Application software for pCO²

Standard Air-Conditioners

Release 1.0 del 21/08/2001

Code : FLSTDECZ0A

Preliminary Version

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 OPERATING ON THE DEVICE, READ CAREFULLY THE INSTRUCTIONS IN THIS MANUAL.

This instrument, to which this software has been dedicated, has been designed to operate without risks only if:

- Installation, operation and maintenance of the software are performed according to the instructions of this manual and by skilled personnel;
- All the conditions established and contained in the installation manuals of the equipment in question.

Any different use or changes which have not been previously authorised by the manufacturer, are considered improper.
Responsibility for injures or damage caused by improper use will fall exclusively on the user.

Certification: the quality and safety of Carel products are guaranteed by Carel's **ISO 9001** certified design and production system, as well as the CE mark.

CONTENTS:

1 THE PROGRAM

1.1 Introduction

The program allows you to mange a conditioner with the following characteristics:
humidity and temperature control of technological or civil environments
1 to 2 compressors with or without capacity control
1 to 3 electrical resistances
valvole di riscaldamento modulanti 0-10Volt e 3 punti modulating
valvole di raffreddamento modulanti 0-10Volt e 3 punti
external or integrated humidifier
ventilatori di condensazione in pressione o comandati dai compressori
controllo temperatura di mandata
alarm, time, and signalling management
connection to supervisory networks
display and control of the quantities being measured;
programming of the configuration parmeters and of some e di alcuni parametri operativi with password-protected access
three access levels to the parameter-setting masks, managed by three different passwords
modification of the main operation parameters (Set Point, differentials, alarm thresholds, time)
multilingual management

1.2 General description

The air-conditioner standard permits the management of direct-expansion conditioning units, with compressors or valves.
Furthermore, it is possible not only to control the temperature but also the humidity through dehumidification and humidification, with special devices.
In addition, many accessory functions, which can be excluded when required, as the condensation fan control, the alarm data logging, the supervisory system, the current or voltage absorption of the conditioner……
All this is equipped with a sound alarm and time management of the devices, with immediate and lasting signals for a better protection of the devices.
According to the type of card being utilised (small, medium, large), it is possible to extend the utilisation of the program by connecting more and more probes devices (see 3.0).
The alarm signals relative to the various devices are connected to the pCO² card digital inputs.
Their intervention is signalled on the display that shows the specific masks and via the activation of a buzzer (only with the external terminal).
The program includes some masks for setting the functioning values and other masks for setting the machine configuration, all of them protected by password.
Three access levels to the protected masks are available, referring to three different passwords:

level 1	User Password (“user branch”): modifiable password, permits the access to the operation parameters of the controller.	Manufacturer value = 0
Level 2	After-sales service Password (“service branch”): modifiable password, that permits the access to the maintenance parameters.	Manufacturer value = 0
Level 3	Manufacturer’s Password (“manufacturer’s branch”): modifiable password that allows the access to all the machine configuration masks, included the one allowing you to set the new user, service and manufacturer’s password and also the one that permits the insertion of default values.	Manufacturer value = 1234

Table 1

There is a ***fixed*** password that gives access to any ram: ***1234***.
IMPORTANT: to prevent tampering during the machine operation, only skilful personnel must know the password.

2 HARDWARE DESCRIPTION

Below a description of the pCO^2 is given with reference to the essential layout, Large model with Built-in display.
Note that the medium pCO2 card lacks the connectors J19…J23; a small pCO2 card also lack the connectors J6…J8 e J16…J18 with respect to the reported diagram.

1. Power supply connector [G(+), G0(-)]
2. Green LED: indicates the presence of voltage supply; red LED: alarm
3. delayed 250 Vac, 2 A (T2 A) fuse
4. NTC, 0/1 V, 0/10 V, 0/20 mA, 4/20 mA universal analog inputs
5. NTC, PT1000, ON/OFF passive analog inputs
6. 0/10 V analog outputs
7. 24 Vac/Vdc digital input
8. 230 Vac or 24 Vac/Vdc digital inputs
9. connector for the synoptic terminal
10. connector for PCOT*, PCOI* standard terminals of the pCO^2 series and for the application software download
11. relay digital output
12. connector for the connection to the I/O expansion modules
13. connector, addressing and LED for the pLAN local network
14. door for the RS485 serial card insertion (for connection to Carel supervisory system serial line) or RS232 (modem interface)
15. door for the insertion of the connection card to a parallel printer
16. door for the insertion of the programming/memory expansion key
17. (LCD, buttons and LED) built-in terminal.

3 INPUT AND OUTPUT TABLE

3.1 DIGITAL INPUT

POWER VOLTAGE	INPUT NUMBER	PCO2 CARD SMALL	pCO2 CARD MEDIUM	pCO2 CARD LARGE
24Vac/Vdc	ID 1	Compress. 1 alarm	Flooding sensor	Flooding sensor
24Vac/Vdc	ID 2	Compress. 2 alarm	Auxiliary alarm	Auxiliary alarm
24Vac/Vdc	ID 3	Resistance 1 overload (thermal)	C1 low pressure	C1 low pressure
24Vac/Vdc	ID 4	Resistance 1 overload	C2 low pressure	C2 low pressure
24Vac/Vdc	ID 5	Fire sensor/ filter / flooding / auxil.	Dirty filters	Dirty filters
24Vac/Vdc	ID 6	Fan overload	Fan overload	Fan overload
24Vac/Vdc	ID 7	Air flow control	Air flow control	Air flow control
24Vac/Vdc	ID 8	On-Off from remote	On-Off from remote	On-Off from remote
24Vac/Vdc	ID 9	---	Resistance 1 overload	Resistance 1 overload
24Vac/Vdc	ID 10	---	Resistance 1 overload	Resistance 1 overload
24Vac/Vdc	ID 11	---	Humidif. water level	Humidif. water level
24Vac/Vdc	ID 12	---	Fire sensor	Fire sensor
24Vac/Vdc 230 Vac	ID 13 ID 13H	---	C1 general alarm (overload – high press.)	C1 high pressure
24Vac/Vdc 230 Vac	ID 14 ID 14H	---	C2 general alarm (overload – high press.)	C2 high pressure
24Vac/Vdc 230 Vac	ID 15 ID 15H	---	---	Compress. 1 overload
24Vac/Vdc 230 Vac	ID 16 ID 16H	---	---	Compress. 2 overload

3.2 ANALOG INPUTS

PROBE SIGNAL	INPUT NUMBER	PCO2 CARD SMALL	pCO2 CARD MEDIUM	pCO2 CARD LARGE
NTC / VI	B 1	Ambient humidity	Ambient humidity	Ambient humidity
NTC / VI	B 2	Circuit 1 high press.	Circuit 1 high press.	Circuit 1 high press.
NTC / VI	B 3	Circuit 2 high press.	Circuit 2 high press.	Circuit 2 high press.
NTC / PT1000	B 4	Ambient temperature	Ambient temperature	Ambient temperature
NTC / PT1000	B 5	Supply temperature / Free-Cool. Water	Supply temperature	Supply temperature
NTC / VI	B 6	---	Absorbtion probes / Free-C. water temp.	Absorption probes
NTC / VI	B 7	---	Humidif.conductivity	Humidif.conductivity
NTC / VI	B 8	---	Humidif. current / External air temp.	Humidif. current
NTC / PT1000/ ON-OFF	B 9	---	---	Free-C. water temp.
NTC / PT1000/ ON-OFF	B 10	---	---	External air temp.

3.3 DIGITAL OUTPUTS

CONTACT LOGIC	NUMBER OUTPUT	PCO2 CARD SMALL	PCO2 CARD MEDIUM	PCO2 CARD LARGE
NO	DO 1	Supply fan	Supply fan	Supply fan
NO	DO 2	Cooling valve opening / Compress.1	Cooling valve opening / Compress.1	Compressor 1
NO	DO 3	Cooling valve closing / Compress.2	Cooling valve closing / Compress.2	Compressor 2
NO	DO 4	Heating valve opening / Resistance 1	Heating valve opening / Resistance 1	Resistance 1
NO	DO 5	Heating valve closing / Resistance 2	Heating valve closing / Resistance 2	Resistance 2
NO	DO 6	Dehumidification / Compr. 1 flow contr.	Dehumidification	Dehumidification
NO	DO 7	Free – Cooling / Compr. 1 flow contr.	Free – Cooling / Slight alarms	Slight alarms
NO/ NC	DO 8	Generic alarms	Generic alarms / Serious alarms	Serious alarms
NO	DO 9	---	Cond. 1 fan / Compr. 1 flow contr.	Fan cond. 1 / Compr. 1 flow contr.
NO	DO 10	---	Cond. 2 fan / Compr. 2 flow contr.	Cond. 2 fan / Compr. 2 flow contr.
NO	DO 11	---	Humidification	Humidification
NO/ NC	DO 12	---	Humidif. entering water	Humidif. entering water
NO/ NC	DO 13	---	Humidif. leaving water	Humidif. leaving water
NO/ NC	DO 14	---	---	Cooling valve open.
NO/ NC	DO 15	---	---	Cooling valve clos.
NO	DO 16	---	---	Heating valve open.
NO	DO 17	---	---	Heating valve clos.
NO	DO 18	---	---	Free – cooling

3.4 ANALOG OUTPUTS

ACRONYM	OUTPUT NUMBER	pCO2 CARD SMALL	pCO2 CARD MEDIUM	pCO2 CARD LARGE
Y1	AO 1	Cold water valve	Cold water valve	Cold water valve
Y2	AO 2	Warm water valve	Warm water valve	Warm water valve
Y3	AO 3	Cond. Fan 1	Cond. Fan 1	Cond. Fan 1
Y4	AO 4	Cond. Fan 2/ Valve Free-Cooling	Cond. Fan 2/ Shutter or Free-Cooling valve	Cond. Fan 2
Y5	AO 5	---	---	Shutter or Free-Cooling valve
Y6	AO 6	---	---	---

4 FIRST INSTALLATION AND SOFTWARE UPDATE

To install the manufacturer's parameters onto the Pico means to write the buffer storage automatically, by means of a simple operation with the terminal. The buffer storage is of flash type and contains the software operation parameters (also in case of black-out).
The storage writing is necessary because the new and not yet utilised cards have a "dirty" storage, that is it contains unforeseeable data, but it is also necessary if you want to work again with the manufacturer's value on the pCO2 already utilised.
In the first case, namely the first time, the installation is automatically executed after you have "dumped" the software on the pCO2 card with the WINLOAD.EXE program; in the second case it is possible to do it at any moment with a manual operation from LCD terminal.
The table 24.1 contains the list of all the manufacturer's parameters, that is of all the setpoints, time, enabling interventions to be found in the program masks, with the values established by Carel.
After the installation, it is possible to modify all the parameters one at a time.

Description of the operations you must carry out to installate the manufacturer's parameter manual:

1. start the pCO² and wait until the main mask is visualised. If the software has been just installed with Winload.exe, IGNORE the alarms because they may be the result of incorrect data present in the buffer storage.
2. Press the MENU + PROG buttons, successively insert the password (1234)and press Enter; the password inhibits the access to the configuration branch by non authorised persons.
3. Seek the last row: "INITIALISATION->" and press ENTER.
4. Press the UP button. The parameter installation mask is displayed.
5. Select the configuration model to be configured;
6. Press ENTER and UP, for a few seconds the writing "PLEASE WAIT" will be shown; in this way the permanent storage will be erased and the manufacturer's parameters will be inserted.

NOTE: the manufacturer's parameter installation varies according to the type of card being utilised. If some standard values do not prove to be correct for the intended utilisation, the user can always change them at will both via mask and via supervisor, making the machine customisable according to the desired utilisation.
The main parameters to be verified are:

- the number of devices and their configuration;
- the language being utilised;
- the control parameters (Set Point, time, alarm threshold, etc.).

All the set data are held in an area of permanent storage to prevent them from being lost when the machine is deenergized.
It is possible, by using the WINLOAD program, to read the entire buffer storage and save it in a file for the successive programming. In this way, it is possible to modify, read and save various configurations for different air conditioner models.

5 LANGUAGE SELECTION

Once the software has been installed on the pCO2 card, the texts being displayed on the terminal are in Italian language. To select one of the other dialogue languages scheduled scheduled by the software (French, German and English), it is necessary to access the manufacturer's masks and reach the mask: Manufacturer \ Initialisations \ Mask name (?)
If you modify the parameter present in this mask, it is possible to change the dialogue language. When you have chosen the language, this remains in storage also if you carry out a new installation of the manufacturer's values (automatic or manual), or after a black-out.

6 GLOSSARY

Glossary of the technical terms:

- Step: defines an area of the proportional band (of temperature or humidity) within which a device is switched on and also defines at the same time the start and stop values of the device. See the graph 7.2
- Setpoint: defines a temperature (or humidity) value to be satisfied; the system activates the cooling or heating devices until the temperature or humidity equal the setpoint
- Default: this term defines the values, for example the setpoint and the temperature proportional band, automatically utilised by the system in the absence of modifications by the user; they are all listed in the table 24.1
- Proportional band: defines a temperature range of a few degrees beginning from the setpoint, within which the system carries out the management of the regulation devices; see the regulation graphs 7.1 … 7.11
- Dead zone – neutral zone: defines a very little temperature range between the setpoint and the proportional band, within which the devices do not start.
- Branch – loop: series of masks concerning the same argument and which therefore can be easily reached by only pressing the arrow buttons; the access to the branch occurs by pressing one of the terminal buttons, that visualises on the display the first loop mask.
- Mask: defines the display page being shown; the program is composed of the masks listed in the paragraph 27.0
- Incline: this term defines the range of a modulating valve from 0% to 100%
- 3-point valve – modulating valve: 3-point valve is a valve commonly in use, operated by 2 relays which control the time opening and closing respectively; modulating valve is on the contrary controlled by a 0-10V signal and is more precise
- Master: by Master is meant the pCO2 card that controls the pLAN local network and therefore all the other connected pCO2 card; usually it identify itself with the address 1 card, except when the latter is Off or disconnected
- Sleep mode: defines the Off state of a pCO2 unit when required by the Master unit, in the automatic Rotation mode

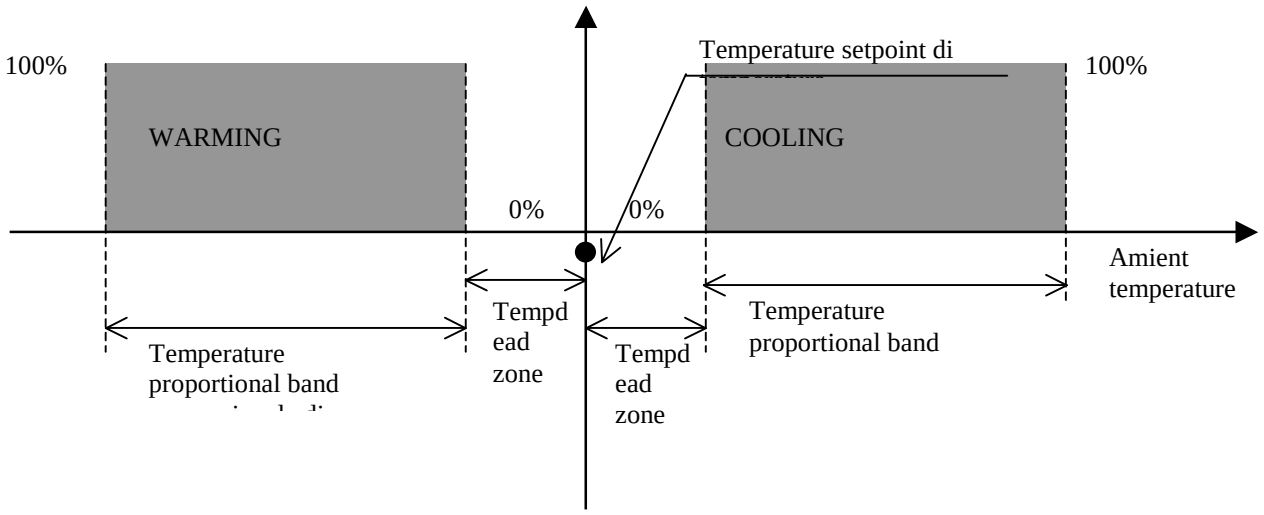
- Built-in: display located on the back of the pCO2 card
- Range: set of values available for a parameter; see table 24.1
- Entering air: is the air introduced into the ambient by the conditioner
- Leaving air – suction: air of the conditioned ambient, sucked by the conditioner
- Free cooling: introduction of external air into the conditioned space through opening of a shutter, in order to refresh the room by saving energy
- Manual: start and stop of all the devices connected to the pCO2 card outputs, from special masks and the unit being off.
- Buffer (storage): pCO2 memory on which the manufacturer's values of all the parameters chosen by Carel are stored. Permanent storage also in the absence of voltage.
- Buzzer: acoustic device mounted on the external terminals; sounds for a long time in case of alarm or briefly if the limits are exceeded when setting the parameters. The built-in terminals are not equipped with it.

7 TEMPERATURE REGULATION

The ambient temperature control is carried out by the pCO2 card by activating the cooling and heating devices connected to the outputs, modifying at any moment the requests according to the ambient temperature change with regard to the setpoint.
The devices utilised to regulate the ambient temperature are those being selected by the user in the manufacturer's branch; the masks that constitute this branch allowing you to choose, among a certain number of devices which depends also from the type of pCO2 card being utilised, which ones to use or not, according to the type of conditioner to be managed (see input and output table 3.0).
The following graphs offer a general description of the behaviour of all the possible devices.

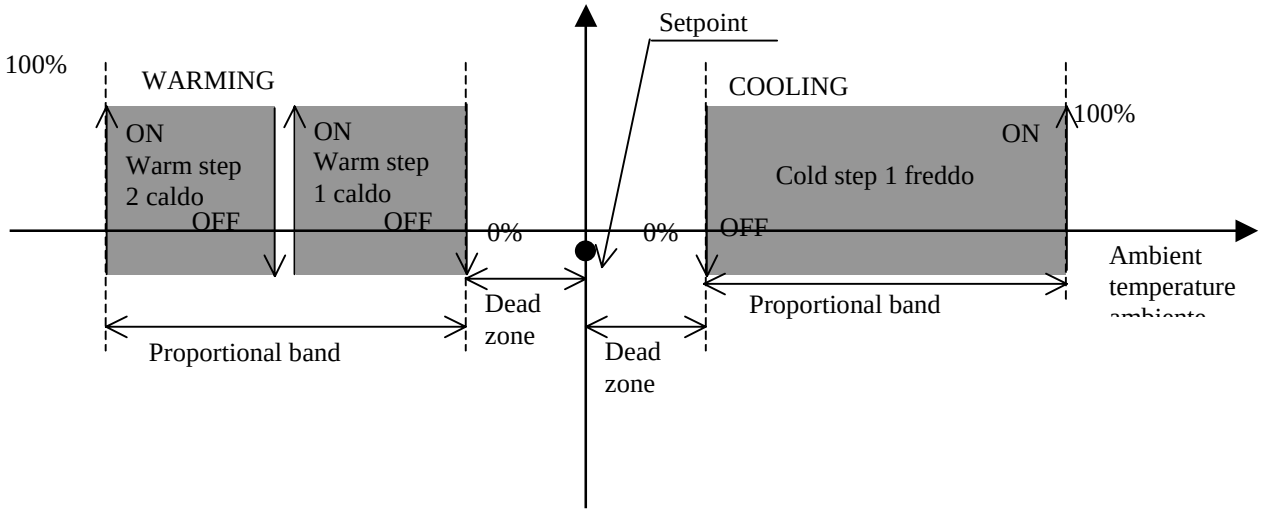
The graph below explains the relation between the parameters Setpoint, Dead zone and Proportional band.
The parameters Dead zone and Proportional band, mask selectable, are automatically applied both on the cooling zone and the warming zone. If the dead zone is 0, the proportional band begins in proximity to the setpoint and therefore turns out to be shifted with respect to the graph.

