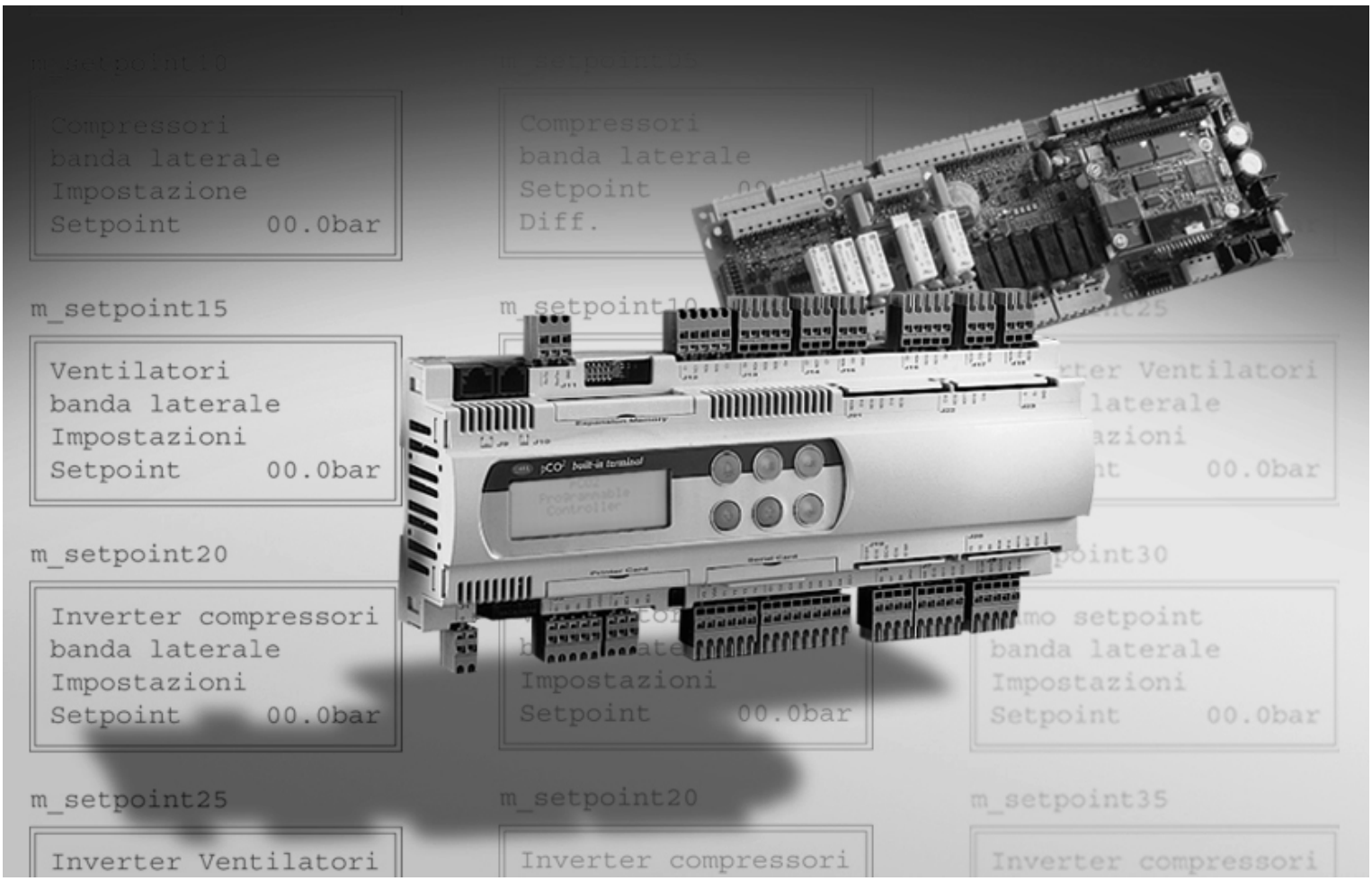
pCO² Standard Application



Refrigeration System
Code: FLSTDMFC0A
Version V1.1 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:

- the software is installed, programmed, run and maintained according to the instructions in this manual and by qualified personnel;
- all the conditions prescribed in the installation and user manual of the appliance in question are respected.

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. Introduction

This program allows the management of a refrigeration system, with the following characteristics:

- display and control of the values measured;
- management of between one and six compressors, depending on the number of outputs, with between zero and three capacity-control steps each, and between one and five condensation stages;
- configuration of the devices being controlled;
- display of alarms by LCD display, and audible signal;
- programming of the configuration parameters and a number of operating parameters with password-protected access;
- availability of three levels of access to the parameter setting screens, controlled by three different passwords;
- modification of the fundamental operating parameters (set point, differentials, alarm thresholds, time settings);
- programming of the time bands, and control of the compressors with a second set point to allow energy savings in the set time bands;
- multi-language management
- connection to a supervisor/telemaintenance serial line.

1.2. General description

The purpose of this application is to control a refrigeration system in which the maximum configuration features the management of 6 compressors with 3 capacity-control steps, 5 fans and 2 controllers.
The control is based on the readings from the two pressure probes connected to analogue inputs B1 and B2.
The digital inputs on the pCO² board are connected to the alarm signals from the devices.
The activation of the alarms is signalled on the display in the specific screens, and by a buzzer (only with the external terminal).
The program features a number of screens for setting the operating values, and others for setting the machine configuration, all protected by password.
There are three levels of access to the protected screens, each referring to different passwords:

level 1	User password (“user branch”): refers to a modifiable password, which allows access only to the setting of the control operating parameters.	Default value = 0
level 2	Service password (“service branch”): refers to a modifiable password, which allows access to the maintenance parameters.	Default value = 0
level 3	Manufacturer password (“manufacturer branch”): refers to a modifiable password which allows access to all the machine configuration screens, including the setting of a new user, service and manufacturer password and the entering of the default values	Default value = 1234

Table 1.2.1

There is a fixed password that accesses any branch and is set during programming: FIXED PASSWORD = 1234.
IMPORTANT WARNING: to avoid tampering during the operation of the machine, only qualified personnel must know the manufacturer password. In particular, the manufacturer and fixed password are used in the preliminary phases of installation and when the setting screens protected by the other passwords cannot be accessed.

1.3. Starting the machine

1.3.1. 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, and any time the software release is upgraded, the default values should be entered.
This is performed automatically the fist time the program is run.
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, M_MAIN_MENU. 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 “M_DEFAULT” screen 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 manufacturer values defined by Carel so as to speed up the work of the installer.

NOTE: The default values differ depending on the type of board used.
To see the parameters installed, please refer to “Default value”; “Configuration examples” to see on which inputs-outputs the devices are configured and which models are covered by the various configurations.
If some standard values are not correct for the required application, the user can always change them by accessing the screen from the supervisor, making the machine 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 machine 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 machine using one board.

1.3.2. Basic configuration

According to the board used (SMALL, MEDIUM, or LARGE) and the number of inputs per compressor (M_CONF_DEV01 manufacturer branch), the number of compressors set can vary from 1 to 6, with between 1 and 3 capacity-control steps, and between 1 and 5 fans. 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.

Number of compressors and fans

The number of compressors controlled, managed by the inlet probe, can be set by the user (screen M_CONF_DEV02 manufacturer branch). Depending on the board, the pCO² system can manage a minimum of 1 compressor up to a maximum of 6, all with the same capacity, and with the possibility to rotate activation.
The number of condenser fans controlled varies from 1 to 5, and can be set by the user (screen M_CONF_DEV01 manufacturer branch), with the possibility to rotate activation.

Input logic

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 M_CONF_LOGIC_IN, manufacturer branch).
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 (M_TYPE_RES_HL_P, general parameter configuration branch)
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 1 thermal overload switch, simply go to the screen M_CONF_INOUT_1 (configuration branch, unit configuration sub-branch), 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 special input needs to be used (also see manufacturer branch, unit configuration, screens M_CONF_INOUT_1).

Output logic

The application can manage a maximum of six compressors with three capacity-control steps each and a maximum of five fans. The user can decide which inputs 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 (screen M_CONF_OUT1), without needing to modify the electrical system and in any case freely deciding upon the use of the outputs.

Language selection.

The user can easily set the language used on the screens. To do this, go to the main screen (M_MAIN_MENU) and press the PROG button (for Built-in terminals press the PROG button, then move to the row “PROG BRANCH: →” and press ENTER), then enter the password (default 0) and press the ENTER button until the desired language appears.
Note 1: the software currently manages three languages (Italian, English, French)
Note 2: the user may at any moment change language, without needing to place the unit in Standby.

Machine On-Off.

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

1. from the alarms: the screen (M_PROG12) can be used to select if a faulty probe alarm is to turn the unit off or not
2. from the supervisor: the screen (M_PROG12, PROG branch) is used to enable shut-down from the supervisor
3. from digital input (if configured, M_CONF_DEV06 configuration branch), in addition to the screen (M_LOGIC_ONOFF configuration branch), the logic can be selected
4. from the keypad : if enabled on the screen (M_ON_OFF_UNITA, maintenance branch) 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 (M_MAIN_MENU) and press the UP button, then select whether to switch the machine on or off
5. from the screen: the unit can be turned off or on from the screen (M_MAINT20)

1.4. The supervisor network

The pCO 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 in the memory
- the enabling of the devices, various management, etc.

Furthermore, a number of parameters can be modified, such as: set point, differential, time settings, unit status, alarm reset, etc.
Also see paragraph 5.2 Variables used in communication with the supervisor, which lists in detail all the variables currently available to the supervisor.

1.4.1. Serial boards.

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

- optically-isolated RS485 serial connection board for pCO² PCO2004850
- RS232 serial connection board per modem, not optically-isolated, for pCO² PCO200MDM0
- LON RS485 serial connection board for pCO² PCO20L4850
- LON FTT10 serial connection board for pCO² PCO20LFTT0

The user may, depending on requirements, decide whether to install the board or not. The board 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, MASTERPLANT CAREL and MODBUS, into the machine's operating system.
As well as installing the board, for the correct operation the identification number of the pCO² needs to be set and the board needs to be enabled (M_CONF_SUPERV configuration branch, initialisation), and the communication protocol used needs to be selected.
Each pCO² must have its address defined so that:

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

As well as the two protocols, boards are also available for LON networks. All the variables defined in the tables for communication with the supervisor can be used in communication with the LON network, but with a maximum limit of 59. When programming the boards, these variables must be defined.
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.

Analogue inputs

Connector	Code	Description	Type of analogue input
J2-1	B1	Inlet pressure probe	Universal analogue input 1*
J2-2	B2	Outlet pressure probe	Universal analogue input 2*
J2-3	B3	Ambient temperature probe (opt.)	Analogue input 3 NTC
J2-4	GND		Common for analogue inputs
J2-5	+VDC		21Vdc power supply for active probes (I_{max}= 200mA)
J3-1	B4	Input can be configured by software	passive analogue input 4 ON/OFF
J3-2	BC4		common for analogue input 4
J3-3	B5	Input can be configured by software	passive analogue input 5 ON/OFF
J3-4	BC5		common for analogue input 5
J6-1	B6	Outside temperature probe (opt.)	analogue input 6 NTC
J6-2	B7	General temperature probe (opt.)	analogue input 7 NTC
J6-3	B8		universal analogue input 8 *
J6-4	GND		common for analogue inputs
J20-3	B9	Input can be configured by software	Passive analogue input 9 ON/OFF
J20-4	BC9		Common for analogue input 9
J20-5	B10	Input can be configured by software	Passive analogue input 10 ON/OFF
J20-6	BC10		Common for analogue input 10

*** (NTC, 0÷1 V, 0÷10V, 0÷20mA, 4÷20mA)**

Table 1.5.1

Analogue outputs

Connector	Code	Description	Type of analogue output
J4-1	VG		power to optically-isolated analogue output, 24Vac/Vdc
J4-2	VG0		power to optically-isolated analogue output, 0Vac/Vdc
J4-3	Y1	Fan controller	analogue output no. 1 0÷10V
J4-4	Y2	Compressor controller	analogue output no. 2 0÷10V
J4-5	Y3		analogue output no. 3 0÷10V
J4-6	Y4		analogue output no. 4 0÷10V

Table 1.5.2

Digital inputs

Connector	Code	Description	Type of digital input
J5-1	ID1	Inputs can be configured by software, see corresponding paragraph	digital input no. 1, 24Vac/Vdc
J5-2	ID2		digital input no. 2, 24Vac/Vdc
J5-3	ID3		digital input no. 3, 24Vac/Vdc
J5-4	ID4		digital input no. 4, 24Vac/Vdc
J5-5	ID5		digital input no. 5, 24Vac/Vdc
J5-6	ID6		digital input no. 6, 24Vac/Vdc
J5-7	ID7		digital input no. 7, 24Vac/Vdc
J5-8	ID8		digital input no. 8, 24Vac/Vdc
J5-9	IDC1		common for digital inputs from 1 to 8
J7-1	ID9	Inputs can be configured by software, see corresponding paragraph	digital input no. 9, 24Vac/Vdc
J7-2	ID10		digital input no. 10, 24Vac/Vdc
J7-3	ID11		digital input no. 11, 24Vac/Vdc
J7-4	ID12		digital input no. 12, 24Vac/Vdc
J7-5	IDC9		common for digital inputs from 9 to 12
J8-1	ID13H		digital input 13, 230Vac
J8-2	ID13	Inputs can be configured by software, see corresponding paragraph	digital input 13, 24Vac/Vdc
J8-3	IDC13		common for digital inputs 13 and 14
J8-4	ID14	Inputs can be configured by software, see corresponding paragraph	digital input 14, 24Vac/Vdc
J8-5	ID14H		digital input 14, 230Vac
J19-1	ID15H		Digital input 15, 230Vac
J19-2	ID15	Inputs can be configured by software, see corresponding paragraph	Digital input 15, 24Vac/Vdc
J19-3	IDC15		Common for digital inputs 15 and 16 (negative pole if the group is supplied in DC)
J19-4	ID16	Inputs can be configured by software, see corresponding paragraph	Digital input 16, 24Vac/Vdc

