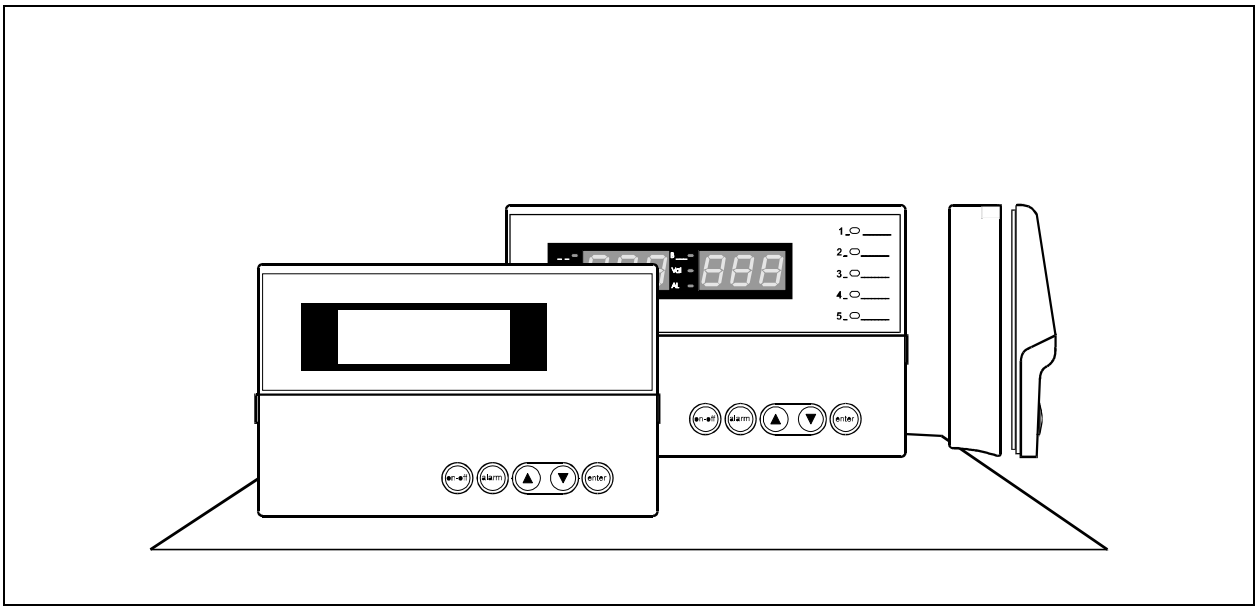
Application program for pCO



Standard 1/3 compressor pack control

Manual version: 1.0 - 21/10/94

Program code: **EPSTDEFC2A**

CAREL

Technology & Evolution

Rif.: 83**EM**

pCO controller
for refrigeration

EPSTDIFC2A ver. 1.002 (normally closed inputs)

Functions performed by pCO:

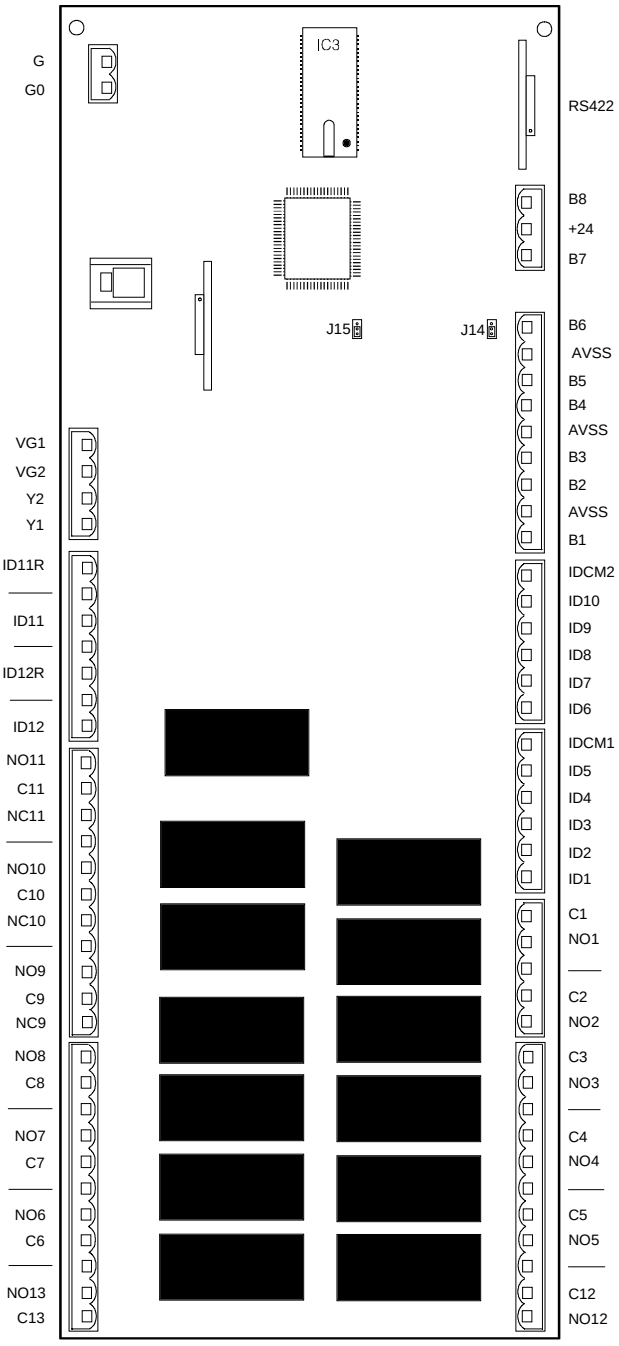
- Control and regulation of a refrigeration system, max. 3 compressors
- Display of all measured values and set-points
- Possibility of selecting and successively modifying the regulation parameters
- Indication of any off-normal condition via acoustic and visual signals (BUZZER and ALARM MESSAGES)
- USER-UNIT communication interface (KEYPAD - DISPLAY - LED INDICATORS)
- Possible connection to remote supervisor via RS422 serial line.