7.1 TEMPERATURE REGULATION GRAPH



The step locates an area of the proportional band within which a device is switched on. According to the type of conditioner and its number of compressors and resistors, it is possible to have 1 or 2 steps positioned on the proportional band.
The following graph illustrates, as an example, two heating steps (2 resistors) and a cooling step (1 compressor) positioned, namely they occupy the entire proportional band, dividing it into two equal parts in the case of two steps.
As we shall see below, with regard to Free Cooling and particular cases (see 10.0), the steps can be positioned and dimensioned manually by the user so as to obtain different steps within the proportional band or steps that do not occupy all the proportional band.

7.2 STEP DESCRIPTION GRAPH

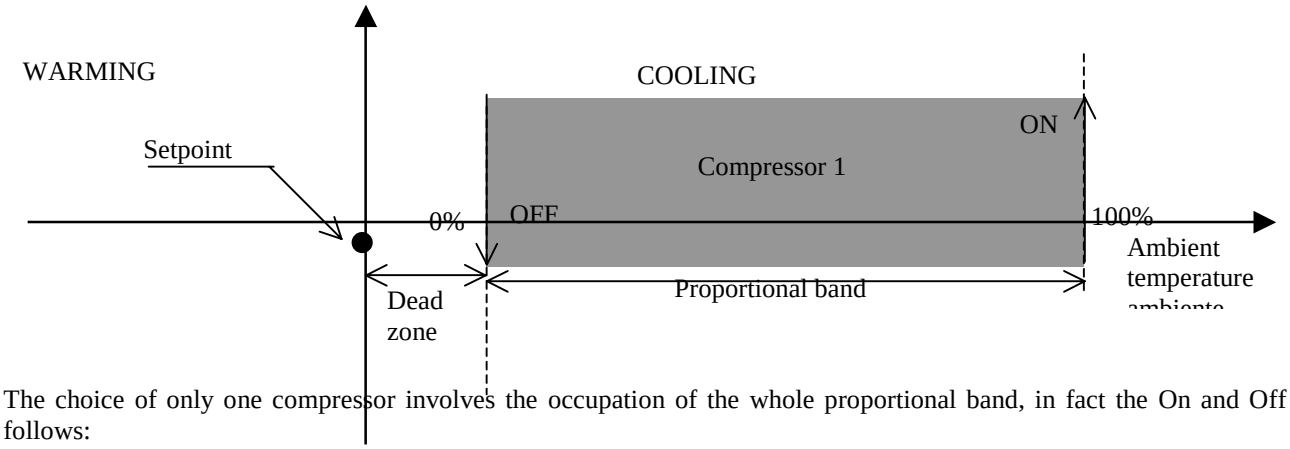


The cooling management can be carried out, according to the pCO2 utilised, by the following devices:

- 1 – 2 compressors (+ one flow control)
- chilled water modulating valve 0-10V
- chilled water 3-point valve

As we have already noted, not all these devices can be activated simultaneously, except in the pCO2 Large card. The following graphs show the behaviour of all the devices taken individually, to help the comprehension.

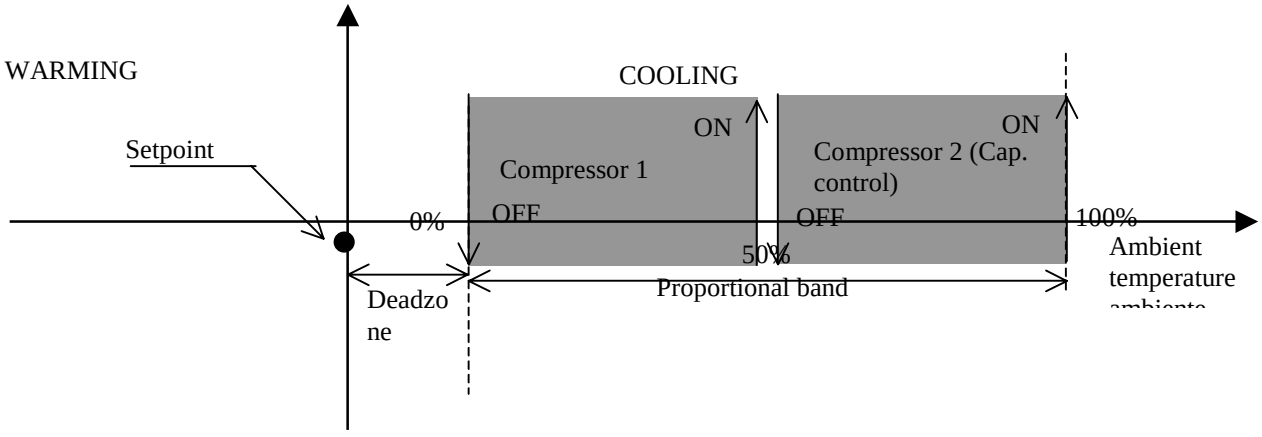
7.3 COOLING GRAPH WITH 1 COMPRESSOR



The choice of only one compressor involves the occupation of the whole proportional band, in fact the On and Off values are as follows:

ON COMP. → Ambient temperature > (Setpoint + Dead zone + Proportional band)
OFF COMP. → Ambient temperature < (Setpoint + Dead zone)

7.4 COOL. GRAPH WITH 2 COMPRESSORS OR 1 COMPR. + CAP. CONTROL

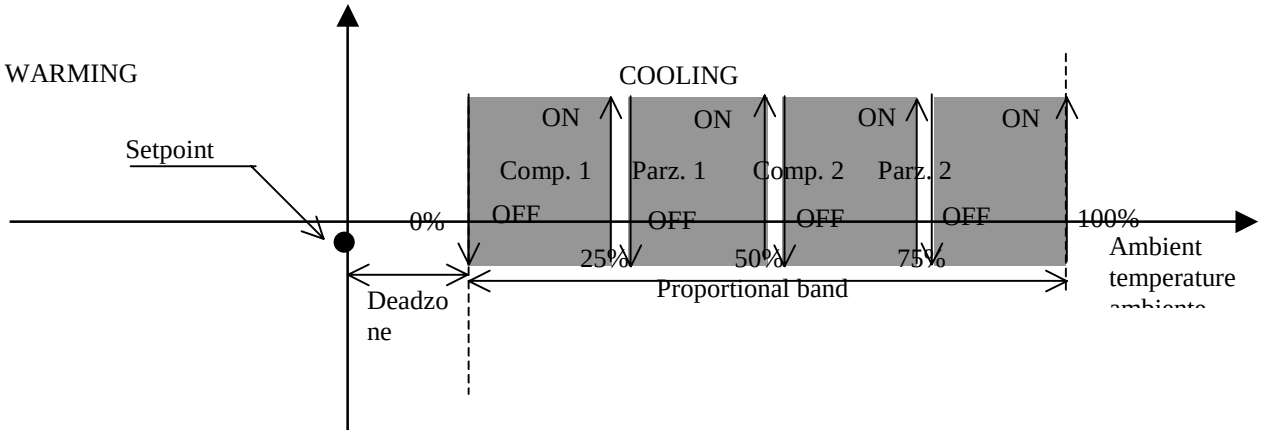


The two step selection (2 compressors or 1 compressor with the capacity control) involves the occupation of the entire proportional band exactly divided into two halves; actually, the On and Off values are as follows :

ON COMP.1 → Ambient temperature > (Setpoint + Dead zone + 50% Prop.band)
OFF COMP.1 → Ambient temperature < (Setpoint + Dead zone)

ON COMP.2 / CAP. CONTR. → Ambient temp. > (Setpoint + Dead zone + Prop.band) OFF COMP.2 / CAP. CONTR. → Ambient temp. < (Setpoint + Dead zone + 50% Prop.band)

7.5 COOLING GRAPH WITH 2 COMPRESSORS + CAPACITY CONTROL



The four step selection (2 compressors with capacity control) involves the occupation of the entire proportional band exactly divided into four halves; actually, the On and Off values are as follows :

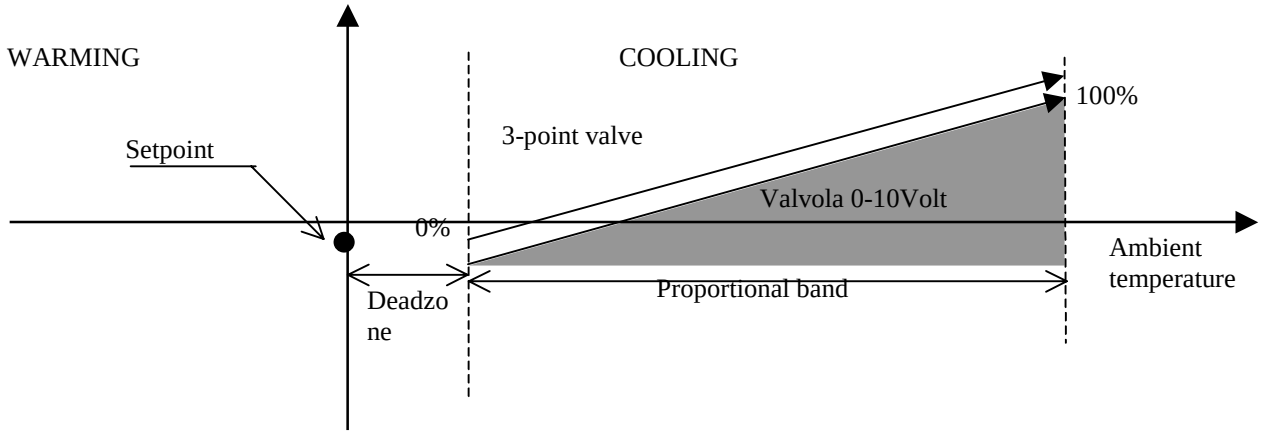
ON COMP.1 → Ambient temperature > (Setpoint + Dead zone + 25% Prop. Band)
OFF COMP.1 → Ambient temperature < (Setpoint + Dead zone)

ON CAP.CONTR.1 → Ambient temp. > (Setpoint + Dead zone + 50% Prop. band)
OFF CAP.CONTR.→ Ambient temp. < (Setpoint + Dead zone + 25% Prop. band)

ON CAP.CONTR.2→ Ambient temperature > (Setpoint + Dead zone + 75% Prop. band)
OFF CAP.CONTR.2→ Ambient temperature < (Setpoint + Dead zone + 50% Prop. band)

ON CAP.CONTR.2→ Ambient temp. > (Setpoint + Dead zone + Prop. band
OFF CAP.CONTR.2 → Ambient temp. < (Setpoint + Dead zone + 75% Prop. band)

7.6 COOLING GRAPH WITH 0-10V AND 3-POINT VALVES



As you can see, the characteristic of the two valves is the same and actually the effect is the same, namely they are open from minimum (0%) to maximum (100%) proportionally to the proportional band. The difference between the two valves is only due to the type of driving that in one case is a 0-10V modulating signal, more precise, whereas in the other case the management is provided by 2 time-activated relays, and is less precise.

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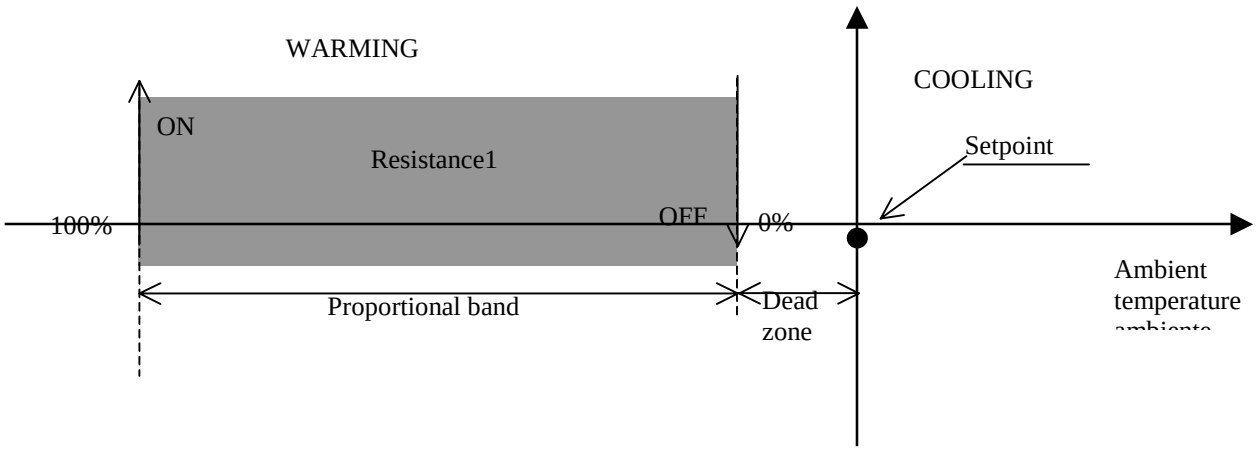
The heating management can be carried out, according to the pCO2 card being utilised, by the following devices:

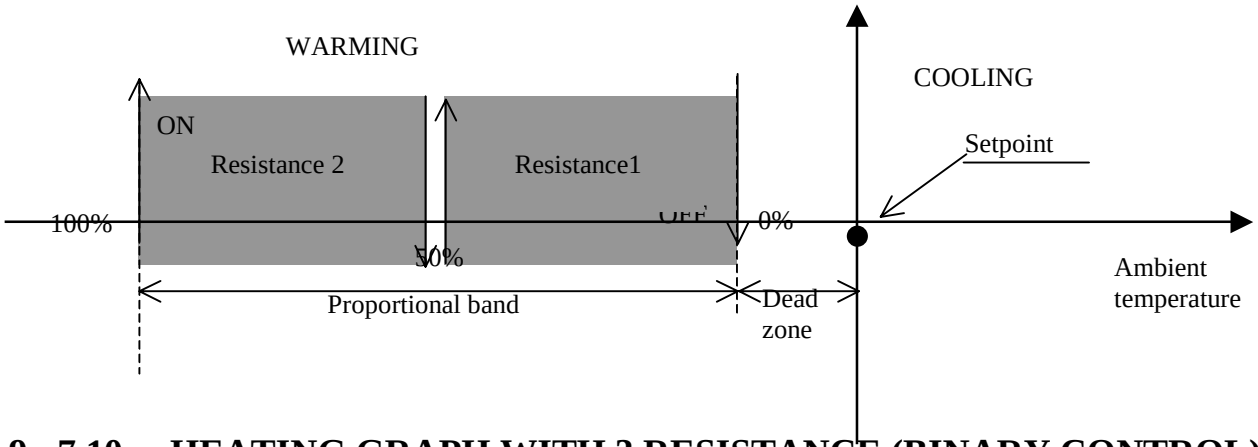
- 1 – 2 resistors (or 3 resistors managed in binary logic)
- warm water 0-10V modulating valve
- warm water 3-point valve

As already discussed, not all these devices can be activated simultaneously, except in the pCO2 Large card. The following graphs show the behaviour of all these devices taken separately, for a better understanding.

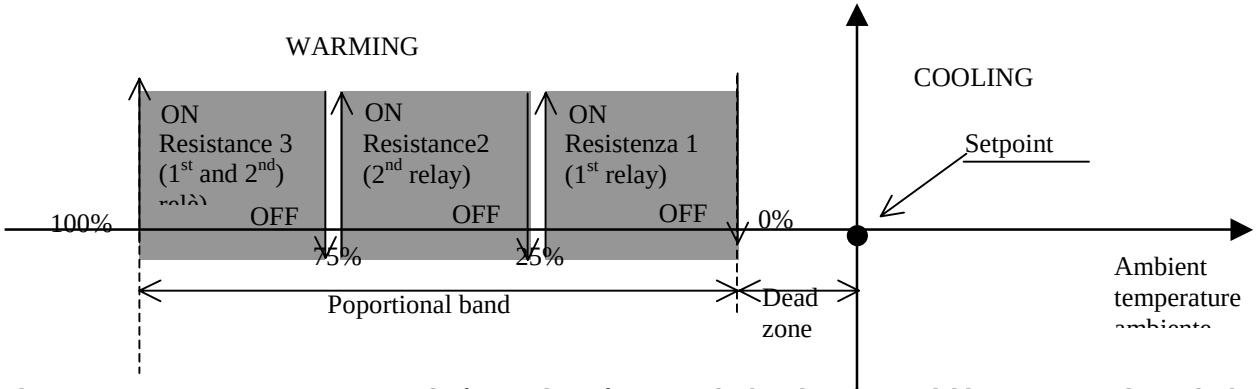
7.7 HEATING GRAPH WITH 1 RESISTANCE



7.8 HEATING GRAPH WITH 2 RESISTORS



7.9 7.10 HEATING GRAPH WITH 3 RESISTANCE (BINARY CONTROL)

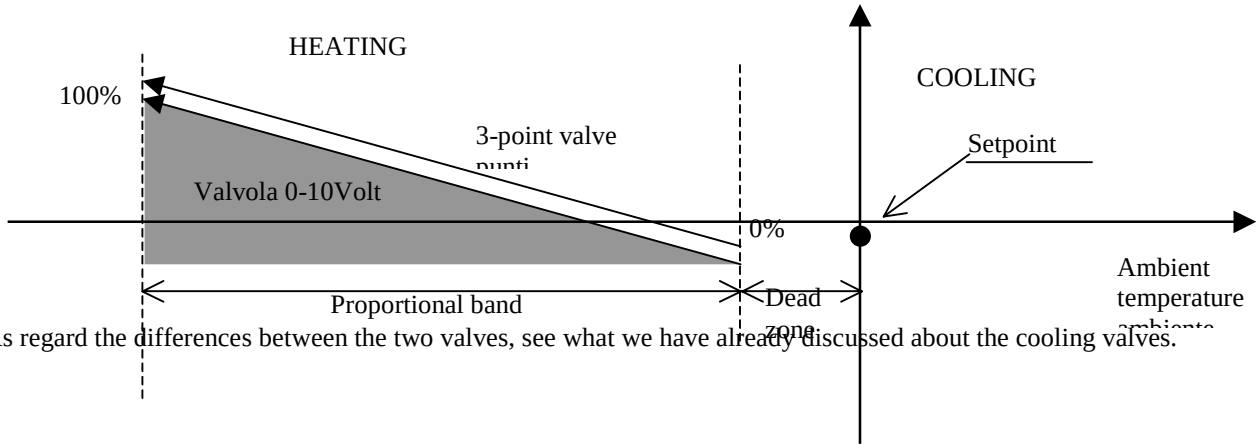


By binary management is meant a control of a number of resistors higher than the available outputs, applying the binary logic. The use of this system involves an electronic device connected to two outputs, being able to read the code and consequently activate the resistance.