Connector	Code	Description	Type of digital input
J19-5	ID16H		Digital input 16, 230Vac
J20-7	ID17	Inputs can be configured by software, see corresponding paragraph	Digital input no.17, 24Vac/Vdc
J20-8	ID18		Digital input no.18, 24Vac/Vdc
J20-9	IDC17		Common for digital inputs 17 and 18 (negative pole if the group is supplied in DC)

Table 1.5.3

Digital outputs

Connector	Signal	Description	Type of digital output
J12-1	C1		common relay: 1, 2, 3
J12-2	NO1	Outputs can be configured by software, see corresponding paragraph	normally-open contact, relay no. 1
J12-3	NO2		normally-open contact, relay no. 2
J12-4	NO3		normally-open contact, relay no. 3
J12-5	C1		common relay: 1, 2, 3
J13-1	C4		common relay: 4, 5, 6
J13-2	NO4	Outputs can be configured by software, see corresponding paragraph	normally-open contact, relay no. 4
J13-3	NO5		normally-open contact, relay no. 5
J13-4	NO6		normally-open contact, relay no. 6
J13-5	C4		common relay: 4, 5, 6
J14-1	C7		common relay no. 7
J14-2	NO7	Outputs can be configured by software, see corresponding paragraph	normally-open contact, relay no. 7
J14-3	C7		common relay no. 7
J15-1	NO8		normally-open contact, relay no. 8
J15-2	C8	Outputs can be configured by software, see corresponding paragraph	common relay no. 8
J15-3	NC8		normally-closed contact, relay no. 8
J16	NO9	Outputs can be configured by software, see corresponding paragraph	normally-open contact, relay no. 9
J16	NO10		normally-open contact, relay no. 10
J16	NO11		normally-open contact, relay no. 11
J16	C9		common relay no. 9
J17	NO12	Outputs can be configured by software, see corresponding paragraph	normally-open contact, relay no. 12
J17	C12		common relay no. 12
J17	NC12	Outputs can be configured by software, see corresponding paragraph	normally-closed contact, relay no. 12
J18	NO13	Outputs can be configured by software, see corresponding paragraph	normally-open contact, relay no. 13
J18	C13		common relay no. 13
J18	NC13	Outputs can be configured by software, see corresponding paragraph	normally-closed contact, relay no. 13
J21-1	NO14	Outputs can be configured by software, see corresponding paragraph	Normally-open contact, relay no.14
J21-2	C14		Common relay no.14
J21-3	NC14		Normally-closed contact, relay no.14
J21-4	NO15	Outputs can be configured by software, see corresponding paragraph	Normally-open contact, relay no.15
J21-5	C15		Common relay no.15
J21-6	NC15	Outputs can be configured by software, see corresponding paragraph	Normally-closed contact, relay no.15
J22-1	C16		Common relay: 16, 17, 18
J22-2	NO16	Outputs can be configured by software, see corresponding paragraph	Normally-open contact no.16
J22-3	NO17		Normally-open contact no.17
J22-4	NO18		Normally-open contact no.18
J22-5	C16		Common relay: 16, 17, 18

Table 1.5.4

2. MAIN SETTINGS

2.1. Dead zone

This setting determines a zone 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 dead zone (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. The controller checks the parameter TIME_SWITCH_ON1 (configuration branch, times, screen M_COMP_TIMING01), 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 TIME_SWITCH_OFFX (configuration branch, times, screen M_COMP_TIMING01); 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

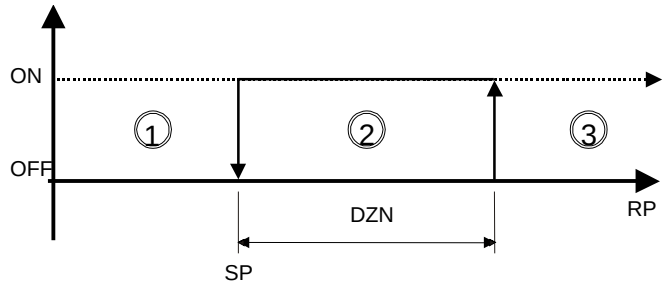


Figure 2.1.1

2.1.1. 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.

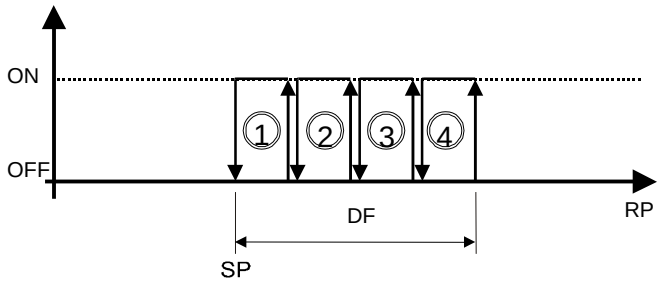


Figure 2.1.1.1

2.2. Compressor management

The compressors can be managed with inverter control or as simple ON-OFF stages
Inputs Used:
Inlet pressure probe
Digital inputs dedicated to the compressor safety devices
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
compressors times
type of rotation
type of control

2.2.1. ON OFF 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 (M_SETPOINT10, SET branch) and on the value read by the inlet probe.
In the default configuration, dead zone control is activated - which can be set on the screen (M_MANUF220, manufacturer branch) - with FIFO rotation (M_MANUF220, manufacturer branch), respecting the various time settings (see the corresponding paragraph).
For a description of dead zone or proportional band operation, please see the following paragraph.

2.2.2. 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 (M_MANUF115 manufacturer branch), if no capacity-control steps are configured.
A lower limit can be set for the inverter (M_MANUF240 manufacturer branch),
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 (M_SETPOINT35 branch SET) 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 probe a1 exceeds the inverter Set Point + the differential. A decrease occurs when the reading of probe a1 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 (M_SETPOINT35, SET branch)
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.

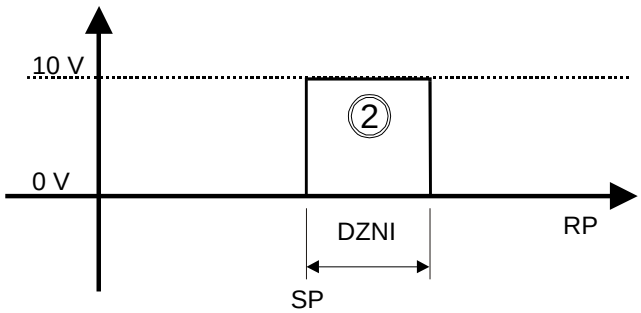


Figure 2.2.2.1

case 2 - proportional band control
The control requires the setting of a set point and a differential (M_SETPOINT20-50, SET branch). When the value measured by the inlet 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.

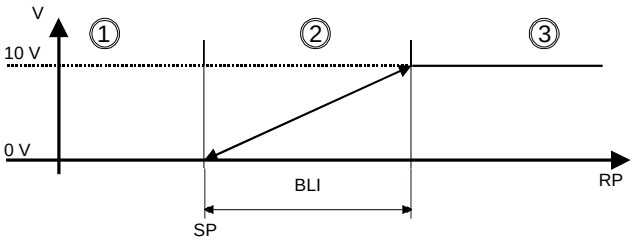


Figure 2.2.2.2

2.2.3. Compressor parameters

Number of capacity-control steps

Manufacturer branch, configuration, screen M_CONF_DEV02
One, two or three capacity control steps can be selected.
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 M_CONF_UNLOADER
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 M_CONF_UNIT04
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 M_CONF_UNIT04
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).

Compressor and fan rotation

Manufacturer branch, general parameters, screen M_CONF_UNIT02 - M_CONF_UNIT06
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.)

Compressor and fan control

Manufacturer branch, general parameters, screen M_CONF_UNIT02 - M_CONF_UNIT06
Dead zone (see **Dead zone**) or proportional band control (see **Proportional band**) can be selected.

Type of compressor control

Manufacturer branch, general parameters, screen M_CONF_UNIT03
Can be proportional or proportional plus integral (only in proportional band):

- Proportional control
  Based on the set point entered (SET branch, screen M_SET_COMP), a proportional band is calculated, the width of which is equal to the differential set (SET branch, screen M_DIFF_DEVICE).
  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 (Manufacturer branch, general parameters, screen M_CONF_UNIT03)
  The integral 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 M_CONF_UNIT5
If the probe 1 failure or not connected alarm is activated (BROKEN_PROBE1), this parameter indicates the minimum number of compressors forced on.

2.2.4. 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 M_COMP_TIMING01
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 M_COMP_TIMING01
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.

Minimum compressor ON time.

Manufacturer branch, general parameters, screen M_COMP_TIMING02
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 M_COMP_TIMING02
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

Manufacturer branch, general parameters, screen M_COMP_TIMING03
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 M_COMP_TIMING04
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 M_TIME_UNLOAD
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.

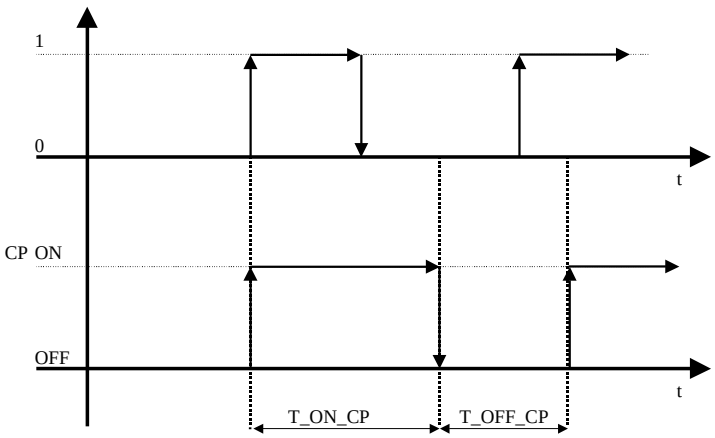


Figure 2.2.4.1

2.3. Fan management

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

Inputs Used:

Outlet 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

2.3.1. ON OFF 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 (M_SETPOINT15, SET branch) 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 (M_MANUF250, manufacturer branch) with FIFO rotation (M_MANUF250, manufacturer branch), respecting the various time settings.
If a fan remains off due to an alarm, the pressure tends to increase, requesting the start of another fan; once the alarm has passed, the fan will restart normal operation.

2.3.2. Fan management with inverter

Parameters used:

Fan inverter set point
Fan inverter differential

The fan inverter can be set on the screen (M_MANUF115, manufacturer branch). A minimum value can be set for the inverter (M_MANUF240, manufacturer branch, general parameters)
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 (M_SETPOINT40 branch SET) 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 (M_SETPOINT25, SET branch), 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.

2.3.3. Fan parameters

Fan rotation

Manufacturer branch, general parameters, screen M_CONF_UNIT06
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 M_CONF_UNIT06
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 M_CONF_UNIT7
If the probe 2 failure or not connected alarm is activated (BROKEN_PROBE2), this parameter indicates the minimum number of fans forced on.

2.3.4. Fan time settings

Time between start requests (dead zone)

Manufacturer branch, general parameters, screen M_TIME_FAN_1
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 M_TIME_FAN_1
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 M_TIME_FAN_2
Represents the minimum time that must elapse between the start of one device and the next. This parameter allows simultaneous starts to be avoided.

2.4. Special functions

2.4.1. Compressor time bands

Clock branch, screen M_CLOCK02 and M_CLOCK03
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 (M_CLOCK03, clock branch). 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:

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

Table 2.4.1.1

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.

2.4.2. 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.

2.4.3. 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 M_CONF_PROBE4. The three probes are:
B3 ambient temperature probe
B6 outside temperature probe. Medium and Large boards only
B7 general temperature probe (the name can be set). Medium and Large boards only

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

2.5. 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.
Also see ALARM button branch, chap. 3.7.10.
WARNING: 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 M_CONF_LOGIC_IN.