Contents

pCO

The figure below shows all the components and optional devices of pCO dedicated to the control and regulation of refrigeration units.

Main card



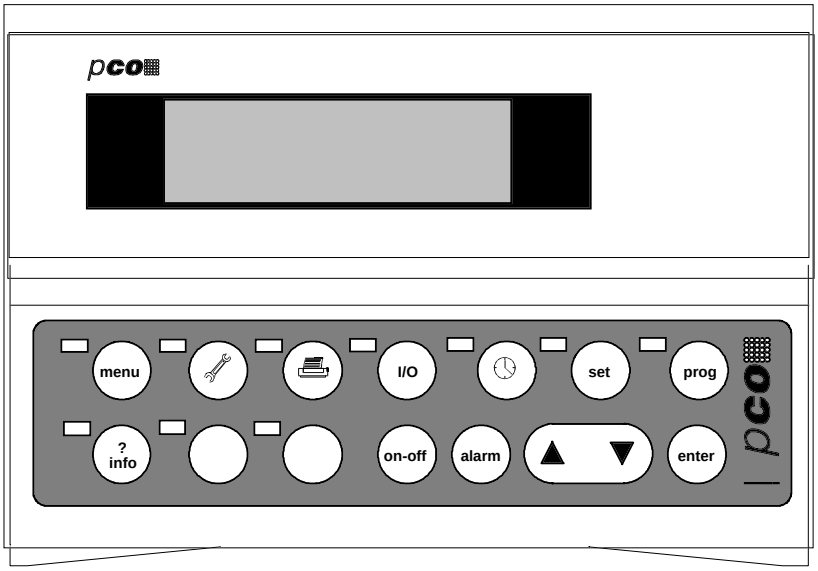
The microprocessor-based main card is the intelligent part of the system since it carries out the regulation program. It comes complete with terminals dedicated to the connection of the main devices (eg. valves, compressors, fans). The software is contained in the Eprom whereas all parameters set by the User will be permanently stored (also in the event of power source failure) into the EEprom.

The main card can be connected to the Rs422 serial line so as to provide supervisory/telemaintenance services (standard RS422 and Carel communication protocol).

Terminal

The terminal unit - managed by the microprocessor - comes complete with display, keypad and led indicators. Setting the main control parameters (set-points, differential, alarm thresholds) and performing any other operation is extremely simple.
The terminal unit must be connected to the main card only when programming the instrument; after that, the two units can be disconnected.
The terminal unit enables you to perform the following operations:

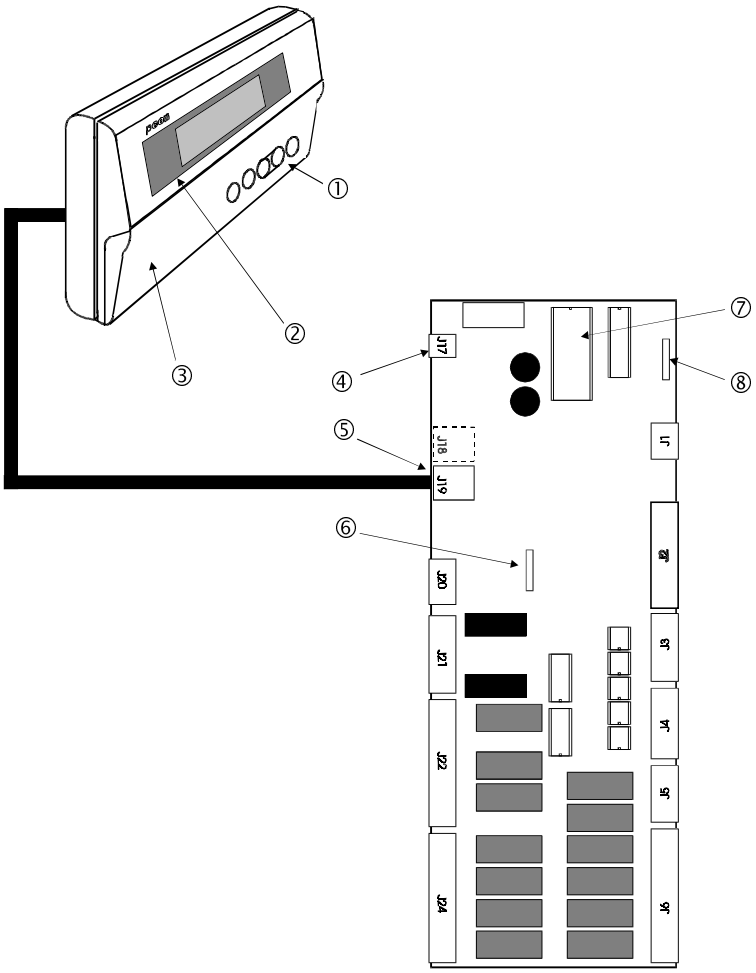
- initial programming via password;
- possibility of modifying run-time any working parameter;
- display of any alarm condition (via alarm messages and buzzer);
- display of all measured values.



Terminal unit with open front panel lid

Configuration of pCO

The figure below shows the hardware architecture of pCO.



Description of the components

1. Rubber keypad
2. LCD display, 4 x 20
3. Polycharbonate front panel and front lid
4. Connector for 24 Vac 50/60 Hz 15 VA power source or 24 Vdc 10 W
5. Telephone connector for connection to terminal unit
6. Clock card (optional)
7. Program Eprom
8. RS422 card for serial line connection to supervisory/telemaintenance systems

User Interface

Display

The Liquid Crystal Display shows the values of the controlled variables, selected set-points, alarm thresholds and any other information concerning the status of the unit. In the event of an off-normal condition, a special alarm message will appear on the display.

Keypad

pCO comes complete with a 15 button keypad. Keypad and display represent the User Interface. Each button has a specific function, as listed below:

ON / OFF	Operates and stops compressors and fans.
ALARM	Goes to the first active alarm mask and turns off the buzzer. If pressed a second time on the active alarm mask, it resets the alarm and returns to the first mask again. If you press this button and there are no active alarms, the message 'NO ACTIVE ALARM' will appear on the display. All alarm masks can be scrolled by pressing the UP and DOWN buttons.
UP & DOWN	When the cursor is on the HOME position, these buttons allow you to read all the masks of a specific section (masks are organized in a loop structure). When the cursor is within a numeric field, the UP & DOWN button allow you to increase and decrease the value on which the cursor is positioned. When the cursor is on a choice field, pressing these buttons allows you to display all the options available (eg. Yes/No).
ENTER	When the cursor is on the selection masks, press ENTER once to move the cursor to the first introduction field. Press ENTER again to confirm the set value and to move the cursor to the next field. When the cursor reaches the last field, it will return to the HOME position again (cursor at position 0,0 on the display).
MENU	Press it to go to the MENU mask.
INFO	Press it to go to the M_INFO1 mask.
MAINT 	Press it to go to the M_MAINT1 mask.
PRINT 	Usable only in models with printer.
I/O	Press it to go to the IN_OUT1 mask.
TIME 	Press it to go to the CLOCK1 mask.

SET	Press it to go to the M_SET1 mask.
PRG	Press PROG to prompt the password. Introduce the correct password to gain access to the M_SERVICE mask.
MENU+PROG	Press and release the MENU and PROG buttons SIMULTANEOUSLY. Then, introduce the password to gain access to the CONF_MACHINE1 mask.