With reference to the graph above, the logic being utilised is as follows:

1st relay ON – 2nd relay OFF (code 10)	→	RESISTANCE 1 activation
1st relay OFF - 2nd relay ON (code 01)	→	RESISTANCE 2 activation
1st relay ON - 2nd relay ON (code 11)	→	RESISTANCE 1 and 2 activation

7.10 HEATING GRAPH WITH THE VALVES (0-10V + 3-POINTS)



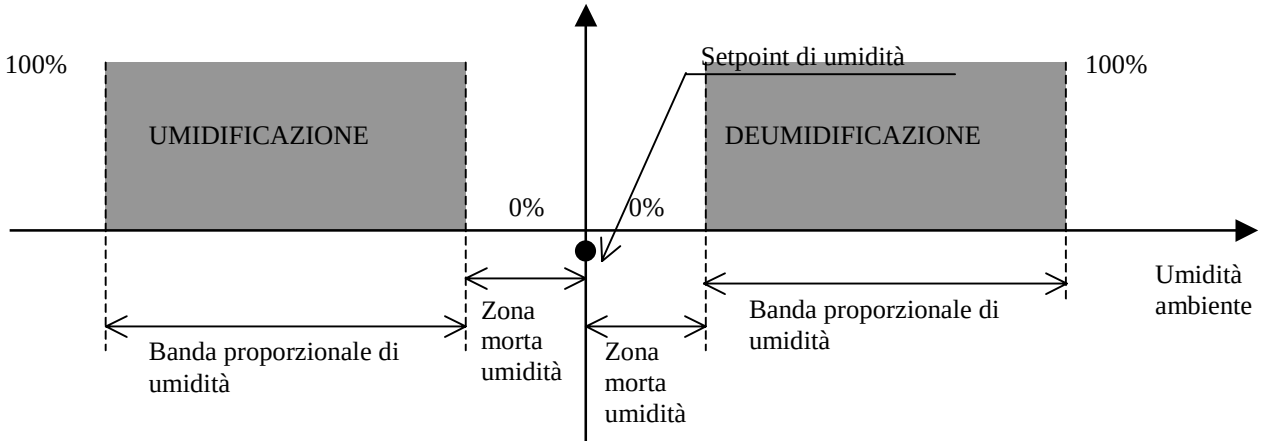
As regard the differences between the two valves, see what we have already discussed about the cooling valves.

8 HUMIDITY REGULATION

The ambient humidity control is carried out by the pCO2 card through the activation of the humidification and dehumidification devices connected to the outputs, modifying at any moment the requests according to the ambient humidity change with respect to the setpoint.
The devices utilised to regulate the ambient humidity are those selected by the user in the manufacturer's branch; The masks that constitute this branch allow you to choose among a certain number of devices, that depends also on the type of pCO2 card being utilised and on the type of conditioner to be managed (see input and output table 3.0).
The following graphs describe the general behaviour of all the possible humidity regulation devices.

The graph below explains the relationship between the following parameters: Humidity setpoint, Humidity dead zone and Humidity proportional band.

8.1 HUMIDITY REGULATION GRAPH



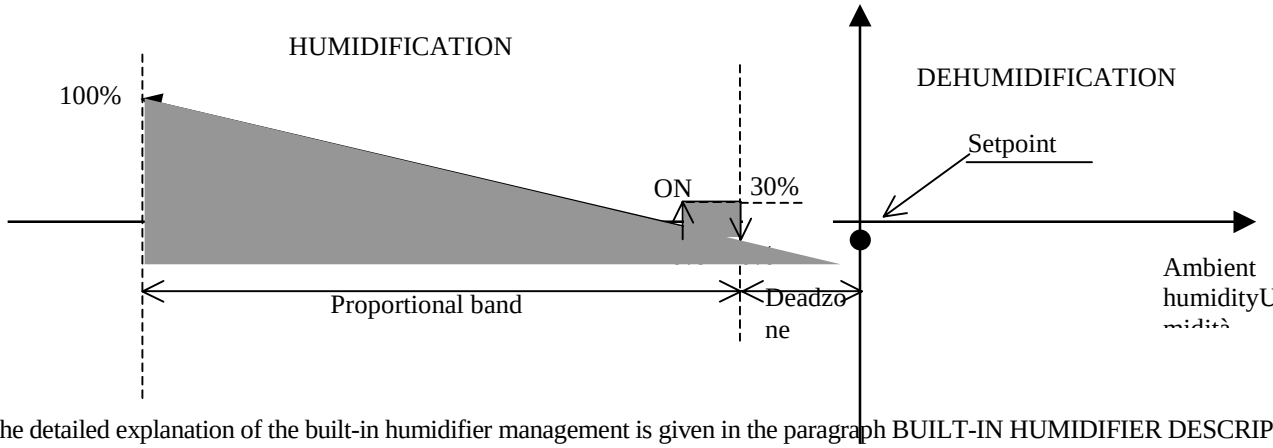
The Proportional band and Dead zone, selectable from mask, are automatically applied both on the humidification zone and on the dehumidification zone. When the dead zone is 0, the proportional band starts in proximity to the setpoint and consequently turns out to be shifted with respect to the graph.

As regards the step concept, the logic is the same with respect to the temperature management; see the STEP DESCRIPTION GRAPH, remembering that the Cooling zone corresponds to the Dehumidification, whereas the Warming corresponds to the Humidification zone.

The humidification management can be carried out, according to the pCO2 card being utilised, in the following way:

- external humidifier (managed by an On-Off contact)
- built-in humidifier (complete management of a Carel immersed electrode humidifier). The built-in humidifier management is not available with all types of cards, whereas the external humidifier management is always available; this is managed by a contact whose behaviour corresponds to the step shown in the HUMIDITY REGULATION GRAPH.

8.2 HUMIDIFICATION GRAPH WITH BUILT-IN HUMIDIFIER



The detailed explanation of the built-in humidifier management is given in the paragraph BUILT-IN HUMIDIFIER DESCRIPTION.
As shown in the graph, the output of an immerse electrode humidifier can not fall below 30% due to technical reasons.
While the graph only describes the result of the humidifier operation, that is to say the hourly steam output ranging from 30% to 100% proportionally to the proportional band, actually the pCO2 card manages several digital contacts and various digital and analog inputs, to control the humidifier. In fact the utilisation of this option allows you to save the CDA electronic control which otherwise would be necessary on the humidifier.

8.3 DEHUMIDIFICATION

The dehumidification management can be carried out, depending on the pCO2 card being utilised, in the following ways:

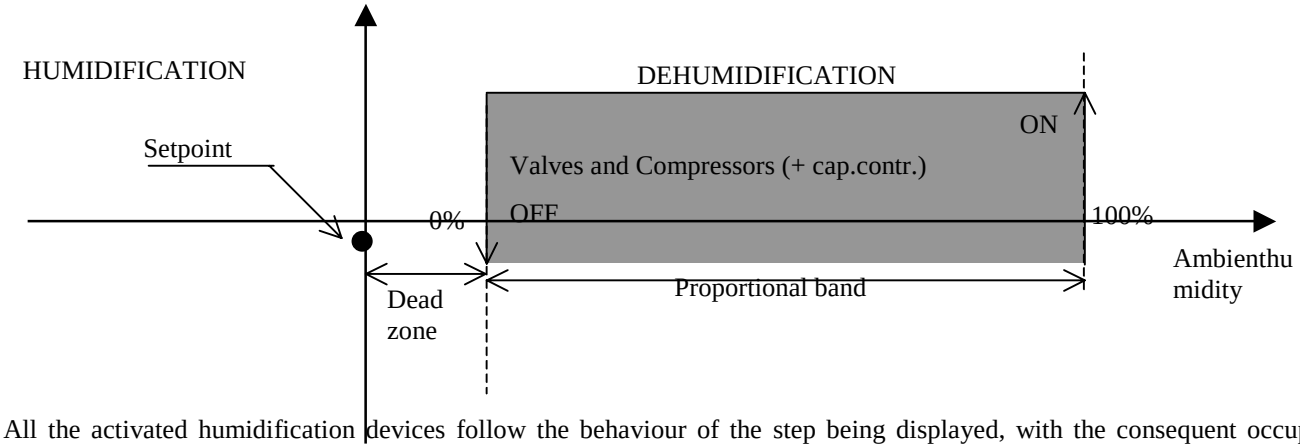
- On-Off contact for external device management
- One or two compressors with capacity controllers
- 0-10Volt modulating cooling valve
- 3-point modulating cooling valve

While the use of the On-Off clean contact to manage an external device is always available, all the other devices as always subjected to the type of card being utilised and to the enabling of each device by the user.

It is very important to notice that the cooling devices are also utilised for the dehumidification, and in this case they are always activated at their maximum power, that is the compressors being with capacity controls and the valves at 100%.
The devices, after a maximum capacity activation, keep on operating at the same rate until the setpoint is reached; only then they will be stopped. The dehumidification can take place only if the cooling reaches a maximum value, and that is why the devices are activated at their maximum power.

For the above mentioned reason, the behaviour of all the devices being used for the dehumidification can be illustrated in a single graph with a single step; this because both the valves and the compressors will switch on at the maximum allowed humidity (Setpoint + Dead zone + Proportional band) and stop as soon as they reach the humidity setpoint, remaining in the meantime at the maximum power.

8.4 DEHUMIDIFICATION GRAPH



All the activated humidification devices follow the behaviour of the step being displayed, with the consequent occupation of the whole proportional band. Actually, the start and stop values are as follows:
ON DEHUMIDIFICATION → Ambient humidity > (Setpoint + Dead zone + Prop. band)
OFF DEHUMIDIFICATION → Ambient humidity < (Setpoint + Dead zone)

9 FREE COOLING

The FREE COOLING conceptually is the cooling of the controlled space, utilising free cold sources or more economical than the conditioner itself. In practice either you utilise a cold water battery coming for example from a chiller, or you use external air. In the case of the battery, you have to drive a 0-10Volt modulating valve that controls the water intake, whereas in the case of the external air you have to drive a damper modulating the volume of air to be taken in. In both cases, a control device is required which checks constantly the water or air temperature, and stops the Free Cooling if the temperature is no more favourable. When the Free Cooling operates, you can manage the conditioner in two ways: either you keep Off all the normal cooling devices, or you can enable them, but in this case they only switch on at high temperature, that is if the Free Cooling by itself can not reduce the temperature.

The Humidification and Dehumidification functions are not conditioned by the Free Cooling and in any case to meet the dehumidification request, the cooling devices are activated also when Free Cooling is active.

There are some parameters which regulate the operation beginning of the Free Cooling and the possible operation of the cooling devices at the high temperatures. As regards the activation of the Free Cooling, the equation to comply with is the following one:

(Ambient temperature – Free Cooling Water/Air Temperature) > Delta Free Cooling

that is the water or air temperature of the Free Cooling must always be lower than the ambient temperature. The meaning of the Delta is to have a significant difference of temperature between the air/water of Free Cooling and the ambient temperature in order the Free Cooling to be efficient. Another necessary condition is that:

Ambient temperature > Setpoint

Actually, it is necessary for the room to be requiring cold, otherwise if you open the damper or activate the battery you could cause a damage. The management of the cold devices (compressors and valves) by means of active Free cooling; it is possible to choose between their disabling or the delayed start with respect to the normal values described in the graphs of the paragraph 7.0

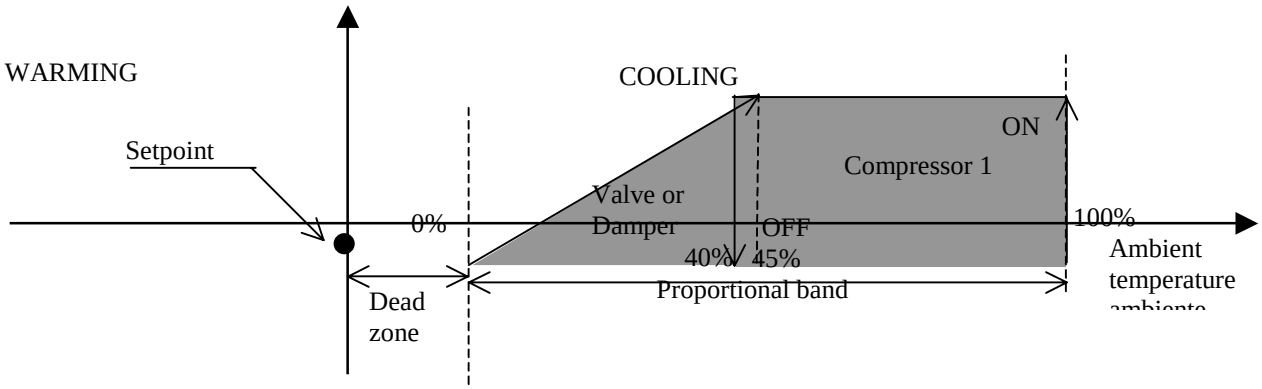
9.1 COLD DEVICE DISABLING

When the free cooling is active, the conventional cold devices can not start, even if the free cooling is not effective and the temperature for example continues to increase. If when the cold request is active the external conditions are no more favourable and the free cooling is Off, the cold devices return to a normal operation as described in the paragraph 7.0

9.2 COLD DEVICE DELAYED START

Function scheduled in the situations in which the free cooling is not always efficient. If, notwithstanding the activation of the free cooling, the temperature increases, the cooling devices switch on in order to add their effect and contribute to the temperature reduction, but they are switched off before the setpoint, in order to obtain energy saving. As shown in the following graphs, the steps of the cooling devices have been moved and made smaller compared to the graphs 7.0 to ensure the energy saving and their operation occur only when required; the values indicated in the graphs are for reference, namely they are established by Carel, but they may be modified at any moment. If , when the cold request is active, the external conditions are no more favourable and the free cooling is switched off, the cool devices operate again normally as described in the paragraph 7.0

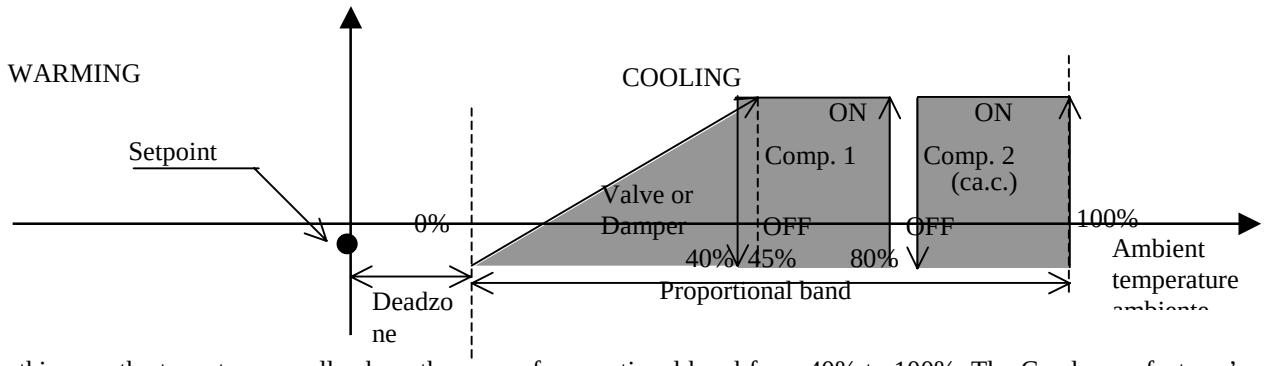
9.3 COOL. GRAPH WITH FREE COOLING AND 1 COMPRESSOR



As shown in the graph, the opening of the free cooling valve / damp takes place within the 45% of the proportional band. The compressor, if enabled when free cooling is active, starts at the usual temperature value stops in advance, that is under 40% of the proportional band; in fact the compressor in free cooling starts only to help, therefore after reducing the temperature it can stop and the free cooling keeps on operating by itself. Obviously all the start and stop values correspond to the Carel manufacturer's values, and are modifiable at any moment.

ON COMP. → Ambient temperature > (Setpoint + Dead zone + Proportional band)
OFF COMP. → Ambient temperature < (Setpoint + Dead zone + 40% Proportional band)

9.4 COOL. GRAPH WITH FREE COOLING AND 2 COMP. OR 1 COMP.+ CAP. CONTROL

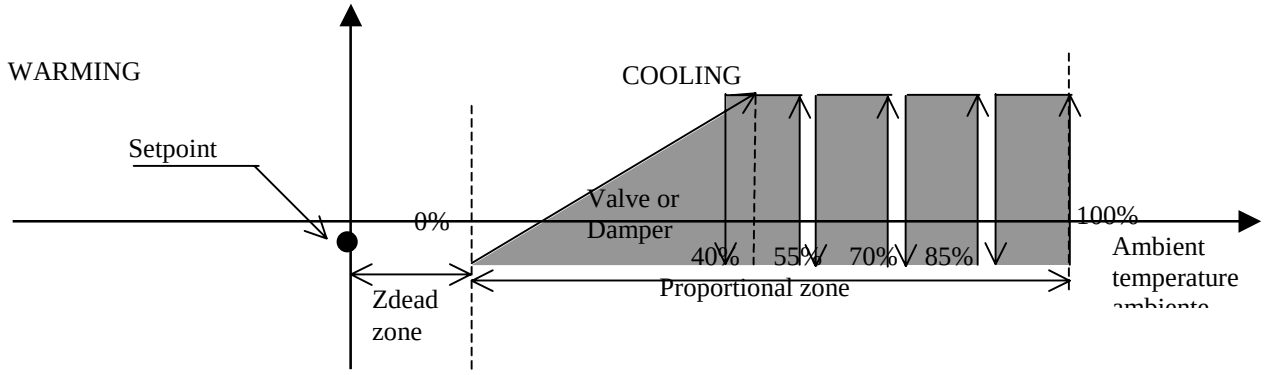


In this case the two steps equally share the zone of proportional band from 40% to 100%. The Carel manufacturer's values schedule two identical steps as shown in the graph. The free cooling valve or damper modulates from 0% to 45% of the proportional band.

