PROG**	**ESC**
UP	**DOWN**	**ENTER**

Table 5.3 Buttons on the built in terminal

Button	**Description**
ALARM	Has the same functions as the button on the external terminal
UP- DOWN	Have the same functions as on the external terminal
ENTER	This button has the same functions as the button on the external terminal, while the LED under the button indicates that the unit is on
ESC	Returns to the previous branch
PROG	Accesses the menu screens for entering the various sub-branches.

The built in terminal, as can be seen from the figures in this paragraph, only has 6 buttons.
To switch the unit on-off, go to screen M5 in the main branch; this is enabled only if a built in terminal is present.
To access the branches of the software, press the PROG button on the built in terminal to enter a menu with two screens. Use the UP and DOWN buttons to move the cursor and highlight the various fields, displayed in capital letters. Pressing ENTER accesses the highlighted branch.
The two screens allow access to the following branches:

1st Menu	SET POINT	2nd Menu	CONFIGURATION
	INPUTS/OUTPUTS		TIME / DATA
	USER		INFO
	MAINTENANCE		ALARM LOG

6 LIST OF PARAMETERS

This table contains the list of all the parameters that appear on the screens, with the corresponding description.
Parameter: string that appears on the screen;
Type: (R) read-only, (R/W) read/write;
Pos.: position of the screen in the application, screen index;
Description: synthetic description of the parameter;
UOM: unit of measure of the value in question;
Range: range of possible values for the parameter;
Default: factory-set value of the parameter
Note: column available for user notes.
IMPORTANT: Not all the screens listed below will be displayed when scrolling the screens; enabling a certain type of configuration will mean that new screens are displayed that were previously not available.

Table 6.1 Table of parameters

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
M0.1,...6 main menu loop, press menu button							
Inlet pres	R	M0	Pressure measured by the compressor intake sensor (suction), pressing ENTER displays the value in degrees Celsius or Fahrenheit.	bar	Screen Cc		
Outlet pres	R	M0	Pressure measured by the compressor outlet sensor (discharge) pressing ENTER displays the value in degrees Celsius or Fahrenheit	bar	Screen Cd		
Inlet temp	R	M0	Temperature measured by the compressor intake sensor (suction) pressing ENTER displays the value in degrees Celsius, Fahrenheit or bars	°C / F	(-40 to +90)°C		
Outlet temp	R	M0	Temperature measured by the compressor outlet sensor (discharge) pressing ENTER displays the value in degrees Celsius, Fahrenheit or bars	°C / F	(-40 to +90)°C		
Comp. status	R	M1	Display compressor status				
Fans status	R	M2	Display fan status				
Inverter status Fans	R	M3	Fan inverter status	%	0-100		
Inverter status Compressors	R	M3	Compressor inverter status	%	0-100		
Auxiliary probe Amb.temp	R	M4	Auxiliary room temperature probe	°C	(-40 to +90)°C		
Auxiliary probe Ext.temp.	R	M4	Auxiliary outside temperature probe	°C	(-40 to +90)°C		
Auxiliary probe (Configurable)	R	M4	Auxiliary probe (can be configured as temperature probe in °C or gas leak sensor)	°C / ppM			
Unit status	R	M5	With the built-in terminal this screen describes the operation (1:OFF from alarm, 2:OFF from supervisor, 3:Restart after Blackout, 4:OFF from remote input, 5:OFF from button, 6:>>Manual operation<<, 7:Install default ","OFF from screen.)		1,2,...9		
unit?	R/W	M5	Used to switch the unit on using a built in terminal		No/Yes		
K0,k1,..,k4 clock loop, press clock button							
Change hour/date	R/W	K0	Hour, minutes setting		(0-23), (0-59)		
Date	R/W	K0	Day, month, year setting		(1-31), (1-12), (0-99)		
Daily time zones with setpoint variation enabled	R/W	K1	Enable time band with set point variation		N / Y		
Schedule 1,2,..,4 00h 00m	R/W	K2	Setting for time band 1,2,...4 in hours and minutes		(0-23), (0-59)	7	
Set 1,2,..,4	R/W	K2	Set Point during time band (1,2,...4)		min-max comp. set		
Clock not Installed	R	K4	Display				
I0,I1,..,Im inputs / outputs loop, press i/o button							
Digital inputs (O)-open,(C)-close 01: 06: 11: 16:	R	I0	Status of digital inputs 1..16 (C) = closed (O) = open				
Probes inputs Inlet pres. Outlet pres.	R	I1	Status of intake and outlet probes	bar/°C / F	Screen Cc and Cd		

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
Freon type							
Auxiliary probe Amb.temp	R	I2	Status of auxiliary probe	°C	(-40 to +90)°C		
Auxiliary probe Ext.temp.	R	I2	Status of auxiliary probe	°C	(-40 to +90)°C		
Auxiliary probe Gas probe	R	I2	Status of auxiliary probe	°C / ppM	(-40 to +90)°C or screen Cg		
Probe input B3 Electrical absorpt. instant value	R	I3	Display Probe B3: instant power consumption, if enabled	kW	Screen Cf		
Input b4 - b5 (O)-open,(C)-close b4 b5	R	I4	Status of analogue inputs used as digital (C) = closed (O) = open		C / O		
Input b9 - b10 (O)-open,(C)-close b9 : b10	R	I5	Status of analogue inputs used as digital (LARGE board); (C) = closed, (O) = open		C / O		
Digital outputs (O)-Open,(C)-Close 01: 06: 11: 16:	R	I6	Status of digital outputs 1..16 (O) = open (C) = closed		O / C		
Inverter 0ý1000 Y1	R	I7	Fan inverter status		0 - 1000		
Y2	R	I7	Compressor inverter status		0 - 1000		
Input/output Configuration Board	R	I8	Display the type of board uses		Small, Medium, Large		
Outputs config. relay k1,k2..k18:	R	I9,Ia,..Ie	Configuration of relay outputs k1,k2,..k18				
Inputs config. b4,b5,..,b6	R	If	Configuration of inputs b4,b5,..b6				
Inputs config. ID1,ID2,..ID18	R	Ig,Ih,..Il	Configuration of inputs ID1, ID2,.. ID18				
Inputs config. b9,b10	R	Im	Configuration of inputs b9,b10				
S0,S1,..,Sc Set Point loop, press set point button							
Compressors Set.	R	S0	Displays if the compressors work in dead zone or proportional band mode and displays the operating Set Point				
Diff.	R	S0	Displays the compressor differential				
Fans Set.	R/W	S1	Fan set point setting	bar / °C	min-max fan set	15.5	
Diff.	R	S1	Displays the fan differential				
Compressors Change Setpoint	R/W	S2	Compressor set point setting	bar / °C	min-max comp. set	1.0	
Comps. Inverter Change Setpoint	R/W	S3	Compressor inverter set point setting	bar / °C	min-max comp. set	1.0	
Fans inverter Change Setpoint :	R/W	S4	Fan inverter set point setting	bar / °C	min-max fan set	15.5	
Insert setpoint password	R/W	S5	Enter Set Point password		0 - 9999	0	
Compressors inverter insert Offset	R/W	S6	Compressor inverter offset setting	bar / °C	min-max comp. set		
Step :	R/W	S6	Compressor inverter step setting	V	0 - 10.0	2	
Fans inverter insert offset :	R/W	S7	Fan inverter offset setting	bar / °C	min-max fan set		
Step :	R/W	S7	Fan inverter step setting	V	0 ÷ 10.0	1.0	
Change Comps.diff	R/W	S8	Compressor differential setting	bar / °C	0 ÷ 20.0	0.5	
Fans diff	R/W	S8	Fan differential setting	bar / °C	0 ÷ 20.0	2.0	
Change Inverter diff. Comps.inv.	R/W	S9	Compressor inverter differential setting	bar / °C	0 ÷ 99.9	0.5	
Fans inv.	R/W	S9	Fan inverter differential setting	bar / °C	0 ÷ 99.9	2.0	
Insert new	R/W	Sa	Enter a new Set Point password		0 ÷ 9999	0	