Table of alarms

The following table explains the alarms controlled by the pCO²:

code	alarm description	Action performed	reset auto/man	delay	NOTES
AL0	thermal overload Klixon/generic compressor 1	OFF comp.1	manual	no	
AL1	thermal overload Klixon/generic compressor 2	OFF comp.2	manual	no	
AL2	thermal overload Klixon /generic compressor 3	OFF comp.3	manual	no	
AL3	thermal overload Klixon /generic compressor 4	OFF comp.4	manual	no	
AL4	thermal overload Klixon /generic compressor 5	OFF comp.5	manual	no	
AL5	thermal overload Klixon /generic compressor 6	OFF comp.6	manual	no	
AL6	fan thermal overload switch 1	OFF fan 1	manual	no	
AL7	fan thermal overload switch 2	OFF fan 2	manual	no	
AL8	fan thermal overload switch 3	OFF fan 3	manual	no	

AL9	fan thermal overload switch 4	OFF fan 4	manual	no	
AL9	fan thermal overload switch 5	OFF fan 5	manual	no	
AL10	pressure switch comp.1	OFF comp.1	manual	no	
AL11	high/low pressure switch comp.2	OFF comp.2	manual	no	
AL12	high/low pressure switch comp.3	OFF comp.3	manual	no	
AL13	high/low pressure switch comp.4	OFF comp.4	manual	no	
AL14	high/low pressure switch comp.5	OFF comp.5	manual	no	
AL15	high/low pressure switch comp.6	OFF comp.6	manual	no	
AL16	oil differential comp.1	OFF comp.1	manual	can be set	
AL17	oil differential comp.2	OFF comp.2	manual	can be set	
AL18	oil differential comp.3	OFF comp.3	manual	can be set	
AL19	oil differential comp.4	OFF comp.4	manual	can be set	
AL20	oil differential comp.5	OFF comp.5	manual	can be set	
AL21	oil differential comp.6	OFF comp.6	manual	can be set	
AL22	low liquid level alarm	/	manual	can be set	display only
AL23	gen. low pressure switch	compressors OFF	automatic	no	
AL24	gen. high pressure switch	compressors OFF	manual	no	
AL25	maintenance comp. 1	/	manual	no	display only
AL26	maintenance comp. 2	/	manual	no	display only
AL27	maintenance comp. 3	/	manual	no	display only
AL28	maintenance comp. 4	/	manual	no	display only
AL29	maintenance comp. 5	/	manual	no	display only
AL30	maintenance comp. 6	/	manual	no	display only
AL31	pre-alarm low outlet pressure	all fans OFF	automatic	no	
AL32	pre-alarm high outlet pressure	all fans ON	automatic	can be set	
AL33	pre-alarm low inlet pressure	all comps. OFF	automatic	can be set	
AL34	pre-alarm high inlet pressure	all comps. ON	automatic	can be set	
AL35	Exceeded max no. inputs avail.	/	automatic	no	display only
AL36	Exceeded max no. devices	/	automatic	no	display only
AL37	Clock fault or battery discharged	Disable time bands	manual	no	
AL38	probe 1 fault or disconnected	no. of comps. ON can be set	manual	no	
AL39	probe 2 fault or disconnected	no. of fans ON can be set	manual	no	

Table 2.5.1

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 M_CONF_LOGIC_AL), if enabled (manufacturer branch, unit configuration screen M_CONF_DEV04).

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).

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.

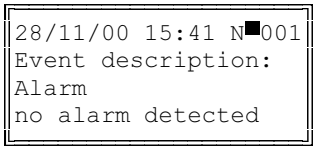
Alarm relay

The user may decide whether to configure the alarm relay simply by enabling it (manufacturer branch, unit configuration, screen M_CONF_DEV04) and entering the relay to assign to the alarm (manufacturer branch, unit configuration, screen M_CONF_OUT_9).
If enabled, a delay time can be set (screen M_PROG05, PROG branch) 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.

Alarm log

Press the MENU or PROG button, for the built-in terminal, and scroll the rows until reaching the alarm log branch.
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 screen “M_AL_HISTORY1” in the Alarm log branch.

m_al_history1



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 the screen “M_RESET_HISTORY” in the maintenance branch (password-protected).
Installing the default values also resets the log.

3. USER INTERFACE

The user interface for this application is divided into four fundamental parts:

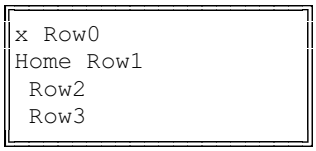
- **a USER section**, not password-protected, for monitoring the controlled values, setting the main control Set point, control differential, and displaying the active alarms and saved alarms;
- **a USER section**, password-protected, which sets all the control parameters for the various functions and processes managed by the program: Set point limits, alarm thresholds etc.; only the parameters regarding the manufacturer password-enabled functions are displayed and can be set;
- **a SERVICE section**, password-protected, reserved for service operations, that is, the management of the device hour counters, the calibration of the connected probes, and the forcing of the relay outputs;
- **a MANUFACTURER section**, password-protected, for configuring the system, selecting and activating the functions of the controlled devices.

The password-protected Manufacturer section contains a menu with four choices:

- Unit configuration
- General parameters
- Time settings
- Unit initialisation

3.1. 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:



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

3.2. 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.

3.3. External 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**

3.3.1. Use of the buttons on the external terminal

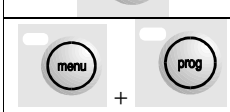
	Button	Description
	MENU	Pressed once returns to the main screen (M_mean_menu) Pressed again goes to the screens for accessing the various branches (m_menu_1)
	MAINT	displays the values corresponding to the maintenance of the devices (operating hours of the devices and reset hour counter, accesses the manual operation procedure)
	PRINTER	accesses the group of screens for printer management (not featured in this application)
	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 machine's configuration
	INFO	displays the version of the software application and other information on the machine

Table 3.3.1.1

External silicon rubber buttons.

1. **ON/OFF** button: switches the machine on and off. The green LED on the button indicates if the machine 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.

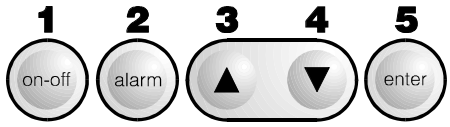
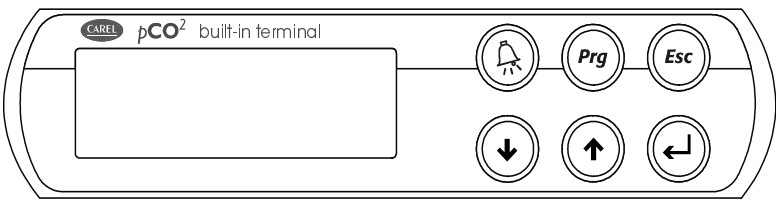


Fig. 3.3.1.1

3.4. Built-in terminal

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



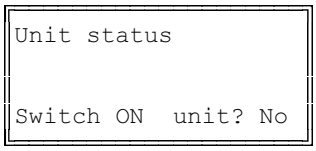
ALARM	**PROG**	**ESC**
UP	**DOWN**	**ENTER**

3.4.1. Use of the 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 screen "M_MENU_1" for entering the various sub-branches.**

The Built-in terminal does not have an ON/OFF button, therefore to switch the unit on/off, the user must go to the main screen "M_MAIN_MENU" and press the UP button: a screen will be displayed allowing the unit to be switched on or off.

m_main_5

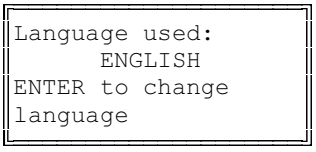


Unit status
On the built-in terminal, this screen can be used to switched the unit on or off

This is only displayed if enabled on the screen "M_ON_OFF_UNITA", maintenance branch

3.5. Tree layout of the screens.

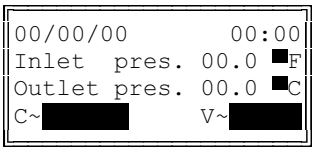
m_start



This screen appears when the unit is started, and remains active for a few seconds
During this period, the software initialises the operating parameters and, if
the program is installed for the first time, automatically saves
the default values.

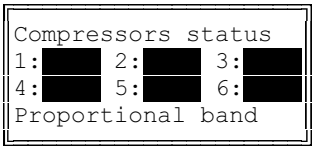
3.5.1. MENU button branch.

m_main_menu



Main screen accessed by pressing the MENU button.
It displays the pressure values read by the two probes; the current date and
time, the type of gas configured, the presence of an alarm signal, the machine status
Pressing the ENTER button changes the type of display (bar, Celsius or Fahrenheit)
The last row shows the status of the machine: ("On", "OFF from alarm", "OFF from
Supervisor", "Ret. ON from Blackout", "OFF from remote input"," OFF from
keypad", "Manual oper.", "Default inst.", "OFF from screen")

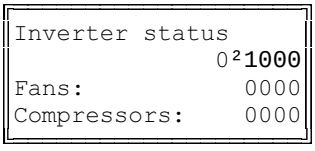
m_main_2



Displays the status of the devices present

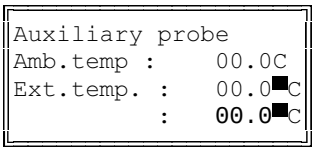
device on
device off
the last row indicates if the unit is the start or stop phase

m_main_3



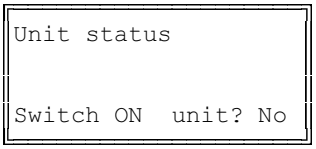
Displays the status of the analogue outputs, if configured

m_main_4



displays the status of the auxiliary probes, if enabled (only medium or large boards)
ambient probe b3
outside temperature probe B6
general probe B7 (can be enabled only if the inlet probe is not connected to B7)

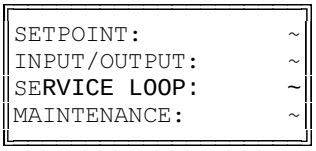
m_main_5



Unit status. On the built-in terminal, this screen can be used to switch the unit on or off.

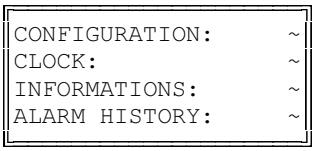
Pressing the MENU button (or PROG on the built-in terminal) from the main screen M_MAIN_MENU accesses the two screens M_MENU_1 and M_MENU_1; move around these screens with the UP and DOWN buttons, until reaching the branch that needs to be accessed, and then press the ENTER button to access the branch highlighted by the cursor.

m_menu_1



Point branch
input-output branch
programming branch
maintenance branch and manual procedures

m_menu_2

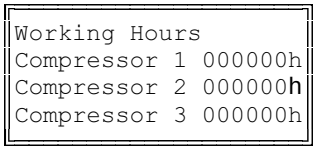


configuration branch
time modification and print branch
branch with information on the version of the software, the bios and the boot

3.5.2. MAINT button, maintenance branch

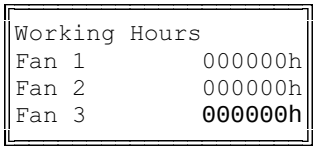
Pressing the MAINT button accesses the following screens, which display the number of operating hours for each compressor and fan configured.
The pCO² counts the operating time of each device, and every three hours saves this value in the flash memory on the board.
If the number of operating hours of a device reaches or exceeds the set maintenance threshold, the corresponding alarm signal is activated.

m_maint01



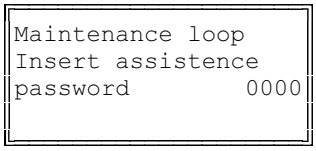
Displays the operating hours of the various devices

m_maint03



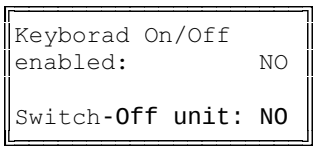
Displays the operating hours of the various devices

m_maint05



Entering the password accesses the following screens

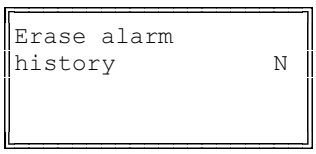
m_on_off_unita



The ON/OFF button can be enabled from the keypad

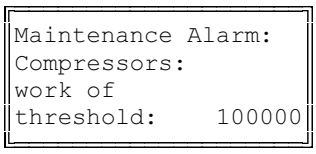
If YES is selected the unit will remain off

m_reset_history



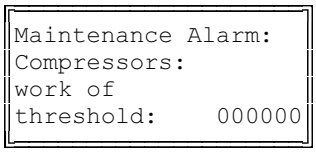
Deletes all the alarms saved in the log

m_maint06



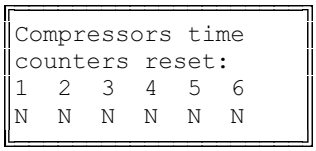
Modifies the value of the maintenance threshold alarm for the compressors and fans, over which an alarm is activated

m_maint07



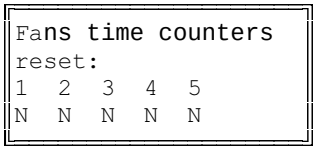
as above

m_maint08



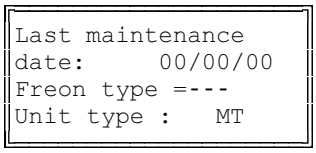
Sets the operating hours of the compressors to zero

m_maint09



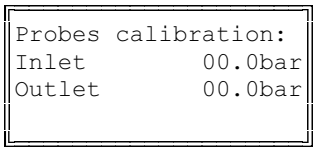
Sets the operating hours of the fans to zero

m_maint10



This screen is reserved for the parameters corresponding to the last maintenance operations performed on the system.
This includes the date, the type of gas used, and the type of system.
All this data can be displayed by pressing the INFO button
Setting these parameters sets all the hour counters for the compressors and fans to zero

m_maint11

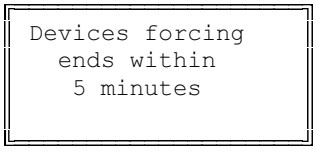


Sets the calibration values for the probes, to be added or subtracted

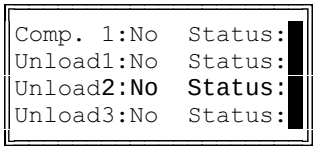
Manual device operation

The following screens include the parameters that allow the manual activation of the individual devices, 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 only be activated if the unit is OFF; therefore the parameters are not enabled if the unit is ON.
The manual procedure is in any case automatically ended after 5 minutes.
The status of the corresponding device is displayed to the right.