ON COMP.1 → Ambient temperature > (Setpoint + Dead zone + 80% Prop. band)
OFF COMP.1 → Ambient temperature < (Setpoint + Dead zone + 40% Prop. band)

ON COMP.2 / CAP. CONTR. → Ambient temp. > (Setpoint + Dead zone + Prop. band)
OFF COMP.2 / CAP. CONTR. → Ambient temp. < (Setpoint + Dead zone + 80% Prop. Band)

9.5 COOLING GRAPH WITH FREE COOLING AND 2 COMP. + 2 CAP. CONTR.

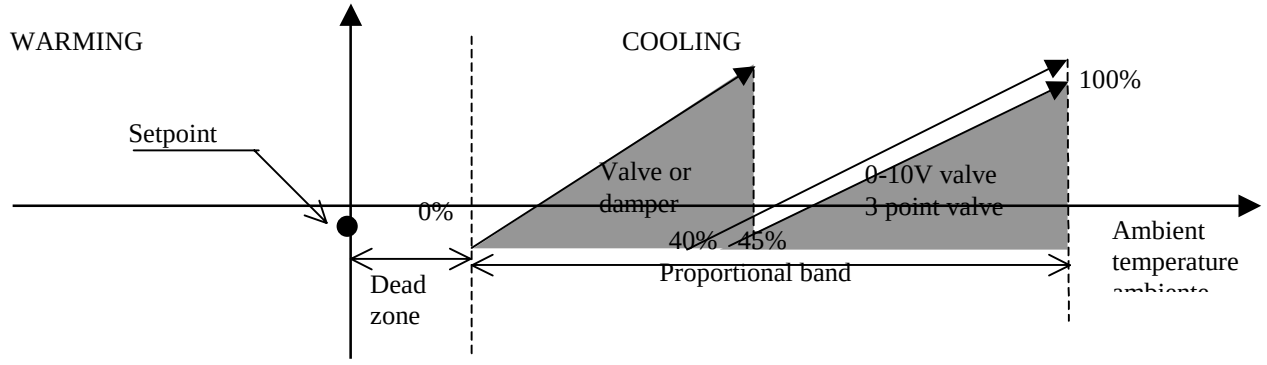


In this case the four steps share equally the proportional band zone ranging from 40% to 100%. The Carel manufacturer's values schedule four identical steps as shown by the graph. The free cooling valve or damper modulates from 0% to 45% of the proportional band.

COMP.1 ON → Ambient temperature > (Setpoint + Dead zone + 55% Prop. Band)
COMP.1 OFF → Ambient temperature < (Setpoint + Dead zone + 40% Prop. Band)
CAP. CONTR.1 ON → Amb. temperature > (Setpoint + Dead zone + 70% Prop. Band)
CAP. CONTR.1 OFF → Amb. temperature < (Setpoint + Dead zone + 55% Prop. Band)

COMP.2 ON → Ambient temperature > (Setpoint + Dead zone + 85% Prop. Band)
COMP.2 OFF → Ambient temperature < (Setpoint + Dead zone + 70% Prop. Band)
CAP. CONTR.2 ON → Amb. temperature > (Setpoint + Dead zone + Prop. Band)
CAP. CONTR.2 OFF → Amb. temperature < (Setpoint + Dead zone + 85% Prop. Band)

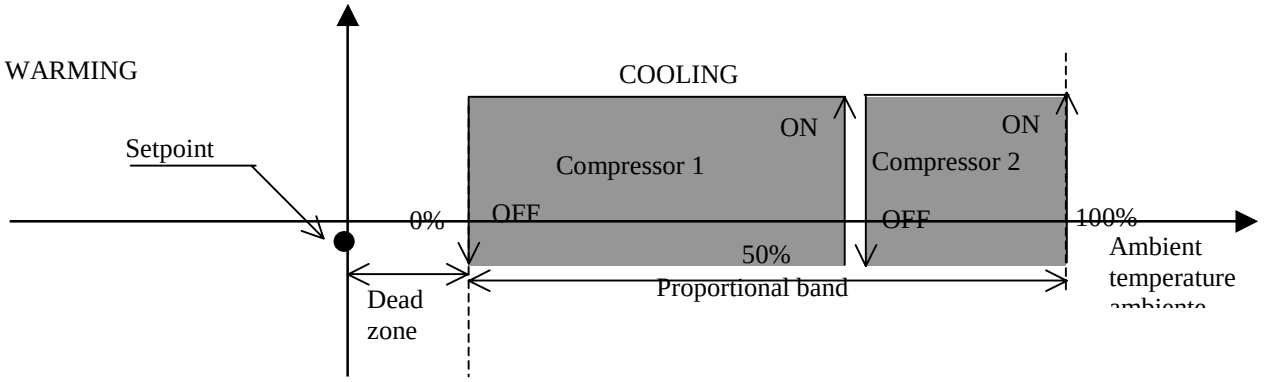
9.6 COOLING GRAPH WITH FREE COOLING AND 0-10V AND 3 P. VALVE



The range of the two valves in free cooling is reduced from 40% of the proportional band to 100%. As in the other cases, the free cooling valve or damper modulates up to 45% of the proportional band and this allows a slight overlap of the valves.

10 COMPRESSOR STEP SPECIAL MANAGEMENT

In all the graphs above we have used start and stop values of the devices, in relation to the proportional band, recommended by Carel and all available in the summary table of the manufacturer's values 24.1
All these parameters are also reported in some masks so allowing you to modify them at will.
For example, a conditioner with two compressors without different capacity controls (C1 > C2) will be regulated in following way. Remember that this, although being merely an example, apply to all the devices (valves, compressors, capacity controls, resistance) and all the configurations.



11 PROPORTIONAL AND PROPORT.+INTEGRAL REGULATION

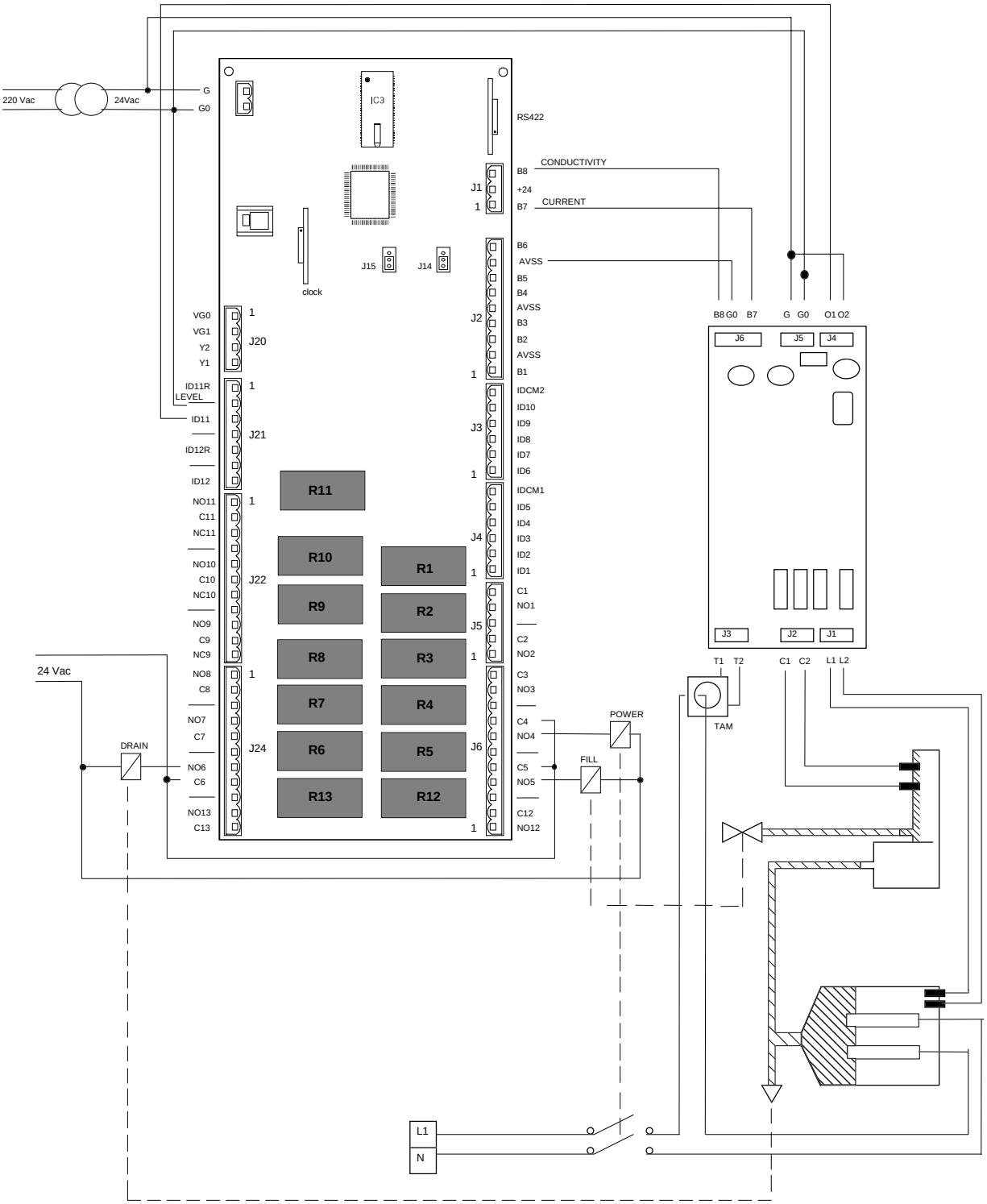
The temperature regulation can be of two types: Proportional (P) or Proportional + Integral (P+I); the selection can be carried out under the manufacturer's branch (see paragraph 27.0)
The proportional control (P) operates as a function of the difference between the ambient temperature value being measured and the temperature value you want (setpoint). The more remarkable is the difference between the two values, the more intense is the action of the devices; on the contrary, the more the ambient temperature approaches the setpoint, the more reduced become the action of the devices.
However, in certain spaces a thermal equilibrium may be reached notwithstanding the action of the devices, and it is therefore possible that the ambient temperature do not deviate from its value for a long time, thus maintaining constant the action of the devices which however is not sufficient to reach the setpoint.
The proportional + integral (P+I) control acts as a function of the difference between the ambient temperature value being measured and the temperature value you want (setpoint), and according to the time of permanence on the same value. When a selectable time is exceeded (integration constant), the control increases automatically the action by the devices, although the ambient temperature have been steady; this will allow you to reach the setpoint.

The humidity regulation is only of the proportional type.

12 BUILT-IN HUMIDIFIER MANAGEMENT

The program for the control of the Carel conditioners on pCO2 allow you to manage, when necessary, also a Carel external immerse-electrode humidifier enabling you to save the control electronic device which normally equips the humidifier.
In the program there are some masks which allow you to set and display all the parameters and the operation mode of the humidifier, exactly as if you were utilising the normal electronic control of the humidifier.
It is possible to manage the humidifier from 1 to 42 Kg/h ,three phase and single phase, with voltage supply from 200 to 660 Volts (we recommend the following voltages: 220-240 Volts or 380-415 Volts)
The pCO2 card that manages its control must interfaced to the humidifier simply by adding a card (code PCOUMID000) that permits the dialogue with the various signals from and to the humidifier.
The pCO2, according to the current and relative humidity signals, controls the production of steam and the humidifier operation conditions; furthermore it manages and signals all the states and alarms of the humidifiers.
All the parameters involved in the regulation of the built-in humidifier are listed in the Carel manufacturer's value paragraph .

12.1 PCOUMID000 CARD CONNECTION DIAGRAM.



12.2 C0-C1 PARAMETER SETTING TABLES

Among the humidifier parameters there are two parameters, C0 and C1, which vary according to the type of humidifier being connected. These are Carel constants which ensure a correct functioning of the humidifier.
The following tables report the C0 and C1 values as a function of the nominal output (columns) and of the power supply (rows) :

12.2.1 F200MA SINGLE PHASE CYLINDERS WITH 1 - 3KG/h NOM. OUTPUT

	Nominal Output in Kg/h					
	1 Kg/h		**2** Kg/h		**3** Kg/h	
	C0	C1	C0	C1	C0	C1
208	90	70	96	70	103	70
220	78	70	86	70	93	70
230	72	70	80	70	87	70
240	67	70	74	70	82	70

12.2.2 F400TA THREE-PHASE CYLYNDERS WITH 3 - 5 KG/h NOM. OUTPUT

	Nominal Output in Kg/h			
	3 Kg/h		**5** Kg/h	
	C0	C1	C0	C1
208	94	150	100	150
220	84	150	90	150
230	78	150	83	150
240	72	150	77	150
380	34	150	39	150
400	31	150	37	150
415	29	150	35	150
440	27	150	33	150
480	25	150	31	150
575	20	150	26	150

12.2.3 E400TA THREE-PHASE CYLYNDERS WITH 8 - 13KG/h NOM. OUTPUT

	Nominal Output in Kg/h			
	8 Kg/h		**13** Kg/h	
	C0	C1	C0	C1
208	95	250	103	250
220	84	250	93	250
230	78	250	85	250
240	72	250	79	250
380	34	250	37	250
400	32	250	34	250
415	30	250	32	250
440	28	250	30	250
480	26	250	27	250
575	21	250	22	250

12.2.4 I400TW THREE-PHASE CYLINDERS WITH 23 - 42 KG/h NOM. OUTPUT

	Nominal Output in Kg/h			
	23 Kg/h		**33** Kg/h	
	C0	C1	C0	C1
208	57	500	59	500
220	52	500	53	500
230	48	500	49	500
240	44	500	46	500
380	20	500	22	500
400	18	500	20	500
415	17	500	19	500
440	16	500	17	500
480	14	500	16	500
575	11	500	13	500

	Nominal Output	
	42 Kg/h	
	C0	C1
380	23	150
400	21	150
415	20	150
440	19	150
480	18	150
575	15	150

12.3 SELECTION OF THE TYPE OF HUMIDIFIER

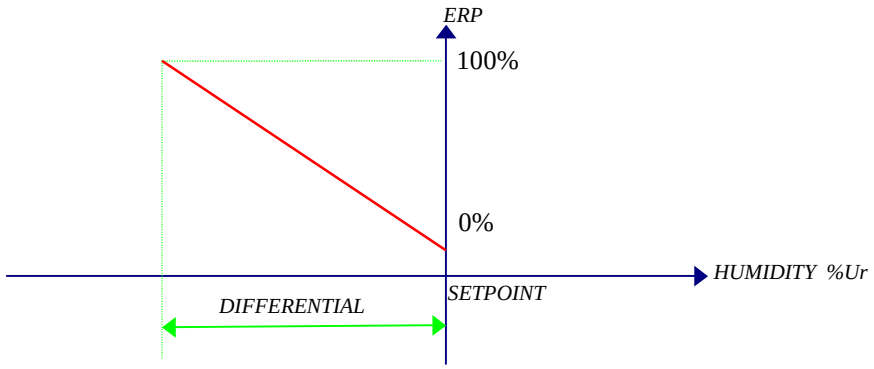
To select the type of humidifier to be connected you have to set as required 4 parameters in the masks dedicated to the humidifier under the manufacturer' s password.
NOMINAL OUTPUT: is the maximum output of steam that can be delivered by the humidifier being selected. You can set values ranging from 1Kg/h to 42 Kg/h.
VOLTAGE: is the grid voltage. You can set values ranging from 0Volts to 660Volts.
PHASE NUMBER: is the number of phases of the grid. You can set 1 or 3 phases (single phase or three phase).
TAM MODEL: You select the amperometric transformer being utilised, that is the device that measures the current between the electrodes. If you set 0= TAM 50 , 1=TAM 100 , 2=TAM 150 , 3= TAM 300 ,4=TAM 500 , 5=TAM 700.
DRAIN ENABLING WITHOUT VOLTAGE: when choosing this option, the humidifier stops in the short period of water discharge; it is important where the drains of the discharged water may make contact with persons also indirectly, since the humidifier water is live.

12.4 12.4 STEAM OUTPUT AND HUMIDITY REGULATION

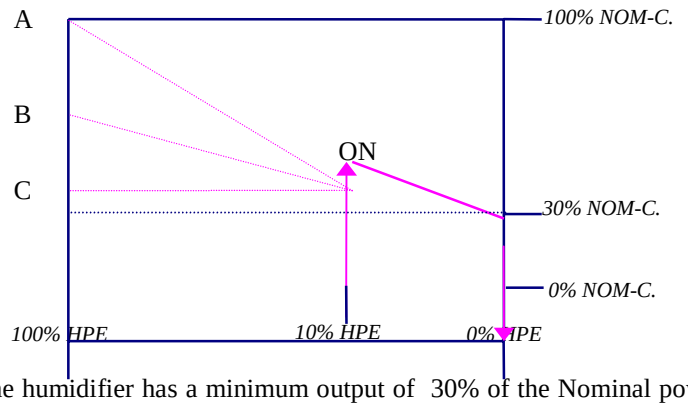
The regulation of the humidifier steam output depends on:

-Humidity Regulation
-output set by mask (value ranging from 30% and 100% of the nominal production)

The humidity regulation is carried out by the pCO2 in accordance with the humidity probe reading, at the humidity setpoint and at humidity differential (see also the graph 8.1). The pCO2 calculate the ERP humidity proportional error:



The humidifier regulation graph depends on the nominal Output, set Output and ERP proportional error:



HPE = humidity proportional error

Set output: A=100% Nom cap.
B= 75% Nom cap.
C= 45% Nom cap.

The humidifier has a minimum output of 30% of the Nominal power (for technical reasons) when ERP = 0% and it increases as the ERP increases until the output being set with ERP=100% is reached. The humidifier is managed so as not to be started with minimum values of ERP, otherwise the minimum output, 30% Nom. capacity, would cause an excessive humidity increase.
To face this drawback, the humidifier starts obviate when the ERP value is at least 10%.

12.5 HUMIDIFIER CHARACTERISTIC VALUES

The user can verify constantly the steam instantaneous output in the group of masks dedicated to the humidifier, and he can also control the main characteristic values such as conductivity of the supply water, the current absorbed for each phase and the operation mode.

12.6 HUMIDIFIER ALARM MANAGEMENT

The list below describes the alarms connected to the humidifier that can occur and that are displayed and managed as any other alarm from pCO2.

MESSAGE	CRITERIA	ACTION	RELAY	BUZZER
Power7 Failure	The water level reaches the full sensor and Im<5%In[1]	Cut off power Empty the cylinder[2]	YES	YES
No Water	Entering water valve open for more than 20 consecutive minutes	None	YES	YES
High or low humidity	Humidity over and below the established threshold. Signalled after 20 min. by pressing the ON button	None	YES	YES
Presence of foam	Foam detection inside the cylinder. The presence of foam is signalled in the humidifier masks.	The situation is managed up to its extinction with a particular procedure. (Momentarily the maximum output is not ensured)	NO	NO
Saturated cylinder	The cylinder is saturated with limestone	Replace the cylinder	NO	NO
High current	Current exceeding the scheduled limits	Forced drain for 5'' Cut off power	YES	YES

12.6.1 HIGH CURRENT ALARM

To prevent the current from exceeding the maximum acceptable values, precise limits have been fixed. Anyway they depend on the time, since they have to allow momentary spikes when the humidifier starts.

The forced discharge lasts 5 seconds and is not signalled. The high current alarm causes water discharge for 30 seconds and stops the humidifier.

[1] Se manca corrente non dovrebbe funzionare neppure il controllo, ma se manca solo una fase potrei misurare una corrente nulla mentre, in realtà, questa è al di sopra delle soglie di sicurezza.
[2] Questo per evitare che, una volta resettato l'allarme e riattivato il contattore di potenza, la corrente salga velocemente oltre i limiti consentiti.

13 USER TERMINAL

It can be of two different types: internal (built-in) or external.
Because of some management differences due to the different number of buttons, it is recommended to connect an external terminal on cards with built-in terminal, otherwise the use of the so al terminal could turn out to be faulty.
Independently of display being utilised, internal or external, all the masks of the software can be visualised, even if in a different way because of the different quantity of buttons.
The user terminal allows you to display the operation conditions of the unit at any moment, the modification of all the parameters at any moment, and can connected and disconnected only when needed, being actually necessary for the normal operation of the pCO2.