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
password							
A0,A1,..,Ai – B0,B1,..,Bs service loop, press service button							
Working Hours Compressor 1,2,..6 :	R	A0,A1	Displays the operating hours for the compressors 1,2,...6	hours	0-999999		
Working Hours Fan 1,2,..16 :	R	A2,A3,.. A6	Displays the operating hours for the fans 1.2..16	hours	0-999999		
Delta Efficiency instant value	R	A7	Displays the instant efficiency value	%	0-99.9		
Delta Efficiency Daily act Monthly act Yearly act	R	A8	Displays current daily, monthly and annual efficiency	%	0-99.9		
Delta Efficiency Daily old Monthly old Yearly old	R	A9	Displays previous daily, monthly and annual efficiency	%	0-99.9		
Delta Efficiency 00:00 C-day 00:00 C-day act	R	Aa	Indicates the time band in which the current daily efficiency percentage is calculated and displays the current daily efficiency percentage	%	0-99.9		
Delta Efficiency 00:00 C-day 00:00 C-day old C-night old	R	Ab	Indicates the time band in which the previous daily efficiency percentage is calculated and displays the previous daily efficiency percentage and the previous night efficiency percentage	%	0-99.9		
Electrical absorption instant value	R	Ac	Displays the instant power consumption	kW	0-9999		
Electr. absor. Daily act Monthly act Yearly act	R	Ad	Displays power consumption for the current day (kW), month (kW) and year (MW)	kW, MW	0-999999		
Electr. absor. Daily old Monthly old Yearly old	R	Ae	Displays power consumption for the previous day (kW), month (kW) and year (MW)	kW, MW	0-999999		
Electrical absorption total	R	Af	Displays the total power consumption (MW)	MW	0-999999.999		
Electr. absor. 00:00 C-day 00 C-day act	R	Ag	Indicates the time band in which the current daily power consumption percentage is calculated and displays the current daily power consumption percentage	kW	0-9999		
Electr. absor. 00:00 C-day 00:00 C-day C-night	R	Ah	Indicates the time band in which the daily and night-time power consumption percentage is calculated and displays the daily power consumption percentage and night-time power consumption percentage	kW	0-9999		
GSM MODEM Status Start Initialization Field	R	Ai	GSM modem: GSM status and signal reception, expressed as a percentage				
Insert maintenance password	R/W	B0	Enter maintenance password		0 - 9999	0	
Keyborad On/Off enabled	R/W	B1	Enable Off from the keypad		Y/N	Yes	
Switch-Off unit	R/W	B1	Enable Off unit from the screen		Y/N	Yes	
Erase alarm history memory	R/W	B2	Deletes alarm log		Y/N	N	
Test invio sms :	R/W	B2	Used to send test SMS if the GSM modem is enabled		Y/N	N	
Number attempt	R/W	B3	Number of attempt to use the GSM modem. Displayed if GSM modem enabled		0 - 9	3	
Phone number	R/W	B3	GSM modem telephone number. Displayed if GSM modem enabled		20 digits can be set by the user	0	
Password sms	R/W	B3	GSM modem password. Displayed if GSM enabled modem		0 - 9999	0	
Event description:	R/W	B4	This screen is sent as an SMS. Displayed if GSM modem enabled		Text can be set		
Maint. Alarm Compressors working hours threshold	R/W	B5	Max hour threshold of working compressors exceeded the threshold is activated a alarm	Hours	1 - 999000	1000000	

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
Maint. Alarm Fans working hours threshold	R/W	B6	Ma fan operating hour threshold, when exceeded an alarm is activated	Hours	1 - 999000	1000000	
Compressors time counters reset 1,2,..,6	R/W	B7,	Used to reset the compressor hour counter		Y/N	N	
Fans time counters reset 1,2,..,16	R/W	B8,B9	Used to reset the fan hour counter		Y/N	N	
Electr. absor. Daily reset Monthly reset Yearly reset	R/W	Ba	Reset daily power consumption count, reset monthly power consumption count, reset annual power consumption count		Y/N	N	
Electr. absor. Total reset	R/W	Bb	Reset total power consumption count		Y/N	N	
C-day reset	R/W	Bb	Reset daily power consumption count		Y/N	N	
C-night reset	R/W	Bb	Reset night-time power consumption count		Y/N	N	
Delta Efficiency Total reset	R/W	Bc	Reset total efficiency		Y/N	N	
Last maintenance date	R/W	Bd	Last maintenance date day month year		(1 - 31) (0-23) (0-99)		
Freon type	R/W	Bd	Freon setting		5		
Unit type	R/W	Bd	Type of board setting		MT / LT		
Probes calibration Inlet	R/W	Be	Intake probe calibration	bar	-9.9 - 9.9	0	
Outlet	R/W	Be	Outlet probe calibration	bar	-9.9 - 9.9	0	
Probes calibration Probe gas	R/W	Bf	Gas probe calibration	ppM	-9.9 - 9.9	0	
Probe ext	R/W	Bf	Outside probe calibration	°C	-9.9 - 9.9	0	
Devices forcing ends within 5 minutes	R	Bg	Manual operation of the devices		Y/N	N	
Compressor1 (compres.1,2,..,6)	R/W	Bh,Bi,..,Bm	Manual operation of compressor 1,2,...6		Y/N	N	
Unload 1	R/W	Bh,Bi,..,Bm	Manual operation of capacity-control step compressor 1,2,...6		Y/N	N	
Unload 2	R/W	Bh,Bi,..,Bm	Manual operation of capacity-control step compressor 1,2,...6		Y/N	N	
Unload 3	R/W	Bh	Manual operation of capacity-control step, compressor 1		Y/N	N	
Force ON Fan1,2,..,16: Status	R/W	Bn,Bo,..,Bq	Manual operation of fan 1,2,...16		Y/N	N	
Forcing comp Comps.inveter	R/W	Br	Force the inverter to 100% (MANU.) or zero (AUTO.)		AUTO /MAX	AUTO	
Fans inveter	R/W	Br	Force the inverter to 100% (MANU.) or zero (AUTO.)		AUTO /MAX	AUTO	
Insert new password	R/W	Bs	Enter a new maintenance password		0 - 9999	0	
P0,P1,..,Pj programming loop, press PROGRAM button							
Insert program password	R/W	P0	Enter user password		0 - 9999	0	
Current language ENGLISH press ENTER to change language	R/W	P1	Based on the configuration installed, the language used on the screens can be changed (ITALIAN, ENGLISH, FRENCH, GERMAN, SPANISH)		5 Languages		
Max comps.setp.	R/W	P2	Setting of the upper limit for the compressor Set Point	bar / °C	(-95/+95) or (-5/+70)	2.5	
Min comps.setp	R/W	P2	Setting of the lower limit for the compressor Set Point	bar / °C	(-95/+95) or (-5/+70)	0.1	
Max fans setp	R/W	P3	Setting of the lower limit for the fan Set Point	bar / °C	(-95/+95) or (0/+30)	1.0	
Min fans setp	R/W	P3	Setting of the upper limit for the fan Set Point	bar / °C	(-95/+95) or (0/+30)	25.0	
Alarms Oil diff. delays Startup	R/W	P4	Oil differential (if configured) alarm delay at start	s	0 - 360	120	
Running	R/W	P4	Alarm dealt in stable operating conditions	s	0 - 99	10	

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
Alarms relay delay	R/W	P5	Alarm relay delay	s		1	
Auto->manual reset time change 5al	R/W	P5	On the fifth activation, within the set time, the alarm switches from automatic reset to manual reset.	minutes		10	
Inlet press.al. H. thres.	R/W	P6	Intake probe alarm: high threshold setting	bar / °C	(-95/+95) or (-5/+70)	4.0	
Diff	R/W	P6	Intake probe alarm: differential setting	bar / °C	0-99.9	0.5	
Delay	R/W	P6	Intake probe alarm: delay setting	minutes	0-999	1	
Inlet press.al. L. thres.	R/W	P7	Intake probe alarm: low threshold setting	bar / °C	(-95/+95) or (-5/+70)	0.5	
Diff	R/W	P7	Intake probe alarm: differential setting	bar / °C	0-99.9	0.5	
Delay	R/W	P7	Intake probe alarm: delay setting	minutes	0-999	1	
Outlet press.al H. thres	R/W	P8	Outlet probe alarm: high threshold setting	bar / °C	(-95/+95) or (0/+30)	20.0	
Diff	R/W	P8	Outlet probe alarm: differential setting	bar / °C	0-99.9	1.0	
Prevent timing Time prevent1	R/W	P9	Prevent high pressure function time 1	Minutes	0-99	5	
Time prevent2	R/W	P9	Prevent high pressure function time 2	Seconds	0-999	60	
Time prevent3	R/W	P9	Prevent high pressure function time 3	minutes	0-99	30	
Outlet press.al. L. thres.	R/W	Pa	Outlet probe alarm: low threshold setting	bar / °C	(-95/+95) or (0/+30)	2.0	
Diff.	R/W	Pa	Outlet probe alarm: differential setting	bar / °C	0-99.9	1.0	
Delay	R/W	Pa	Outlet probe alarm: delay setting	minutes	0-999	1	
Liquid level al. delay	R/W	Pb	Liquid level alarm delay	S	0-999	90	
Alarm gas detec. Threshold	R/W	Pc	Refrigerant leak alarm threshold	ppM	99.9 - 99.9	50.0	
Different	R/W	Pc	Refrigerant leak alarm differential	ppM	9.9 - 9.9	2.0	
Delay	R/W	Pc	Refrigerant leak alarm delay	minutes	0-99	3	
Black out start. delay enabled	R/W	Pd	Start delay after a blackout.		Y/N	N	
Delay time	R/W	Pd	Used to set different restarting times for different units when power returns after a blackout	s	0-9999		
Swich OFF unit mode OFF by supervisor	R/W	Pe	Enable Off from the supervisor		Y/N	N	
Probes faulty	R/W	Pe	Enable Off when probe disconnected		Y/N	N	
Elect. absor start sampling Daily Monthly	R/W	Pf	Start sampling daily, monthly power consumption hours, minutes,		(0-23) (0-59) (0-31)	23	
Elect. absor start sampling yearly	R/W	Pg	Start sampling annual power consumption		1-12	12	
Elect. absor Zone day start	R/W	Ph	Start sampling power consumption, start hour		0-23	8	
Minute	R/W		start minutes		0-59	0	
Zone day end	R/W	Ph	Start sampling power consumption, end hour		0-23	20	
Minute	R/W		end minutes		0-59	30	
Evaporator Evap. temp.	R/W	Pi	Evaporation temperature		-99.9 - comp set °C	-265	
Evap. Delta Eff.	R/W	Pi	Evaporator efficiency	%	0-99	3	
Condenser Cond. temp.	R/W	Pj	Condensing temperature		fan set °C - 999	430	
Cond. Delta Eff.	R/W	Pk	Condenser efficiency	%	0-99	2	
Insert new password	R/W	Pk	Enter new user password		0-9999	0	