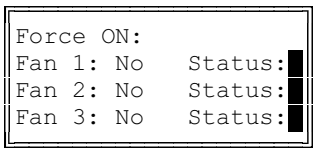
manual_protocol12



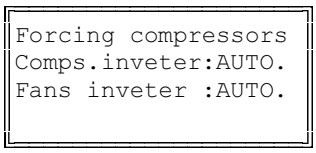
m_maint13



m_maint19

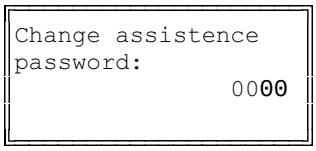


m_maint21



Forces the inverter to 100% (MAN.) or zero (AUTO.)

m_change_pass2



Changes the maintenance password.
The default is 0

3.5.3. PRINTER button branch

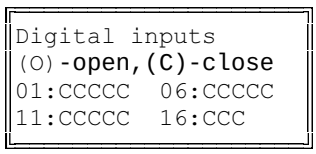
m_print1

Pressing the PRINTER button accesses this screen for managing the serial printer.
The printer is not featured in this version.

3.5.4. I/O button, input/output status branch

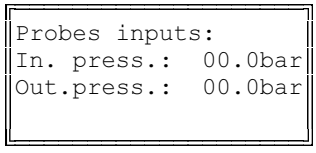
This group of screens displays the complete status of the inputs and outputs connected to the board.
In addition, it provides information on which devices are physically connected to the board.

m_in_out01



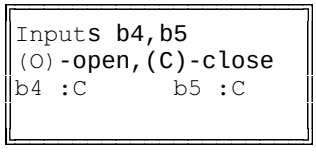
A = Contact open
C = Contact closed

m_in_out02



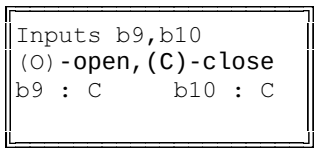
inlet probe status
outlet probe status

m_in_out04



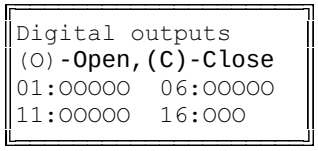
status of analogue inputs used as digital b4,b5

m_in_out05



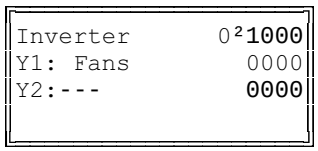
status of analogue inputs used as digital b4,b5 (Large board only)

m_in_out20



Digital outputs

M_in_out25



status of analogue outputs (vary from 0÷1000)

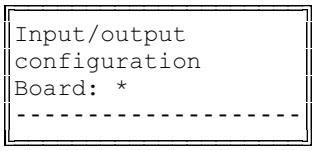
The following screens show where the various devices configured are connected:
Key:

Inputs	
---	no device connected
Therm.fan.	fan thermal overload switch
Press.sw.A/B.C1	individual compressor high-low pressure switch
Oil diff.C1	oil differential compressor
Therm.comp.1	compressor thermal overload switch
Liquid level	
On/Off from input	enable ON from digital input
LP pressure switch	general low pressure switch
HP pressure switch	general high pressure switch

Outputs	
---	no device connected
Comp.1	compressor
Step1 C1	capacity-control
Fan1	Fan
alarm	Alarm relay

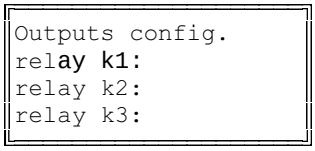
Table 3.5.4.1

m_see_in_out1

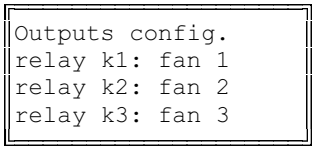


type of board used

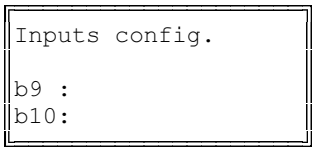
m_see_out1



m_see_in_1



m_see_in_7



3.5.5. Clock branch

m_clock01

```
Change hour/date
Hour   00:00:00
Date   00/00/00
       Dd/Mm/Year
```

Sets the date

m_clock02

```
Daily time zones
with setpoint
variation
enabled:     N
```

Enables the daily time bands

m_clock03

```
1 00:00h  Set = 00.0
2 00:00h  Set = 00.0
3 00:00h  Set = 00.0
4 00:00h  Set = 00.0
```

4 bands are available with the corresponding 4 set points that can be set within the limits configured in the PROG branch

3.5.6. SET button, set point branch

Pressing the SET button accesses the following screen for displaying and setting the Set Point and differential values for the compressors and the fans.

m_see_set_comp

```
Compressors
Proportional Band
Set. 00.0bar  00.0■C
Diff.00.0bar
```

Compressors
Displays if the compressors are working with dead zone or proportional band control
Displays the Set Point and the differential

m_set_comp

```
Compressors
Proportional Band
Change
Setpoint     00.0bar
```

Compressors
Changes the Set Point within the limits set on the screen M_LIMIT_SET PROG branch

m_set_fan

```
Fans
Proportional Band
Change
Set  00.0bar  00.0■C
```

Changes the Set Point within the limits set on the screen M_LIMIT_SET_FAN, PROG branch

m_inv_comp_step

```
Compressors Inveter
Proportional band
Change
Setpoint     00.0bar
```

This screen is only displayed if the compressor inverter is enabled
indicates if the inverter is working with proportional band control
Sets an inverter Set Point in proportional band

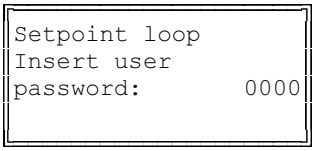
m_set_inv_fan

```
Fans inverter
Proportional band
Change
Setpoint    00.0 bar
```

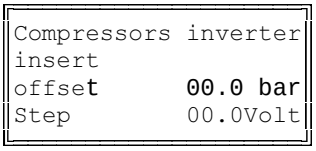
Screen only displayed if the fan inverter is enabled and is working in proportional band.
Indicates if the inverter is working in dead zone or proportional band
Sets an inverter Set Point in proportional band

M_SETPOINT6

Entering the user password accesses the protected branch

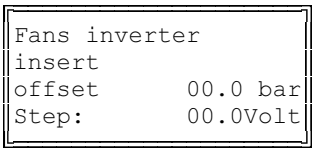


m_set_inv1_zn



This screen is displayed only if the inverter is enabled and is working in the dead zone
Sets a deviation from the compressor Set Point and the increase
per second of the inverter

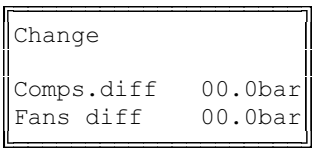
m_setinv2_zn



This screen is displayed only if the inverter is enabled and is working in the dead zone
Sets a deviation from the fan Set Point and the increase
per second of the inverter

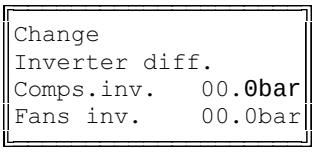
m_diff_device

This screen is used to set the differentials



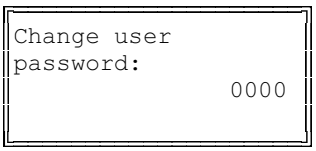
m_diff_inverter

This screen is used to set the inverter differentials if working in the proportional band and if enabled



m_password_set

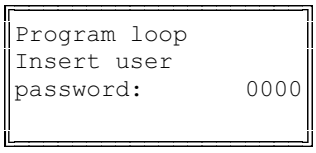
Modifies the user password



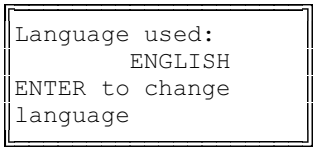
3.5.7. PROG button branch

m_password_prog

Entering the correct password accesses the following setting screens

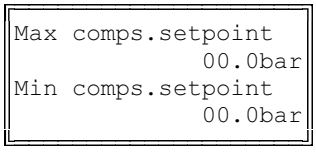


m_language



This screen changes the language used on the screens
in the application (the number of languages available depends on the type of installation performed)

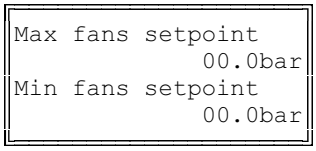
m_prog02



Sets the upper and lower limit for the compressor Set Point

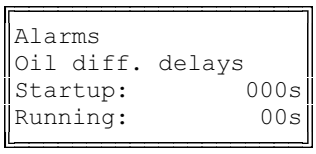
m_prog03

Sets the upper and lower limit for the fan Set Point



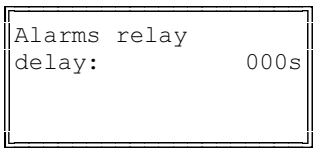
m_prog04

Management of alarm times
for the oil differential digital input, if configured
oil differential alarm delay from the start of the individual device
oil differential alarm delay when individual device is running



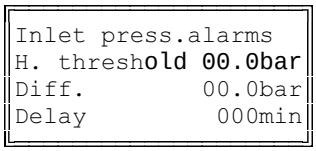
m_prog05

This screen is displayed only if the alarm relay has been configured
Delay in the activation of the alarm relay following an alarm



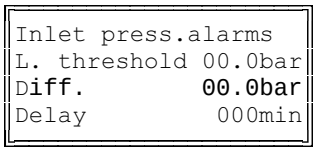
m_prog06

Sets the pre-alarm threshold for high inlet pressure
with corresponding differential and delay



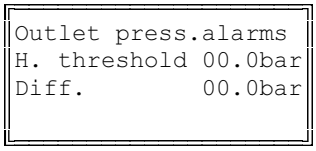
m_prog07

Sets the pre-alarm threshold for low inlet pressure
with corresponding differential and delay



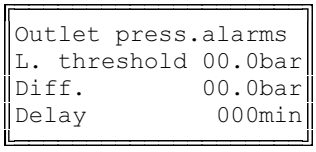
m_prog08

Sets the pre-alarm threshold for high outlet pressure with
corresponding differential



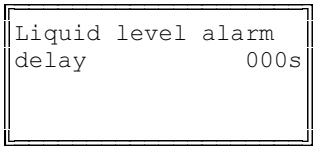
m_prog09

Sets the pre-alarm threshold for low outlet pressure with
corresponding differential and delay



m_prog10

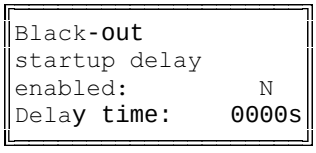
Management of alarm times
delay in the activation of the liquid level alarm, if configured



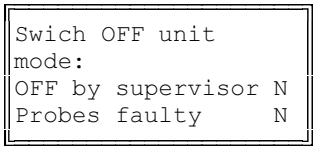
m_prog11

Delay at unit start-up after black-out
Enable delay at start

Used to diversify the restart times for various units, when power returns
after a black-out



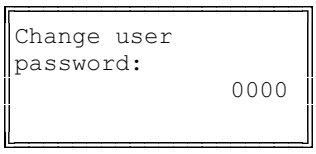
m_prog12



Enable to unit shut-down due to:

- supervisor
- inlet or outlet probe broken

m_change_pass3

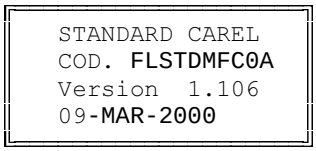


Changes the user password

3.5.8. INFO button branch

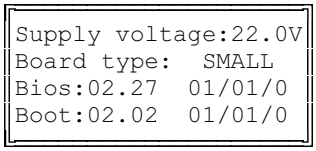
This group of screens is accessed by pressing the INFO button. The screens provide information on the characteristics of the system, the software installed and the date of the most recent maintenance performed.

m_info01



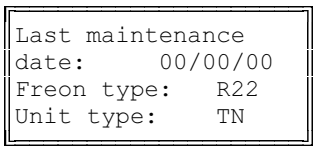
Code, date, version of the application

m_info02



Supply voltage to the pCO² board,
the type of board used
the version and the date of the Bios and Boot

m_info03

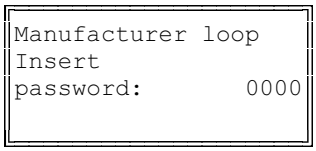


Screen displaying the last maintenance performed
the type of refrigerant used
and the type of system configured

3.5.9. MENU+PROG buttons, unit configuration branch

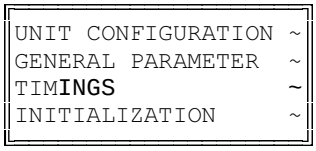
The screens in this branch can be accessed only by personnel who know the manufacturer password

m_manuf01



Entering the correct password accesses the following setting screens
(default 1234)

m_manuf_menu



This is a sub-menu that allows access to the various manufacturer branches

Unit configuration	→	enable devices and define their position on the board
General parameters	→	general parameter settings
Times	→	main time settings for the management of the compressors and fans
Unit initial.	→	default installation, password management, supervisor management

N.B. All the parameters in the manufacturer branch can only be modified with the machine off

Unit configuration

m_conf_dev01

```
Compressor inputs
type selection:  C
 Overload+pressostat
 high/low pressure
```

Configures the number of inputs per compressor and the type:
A: One generic input only (instant manual reset)
B: 2 inputs: 1 for the thermal overload (instant manual reset) plus 1 for the oil differential (delayed with manual reset)
C: 2 inputs: 1 for the thermal overload plus 1 for the high/low pressure switch (instant with settable reset)
D: 3 inputs: 1 for overload, 1 for high/low pressure switch, and 1 for the oil differential

m_conf_dev02

```
Configuration:
Fans    number:    0
Comps.  number:    0
Unloads number:    0
```

