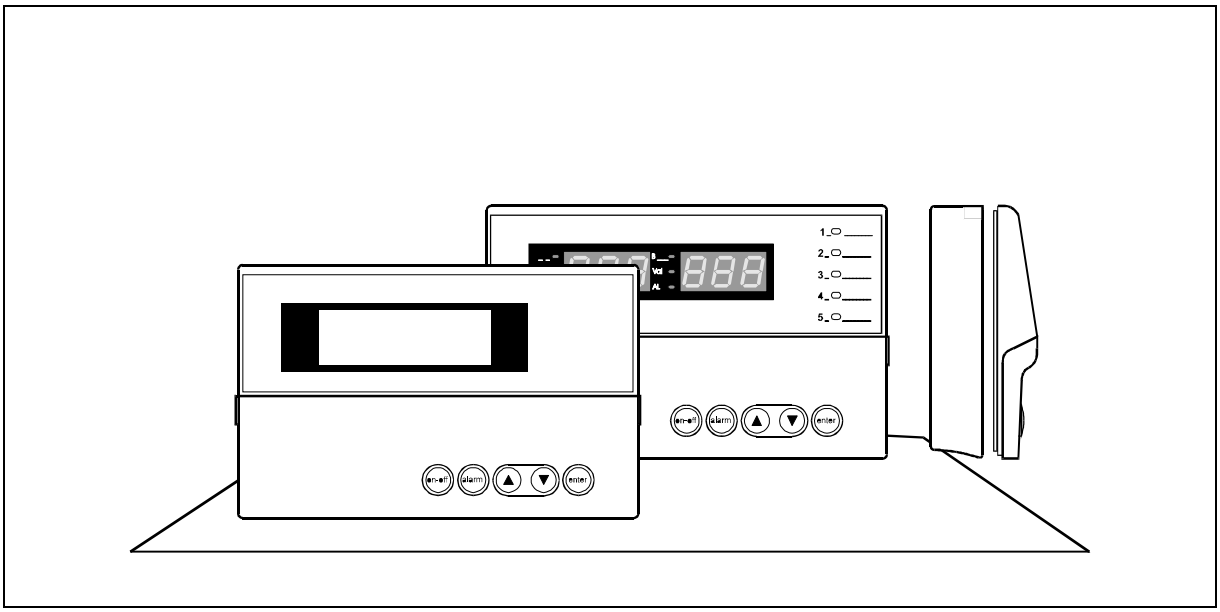
Application program for pCO



Standard 1/2 compressor chiller/heat pump

Manual version: 1.3 - 25/06/99

Program code: **EPSTDEHP0A**

CAREL
Technology & Evolution

Rif.: **86EM**

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Hardware architecture

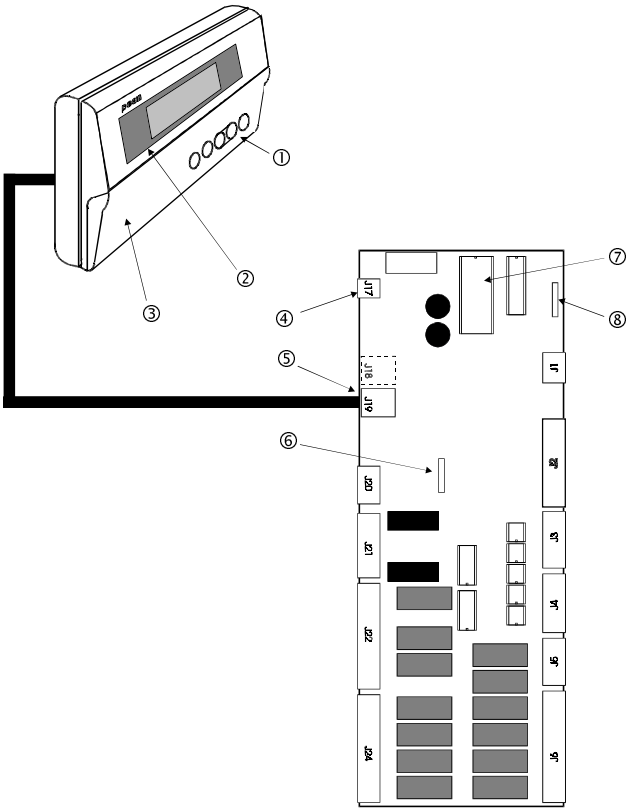


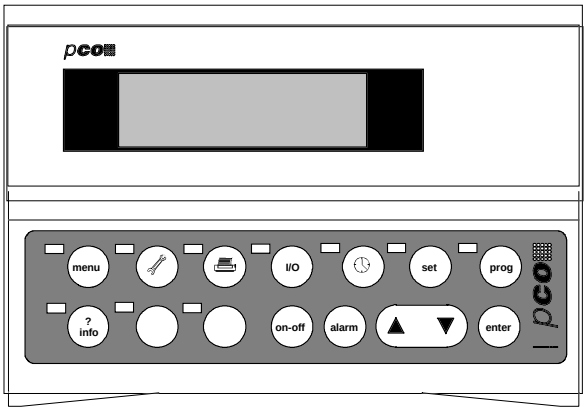
FIG. 1

The figure above shows pCO's hardware architecture:

- Main Board with CPU, BIOS, application SW and I/O
- Keypad-LED-display: terminal unit
- Connection cable between terminal and main card

Keypad

The figure below shows pCO's front panel with open front lid.
The microprocessor-based terminal is equipped with LCD (4 x 20), keypad and LED indicators which make it extremely simple to set the working parameters (set-points, differential, alarm thresholds) and to perform any other regulation operation.
The connection between terminal unit and main card is not necesssary during pCO's normal functioning.



The terminal unit is necessary to program the unit and display its working parameters. It enables you to perform the following operations:

- initial programming via password;
- possibility of modifying run-time any working parameter; display of any alarm condition (via alarm messages and buzzer);
- display of all measured values.

Technical specifications

The unit is powered via the main card by means of a 6-way connector.

The working temperature should range between 0 and 50 °C, the storage temperature between -20 and 50°C.

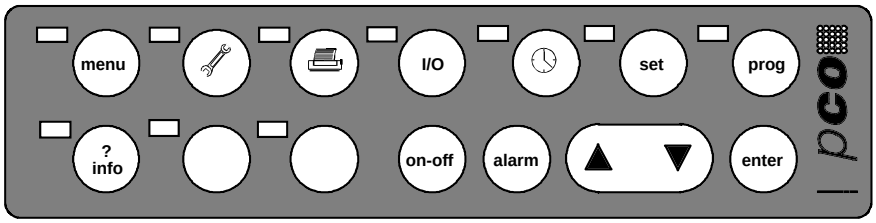
There are 10 buttons on the polycharbonate front panel plus 5 buttons in silicone translucent rubber.

There are 3 LED indicators below the rubber buttons, 10 LED below the polycharbonate front panel plus 5 extra (optional) LEDs on the right side of the display.

Electromagnetic, 2 KHz self-oscillating buzzer.

The electronic card, that includes the support for LED indicators and buttons, has been housed inside a standard plastic case together with the display.
Panel and wall mounting cases available.

As you can see on pag. 4, pCO's housing comes complete with a front panel lid that opens with a max. span of 150 °C.
When the lid is closed, only the five backlit silicone rubber buttons will be directly accessed.
pCO comes complete with a small 15-button keypad. Keypad and display represent the User Interface.



The main parameters or parameters loops are directly accessed by keypad by acting on the following buttons:

ON / OFF 

Operates and stops the controlled devices.

ALARM 

Goes to the first active alarm mask and silences the buzzer. If pressed a second time on the active alarm mask, it resets the alarm and returns to the first mask again.
If you press this button and there are no active alarms, the message 'NO ACTIVE ALARM' will appear on the display.

All alarm masks can be scrolled by pressing the ▲ and ▼ buttons.

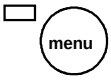
UP & DOWN 

When the cursor is at the HOME position (position 0,0 on the display), these buttons allow you to read all the masks of a specific section.

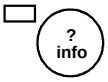
When the cursor is within a numeric field, the ▲ and ▼ buttons allow you to increase and decrease the value on which the cursor is positioned.
When the cursor is on a choice field, pressing these buttons allows you to display all the options available (eg. Yes/No).

ENTER 

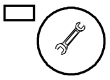
When the cursor is on the selection masks, press ENTER once to move the cursor to the first introduction field.
Press ENTER again to confirm the set value and to move the cursor to the next field. When the cursor reaches the last field, it will return to the HOME position again.

MENU 

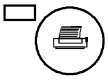
Goes to the MAIN mask

INFO 

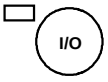
Goes to the M_VERSION mask

MAINT 

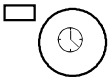
Goes to the M_VIS_TIMER mask

PRINTER 

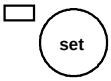
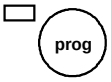
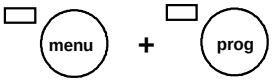
Goes to the M_PRINT mask (models with printer only)

I/O 

Goes to the M_SYNOPTIC1 mask

TIME 

Goes to the REG_CLOCK_US mask

SET		Goes to the M_VIS_SETPOINT mask
PROG		You have to introduce the correct password to access the M_PASS_USER mask.
MENU+PROG		Press and release the MENU and PROG buttons SIMULTANEOUSLY. Then, introduce the password to access the M_PASS_MANUFAC mask.

LED Indicators

The keypad buttons and the green LED indicators are placed side by side.
Any time you press a button, the corresponding green LED will light up thus making it easier for the you to identify which mask section you are using.

When pressing the MENU+PROG buttons to access the configuration parameters, it is the LED indicator corresponding to the PROG button that will light up.
There are other three LED indicators under the following rubber buttons:

1. ON / OFF button	green LED indicator - Indicates that the unit is ON.
2. ALARM button	red LED indicator - Indicates an alarm condition.
3. ENTER button	yellow LED indicator - Indicates correct power supply.

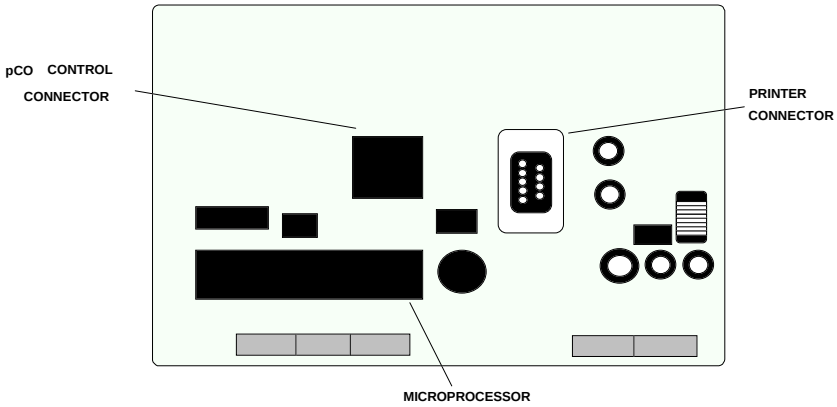
When the unit is forced into the manual operation mode (in this case the unit turns OFF), the LED corresponding to the ON/OFF button will flash.
It will stop blinking as soon as the Operator disenables all devices by means of the manual procedure.
In the event of OFF-normal condition the LED relative to the ALARM button will flash and the buzzer will sound.
Press the ALARM button once to display the type of alarm occurred and disactivate both LED and buzzer.
By pressing the ALARM button a second time you will cancel the stored alarm but if the cause that generated the alarm still persists, the same alarm message will appear again.
All alarms must be manually reset (by pressing the ALARM button) before reactivating the relative devices.

If you do not perform any operation within 5 minutes, the unit will return to the Main mask (accessible by the MENU button) where you can display the values measured by the temperature probe at evaporator inlet.

Back part of the card

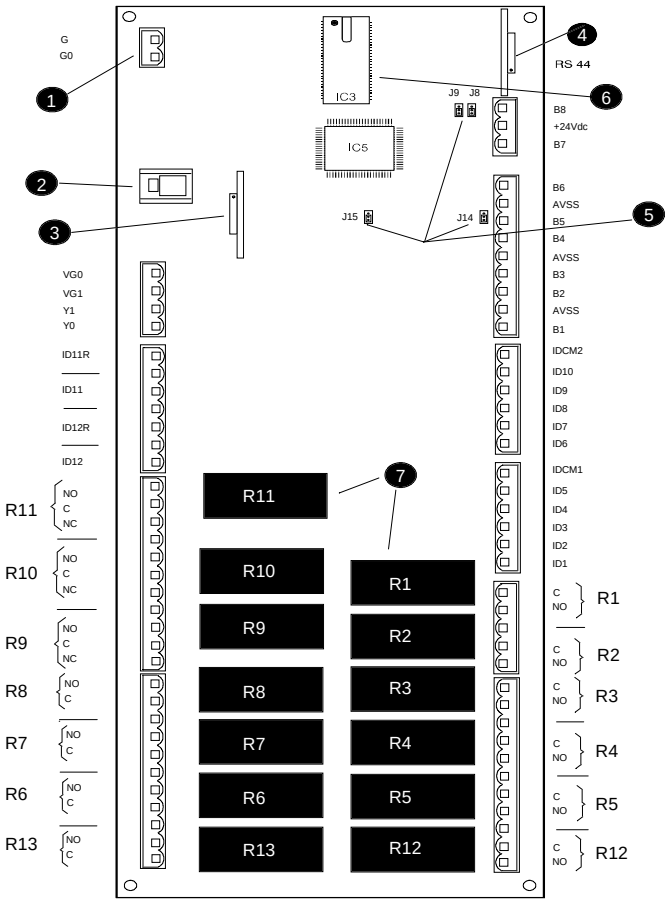
The terminal card includes:

- the microprocessor
- the outputs for connections to pCO and serial printer



Main Board

The controller's card is the heart of the entire system since it contains the microprocessor that performs the control algorithm.