Led Indicators

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

When pressing the MENU+PROG buttons to gain access to the configuration parameters, it is the led indicator corresponding to the PROG button that will light up.

There are other three led indicators under the following rubber buttons:

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

Inputs/Outputs

Analogue Inputs

TERMINAL	N°	DESCRIPTION
J2 - 7	B5	Suction pressure
J2 - 8		Common to analogue inputs
J2 - 9	B6	Delivery pressure

Digital Inputs

TERMINAL	N°	DESCRIPTION
J4 - 1	ID1	Klixon circuit breaker / high pressure pressurestat, compressor no. 1
J4 - 2	ID2	Klixon circuit breaker / high pressure pressurestat, compressor no. 2
J4 - 3	ID3	Klixon circuit breaker / high pressure pressurestat, compressor no. 3
J4 - 4	ID4	Circuit breaker fan no. 1
J4 - 5	ID5	Circuit breaker fan no. 2
J4 - 6	IDCM1	Common to digital inputs J4 - 1 / 5
J3 - 1	ID6	Circuit breaker fan no. 3
J3 - 2	ID7	Oil differential pressurestat, compressor no. 1
J3 - 3	ID8	Oil differential pressurestat, compressor no. 2
J3 - 4	ID9	Oil differential pressurestat, compressor no. 3
J3 - 5	ID10	Coolant level
J3 - 6	IDCM2	Common to digital inputs J3 - 1 / 5
J21 - 1	ID11R	Common to digital input J21 - 3
J21 - 3	ID11	General low pressure pressurestat
J21 - 5	ID12R	Common to digital input J21 - 7
J21 - 7	ID12	General high pressure pressurestat

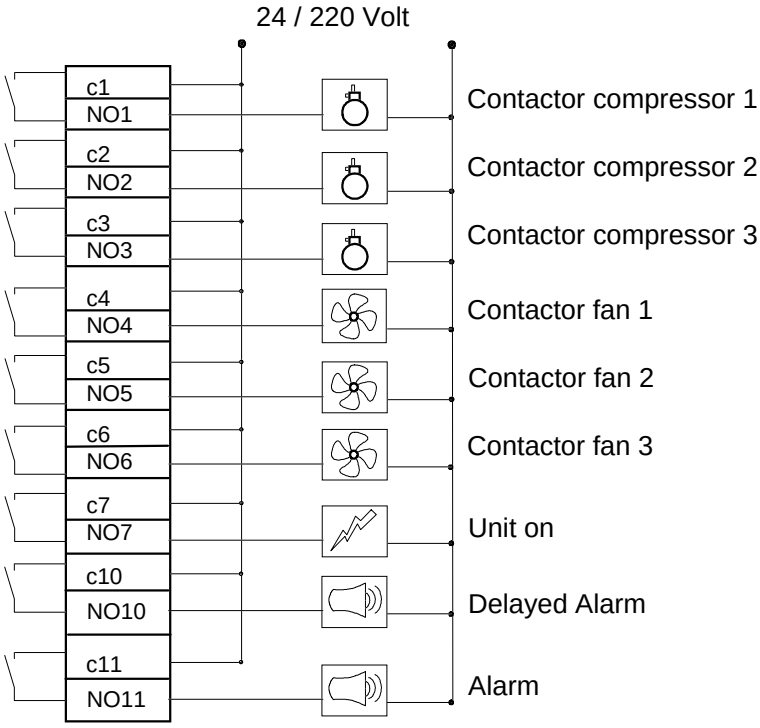
Digital Outputs

TERMINAL	N°	DESCRIPTION
J5 - 4 / J5 - 5	1 - NO1 / C1	Compressor no. 1
J5 - 1 / J5 - 2	2 - NO2 / C2	Compressor no. 2
J6 - 10 / J6 - 11	3 - NO3 / C3	Compressor no. 3
J6 - 7 / J6 - 8	4 - NO4 / C4	Fan no. 1
J6 - 4 / J6 - 5	5 - NO5 / C5	Fan no. 2
J24 - 7 / J24 - 8	6 - NO6 / C6	Fan no. 3
J24 - 4 / J24 - 5	7 - NO7 / C7	Unit on
J22 - 5 / J22 - 6	10 - NO10 / C10	Delayed general alarm
J22 - 1 / J22 - 2	11 - NO11 / C11	General alarm