Configures the number of fans, compressors and capacity-control steps per compressor:
- number of fans
- number of compressors
- number of capacity-control steps (cannot be configured with the compressor inverter)

The software automatically limits the number of devices that can be configured according to the inputs and outputs available for that type of board

m_conf_dev03

```
Compressor inverter
DISABLED
Fans inverter
DISABLED
```

enables or disables the inverter on the first compressor (cannot be configured if capacity-control steps are present)

enables or disables the fan inverter

m_conf_dev04

```
Alarm relay
enabled:        No
```

Enables the alarm relay. If not configured, an extra output is available

m_conf_dev05

```
Enable inputs
Gen.LP pressostat: N
Gen.HP pressostat: N
```

Enable inputs:
general low pressure switch (automatic reset)
general high pressure switch (manual reset)

m_conf_dev06

```
Enable inputs
On/OFF by dig.in:  N
Liquid livel al.:  N
```

Enable inputs

enable unit on/off from digital input, priority over keypad command
enable liquid level alarm from digital input (display only)

m_conf_probe4

```
Probes enable:
B3 Ambient temp. :N
B6 External temp :N
B7                 N
```

Enable auxiliary probes, display only

enable NTC ambient temperature probe
enable NTC outside temperature probe (medium or large board only)
enable general NTC temperature probe (medium or large board only)

In the following two screens, the type of inlet and outlet probe connected can be configured
Type of analogue probes:

- ⇨ Carel NTC temperature probes, (50 ÷ 100°C; R/T 10KΩ at 25°C),
- ⇨ Voltage: 0 ÷ 1Vdc or 0 ÷ 10Vdc
- ⇨ Current: 0 ÷ 20mA or 4 ÷ 20mA

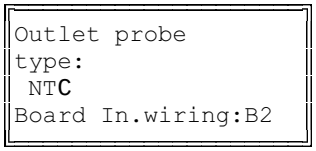
m_conf_probe1

```
Inlet probe
type:
 NTC
Board In.wiring:B1
```

defines the type of inlet probe connected

defines the position of the inlet probe (B1 or B7); for Medium or Large boards only
note: if positioned at b7, the NTC general temperature probe cannot be configured

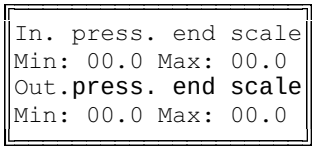
m_conf_probe2



defines the type of outlet probe connected

defines the position of the outlet probe (B2 or B8); for Medium or Large boards only

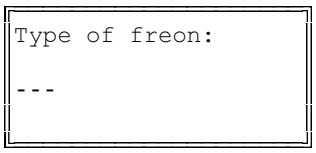
m_conf_probe3



Sets the limits for the inlet probes

Sets the limits for the outlet probes

m_conf_freon



sets the type of freon used
(used to convert from pressure to temperature)
can be configured: none, R22, R134a, NH3, R404a

The position the various digital inputs for the compressors on the board can be configured.
The software automatically limits the inputs that are already occupied
The following inputs can be used:

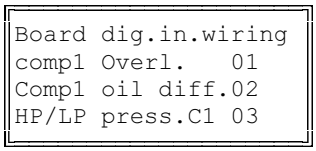
- all the digital inputs
- analogue inputs B4,B5, used as digital
- analogue inputs B9,B10 (Large board only) used as digital

To reverse the position of two inputs, proceed as follows:

1. Position the first device on input --
2. Position the second device on the previous input of the first device
3. Position the first device on the previous input of the second device

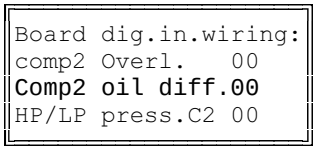
Note: if a device remains configured at position --, it is not considered

m_conf_inout_1



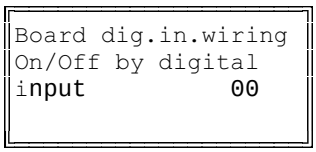
Position of the digital inputs used as safety devices for the compressors

m_conf_inout_2



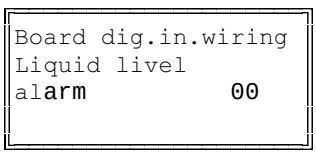
Position of the digital inputs used as safety devices for the fans

m_dig_on_off1



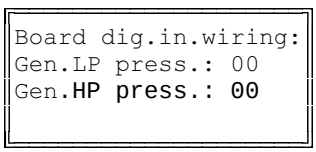
Position on the board of the digital input used as an external ON-OFF
this parameter is only displayed if enabled

m_dig_on_off2



this parameter is only displayed if enabled

m_conf_main_pss



Position on the board of the digital input used as

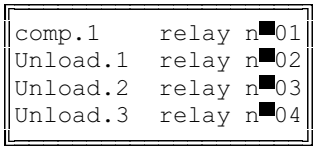
general low pressure switch
general high pressure switch
these parameters are only displayed if enabled

In the following screens, the outputs on the board can be configured for the various devices
To reverse the position of two outputs, proceed as follows:

1. Position the first device on output 00
2. Position the second device on the previous output of the first device
3. Position the first device on the previous output of the second device

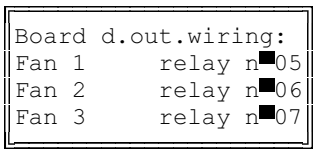
Note: During normal operation, DO NOT leave any device configured in position 00

m_conf_out_1



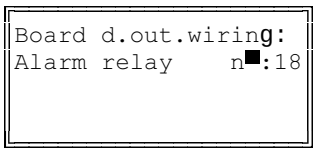
Position on the board of the digital outputs for the first compressor

m_conf_out_7



Position on the board of the digital outputs for the fans

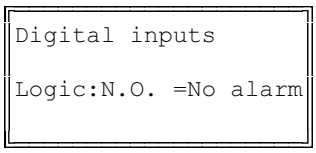
m_conf_out_8



If outputs are available and if the alarm relay has been enabled, its position can be configured

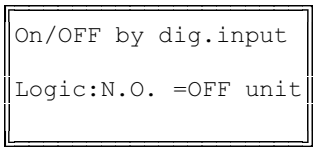
General parameters

m_conf_logic_in



Logic of the digital inputs
Normally open: when there is no alarm the contact is open

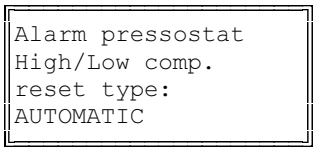
m_logic_onoff



Logic of the remote On/Off from digital input

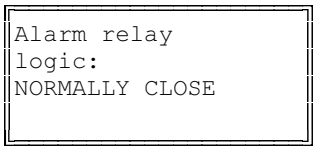
Normally open: unit Off from digital input

m_type_res_hl_p



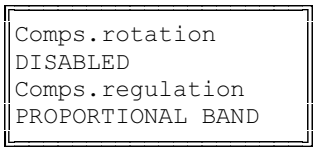
The type of reset for the high/low pressure switch for each compressor can be set
Automatic: when the alarm stops, the compressor starts
this screen is only displayed if the high/low pressure switches are enabled for each compressor

m_manuf210



Logic of the alarm relay
This screen is not visible unless the alarm relay is enabled

m_conf_unit2



Enable FIFO rotation (first on - first off) for the compressors
Type of control used for compressor management: Proportional band or Dead zone

m_conf_unit3

```
Compressors
regulation type:P
Integration time
(only P+I)      000s
```

This screen is displayed only if Proportional band control is set for the compressors
Type of control: (P) Proportional or (P+I) Proportional plus integral.
If P+I is used, the integration time needs to be set

m_conf_unit4

```
Comps.switch ON
mode: CppCppCpp
Comps.switch OFF
mode: ppCppCppC
```

Compressor start mode (see paragraph 3.3)
CppCppCpp= switch on one compressor completely at a time
CCCppppppp= first all the compressors then all the capacity-control steps
Compressor stop mode (see paragraph 3.3)
ppCppCppC= switch off one compressor completely before moving to the following comp.
pppppCCC= switch off all the capacity-control steps, then the compressors;

m_conf_unloader

```
Unloaders
Logic:
 NORMALLY CLOSE
```

configures whether the capacity-control step solenoids are:
normally energised (NORMALLY CLOSED)
normally de-energised (NORMALLY OPEN)

m_conf_inverter

```
Inverter minimum
opening       0²1000
Compressors:     000
Fans:            000
```

Sets the minimum opening threshold for the inverter configured
the screen is displayed only if the inverters are enabled

m_conf_unit5

```
Probe fault alarm
forced compressors
number:           0
```

In the event of a probe b1 (inlet) broken or not connected alarm (AL38),
forces a number of compressors on (controlled in any case by the individual alarms
and by the general pressure switches)

m_conf_unit6

```
Fans rotation
DISABLED
Fans regolation
PROPORTIONAL BAND
```

Enable FIFO rotation (first on - first off)
for the fans
Type of control used for fan management:
Proportional band or Dead zone

m_conf_unit7

```
Probe fault alarm
forced fans
number:           0
```

In the event of a probe b2 (outlet) broken or not connected alarm (AL38),
forces a number of fans on (controlled in any case by the individual alarms
and by the general pressure switches)

m_conf_unit8

```
Operating range
Inverter (Hertz)
Min: 00.0 Max: 00.0
```

Time settings

m_comp_timing01

```
Comps.switching on
delay time      000s
Comps.switching off
delay time      000s
```

These parameters are displayed only if dead zone control is set for the compressors

Time between compressor start requests
Time between compressor stop requests

m_comp_timing02

```
Minimum compressors
power-on time  0000s
Minimum compressors
power-off time 0000s
```

Minimum ON time for same compressor
Minimum OFF time for same compressor
Also see paragraph 3.3.1

m_comp_timing03

```
Compressors
Min time between
different start
               0000s
```

Minimum time between two start requests for different compressors
avoids simultaneous starts

m_comp_timing04

```
Compressor
Min. time between
same start:     000s
```

Minimum time between two effective starts of same compressor

m_comp_timing05

```
Unloaders
Switching On
delay time:
               000s
```

This parameter is displayed only if the capacity-control steps are configured
Delay between the request and the effective activation of the capacity-control steps

m_time_fan_1

```
Fans switching ON
delay time      000s
Fans switching OFF
delay time      000s
```

Minimum time between two starts of the same fan

Minimum time between two stops of the same fans

m_time_fan_2

```
Fans
Min. time between
different start:
               000s
```

Minimum time between two start requests for different fans
Avoids simultaneous starti

Initialisation

m_conf_superv1

```
Supervisor system:
Identification N:000
Com.Speed: 1200 baud
Protocol type:CAREL
```

Supervisor configuration
Enters the identification number of the pCO² board for the supervisor serial network

communication speed with the supervisor system
type of conversion protocol

m_manuf420

```
Change passwords
Manufacturer    0000
Assistence      0000
User            0000
```

changes the password for access to the various branches

m_manuf425

```
Default values
initialization:   N

 - PLEASE WAIT -
```

Deletes the entire permanent memory and resets the default values
(N.B. This operation should be performed when the machine is off)

3.5.10. ALARM button branch

If there are no active alarms or alarms in the memory

- the buzzer is off
- alarm relay is in rest status
- the red LED is off

pressing the ALARM button will display the following screen:

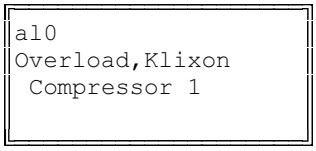
no_alarm

If there is at least one active alarm

- the buzzer is on
- the alarm relay has changed status
- the red LED is on

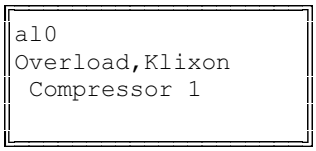
pressing the ALARM button and the using the UP and DOWN buttons will display all of the alarms present in the memory. To reset or delete an alarm from the memory, press the ALARM button again (also see paragraph 3.3.2)

al0



displays if the generic safety device from the digital input corresponding to that compressor has been activated
stops the corresponding compressor
manual reset

al0

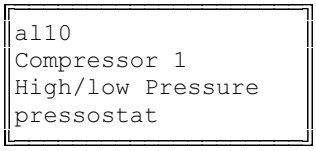


displays if the thermal overload corresponding to that compressor has been activated
stops the corresponding compressor
manual reset

al6

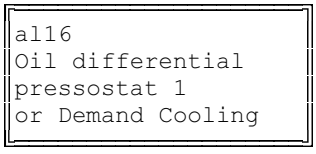
displays if the thermal overload corresponding to that fan has been activated
switches off the corresponding fan
manual reset

al10



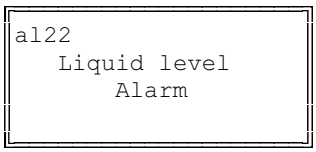
displays if the high/low pressure switch corresponding to that compressor has been activated
stops the corresponding compressor
automatic reset

al16



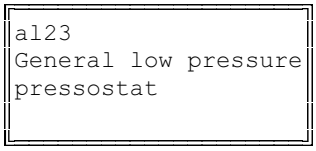
Displayed if the input configured as the oil differential changes status for a set time (screen M_ALARM1, PROG branch)
stops the corresponding compressor
manual reset

al22



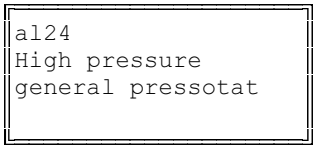
Displayed if the input configured as the liquid level changes status for a set time (screen M_ALARM1. PROG branch)
Display only
manual reset

al23



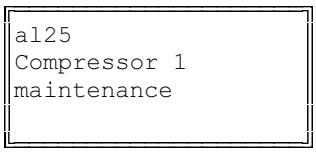
Displayed only if the general low pressure switch is activated.
All compressors will be stopped.
Alarm with automatic reset

al24



Displayed only if the general high pressure switch is activated. All compressors will be stopped.
Alarm with manual reset