The masks that compose this software have been divided into 4 fundamental parts:

- a **USER** section, not protected by password, which allows you to display the regulated quantities, the active alarms and the memorised ones, and to set up the Set Points;
- a **USER** section, protected by password, which allows you to set up all the control parameters of the main functions and of the processes managed by the program, such as Set Point limits, alarm thresholds, etc… Only the parameters regarding the functions enabled in the manufacturer's branch are displayed;
- a **SERVICE** section, protected by password, intended for the service aimed at the periodical management of the devices, the calibration of the connected probes and for the forcing of the various devices (manual management);
- a **MANUFACTURER** section, protected by password, that allows the configuration of the conditioner via the selection and activation of the functions and of the devices to be controlled.

13.1 DISPLAY

The display being used is of the type LCD, 4 rows x 20 columns. The information relevant to the operation are alternated in the form of successive video displays called *masks*.It is possible to move among the masks and within one mask utilising the terminal up/down arrow and enter buttons in the following way:

- if the blinking cursor is in the top left angle of the mask (Home), if you press the arrow buttons you have access to the other masks associated with the selected branch;
- if in a mask appropriate value selection fields are scheduled, if you press the ENTER button, the cursor move from the home position to the first of these fields, and then to the successive ones; if there are no fields, the enter button has no effect;
- when the cursor is on a set field, it is possible to modify its value, within scheduled limits, by pressing the arrow buttons; once the wanted value has been fixed, simply press Enter to memorise it and move the cursor to the successive field or on home.

13.2 LED UNDER THE BUTTONS

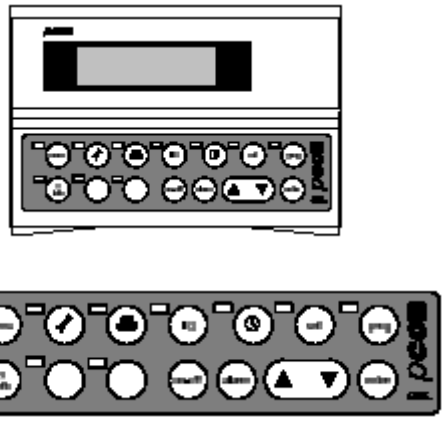
Three LEDs have been placed under the rubber buttons of the external terminal and indicated respectively:

ON/OFF button	Green LED – indicates that the PcO2 is On.
ALARM button	Red LED - indicates the presence of alarms; if it blinks, this means that the alarms are no more active but that in any case they are memorised.
ENTER button	Yellow LED – indicates that the instrument is correctly powered

Two LEDs have been placed under the rubber buttons of the built-in terminal and indicate respectively:

ALARM button	Red LED - indicates the presence of alarms; if it blinks, this means that the alarms are no more active but that in any case they are memorised.
ENTER button	Yellow LED – indicates that the instrument is correctly powered

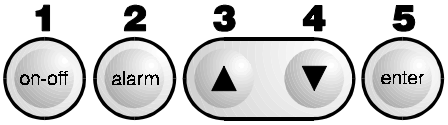
13.3 EXTERNAL DISPLAY



Button utilisation in the external terminal

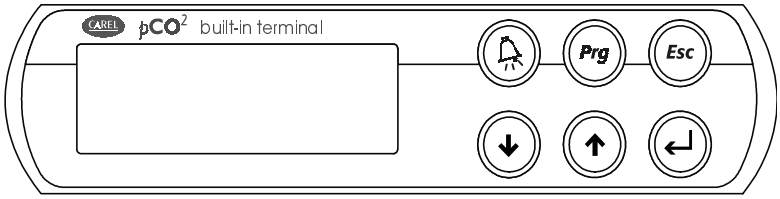
Button		Description
	MENU	pressed once it returns to the main mask pressed again it moves to masks in order to access the various branches
	MAINT	displays the values relevant to the maintenance of the devices (utilisation hours of the devices and hour counter reset, access to the manual operation procedure)
	PRINTER	Accesses the printer-management group of masks
	I/O	displays the state of the digital and analog state and the input and output configuration
	TIME	permits the display / programming of the clock and time bands
	SET	allows the Set Point and differential set up
	PROG	allows the set up of various operation parameters (thresholds, delays etc.)
 + 	MENU+PROG	by pressing simultaneously these buttons you enter the machine configuration
	INFO	Displays software version and other information on the machine

13.4 SILICONE-RUBBER EXTERNAL BUTTONS



1. **ON/OFF** button: allows the conditioner to start and stop. The green LED that illuminate the button lights up if the conditioner is in On mode; the off LED indicates the OFF state.
2. **ALARM** button: is utilised to display the alarms, to manually reset them and to stop the buzzer. If the button is lit (red colour) that means that at least one alarm is active; if the LED blinks that means that the alarms are no more active but can still be visualised. This only occurs with the automatic-reset alarms, whereas those with manual reset need the alarm button pressure to be reset.
3. **UP ARROW**: has two functions: to scroll the preceding masks of the same branch while the cursor is in home position, and to increase the value of a setting field if the cursor is on it. If on the contrary a field of choice is the case, the arrow button pressure causes the visualisation of the preceding associated text.
4. **DOWN ARROW** has two functions, to scroll the preceding masks of the same branch while the cursor is in home position, and to decrease the value of a setting field if the cursor is on it. If it is the case of a field choice on the contrary, the arrow button pressure causes the visualisation of the successive associated text.
5. **ENTER** button: utilised to display the cursor between the home position and the setting or choice fields, and to save the values of the parameters being set after the cursor have left the setting fields. The button is constantly backlit (yellow light) to indicate the presence of the electric power.

13.5 13.5 DISPLAY BUILT-IN



ALARM	PROG	ESC
UP	DOWN	ENTER

Button use in the Built_in terminal

Button	Description
ALARM	See functions of the Alarm button of the external terminal
UP- DOWN	See functions of the arrow buttons of the external terminal
ENTER	See Enter function button of the external terminal The LED under the button indicates that the unit is On (ON)
ESC	Allows you to return to the mask branch previously visited, or to the menu mask
PROG	Gives access to the masks that allow you to enter the various branches.

The Built-in terminal, lacking the ON/OFF button, carries out the switching on and off of the unit (On-Off) positioning itself on the main mask and pressing the arrow upwards this mask will be displayed where it is possible to start and stop the unit.

14 COMPRESSOR MANAGEMENT

The compressors are managed as simple ON-OFF loads. Their number ranges from 0 to 2 and each one may have a capacity control. In all therefore with the compressors and the capacity controls you can obtain from 1 to 4 cooling steps (see temperature graphs).

14.1 COMPRESSOR FLOW CONTROLS

May have N.O. logic (normally open) or N.C. logic (normally closed) at the user's will. Their insertion with respect to the compressors is delayed with a selectable time. They are not available with all the pCO2 card versions.In dehumidification, if you utilise the compressors, the capacity controls are always switched on simultaneously with the compressors, because it is necessary the maximum available capacity.

14.2 COMPRESSOR ROTATION

If you enable the compressor rotation function, the F.I.F.O. logic (first in, first out) holds. The F.I.F.O. logic establishes that the compressor which has started first, is also first to stop; in this way we try to compare the operation hour of the two compressors in order to produce the same ageing of the two devices. Successively, the compressor which had been stopped first is started.
If you disable the rotation always the compressor 1 is stated, then the compressor 2 and in stopping phase always the compressor 2 stops and then the compressor 1.

14.3 COMPRESSOR TIME

COMPRESSOR. MINIMUM START TIME
Establishes the compressor-start minimum time (in seconds), and so, once activated, they must remain On for a time equal to that being set by the above mentioned parameter.

COMPRESSOR. MINIMUM STOP TIME
Establishes the compressor-stop minimum time. The devices are not restarted if the minimum selected time, from the last stop, has not elapsed.

MINIMUM TIME BETWEEN DIFFERENT COMPRESSOR STARTS
Represents the minimum time that must elapse between the start of a device and the successive one. This parameter enables you to avoid simultaneous starts.

MINIMUM TIME BETWEEN SAME COMPRESSOR STARTS
Establishes the minimum time that must elapse between two starts of the device, independently of the measured quantity and the Set Point. This parameter allows you to reduce the number of starts per hour. If, for example, the maximum allowed number of starts / hour is equal to 10, simply set a value of 360 seconds to comply with this limit.

COMPRESSOR CAP. CONTR.-START MINIMUM TIME
Establishes the minimum time that must elapse between the compressor start and its capacity control. The parameter is present only if the capacity controls have been selected.

14.4 COMPRESSOR ALARMS

In accordance with the availability of digital input of the pCO2 card digital input, the compressor alarms can be grouped together or divided. In the maximum configuration (Large card) there is a digital input for each of the following alarms and for each compressor: high pressure, low pressure, overload. The configurations that schedule the grouping together of the alarms on a single input, operate without delays blocking the relevant compressor. If you decide not to use one or more digital inputs of alarms dedicated to the compressors, it is necessary to close them electrically on the 24Vac power supply, because they operate with normally open logic and not to connect them would be the same thing as an alarm signalling.

HIGH PRESSURE ALARM
Immediate alarm caused by an external pressure controller; the digital input switches from close to open and the compressor is immediately stopped without any delay. The manual reset, that is the user, has to press the terminal Alarm button, after the digital input has switched from open to close, to make the compressor restart. Following the compressor stop, the time is immediately activated (stop minimum time etc…), so even if the alarm is immediately erased by the user, the compressor keeps all the same a stop period.

LOW PRESSURE ALARM
Delayed alarm caused by an external pressure controller; the digital input switches from close to open and this activates an internal timer; if at the end of the time (selectable from parameter) the contact is still open, the compressor is stopped. If on the contrary the contact switches again from open to close before the timer exhaustion, the alarm does not activate and the timer is reset.
The reset is manual, that is the user has to press the Alarm bottom of the terminal, after the digital input has switched from open to close, to make the compressor restart.
Following the compressor stop, the time is immediately activated (stop minimum time etc…), so even if the alarm is immediately erased by the user, the compressor keeps all the same a stop period. The low pressure alarm comply with two different time before operating: delay with started compressor and delay at the compressor start. The started-compressor delay is always observed whereas the delay at the compressor start is added if the contact is open at the start of the compressor, in order ensure additional time for the cooling fluid stabilisation.

COMPRESSOR OVERLOAD ALARM

Immediate alarm caused by an overload or external differential; the digital input switches from close to open and the compressor is immediately stopped without any delay. The manual reset, that is the user, has to press the terminal Alarm button, after the digital input has switched from open to close, to make the compressor restart. Following the compressor stop, the time is immediately activated (stop minimum time etc…), so even if the alarm is immediately erased by the user, the compressor keeps all the same a stop period.

15 RESISTANCE MANAGEMENT

The resistors are managed as simple ON-OFF loads. Their number ranges from 0 to 2 if normally managed, that is by supposing that each one is driven by a digital input; while with the management of the binary type it is possible to manage 3 resistors but an external device is required to code the relay combinations. In total therefore it is possible to obtain from 1 to 3 warm steps (see temperature graphs).

15.1 RESISTANCE DELAY

Represents the minimum time that must elapse between the switching on of a resistance and the successive one. This parameter allows you to avoid simultaneous accelerations.

15.2 RESISTANCE ALARMS

Each resistance is equipped with a digital input to be connected to an overload or to a differential for signalling of possible anomalies. If you decide not to use one or more digital inputs of alarms dedicated to the resistance, it is necessary to close them electrically on the 24Vac power supply, because they operate with normally open logic and not to connect them would be the same thing as an alarm signalling.

They are immediate alarms caused by an external device (overload or differential); the digital input switches from close to open and the resistance is immediately switched off without any delay.

The manual reset, that is the user, has to press the terminal Alarm button, after the digital input has switched from open to close, to make the resistance restart.

16 VALVE MANAGEMENT

16.1 3-POINT VALVES

These are modulating valves that according to electrical signals coming from the pCO2 vary their opening from 0% to 100% taking a certain ranging time called running time.

The electrical signals utilised to drive these valves come from 2 relays, one utilised for opening the valve and one for closing it. They never operate simultaneously.

To calculate the correct percentage of the valve opening the pCO2 refers to the running time parameter, that is the time taken by the valve to reach a complete opening or a complete closing, as indicated in its instruction sheet.

The relays remain switched for time corresponding to the valve opening degree requested by the temperature / humidity regulation.

They are called 3-point valves because they are driven by means of 3 electrical contact (besides the power supply): common contact, opening contact, closing contact.

During the normal operation, many partial openings and closings are carried out, and the pCO2 knows the opening degree of the valve at any moment adding and subtracting all the partial times carried out beginning from the start moment.

3-POINT VALVE REALIGNMENT

Obviously, due to the management type, these valves are not easily managed by the pCO2, since there is no feedback of the outputs. A minimum inaccuracy of the closing time of one of the relays or a simple mechanical friction of the valve that slows down its movement can cause a lack of correspondence between the real opening degree and the one calculated by the pCO2.

To face this drawback, the following remedies are available.

Whenever the temperature / humidity regulation requests the total closing / opening of the valves, the pCO2 increases 25% of the activation time of the corresponding relay to ensure the complete closing / opening.

At each conditioner start (On) the valves are immediately closed completely, afterwards they begin to open if requested by the regulation.

16.2 16.2 0-10Volt MODULATING VALVES

They are modulating valves which according electrical signals coming from the pCO2 vary their opening from 0% to 100%. The electrical signals utilised to drive these valves come from analog outputs with a signal ranging from 0 to 10Volts.

The 0-10Volts modulating signal is directly proportional to the deviation of the regulation temperature with reference to the setpoint (see temperature graphs).

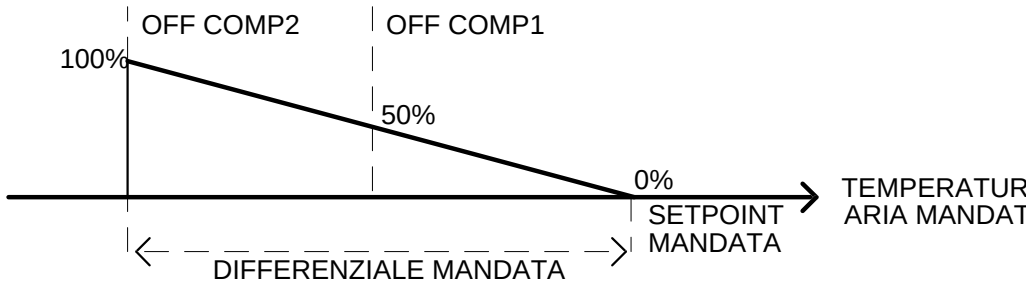
These valves do not have any problem of alignment since the opening degree to which they have to comply is communicated at each moment, and actually the modulating signal remain constant until the temperature or humidity undergo a change.

17 DEVICE MANUAL MANAGEMENT

It is possible to activate manually all the devices connected to the outputs without the help of the time and rotation and independently of the regulation and of the quantities being measured by the probes. The only support of the control in manual operation is the alarm management, to safeguard the security and the integrity of the active devices.
The activation of the valves in manual allows you to force the relevant analog outputs to the value being set.
The manual procedure can be activated only if the conditioner is in the OFF mode and, once activated, it is automatically terminated after 5 minutes. During the manual management of the devices it is not possible to start the conditioner (On).
The MANUAL state of the machine is identified by the appearance of the writing “Manual procedure” in the last row of the display.

18 ENTERING AIR TEMPERATURE LIMIT

The limit of minimum temperature on the supply air protects the environment from the temperature reduction. To carry out this function it is necessary to position a temperature control probe on the supply of the conditioner.
The aim is to prevent excessively cold air from being blown on the individuals present in the room, possibly impairing their health.
To manage this function you have to set the following parameters: Setpoint and Supply differential. The Setpoint and Supply differential locate a limiting zone.
When the supply temperature is inside zone described in the graph, the action of the cooling devices is limited until the supply temperature raises beyond the supply Setpoint.



As you can see in the graph, the limiting action increases proportionally to reduction of the temperature below the supply setpoint . It reaches its maximum when it is equal or less than:

Setpoint – Entering air differential.

According to the cooling devices being utilised, the limiting action is different:

- 2 compressors: the first compressor is spent at 50% of the limiting zone and restarted at 0% ; the second one is stopped at 100% and restarted at 50%;
- 1 compressor: the compressor is stopped at 100% of the limiting zone and restarted at 0%;
- 0-10V and 3 point cold valve: to the actual opening value of the valve is subtracted the percentage of the limiting zone; if for example the valve is open at 100% and the supply temperature begins to decrease, the valve closes gradually until a complete closure is each (when the limiting zone is at its 100%);

19 CURRENT AND VOLTAGE ABSORPTION PROBES

It is possible to connect a probe that measures the conditioner current or voltage absorption; besides keeping under control the current or voltage values on the terminal display, it is possible to manage a specific warning alarm, that informs if the consumption exceeds the scheduled limit.
To eliminate this function you have to possess a probe for measuring the current or voltage connected to the conditioner power supply; furthermore, you have to set the following parameters: Scale start and Scale end of the connected probe, and Setpoint of the high current or voltage absorption alarm.
As soon as the value being measured by the probe exceeds the absorption Setpoint being set, a non delayed and automatically resettable only-signalling alarm becomes active.

20 CONDENSATION FANS

The condensation fan management can be connected to the value of the pressure transducers on the condensation side, and can be carried out in the following ways:

- on/off fans with single condenser 1 - 2 step single condenser ;
- modulating fans (only one output) with single condenser;
- modulating fans (two outputs, one for each circuit) with separate condensers;
- on/off fans (two outputs, u one for each circuit) with separate condensers.

In order to correctly manage the Condensation, at least one compressor must be part of the conditioner, and furthermore you have to set the following parameters:

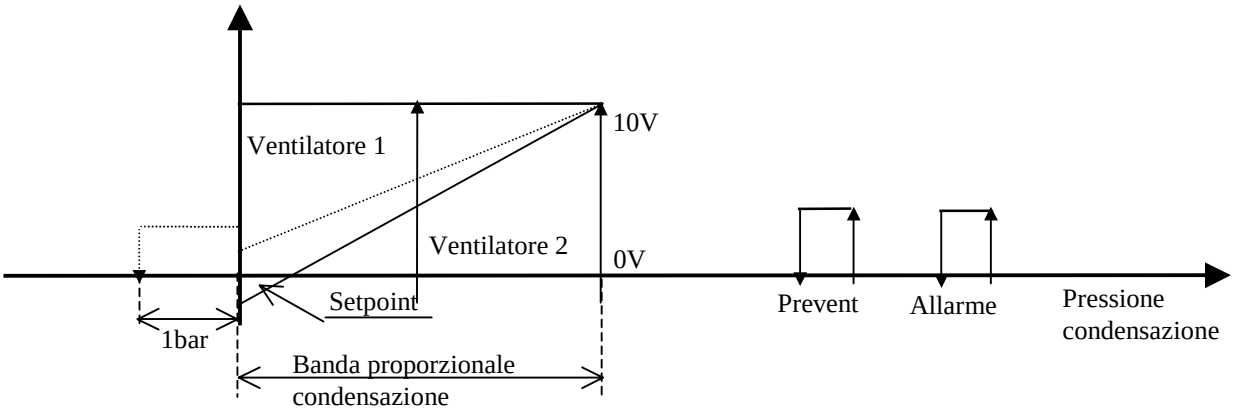
- Single or Distinct condenser;
- Step condensation or Inverter;
- fan number (1 or 2);
- pressure probe calibration;
- condensation setpoint and differential;
- accessory functions: Speed-up time, modulating fan maximum and minimum voltage, prevent function.