Analogue Outputs

TERMINAL	N°	DESCRIPTION
J20 - 1 / 4	Y1	Fans Inverter

Relay outputs layout

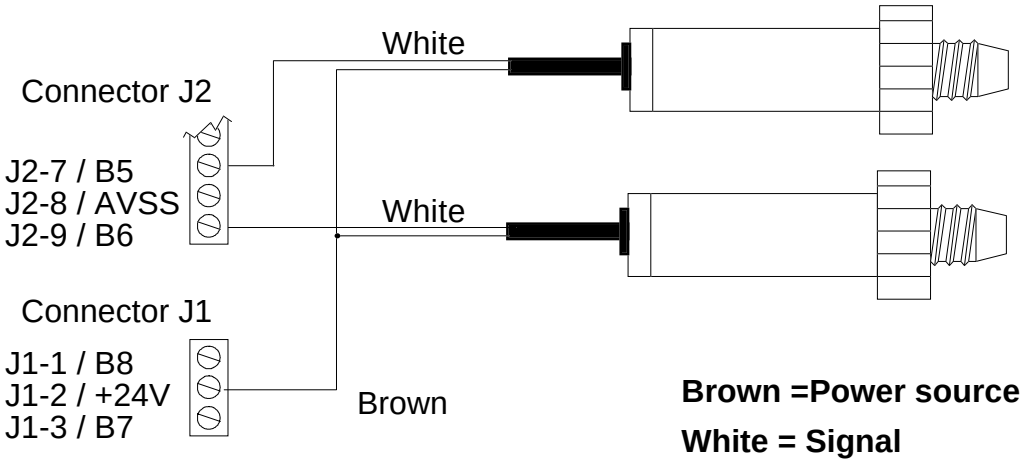


Connecting Keller pressure transducers

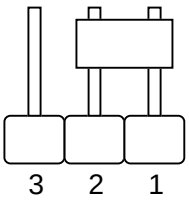
This application requires two pressure transducers that must be connected to terminals B5 and B6. The first transducer will measure low pressure (suction pressure), the second transducer high pressure (delivery pressure).

The fig. below shows how to connect the two KELLER transducers to the interface.
Series 21 / 22

-	Delivery side:	0:30 bar	Code SPK3000000
-	Suction side:	-0,5:7 bar	Code SPK1000000



Connect the transducers directly to the interface.



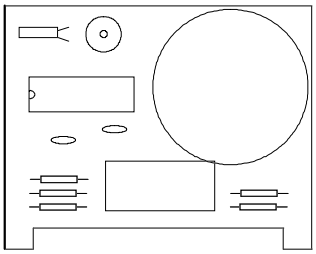
IMPORTANT:

Set the 4-20 mA configuration by placing the jumper of connectors J14 and J15 as indicated in the figure on the left.

Optional Cards and Eprom

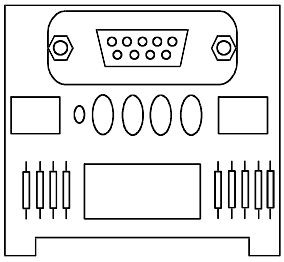
Clock Card

Clock Card



The clock card - necessary to display current time and date - must be directly inserted into the main card through a plug-in connector. The clock card is necessary to provide a time-zones control action. In the event of power supply failure to pCO, the clock card will be powered by a lithium battery for more than one month. For connection to the relative connector (6) see page 4 above.
Code MNEWCLOCK0

RS422 Serial Card



The RS422 serial card allows pCO to be network connected into local or remote supervisory and telemaintenance systems. For connection to the relative connector (8) see page 4 above.

Mounting the Eprom

The Eprom - separately supplied - contains the application program.

When inserting the eprom into its socket (see page 4) pay attention to align its polarity correctly (the notch on the eprom must coincide with that of the socket). Insert the eprom carefully without bending or breaking its small pins.

Before requesting Service

THE UNIT DOES NOT START
Led indicator (power on) OFF, Lcd off, other led indicators off.

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

THE UNIT IS ON BUT:
the alarm led indicator is ON
the LCD shows no messages or random messages
the buzzer sounds

Cause:
a. eprom inserted with wrong polarity
b. pins of the eprom bent
c. microprocessor chip damaged: contact qualified service personnel

WRONG INPUT SIGNALS READING

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

FAULTY EEPROM

a. contact qualified service personnel

pCO turns Off and On repeatedly (watch-dog) or it operates some (digital and/or analogue) outputs at random.

Cause:
a. incorrect connections between interfaces and controller
b. power cables are too close to the microprocessors of the interfaces and to the control card.