Components of the Main Board

(1) Power supply connector 24 Vac
(2) Telephone connector to the terminal unit (RS485) or to local network connection
(3) Clock card (optional)
(4) RS422 optoisolated card for serial line connection to supervisory/telemaintenance systems
(5) Pin strips to be positioned as follows, depending on your application requirements:
- J8: position 1-2 for connecting the card to a terminal unit or to the supervisor; position 2-3 just allows a local network connection
- J9: position 1-2 enables remote reset from the supervisor;
- J14: position 1-2 enables tension input B5, position 2-3 enables current input B5.
- J15: position 1-2 enables tension input B6, position 2-3 enables current input B6.

(6) Program Eprom.
(7) Output relays

Rxx:	Relay output connectors
No:	Normally open contact
Nc:	Normally closed contact
C:	Common reference
ID:	Digital inputs
IDCM:	Common for digital inputs
Bx:	Analogue input
AVSS:	Reference for analogue inputs
Yx:	Analogue outputs
VG1/0:	Analogue outputs power source 24V

Technical specifications

MAIN CARD - MECHANICAL SPECIFICATIONS

Card, 16.5 DIN modules	107 x 292.5 mm
Fastners	6 fastners ∅ 4 mm plus optional support for DIN rail mounting

Terminal block

Type	male/female plug-in connectors
Max. current	16 A
Max. voltage	250 Vac
Max. cable section	2,5 mm^2

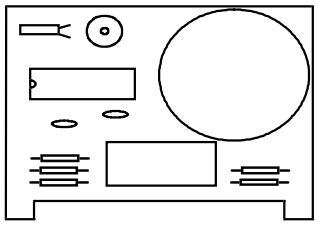
CONNECTION TO KEYPAD - DISPLAY UNIT (see figure)

Type	Asyncronous, half duplex, 2-wire lead
Connector	telephone-type 6-way lead
Driver	balanced differential CMR 7 V (type RS422)
Distance	max. 1 Km

Alternatively, Carel local network connection available. In this case interfacing the unit to the supervisory system will not be possible.

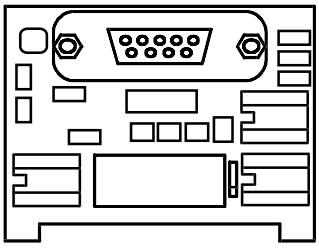
Mounting pCO optional cards

Clock card
The clock card is necessary to display the current time and date and to perform a time-band control action.



Connect it to connector no. 3 shown in the figure on page 7.
In the event of power supply failure to pCO, the clock card will be powered by a rechargable lithium battery (45 mA/h, min. operating time = one month).

Code MNEWCLOCK0

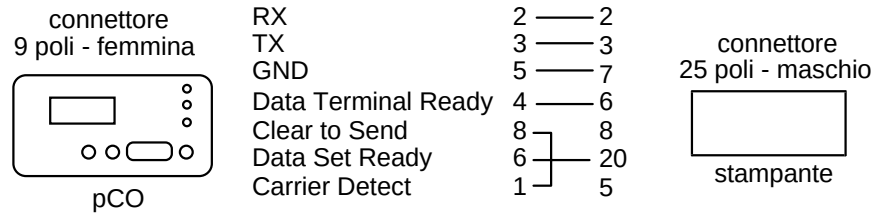


Optoisolated RS422 serial card

The RS422 serial card allows pCO to be network connected into local or remote supervisory and telemaintenance systems.
Connect this card to the relative connector (4) shown on page 7.

Code PCOSER0000

Connection to a 80-column serial printer: electrical diagram.



Mounting the Eprom

The Eprom must be inserted into the main card.
An arrow on the label of the eprom indicates how to insert it correctly.

When inserting the eprom into its socket pay attention to align its polarity correctly (the notch on the eprom must coincide with that of the socket).
Insert the eprom carefully without bending or breaking its small pins.

Before requesting Service

THE UNIT DOES NOT START

LED of the Enter button OFF, LCD OFF, other LED indicators OFF.

Cause:

a. no mains voltage
b. transformer (220 - 24V) is not powered with 24 Vac
c. 24V power supply connector is not well plugged-in

THE UNIT IS ON BUT:

the alarm LED indicator is ON
the LCD shows no messages or random messages
the buzzer sounds

Cause:

a. eprom inserted with wrong polarity
b. pins of the eprom bent
c. microprocessor chip damaged: contact qualified service personnel
d: telephone cable from terminal to main card is not correctly connected

WRONG INPUT SIGNALS READING

Cause:

a. incorrect probe connections
b. probes' wires must be placed far from electrical noises (power cables, contactors, high tension cables, etc.)
c. incorrect connection between interfaces and controller (flat cables)
d. incorrect power source to interfaces

FAULTY EEPROM

a. contact qualified service personnel

pCO TURNS OFF AND ON REPEATEDLY (WATCH-DOG) OR IT OPERATES SOME (DIGITAL AND/OR ANALOGUE) OUTPUTS AT RANDOM.

Cause:

a. incorrect power supply
b. power cables are too close to the microprocessors of the interfaces and to the control card.

Inputs / Outputs

Analogue inputs

TERMINAL	SCREEN PRINT	FUNCTION
J2 - 1	B1	Water temperature at evaporator inlet
J2 - 2	AVSS	Common to analogue inputs
J2 - 3	B2	Water temperature at evaporator outlet
J2 - 4	B3	Temperature coil 1/External air temperature[1]
J2 - 5	AVSS	Common to analogue inputs
J2 - 6	B4	Temperature coil 2/unused[1]
J2 - 7	B5	High pressure circuit no. 1
J2 - 8	AVSS	Common to analogue inputs
J2 - 9	B6	High pressure circuit no. 2

Digital inputs

TERMINAL	SCREEN PRINT	FUNCTION
J4 - 1	ID1	Start / stop
J4 - 2	ID2	Winter / Summer (close contact = Summer)
J4 - 3	ID3	Flowmeter
J4 - 4	ID4	Antifreeze
J4 - 5	ID5	Electropump circuit breaker
J4 - 6	IDCM1	Common to digital inputs J4 - 1 / 5
J3 - 1	ID6	Interblock/End defrosting pressurestat1
J3 - 2	ID7	Oil differential pressurestat compressor no. 1
J3 - 3	ID8	Oil differential pressurestat compressor no. 2
J3 - 4	ID9	Low pressure pressurestat circuit 1
J3 - 5	ID10	Low pressure pressurestat circuit 2
J3 - 6	IDCM2	Common to digital inputs J3 - 1 / 5
J21 - 1	ID11	High pressure pressurestat/Compressor circuit breaker/Fan circuit breaker no. 1
J21 - 3	ID11R	Common to digital input J21 - 1
J21 - 5	ID12	High pressure pressurestat/Compressor circuit breaker/Fan circuit breaker no. 2
J21 - 7	ID12R	Common digital input J21 - 5

[1] Depending on the type of defrosting, you will have to connect the coil probes to inputs B3 and B4 or the external air temperature probe to input B3 (input B4 won't receive any device).
Input ID6 can be used to detect the alarm (interlock alarm) that will block the unit during two-probe defrosting cycles (otherwise connect an end-defrosting pressurestat).

Digital outputs

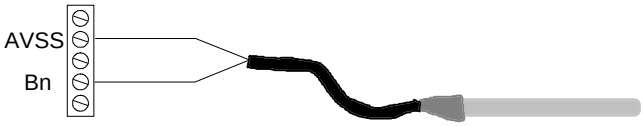
TERMINAL	SCREEN PRINT	FUNCTION
J5 - 4 / J5 - 5	C1 - NO1	Compressor no 1
J5 - 1 / J5 - 2	C2 - NO2	Solenoid coolant compressor no. 1
J6 - 10 / J6 - 11	C3 - NO3	Capacity-controlled solenoid compressor no. 1
J6 - 7 / J6 - 8	C4 - NO4	Compressor no. 2
J6 - 4 / J6 - 5	C5 - NO5	Solenoid coolant compressor no. 2
J24 - 7 / J24 - 8	C6 - NO6	Capacity-controlled solenoid compressor no. 2
J24 - 4 / J24 - 5	C7 - NO7	Fan no. 1
J24 - 1 / J24 - 2	C8 - NO8	Fan no. 2
J22 - 9 / J22 - 10	C9 - NO9	Reversing cycle electrovalve no. 1
J22 - 5 / J22 - 6	C10 - NO10	Reversing cycle electrovalve no. 2
J22 - 1 / J22 - 2	C11 - NO11	General alarm
J6 - 1 / J6 - 2	C12 - NO12	Unused
J24 - 10 / J24 - 11	C13 - NO13	Electropump

Analogue output

TERMINAL	SCREEN PRINT	FUNCTION
J20 - 3	Y0 - VG0	Fan inverter

Inputs and outputs connections

Connecting NTC temperature probes



The two cables of the NTC probe have no polarity so connect them as you like.

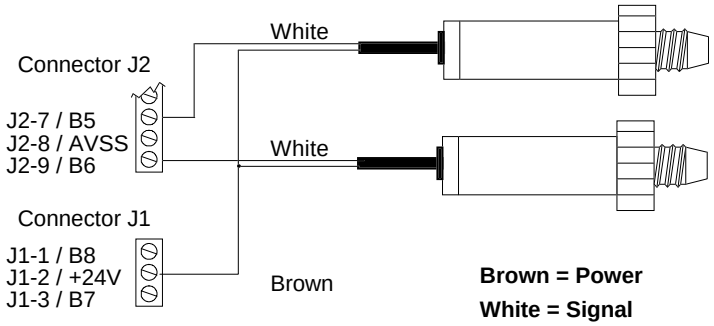
CODES "NTC" PROBES:		
code: NTC0000000	code: NTC3500000	code: NTC4000000
code: NTC6000000	code: SSWNTC0000	code: STHONTC0/1

Connecting Keller pressure transducer

If your unit includes pressure probes, connect them to terminals B5 and B6 asshown in the diagram below.

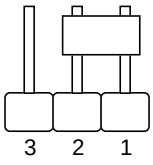
KELLER transducer - interface connection

Series 21 / 22
Delivery side 0 : 30 bar Code SPK3000000



Connect the transducers directly to the interface

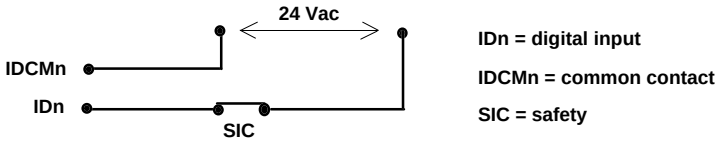
IMPORTANT:

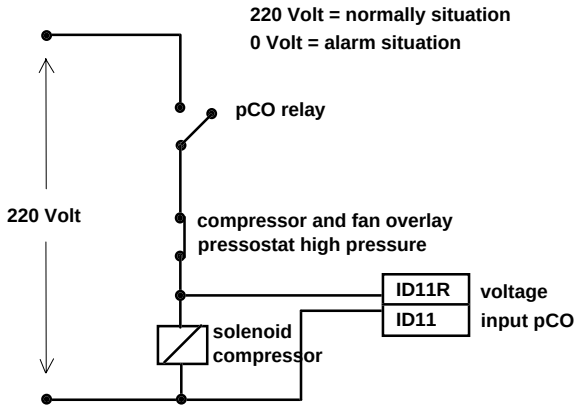


Set the 4-20 mA configuration by placing the jumper of connectors J14 (referring to B5) and J15 (referring to B6) as indicated in the figure onthe left.