20.1 ON/OFF CONDENSATION DEPENDING ON THE PRESSURE SENSOR

With this type of condensation the fan operation is subordinate to the compressor operation and to the value measured by the pressure sensors as a function of a set and a band. When the pressure is less than or equal to the set, the fans remain Off; if the pressure increases up to set + band, all the fans are gradually switched on (see the following graph). It is possible to chose between condensation with single battery or with separate battery; with the single battery condensation the fans are commanded by the higher pressure between the two probes; with the separate battery condensation, each pressure sensor controls its own fan.

20.2 MODULATING CONDENSATION DEPENDING ON THE PRESSURE SENSOR

With this type of condensation the fan control is carried out through the 0/10 V analog outputs. Their value is proportional to the deviation of the pressure with respect to the setpoint and to the condensation differential; also in this case, the compressors must be On and it is possible to choose between condensation with single battery or with separate batteries. The control comply with the same modes described above. Since you utilise a modulating output, it is possible to choose a minimum velocity exceeding 0V; in this case, when the pressure decreases below the setpoint, the fan is not stopped immediately but is kept operating at minimum velocity up to 1 bar of pressure below the setpoint. In the graph below the continuous slanting straight line describes the velocity of a fan with minimum velocity 0V; the discontinuous slanting straight line describes the velocity of a fan with minimum velocity greater than 0V. In this way a step is created to avoid annoying On-Off of the fan caused by minimum oscillations of the pressure.



20.3 PREVENT FUNCTIONS

This function serve for avoiding conditioner blocking due to high pressure alarm. Since the condensation fans activate only if the compressors are On, as explained above, it is evident that if the pressure starts increasing, because of radiation on the condenser for example, and the compressors are Off, the fans do not switch on. This causes a further increase of the pressure with consequent attainment of the high pressure limit and alarm intervention. To avoid this, when the pressure exceeds the Prevent threshold the compressors being Off, the fans are forced On at maximum until the pressure returns to the pressure value that causes the Prevent step to re-enter.

20.4 20.4 SPEED-UP FUNCTION

this is a function that allows you to overcome the inertia at the take-off from rest of the high-power modulating fans: they are made to function at maximum velocity for a few seconds when their start is requested, then the velocity is reduced until the requested value is reached.

21 ALARM LOGGING

Thanks to the remarkable availability of permanent (flash memory) of the pCO2, it is possible to utilise a portion of it to log all the alarms of the conditioner. This function allows you to memorise more than 300 alarms; after reaching the three hundredth alarm that is the last available space available in memory, the successive alarms are memorised over the most ancient alarms that consequently are erased; it is a circular management of this memory section.The alarm data logging is as follows:

```
        HISTORY_ALARMS
+--------------------+
¦Data log. alrms 0001¦
¦AL18  12:34 01/08/01¦
¦Set T: 23.0  T: 23.8¦
¦Set U:050.0  U:045.0¦
+--------------------+
```

For each alarm the following data are memorised regarding the conditioner at the moment in which the alarm has occurred:

- alarm code for recognition (see alarm table);
- hour;
- date;
- temperature setpoint;
- humidity setpoint;
- ambient temperature;
- ambient humidity;
- alarm time-order.

The alarm chronological number, in the top right angle of the mask, indicates “the age” of the alarm with respect to the 300 available memorisation options. The alarm with number 0001 is the oldest alarm of the ’unit’ that is the first one happened after the start.
If you move the cursor on the field 0001 with the Enter button, it is possible to scroll the “history’ of the alarms by pressing the arrow buttons. If you are in position 0001 as in the example, it is not possible to go on by pressing the arrow downwards.
If for example 15 alarms in all have been memorised and you are in position 0015, it is not possible to go on by pressing the arrow upwards. It is possible to erase all the alarms being memorised with a special parameter under password.

22 SETPOINT COMPENSATION

The compensation function causes the automatic increase of the temperature setpoint as a function of the external temperature, in warm mode. The reason of the automatic modification of the temperature setpoint is to be found in the maintenance of the comfort: think of a supermarket where people go in and come out continuously; if the temperature inside the building is 10 degrees less than the external environment, the thermal sudden change may annoy the customers besides impairing their health. The maximum difference between internal and external temperature as regards the optimal comfort should not exceed 6 degrees. The compensation allows you to maintain a maximum difference, selectable, between internal and external temperature, increasing the setpoint when this difference tends to increase.
To enable the compensation it is necessary to position an external air temperature probe and to set the following parameters: setpoint, differential and compensation offset
The compensation adds to the setpoint being set ”delta” value, that depends on the external temperature (as the external temperature increases the value increases). The “delta” value to be added to the set of temperature regulation is "0" if:

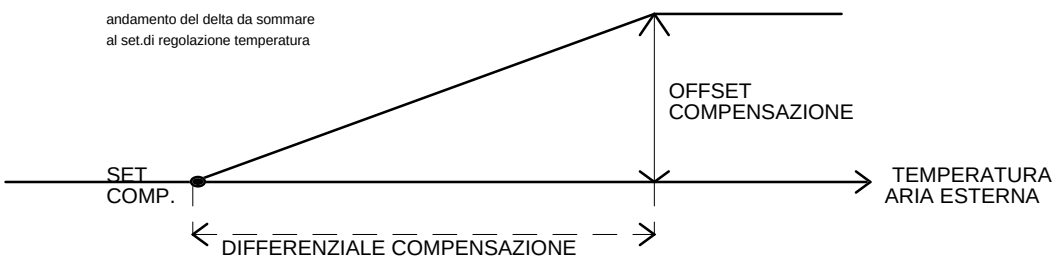
$$external\ \ temperature \leq compensation\ setpoint$$

The “delta” value to be added to the temperature regulation set increases if:

$$external\ \ temperature > compensation\ setpoint$$

The “delta” value to be added to the temperature setpoint reaches the maximum value (compensation offset) if:

$$external\ \ temperature \geq setpoint + compensation\ differential$$



23 SUPERVISORY SYSTEM

This software envisages the possibility of connection of the pCO2 to a supervisory system.
To enable this function it is necessary to insert an interface card (Rs485 or LON) in the special connector on the pCO2 board, to develop the electric communication line between the card and the supervisor PC, and to set the following parameters: identification number and communication velocity of the serial line.
If you utilise the Rs485 card it is possible to communicate with supervisors of the type Modbus (directly), Bacnet (by adding the Carel Gateway) or with the Carel Masterplant (directly).
The Carel Masterplant supervisor software contains the supervision of all the Carel instruments and of all the Carel standard software for pCO and pCO2. For the communication with the LON systems, the LON interface card is required.

23.1 DATABASE SUPERVISORY PROGRAM

This software schedules a communication database that is a complete list of all the parameters and the variables that are present in the masks, in order to be able to exchange them with the supervisor. All the parameters have been divided into 3 categories: integer, digital and analog. The supervisor being utilised must have the same database of variables because this represents a recognition code indispensable for the communication.
The variables are reported in the tables below with: address, description and type.

ADDRESS
The supervisor recognises the variables not because of their name but on the basis of their address and CATEGORY, and therefore the address is useful if you intend to construct the supervisor.

CATEGORY
Identifies the type of variable (Integer, Analog or Digital). Recommended for supervisor construction.

TYPE
When constructing a supervisor, it is necessary to know if a given variable is only readable or also modifiable, and this datum is supplied for each variable being transmitted.

IDENTIFICATION NUMBER
This parameter is absolutely not related to the table of variables but serves to identify the pCO2 card with a progressive number from 1 to n. A supervisory PC is often connected to several identical conditioners and consequently to various pCO2 cards and the PC user must somehow to know which conditioner he is "talking" with at any moment, and he does this by choosing the identification number with which to talk. This parameter is fixed in every conditioner and must be a number each time different and possibly progressive and without leaps for a reason of order.

23.2 DIGITAL VARIABLES

Address	Description	Type
1	Compressor 1 general alarm digital input	Reading
2	Compressor 2 general alarm digital input	Reading
3	Circuit low-pressure alarm digital input near state 1	Reading
4	Circuit low-pressure alarm digital input near state 2	Reading
5	Air filter alarm digital input	Reading
6	Fan overload alarm digital input	Reading
7	Air flow controller digital input	Reading
8	Remote ON/OFF	Reading
9	Resistance 1 overload digital input	Reading
10	Resistance 2 overload digital input	Reading
11	Fire / smoke alarm digital input	Reading
12	Dehumidification	Reading
13	Unit ON /OFF	Reading
14	Free cooling	Reading
15	Humidification / Humidification power contact	Reading
16	Compressor 1 capacity control / Integrated humidifier charging	Reading
17	Compressor 2 capacity control / Integrated humidifier discharging	Reading
18	3p chill valve opening contact	Reading
19	3p chill valve closing contact	Reading
20	3p warm valve opening contact	Reading
21	3p warm valve opening contact	Reading
22	General alarm	Reading
23	Compressor 1 general alarm	Reading
24	Compressor 2 general alarm	Reading
25	Circuit 1 near low-pressure state alarm	Reading

Address	Description	Type
26	Circuit 2 near low-pressure state alarm	Reading
27	Air flow controller alarm	Reading
28	Fan overload alarm	Reading
29	Resistance 1 overload alarm	Reading
30	Resistance 2 overload alarm	Reading
31	Fire / smoke alarm	Reading
32	Air filter alarm	Reading
33	High ambient temperature alarm	Reading
34	Low ambient temperature alarm	Reading
35	High ambient humidity alarm	Reading
36	Low ambient humidity alarm	Reading
37	Compressor 1 working hours	Reading
38	Compressor 2 working hours	Reading
40	Fan working-hour alarm	Reading
43	Leaving water high temperature alarm	Reading
44	Leaving water low temperature alarm	Reading
45	Damaged ambient temperature probe alarm	Reading
46	Damaged entering air temperature probe alarm	Reading
47	Damaged leaving water temperature probe alarm	Reading
48	Disconnected external air temperature probe alarm	Reading
49	Damaged humidity probe alarm	Reading
51	Damaged E²PROM alarm	Reading
53	Type of temperature regulation	Writing / Reading
55	Humidity probe enabling	Writing / Reading
56	Leaving water probe enabling	Writing / Reading
57	External air probe enabling	Reading
58	Entering water probe enabling	Writing / Reading
59	Entering air probe enabling	Writing / Reading
60	Binary-combined resistance enabling	Reading
61	Cold 0/10V modulating valve enabling	Writing / Reading
62	Free cooling enabling	Writing / Reading
63	Compressor operation enabling with 0/10V valve	Writing / Reading
64	Warm 0/10V modulating valve enabling	Writing / Reading
65	Capacity control enabling	Writing / Reading
66	Compressor rotation enabling	Writing / Reading
67	Compressor 1 dehumidification enabling	Reading
68	Compressor 2 dehumidification enabling	Reading
71	Temperature time band enabling	Writing / Reading
73	Supervisor ON/OFF enabling	Writing / Reading
74	3p cold valve enabling	Reading
75	3p warm valve enabling	Reading
76	Manual procedure enabling	Reading
77	Alarm-stopped machine alarm	Reading
78	Humidity time band enabling	Writing / Reading
80	High current in the humidifier alarm	Reading
82	Water absence in the humidifier alarm	Reading
83	Current absence in the humidifier alarm	Reading
90	Built-in humidifier enabling	Reading
100	Supervisor internal variable for version check	Reading
101	Clock card enabling	Writing / Reading
102	Printer enabling	Writing / Reading
103	Supervisor	Writing / Reading
104	Unit current / voltage probe present	Reading
105	Condensation enabling	Writing / Reading
106	Type of condensation	Writing / Reading
107	Type of condenser	Writing / Reading
108	Compressor flow control logic	Writing / Reading
109	Dehumidification logic	Writing / Reading
110	Dehumidification enabling with cold modulating valve	Writing / Reading
111	Dehumidification enabling with 3P cold valve	Writing / Reading
112	Humidifier phase number	Writing / Reading

Address	Description	Type
113	Type of humidifier discharge	Writing / Reading
114	Chilling in action	Reading
115	Warming in action	Reading
116	Dehumidification in action	Reading
117	Humidification in action	Reading
118	Supply limit active	Reading
119	Dehumidification limit active	Reading
120	Circuit 1 high pressure alarm	Reading
121	Circuit 2 high pressure alarm	Reading
122	Unit high current / voltage alarm	Reading
123	Clock alarm	Reading
124	Prevent HP function enabling	Writing / Reading
125	Supply limit enabling	Writing / Reading

23.3 INTEGER VARIABLES

Address	Description	Type
10	Cold 0/10V valve incline start	Writing / Reading
11	Cold 0/10V valve incline end	Writing / Reading
12	Warm 0/10V valve incline start	Writing / Reading
13	Warm 0/10V valve incline end	Writing / Reading
16	Compressor 1 step without free cooling	Writing / Reading
17	Compressor 1 hysteresis without free cooling	Writing / Reading
18	Compressor 2 step without free cooling	Writing / Reading
19	Compressor 2 hysteresis without free cooling	Writing / Reading
22	Compressor 1 step with free cooling	Writing / Reading
23	Compressor 1 hysteresis with free cooling	Writing / Reading
24	Compressor 2 step with free cooling	Writing / Reading
25	Compressor 2 hysteresis with free cooling	Writing / Reading
26	Interval between same compressor start	Writing / Reading
28	Low pressure delay alarm	Writing / Reading
29	Stop minimum time	Writing / Reading
30	Interval between various compressor start	Writing / Reading
31	No. of resistors	Writing / Reading
32	No. of compressors	Writing / Reading
33	High/low temperature/humidity alarm delay	Writing / Reading
34	Resistance switch on interval	Writing / Reading
38	Capacity control 1 step without free cooling	Writing / Reading
39	Capacity control 1 hysteresis without free cooling	Writing / Reading
40	Capacity control 2 step without free cooling	Writing / Reading
41	Capacity control 2 hysteresis without free cooling	Writing / Reading
44	Capacity control 1 step with free cooling	Writing / Reading
45	Capacity control 1 hysteresis with free cooling	Writing / Reading
46	Capacity control 2 step with free cooling	Writing / Reading
47	Capacity control 2 hysteresis with free cooling	Writing / Reading
48	Integration time	Writing / Reading
50	Fan working hour limit	Writing / Reading
51	Compressor 1 working hour limit	Writing / Reading
52	Compressor 2 working hour limit	Writing / Reading
54	Cold 3p valve incline start	Writing / Reading
55	Cold 3p valve incline end	Writing / Reading
56	Warm 3p valve incline start	Writing / Reading
57	Warm 3p valve incline end	Writing / Reading
58	3p valve complete opening time	Writing / Reading
59	Fan start delay	Writing / Reading
61	Cold valve incline limit	Reading
62	Warm valve incline limit	Reading
63	Fan fulfilled working-hour high part	Reading
65	Compressor 1 fulfilled working-hour high part	Reading
66	Compressor 1 fulfilled working-hour high part	Reading
67	Fan working-hour low part	Reading

Address	Description	Type
68	Compressor 1 fulfilled working-hour low part	Reading
69	Compressor 2 fulfilled working-hour low part	Reading
70	Type of electric probe	Writing / Reading
71	Condensation fan number	Writing / Reading
72	Humidifier TAM type	Writing / Reading
73	Humidifier voltage	Writing / Reading
74	Humidifier nominal output	Writing / Reading
75	Condensation speed-up time	Writing / Reading

23.4 ANALOG VARIABLES

Address	Description	Type
1	Ambient temperature	Reading
2	Ambient humidity	Reading
3	Leaving water temperature	Reading
4	External air temperature	Reading
5	Supply air temperature	Reading
6	Temperature dead zone	Writing / Reading
7	Ambient humidity band	Writing / Reading
8	Ambient humidity set	Writing / Reading
9	Low temperature alarm offset	Writing / Reading
10	High temperature alarm offset	Writing / Reading
11	Low humidity alarm offset	Writing / Reading
12	High humidity alarm offset	Writing / Reading
13	Ambient temperature set	Writing / Reading
17	Ambient temperature band	Writing / Reading
18	Water low temperature limit	Writing / Reading
19	Water high temperature limit	Writing / Reading
20	Unit current / voltage probe	Reading
21	Pressure 1	Reading
22	Pressure 2	Reading
23	pCO analog output 1	Reading
24	pCO analog output 2	Reading
25	Current / voltage probe scale start	Writing / Reading
26	Current / voltage probe scale end	Writing / Reading
27	Current / voltage alarm threshold	Writing / Reading
28	Pressure probe scale start	Writing / Reading
29	Pressure probe scale end	Writing / Reading
30	High pressure alarm threshold	Writing / Reading
31	High pressure alarm differential	Writing / Reading
32	Condensation setpoint	Writing / Reading
33	Condensation differential	Writing / Reading
34	Condensation fan maximum velocity	Writing / Reading
35	Condensation fan minimum velocity	Writing / Reading
36	HP prevent setpoint	Writing / Reading
37	HP prevent differential	Writing / Reading
38	Supply limit threshold	Writing / Reading
39	Supply limit differential	Writing / Reading

24 24.0 PARAMETER LIST

As described in the section dedicated to the first installation of the pCO2 card, and to the successive ones, this software can manage automatically the conditioner main configuration parameters. This occurs the first time you use the pCO2 card exactly when the software is transferred onto the flash memory, and then at will, by enabling a password protected procedure.

24.1 24.1 PARAMETER TABLE

The following table shows all the software parameters and you can read the Carel manufacturer's values for each of them in the last column, that is the values that are assigned with the automatic procedure.