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
Press MENU+PROGRAM, the cursor will be positioned on CONFIGURATION, press ENTER, the cursor will be positioned on DEVICES, press ENTER to display loop C1,2,..,Ch							
Insert Manufacturer password	R/W	C0	Enter manufacturer password		0-9999	0	
Comp. inputs type selection	R/W	C3	Setting of the type of safety devices for the compressors: Generic, oil differential thermal overload, thermal overload + high/low pressure switch, thermal overload + high/ low pressure switch + oil diff.		4	1	
Configuration Fans number	R/W	C4	Number of fans		0-16	4	
Comps. number	R/W	C4	Number of compressors		0-6	3	
Unloads number	R/W	C4	Number of capacity-control steps		0-3	0	
Comp. inverter No configurable	R/W	C5	Enable control of the compressors with inverter if configured without capacity-control steps		Y/N	N	
Fans inverter enabled	R/W	C5	Enable control of the fans with inverter		Y/N	Y	
Alarm relay enabled	R/W	C6	Enable alarm relay		Y/N	Y	
Clock board enabled	R/W	C6	Enable clock card if pCO1		Y/N	Y	
Enable inputs **Gen.LP pressostat Gen.HP pressostat**	R/W	C7	Enable inputs: general low pressure switch (automatic reset) and high pressure switch (manual reset)		Y/N	Y	
Enable inputs **On/OFF by dig.in**	R/W	C8	Enable unit On-Off from digital input, has priority over keypad		Y/N	N	
Liquid livel al.	R/W	C8	Enable liquid level alarm from digital input (display only).		Y/N	Y	
Enable expansion electronic valve	R/W	C9	Enable electronic expansion valve		Y/N	N	
Inlet probe type NTC	R/W	Ca	Defines the type of intake probe, Carel NTC temperature probes, (50 - 100°C; R/T 10KW at 25 °C), voltage (0-1)V, (0-10)V and current (0-20)mA, (4-20)mA			(4-20)mA	
Board In.wiring	R/W	Ca	Defines the position of the intake probe: B1 or B7 only per boards Medium or Large		Y/N	N	
Outlet probe type NTC	R/W	Cb	Defines the type of outlet probe, Carel NTC temperature probes, (50 - 100°C; R/T 10KW at 25 °C), voltage (0-1)V, (0-10)V and current (0-20)mA, (4-20)mA			(4-20)mA	
Board In.wiring	R/W	Cb	Defines the position of the outlet probe: B2 or Bx only for Medium or Large boards		Y/N	N	
Inlet probe range Min	R/W	Cc	End scale setting for the intake probe	bar	-10.0/40.0	-5	
Max	R/W	Cc	End scale setting for the intake probe	bar	-10.0/40.0	70	
Outlet probe range Min	R/W	Cd	End scale setting for the outlet probe	bar	-10.0/40.0	0	
Max	R/W	Cd	End scale setting for the outlet probe	bar	-10.0/40.0	300	
Probes enable B3 Ambient temp.	R/W	Ce	Enable the auxiliary probes		Y/N	N	
B6 External temp	R/W	Ce	Enable the auxiliary probes		Y/N	N	
B7	R/W	Ce	Enable the auxiliary probes		Y/N	N	
B3 Ele.absor.	R/W	Cf	Enable probe B3 for power consumption		Y/N	N	
Probe range Min	R/W	Cf	End scale settings		0-999	0	
Max	R/W	Cf	End scale settings		0-200.0	200	
B7 gas detect.	R/W	Cg	Enable probe B7 to detect refrigerant leaks		Y/N	Y	
Probe range Min	R/W	Cg	Minimum and maximum end scale settings		-99.9 / 99.9	0	
Max	R/W	Cg	Minimum and maximum end scale settings		-999.9 / 999.9	90	
Type of freon	R/W	Ch	Type of freon uses: R22, R134a, NH3, R404a, R407C, R410A or none of these types		7	1	

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
Press MENU+PROGRAM, the cursor will be positioned on CONFIGURATION, press ENTER, position the cursor on INPUT POSITIONS, press ENTER and use UP/DOWN to scroll the screens in loop D1,D2,..,Dd							
Board DI wiring comp1 Overl.	R/W	D0,D1, ..,D5	Position of digital inputs used as safety devices compressor 1,2,...6		0-23		
Comp1 oil diff.	R/W	D0,D1, ..,D5	Position of digital inputs used as safety devices compressor 1,2,...6		0-23		
HP/LP press.C1	R/W	D0,D1, ..,D5	Position of digital inputs used as safety devices compressor 1,2,...6		0-23		
Board DI wiring Fan 1 overload Fan1,2,..,16	R/W	D6,D7, ..,Da	Position of digital inputs used as safety devices, fans 1,2,...16		0-23		
Board d.i.wiring On/Off by digital input	R/W	Db	Position on the board of the On-Off digital input. Parameters visible only if enabled.		0-23		
Board DI wiring Liquid livel alarm	R/W	Dc	Position on the board of the liquid level alarm. Parameters visible only if enabled.		0-23		
Board DI wiring Gen.LP press Gen.HP press	R/W	Dd	Position on the board of the high and low pressure switches. Parameters visible only if enabled.		0-23		
Press MENU+PROGRAM, the cursor will be positioned on CONFIGURATION, press ENTER, position the cursor on OUTPUT POSITIONS, press ENTER and use UP/DOWN to scroll the screens in loop E1,E2,..Eb							
Comp.1relay n°00 comps1,2,..,6	R/W	E1,E2, ..,E5	Position on the board of the digital outputs, compressor 1,2,...6		0-(8-13-8)		
Unload.1 relay°ß comps1,2,..,6	R/W	E1,E2, ..,E5	Position on the board of the digital outputs, capacity-control step 1 for compressor 1,2,...6		0-(8-13-8)		
Unload.2 relay n° comps1,2,..,6	R/W	E1,E2, ..,E5	Position on the board of the digital outputs, capacity-control step 2 for compressor 1,2,...6		0-(8-13-8)		
Unload.3 relay n° comps1,2,..,6	R/W	E1,E2, ..,E5	Position on the board of the digital outputs, capacity-control step 3 for compressor 1,2,...6		0-(8-13-8)		
Board DO wiring Fan 1 relay n° Fan1,2,..,16	R/W	E6,E7, ..,Ea	Position on the board of the digital outputs for fans 1,2,..16		0-(8-13-8)		
Board DO wiring Alarm relay n°	R/W	Eb	Position on the board of the alarm digital output		0-(8-13-8)		
Press MENU+PROG, use UP/DOWN to move to PARAMETERS and press ENTER							
Digital inputs Logic =No alarm	R/W	G0	Setting of the logic of the digital inputs. Normally open: when there is no alarm the contact is open		N.O./N.C	N.C.	
On/OFF by DI Logic =OFF unit	R/W	G1	Setting of the Remote off logic. Normally open: unit Off from digital input.		N.O./N.C	N.O.	
Alarm pressostat High/Low comp reset type	R/W	G2	Setting of the type of reset for the high/low pressure switch relating to the individual compressor. Automatic: when the alarm ends the compressor restarts. Visible if the parameters are enabled		AUTOMATIC/MANUAL	MANUAL	
Prevent outlet pression	R/W	G3	Enable high pressure prevent function		DISABLED/ ENABLED	ENABLED	
Threshold:	R/W	G3	High pressure prevent function set point	bar	0-99	18	
Alarm relay logic	R/W	G4	Logic of the alarm relay. Visible if the alarm relay is enabled		NORMALLY CLOSED / OPEN	NORMALLY CLOSED	
Comps.rotation	R/W	G5	Enable FIFO rotation (first on-first off) for the compressors.		Disabled/Enabled	Enabled	
Comps.regulation	R/W	G5	Type of compressor control used: Proportional band or Dead zone		Proportional band / Dead zone	Dead zone	
Compressors regulation type	R/W	G6	This screen is visible only if a Proportional band is set for the compressors. Type of control: (P) Proportional or (P+I) Proportional plus integral.		P / P+I	P	
Integration time (only P+I)	R/W	G6	If using the P+I, enter the integration time.	s	0-999	600	
Comps.switch ON	R/W	G7	Compressor start mode CppCppCpp= switch on completely one compressor at a time CCCppppppp= first all the compressors then all the capacity-control steps		CppCppCpp / CCCppppppp	CppCppCpp	
Comps.switch OFF	R/W	G7	Compressor stop mode CppCppCpp= switch off completely one compressor at a time CCCppppppp= first all the compressors then all the capacity-control steps		CppCppCpp / CCCppppppp	CppCppCpp	