The program

General description

pCO by Carel has been specifically designed to control and regulate refrigeration units with 1 to 3 compressors as well as 1 to 3 condensation-removal fans. The activation of the compressors depends on the value measured by the suction trnasducer and on the selected set-point; the activation of the fans depends on the delivery pressure value.
The control of the pressure is based on a 'neutral zone regulation' that minimizes the changes of pressure thus balancing the entire system. The system includes 12 digital inputs for the detection of alarm signals. In case of off-normal condition, the interested device will be stopped and the Operator will be alerted by the buzzer and by a red led indicator placed on the front panel of the instrument.
Alarm, pressure and set-point messages are freely accessible whereas setting the working parameters requires the introduction of a key word so as to prevent unauthorized access to the regulation data. It is possible to display a wide range of message masks by simply acting on the keypad (eg. clock masks and pCO identification number, necessary to enable supervisory services within a local network). Access to the reserved masks requires a password (1234). These special masks contain the main working parameters of the system, eg. number of compressors, number of fans, times, alarm thresholds, etc.
The configuration masks - accessible via password only - afford you a special procedure whereby you can initialize pCO with factory-set parameters, making the configuration of the entire system even faster and easier.

Finally, remember that pCO can be easily connected to a SUPERVISORY COMPUTER for the centralized control of any normal and off-normal condition of the system.

Software Initialization

Initializing the software means to set a series of important parameters such as:

- number of compressors and fans
- control parameters (set-points, times, alarm thresholds, etc.)

All set data are permanently stored and retrieved any time pCO is turned ON. The very first time pCO is turned ON, we recommend cancelling the original data since they might be unsuitable for your application requirements and then loading the factory-set parameters so as to make the initialization procedure fast and easy.
Follow these indications:

- Turn pCO ON. After a few seconds the main mask - MENU MASK - appears on the display. When starting pCO the very first time, ignore any alarms since they probably result from incorrect data.

- Press MENU + PRG simultaneously. Now you have to digit the password, necessary to prevent unauthorized access to the operational parameters (configuration section).

- Digit the correct password. After that the configuration masks can be accessed. Use the UP & DOWN buttons to reach the CONF_MACHINE7 mask allowing you to delete the back-up memory and automatically set the entire range of factory-set values.

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

- [1] MANUFACTURER password: "1234" . We recommend keeping the password secret so as to prevent unauthorised access to the operational parameters. The Manufacturer password can be used when performing preliminary operations as well as any time you do not manage to gain access to the configuration mask by the SERVICE password in the CONF_MACHINE6 mask.

Configuring pCO

Number of compressors

You can select the number of compressors to be controlled directly through the mask CONF_MACHINE1. pCO manages 1 to 3 compressors having the same capacity as well as their shifts.

Number of fans

You can select the number of fans to be controlled directly through the mask CONF_MACHINE2. pCO manages 1 to 3 fans and their shifts.

Optional devices

You can enhance the functions of the pCO controller by adding a series of optional devices (clock card, RS422 serial card) that can be enabled by simply acting on the dedicated masks.

In order to enable the clock card it is necessary to set time and date in the dedicated mask. When pCO is network-connected into a supervisory/telemaintenance system by means of the RS422 serial card, it is necessary to give each pCO a specific identification number so as to address messages correctly.

When giving each pCO its identification number,

- do NOT give different pCOs the same address (each pCO must have its own identification number);

- the addresses of the pCOs belonging to the same serial line must be consecutive, starting from no. 1.

Supervisor

The table below lists the variables pCO tramsits to the supervisory computer when network-connected into a centralized system.

MEANING	TYPE	IN/OUT
Status of compressor no. 1/3	Digital	On dispaly
Status of fan no. 1/3	Digital	On dispaly
Status of the system	Digital	selectable
Klixon 1/3 circuit breaker (alarm)	Digital	On dispaly
Alarm: oil differential pressurestat 1/3	Digital	On dispaly
Alarm: general high pressure (pressurestat)	Digital	On dispaly
Alarm: general low pressure (pressurestat)	Digital	On dispaly
Coolant level alarm	Digital	On dispaly
Alarm: circuit breaker fan no. 1/3	Digital	On dispaly
Alarm: exceeded hours threshold of compressor no. 1/3	Digital	On dispaly
Alarm: high delivery pressure	Digital	On dispaly