LEVEL: Indicates in which mask branch the variable of interest.
RANGE: Indicates within which values you can modify the parameter of interest.
PRE-SET: Carel manufacturer's value.
LEGENDA: Unit conf.: unit configuration - Gen. param.: general parameters

SELECTABLE QUANTITIES	LEVEL	RANGE	PRE-SET
Fan hour threshold	Service	0 / 999 (x1000)	200h
Compressor 1 hour threshold	Service	0 / 999 (x1000)	100h
Compressor 2 hour threshold	Service	0 / 999 (x1000)	100h
Temperature probe calibration	Service	-9.9°C / 9.9°C	0°C
Entering air temperature probe calibration	service	-9.9°C / 9.9°C	0°C
Leaving water temperature probe calibration	Service	-9.9°C / 9.9°C	0°C
External air temperature probe calibration	Service	-9.9°C / 9.9°C	0°C
Humidity probe calibration	Service	-9.9% / 9.9%	0%
Pressure probe 1 calibration	Service	-9.9bar / 9.9bar	0bar
Pressure probe 2 calibration	Service	-9.9bar / 9.9bar	0bar
Current – voltage probe calibration	Service	-9.9A-V/ 9.9A-V	0A-V
Fan Manual	Service		N
Free cooling Manual	Service		N
Dehumidifier Manual	Service		N
Humidifier Manual	Service		N
Compr. 1 / Cold 3P valve opening Manual	Service		N
Compr. 2/ Cold 3P valve opening Manual	Service		N
Resistance 1 / Warm 3P valve opening Manual	Service		N
Resistance 2/ Warm 3P valve opening Manual	Service		N
Cold valve / Fan condens. 1 Manual	Service	0 / 10.0V	N 0V
Warm valve / Fan condens. 2 Manual	Service	0 / 10.0V	N 0V
Temperature Setpoint	Setpoints	Variable	23°C
Humidity Setpoint	Setpoints	Variable	50%
Minimum temperature setpoint limits	user	-99.9 / 99.9°C	-99.9°C
Maximum temperature setpoint limits	user	-99.9 / 99.9°C	99.9°C
Minimum humidity setpoint limits	user	0%	0%
Maximum humidity setpoint limits	user	100%	100%
Temperature band	user	0 / 99.9°C	3°C
Neutral zone temperature	user	0 / 99.9°C	0°C
Humidity band	user	0 / 99.9%	10%
Output	user	Variable	3 kg/h
Automatic restart after voltage drop	user		N
Remote ON/OFF enabling	user		N
Compensation enabling	user		N
Compensation setpoint	user	-99.9 / 99.9°C	25.0°C
Compensation band	user	-99.9 / 99.9°C	3.0°C
Compensation offset	user	-99.9 / 99.9°C	2.0°C
Low offset temperature alarm	user	0 / 100°C	10°C
High offset temperature alarm	user	0 / 100°C	10°C
Low offset humidity alarm	User	0 / 100%	20%
High offset humidity alarm	user	0 / 100%	30%

SELECTABLE QUANTITIES	LEVEL	RANGE	PRE-SET
Low offset leaving water temp. threshold alarm	user	-99.9 / 99.9°C	2.0°C
High offset leaving water temp. threshold alarm	user	-99.9 / 99.9°C	20.0°C
Print repetition	Printer	0 / 999h	24h
Temperature setpoint automatic variation	Clock		N
Temperature time band (1-4)	Clock		
Start hour		00:00 / 23:59	00:00
Setpoint		Variable	0°C
Humidity hour time (1-4)	Clock		
Start hour		00:00 / 23:59	00:00
Setpoint		Variable	0%
Clock card enabling	Unit conf.		N
Printer enabling	Unit conf.		N
Supervisor enabling	Unit conf.		N
Supply air probe enabling	Unit conf.		N
Leaving water probe enabling	Unit conf.		S
External air enabling	Unit conf.		N
Entering water probe enabling	Unit conf.		N
Humidity probe enabling	Unit conf.		S
Built-in humidifier enabling	Unit conf.		N
Free cooling enabling	Unit conf.		N
No. of resistors	Unit conf.	0 / 2	2
No. of compressors	Unit conf.	0 / 2	2
Compressor capacity control enabling	Unit conf.		N
Cold modulating valve enabling	Unit conf.		S
Warm modulating valve enabling	Unit conf.		S
Cold 3 point valve enabling	Unit conf.		N
Warm 3 point valve enabling	Unit conf.		N
Current –voltage probe enabling	Unit conf.		NO
Condensation enabling	Unit conf.		NO
Type of condensation	Unit conf.	Single/Steps	Inverter
Mode of condensation	Unit conf.	Single /Distinct	Single
Number of fans	Unit conf.	1/2	1
Type of regulation	Gen.Param.	P / P+I	P
Dehumidification logic	Gen.Param.	N.O / N.C.	N.O.
Single compressor step	Gen.Param.		
Position		0 / 100 %	50%
Hysteresis		0 / 100 %	50%
Single compressor step with Free cooling	Gen.Param		
Position		0 / 100 %	66%
Hysteresis		0 / 100 %	33%
Compressor ½ steps	Gen.Param		
C1 position		0 / 100 %	25%
C1 hysteresis		0 / 100 %	25%
C2 position		0 / 100 %	75%
C2 hysteresis		0 / 100 %	25%
Compressor ½ steps with Free cooling	Gen.Param		
C1 position		0 / 100 %	50%
C1 hysteresis		0 / 100 %	16%
C2 position		0 / 100 %	83%
C2 hysteresis		0 / 100 %	16%

SELECTABLE QUANTITIES	LEVEL	RANGE	PRE-SET
Single compressor step + capacity control	Gen.Param.		
C position		0 / 100 %	25%
C hysteresis		0 / 100 %	25%
P position		0 / 100 %	75%
P hysteresis		0 / 100 %	25%
Single comp. step + cap. contr. + Free cooling	Gen.Param.		
C position		0 / 100 %	50%
C hysteresis		0 / 100 %	16.6%
P position		0 / 100 %	83.3%
P hysteresis		0 / 100 %	16.6%
Comp. 1/2 step + capacity control	Gen.Param.		
C1 position		0 / 100 %	12.2%
C1 hysteresis		0 / 100 %	12.5%
P1 position		0 / 100 %	37.5%
P1 hysteresis		0 / 100 %	12.5%
C2 position		0 / 100 %	62.5%
C2 hysteresis		0 / 100 %	12.5%
P2 position		0 / 100 %	87.5%
P2 hysteresis		0 / 100 %	12.5%
Comp.1/2 steps + cap. contr. + Free cooling	Gen.Param.		
C1 position		0 / 100 %	41.6%
C1 hysteresis		0 / 100 %	8.3%
P1 position		0 / 100 %	58.3%
P1 hysteresis		0 / 100 %	8.3%
C2 position		0 / 100 %	75%
C2 hysteresis		0 / 100 %	8.3%
P2 position		0 / 100 %	91.6%
P2 hysteresis		0 / 100 %	8.3%
Single resistance step	Gen.Param.		
Position		0 / 100 %	50%
Hysteresis		0 / 100 %	50%
Resistance ½ steps	Gen.Param.		
R1 position		0 / 100 %	25%
R1 hysteresis		0 / 100 %	25%
R2 position		0 / 100 %	75%
R2 hysteresis		0 / 100 %	25%
Binary resistance steps	Gen.Param.		
R1 position		0 / 100 %	16.6%
R1 hysteresis		0 / 100 %	16.6%
R2 position		0 / 100 %	50%
R2 hysteresis		0 / 100 %	16.6%
R3 position		0 / 100 %	83.3%
R3 hysteresis		0 / 100 %	16.6%
Cold modulating valve	Gen.Param.		
Start		0%	0%
Fine		100%	100%
Warm modulating valve	Gen.Param.		
Start		0%	0%
End		100%	100%
Cold 3 point valve	Gen.Param.		
Start		0 / 100%	0%
End		0 / 100%	100%
Warm 3 point valve	Gen.Param.		
Start		0 / 100%	0%

SELECTABLE QUANTITIES	LEVEL	RANGE	PRE-SET
End		0 / 100%	100%
Humidification step	Gen.Param.		
Position		0 / 100%	50%
Hysteresis		0 / 100%	50%
Dehumidification step	Gen.Param.		
Position		0 / 100%	50%
Hysteresis		0 / 100%	50%
Low temp. limit (dehumidification stop)	Gen.Param.		
Position		0 / 100%	50%
Hysteresis		0 / 100%	35%
High temp. limit (dehumidification stop)	Gen.Param.		
Position		0 / 100%	50%
Hysteresis		0 / 100%	35%
Humidifier nominal output	Gen.Param.	0 / 42	3 kg/h
Humidifier voltage	Gen.Param.	0 / 660	220V
Humidifier phase num.	Gen.Param.	1 o 3	1
Humidifier TAM model	Gen.Param.	50 / 700	100
Discharge enabling without voltage	Gen.Param.		N
C0 parameter		0 / 1000	93
C1 parameter		0 / 1000	75
Fan start delay time	Time	0 / 999	10 sec.
Fan stop delay time	Time	0 / 999	20 sec.
Integration time	Time	0 / 999	600 sec.
3 point valve opening time	Time	0 / 999	180 sec.
Low pressure delay alarm	Time	0 / 999	180 sec.
Probe delay alarm (temperature, humidity, leaving water)	Time	0 / 999	600 sec.
Air flow control delay alarm	Time	0 / 999	10 sec.
Delay between 2 capacity control start	Time	0 / 999	10 sec.
Delay between different resistance start	Time	0 / 999	3 sec.
Supply limit setpoint	Gen.Param.	0 / 999.9	15.0
Supply limit differential	Gen.Param.	0 / 999.9	5.0
Supply limit enabling	Gen.Param.		N
Current probe scale start	Gen.Param.	0 / 999.9	0A
Current probe scale end	Gen.Param.	0 / 999.9	100A
Voltage probe scale start	Gen.Param.	0 / 999.9	0V
Voltage probe scale end	Gen.Param.	0 / 999.9	450V
Current probe alarm setpoint	Gen.Param.	0 / 999.9	90A
Voltage probe alarm setpoint	Gen.Param.	0 / 999.9	440V
Pressure probe scale start	Gen.Param.	0 / 999.9	0bar
Pressure probe scale end	Gen.Param.	0 / 999.9	30.0bar
Condensation setpoint	Gen.Param.	0 / 999.9	14.0bar
Condensation band	Gen.Param.	0 / 999.9	2.0bar
Cond. fan minimum ‘velocity’	Gen.Param.	0 / 999.9	0V
Cond. fan maximum ‘velocity’	Gen.Param.	0 / 999.9	10V
Speed-up time	Gen.Param.	0 / 999	2sec
High pressure alarm setpoint	Gen.Param.	0 / 999.9	23.5bar
High pressure alarm differential	Gen.Param.	0 / 999.9	1.0bar
HP prevent enabling	Gen.Param.		NO
HP prevent setpoint	Param.gen.	0 / 999.9	20.0bar
HP prevent differential	Param.gen.	0 / 999.9	2.0bar
Supervisor communication ‘velocity’	Gen.Param.	1200 / 2400 / 4800 / 9600 / 19200	1200
Supervisor identification number	User	0 / 200	1

25 ALARMS

The pCO2 card manages a complete alarm series connected to the single devices for their safeguard, at the conditions of the controlled environment to signal the presence of anomalies, and also to the pCO2 card itself in the case in which it is damaged or tampered.
The source of the alarms may be of two types:
- alarms coming from the digital inputs or from the probes, therefore from the outside;
- alarms signalled by the pCO2 card on the basis of calculations or computations during the operation.

The effect of the alarms may be of three types and each of them is described in the summary table of the alarms:
- only signalling;
- blocking of one or more devices;
- conditioner stop (Off).

Signalling, blocking, unit stop are ***non modifiable*** actions.

The pCO2 card can completely manage the procedures of the alarms: action, delays, resets and relevant signalling.
When an alarm becomes active, it acts on the devices (stop if scheduled), and the simultaneous activation of some signalling devices.

When an alarm is produced, it is signalled with the following actions:
- switching on of the buzzer that is built in external terminal (absent on the built-in terminal);
- switching on of the red LED under the terminal ALARM.

Now, if you press the Alarm button the following results are obtained:
- buzzer stop;
- visualisation on the display of the alarm mask. If there is more than one alarm active, the alarm mask is shown with a higher position in the mask branch (see 27.0); then with the arrow buttons it is possible to visualise also the other alarms being active.

By pressing another button of the terminal now you leave the alarm branch, however the alarms being displayed remain in memory and may be visualised again at any moment with the Alarm button.

The last operation that you can execute with the Alarm button is the erasure of the alarms from the memory. The operations to be executed are as follows:
- press the Alarm button to enter the alarm branch and visualise the first alarm mask;
- press again the Alarm button to carry out the erasure of all the memorised alarms;
- if the causes which had activated the alarms have disappeared (reset digital inputs, return of temperature to the mean etc…), then all the alarm masks are erased, the red LED light off and the following mask appears: NO ACTIVE ALARM
- if the cause of one or more alarms is still active, only the deactivated alarms are erased, whereas those still active are visualised again and the buzzer and the red LED light again and restart all the alarm procedure.

A clear distinction that has to be made is based on the type of reset of the alarms:
- *manual reset; - automatic reset.*

The type of automatic or manual reset is fixed for every alarm and so ***not modifiable***.
The manual reset, that is the intervention of the operator for resetting, is requested for the alarms that necessarily the user must notice, and occurs after the cause of the alarms has disappeared.
The automatic reset on the contrary is utilised for the not serious alarms, after which the conditioner or the devices can restart without the operator's intervention. In this case the end of the alarm source serves also as reset.

25.1 AUTOMATIC RESET ALARMS

When the source of the alarm reappears, the devices operate again normally and the state of the signalling devices becomes:
- the buzzer, if not yet stopped through ALARM button pressure , stops;
- the red LED under the ALARM button blinks.

The blinking red LED informs the user that alarms have occurred during the day and that by pressing the Alarm button he can see them although they have been already reset. To know at what hour they have taken place, simply access the date logger.

25.2 MANUAL RESET ALARMS

When the alarm source appears again, human intervention is required. The Alarm button pressure while you are displaying the alarm branch causes the alarm reset and the device state becomes:
- the buzzer, if not yet stopped by the ALARM button pressure, stops;
- the red LED under the ALARM button switches off and all the alarm masks disappear.

Unlike the automatic-reset alarms, if the alarm sources reappear, the red LED remains lit to inform the user that there are alarms and in order to restore the situation his intervention is required.

25.3 ALARM RELAY

The alarm relays deserve special consideration since they are signalling devices that are active with regard to the LED, the buzzer and the masks. The pCO2 permits the management of a serious alarm relay and one of generic alarm. The generic alarm relay switches its logic state as a consequence of any alarm; the serious alarm relay instead only switches because of serious alarms. Obviously, the importance of these relays is due to the fact that they can drive remote signalling devices such as sirens or lights or other. This software allows you to choose, alarm after alarm, if only the generic alarm relay must be activated or also that of serious alarm. For both relays it is possible to decide the logic and a delay time before the switch.
ATTENTION: the rotation for alarms described in the paragraph 31.0 takes into account the alarms that activate the serious alarm relay.

26 ALARM SUMMARISING TABLE

The table below includes the complete list of all the alarms managed by this software and for each alarm the action, the delay, the reset and the possible notes are indicated.
Thanks to this table it is possible to know the consequences of each alarm.
Only one thing is not reported: the association of the alarms with the generic alarm relay and the serious alarm relay; this because the selection is not fixed.

code	Alarm description	Action	Reset aut/man	delay	NOTES
AL0					
AL1					
AL2					
AL3					
AL4					
AL5					
AL6					
AL7					
AL8					
AL9					
AL9					
AL10					
AL11					
AL12					
AL13					
AL14					
AL15					
AL16					
AL17					
AL18					
AL19					
AL20					
AL21					
AL22					
AL23					
AL24					
AL25					
AL26					
AL27					
AL28					
AL29					

27 MASK TREE

28 MATERIAL AND CODE LIST

29 pLAN MANAGEMENT

The pLAN network identifies a physical connection between the Carel pCO2 cards and their external terminals.
Meaning of the term pLAN = **p**.CO/**p**.CO2 **L**.ocal **A**.rea **N**.etwork.
The function of the pLAN is to permit the communication between the pCO2 cards in order to exchange all information necessary for a correct operation of the installation.
The variables that are exchanged between the pCO2 cards have already been established in the software, and also the direction toward which they must go and from which they come, and furthermore they absolutely do not undergo the setting up by the user, who consequently has only to realise the electrical connections to make them possible.

29.1 PHYSICAL CONNECTION OF THE pLAN

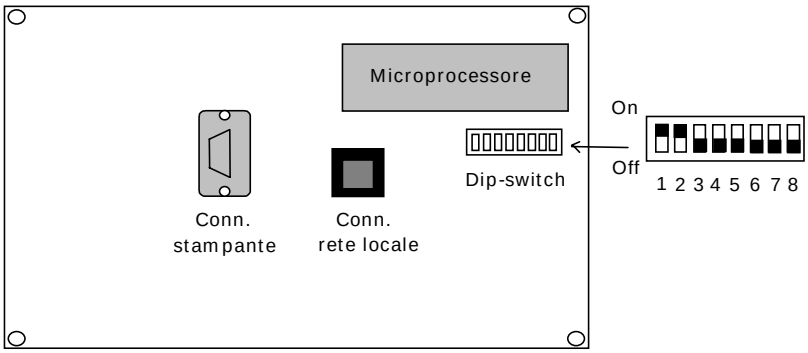
The pLAN electrical connection between the pCO2 cards takes place in parallel with three leads, from one card to the other, utilising the connector J11; the information run in Rs485 logic; no other device is required. There is, and is not required, a set in advance order; the only necessary intervention is the card connection.
The terminals are connected in pLAN with the pCO2 cards utilising the telephone cable.

29.2 CHARACTERISTICS AND LIMITATIONS OF THE pLAN ADDRESSING

The pCO2 cards and the external terminals (not the built-in terminals because they are constituents of the pCO2 cards) have to be addressed for the correct operation of the pLAN, and must have different and sequential addresses, that is without leaps in order to be recognised.
NOTE 1: if you utilise only one pCO2 card with or without external terminal, in any case the addresses are necessary: 1 on the pCO2 and 17 on the external terminal.
NOTE 2: if the same address is assigned to several units (pCO2 or external terminals) the pLAN can not operate.
The addresses that can be assigned range from 1 to 32 (in binary logic), therefore the total number of peripherals that can be connected in pLAN are 32 between pCO2 cards and external terminals.
The Carel maximum scheduled configuration, and not modifiable, comprises 16 pCO2 cards and 16 external terminals, that is one external terminal for each pCO2 card.
If you do not utilise the external terminals, the maximum number of pCO2 cards remain in any case 16.
Also the addresses to be assigned to the cards and the terminals have already been fixed by Carel to facilitate as much as possible the installation, and are listed below.

29.3 WHERE AND HOW TO ASSIGN THE pLAN ADDRESSES

The pLAN addresses, in binary logic, are set by means of a dip switch positioned on the back of the external terminals (see figure below) and on the pCO2 cards (see layout point 13), absolutely the devices being Off.
The addresses are recognised only at start (when the unit is energised), and therefore the selection must be carried out always when the units are Off, otherwise it will not be effective.