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
Unloaders Logic	R/W	G8	Used to configure if the capacity-control solenoids are: normally energised (closed), de-energised(open)		NORMALLY CLOSED / OPEN	NORMALLY CLOSED	
Inverter minimum opening Compressors	R/W	G9	Minimum inverter opening. Screen visible if the inverters are enabled	%	0-99.9	0	
Fans	R/W	G9	Minimum inverter opening.	%	0-99.9	0	
PWM phase cutt. Triac max.	R/W	Ga	If using the pCO1 controller and the PWM outputs are enabled, this screen shows the max Triac value: voltage delivered by the triac to the electric fan motor corresponding to the maximum speed. It does not correspond to the effective voltage in volts applied, but to an internal unit of calculation inside the pCO1.	%	0-100	75	
Triac min.	R/W	Ga	Min Triac value: voltage delivered by the triac to the electric fan motor corresponding to the minimum speed. It does not correspond to the effective voltage in volts applied, but to an internal unit of calculation inside the pCO1.	%	0-100	25	
Pulse width	R/W	Ga	Amplitude of the impulse, which represents the duration of the triac impulse: this is the duration in milliseconds of the impulse applied to the triac	ms	0-10.0	2.5	
Probe fault alarm forced compressors number	R/W	Gb	If an intake probe fault or not connected alarm occurs, a number of compressors can be forced on. They are in any case controlled by the individual alarms and general pressure switches.		0-6	1	
Fans rotation	R/W	Gc	Enable FIFO rotation (first on-first off) for the fans.		Disabled/enabled	Disabled	
Fans regolation	R/W	Gc	Type of fan control used: Proportional band or Dead zone		Proportional band / Dead zone	Proportional band	
Probe fault alarm forced fans number	R/W	Gd	If an outlet probe fault or not connected alarm occurs, a number of fans can be forced on. They are in any case controlled by the individual alarms and general pressure switches.		0-4	2	
Press MENU+PROG, use UP/DOWN to move to TIMES and press ENTER							
Comps. switching on delay time in neutral zone	R/W	T0	These parameters are visible only if dead zone control is set for the compressors. Time between the request and the start of the compressors	s	0-999	20	
Comps.switch.off delay time in	R/W	T1	Time between compressor stop request (Dead zone or prevent in proportional band)	s	0-999	10	
Minimum comps power-on time	R/W	T2	Minimum compressor On time	s	0-9999	10	
Minimum compressors power-off time	R/W	T2	Minimum compressor Off time	s	0-9999	120	
Compressors min. time between different start	R/W	T3	Minimum time between two starts of different compressors to avoid simultaneous starts	s	0-9999	20	
Compressor Min. time between same start	R/W	T4	Minimum time between two effective starts of the same compressor	s	0-999	360	
Unloaders Switching On delay time	R/W	T5	This parameter is visible only if the capacity-control steps are configured. Delay between the request and the effective activation of the capacity-control steps	s	0-999	20	
Fans switch. ON delay time	R/W	T6	Minimum time between two starts of the same fan.	s	0-999	2	
Fans switch. OFF delay time	R/W	T6	Minimum time between two stops of the same fan.	s	0-999	2	
Fans Min. time between different start	R/W	T7	Minimum time between fan start requests to avoid simultaneous starts	s	0-999	5	
Press MENU+PROG, use UP/DOWN to move to INITIALISATION and press ENTER							
Supervisor Comunication speed	R/W	VO	Supervisor configuration. Setting of the communication speed with the supervisory system.	baud	0-5	19200	
Identification	R/W	VO	Supervisor configuration. Used to enter the identification number of the pCO^2 board for the supervisor serial network		1-200	1	
Protocol type	R/W	V1	Type of protocol: Carel Supervisor, Modbus Supervisor or GSM modem		1-3	Carel supervisor	
New passwords Manufacturer	R/W	V2	Used to change the access password for the manufacturer loop		0-9999	1234	

Parameter	Type	Pos.	Description	UOM	Range	Default	Note
Maintenance	R/W	V2	Used to change the access password for the maintenance loop		0-9999	0	
Program	R/W	V2	Used to change the access password for the user loop		0-9999	0	
View language message to start	R/W	V3	Position Y displays the change language message at start-up. Position N does not display the change language message at start-up	On/Off	Y/N	Y	
Default values initialization	R/W	V4	Used to delete the permanent memory and reset the default values N.B. This operation should be performed with the unit off	On/Off	Y/N	N	

7 PCO² INSTRUMRNT AND ACCESSORY CODES

Table 7.1 Terminals with plastic container for panel installation

Code	Description
PCOI000CBB	LCD backlit display, 4x20
PCOI000CB0	LCD display, 4x20

Table 7.2 Terminals with plastic container for panel and wall installation

Code	Description
PCOT000CB0	LCD display 4x20
PCOT00SCB0	LCD display 4x20, for connection to serial printer
PCOT000CBB	LCD backlit display, 4x20

Table 7.3 Control/interface card

Code	Description
PCO2000AL0	LARGE with plug-in connectors
PCO2000AM0	MEDIUM with plug-in connectors
PCO2000AS0	SMALL with plug-in connectors
PCO2000BL0	LARGE with plug-in connectors, built-in terminal
PCO2000BM0	MEDIUM with plug-in connectors, built-in terminal
PCO2000BS0	SMALL with plug-in connectors, built-in terminal
PCO2003AL0	LARGE with plug-in connectors, 3 SSR
PCO2002AM0	MEDIUM with plug-in connectors, 2 SSR
PCO2001AS0	SMALL with plug-in connectors, 1 SSR

Table 7.4 Plug-in connector kits

Code	Description
PCO2CON0S0	Screw version for pCO2 SMALL
PCO2CON0M0	Screw version for pCO2 MEDIUM
PCO2CON0L0	Screw version for pCO2 LARGE
PCO2CON1S0	Spring version for pCO2 SMALL
PCO2CON1M0	Spring version for pCO2 MEDIUM
PCO2CON1L0	Spring version for pCO2 LARGE
PCO2CON3S0	Pitch header version for pCO2 SMALL
PCO2CON3M0	Pitch header version for pCO2 MEDIUM
PCO2CON3L0	Pitch header version for pCO2 LARGE

Table 7.5 Control-terminal connection cables

Code	Description
S90CONN002	0.8m cable, telephone connector
S90CONN000	1.5m cable, telephone connector
S90CONN001	3m cable, telephone connector
S90CONN003	6m cable, telephone connector
TCONN6J000	T-device for pCO and terminal connections

Table 7.6 Options

Code	Description
PC200MEM0	Flash memory expansion card for pCO2
PCO200KEY0	Programming key card for pCO2
PCO2004850	Optically-isolated RS485 serial connection card for pCO2
PCO200MDM0	Non optically-isolated RS232 serial connection card for modem pCO2
PCO20LFTT0	Serial interface LON FTT10 (*)
PCO20L4850	Serial interface LON RS485 (*)
PC485KIT00	RS485 - RS232 serial converter including serial cable for connection to PC
PCO20DCDC0	Converter DC/DC 48Vdc / 24Vdc or 48Vdc / 30Vdc
0907858AXX	Ferrite toroid

(*) To make the card operative, it must be programmed by the user depending on the software that has been installed.

Table 7.7 Driver for electronic expansion valves

Code	Description
EVD0000000	Driver for electronic expansion valve
EVBAT00000	Rechargeable battery module, for EVD
0907930AXX	Network filter for EVD driver
0907858AXX	Ferrite toroid

Table 7.8 Carel RS485 network (2 wires)

Code	Description
IR32SER00E	Serial card RS485 2 wires for IR32 refrigeration (old version) and universal
IRDRSER00E	Serial card RS485 for IRDR, IR96, MasterCella.
PJOPZ48500	Additional optically-isolated RS485 module for PJ32
PCO2004850	Optically-isolated RS485 serial connection board for pCO2
PCOSER4850	Serial card RS485 2 wires for pCO
MCHSMLSER0	RS 485 serial card / remote terminal interface for µchiller Compact
PC485KIT00	Serial Converter RS485 - RS232 including serial cable for connection to PC
PC485KITN0	Serial Converter RS232/RS485 without transformer
09C425A017	Transformer for PC485KITN0

Table 7.9 Accessories

Code	Description
S90CONN002	0.8m cable, telephone connector
S90CONN000	1.5m cable, telephone connector
S90CONN001	3m cable, telephone connector
S90CONN003	6m cable, telephone connector
TCONN60000	T-device connection (**)

(**)T-connectors with the possibility of an earth connection and screw connectors for shielded cable.