Alarm: high suction pressure	Digital	On dispaly
Alarm: suction probe broken or disconnected	Digital	On dispaly
Alarm: delivery probe broken or disconnected	Digital	On dispaly
Alarm: clock card broken or disconnected	Digital	On dispaly
Alarm: eeprom damaged	Digital	On dispaly
Alarm: low suction pressure	Digital	On dispaly
General alarm	Digital	On dispaly
Buzzer off / alarm reset (like ALARM button)	Digital	Selectable
Call supervisor	Digital	Selectable
Suction pressure	Analogue	On display
Delivery pressure	Analogue	On display
Compressors set-point	Analogue	selectable
Compressors differential	Analogue	selectable
Alarm threshold: low suction pressure	Analogue	selectable
Alarm threshold: high suction pressure	Analogue	selectable
Alarm threshold: high delivery pressure	Analogue	selectable
Fans set-point	Analogue	selectable
Fans differential	Analogue	selectable
ON routine of the compressors	Analogue	On display
OFF routine of the compressors	Analogue	On display
Number of compressors	Integer	Selectable
Number of fans	Integre	Selectable
Setting the hour	Integer	Selectable
Setting minutes	Integer	Selectable
Current hour	Integer	On display
Current minutes	Integer	On display
Time to call the supervisor (set the hour)	Integer	Selectable
Time to call the supervisor (set the minutes)	Integer	Selectable
Compressors hours threshold	Integer	On display
Working hours of compressor no. 1/3	Integer	On display

Status of the system

The system can be ON, OFF or in the MANUAL functioning mode.

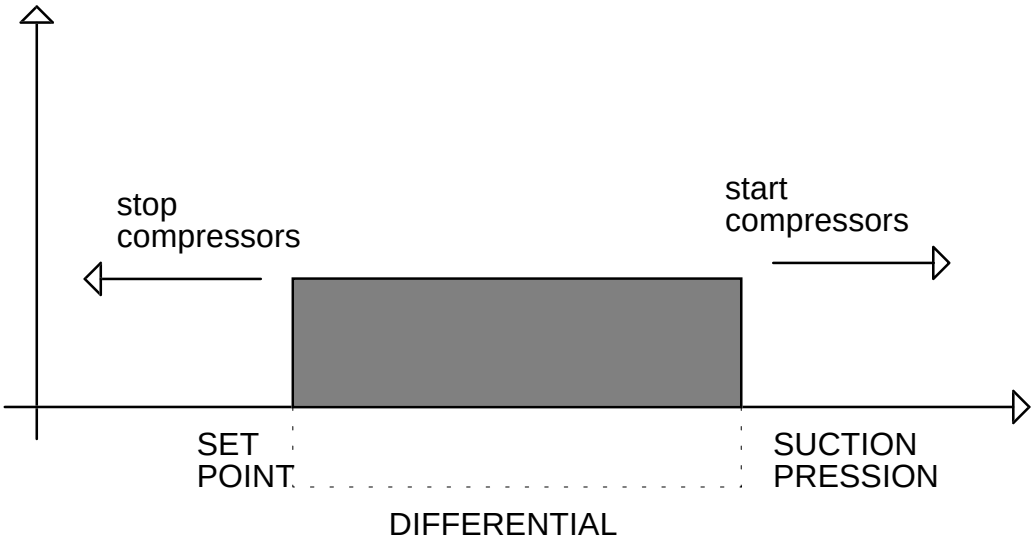
- It is possible to turn ON the refrigeration unit by pressing the ON button on the keypad or - in case of network connection to a centralized computer - by means of the external command operated by the supervisor. When the system is ON, compressors and fans will will be operated on the basis of the values measured by the pressure transducers.

- To turn the system off, press the OFF button on the keypad (this function must be enabled through the CONF_MACHINE4 mask) or send the 'off' command from the supervisor. In the event of low pressure alarm (broken probe), the system will automatically turn off. This function, however, must be previously enabled through the CONF_MACHINE4 mask. When the system is Off, all connected devices will turn Off.

- To activate the manual procedure, act on the masks M_MAINT6 and M_MAINT7 (protected by password). The manual procedure forces the unit into the Off status so that it will be possible to operate all connected devices manually, with the exception of the pressure control action and all alarm conditions that will be always automatically detected.

Compressors

The regulation action is based on a 'neutral zone control': when the pressure value goes below the set-point the compressors will be stopped, when the pressure exceeds the value given to set-point + differential, the compressors will be activated. Set differential and set-point in the dedicated mask.



When the pressure value ranges between the set-point and the set-point + differential zone, the system will be under stable conditions (neutral zone) and there won't be any requests for compressors ON/OFF.

Compressors shift

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

The shift is based on a F.I.F.O. logic: the first compressor that turns On will be the first to turn Off. At the very beginning this logic might cause an unbalanced compressors management but the system will gradually settle.