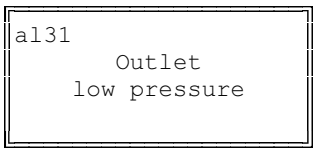
al25



Displayed only if the operating hours of compressor no. 1 exceed the limit

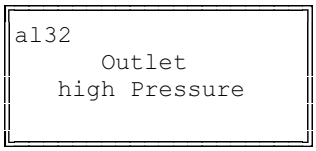
Call service
Display only

al31



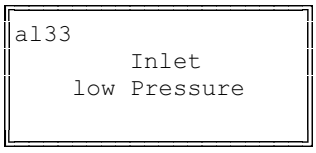
Low outlet pressure pre-alarm
Displayed if the low outlet pressure limit is exceeded
Goes off after a pre-set time (see screen M_ALARM6, PROG branch)
Stops all the fans
Automatic reset

al32



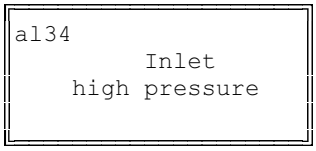
High outlet pressure pre-alarm
Displayed if the high outlet pressure limit is exceeded (screen M_ALARM5, PROG branch)
Starts all the fans
Automatic reset

al33



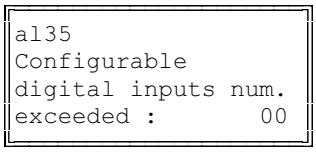
Low inlet pressure pre-alarm
Displayed if the low inlet pressure limit is exceeded
Goes off after a pre-set time (see screen M_ALARM4, PROG branch)
Stops all the compressors
Automatic reset

al34



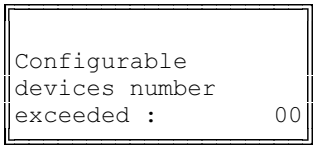
High inlet pressure pre-alarm
Displayed if the high inlet pressure limit is exceeded
Goes off after a pre-set time (see screen M_ALARM3, PROG branch)
Starts all the compressors
Automatic reset

al35



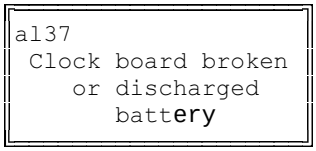
indicates that there is an error in the configuration of the inputs on the board
display only
automatic reset
call service

al36



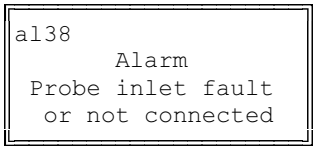
indicates that there is an error in the configuration of the outputs on the board
display only
automatic reset
call service

clock



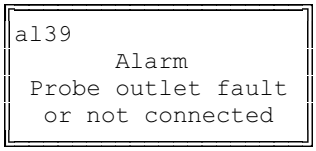
Clock board fault or flat battery
this alarm inhibits the time bands

broke_probe1



Warns that the values measured by the inlet probe are not possible
Check the connection and the probe itself
Inhibits compressor control
Some compressors can be forced on when this alarm is activated

broke_probe2



Warns that the values measured by the outlet probe are not possible
Check the connection and the probe itself
Inhibits fan control
Some fans can be forced on when this alarm is activated

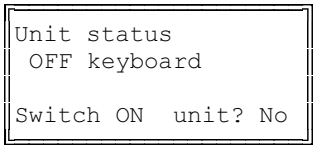
3.5.11. ON/OFF button branch

There are various ways to control the switching on/off of the unit (see paragraph Machine On/Off).
One of the ways is using the On-Off button on the external keypad:

- Unit off (OFF from keypad) pressing the ON/OFF button starts the machine (LED under ON-OFF button lights up).
- Unit on, pressing the ON/OFF button turns the machine off, forcing the outputs to zero; the LED under the button goes off.

When using the built-in terminal, go to the main screen and press the UP button. The following screen will appear:

m_main_5

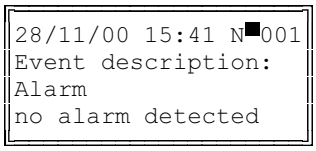


This screen can be used to switch the unit on or off (also see the paragraph Machine On/Off)

3.5.12. Log branch

To access this branch, go to the main screen, press the Menu button and then scroll the rows until the “ALARM LOG →” row is selected, then press the ENTER button; the following screen will appear:

m_al_history1



The first screen displayed is the most recent alarm activated. Pressing the UP button scrolls the log in reverse order of time.
All the alarms are saved together with the date. The data from when the unit was restarted and when the user attempted to reset the alarms by pressing the ALARM button can also be saved.

4. PCO2 INSTRUMENT AND ACCESSORY CODES

Terminal for flush plastic box for built-in mounting

Code	Description
PCOI00PGL0	Large backlit graphic display
PCOI000CBB	LCD backlit display, 4x20
PCOI000CB0	LCD display, 4x20

Terminal for plastic box for built-in / wall mounting

Code	Description
PCOT00PGH0	Small backlit graphic display, 64x128 pixels
PCOT000CB0	LCD display 4x20
PCOT00SCB0	LCD display 4x20, for connection to serial printer
PCOT000CBB	LCD backlit display, 4x20
PCOT000L60	LED display, 6 digits

Terminal for IR32 plastic box 32x74 for built-in mounting

Code	Description
PCOT32RN00	LED display, 3 digits

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

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

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

Options

Code	Description
PCOUMID000	Control card for CAREL OEM humidifiers
PC200MEM0	Flash memory expansion board for pCO2
PCO200KEY0	Programming key board for pCO2
PCO2004850	Optically-isolated RS485 serial connection board for pCO2
PCO200MDM0	Non optically-isolated RS232 serial connection board for modem pCO2
PCO20LFTT0	Serial interface LON FTT10 (*)
PCO20L4850	Serial interface LON RS485 (*)
PC485KIT00	Serial Converter RS485 - RS232 including serial cable for connection to PC
PCO20DCDC0	Converter DC/DC 48Vdc / 24Vdc o 48Vdc / 30Vdc
0907858AXX	Ferrites toroid

(*) To let the board be operative, it must be programmed by the End-user depending on the software that has been installed.

Driver for electronic expansion valve

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

Carel network RS485 (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 module for RS485 optoinsulated 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

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.

5. PARAMETER DEFINITION TABLE.

Below is a list of the codes used in the figures in this manual.

NO.	Code	Meaning
1	SP	Set Point
2	RP	Read parameter
3	DF	Differential
4	DZN	Dead zone differential
5	DFNI_CP	Dead zone differential, Compressor inverter
6	DFNI_F	Dead zone differential, Fan inverter
7	BL	Proportional band
8	BLI_CP	Proportional band, Compressor inverter
9	BLI_F	Proportional band, Fan inverter
10	T_ON_CP	Minimum compressor ON time
11	T_ON_CP	Minimum compressor OFF time

6. PARAMETER TABLES

6.1. Default value

The following table provides a complete list of the values set as default (parameters set by automatic installation),
In addition, a column is available for the users to write their own settings.

Variable	Description	default	limits	unit
SET_COMP	compressor set point	1.0	can be set	bar
DIFF_COMP	compressor differential	5	0 / 2.0	bar
MIN_SET_COMP	minimum compressor set point limit	2.5	-9.9/99.9	bar
MAX_SET_COMP	maximum compressor set point limit	0.1	-9.9/99.9	bar
SET_FAN	fan set point	15.5	can be set	bar
DIFF_FAN	fan differential	2.0	0/ 20.0	bar
MIN_SET_FAN	minimum fan set point limit	1.0	-9.9/99.9	bar
MAX_SET_FAN	maximum fan set point limit	25.0	-9.9/99.9	bar
SET_VENT_INV	fan inverter set point	15.5	10 / 25	bar
DIFF_VENT_INV	fan inverter differential	1.5	0.2 / 2	bar
SG_ORE_COMP	Compressor operating hour threshold	1000	0 / 99999	hours
THRESH_HIGH1	High inlet threshold	5	0.1 / 6	bar
DIFF_HIGH1	High inlet differential	0.5	0.1 / 2	bar
THRESH_HIGH2	High outlet threshold	18.5	15 / 30	bar
DIFF_HIGH2	High outlet differential	1	0.2 / 4	bar
THRESH_LOW1	Low inlet threshold	1	-0.5 / 5	bar
DIFF_LOW1	Low inlet differential	0.5	0.1 / 1	bar
THRESH_LOW2	Low outlet threshold	10.0	5 / 30	bar
DIFF_LOW2	Oil differential alarm delay	120	0 / 360	s
RIT_ALLARMI	Alarm relay delay	0	0 / 999	s
RIT_DIF_OLIO	Liquid level alarm delay at start	90	0 / 360	s
RUN_DELAY_OILD	Liquid level alarm delay when running	10	0 / 360	s
TIME_SWITH_ON1	Compressor start request delay	20	10 / 360	s
TIME_SWITH_OFF1	Compressor stop request delay	10	10 / 360	s
TIME_MIN_ON	Minimum compressor ON time	60	10 / 360	s
TIME_MIN_OFF	Minimum compressor OFF time	120	10 / 360	s
TIME_BETW_COMP	Time between two starts of different compressors	20	0/9999	s
TIME_SAME_COMP	Time between two starts of the same comp	360	240 / 600	s
UNLOAD_DELAY	Capacity-control step delay time	20	0 / 999	s
TIME_SWITH_ON2	Time between fan starts (ZN)	2	0 / 999	s
TIME_SWITH_OFF2	Time between fan stops (ZN)	2	0 / 999	s
TIME_BETW_FAN	Time between two starts of different fans	5	0 / 999	s
N_COMP	Number of compressors	4 SMALL board 4 MEDIUM board 5 LARGE board	1 / 6	
TYPE_INPUT_X_COMP	Type of inputs per compressor	1 SMALL board 2 MEDIUM board 3 LARGE board	1 / 3	
ABIL_ROTAZ_COMP	FIFO rotation compressors	Yes	Yes / No	
EN_ROT_FAN	FIFO rotation fans	Yes	Yes / No	
N_VENT	Number of fans	4 fan.		
EN_INV_COMP	Compressor inverter	No	Yes / No	
EN_INV_FAN	Fan inverter	Yes	Yes / No	
EN_KEYB_ON_OFF	Enable off from keypad	No	Yes / No	
STOP_SONDE	Off from probe fault	No	Yes / No	
EN_OFF_SUPERVISOR	Enable on/off from supervisor	No	Yes / No	
input_logic INPUT_LOGIC	Input logic	N.C.	N.O. N.C.	
UNLOAD_LOGIC	Capacity-control step logic	N.C.	N.C. / N.O.	
TYPE UNIT	Type of system	TN	LT / NT	
TYPE_FREON	Type of freon	R22	---, R22, R134a, R404a, NH3, R12	
BAUD_RATE	Communication baud rate	19200	19200	bps
IDENT	Identification number for supervisor	1	0 / 200	
NEW_PASS_UTENTE	User password	0000	0 / 9999	
NEW_PASS_MANU	Service password	0000	0 / 9999	
NEW_PASS_COST	Manufacturer password	1234	0 / 9999	
FSC_MIN_MAND	Minimum outlet	-1		bar
FSC_MAX_MAND	Maximum outlet	19		bar
FSC_MIN_ASP	Minimum inlet	-1		bar
FSC_MAX_ASP	Maximum inlet	19	-2	bar

Table 6.1.1

6.2. Variables for communication with the supervisor

The pCO² can be connected to a local or remote supervisory/telemaintenance system for controlling the unit.
The accessories for the pCO² board include an optional serial communication board using an RS485 interface.
In this version of the software, the baud rate can be set to: 1200, 2400, 4800, 9600 or 19200 bps.
The variables sent and received by the supervisor are shown in the tables **Tab. 6.2.1.1** – **Tab. 6.2.2.1** – **Tab. 6.2.3.1**, with reference to the following key:

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

6.2.1. Analogue variables

flow	type	Index	variable name	Description
OUT	A	1	SUCT_PRESS	Value of analogue input B1
OUT	A	2	DISCH_PRESS	Value of analogue input B2
OUT	A	3	OUT_INV_FAN	Value of analogue output 1
OUT	A	4	INVERTER_COMP1	Value of analogue output 2
OUT	A	5	SET_COMP	compressor Set Point
OUT	A	6	DIFF_COMP	compressor differential
OUT	A	7	SET_FAN	fan Set Point
OUT	A	8	DIFF_FAN	fan differential
OUT	A	9	VOLTAGE_IN	power supply voltage to the pCO² board
IN/OUT	A	10	MAX_SET_COMP	maximum compressor Set Point
IN/OUT	A	11	MIN_SET_COMP	minimum compressor Set Point
IN/OUT	A	12	MAX_SET_FAN	maximum fan Set Point
IN/OUT	A	13	MIN_SET_FAN	minimum fan Set Point
IN/OUT	A	14	THRESH_HIGH1	High inlet alarm Set Point
IN/OUT	A	15	DIFF_HIGH1	High inlet alarm differential
IN/OUT	A	16	THRESH_LOW1	Low inlet alarm Set Point
IN/OUT	A	17	DIFF_LOW1	Low inlet alarm differential
IN/OUT	A	18	THRESH_HIGH2	High outlet alarm Set Point
IN/OUT	A	19	DIFF_HIGH2	High outlet alarm differential
IN/OUT	A	20	THRESH_LOW2	Low outlet alarm Set Point
IN/OUT	A	21	DIFF_LOW2	Low outlet alarm differential
IN/OUT	A	22	INS_COMP	compressor on point
IN/OUT	A	23	DIS_COMP	compressor off point
IN/OUT	A	24	STEP_INVDAV1	compressor inverter step
IN/OUT	A	25	MIN_FREQUENZA	minimum frequency
IN/OUT	A	26	MAX_FREQUENZA	maximum frequency
IN/OUT	A	27	SET_VENT_INV	fan inverter Set Point
IN/OUT	A	28	DIFF_VENT_INV	fan inverter differential
IN/OUT	A	29	FREQUENZA	Frequency
IN/OUT	A	30	TAR_ASP	Calibration, probe 1
IN/OUT	A	31	TAR_MAND	Calibration, probe 2
IN/OUT	A	32	SET_INV_COMP	Compressor inverter Set Point (proportional band)
IN/OUT	A	33	DIFF_INV_COMP	Inverter differential (proportional band)