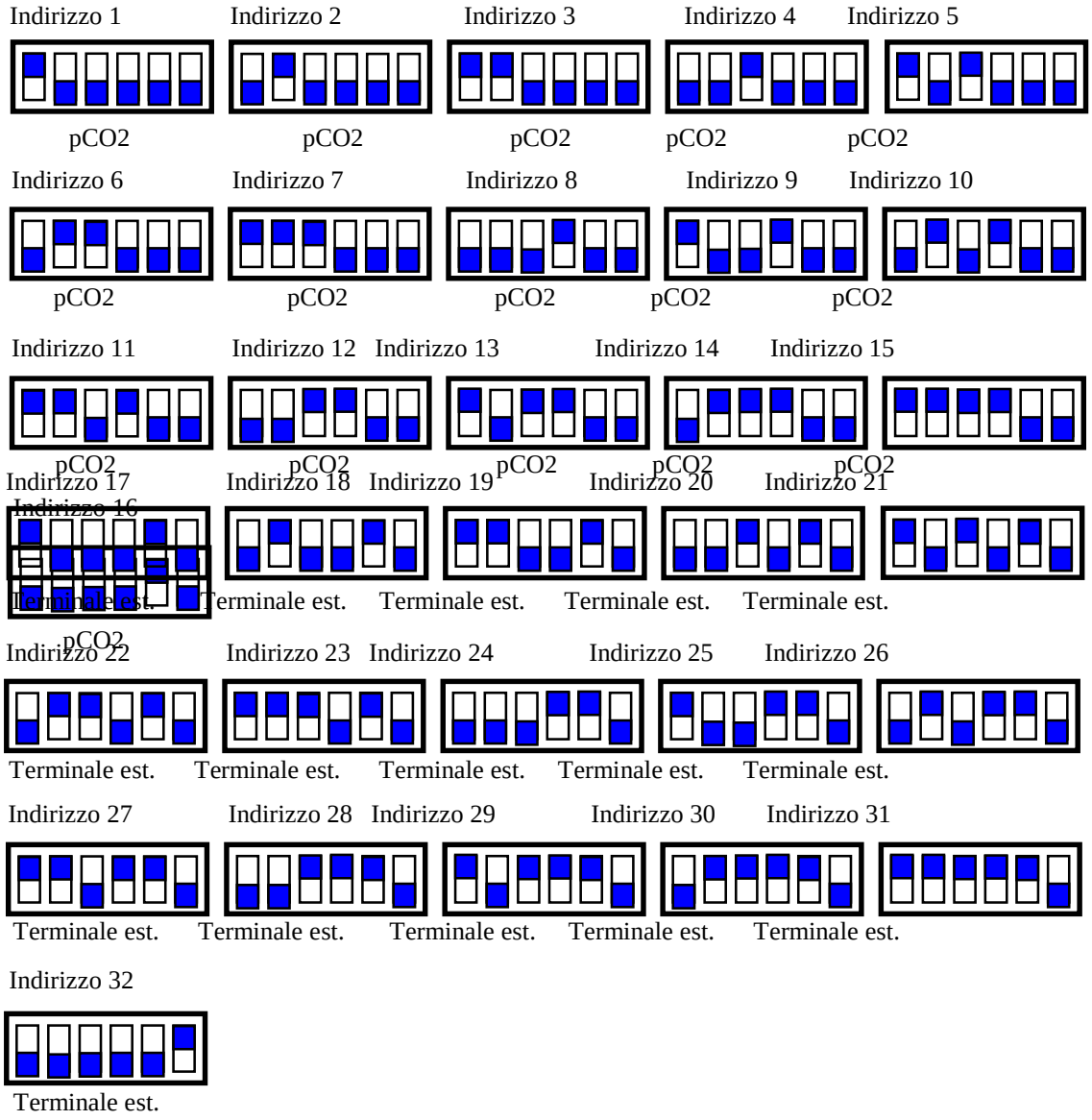
Each switch is numbered from 1 to 6, and the addressing must be carried out beginning from the switch number 1; below a certain number of addressing examples are given.

Adr	Sw1	Sw2	Sw3	Sw4
0	not admitted			
1	On	Off	off	off
2	Off	On	off	off
3	On	On	off	off
4	Off	Off	on	off
....	....	....	....	....

To red the address of a card or terminal without remembering by heart the binary code, simply follow the rule of this example: if the switch is in position 1, add the value 1 for the switch 1, 2 for the switch 2, 4 for the switch 3, 8 for the switch 4 and so on. Nothing must be added for the switches in position 0.
In the example below, the selected address is: 1 + 2 + 4 + 8 = 15.

	Sw1		Sw2		Sw3		Sw4	
State	off	on	off	on	off	On	off	On
P	0	1	0	2	0	4	0	8
Addr=P(Sw1)+P(Sw2)+P(Sw3)+P(Sw4)								

The addressing already set in advance by Carel for all the pCO2 cards and the external terminals are reported are reported below.



It is evident that each terminal corresponds to a particular pCO2 card, that is:

pCO2 addr.1 → addr.17 terminal
pCO2 addr.2 → addr.17 terminal
….

To avoid confusion as regards the main mask top right, we show the pCO2 card to which the terminal being utilised is connected; in this way any possibility of error is excluded.
The only exception regards the terminal with addr.32 that, besides being connected to the pCO2 card with addr. 16, can also operate as sole terminal of all the pLAN network, with the possibility of connecting to all the CO2 cards. Obviously it can show and manage only one pCO2 card at a time, anyway in the meantime all the others will continue to operate normally.
The passage from one card to the other occurs through a special function of the Info button.

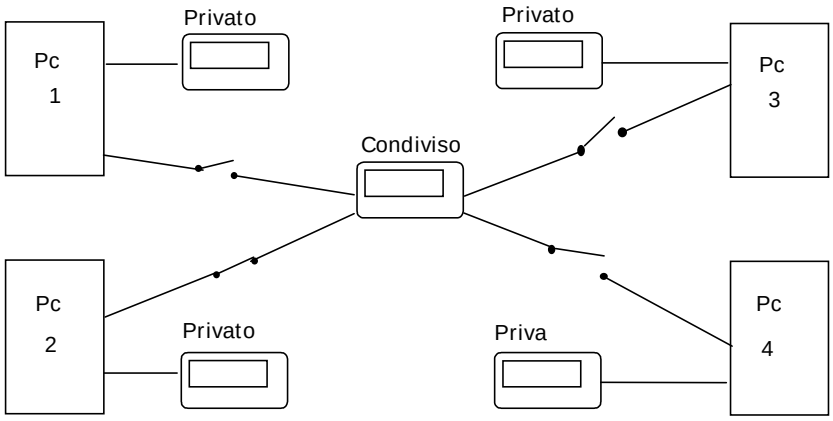
29.4 TERMINAL MANUAL CONFIGURATION

What described above only illustrates the electrical connections and the manual operations to be carried out to activate the pLAN, whereas nothing is said on the configuration from the point of view of the software. This because the terminals and the pCO cards are automatically configured with the installation of the manufacturer's values. That is the reason why the addresses of the cards and terminals are established in advance and not modifiable; if you modify them in fact the automatic configuratio of the pLAN does not correspond to the reality and nothing will be displayed on the terminals.

The manual configuration mode of the terminals in pLAN is explained below.
It may be useful in the following cases:

- you want to configure a pLAN network with different addresses compared to the Carel configuration;
- you want to configure a shared terminal (not the no.32) with all or some pCO2 cards.

Each pCO2 card connected to the pLAN network, can mange at most 3 terminals. The visualisation on them occurs simultaneously and not independently; it is the same as having keypads and displays connected in parallel.
Each terminal associated to a particular card, may be *private* or *shared*.
A terminal is said to be *private* if it visualises exclusively the data of a single I/O card.
A terminal is said to be *shared* if , automatically or through keypad, can be switched among several control cards.
Each pCO2 maintains constantly updated display of the private terminals, on the contrary if there is a shared terminal, the latter, is updated only if the pCO2 of interest possesses actually its control. From the logical point of view the following graph is valid:



In this example the shared terminal is associated to 4 pCO2 cards but only the card with addr. 2 can be visualised and can receive the keypad commands from it. The switching between the cards occurs, cyclically (1→2→3→4→1....), by pressing the *info* button.
The switching can also take place automatically on direct request by the program.
For example a pCO2 card may be requested to be immediately visualised on the display of the shared terminal to visualise alarms or, on the contrary, it pass it to the successive one after a predetermined time (cyclic rotation).
IMPORTANT: this software offers 3 possibilities, namely to have a private terminal for each pCO2 card, to have only one terminal (the number 32) being shared between the units, or to have a mixed configuration that is the private terminals plus the shared terminal.

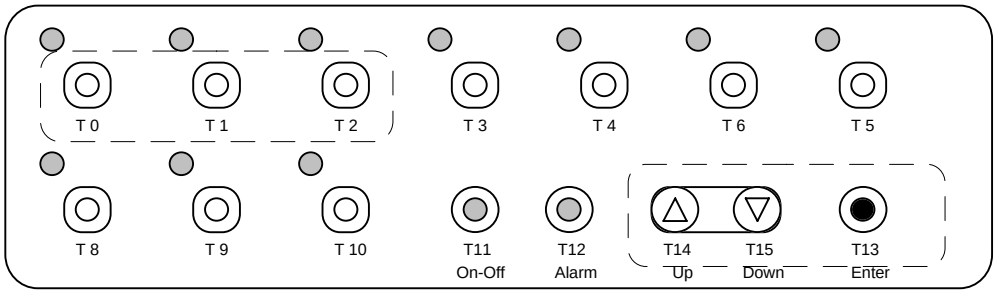
29.5 CONFIGURATION PROCEDURE

Before starting this procedure, be sure that each pCO2 card and each terminal have been named with the correct address established during the network planning.
It is important to carry out the addressing the pCO2 card and the terminals being Off, in order to ensure their reception; otherwise they will be received only after stop and successive restart.
Furthermore it is recommended to switch off all the networked devices in case of incorrect configuration of the addresses (several cards with the same address).
The configuration procedure must be activated for each pCO2 card and must involve all the terminals of the network. This procedure can be activated from any terminal, which can also have been connected momentarily to carry out the configuration operations and removed at the end of them.

The operations you have to carry out are as follows:

Step 1: pCO2 card selection

The procedure is activated by simultaneously pressing the 0-1-2 buttons for at least 5 sec. (for compatibility the same function is carried out also by the Up-Down-Enter buttons):



The display shows the following mask:

```
Terminal  Adr: nn
I/O Board Adr: 01
```

The *Terminal Adr* field is fixed and represents the address of the terminal on which you are operating, being set via the posterior dipswitches.
The *I/O Board Adr* field visualises initially the address of the pCO2 card currently connected to the terminal. If the terminal is not connected with any pCO2 card, the characters '--' are shown. With the arrow buttons it is possible to modify this set up to force the connection to another controller. The values being visualised during the selection are the addresses of the pCO2 cards actually networked. If no pCO2 is actually active, it is not possible to change the display '--'.
By pressing the Enter button you leave the procedure first phase, that is resident in the terminal, you enter the terminal configuration mask itself, see step 2.
If the terminal remains inactive (no button pressed) for more than 15 seconds, it automatically leaves the configuration.

Step 2: associated terminal selection

The masks being displayed are:

```
    Terminal Config

      Press ENTER
      To continue
```

Enter

⇓

```
P:01  Adr     Priv/Shared
Trm1  09        Pr
Trm2  none      --
Trm3  16        Sh  Ok? Nc
```

In this mask the Enter button moves the cursor from one field to the other, whereas the arrow buttons current field value. The P:12 writing, in this case, indicates that the I/O card with address 1 has been selected.
To leave the configuration procedure and memorise, select the 'Ok ? no' field and with the cursor button display the writing 'Yes', then press Enter. To exit without memorising, a 30 sec waiting is required.

If the terminal reveals the state of pCO2 card inactivity whose output it is displaying, it erases completely the display and shows the message:

```
I/O Board xx fault
```

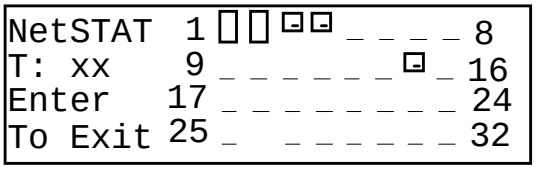
If the terminal does not receive network synchronisation message (token) for more than 10 sec, it erases completely the display and shows the message:

```
          NO LINK
```

this is equivalent to the green LED Off condition for the I/O cards.

29.6 LOCAL AREA NETWORK STATE

In the program there is a procedure that allows you to display the in real time the state and the type of peripherals actually connected. The procedure is activated by the simultaneous pressure of the 0-1-2 buttons (or Up-Down-Enter) for at least 10 sec (after the first 5 sec have been elapsed, obviously you enter the procedure of terminal configuration). The mask being displayed is as follows:



The number after T: indicates the terminal address on which the procedure is activated; the symbols indicate the type of peripheral (terminal/pCO2) and its address.
The example shows that the network consists of two pCO2 cards with address 1, 2, and of three terminals with the following addresses 3, 4, 15.

30 pLAN UTILIZATION

The pLAN networking of the pCO2 cards offers numerous advantages:

1. balancing of the conditioner hour operation
2. back-up unit switch on in case of serious alarms, malfunctioning or black-out
3. cyclic rotation of the units
4. back-up unit switch on in conditions of excessive heating load
5. control of the whole system with one only terminal
6. respect of the “driver” unit operation mode by the others

These are only the main advantages, which many others are to be added to according the type of management you intend to carry out.

This software permits the configuration of wide range of installations according to the requirements:

1. only one conditioner (the pLAN is not required)
2. several independent conditioners but only one terminal being shared (pLAN)
3. various several connected conditioners (pLAN)
4. some connected conditioners and other independent conditioners (pLAN) in the same installation

It is possible to carry out these types of installations and many others.
The aim of the pLAN network is to carry out the information exchange between the pCO2 cards so as to exploit them in the cases envisaged and listed above, on the basis of the selections being carried out.

IMPORTANT: in case all this is purposeless, such as in the installations with one or more conditioners perfectly independent, each pCO2 card must have the address 1, you need not to carry out any electrical connection of the pLAN and the external terminal (if present) must have the address 17.
On the contrary, the installations composed of two or more pLAN-connected pCO2 cards, have to comply with the rules of the pLAN, that is the addressing and the three-wire electrical connection as described in the paragraph 29.1

The following paragraphs explain how it is possible to exploit the pLAN network.

31 UNIT ROTATION

Some pCO2 cards of the system remain normally Off in a state signalled with the acronym SLEEP . Actually, it is a switching off carried out by the pLAN system, which then start them if necessary.
Obviously, the number of pCO2 cards (and therefore of conditioning units) normally ON must be enough to air-condition the controlled space. All the other units in SLEEP mode only serve for replacing, or possibly helping, in one of the following cases:

1. one of the energised cards remains unpowered (black-out)
2. in one of the switched on cards a serious alarm occurs (see paragraph 25.3)
3. one of the cards On disconnects from the pLAN network because of the electrical connections
4. one of the cards On is switched off by OFF button
5. the On cards are not able by themselves to reach the (uncommon case) setpoint

The rule is valid that that for each unit normally ON to which one of the listed cases occurs, one SLEEP card is automatically switched on, up to run out of the back-up cards. If a higher number of units fails compared to the back-up units, the system loses one balance.
If, for example, two units normally open break out or disconnect themselves, the pLAN system starts automatically two SLEEP units.
As soon as the alarm or the disconnection stops, the original unit is started again and then one of the SLEEP unit is stopped.
The automatic start and stop operations of the units carried out by the pLAN network, are called ROTATION.
The number of SLEEP unit is automatically limited between 0 and (Unit total number – 1).

There is a particular case of SLEEP unit start even if in the absence of alarms or disconnection of the ON units, and it is the case in which they are unable to reach temperature setpoint. If after some selectable time the temperature is higher or lower with respect to the setpoint of a certain limit value, the SLEEP units begin automatically to be started.

It is obvious that in a system composed of units normally ON and of units that switch on only occasionally, problems of unbalance may easily arise. The unavoidable consequence of this is that, a little later, some units are used and others are used very little and so they are still new. To face this drawback, the pLAN network is able to operate the automatic rotation of the units at regular time intervals, helping the smoothing of the hour operation.
It is possible to establish the interval duration in hours; after this time, an ON unit becomes SLEEP and a SLEEP unit switches on. At this point the units normally ON and those SLEEP are not always the same and in any case the total effect of the air conditioning is not altered.
EXAMPLE: installation composed of 15 units in all, of which you establish that 5 are SLEEP. The user, after switching on all the pCO2 cards (pressure of the On button), will see the cards switch on in sequence with addresses from 1 to 10 and will see the cards from 11 to 15 remain in SLEEP mode.
After reaching the first time interval for the automatic rotation, the unit 1 moves to SLEEP and the unit 11 switches on, the next time the unit 2 passes to SLEEP and the unit 12 starts and so on.
Also in case of damage or disconnection of an ON unit, the SLEEP unit that replaces it is always that with lower pLAN address among the SLEEP units.

32 UNIT

The dependency is the second utilisation of the pLAN network.
All the connected units are constantly ON but must obey the operation mode of the Master unit with address 1.
It is useful in wide spaces where warm and cold zones or humid and dry zones can easily occur simultaneously, at the risk that the units operate the opposite way, and consequently with energy waste. In fact each unit starts the devices according to the signal being measured by its temperature and humidity probes, and if two conditioners in the same space sense the one cold and the other warm with respect to the same setpoint, they will operate the opposite way cancelling each other.
The Master unit is established to drive the others, therefore it must be placed in a position reflecting the mean of the environment, or at least its probes must do the same.
The other units operate basing themselves both on their probes and the Master probes, that is if the Master activates the cooling, also the other units can activate it if their probes require it. If however their probes require for example heating to be carried out, then they can not do it.
In conclusion, the Master unit tell the other ones what is allowed to do and the others do or not do it based on their probe measurement.
The result is that in this way no unit will operate the opposite way.

In case of damage or disconnection of the Master unit, the dependence function is temporarily suspended and each unit operates independently.

33 UTILISATION OF ONLY ONE EXTERNAL TERMINAL

As illustrated in the paragraph 29.0, the external terminal with pLAN address number 32, if present, can manage all the pCO2 cards.
For example, installations that must be controlled from a remote point of the installation such as an office, or installations where only one terminal is needed. In the first case the terminal with address 32 operates together with the others.
The main mask displays in the top left angle the adds of the pCO2 card which the terminal is connected to; only in the terminal 32, at each pressure of the Info button, this address changes, according to a rotational pattern, between the addresses of pCO2 networked cards.
In this way it is possible to control one by one all the pCO2 cards and in case of alarm of one of them, it orders the terminal to show automatically its data.

In the pLAN networks with less than 16 pCO2 cards and all with their own external terminal, connect the terminal with address 32 to one pCO2 card whatever shunted to the J10 connector, by way of telephone cable and T shunt (code TCONNJ6000). In practice the J10 connector of the card at issue receives the signals from two terminals.

In the pLAN networks with less than 16 cards but lacking external terminals or with only built-in terminals, the shared terminal with address 32 can be connected to any one of the pCO2 cards by using the connector J10 and the telephone cable.

34 pCO2 CARDS IN pLAN NETWORK AND INDEPENDENT CARDS

In the manufacturer's branch, by way of a very important parameter (pCO2 card number), you establish how many pCO2 cards the installation is composed of; the minimum number that can be set is 1, whereas the maximum number is 32. Therefore be careful when modifying the value.

Number of pCO2cards = 1. In this case all the masks and the parameters relevant to the rotation and the dependency are no more visible and all the functions that depends on presence of the pLAN network are automatically disabled. The single pCO2 card of the installation operates independently.

Number of pCO2 cards > 1. Possibility of utilising the rotation and dependence functions.

Number of pCO2 cards < Total number of pCO2 cards connected to the network. The cards with address from 1 to "Number of pCO2 cards" are managed with the rotation or the dependency; the excess pCO2 cards operate independently, that is they do not comply neither the rotation nor the dependency.
The presence of independent units in the pLAN network allows you to utilise them in case of permanent damage of one of the cards normally utilised, new pLAN connections being not required, or in case of successive extension of the installation. Or else it could be the case of units that manage a nearby but independent space, and that you want to be driven by the terminal number 32.

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