Connection to the tension digital inputs

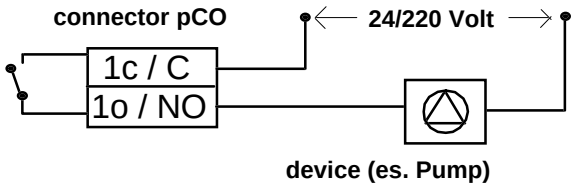
Connect the 24 Vac digital inputs (or 220 Vac on terminals ID11 and ID12) as shown below:



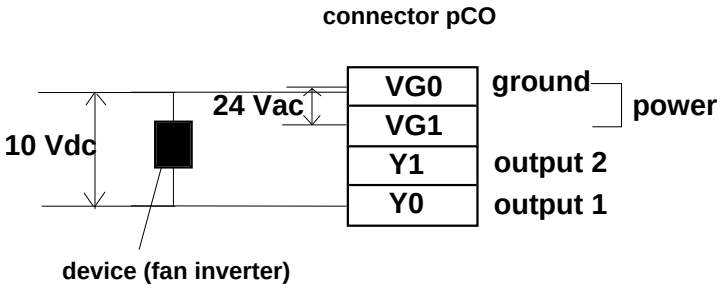


When pCO's relay enabling the compressor's functioning is closed and that relative to the high pressure pressurestat is open, the 'high pressur alarm' will be detected through the 220 Volt input.

Connecting the digital outputs



Connecting the analogue outputs



The figure above shows pCO's analogue outputs connections. Power terminals VG0 and VG1 by 24 Vac.
If the device connected to pCO is powered by 24 Vac, it is recommended to power also terminals VG0 and VG1 or draw power supply from terminals G0 and G on pCO card. Connect all devices (inverter, valves, etc.) either between terminals VG0 and Y0 or between VG0 and Y1. As for the fans inverter, connect it between terminals VG0 and Y0 (see figure above).

The program

General description

This application program has been designed to control a chiller or a heat pump equipped with max. 2 compressors.
The program controls the water temperature of the system keeping it within the limits set by the User. Each circuit controls and regulates:
- one compressor;
- one capacity-controlled routine;
- one condensation-removal fan;
- one electrovalve necessary to reverse the refrigeration cycle (winter/summer) and to perform defrosting cycles.

The temperature control is based on a Proportional or Proportional + Integral regulation logic, depending on the User's actual application requirements.

A series of special settings allow you to ensure long life to the compressors through dedicated alarms (circuit breakers and pressurestat interventions) and times management (including: minimum On routine of the compressor, time-interval between two consecutive On routines, time-interval between On routines of different compressors).
The most important parameters (set-point, alarm thresholds, alarms) can be displayed (LCD 4 x 20) and modified via keypad according to the User's requirements.

12 digital inputs - connected to mechanical/electrical external alarm sensors - are meant to detect any OFF-normal condition forcing, if necessary, the controlled device to stop.
In the event of abnormal working conditions, the operating personnel will be alerted by a red led indicator placed below the ALARM button and by the buzzer. The display will also show which type of OFF-normal condition has occurred.

Alarm and temperature masks can be freely accessed whereas ALL SELECTION MAKS CAN BE ACCESSED ONLY BY A SECRET KEY WORD (SERVICE PASSWORD, '1234') KNOWN ONLY BY QUALIFIED PERSONNEL.
In this way you will be allowed to enter special fields where you will set the most important working parameters such as number of compressors, time-intervals, set-points, etc.).
One of the protected sections will permit you to initialize pCO with factory-set parameters so as to make the configuration procedure even easier and faster.

This program application also allows network connections into supervisory or telemaintenance services so as to ensure the remote control and management of the entire installation and the optimization of maintenance procedures in the event of OFF-normal conditions.

Connection to a 80-colums serial printer allows you to get periodic printouts of any alarm occurred as well as reports of the values measured by the probes.

Software initialization

Initializing the software means to set a series of important parameters such as:
- number of compressors and fans
- control parameters (set-points, times, alarm thresholds, etc.)

All set data are permanently stored and retrieved any time pCO is turned ON.
The very first time pCO is turned ON, we recommend cancelling the original data since they might be unsuitable for your application requirements and then loading the factory-set parameters so as to make the initialization procedure fast and easy. Follow these indications:
- Turn pCO ON. After a few seconds the main mask - MENU MASK - will appear on the display. When starting pCO the very first time, ignore any alarms since they probably result from incorrect data.
- Press MENU + PRG simultaneously.
  Now you have to digit the manufacturer password[1] , necessary to prevent unauthorized access to the operational parameters (configuration section).
- Digit the correct password. After that a menu mask with 4 options will be displayed. Press first ▼ then 'Enter' to access the Initialization mask whereby you can set the entire range of factory-set parameters (standard configuration for refrigeration units).

If some standard values do not suit your application requirements, you can simply change them by entering the dedicated selection mask/s.

[1]MANUFACTURER password "1234" . We recommend keeping the password secret so as to prevent unauthorised access to the operational parameters.
The Manufacturer password can be used when performing preliminary operations and any time you do not manage to gain access to the configuration mask by the SERVICE password.

Configuration Guide

Number of compressors
The factory-set number of compressors to be controlled is one (default value). Should your unit comprise two compressors, enter the protected mask (via manufacturer password, see section about masks below) and change the default parameter.
The system can control up to 2 compressors (max.) plus their relative capacity-controlled routines.
The capacity-controlled routine can be operated according to two different modes:
- DWM COPELAND logic: the capacity-controlled routine occurs when the output is closed;
- FEDDERS logic: the capacity-controlled routine occurs when the output is open.

Number of fans
pCO manages 2 fans, one per circuit. The fans will be operated on the basis of the controller's functioning mode, that is Winter or Summer:

Summer functioning mode:
Fans are operated according to the HIGH PRESSURE values measured by thepressure transducers. If there are no pressure probes, the fans' activation will depend on the relative compressors (fan on when compressor on and vice versa).

Winter functioning mode:
Fans and compressors will be activated and stopped at the same time.
During a defrosting cycle the fan of the circuit undergoing defrosting will be stopped.

In the event of circuit breakers (fan/flowmeter circuit breaker, etc.) the fans will be stopped immediately.

Optional devices
You can enhance the functions of the pCO controller by adding a series of optional devices (RS422 serial card, printer cable, clock card) that can be enabled by simply acting on the dedicated masks.
The RS422 card interfaces pCO to a supervisory network that can receive all data and alarms from pCO.
A dedicated cable will allow you to connect pCO to an external printer.
Depending on the option selected, you will have to set in the dedicated masks time and date (to enable the clock card) or pCO's identification number (so as to address messages correctly when the controller is network-connected into a supervisory/telemaintenance system by means of the RS422 card).
You can get periodic or immediate printouts of the values measured by the probes; in the event of OFF-normal conditions, the relative alarm will be immediately printed.

Use guide

Status of the system

The system can be ON, OFF or in the MANUAL functioning mode.
To turn ON the chiller or heat pump and consequently start the regulation process, follow these indications:

- press the ON button (LED indicator ON);
- be sure that the daily or weekly time-bands control action has been enabled;
- for remote ON/OFF be sure that digital input no. 1 is closed;
- be sure that - in case of network connection to a supervisory unit - the two units are correcly connected;
- the unit must not be in the manual functioning mode;
- there must be NO alarm conditions (eg. flowmeter alarm, unit interlock, electropump circuit breaker).

If all these conditions occur, the green LED will light up.
When the system is ON, compressors and fans will be operated on the basis of the values measured by the temperature and pressure transducers.

If one of the above conditions does not occur, the unit will remain in the OFF status.

The display and the ON LED indicator will inform the User of the status of the entire system: in particular, the last row of the main mask (which can be accessed by pressing the 'MENU' button) will show one of the following messages:

- Unit ON
When the unit is ON, all devices can be operated.
The ON/OFF LED indicator is ON.

- Unit OFF
When the unit is OFF, it is not possible to operate the connected devices.
The ON/OFF LED indicator is OFF.

- Remote OFF
The controller's OFF status has been forced by acting on the relative digital input. The connected devices can not be operated.
The ON/OFF LED indicator is ON.
To start the unit, close the digital contact.

- OFF status via supervisory unit
The controller's OFF status has been forced by the supervisory pc. All connected devices can not be operated.
When in this status, the ON/OFF LED indicator will flash; the controller can be turned on via supervisory pc or simply by pressing the ON button on the controller's keypad.
It will be possible to turn on the controller via supevisory pc only if the controller's ON LED indicator is ON.
When the unit has been turned OFF by acting on the OFF button (local OFF), it will not be possible to turn it on again via external command (this ensures complete safety to the entire system).

- OFF status determined by time-bands control action
The OFF status has been determined by a time-bands control action.
When in this status, all connected devices can not be operated.
The ON/OFF LED indicator is ON.
The unit will re-start as soon as the time-band control action instructs the system to start again.

- Manual procedure

The manual procedure can be operated by selecting it on the dedicated mask ('maintenance loop' protected by the key word).
When the unit is ON, the activation of the manual procedure forces the unit into the OFF status; therefore it will be possible to operate all connected devices manually, with the exception of the temperature control and of any alarm condition. When in the manual procedure status, the ON LED indicator flashes.
The manual procedure will be disenabled as soon as all the devices undergoing such a procedure are disenabled or simply by pressing the ON/OFF button.

Water temperature regulation

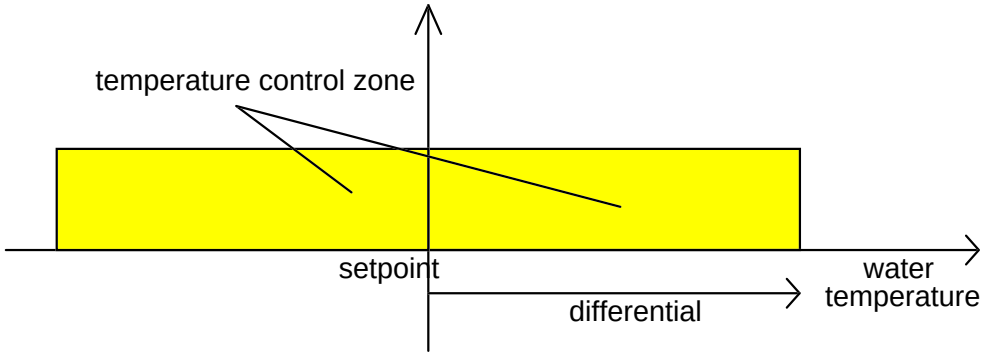
Water temperature can be regulated by means of a Proportional (P) or Proportional + Integral (P+I) control action, according to your specific application requirements.

PROPORTIONAL CONTROL:
since the set-point represents the ideal working condition, the pCO controller will operate its connected devices so as to reach the set-point in a proportional way, that is proportionally to the distance between the actual condition and the set-point.
The control action depends on the differential zone selected by the User:
within this zone pCO will minimize the action of the connnected devices as the actual conditions get closer to the set-point and vice versa.

PROPORTIONAL + INTEGRAL CONTROL:
besides what performed by the proportional mode, the P+I control action will also rely on the 'time' factor. A time constant (in seconds) will determine the velocity with which the controller performs its actions (less seconds, higher velocity). Usual time constant = 600 seconds.

SET-POINT AND DIFFERENTIAL

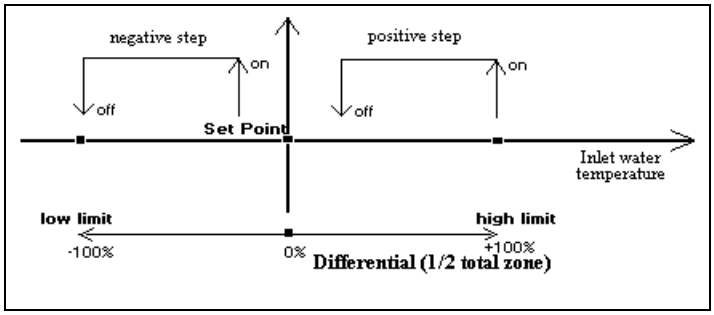
SET-POINT	==>	selectable in ºC; ideal working condition.
DIFFERENTIAL	==>	selectable in ºC; indicates the working range of the controller.



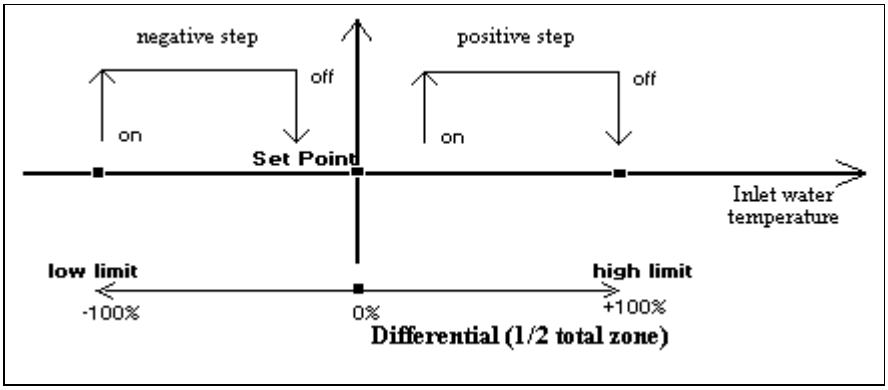
In the application shown in the figure above the set-point has been set so as to represent the **CENTRAL** point of the regulation zone.