8 GLOSSARY

Step: defines an area of the proportional band (pressure or temperature) inside which a device is on, and at the same time also defines the device on/off values.
Set point: defines the working pressure (or temperature) value; the system starts or stops the devices until the pressure (or temperature) has reached the set point.
Default: this term defines the values, for example, the temperature set point and proportional band, that are automatically used by the system if no modifications have been made by the user.
Proportional band: defines a temperature band a few degrees away from the set point, inside which the system manages the control devices.
Dead zone: defines a very small temperature band between the set point and the proportional band, inside which the devices are not activated.
Differential: defines a pressure (or temperature) difference from the corresponding set point
Branch – loop: series of screens on the same subject. These can be accessed simply by pressing the arrow buttons; the branches are accessed by pressing one of the buttons on the terminal, which displays the first screen in the loop.
Screen: defines the screen that is shown on the display; the program is made up of the screens described in the list of parameters
Built-in: display housed on the backbone of the pCO2 board
Outlet - discharge: refers to the physical value (pressure or temperature) at the compressor outlet
Intake - suction: refers to the physical value (pressure or temperature) at the compressor intake
Manual: activation and deactivation of all the devices connected to the pCO2 board outputs, from the corresponding screens and with the unit off
Buffer (memory): memory on the pCO2 used to save the default values set by Carel for all the parameters. Permanent memory when power is off.
Buzzer: audible buzzer fitted on the external terminals; sounds a long beep in the event of alarms or a short beep if the parameter limits are exceeded when making the settings. The built-in terminals do not have a buzzer.
Upload: the operation used to copy the application software from the computer or programming key to the flash memory on the pCO1– pCO2 board.
TABLE OF ACRONYMS
The following acronyms are used in the figures in the manual.

NO.	Acronym	Meaning
1	SP	Set point
2	RP	Read-only parameter
3	DF	Differential
4	DZN	Dead Zone Differential
5	DFNI_CP	Compressor Inverter Dead Zone Differential
6	DFNI_F	Fan Inverter Dead Zone Differential
7	BL	Proportional Band
8	BLI_CP	Compressor Inverter Proportional Band
9	BLI_F	Fan Inverter Proportional Band
10	T_ON_CP	Minimum compressor on time
11	T_ON_CP	Minimum compressor off time

9 SUPERVISOR COMMUNICATION VARIABLES

The pCO² can be connected to a local or remote supervisory/telemaintenance system used to control the unit.
The accessories available for the pCO² board include an optional serial communication card using the RS485 interface.
In this version of the software, the baudrate can be set to: 1200, 2400, 4800, 9600 or 19200 bps.
The variables sent and received by the supervisor are shown in the tables below, with reference to the following key:

I	Supervisor --> pCO²		**D**	digital
O	Supervisor <-- pCO²		**I**	integer
I/O	Supervisor <-> pCO²		**A**	analogue

9.1 Analogue variables

Flow	Index	Description
O	1	Value of analogue input B1
O	2	Value of analogue input B2
O	3	Value of analogue output 1
O	4	Value of analogue output 2
I/O	5	Compressor set point
I/O	6	Compressor differential
I/O	7	Fan set point
I/O	8	Fan differential
O	9	Power supply to pco² board
I/O	10	Maximum compressor set point
I/O	11	Minimum compressor set point
I/O	12	Maximum fan set point
I/O	13	Minimum fan set point
I/O	14	High suction alarm set point
I/O	15	High suction alarm differential
I/O	16	Low suction alarm set point
I/O	17	Low suction alarm differential
I/O	18	High discharge alarm set point
I/O	19	High discharge alarm differential
I/O	20	Low discharge alarm set point
I/O	21	Low discharge alarm differential
O	22	Compressor start point
O	23	Compressor stop point
I/O	27	Fan inverter set point
I/O	28	Fan inverter differential
I/O	30	Calibration probe 1
I/O	31	Calibration probe 2
I/O	32	Compressor inverter set point (proportional band)
I/O	33	Inverter differential (proportional band)
I/O	34	Evaporator inlet temperature
I/O	35	Evaporator outlet temperature
I/O	36	Evaporator input efficiency variation
I/O	37	Evaporator outlet efficiency variation
I/O	38	Current instant efficiency
I/O	39	Current daily efficiency
I/O	40	Current monthly efficiency
I/O	41	Current annual efficiency
I/O	42	Previous daily efficiency
I/O	43	Previous monthly efficiency
I/O	44	Previous annual efficiency
O	45	Current daily efficiency with time band
O	46	Previous daily efficiency with time band
O	47	Previous night-time efficiency with time band
O	48	instant consumption
O	49	current daily power consumption hundreds
O	50	current daily power consumption thousands
O	51	current monthly power consumption thousands
O	52	current monthly power consumption billions
O	53	current annual power consumption thousands
O	54	current annual power consumption billions

Flow	Index	Description
O	55	previous daily power consumption hundreds
O	56	previous daily power consumption thousands
O	57	previous monthly power consumption thousands
O	58	previous monthly power consumption billions
O	59	previous annual power consumption thousands
O	60	previous annual power consumption billions
O	61	Total power consumption hundreds
O	62	Total power consumption thousands
O	63	Total power consumption billions
O	64	Power consumption with time band hundreds
O	65	Power consumption with time band thousands
O	66	Daily power consumption hundreds
O	67	Daily power consumption thousands
O	68	Night-time power consumption hundreds
O	69	Night-time power consumption thousands
O	70	Start sampling daily power consumption hours
O	71	Start sampling daily power consumption minutes
O	72	Start sampling monthly power consumption
O	73	Start sampling annual power consumption
O	74	Power consumption zone start minutes
O	75	Power consumption zone start hours
O	76	Power consumption zone end minutes
O	77	Power consumption zone end hours
O	78	Evaporation temperature
O	79	Evaporator efficiency
O	80	Condensing temperature
O	81	Condenser efficiency
O	82	Value measured by the refrigerant leak sensor
I/O	83	Gas refrigerant leak alarm set point
I/O	84	Prevent high suction pressure set point

9.2 Digital variables

Flow	Index	Description
I/O	1	Modem card present
O	2	Expansion card present
O	3	Status of fan 1
O	4	Status of fan 2
O	5	Status of fan 3
O	6	Status of fan 4
O	7	Status of compressor 1
O	8	Status of capacity-control step 1 compressor 1
O	9	Status of capacity-control step 2 compressor 1
O	10	Status of compressor 2
O	11	Status of capacity-control step 1 compressor 2
O	12	Status of capacity-control step 2 compressor 2
O	13	Status of compressor 3
O	14	Status of capacity-control step 1 compressor 3
O	15	Status of capacity-control step 2 compressor 3
O	16	Status of compressor 4
O	17	Status of capacity-control step 1 compressor 4
O	18	Status of capacity-control step 2 compressor 4
O	19	Status of compressor 5
O	20	Status of capacity-control step 1 compressor 5
O	21	Status of capacity-control step 2 compressor 5
O	22	Status of compressor 6
O	23	Status of capacity-control step 1 compressor 6
O	24	Status of capacity-control step 2 compressor 6
O	25	Status of digital input 1
O	26	Status of digital input 2
O	27	Status of digital input 3
O	28	Status of digital input 4
O	29	Status of digital input 5
O	30	Status of digital input 6
O	31	Status of digital input 7
O	32	Status of digital input 8
O	33	Status of digital input 9
O	34	Status of digital input 10
O	35	Status of digital input 11
O	36	Status of digital input 12
O	37	Status of digital input 13
O	38	Status of digital input 14
O	39	Status of digital input 15
O	40	Status of digital input 16
O	41	Status of digital input 17
O	42	Status of digital input 18
O	43	Low pressure switch alarm
O	44	High pressure switch alarm
O	45	Status of expansion digital input no.1
O	46	Status of expansion digital input no.2
O	47	Status of expansion digital input no.3
O	48	Status of expansion digital input no.4
O	49	Status of expansion digital input no.5
O	50	Status of expansion digital input no.6
O	51	Status of expansion digital input no.7
O	52	Status of expansion digital input no.8
O	53	Thermal overload alarm compressor 1
O	54	Thermal overload alarm compressor 2
O	55	Thermal overload alarm compressor 3
O	56	Thermal overload alarm compressor 4
O	57	Thermal overload alarm compressor 5
O	58	Thermal overload alarm compressor 6
O	59	High/low pressure switch alarm compressor 1
O	60	High/low pressure switch alarm compressor 2
O	61	High/low pressure switch alarm compressor 3