Table 6.2.1.1

6.2.2. Digital variables

flow	type	Index	variable name	Description
OUT	D	1	SCHEDA_MODEM	Presence of modem board
OUT	D	2	PRESENT_EXPANSION	Presence of expansion board
OUT	D	3	FAN1	Status of fan 1
OUT	D	4	FAN2	Status of fan 2
OUT	D	5	FAN3	Status of fan 3
OUT	D	6	FAN4	Status of fan 4
OUT	D	7	COMP1	Status of compressor 1
OUT	D	8	RICH_PARZ11	Status of capacity-control 1 compressor 1
OUT	D	9	RICH_PARZ21	Status of capacity-control 2 compressor 1
OUT	D	10	COMP2	Status of compressor 2
OUT	D	11	RICH_PARZ12	Status of capacity-control 1 compressor 2
OUT	D	12	RICH_PARZ22	Status of capacity-control 2 compressor 2
OUT	D	13	COMP3	Status of compressor 3

OUT	D	14	RICH_PARZ13	Status of capacity-control 1 compressor 3
OUT	D	15	RICH_PARZ23	Status of capacity-control 2 compressor 3
OUT	D	16	COMP4	Status of compressor 4
OUT	D	17	RICH_PARZ14	Status of capacity-control 1 compressor 4
OUT	D	18	RICH_PARZ24	Status of capacity-control 2 compressor 4
OUT	D	19	COMP5	Status of compressor 5
OUT	D	20	RICH_PARZ15	Status of capacity-control 1 compressor 5
OUT	D	21	RICH_PARZ25	Status of capacity-control 2 compressor 5
OUT	D	22	COMP6	Status of compressor 6
OUT	D	23	RICH_PARZ16	Status of capacity-control 1 compressor 6
OUT	D	24	RICH_PARZ26	Status of capacity-control 2 compressor 6
OUT	D	25	DIN1	Status of digital input 1
OUT	D	26	DIN2	Status of digital input 2
OUT	D	27	DIN3	Status of digital input 3
OUT	D	28	DIN4	Status of digital input 4
OUT	D	29	DIN5	Status of digital input 5
OUT	D	30	DIN6	Status of digital input 6
OUT	D	31	DIN7	Status of digital input 7
OUT	D	32	DIN8	Status of digital input 8
OUT	D	33	DIN9	Status of digital input 9
OUT	D	34	DIN10	Status of digital input 10
OUT	D	35	DIN11	Status of digital input 11
OUT	D	36	DIN12	Status of digital input 12
OUT	D	37	DIN13	Status of digital input 13
OUT	D	38	DIN14	Status of digital input 14
OUT	D	39	DIN15	Status of digital input 15
OUT	D	40	DIN16	Status of digital input 16
OUT	D	41	DIN17	Status of digital input 17
OUT	D	42	DIN18	Status of digital input 18
OUT	D	43	ALL_PRES_LPRES	Low pressure switch alarm
OUT	D	44	ALL_PRES_HPRES	High pressure switch alarm
OUT	D	45	DIN101	Status of digital input expansion no.1
OUT	D	46	DIN102	Status of digital input expansion no.2
OUT	D	47	DIN103	Status of digital input expansion no.3
OUT	D	48	DIN104	Status of digital input expansion no.4
OUT	D	49	DIN105	Status of digital input expansion no.5
OUT	D	50	DIN106	Status of digital input expansion no.6
OUT	D	51	DIN107	Status of digital input expansion no.7
OUT	D	52	DIN108	Status of digital input expansion no.8
OUT	D	53	MALL_TERM_KLIX1	Thermal overload alarm compressor 1
OUT	D	54	MALL_TERM_KLIX2	Thermal overload alarm compressor 2
OUT	D	55	MALL_TERM_KLIX3	Thermal overload alarm compressor 3
OUT	D	56	MALL_TERM_KLIX4	Thermal overload alarm compressor 4
OUT	D	57	MALL_TERM_KLIX5	Thermal overload alarm compressor 5
OUT	D	58	MALL_TERM_KLIX6	Thermal overload alarm compressor 6
OUT	D	59	MALL_PRES_H1	High/low pressure switch alarm compressor 1
OUT	D	60	MALL_PRES_H2	High/low pressure switch alarm compressor 2
OUT	D	61	MALL_PRES_H3	High/low pressure switch alarm compressor 3
OUT	D	62	MALL_PRES_H4	High/low pressure switch alarm compressor 4
OUT	D	63	MALL_PRES_H5	High/low pressure switch alarm compressor 5
OUT	D	64	MALL_PRES_H6	High/low pressure switch alarm compressor 6
OUT	D	65	MALL_DIF_OLIO1	Oil differential alarm compressor 1
OUT	D	66	MALL_DIF_OLIO2	Oil differential alarm compressor 2
OUT	D	67	MALL_DIF_OLIO3	Oil differential alarm compressor 3
OUT	D	68	MALL_DIF_OLIO4	Oil differential alarm compressor 4
OUT	D	69	MALL_DIF_OLIO5	Oil differential alarm compressor 5
OUT	D	70	MALL_DIF_OLIO6	Oil differential alarm compressor 6
OUT	D	71	MALL_ORE_COMP1	Maintenance hours threshold exceeded alarm, compressor 1
OUT	D	72	MALL_ORE_COMP2	Maintenance hours threshold exceeded alarm, compressor 2
OUT	D	73	MALL_ORE_COMP3	Maintenance hours threshold exceeded alarm, compressor 3
OUT	D	74	MALL_ORE_COMP4	Maintenance hours threshold exceeded alarm, compressor 4
OUT	D	75	MALL_ORE_COMP5	Maintenance hours threshold exceeded alarm, compressor 5
OUT	D	76	MALL_ORE_COMP6	Maintenance hours threshold exceeded alarm, compressor 6
OUT	D	77	MALL_TERM_VENT1	Thermal overload alarm fan 1
OUT	D	78	MALL_TERM_VENT2	Thermal overload alarm fan 2
OUT	D	79	MALL_TERM_VENT3	Thermal overload alarm fan 3
OUT	D	80	MALL_TERM_VENT4	Thermal overload alarm fan 4

OUT	D	81	mAL_LIQUID_LEVEL	Liquid level alarm
OUT	D	82	MALL_PRES_LPRES	General low pressure switch alarm
OUT	D	83	MALL_PRES_HPRES	General high pressure switch alarm
OUT	D	84	mAL_LOW2	Low pressure outlet probe alarm
OUT	D	85	MALL_ALTA_MAND	High pressure outlet probe alarm
OUT	D	86	mAL_LOW_PRESS	Low pressure inlet probe alarm
OUT	D	87	mAL_HIGH_PRESS	High pressure inlet probe alarm
OUT	D	88	mAL_N_INPUT	Exceeded number of inputs available alarm
OUT	D	89	mAL_N_DEVICES	Exceeded number of devices available alarm
OUT	D	90	MALL_ORA	Clock fault or flat battery alarm
OUT	D	91	mAL_BROKEN_PR1	Inlet probe faulty or disconnected alarm
OUT	D	92	mAL_BROKEN_PR2	Outlet probe faulty or disconnected alarm
OUT	D	93	GLB_AL	General alarm signal
IN/OUT	D	94	RES_SIR	silence buzzer
IN/OUT	D	95	RES_AL	reset alarm relay
IN/OUT	D	96	CH_HOUR	Hour setting
IN/OUT	D	97	CH_MINUTE	Minute setting
IN/OUT	D	98	CH_DAY	Day setting
IN/OUT	D	99	CH_MONTH	Month setting
IN/OUT	D	100	CH_YEAR	Year setting
OUT	D	101	SYSON	Unit status
IN/OUT	D	102	INPUT_LOGIC	Input logic
IN/OUT	D	103	ALARM_LOGIC	Alarm relay logic
IN/OUT	D	104	EN_INV_COMP	Enable compressor inverter
IN/OUT	D	105	EN_INV_FAN	Enable fan inverter
IN/OUT	D	106	EN_DIG_ON_OFF	Enable ON/OFF from digital input
IN/OUT	D	108	RICH_DEFAULT	Set default value
IN/OUT	D	110	UNLOAD_LOGIC	Capacity-control logic
IN/OUT	D	111	SUPERV_ONOFF	Select ON/OFF from supervisor
IN/OUT	D	112	EN_SUPERV_ONOFF	Enable ON/OFF from supervisor
IN/OUT	D	113	EN_AL_LIQUID_LEVEL	Enable liquid level alarm
OUT	D	114	FAN5	Status of fan 5
OUT	D	115	MALL_TERM_VENT5	Thermal overload alarm fan 5
IN/OUT	D	116	EN_KEYB_ON_OFF	Enable On-Off from the keypad
IN/OUT	D	117	EN_ALARM_RELE	Enable alarm relay
IN/OUT	D	118	EN_ON_BALCK_OUT	Enable delay at restart after Black-Out
OUT	D	119	DOUT1	Status of digital output 1
OUT	D	120	DOUT2	Status of digital output 2
OUT	D	121	DOUT3	Status of digital output 3
OUT	D	122	DOUT4	Status of digital output 4
OUT	D	123	DOUT5	Status of digital output 5
OUT	D	124	DOUT6	Status of digital output 6
OUT	D	125	DOUT7	Status of digital output 7
OUT	D	126	DOUT8	Status of digital output 8
OUT	D	127	DOUT9	Status of digital output 9
OUT	D	128	DOUT10	Status of digital output 10
OUT	D	129	DOUT11	Status of digital output 11
OUT	D	130	DOUT12	Status of digital output 12
OUT	D	131	DOUT13	Status of digital output 13
OUT	D	132	DOUT14	Status of digital output 14
OUT	D	133	DOUT15	Status of digital output 15
OUT	D	134	DOUT16	Status of digital output 16
OUT	D	135	DOUT17	Status of digital output 17
OUT	D	136	DOUT18	Status of digital output 18

Table 6.2.2.1

6.2.3. Integer variables

Flow	Type	Index	Variable name	Description
OUT	I	10	IDENT	identification number
IN/OUT	I	11	LDAY	Day setting value
IN/OUT	I	12	LHOUR	Hour setting value
IN/OUT	I	13	LMINUTE	Minute setting value
IN/OUT	I	14	LMONTH	Month setting value
IN/OUT	I	15	LYEAR	Year setting value
OUT	I	16	HOUR	current hour
OUT	I	17	MINUTE	current minute
OUT	I	18	MONTH	current month