POSITION OF THE STEPS

STEPS POSITION - **Summer Functioning Mode** -



STEPS POSITION - **Winter Functioning Mode** -



ON ===> ACTIVATION OF THE STEP
OFF ===> DISACTIVATION OF THE STEP

In the SUMMER functioning mode the steps will activate when the temperature rises and disactivate when it falls.

In the WINTER functioning mode the steps will activate when the temperature falls and disactivate when it rises.

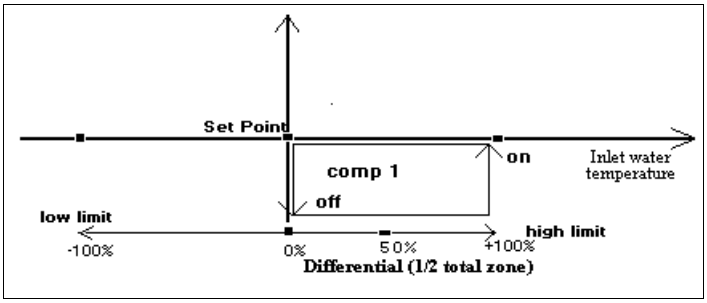
The steps' effect consists of moving the set-point to the left (SUMMER functioning mode) or to the right (WINTER functioning mode) so as to reach the ideal working condition (set-point).

COMPRESSORS SET-POINT AND WORKING ZONE

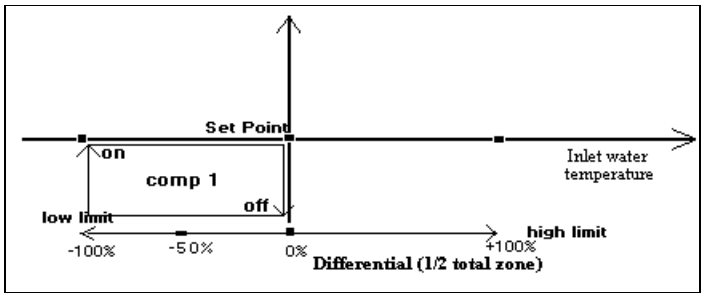
The water temperature control action will be based on the selected set-point and differential. Depending on the selected devices, the following configurations will be possible:

SINGLE COMPRESSOR UNIT WITHOUT CAPACITY-CONTROLLED ROUTINE

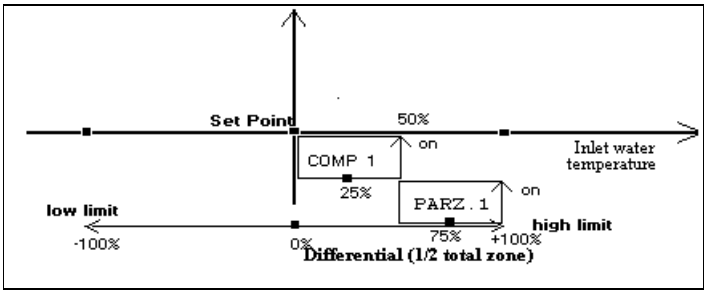
'SUMMER' FUNCTIONING MODE



'WINTER' FUNCTIONING MODE

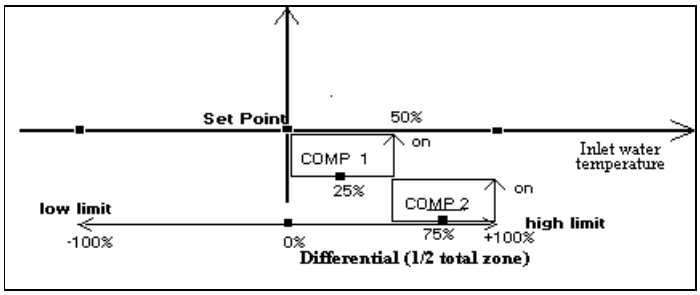


SINGLE COMPRESSOR UNIT WITH 1 CAPACITY-CONTROLLED STEP



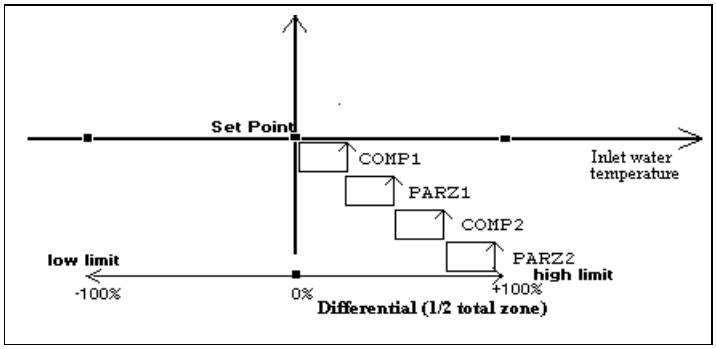
Note: the example above refers to cooling applications ('Summer' functioning mode). For heating applications ('Winter' functioning mode), the steps will be positioned specularly with respect to the set-point.

TWO-COMPRESSOR UNIT WITHOUT CAPACITY-CONTROLLED ROUTINE



Note: the example above refers to cooling applications (Summer mode).
For heating applications (Winter mode), the steps will be positioned specularly with respect to the set-point.

TWO-COMPRESSOR UNIT WITH 1 CAPACITY-CONTROLLED ROUTINE PER COMPRESSOR



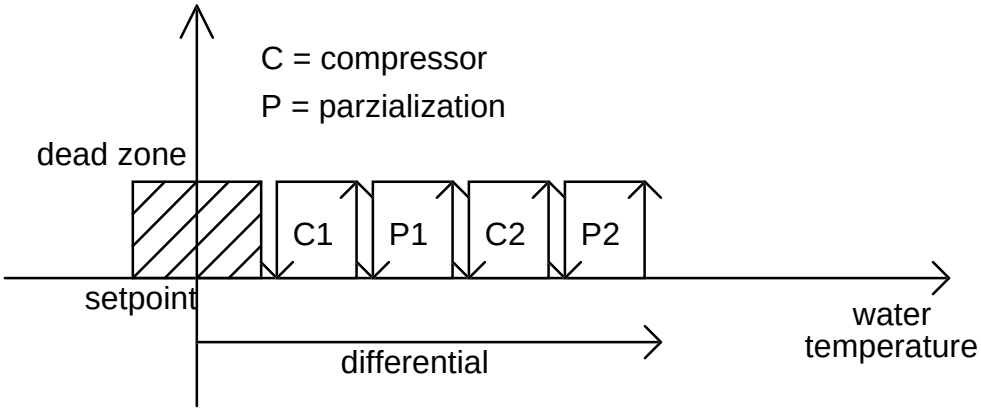
Note: the example above refers to cooling applications (Summer mode).
For heating applications (Winter mode), the steps will be positioned specularly with respect to the set-point.

The best working condition is achieved when the unit manages to reach and keep the set-point value without operating any of the connected devices.

If the unit works as a heat pump, the compressors' position on the diagrams will be in the negative field of the proportional zone.

Important: the regulation of the water temperature will depend either on the water temperature probe at evaporator inlet or evaporator outlet, as required by the User.

It is also possible to set a dead (neutral) zone around the set-point permitting the compressors - as well as the fans when working in freecooling mode - to remain OFF.
In this way the steps of both fans and compressors will be moved on the right with respect to the selected dead zone. The example below shows the position of the steps after having selected a neutral zone around the set-point.



Note: the range of the dead zone must be inferior to the selected differential otherwise the connected devices will not activate.

Compressors start-up (with and without capacity-controlled)

Any time the compressor is instructed to start, the relative contactor will energize and - depending on the value of the water temperature at evaporator inlet or outlet - the controller will:

- instruct the compressor to start;
- energize the LIQUID SOLENOID valve.
- the compressor will start.

Compressors shift

Selecting the compressors shift ensures longer life to the compressors.
This procedure, in fact, makes them work in a very balanced way and compensates the number of their ON/OFF routines as well as their working hours.

The shift is based on a F.I.F.O. logic: the first compressor that starts will be the first to be stopped.
At the very beginning this logic might cause an unbalanced compressors management but the system will gradually settle.
Upon a call for compressor start-up, the logic will be as follows:
- the compressor that has been OFF for the longest time-interval will be the first to start;
- the first compressor that starts will be the first to be stopped;
- any compressor will start again only after all the other compressors have started once.

Capacity-controlled routines do not undergo shifts.

Compressors timer

pCO also controls the working hours of the compressors.
Set the required value (default 10,000 hours) in the dedicated mask. When the compressors reach the set threshold an alarm message (indication only) prompting maintenance will be displayed.
It is possible to zero down the timer relative to each single compressor.

Reversing cycle electrovalves

These valves are used in units working as 'heat pumps' in order to pass from the Summer to the Winter functioning mode.
In the Winter mode the valve will be used when performing defrosting cycles so as to reverse the cycle, in this way:

- Summer mode electrovalve energizes
- Winter mode electrovalve disenergizes except when performing a defrosting cycle

Defrosting cycle

When the unit works as a heat pump the defrosting cycle will be performed in order to keep the evaporator in good conditions.

Defrosting cycles can be performed in two ways, depending on the input used by the Operator.

DEFROSTING BASED ON TWO PROBES
If your system comprises one probe per coil, you can operate defrostings in each circuit as well as simultaneous defrostings, depending on the system itself.

Independent defrostings
The defrosting cycle will be performed as soon as the temperature measured by the probe falls below the DEFROSTING SET-POINT while the compressor of the same circuit is ON. There will be a time-delay (DELAY BEFORE PERFORMING A DEFROSTING CYCLE) at the end of which the cycle will take place.

The defrosting parameters to be set are the following:
- set-point at which you want a defrosting cycle to occur;
- end-defrosting set-point;
- time-delay before performing the defrosting cycle;
- max. duration of the cycle.

When the defrosting cycle begins, the following conditions will occur:
- reversing cycle valve energizes;
- low pressure pressurestat bypassed during the entire defrosting cycle;
- all fans relative to the circuit undergoing the defrosting cycle will be stopped.

When the defrosting cycle is over:
- the reversing cycle valve energizes;
- the low pressure pressurestat will resume its control action;
- the fans will start again.

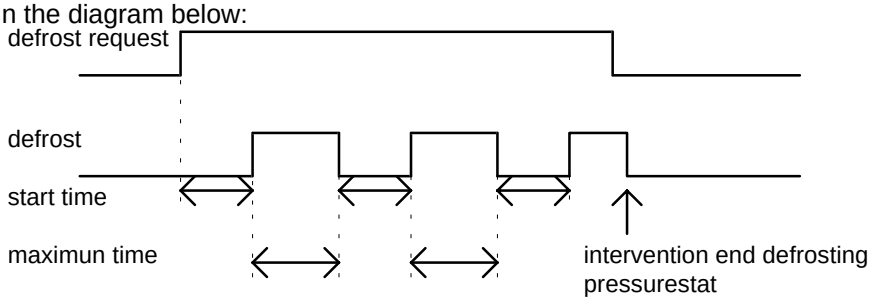
Simultaneous defrosting cycles
The two circuits will undergo a defrosting cycle simultaneously as soon as the temperature measured by one of the two probes falls below the start-defrosting set-point for a 't' time depending on the time-delay before defrosting previously selected by the User.
The defrosting cycle will end when the temperature rises above the selected end-defrosting set-point.
Two situations can occur:
- the temperature of one of the two circuits rises above the end-defrosting set-point: in this case the compressor of that circuit is forced into a stand-by mode until the defrosting cycle of the other circuit ends.
- the temperature of one of the two circuits is above the end-defrosting set-point; in this case only one circuit will undergo the defrosting procedure. Should the temperature of the first circuit fall below the end-defrosting set-point, the defrosting cycle will not take place and the relative compressor will remain in a stand-by mode until the other active defrosting cycle (that of the second circuit) ends.

DEFROSTING BASED ON ONE PROBE
In order to enable one-probe-defrosting cycles it is necessary to select them through the dedicated mask (COMPRESSOR_COS6 mask, manufacturer branch).
In this case just one probe is used (analogue input no. 3) to measure the external air temperature. Defrostings will therefore be always simultaneous.
When the external air temperature falls below the start-defrosting set-point and one of the two compressors is ON, there will be a time-delay (DELAY BEFORE PERFROMING A DEFROSTING CYCLE) after which the defrosting cycles will occur in both circuits.
Defrostings will end:
- following the intervention of the end-defrosting pressurestat (digital input no. 6);
- after the defrosting time has passed.

Defrostings will occur when:

External air temperature < Start-defrosting set-point

as shown in the diagram below:



Electropump

The electropump functioning is prior to any other device.
The pump is forced into the ON status as soon as the unit is switched ON.
The pump will then be stopped a certain 't' time after the unit has been switched OFF (selectable time-interval before stopping the pump).

In the event of pump lockout due to alarm conditions, the unit is forced into the OFF status; the compressors will perform the PUMP-DOWN procedure - if previously selected - otherwise they will be stopped in the usual way.

Should the water temperature fall below safety values while the pump-down procedure is being performed and the pump is in stand-by, the relative ANTIFREEZE alarm will interrupt the pump-down procedure and stop the compressors.