Flow	Index	Description
O	62	High/low pressure switch alarm compressor 4
O	63	High/low pressure switch alarm compressor 5
O	64	High/low pressure switch alarm compressor 6
O	65	Oil differential alarm compressor 1
O	66	Oil differential alarm compressor 2
O	67	Oil differential alarm compressor 3
O	68	Oil differential alarm compressor 4
O	69	Oil differential alarm compressor 5
O	70	Oil differential alarm compressor 6
O	71	Maintenance hours threshold exceeded alarm, compressor 1
O	72	Maintenance hours threshold exceeded alarm, compressor 2
O	73	Maintenance hours threshold exceeded alarm, compressor 3
O	74	Maintenance hours threshold exceeded alarm, compressor 4
O	75	Maintenance hours threshold exceeded alarm, compressor 5
O	76	Maintenance hours threshold exceeded alarm, compressor 6
O	77	Thermal overload alarm, fan 1
O	78	Thermal overload alarm, fan 2
O	80	Thermal overload alarm, fan 3
O	79	Thermal overload alarm, fan 4
O	81	Liquid level alarm
O	82	Low general pressure switch alarm
O	83	High general pressure switch alarm
O	84	Low discharge pressure probe alarm
O	85	High discharge pressure probe alarm
O	86	Low suction pressure probe alarm
O	87	High suction pressure probe alarm
O	88	Exceeded number of inputs available alarm
O	89	Exceeded number of devices available alarm
O	90	Clock fault or battery discharged alarm
O	91	Intake probe faulty or disconnected alarm
O	92	Outlet probe faulty or disconnected alarm
O	93	General alarm signal
I/O	94	Mute buzzer
I/O	95	Reset alarm relay
I/O	96	Hour setting
I/O	97	Minute setting
I/O	98	Day setting
I/O	99	Month setting
I/O	100	Year setting
O	101	Unit status
I/O	102	Input logic
I/O	103	Alarm relay logic
I/O	104	Enable compressor inverter
I/O	105	Enable fan inverter
I/O	106	Enable ON/OFF from digital input
I/O	108	Set default values
I/O	110	Capacity-control step logic
I/O	111	Select ON/OFF from supervisor
I/O	112	Enable ON/OFF from supervisor
I/O	113	Enable liquid level alarm
O	114	Status of fan 5
O	115	Thermal overload alarm, fan 5
I/O	116	Enable On-Off from the keypad
I/O	117	Enable alarm relay
I/O	118	Enable to the delay start after Black-Out
O	119	Status of digital output 1
O	120	Status of digital output 2
O	121	Status of digital output 3
O	122	Status of digital output 4
O	123	Status of digital output 5
O	124	Status of digital output 6
O	125	Status of digital output 7
O	126	Status of digital output 8

Flow	Index	Description
O	127	Status of digital output 9
O	128	Status of digital output 10
O	129	Status of digital output 11
O	130	Status of digital output 12
O	131	Status of digital output 13
O	132	Status of digital output 14
O	133	Status of digital output 15
O	134	Status of digital output 16
O	135	Status of digital output 17
O	136	Status of digital output 18
O	137	Refrigerant leak in environment alarm
I/O	138	Enable electronic expansion valve
I/O	139	Enable outside temperature probe (electronic valve)
O	140	Thermal overload, fan 5
O	141	Thermal overload, fan 6
O	142	Thermal overload, fan 7
O	143	Thermal overload, fan 8
O	144	Thermal overload, fan 9
O	145	Thermal overload, fan 10
O	146	Thermal overload, fan 11
O	147	Thermal overload, fan 12
O	148	Thermal overload, fan 13
O	149	Thermal overload, fan 14
O	150	Thermal overload, fan 15
O	151	Thermal overload, fan 16
O	152	Prevent alarm in progress
O	153	Compressors off from prevent alarm
O	154	Excessive prevent frequency alarm
I/O	155	Enable prevent function
O	156	Status of fan 5
O	157	Status of fan 6
O	158	Status of fan 7
O	159	Status of fan 8
O	160	Status of fan 9
O	161	Status of fan 10
O	162	Status of fan 11
O	163	Status of fan 12
O	164	Status of fan 13
O	165	Status of fan 14
O	166	Status of fan 15
O	167	Status of fan 16

9.3 Integer variables

Flow	Index	Description
I/O	11	Day setting
I/O	12	Hour setting
I/O	13	Minute setting
I/O	14	Month setting
I/O	15	Year setting
I/O	16	Current hour
I/O	17	Current minute
I/O	18	Current month
I/O	19	Current year
O	20	Current day
I/O	21	Oil differential alarm delay in stable operation
I/O	22	Number of inputs per compressor
I/O	23	Number of compressors
I/O	24	Number of fans
I/O	25	Number of capacity-control steps
O	26	Status of analogue output 1
O	27	Status of analogue output 2
O	28	Type of board connected
O	29	Unit status ("On","OFF from alarm","OFF from supervisor","Restart from Blackout","OFF from remote input","OFF from keypad","Manual operation","Install.Default","OFF from screen")
O	30	Type of probe b1 connected
O	31	Type of probe b2 connected
O	32	Current bios version
O	33	Current bios date
O	34	Current boot version
O	35	Current boot date
I/O	36	Integration time
I/O	37	Delay to call compressor starts (dead zone)
I/O	38	Delay to call compressor stops (dead zone)
I/O	39	Minimum compressor on time
I/O	40	Minimum compressor off time
I/O	41	Delay between starts of different compressors
I/O	42	Delay between starts of same compressor
I/O	43	Delay between capacity-control step starts
I/O	44	Delay to call fan starts (dead zone)
I/O	45	Delay to call fan stops (dead zone)
I/O	46	Delay between starts of different fans
I/O	47	Oil differential alarm delay at start
I/O	48	Liquid level alarm delay
I/O	49	Minimum compressor inverter opening
I/O	50	Minimum fan inverter opening
I/O	51	Number of compressors forced on with probe B1 faulty or disconnected
I/O	52	Number of compressors forced on with probe B2 faulty or disconnected
I/O	53	Compressor operating hour threshold (by 1000)
O	54	More significant part, compressor 1 operating hours
O	55	Less significant part, compressor 1 operating hours
O	56	More significant part, compressor 2 operating hours
O	57	Less significant part, compressor 2 operating hours
O	58	More significant part, compressor 3 operating hours
O	59	Less significant part, compressor 3 operating hours
O	60	More significant part, compressor 4 operating hours
O	61	Less significant part, compressor 4 operating hours
O	62	More significant part, compressor 5 operating hours
O	63	Less significant part, compressor 5 operating hours
O	64	More significant part, compressor 6 operating hours
O	65	Less significant part, compressor 6 operating hours
O	66	More significant part, fan 1 operating hours
O	67	Less significant part, fan 1 operating hours
O	68	More significant part, fan 2 operating hours
O	69	Less significant part, fan 2 operating hours
O	70	More significant part, fan 3 operating hours

Flow	Index	Description
O	71	Less significant part, fan 3 operating hours
O	72	More significant part, fan 4 operating hours
O	73	Less significant part, fan 4 operating hours
I/O	74	Fan maintenance alarm threshold (by 1000)
O	75	Application version
O	76	More significant part, fan 5 operating hours
O	77	Less significant part, fan 5 operating hours
O	78	Minimum off time after restart from blackout
O	79	Type of device connected to input 1
O	80	Type of device connected to input 2
O	81	Type of device connected to input 3
O	82	Type of device connected to input 4
O	83	Type of device connected to input 5
O	84	Type of device connected to input 6
O	85	Type of device connected to input 7
O	86	Type of device connected to input 8
O	87	Type of device connected to input 9
O	88	Type of device connected to input 10
O	89	Type of device connected to input 11
O	90	Type of device connected to input 12
O	91	Type of device connected to input 13
O	92	Type of device connected to input 14
O	93	Type of device connected to input 15
O	94	Type of device connected to input 16
O	95	Type of device connected to input 17
O	96	Type of device connected to input 18
O	97	Type of device connected to output 1
O	98	Type of device connected to output 2
O	99	Type of device connected to output 3
O	100	Type of device connected to output 4
O	101	Type of device connected to output 5
O	102	Type of device connected to output 6
O	103	Type of device connected to output 7
O	104	Type of device connected to output 8
O	105	Type of device connected to output 9
O	106	Type of device connected to output 10
O	107	Type of device connected to output 11
O	108	Type of device connected to output 12
O	109	Type of device connected to output 13
O	110	Type of device connected to output 14
O	111	Type of device connected to output 15
O	112	Type of device connected to output 16
O	113	Type of device connected to output 17
O	114	Type of device connected to output 18

10 DEFAULT CONFIGURATIONS

The following tables show the configurations of inputs-outputs for some applications.
Each configuration refers to the type of board used.
For this reason, the instrument, thanks to its versatility, can be programmed in a number of modes, depedning on the common characteristics of the installation being managed:

- alarm relay;
- intake probe
- outlet probe
- general high pressure switch
- general low pressure switch.