OUT	I	19	PYEAR	current year
OUT	I	20	DAY	current day
IN/OUT	I	21	RUN_DELAY_OILD	Oil differential alarm delay when running
IN/OUT	I	22	N_INPUT_FOR_COMP	number of inputs per compressor
IN/OUT	I	23	N_COMP	Number of compressors
IN/OUT	I	24	N_FAN	Number of fans
IN/OUT	I	25	N_UNLOAD	Number of capacity-control steps
OUT	I	26	OUT_INV_FAN	Status of analogue output 1
OUT	I	27	OUT_INV_COMP	Status of analogue output 2
OUT	I	28	BOARD_TYPE	type of board connected
OUT	I	29	UNIT_STATUS	Unit status ("On", "OFF from alarm", "OFF from supervisor", "Restart after Blackout", "OFF from remote input", "OFF from keypad", "Manual op.", "Default installation", "OFF from screen")
OUT	I	30	TYPE_B1	type of probe b1 connected
OUT	I	31	TYPE_B2	type of probe b2 connected
OUT	I	32	BIOS_RELEASE	version of bios used
OUT	I	33	BIOS_DATE	date of bios used
OUT	I	34	BOOT_RELEASE	version of boot used
OUT	I	35	BOOT_DATE	date of boot used
IN/OUT	I	36	INTEGR_TIME1	integration time
IN/OUT	I	37	TIME_SWITCH_ON1	Delay in calling compressor starts (dead zone)
IN/OUT	I	38	TIME_SWITCH_OFF1	Delay in calling compressor stops (dead zone)
IN/OUT	I	39	TIME_MIN_ON	Minimum compressor ON time
IN/OUT	I	40	TIME_MIN_OFF	Minimum compressor OFF time
IN/OUT	I	41	TIME_BETW_COMP	Delay time between starts of different compressors
IN/OUT	I	42	TIME_SAME_COMP	Delay time between starts of same compressor
IN/OUT	I	43	UNLOAD_DELAY	Delay in capacity-control steps
IN/OUT	I	44	TIME_SWITCH_ON2	Delay in calling fan starts (dead zone)
IN/OUT	I	45	TIME_SWITCH_OFF2	Delay in calling fan stops (dead zone)
IN/OUT	I	46	TIME_BETW_FAN	Delay time between starts of different fans
IN/OUT	I	47	RIT_DIF_OLIO	Delay in oil differential alarm at start
IN/OUT	I	48	RIT_ALL_LIQ	Delay in liquid level alarm
IN/OUT	I	49	MIN_OPEN_INV	Minimum compressor inverter opening
IN/OUT	I	50	MIN_OPEN_INV2	Minimum fan inverter opening
IN/OUT	I	51	MIN_N_COMP_AL	number of compressors forced with probe B1 faulty or disconnected
IN/OUT	I	52	MIN_N_FAN_AL	number of fans forced with probe B2 faulty or disconnected
IN/OUT	I	53	SG_ORE_COMP	Compressor operating hour threshold (by 1000)
OUT	I	54	HOUR_COMP1	High part, operating hours compressor 1
OUT	I	55	HOUR_L_COMP1	Low part, operating hours compressor 1
OUT	I	56	HOUR_COMP2	High part, operating hours compressor 2
OUT	I	57	HOUR_L_COMP2	Low part, operating hours compressor 2
OUT	I	58	HOUR_COMP3	High part, operating hours compressor 3
OUT	I	59	HOUR_L_COMP3	Low part, operating hours compressor 3
OUT	I	60	HOUR_COMP4	High part, operating hours compressor 4
OUT	I	61	HOUR_L_COMP4	Low part, operating hours compressor 4
OUT	I	62	HOUR_COMP5	High part, operating hours compressor 5
OUT	I	63	HOUR_L_COMP5	Low part, operating hours compressor 5
OUT	I	64	HOUR_COMP6	High part, operating hours compressor 6
OUT	I	65	HOUR_L_COMP6	Low part, operating hours compressor 6
OUT	I	66	H_HOUR_FAN1	High part, operating hours fan 1
OUT	I	67	L_HOUR_FAN1	Low part, operating hours fan 1
OUT	I	68	H_HOUR_FAN2	High part, operating hours fan 2
OUT	I	69	L_HOUR_FAN2	Low part, operating hours fan 2
OUT	I	70	H_HOUR_FAN3	High part, operating hours fan 3
OUT	I	71	L_HOUR_FAN3	Low part, operating hours fan 3
OUT	I	72	H_HOUR_FAN4	High part, operating hours fan 4
OUT	I	73	L_HOUR_FAN4	Low part, operating hours fan 4
IN/OUT	I	74	SG_ORE_FAN	Fan maintenance threshold alarm (by 1000)
OUT	I	75	VERSION	version application
OUT	I	76	H_HOUR_FAN5	High part, operating hours fan 5
OUT	I	77	L_HOUR_FAN5	Low part, operating hours fan 5
OUT	I	78	TIME_ON_BLACK_OUT	Minimum off time after restart from black-out
OUT	I	79	CONFIG_IN1	Type of device connected to input 1
OUT	I	80	CONFIG_IN2	Type of device connected to input 2
OUT	I	80	CONFIG_IN2	Type of device connected to input 2
OUT	I	81	CONFIG_IN3	Type of device connected to input 3
OUT	I	82	CONFIG_IN4	Type of device connected to input 4

OUT	I	83	CONFIG_IN5	Type of device connected to input 5
OUT	I	84	CONFIG_IN6	Type of device connected to input 6
OUT	I	85	CONFIG_IN7	Type of device connected to input 7
OUT	I	86	CONFIG_IN8	Type of device connected to input 8
OUT	I	87	CONFIG_IN9	Type of device connected to input 9
OUT	I	88	CONFIG_IN10	Type of device connected to input 10
OUT	I	89	CONFIG_IN11	Type of device connected to input 11
OUT	I	90	CONFIG_IN12	Type of device connected to input 12
OUT	I	91	CONFIG_IN13	Type of device connected to input 13
OUT	I	92	CONFIG_IN14	Type of device connected to input 14
OUT	I	93	CONFIG_IN15	Type of device connected to input 15
OUT	I	94	CONFIG_IN16	Type of device connected to input 16
OUT	I	95	CONFIG_IN17	Type of device connected to input 17
OUT	I	96	CONFIG_IN18	Type of device connected to input 18
OUT	I	97	CONFIG_OUT1	Type of device connected to output 1
OUT	I	98	CONFIG_OUT2	Type of device connected to output 2
OUT	I	99	CONFIG_OUT3	Type of device connected to output 3
OUT	I	100	CONFIG_OUT4	Type of device connected to output 4
OUT	I	101	CONFIG_OUT5	Type of device connected to output 5
OUT	I	102	CONFIG_OUT6	Type of device connected to output 6
OUT	I	103	CONFIG_OUT7	Type of device connected to output 7
OUT	I	104	CONFIG_OUT8	Type of device connected to output 8
OUT	I	105	CONFIG_OUT9	Type of device connected to output 9
OUT	I	106	CONFIG_OUT10	Type of device connected to output 10
OUT	I	107	CONFIG_OUT11	Type of device connected to output 11
OUT	I	108	CONFIG_OUT12	Type of device connected to output 12
OUT	I	109	CONFIG_OUT13	Type of device connected to output 13
OUT	I	110	CONFIG_OUT14	Type of device connected to output 14
OUT	I	111	CONFIG_OUT15	Type of device connected to output 15
OUT	I	112	CONFIG_OUT16	Type of device connected to output 16
OUT	I	113	CONFIG_OUT17	Type of device connected to output 17
OUT	I	114	CONFIG_OUT18	Type of device connected to output 18

Table 6.2.3.1

6.3. Examples

The versatility of the instrument means that it can be programmed in a number of ways, depending on the characteristics of the system being controlled and the type of board used.
For this reason, the following tables show the input-output configurations of a number of applications.
Each configuration has the following in common:

- alarm relay;
- Inlet probe
- Outlet probe
- general high pressure switch
- general low pressure switch.

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

6.3.1. Example of SMALL configuration

Refrigeration system made up of:

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

analogue inputs

connector	code	type of analogue input	description
J2	B1	universal analogue input 1*	inlet pressure probe
J2	B2	universal analogue input 2*	outlet pressure probe
J2	GND	common for analogue inputs	
J2	+VDC	21Vdc power supply for active probes (I_{max}= 200mA)	
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 6.3.1.1

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 6.3.1.2

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 6.3.1.3

Digital outputs

connector	code	type of digital output	Description
J12	C1	common relay: 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 relay: 1, 2, 3	
J13	C4	common relay: 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 relay: 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	

Table 6.3.1.4

6.3.2. Example of MEDIUM configuration

Refrigeration system made up of:

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

Analogue inputs

connector	code	type of analogue input	Description
J2	B1	universal analogue input 1*	inlet pressure probe
J2	B2	universal analogue input 2*	outlet pressure probe
J2	GND	common for analogue inputs	
J2	+VDC	21Vdc power supply for active probes (I_{max}= 200mA)	
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 6.3.2.1

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 6.3.2.2

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 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 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 6.3.2.3

Digital outputs

connector	code	type of digital output	Description
J12	C1	common relay: 1, 2, 3	
J12	NO1	normally-open contact, relay no. 1	Compressor 1
J12	NO2	normally-open contact, relay no. 2	capacity-control 1 compressor 1
J12	NO3	normally-open contact, relay no. 3	Compressor 2
J12	C1	common relay: 1, 2, 3	
J13	C4	common relay: 4, 5, 6	
J13	NO4	normally-open contact, relay no. 4	capacity-control 1 compressor 2
J13	NO5	normally-open contact, relay no. 5	Compressor 3
J13	NO6	normally-open contact, relay no. 6	capacity-control 1 compressor 3
J13	C4	common relay: 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 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	

Table 6.3.2.4

6.3.3. Example of LARGE configuration

4 fans
5 compressors (3 inputs per compressor) (1 capacity-control step per compressor)

fan inverter
Liquid level alarm

analogue inputs

connector	code	type of analogue input	Description
J2	B1	universal analogue input 1*	inlet pressure probe
J2	B2	universal analogue input 2*	outlet pressure probe
J2	GND	common for analogue inputs	
J2	+VDC	21Vdc power supply for active probes (I_{max}= 200mA)	
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 9 (NTC, PT1000, ON/OFF)	Thermal overload Klixon fan 2
J20-	BC10	common analogue input 10	

* NTC, 0÷1 V, 0÷10V, 0÷20mA, 4÷20mA

Table 6.3.3.1

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 6.3.3.2

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 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 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 6.3.3.3

Digital outputs

connector	code	type of digital output	Description
J12	C1	common relay: 1, 2, 3	
J12	NO1	normally-open contact, relay no. 1	compressor 1
J12	NO2	normally-open contact, relay no. 2	capacity-control 1 compressor 1
J12	NO3	normally-open contact, relay no. 3	compressor 2
J12	C1	common relay: 1, 2, 3	
J13	C4	common relay: 4, 5, 6	
J13	NO4	normally-open contact, relay no. 4	capacity-control 1 compressor 2
J13	NO5	normally-open contact, relay no. 5	compressor 3
J13	NO6	normally-open contact, relay no. 6	capacity-control 1 compressor 3
J13	C4	common relay: 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 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 1 compressor 4
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	

Table 6.3.3.4

6.4. Possible configurations

This table shows all the possible configurations for the refrigeration system.
The table is divided by the type of board and the number of inputs per compressor.

Note: the following table does not include the possibility of inserting the following in the place of another occupied input:

- liquid level alarm
- remote On-Off

The same is true for the addition of a further output for the alarm relay
Key: √ = possible configuration

No. of Compressors	No. of steps per comp.	Num. Fans	SMALL			MEDIUM			LARGE			Total outputs used
			1 in. per comp.	2 in. per comp.	3 in. per comp.	1 in. per comp.	2 in. per comp.	3 in. per comp.	1 in. per comp.	2 in. per comp.	3 in. per comp.	
0	0	0	√	√	√	√	√	√	√	√	√	0
0	0	1	√	√	√	√	√	√	√	√	√	1
0	0	2	√	√	√	√	√	√	√	√	√	2
0	0	3	√	√	√	√	√	√	√	√	√	3
0	0	4	√	√	√	√	√	√	√	√	√	4
0	0	5	√	√	√	√	√	√	√	√	√	5
1	0	0	√	√	√	√	√	√	√	√	√	1
1	0	1	√	√	√	√	√	√	√	√	√	2
1	0	2	√	√	√	√	√	√	√	√	√	3
1	0	3	√	√	√	√	√	√	√	√	√	4
1	0	4	√	√	√	√	√	√	√	√	√	5
1	0	5	√	√	√	√	√	√	√	√	√	6
1	1	0	√	√	√	√	√	√	√	√	√	2
1	1	1	√	√	√	√	√	√	√	√	√	3
1	1	2	√	√	√	√	√	√	√	√	√	4
1	1	3	√	√	√	√	√	√	√	√	√	5
1	1	4	√	√	√	√	√	√	√	√	√	6
1	1	5	√	√	√	√	√	√	√	√	√	7
1	2	0	√	√	√	√	√	√	√	√	√	3
1	2	1	√	√	√	√	√	√	√	√	√	4
1	2	2	√	√	√	√	√	√	√	√	√	5
1	2	3	√	√	√	√	√	√	√	√	√	6
1	2	4	√	√	√	√	√	√	√	√	√	7
1	2	5	√	√	√	√	√	√	√	√	√	8
1	3	0	√	√	√	√	√	√	√	√	√	4
1	3	1	√	√	√	√	√	√	√	√	√	5
1	3	2	√	√	√	√	√	√	√	√	√	6
1	3	3	√	√	√	√	√	√	√	√	√	7
1	3	4	√	√	√	√	√	√	√	√	√	8
1	3	5				√	√	√	√	√	√	9
2	0	0	√	√	√	√	√	√	√	√	√	2
2	0	1	√	√	√	√	√	√	√	√	√	3
2	0	2	√	√	√	√	√	√	√	√	√	4
2	0	3	√	√		√	√	√	√	√	√	5
2	0	4	√	√		√	√	√	√	√	√	6
2	0	5	√			√	√	√	√	√	√	7
2	1	0	√	√	√	√	√	√	√	√	√	4
2	1	1	√	√	√	√	√	√	√	√	√	5

2	1	2		√	√	√		√	√	√		√	√	√		6
2	1	3		√	√			√	√	√		√	√	√		7
2	1	4		√	√			√	√	√		√	√	√		8
2	1	5						√	√	√		√	√	√		9
2	2	0		√	√	√		√	√	√		√	√	√		6
2	2	1		√	√	√		√	√	√		√	√	√		7
2	2	2		√	√	√		√	√	√		√	√	√		8
2	2	3						√	√	√		√	√	√		9
2	2	4						√	√	√		√	√	√		10
2	2	5						√	√	√		√	√	√		11
2	3	0		√	√	√		√	√	√		√	√	√		8
2	3	1						√	√	√		√	√	√		9
2	3	2						√	√	√		√	√	√		10
2	3	3						√	√	√		√	√	√		11
2	3	4						√	√	√		√	√	√		12
2	3	5						√	√	√		√	√	√		13
3	0	0		√	√			√	√	√		√	√	√		3
3	0	1		√	√			√	√	√		√	√	√		4
3	0	2		√	√			√	√	√		√	√	√		5
3	0	3		√				√	√	√		√	√	√		6
3	0	4		√				√	√	√		√	√	√		7
3	0	5		√				√	√	√		√	√	√		8
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3	3	5										√	√	√		17
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6	3	5														29

Notes: _____

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