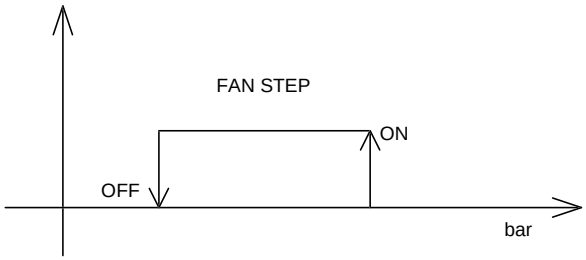
Alarms stopping the pump and forcing the unit into the OFF status:
- electropump circuit breaker;
- flowmeter alarm;
- interlock.

These alarms will appear also when the unit is working in the manaual mode.

Fans and fan inverter

The regulation of the coolant condensation temperature will be performed by a series of fans placed on the condensing coil.
There are two digital outputs (one per circuit) dedicated to the fans.
The fans will be operated by pCO on the basis of the HIGH PRESSURE values measured by the pressure transducers when the unit is working in the Summer functioning mode.
If the system has no pressure probes, the fans will be operated according to the relative compressor (compressors and fans of the same circuit will be started and stopped at the same time).
When the unit works as 'heat pump', fans and compressors of the same circuit will be always operated and stopped simultaneously.

It is possible to select the fans' regulation step on the basis of the pressure values measured by the transducers (manufacturer password/global parameters). Set the start and stop values as shown in the diagram below:



During the defrosting cycle the fans relative to the circuit undergoing such a procedure will be forced into the OFF status.

NUMBER OF TURNS OF THE FANS

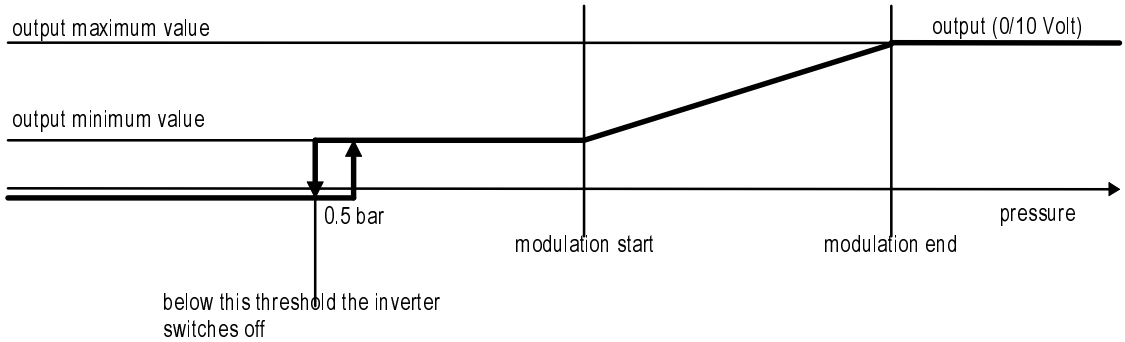
The number of turns of the fans can be adjusted by means of an external inverter through the 1st analogue output (Y0).
The output maximum operating range goes from 0 to 10 Volt. The inverter modulation depends on the condensation pressure values in the plant (B5 and B6 probes).
The parameters of the device are the following:

- inverter selection — it enables the management of the Y0 analog output for inverter control.
- minimum value — it is the minimum value that can be given to the analog output. The value is expressed in percentage, so that by selecting a value equal to 100.0%, the minimum value of 10 Volt will be given to the analog output.
- maximum value — it is the maximum value that can be given to the analog output. This value is expressed in percentage, so that by selecting a value equal to 100.0%, the maximum value of 10 Volt will be given to the analog output.
- modulation start — it indicates the value of the pressure which corresponds to the inverter speed regulation start.
- modulation end — it indicates the value of the pressure which corresponds to the inverter speed regulation end.
- switching-off threshold — it indicates the value of the pressure which corresponds to the inverter switching off (to activate the inverter again, a hysteresis of 0.5 bar must be exceeded). When cooling, if the pressure values are lower than this limit, the inverter is off. When heating, if the pressure values are higher than this limit, the inverter is off.
- starting time — it allows to set the max. speed during starting of the device used to overcome the mechanical inertia of the engine.

The inverter is off when there is at least one of the following situations:

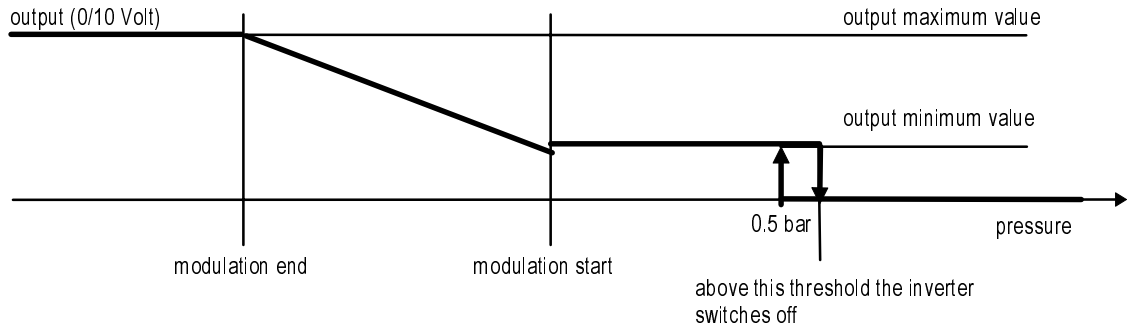
- the inverter has not been selected.
- the unit is switched off.
- on both circuits there are high pressure, compressor overload and fan alarms (ID11 and ID12 digital inputs).
- the defrost cycle is on.
- the pressure value - taken as a point of reference - is below (or above in the heating procedure) the switching off threshold.

Operating mode: cooling (Summer)



- If two refrigerating circuits have been selected (two compressors), the pressure value that will be taken as a point of reference is be the one of the circuit which takes the higher value.

Operating mode: heating (Winter)

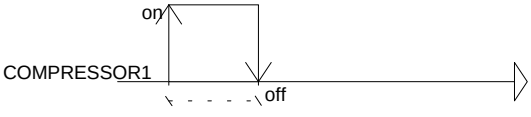


- If two refrigerating circuits have been selected (two compressors), the pressure value that will be taken as a point of reference will be the one of the circuit which takes the lower value.
- During the defrosting cycle the inverter is switched off.
- **When the inverter is being selected the defrosting cycles happen simultaneously.**

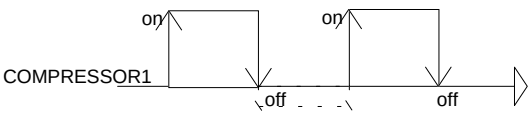
Times

Most of pCO's control actions will be performed according to programmable time-delays (eg. time-delay before the activation of compressors or of certain alarms so as to ensure longer life to the compressors themselves and a well-balanced system management).
pCO allows you to set the following time-intervals:

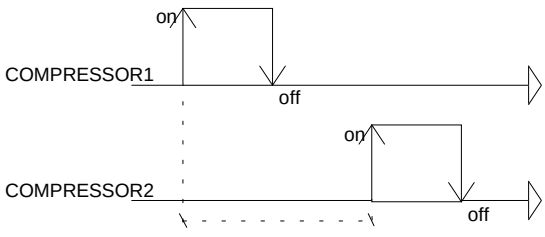
- time-delay before starting the second compressor so as to avoid high absorption at start-up (def.10 sec.);
- minimum ON routine of the compressor (def. 60 sec.);
- minimum OFF routine of the compressor (also after the unit has been switched OFF via keypad, def. 180 sec.);
- time-delay between two consecutive ON routines of the same compressor to limit the number of starting routines per hour (def. 360 sec.);
- time-delay between the compressor start-up and its capacity-controlled routine or between two capacity-controlled routines (def. 360 sec.);
- time-delay before activating the oil differential pressurestat alarm (def. 120 seconds);
- time-delay before the activation of the flowmeter alarm during normal activity (def. 3 sec.);
- time-delay before the activation of the flowmeter alarm at start-up (def. 10 sec.);
- time-delay before stopping the electropump after the unit has been switched OFF (def. 20 sec.);
- time-delay before the intervention of the low pressure pressurestat (def. 40 sec.);
- max. pump-down time (def. 20 seconds);
- max. defrosting time (def. 60 minutes);
- defrosting starting time (def. 30 minutes) ;
- fan speed regulator starting time (default 2 seconds).



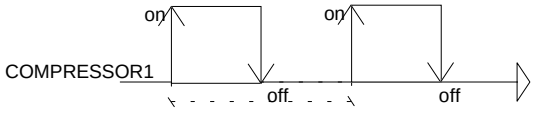
Min. ON of the compressor



Min. OFF of the compressor



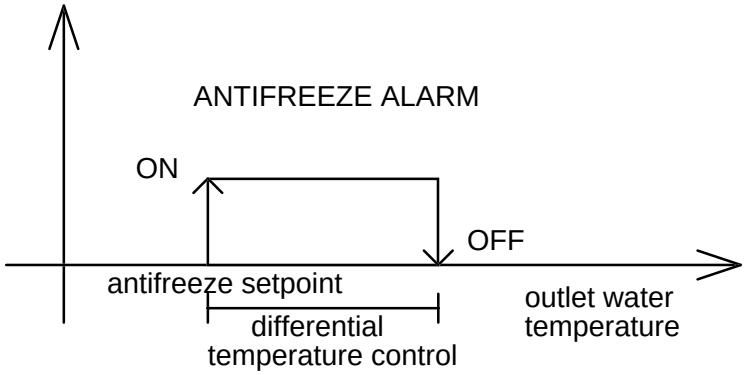
Time delay before starting the second compressor



Time delay between two consecutive ON of the same compressor

Antifreeze procedure

The antifreeze procedure is activated only in the Summer functioning mode.
The antifreeze alarm stops all the connected devices except the electropump.
The antifreeze control action depends on the temperature values measured at the evaporator outlet. When the temperature falls below the previously selected antifreeze set-point the alarm will persist until the temperature rises and reaches a value higher than set-point + differential (Summer differential).



Low pressure pressurestat

FUNCTIONING LOGIC:

open contact =====>LOW PRESSURE CONDITIONS
closed contact =====>NORMAL PRESSURE CONDITIONS

The digital contact relative to the LOW PRESSURE pressurestat is used to detect any LOW pressure condition in the system (pressurestat contact OPEN while the compressor is normally running).

At start-up the pressurestat alarm is ignored for a 't' programmable time-interval (def. 40 sec.) so as to allow the system to reach normal pressure conditions.

When the unit works as 'heat pump' and a defrosting cycle is being performed, any low pressure pressurestat indication will be ignored.

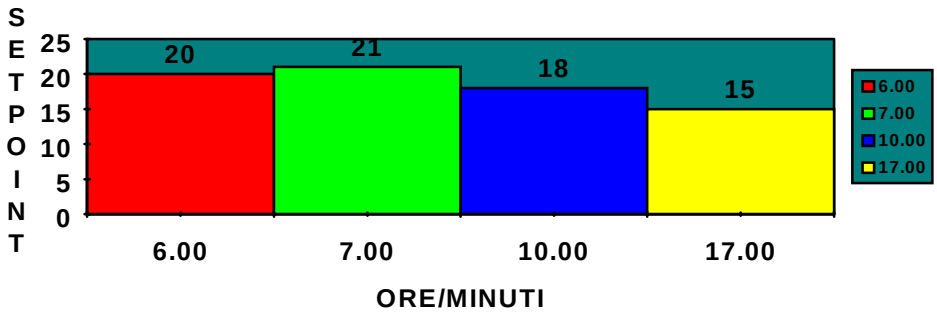
Each circuit is equipped with a LOW PRESSURE pressurestat.

Time-bands

The time-band control action proves to be an extremely useful option allowing pCO to work with a lower set-point during certain periods of the day and above all during the night, so as to avoid wasting energy.
pCO has programmable time-bands. All you have to do is just set them (hour and minutes) and their relative set-points.
The table below shows the working logic of a time-band control action.
Eg:

TIME	SETP.	EFFECT
06:00	20 °C	from 06:00 to 07:00 setpoint = 20 °C
07:00	21 °C	from 07:00 to 10:00 setpoint = 21 °C
10:00	18 °C	from 10:00 to 17:00 setpoint = 18 °C
17:00	15 °C	from 17:00 to 6:00 setpoint = 15 °C

In order to benefit the advantages of a time-bands control action, it is necessary to equip pCO with a clock card.
You can program up to 4 time-bands. Should you need less than 4, it is necessary to give the unused time-bands the same values.



The table below shows RIGHT and WRONG settings when using only TWO time-bands.

WRONG SETTING		RIGHT SETTING	
HOUR/MIN.	SETPOINT	HOUR/MIN.	SETPOINT
07:30	10 °C	07:30	10 °C
00:00	0	17:00	15 °C
00:00	0	17:00	15 °C
17:00	15 °C	17:00	15 °C

With 4 time-bands you can set 8 different set-points: one for the Winter, the other for the Summer mode, that is, two for each single time-band.