Note: these three configurations are set as default in the three types of board

10.1.1 Example of SMALL configuration

Table 10.1 Small refrigeration unit configuration

4 fans		
3 compressors	(1 generic input per compressor)	(0 capacity-control steps)
compressor inverter		
fan inverter		
liquid level alarm		

Table 10.2 analogue inputs

connector	code	type of analogue input	description
J2	B1	universal analogue input 1*	suction pressure probe
J2	B2	universal analogue input 2*	discharge pressure probe
J2	GND	common for analogue inputs	
J2	+VDC	power supply to active probes, 21Vdc (I_{max}= 200 mA)	
J3	B4	passive analogue input 4 (NTC, PT1000, ON/OFF)	general low pressure switch
J3	BC4	common for analogue input 4	
J3	B5	passive analogue input 5 (NTC, PT1000, ON/OFF)	general high pressure switch
J3	BC5	common for analogue input 5	

* NTC, 0-1V, 0-10V, 0-20mA, 4-20mA

Table 10.3 Analogue outputs

connector	code	type of analogue output	description
J4	VG	power to optically-isolated analogue output, 24Vac/Vdc	
J4	VG0	power to optically-isolated analogue output, 0Vac/Vdc	
J4	Y1	analogue output no. 1 0-10V	fan inverter
J4	Y2	analogue output no. 2 0-10V	compressor inverter

Table 10.4 Digital inputs

connector	code	type of digital input	Description
J5	ID1	digital input no. 1, 24Vac/Vdc	thermal overload comp. 1
J5	ID2	digital input no. 2, 24Vac/Vdc	thermal overload comp. 2
J5	ID3	digital input no. 3, 24Vac/Vdc	thermal overload comp. 3
J5	ID4	digital input no. 4, 24Vac/Vdc	Liquid level
J5	ID5	digital input no. 5, 24Vac/Vdc	Thermal overload-Klixon, fan 4
J5	ID6	digital input no. 6, 24Vac/Vdc	Thermal overload-Klixon, fan 3
J5	ID7	digital input no. 7, 24Vac/Vdc	Thermal overload-Klixon, fan 2
J5	ID8	digital input no. 8, 24Vac/Vdc	Thermal overload-Klixon, fan 1

Table 10.5 Digital outputs

connector	code	type of digital output	Description
J12	C1	common relays 1, 2, 3	
J12	NO1	normally open contact, relay no. 1	Compressor 1
J12	NO2	normally open contact, relay no. 2	Compressor 2
J12	NO3	normally open contact, relay no. 3	Compressor 3
J12	C1	common relays 1, 2, 3	
J13	C4	common relays 4, 5, 6	
J13	NO4	normally open contact, relay no. 4	General alarm
J13	NO5	normally open contact, relay no. 5	fan 4
J13	NO6	normally open contact, relay no. 6	fan 3
J13	C4	common relays 4, 5, 6	
J14	C7	common relay no. 7	
J14	NO7	normally open contact, relay no. 7	fan 2
J14	C7	common relay no. 7	
J15	NO8	normally open contact, relay no. 8	fan 1
J15	C8	common relay no. 8	

10.1.2 Example of MEDIUM configuration

Table 10.6 Medium refrigeration unit configuration

4 fans
4 compressors (2 inputs per compressor) (1 capacity-control per compressor)
fan inverter
Liquid level alarm and On-Off from digital input

Table 10.7 Analogue inputs

connector	code	type of analogue input	Description
J2	B1	universal analogue input 1*	suction pressure probe
J2	B2	universal analogue input 2*	discharge pressure probe
J2	GND	common for analogue inputs	
J2	+VDC	power supply to active probes, 21Vdc (I_{max}= 200 mA)	
J3	B4	passive analogue input 4 (NTC, PT1000, ON/OFF)	general low pressure switch
J3	BC4	common for analogue input 4	
J3	B5	passive analogue input 5 (NTC, PT1000, ON/OFF)	general high pressure switch
J3	BC5	common for analogue input 5	

* NTC, 0-1V, 0-10V, 0-20mA, 4-20mA

Table 10.8 Analogue outputs

connector	code	type of analogue output	Description
J4	VG	power to optically-isolated analogue output, 24Vac/Vdc	
J4	VG0	power to optically-isolated analogue output, 0Vac/Vdc	
J4	Y1	analogue output no. 1 0-10V	fan inverter
J4	Y2	analogue output no. 2 0-10V	compressor inverter

Table 10.9 Digital inputs

connector	code	type of digital input	Description
J5	ID1	digital input no. 1, 24Vac/Vdc	thermal overload comp. 1
J5	ID2	digital input no. 2, 24Vac/Vdc	thermal overload comp. 2
J5	ID3	digital input no. 3, 24Vac/Vdc	thermal overload comp. 3
J5	ID4	digital input no. 4, 24Vac/Vdc	thermal overload comp. 4
J5	ID5	digital input no. 5, 24Vac/Vdc	oil differential 1
J5	ID6	digital input no. 6, 24Vac/Vdc	oil differential 2
J5	ID7	digital input no. 7, 24Vac/Vdc	oil differential 3
J5	ID8	digital input no. 8, 24Vac/Vdc	oil differential 4
J5	IDC1	common for digital inputs for 1 to 8	
J7	ID9	digital input no. 9, 24Vac/Vdc	Liquid level
J7	ID10	digital input no. 10, 24Vac/Vdc	On-Off from digital input
J7	ID11	digital input no. 11, 24Vac/Vdc	Thermal overload-Klixon, fan 4
J7	ID12	digital input no. 12, 24Vac/Vdc	Thermal overload-Klixon, fan 3
J7	IDC9	common for digital inputs from 9 to 12	
J8	ID13	digital input 13, 24Vac/Vdc	Thermal overload-Klixon, fan 2
J8	IDC13	common for digital inputs 13 and 14	
J8	ID14	digital input 14, 24Vac/Vdc	Thermal overload-Klixon, fan 1

Table 10.10 Digital outputs

connector	code	type of digital output	Description
J12	C1	common relays 1, 2, 3	
J12	NO1	normally open contact, relay no. 1	Compressor 1
J12	NO2	normally open contact, relay no. 2	capacity-control step 1 compressor 1
J12	NO3	normally open contact, relay no. 3	Compressor 2
J12	C1	common relays 1, 2, 3	
J13	C4	common relays 4, 5, 6	
J13	NO4	normally open contact, relay no. 4	capacity-control step 1 compressor 2
J13	NO5	normally open contact, relay no. 5	Compressor 3
J13	NO6	normally open contact, relay no. 6	capacity-control step 1 compressor 3
J13	C4	common relays 4, 5, 6	
J14	C7	common relay no. 7	
J14	NO7	normally open contact, relay no. 7	Compressor 4
J14	C7	common relay no. 7	
J15	NO8	normally open contact, relay no. 8	capacity-control step 1 compressor 4
J15	C8	common relay no. 8	
J16	C9	common relay no. 9	
J16	NO9	normally open contact, relay no. 9	General alarm

J16	NO10	normally open contact, relay no. 10	fan 4
J16	NO11	normally open contact, relay no. 11	fan 3
J16	C9	common relay no. 9	
J17	NO12	normally open contact, relay no. 12	fan 2
J17	C12	common relay no. 12	
J18	NO13	normally open contact, relay no. 13	fan 1
J18	C13	common relay no. 13	

10.1.3 Example of LARGE configuration

Table 10.11 Large refrigeration unit configuration

4 fans
5 compressors (3 inputs per compressor) (1 capacity-control step per compressor)
fan inverter
Liquid level alarm

Table 10.12 analogue inputs

connector	code	type of analogue input	Description
J2	B1	universal analogue input 1*	suction pressure probe
J2	B2	universal analogue input 2*	discharge pressure probe
J2	GND	common for analogue inputs	
J2	+VDC	power supply to active probes, 21Vdc (I_{max}= 200 mA)	
J3	B4	passive analogue input 4 (NTC, PT1000, ON/OFF)	general low pressure switch
J3	BC4	common for analogue input 4	
J3	B5	passive analogue input 5 (NTC, PT1000, ON/OFF)	general high pressure switch
J3	BC5	common for analogue input 5	
J20-	B9	passive analogue input 9 (NTC, PT1000, ON/OFF)	Thermal overload-Klixon, fan 1
J20-	BC9	common analogue input 9	
J20-	B10	passive analogue input 10 (NTC, PT1000, ON/OFF)	Thermal overload-Klixon, fan 2
J20-	BC10	common analogue input 10	

* NTC, 0-1V, 0-10V, 0-20mA, 4-20mA

Table 10.13 Analogue outputs

connector	code	type of analogue output	Description
J4	VG	power to optically-isolated analogue output, 24Vac/Vdc	
J4	VG0	power to optically-isolated analogue output, 0Vac/Vdc	
J4	Y1	analogue output no. 1 0-10V	fan inverter
J4	Y2	analogue output no. 2 0-10V	compressor inverter