In addition to daily time-bands with set-point variation you can choose other two options allowing you to turn on and OFF the unit as follows:

- daily time-bands: eg. turn the unit ON at 8:00 and OFF at 17:00
- weekly time-bands: eg. turn ON the unit on Monday and OFF on Saturday

Supervisor

The table below shows the variables transmitted to the supervisory pc when the pCO controller is connected to it.

ADDRESS	DESCRIPTION	TYPE	IN/OUT
1	status of the electropump	digital	on display
3	status of compressor no. 1	digital	on display
4	status of compressor no. 2	digital	on display
7	status of capacity-controlled routine no. 1	digital	on display
8	status of capacity-controlled routine no. 2	digital	on display
16	status of the reversing cycle valve no. 1	digital	on display
17	status of the reversing cycle valve no. 2	digital	on display
20	general alarm	digital	on display
21	eeprom damaged: alarm	digital	on display
22	alarm: clock card broken or disconnected	digital	on display
24	antifreeze thermostat alarm	digital	on display
25	alarm: electropump circuit breaker	digital	on display
27	flowmeter alarm	digital	on display
29	alarm: high pressure pressurestat circuit no. 1 / circuit breaker compressor no. 1 / circuit breaker fan no. 1	digital	on display
30	alarm: high pressure pressurestat circuit no. 2 / circuit breaker compressor no. 2 / circuit breaker fan no. 2	digital	on display
33	B3 probe present	digital	on display
36	B4 probe present	digital	on display
45	B5 probe present	digital	on display
46	B6 probe present	digital	on display
53	alarm: oil differential pressurestat compressor no. 1	digital	on display
54	alarm: oil differential pressurestat compressor no. 2	digital	on display
59	summer functioning mode	digital	on display
60	winter functioning mode	digital	on display
61	simultaneous defrostings	digital	selectable
63	interlock alarm	digital	on display
65	alarm: low pressure pressostat circuit no. 1	digital	on display
66	alarm: low pressure pressostat circuit no. 2	digital	on display
73	alarm: high pressure circuit no. 1	digital	on display
74	alarm: high pressure circuit no. 2	digital	on display
77	end defrosting pressostat	digital	on display
79	alarm: exceeded high temperature threshold at evaporator inlet	digital	on display
80	alarm: exceeded low temperature threshold at evaporator inlet	digital	on display
81	alarm: request for maintenance compressor no. 1	digital	on display
82	alarm: request for maintenance compressor no. 2	digital	on display
85	status of the unit (ON/OFF)	digital	on display
86	selection on/off by supervisor	digital	selectable
87	status of fans circuit no. 1	digital	on display
88	status of fans circuit no. 2	digital	on display
89	alarm: inlet water temperature probe damaged	digital	on display
90	alarm: temperature probe circuit no. 1 damaged / external air damaged	digital	on display
91	alarm: temperature probe circuit no. 2 damaged	digital	on display
92	autostart (after a black-out)	digital	selectable
93	selection rotation compressors	digital	selectable
94	capacity-controlled routines	digital	on display
95	selection clock board	digital	selectable
96	selection weekly on/off timezone	digital	selectable
97	selection daily on/off timezone	digital	selectable
98	selection daily timezone with setpoint variation	digital	selectable
99	change hour	digital	selectable

ADDRESS	DESCRIPTION	TYPE	IN/OUT
100	change minutes	digital	selectable
101	change day	digital	selectable
102	change month	digital	selectable
103	alarm: outlet water temperature probe damaged	digital	on display
104	alarm: pressure probe circuit no. 1 damaged	digital	on display
105	alarm: pressure probe circuit no. 2 damaged	digital	on display
106	control probe (IN/OUT)	digital	on display
107	type of control action (P/P+I)	digital	selectable
108	compressors OFF only at defrosting start-up	digital	selectable
109	compressors OFF routine during defrosting	digital	selectable
110	selection pumpdown	digital	selectable
111	selection fan management	digital	selectable
112	alarm: general maintenance required	digital	on display
113	selection fan inverter	digital	on display
1	water temperature at evaporator outlet	analogue	on display
2	water temperature at evaporator inlet	analogue	on display
5	pressure circuit no. 1	analogue	on display
6	pressure circuit no. 2	analogue	on display
12	summer water temperature setpoint	analogue	selectable
13	summer temperature zone	analogue	selectable
14	winter water temperature setpoint	analogue	selectable
15	winter temperature zone	analogue	selectable
20	high pressure threshold	analogue	selectable
21	antifreeze threshold	analogue	selectable
22	summer high temperature threshold at evaporator inlet	analogue	selectable
23	summer low water temperature threshold at evaporator inlet	analogue	selectable
25	winter high temperature threshold at evaporator inlet	analogue	selectable
26	winter low water temperature threshold at evaporator inlet	analogue	selectable
27	start defrosting setpoint	analogue	selectable
30	end defrosting setpoint	analogue	selectable
31	coil temperature circuit no. 1 / external air	analogue	on display
32	coil temperature circuit no. 2	analogue	on display
33	water temperature setpoint of 1st winter time-band	analogue	selectable
34	water temperature setpoint of 2nd winter time-band	analogue	selectable
35	water temperature setpoint of 3rd winter time-band	analogue	selectable
36	water temperature setpoint of 4th winter time-band	analogue	selectable
37	water temperature setpoint of 1st summer time-band	analogue	selectable
38	water temperature setpoint of 2nd summer time-band	analogue	selectable
39	water temperature setpoint of 3rd summer time-band	analogue	selectable
40	water temperature setpoint of 4th summer time-band	analogue	selectable
41	water temperature setpoint	analogue	on display
42	inverter output	analogue	on display
43	dead-zone differential around the set-point	analogue	selectable
44	fans starting point	analogue	selectable
45	fans stopping point	analogue	selectable
48	modulation starting of fan inverter in winter	analogue	selectable
49	modulation end of fan inverter in winter	analogue	selectable
50	modulation starting of fan inverter in summer	analogue	selectable
51	modulation end of fan inverter in summer	analogue	selectable
52	min. value fan inverter	analogue	selectable
53	max. value fan inverter	analogue	selectable
54	threshold at which fan inverter is off in winter	analogue	selectable
55	threshold at which fan inverter is off in summer	analogue	selectable
10	working hours compressor no. 1	integer	on display
11	working hours compressor no. 2	integer	on display

ADDRESS	DESCRIPTION	TYPE	IN/OUT
15	time-delay before oil differential alarm	integer	selectable
16	time-delay before inlet water high temperature alarm	integer	selectable
21	max. defrosting time	integer	selectable
23	defrosting starting time	integer	selectable
24	time-delay before interlock alarm	integer	selectable
25	time-delay before low pressure pressostat alarm	integer	selectable
26	time-delay before flowmeter alarm during normal functioning	integer	selectable
27	time-delay before flowmeter alarm at start-up	integer	selectable
28	number of compressors	integer	on display
29	compressors threshold (hours)	integer	selectable
30	current hour	integer	on display
31	current minutes	integer	on display
32	change current hour	integer	selectable
33	change current minutes	integer	selectable
34	current day	integer	on display
35	current month	integer	on display
36	change current day	integer	selectable
37	change current month	integer	selectable
38	year	integer	selectable
39	time (hour) when starting the unit	integer	selectable
40	minutes when starting the unit	integer	selectable
41	time (hour) when turning off the unit	integer	selectable
42	minutes when turning off the unit	integer	selectable
43	day when turning on the unit	integer	selectable
44	day when turning off the unit	integer	selectable
45	hour of 1st time-band with set-point variation	integer	selectable
46	hour of 2nd time-band with set-point variation	integer	selectable
47	hour of 3rd time-band with set-point variation	integer	selectable
48	hour of 4th time-band with set-point variation	integer	selectable
49	minutes of 1st time-band with set-point variation	integer	selectable
50	minutes of 2nd time-band with set-point variation	integer	selectable
51	minutes of 3rd time-band with set-point variation	integer	selectable
52	minutes of 4th time-band with set-point variation	integer	selectable
53	integration time P+I regulation	integer	selectable
54	time cyclic printout	integer	selectable
55	unit timer threshold	integer	selectable
56	min. time compressors off routine	integer	selectable
57	time-interval for compressors off routine during defrosting	integer	selectable
58	min. time compressors on routine	integer	selectable
59	time-delay before capacity-controlled routines	integer	selectable
60	min. time-interval between consecutive startings of the same compr.	integer	selectable
61	min. time-interval between consecutive startings of different compr.	integer	selectable
62	max. pumpdown time	integer	selectable
63	time-delay before stopping the electropump	integer	selectable
64	working hours of the unit	integer	on display
65	fan inverter starting time	integer	selectable

Printout

Periodic or immediate printouts allow you to keep under control the entire system (connection to a 80 column serial printer).
In the event of alarm conditions the relative printout will report date and time of the OFF-normal condition.

MESSAGGE	TYPE

Pressure 2	Immediate or periodic
Pressure 1	Immediate or periodic
2nd Coil temperature	Immediate or periodic
1st Coil or external air temperature	Immediate or periodic
Outlet water temperature	Immediate or periodic
Inlet water temperature	Immediate or periodic
Set-point	Immediate or periodic
High pressure pressurestat no. 2	Alarm
Compressor no. 2 circuit breaker	Alarm
Fan no. 2 circuit breaker	Alarm
High pressure pressurestat no. 1	Alarm
Compressor no. 1 circuit breaker	Alarm
Fan no. 1 circuit breaker	Alarm
Electropump circuit breaker	Alarm
Flowmeter	Alarm
Antifreeze	Alarm
High pressure circuit no. 2	Alarm
High pressure circuit no. 1	Alarm
Low temperature at evaporator inlet	Alarm
High temperature at evaporator inlet	Alarm
Maintenance compressor no. 2	Alarm
Maintenance compressor no. 1	Alarm
Unit maintenance	Alarm
Low pressure pressurestat no. 2	Alarm
Low pressure pressurestat no. 1	Alarm
Oil differential no. 2	Alarm
Oil differential no. 1	Alarm
Interlock	Alarm
Pressure probe no. 2 broken or disconnected	Alarm
Pressure probe no. 1 broken or disconnected	Alarm
2nd coil probe broken or disconnected	Alarm
1st coil probe broken or disconnected	Alarm
Output probe broken or disconnected	Alarm
Input probe broken or disconnected	Alarm
Clock does not work	Alarm
Eeprom damaged	Alarm

Mask tree

The top left-hand corner on the display represents the HOME position.

You can read the masks loop by simply acting on pCO's keypad.
For further information about the buttons, see 'Keypad' above.

The parameters in the masks below have been given default values.

MENU loop

MAIN MASK

```
 00:00 00/00/98  SUM
Water Tmp. In 00.0°C
Water Tmp.Out 00.0°C
      ALARM
```

The mask above shows the value measured by the water temperature probes at evaporator inlet and outlet.
The first row indicates the current time and date if pCO is equipped with clock card as well as the controller's functioning mode (Summer or Winter).

The last row shows the status of the unit (ON, OFF, manual mode, remote OFF, OFF from supervisor, OFF from time-bands control action).
In the event of OFF-normal condition, the indication on the 4th row will be replaced by a flashing message: 'ACTIVE ALARM'.

MAINTENANCE loop

M_VIS_TIMER

```
Operating hours
Unit           00000
Compressor 1   00000
Compressor 2   00000
```

M_PASS_MAN

```
Enter Maintenance
Password
              1234
Right Password
```

M_SOG_TIMER

```
Maint.Hour Threshold
Unit           20000
Compressors    10000
```

M_RS_TIMER

```
Req.Reset Hour Meter
Unit            N
Compressor 1    N
Compressor 2    N
```

M_CALIBRATION1

```
Probe Adjust
Water In     0.0 °C
Water Out    0.0 °C
Pack 1       0.0 °C
```

M_CALIBRATION2

```
Probe Adjust
Pack 2       0.0 °C
Pressure 1   0.0 bar
Pressure 2   0.0 bar
```

M_MANUAL1

```
Manual Procedure
Elect.Driven Pump N
Compressor 1       N
Compressor 2       N
```

M_MANUAL2

```
Manual Procedure
Capacity Step 1   N
Fan 1             N
Reverse Valve 1   N
```

M_MANUAL3

```
Manual Procedure
Capacity Step 2   N
Fan 2             N
Reverse Valve 2   N
```

M_PASS_MAINT

```
Enter New
Maintenance
Password      1234
```

Press the Maintenance button to access the mask where you can display the working hours of the unit and of each single compressor.