Table 10.14 Digital inputs

connector	code	type of digital input	Description
J5	ID1	digital input no. 1, 24Vac/Vdc	thermal overload comp. 1
J5	ID2	digital input no. 2, 24Vac/Vdc	thermal overload comp. 2
J5	ID3	digital input no. 3, 24Vac/Vdc	thermal overload comp. 3
J5	ID4	digital input no. 4, 24Vac/Vdc	thermal overload comp. 4
J5	ID5	digital input no. 5, 24Vac/Vdc	thermal overload comp. 5
J5	ID6	digital input no. 6, 24Vac/Vdc	oil differential 1
J5	ID7	digital input no. 7, 24Vac/Vdc	oil differential 2
J5	ID8	digital input no. 8, 24Vac/Vdc	oil differential 3
J5	IDC1	common for digital inputs for 1 to 8	
J7	ID9	digital input no. 9, 24Vac/Vdc	oil differential 4
J7	ID10	digital input no. 10, 24Vac/Vdc	oil differential 5
J7	ID11	digital input no. 11, 24Vac/Vdc	High-low pressure switch 1
J7	ID12	digital input no. 12, 24Vac/Vdc	High-low pressure switch 2
J7	IDC9	common for digital inputs from 9 to 12	
J8	ID13	digital input 13, 24Vac/Vdc	High-low pressure switch 3
J8	IDC13	common for digital inputs 13 and 14	
J8	ID14	digital input 14, 24Vac/Vdc	High-low pressure switch 4
J19	ID15	digital input 15, 24Vac/Vdc	High-low pressure switch 5
J19	IDC15	common for digital inputs 15 and 16	
J19	ID16	digital input 16, 24Vac/Vdc	Liquid level alarm
J20	ID17	digital input 17, 24Vac/Vdc	Thermal overload-Klixon, fan 4
J20	ID18	digital input 18, 24Vac/Vdc	Thermal overload-Klixon, fan 3
J20	IDC17	common for digital inputs 17 and 18	

Table 10.15 Digital outputs

connector	code	type of digital output	Description
J12	C1	common relays 1, 2, 3	
J12	NO1	normally open contact, relay no. 1	compressor 1
J12	NO2	normally open contact, relay no. 2	capacity-control step 1 compressor 1
J12	NO3	normally open contact, relay no. 3	compressor 2
J12	C1	common relays 1, 2, 3	
J13	C4	common relays 4, 5, 6	
J13	NO4	normally open contact, relay no. 4	capacity-control step 1 compressor 2
J13	NO5	normally open contact, relay no. 5	compressor 3
J13	NO6	normally open contact, relay no. 6	capacity-control step 1 compressor 3
J13	C4	common relays 4, 5, 6	
J14	C7	common relay no. 7	
J14	NO7	normally open contact, relay no. 7	compressor 4
J14	C7	common relay no. 7	
J15	NO8	normally open contact, relay no. 8	capacity-control step 1 compressor 4
J15	C8	common relay no. 8	
J16	C9	common relay no. 9	
J16	NO9	normally open contact, relay no. 9	compressor 5
J16	NO10	normally open contact, relay no. 10	capacity-control step 1 compressor 5
J16	NO11	normally open contact, relay no. 11	
J16	C9	common relay no. 9	
J17	NO12	normally open contact, relay no. 12	/
J17	C12	common relay no. 12	
J18	NO13	normally open contact, relay no. 13	/
J18	C13	common relay no. 13	
J21	NO14	normally open contact, relay no. 14	general alarm
J21	C14	common relay no. 14	
J21	NO15	normally open contact, relay no. 15	fan 4
J21	C15	common relay no. 15	
J22	C16	common relay no. 16	
J22	NO16	normally open contact, relay no. 16	fan 3
J22	NO17	normally open contact, relay no. 17	fan 2
J22	NO18	normally open contact, relay no. 18	fan 1
J22	C16	common relay no. 16	

11 POSSIBLE CONFIGURATIONS

The following table shows the possible configurations for the devices in the refrigeration system.

Note: the table does not envisage inputs for the “liquid level alarm”, “Remote on-off” and the output dedicated to the alarm relay.

Key to the table

CP : compressor.
P : capacity-control.
V : fan.
TS : Type of board recommended. This may be small, medium or large. It should be remembered that a maximum of three safety devices are available for each compressor. The number in brackets indicates, for the size of board in question, the maximum number of safety inputs available per compressor.
TU : total outputs used.

CP	P	V	TS	TU
0	0	0	SMALL	0
0	0	1	SMALL	1
0	0	2	SMALL	2
0	0	3	SMALL	3
0	0	4	SMALL	4
0	0	5	SMALL	5
1	0	0	SMALL	1
1	0	1	SMALL	2
1	0	2	SMALL	3
1	0	3	SMALL	4
1	0	4	SMALL	5
1	0	5	SMALL	6
1	1	0	SMALL	2
1	1	1	SMALL	3
1	1	2	SMALL	4
1	1	3	SMALL	5
1	1	4	SMALL	6
1	1	5	SMALL	7
1	2	0	SMALL	3
1	2	1	SMALL	4
1	2	2	SMALL	5
1	2	3	SMALL	6
1	2	4	SMALL	7
1	2	5	SMALL	8
1	3	0	SMALL	4
1	3	1	SMALL	5
1	3	2	SMALL	6
1	3	3	SMALL	7
1	3	4	SMALL	8
1	3	5	MEDIUM	9
2	0	0	SMALL	2
2	0	1	SMALL	3
2	0	2	SMALL	4
2	0	3	SMALL(2)	5
2	0	4	SMALL(2)	6
2	0	5	SMALL(1)	7
2	1	0	SMALL	4
2	1	1	SMALL	5
2	1	2	SMALL	6
2	1	3	SMALL(2)	7
2	1	4	SMALL(2)	8
2	1	5	MEDIUM	9
2	2	0	SMALL	6
2	2	1	SMALL	7
2	2	2	SMALL	8
2	2	3	MEDIUM	9
2	2	4	MEDIUM	10
2	2	5	MEDIUM	11
2	3	0	SMALL	8
2	3	1	MEDIUM	9
2	3	2	MEDIUM	10
2	3	3	MEDIUM	11
2	3	4	MEDIUM	12
2	3	5	MEDIUM	13
3	0	0	SMALL(2)	3
3	0	1	SMALL(2)	4
3	0	2	SMALL(2)	5
3	0	3	SMALL(1)	6
3	0	4	SMALL(1)	7
3	0	5	SMALL(1)	8
3	1	0	SMALL(2)	6
3	1	1	SMALL(2)	7
3	1	2	SMALL(2)	8
3	1	3	MEDIUM	9
3	1	4	MEDIUM	10
3	1	5	MEDIUM	11
3	2	0	MEDIUM	9
3	2	1	MEDIUM	10
3	2	2	MEDIUM	11
3	2	3	MEDIUM	12
3	2	4	MEDIUM	13
3	2	5	LARGE	14
3	3	0	MEDIUM	12
3	3	1	MEDIUM	13
3	3	2	LARGE	14
3	3	3	LARGE	15
3	3	4	LARGE	16
3	3	5	LARGE	17
4	0	0	MEDIUM	4
4	0	1	SMALL(1)	5
4	0	2	SMALL(1)	6
4	0	3	SMALL(1) MEDIUM(2)	7
4	0	4	SMALL(1) MEDIUM(2)	8
4	0	5	MEDIUM(2)	9
4	1	0	SMALL(2)	8
4	1	1	MEDIUM	9
4	1	2	MEDIUM	10
4	1	3	MEDIUM(1-2)	11
4	1	4	MEDIUM(2)	12
4	1	5	MEDIUM(2)	13
4	2	0	MEDIUM	12
4	2	1	MEDIUM	13
4	2	2	LARGE	14
4	2	3	LARGE	15
4	2	4	LARGE	16
4	2	5	LARGE	17
4	3	0	LARGE	16
4	3	1	LARGE	17
4	3	2	LARGE	18
5	0	0	SMALL(1) MEDIUM(2)	5
5	0	1	SMALL(1) MEDIUM(2)	6
5	0	2	SMALL(1) MEDIUM(2)	7
5	0	3	SMALL(1) MEDIUM(2)	8
5	0	4	MEDIUM(2)	9
5	0	5	MEDIUM(1)	10
5	1	0	SMALL(1) MEDIUM(2)	10
5	1	1	MEDIUM(2)	11

CP	P	V	TS	TU
5	1	2	MEDIUM(2)	12
5	1	3	MEDIUM(2)	13
5	1	4	LARGE	14
5	1	5	LARGE	15
5	2	0	LARGE	15
5	2	1	LARGE	16
5	2	2	LARGE	17
5	2	3	LARGE	18
6	0	0	SMALL(1) MEDIUM(2)	6
6	0	1	SMALL(1) MEDIUM(2)	7
6	0	2	SMALL(1) MEDIUM(2)	8
6	0	3	MEDIUM(1) LARGE(2)	9
6	0	4	MEDIUM(1) LARGE(2)	10
6	0	5	MEDIUM(1) LARGE(2)	11
6	1	0	MEDIUM(2) LARGE	12
6	1	1	MEDIUM(2) LARGE	13
6	1	2	LARGE	14
6	1	3	LARGE(2)	15
6	1	4	LARGE(2)	16
6	1	5	LARGE(2)	17
6	2	0	LARGE	18

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