After having inserted the maintenance password (1234) you can access the following masks loops where you can:

- select the timer threshold for the unit and for the compressors. When such a threshold is exceeded, the relative alarm prompting maintenance will appear;
- use the mask M_RS_TIMER to zero down the working hours of unit and compressors;
- calibrate the connected probes;
- select the manual procedure. The electropump is always the first device to be started. The other two masks in the manual procedure loop allow you to set capacity-controlled routines, fans and reversing cycle valve in the manual mode relatively to circuit no. 1 and no. 2.
  When selecting the manual procedure, the ON/OFF button on the keypad will flash.
- the last mask gives you the possibility of changing the maintenance password.

PRINTER loop

M_PRINTER

```
Cyclic Print
        24 h
Immediate Print of
Report Unity      N
```

The mask above will appear only if pCo has been connected to a serial printer.
You can set the exact time you wish to get a printout of the main parameters (see list above) as well as immediate printouts of the same parameters.
In the event of OFF-normal condition the relative alarm message including type of alarm, date and time, will be immediately printed.

I/O loop

M_SYNOPTIC1

```
Water Temperature
Evap. Inlet   00.0°C
Evap. Outlet  00.0°C
```

M_SYNOPTIC2

```
Temperature Probe
Pack 1        00.0°C
Pack 2        00.0°C
```

M_SYNOPTIC3

```
Pressure Transducer
Circuit 1   00.0 bar
Circuit 2   00.0 bar
```

M_SYNOPTIC4

```
Digital Inputs
State     (1..12)
CCCCCCCCCCCC
```

M_SYNOPTIC5

```
Inverter Output
Value      00.0 Volt
```

M_SYNOPTIC6

```
Digital Outputs
State    (1..13) :
OOOOOOOOOOXO
```

The I/O loop displays the status of all analogue and digital inputs and outputs:

- value measured by the water temperature probes at evaporator inlet and outlet;
- either value measured by the coil temperature probes when the defrosting is based on two probes or value measured by the external air temperature probe;
- value measured by the pressure transducers;
- display of the status of digital inputs numbered 1 to 12;
- value of the analogue output dedicated to the fans inverter;
- display of the status of digital outputs numbered 1 to 13. The 12th output is indicated with an 'x' because it is not managed by pCO.

The probes that have not been selected in the manufacturer branch will not be displayed.

CLOCK loop

REG_CLOCK_US

```
Clock & Date
Setting
Time    00:00
Date    00/00/1998
```

WEEKLY_TIME-BANDS

```
Time Zone Selection
Unit On/Off
Weekly            N
Daily             N
```

WEEKLY1_TZ

```
Weekly Time Zone
Unit On at      Mon
Unit Off at     Sat
```

WEEKLY2_TZ

```
Daily Time Zone
Unit On at     00:00
Unit Off at    00:00
```

DAILY_TZ

```
Daily Time Zone
with Setpoint
Variation Setting
                  N
```

DAILY1_TZ

```
First Time Zone
Start at     00:00 h
Winter Set    45.0°C
Summer Set    12.0°C
```

DAILY2_TZ

```
Second Time Zone
Start at     00:00 h
Winter Set    45.0°C
Summer Set    12.0°C
```

DAILY3_TZ

```
Third Time Zone
Start at     00:00 h
Winter Set    45.0°C
Summer Set    12.0°C
```

DAILY4_TZ

```
Fourth Time Zone
Start at     00:00 h
Winter Set    45.0°C
Summer Set    12.0°C
```

The first mask appearing after having pressed the CLOCK button is a mask where you can select the presence of the clock card itself and set the current time and date.
If the card is not present but has been selected or has been badly connected or is damaged, the realtive alarm will appear on the display.
Time-bands masks can be accessed only if the controller is complete with clock card.

In the masks loop shown above you will have to set the following parameters:

- weekly and daily time-bands permitting the automatic ON/OFF of the unit at set times and days;
- days in which the unit must be switched ON and OFF (this mask will be displayed only if the weekly time-band mask has been previously enabled);
- ON/OFF time (this mask will be displayed only if the daily ON/OFF mask has been previously enabled);
- daily time-bands with set-point variation;
- time, Winter and Summer set-points relative to the first daily time-band with set-point variation;

- time, Winter and Summer set-points relative to the second daily time-band with set-point variation;
- time, Winter and Summer set-points relative to the third daily time-band with set-point variation;
- time, Winter and Summer set-points relative to the fourth daily time-band with set-point variation;

SET-POINT loop

M_VIS_SETPOINT

```
Temperature Setpoint
Adjustement with
Time Zones Present
              12.0°C
```

M_SETPOINT

```
Temperature Setpoint
Adjustement
Winter        45.0°C
Summer        12.0°C
```

The Set-point masks loop allows you to display the temperature set-point with daily time-bands and set-point variation.
If the time-bands control has not been enabled, pressing the SET button allows you to access directly the M_SETPOINT mask where you can select the values of Winter and Summer set-points.

INFO loop

M_VERSION

```
 CHILLER + HEAT PUMP
   Standard Carel
   code EPSTDEHP0A
ver 2.712   15/02/99
```

TEST

```
Final Test
       00/00/0000
```

The INFO masks display the date and version of the eeprom (first mask).
In the second mask you can set the time of the test.

USER PROGRAM loop

M_USER_PASS

```
Enter the Service
Password
              1234
Right Password
```

PARAMETERS_US1

```
Winter Temperature
Setpoint Limit
Minimum       35.0°C
Maximum       50.0°C
```

PARAMETERS_US2

```
Summer Temperature
Setpoint Limit
Minimum       05.0°C
Maximum       20.0°C
```

PARAMETERS_US3

```
Temperature Band
Adjustement
Winter        03.0°C
Summer        03.0°C
```

PARAMETERS_US4

```
Dead Zone Adjust.
Temperature   00.0°C
Probe Used for
Control     INPUT
```

PARAMETERS_US5

```
Defrost Start
Setpoint     -02.0°C
Defrost End
Setpoint      14.0°C
```

PARAMETERS_US6

```
Defrost Start
Delay Time  0030 min
Maximun Defrost
Delay Time  0060 min
```

PARAMETERS_US7

```
Simultaneous Circuit
Defrost Cycle     N
```

PARAMETERS_US8

```
Automatic Restart
After Black-Out   N
Remote On/Off     N
Remote Win/Sum    N
```

PARAMETERS_US9

```
Inlet Water Temper.
Threshold (Winter)
High          50.0°C
Low           15.0°C
```

PARAMETERS_UT10

```
Inlet Water Temper.
Threshold (Summer)
High          28.0°C
Low           10.0°C
```

PARAMETERS_US11

```
Anti-freeze Alarm
Setpoint     03.0 °C
High Pressure
Threshold   24.0 bar
```

PARAMETERS_US12

```
Inlet Water Low/High
Temperature Alarm
Delay Time
            030  min
```

PARAMETERS_US13

```
Interlock Alarm
Delay Time  000 sec
```

PARAMETERS_US14

```
Identification Numb.
for Supervisory
System Network   001
Baudrate       19200
```

PARAMETERS_US15

```
Enter New
Service Password
              1234
```

Press the 'PRG' button to access the User mask loop.

Then introduce the password (1234) and press the ▼ button to access the following masks where you can:

- set the lower and upper Winter set-point;
- set the lower and upper Summer set-point;
- set the winter/summer temperature working zone;
- set the temperature dead-zone around the set-point;
- select the type of probe used: temperature probes at evaporator inlet or outlet;
- set the start-defrosting temperature value (set-point);
- set the end-defrosting temperature value (set-point);
  Important: this value is not required if end-defrosting depends on the pressurestat (unit equipped with only one probe);
- set the time beyond which the temperature must remain below the start-defrosting set-point and the compressor of that circuit must be started before a defrosting cycle;
- set the max. time of the defrosting cycles relative to the two circuits;
- set simultaneous defrostings;
- select automatic start-up after a power failure condition while the unit is ON;
- select remote ON/OFF (digital input and/or supervisory pc);
- select the remote switch for summer/winter functioning modes (in this case the winter/summer buttons on the front panel keypad will be disenabled);
- set low and high water temperature thresholds at evaporator inlet (winter mode);
- set low and high water temperature thresholds at evaporator inlet (summer mode);
- set antifreeze value (set-point). When the water temperature at the evaporator outlet falls below the antifreeze set-point, the relative alarm will be displayed;
- set high pressure thrshold to be detected by the pressure transducers;
- set a time-delay before activating the high/low water temperature alarm (respectively in summer and winter modes) at evaporator inlet;
- set a time-delay before activating the interlock alarm;
- give the unit a specific address when it is network-connected into a supervisory system;
- set a baudrate for the serial connection to a supervisory system;
- set a different User keyword.
-

MANUFACTURER PROGRAM loop

M_MANUF_PASS

```
Enter Manufacturer
Password
              1234
Right Password
```

MANUFAC_MENU

```
Unit Configuration
Compressors
Global Parameter
Unit Initializat.
```

CONFIG_COS1

```
Clock Board       N
Printer Present   N
Supervisor        N
Part. Logic  DWM.COP
```

CONFIG_COS2

```
Enter Compressors
Number            1
Partial. Comp.    N
Fan Enable        Y
```

CONFIG_COS3

```
Inlet Water Temper.
Probe Present     Y
Outlet Water Temper.
Probe Present     Y
```

CONFIG_COS4

Pack 1 Probe Present	N
Pack 2 Probe Present	N

CONFIG_COS5

Pressure 1 Probe Present	N
Pressure 2 Probe Present	N

CONFIG_COS6

Pressure Probes Full Scale	
Minimum	00.0 bar
Maximum	30.0 bar

CONFIG_COS7

Fan Speed Regulator Present	N

COMPRESSOR_COS1

Compressor Turn Off Min. Time	0180 sec
Compressor Turn On Min. Time	0060 sec

COMPRESSOR_COS2

Time Between Starts Same Comp.	0360 sec
Time Between Starts Diff. Comp.	0010 sec

COMPRESSOR_COS3

Capacity Step Delay Time	010 sec

COMPRESSOR_COS4

Rotation Enable	Y
Pumpdown Enable	N
Pumpdown Maximun Time	020 sec

COMPRESSOR_COS5

Compres. Stop Enable on Defrost	N
Only Start Defr.	N
Off Time	010 sec

COMPRESSOR_COS6

Defrost Start by Ambient Air Probe & Stop by Pressostat	N

PARAMETERS_COS1

Temperature Control Type	P
Integrat. Time On Control P+I	600 sec

PARAMETERS_COS2

Motor-Driven Pump Off Delay Time	020 sec

PARAMETERS_COS3

```
Low Pressure Alarm
Delay Time  0040 sec.
Oil Differ. Alarm
Delay Time  0120 sec
```

PARAMETERS_COS4

```
Waterflow Switch
Delay when
Working      003 sec
Starting     010 sec
```

PARAMETERS_COS5

```
Flow Switch Alarm:
Manual Reset
(Turning OFF Pump)?
                  Y
```

PARAMETERS_COS6

```
Fans Management
Point of
Insertion   13.0 bar
Disinser.   12.5 bar
```

PARAMETERS_COS7

```
Fan Speed Regulator

Min Value    035.0 %
Max Value    075.0 %
```

PARAMETERS_COS8

```
Fan Speed Regulator
in Winter
Start       13.0.bar
Stop        09.0 bar
```

PARAMETERS_COS9

```
Fan Speed Regulator
in Summer
Start       13.0 bar
Stop        16.0 bar
```

PARAMETERS_COS10

```
Threshold at which
Speed Regul. is OFF
in Winter   16.0 bar
in Summer   08.0 bar
```

PARAMETERS_COS11

```
Fan Speed Regulator
Starting Time 02 sec
```

INITIALIZ_COS

```
Entering Default
Values

   OPERATION DONE
```

CH_PASS_COS

```
Setting New
Manufacturer
Password      1234
```

To access the above loop insert the manufacturer password, then press the ▼ button. A 4-choice menu will then be displayed. Use the ▲ and ▼ buttons to select the masks you need, then press 'Enter' to confirm.

Menu:

1st row - Unit Configuration	CONFIG_COS1
2nd row - Compressors	COMPRESSOR_COS1
3rd row - Global Parameters	PARAMETERS_COS1
4th row - Unit Initialization	INITIALIZ_COS

Correspondence between masks and loops:

1st loop - CONFIG_COS1	CONFIG_COS2 / 6
2nd loop - COMPRESSOR_COS1	COMPRESSOR_COS2 / 5
3rd loop - PARAMETERS_COS1	PARAMETERS_COS2 / 6
4th loop - INITIALIZ_COS	CH_PASS_COS

Important: you can display at any time - from any mask listed above belonging to the 'manufacturer program' loop - the MANUFACT_MENU by simply pressing the 'MENU' button once. Press it twice if you want to return to the MAIN menu mask.

Parameters you can select in the 1st masks loop:
- clock card (if you select the clock card but it is not present or is damaged, the alarm message AL_19 will be displayed);
- connection to external serial printer;
- presence of the supervisory pc;
- capacity-controlled routines logic: either DWM COPELAND (capacity-controlled routine when output is closed) or FEDDERS (open output);
- number of compressors to be controlled;
- compressors capacity-controlled routines;
- water temperature probe at evaporator inlet;
- water temperature probe at evaporator outlet;
- temperature probe circuit no.1;
- temperature probe circuit no.2;
- pressure probe circuit no.1;
- pressure probe circuit no. 2;
- min. and max. values for pressure probes (when al least one probe is connected);
- selection presence fan inverter.

In the 2nd masks loop you can set all parameters concerning the compressors:
- min. time compressors' OFF;
- min. time compressors' ON;
- min. time-interval between two consecutive ON routines of the same compressor;
- min. time-interval between two ON routines of different compressors;
- time-delay between two capacity-controlled routines or time-delay between a compressor's start-up and its capacity-controlled routine;
- compressors shift;
- pump-down procedure;
- max time pumpdown procedure (only if the procedure has been previosuly enabled);
- compressor OFF during defrosting;
- compressor OFF only when the defrosting cycle begins or at start/end defrosting (this parameter will be displayed only if the defrosting procedure has been previously enabled);
- time-interval relative to the compressor's OFF routine during defrosting (this parameter will be displayed only if the procedure has been previoulsy enabled);
- defrosting mode: depending on one or two probes (when using just one external air temperature probe the system also needs an end-defrosting pressurestat).

In the 3rd masks loop you can select the following parameters:
- type of regulation: Proportional or Proportional + Integral;
- integration time (when selecting a P+I regulation logic);
- time-delay before stopping the electropump after the unit has been turned OFF (unless there is an alarm condition);
- time-delay before activating the low pressure pressurestat alarm when the compressor starts;

- time-delay before activating the oil differential pressurestat alarm when the compressor starts;
- time-delay before the activation of the flowmeter alarm when the unit is working under steady conditions;
- time-delay before the activation of the flowmeter alarm when the electropump starts;
- pressure values determining the Start/Stop routines of the fans;
- minimum value that can be given to the analog output of the fan inverter;
- maximum value that can be given to the analog output of the fan inverter;
- value of the pressure which corresponds to the inverter speed regulation start in winter;
- value of the pressure which corresponds to the inverter speed regulation end in winter;
- value of the pressure which corresponds to the inverter speed regulation start in summer;
- value of the pressure which corresponds to the inverter speed regulation end in summer;
- threshold that indicates the value of the pressure which corresponds to the inverter switching off in winter (to activate the inverter again, a hysteresis of 0.5 bar must be exceeded);
- threshold that indicates the value of the pressure which corresponds to the inverter switching off in summer (to activate the inverter again, a hysteresis of 0.5 bar must be exceeded);
- time that allows to set the max. speed during starting of the device used to overcome the mechanical inertia of the engine.

-

The 4th masks loop allows you to perform the following operations:
- set factory-set values (this should be done when you start the unit the very first time and any time you change the unit eprom);
- set a new manufacturer keyword.

ALARM loop

AL_1

```
High Pressure Switch
Compr.Therm.Overload
Fan Therm. Overload
Circuit 1
```

This mask refers to digital input no. 11 relative to the high pressure pressurestat, compressor and fan circuit breakers of the 1st circuit.
In this case the OFF-normal condition forces compressor no.1 and relative fan to stop.

AL_2

```
High Pressure Switch
Compr.Therm.Overload
Fan Therm. Overload
Circuit 2
```

This mask refers to digital input no. 12 relative to the high pressure pressurestat, compressor and fan circuit breakers of the 2nd circuit.
In this case the OFF-normal condition forces compressor no.2 and relative fan to stop.

AL_3

```
Low Pressure Switch
Circuit 1
```

The low pressure condition in the 1st circuit forces compressor no. 1 to stop.

AL_4

```
Low Pressure Switch
Circuit 2
```

The low pressure condition in the 2nd circuit forces compressor no. 2 to stop.

AL_5

Oil Differential Pressure Switch Circuit 1

The oil differential OFF-normal condition in the 1st circuit forces compressor no. 1 to stop.

AL_6

Oil Differential Pressure Switch Circuit 2

The oil differential OFF-normal condition in the 2nd circuit forces compressor no. 2 to stop.

AL_7

Flow Switch Alarm

The flowmeter alarm forces the unit into the OFF status.

AL_8

Anti-freeze Alarm

The antifreeze alarm (digital input or water temperature at evaporator outlet lower than the selected antifreeze threshold) forces the OFF status of all connected devices except the electropump.
The alarm condition will disappear as soon as the temperature rises and reaches a value higher than the antifreeze point + differential (proportional logic, Summer functioning mode).

AL_11

Evaporator Inlet Water High Temper. Threshold Exceeded Alarm

The value measured by the water temperature probe at evaporator inlet exceeds the high temperature threshold previously set.

AL_12

Evaporator Inlet Water Low Temper. Threshold Exceeded Alarm

The value measured by the water temperature probe at evaporator inlet exceeds the low temperature threshold previously set.

AL_13

Evap. Inlet Water Temperature Probe Broken or or not Connected

Out-of-range value measured by the water temperature probe at evaporator inlet. The probe might be damaged. This alarm forces the unit into the OFF status.

AL_14

```
Circuit 1 Coil
Temperature Probe
Broken or
not Connected
```

This mask informs the Operator that:
- the temperature probe of the circuit pack no. 1 is either broken or disconnected;
- the external air temperature probe is either broken or disconnected (defrosting depending on only one probe).

AL_15

```
Circuit 2 Coil
Temperature Probe
Broken or
not Connected
```

This mask informs the Operator that the temperature probe of the circuit coil no. 2 is either broken or disconnected.

AL_16

```
Unit Running
Hours Threshold
Exceeded
Alarm
```

This alarm message alerts operating personnel that maintenance is required.

AL_17

```
Running Hours
Threshold
Exceeded Alarm
Compressor 1
```

This alarm message alerts operating personnel that the first compressor requires maintenance.

AL_18

```
Running Hours
Threshold
Exceeded Alarm
Compressor 2
```

This alarm message alerts operating personnel that the second compressor requires maintenance.

AL_19

```
Alarm
Clock Card
not Installed
or not Working
```

Clock card selected but disconnected or broken.

AL_20

```
Motor-Driven Pump
Thermal Overload
Alarm
```

The electropump circuit breaker alarm forces the unit and all connected devices into the OFF status.

AL_21

```
Interblock
Alarm
```

The intelock alarm forces the unit and all connected devices into the OFF status.

AL_22

```
Alarm
Eeprom Broken or
Absent
Call Assistence
```

The eeprom is damaged. Contact the nearest service centre.

AL_23

```
High Pressure
Threshold Exceeded
Alarm Circuit 1
```

The high pressure value measured by the transducer of the 1st circuit is too high.

AL_24

```
High Pressure
Threshold Exceeded
Alarm Circuit 2
```

The high pressure value measured by the transducer of the 2nd circuit is too high.

AL_25

```
Circuit 1
Pressure Probe
Broken Alarm
```

The pressure transducer of the 1st circuit detects out-of-range values.
The probe may be broken.

AL_26

```
Circuit 2
Pressure Probe
Broken Alarm
```

The pressure transducer of the 2nd circuit detects out-of-range values.
The probe may be broken.

AL_27

```
Evap. Outlet Water
Temperature Probe
Broken or not Conn.
Alarm
```

The water temperature probe at the evaporator outlet detects out-of-range values. The probe may be broken. This alarm forces the OFF status of the unit.

M_NO_ALARM

```
No Alarm
 Pending
```

No active alarms.

Selectable parameters

Meaning	Default	Lower Limit	Upper Limit	Unit of Measure
Unit max. working hours	20000	0	32000	h
Compressors max. working hours	10000	0	32000	h
Probes calibration	0	-9.9	9.9	°C
Printout cycle	24	0	99	h
Weekly ON/OFF time-zone	no			
Daily ON/OFF time-zone	no			
Day unit on	monday	sunday	saturday	
Day unit off	friday	sunday	saturday	
Hour unit on	4	0	23	h
Minute unit on	0	0	59	min
Hour unit off	18	0	23	h
Minute unit off	0	0	59	min
Daily time-bands with set-point variation	no			
Setpoint invernale prima fascia oraria	45.0	Lower limit winter set-point	Upper limit winter set-point	°C
Setpoint invernale seconda fascia oraria	45.0	Lower limit winter set-point	Upper limit winter set-point	°C
Setpoint invernale terza fascia oraria	45.0	Lower limit winter set-point	Upper limit winter set-point	°C
Setpoint invernale quarta fascia oraria	45.0	Lower limit winter set-point	Upper limit winter set-point	°C
Setpoint estivo prima fascia oraria	12.0	Lower limit summer set-point	Upper limit summer set-point	°C
Setpoint estivo seconda fascia oraria	12.0	Lower limit summer set-point	Upper limit summer set-point	°C
Setpoint estivo terza fascia oraria	12.0	Lower limit summer set-point	Upper limit summer set-point	°C
Setpoint estivo quarta fascia oraria	12.0	Lower limit summer set-point	Upper limit summer set-point	°C
Winter set-point	45.0	Lower limit winter set-point	Upper limit winter set-p oint	°C
Summer set-point	12.0	Lower limit summer set-point	Upper limit summer set-point	°C
Lower limit winter set-point	35.0	-99.9	99.9	°C
Upper limit winter set-point	50.0	-99.9	99.9	°C
Lower limit summer set-point	5.0	-99.9	99.9	°C
Upper limit summer set-point	20.0	-99.9	99.9	°C
Winter temperature differential	3.0	0	15.0	°C
Summer temperature differential	3.0	0	15.0	°C
Dead zone	0	0	3.0	°C
Probe used	input			
Start-defrosting set-point	-2.0	-50.0	50.0	°C
End-defrosting set-point	14.0	-50.0	50.0	°C
Time-delay before defrosting	30	1	9999	min
Max. defrosting time	60	1	9999	min
Simultaneous defrostings	no			
Automatic start	si			
Remote ON/OFF	no			
Remote Winter/Summer mode	no			
Winter high temperature threshold	50.0	-99.9	99.9	°C
Winter low temperature threshold	15.0	-99.9	99.9	°C
Summer high temperature threshold	28.0	-99.9	99.9	°C
Summer low temperature threshold	10.0	-99.9	99.9	°C
Antifreeze alarm set-point	3.0	-50.0	20.0	°C
High pressure threshold	24.0	0	99.9	bar
Time-delay before high/low inlet temperature	30	0	999	min
Interlock alarm delay	0	0	999	s
Unit address into supervisory network	1	0	200	
Baudrate comunicazione seriale	19200	1200	19200	bps
Clock board	no			
Printer	no			
Supervisory pc	no			
Capacity-controlled routines logic	DWM COP			
Number of compressors	1	0	2	
Capacity-controlled routines	no			
Fans	yes			
Inlet water temperature probe	yes			

Outlet water temperature probe	yes			
Temperature probe coil no. 1	no			
Temperature probe coil no. 2	no			
Pressure probe no. 1	no			
Pressure probe no. 2	no			
Pressure probes min. limit	0	-10.0	50.0	bar
Pressure probes max. limit	30.0	-10.0	50.0	bar
Fan inverter enabling	no			
Min. time compressors' OFF routine	180	0	9999	s
Min. time compressors' ON routine	60	0	9999	s
Time-interval between start-ups of the same compressor	360	0	9999	s
Time-interval between start-ups of two compressors	10	0	9999	s
Time-delay before capacity-controlled routine	10	0	300	s
Compressors shift enabled	yes			
Pumpdown enabled	no			
Max. pumpdown time	20	0	200	s
Compressors' OFF routine during defrosting cycle	no			
Compressors' OFF routine only when defrosting starts	no (also during defrosting end)			
Compressors' OFF time-interval during defrosting cycle	0	0	300	s
Temperature regulation logic	P			
Integration time	600	0	999	s
Time-delay before stopping the electropump	20	0	999	s
Low pressure alarm delay	40	0	9999	s
Oil differential alarm delay	120	0	9999	s
Flowmeter alarm delayed at start-up	10	0	999	s
Flowmeter alarm delayed during normal functioning	3	0	999	s
Manual reset of flowmeter alarm	yes			
Fans starting point	13.0	-10.0	50.0	bar
Fans stopping point	12.5	-10.0	50.0	bar
Minimum value of fan inverter	35.0	0	100.0	%
Maximum value of fan inverter	75.0	0	100.0	%
Modulation start of fan inverter in winter	13.0	pressure probe min. limit	pressure probe max. limit	bar
Modulation end of fan inverter in winter	9.0	pressure probe min. limit	pressure probe max. limit	bar
Modulation start of fan inverter in summer	13.0	pressure probe min. limit	pressure probe max. limit	bar
Modulation end of fan inverter in summer	16.0	pressure probe min. limit	pressure probe max. limit	bar
Switching-off threshold of fan inverter in winter	16.0	pressure probe min. limit	pressure probe max. limit	bar
Switching-off threshold of fan inverter in summer	8.0	pressure probe min. limit	pressure probe max. limit	bar
Fan inverter starting time	2	0	99	s