Upon a call for compressor ON, the logic will be as follows:

- the compressor that has been Off for the longest time-interval will be the first to start;
- the first compressor that turns On will be the first to turn Off;
- any compressor will turn On again only after all the other compressors have turned On.

Compressors timer

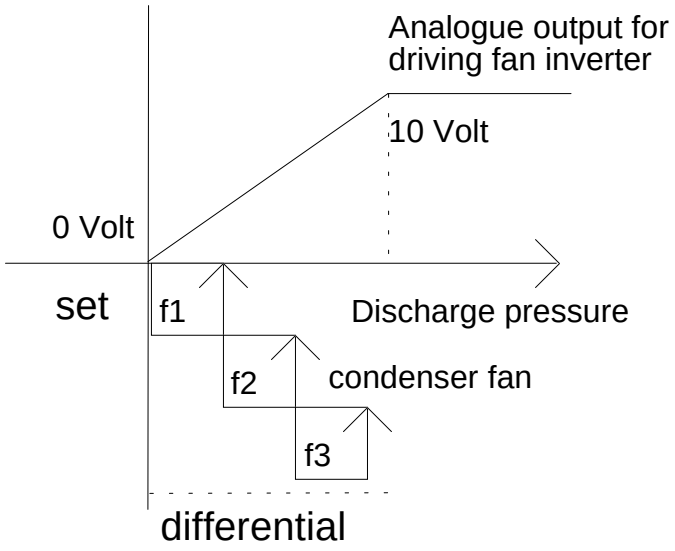
pCO also controls the working hours of the compressors. Set the required value (default 10,000 hours) in the dedicated mask. When the compressors reach the set threshold an alarm message prompting maintenance will be displayed.

Fans

Fans are managed on the basis of a 'steps control action'. After having selected set-point and differential, a series of steps will automatically be created within the working zone. The number of steps depends on the number of fans. The dedicated masks will show the On routines of each single fan. The steps relative to the unused fans will be calculated beyond the working zone, so the fans will never be activated. Fans will start according to the values measured by the high pressure transducer (delivery side of the compressors). Fans shift is also available.

Inverter

The analogue output Y1 (0 - 10 Volt) is used to control an inverter; in this way the fans will be managed according to the values measured by the high pressure probe. The purpose of this function is to keep the condensation pressure as close as possible to the set-point by modulating the speed of the fans. As a result, the fans will work less and with less noise, especially when the external temperature is low.



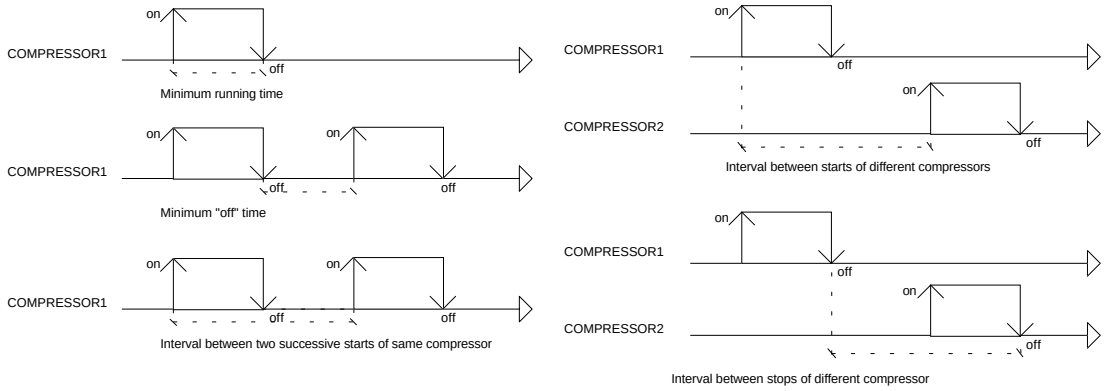
FANS INVERTER DIAGRAM

(Uscita analogica inverter = inverter analogue output
per ventilatori = for fans
Pressione mandata = delivery pressure
Ventilatori condensazione = condensation-removal fans
Differenziale = differential)

Times

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

- time-delay between two consecutive requests for compressor ON
- time-delay between two consecutive requests for compressor OFF
- minimum ON routine of the compressor
- minimum OFF routine of the compressor
- time-delay between two consecutive ON routines of the same compressor
- time-delay between two consecutive requests for fan ON
- time-delay before activating the coolant level alarm
- time-delay before activating the oil differential pressurestat alarm
- 60 seconds' time-delay before activating probe alarms (damaged or disconnected probes)
- 120 seconds' time-delay before activating the high suction pressure alarm.

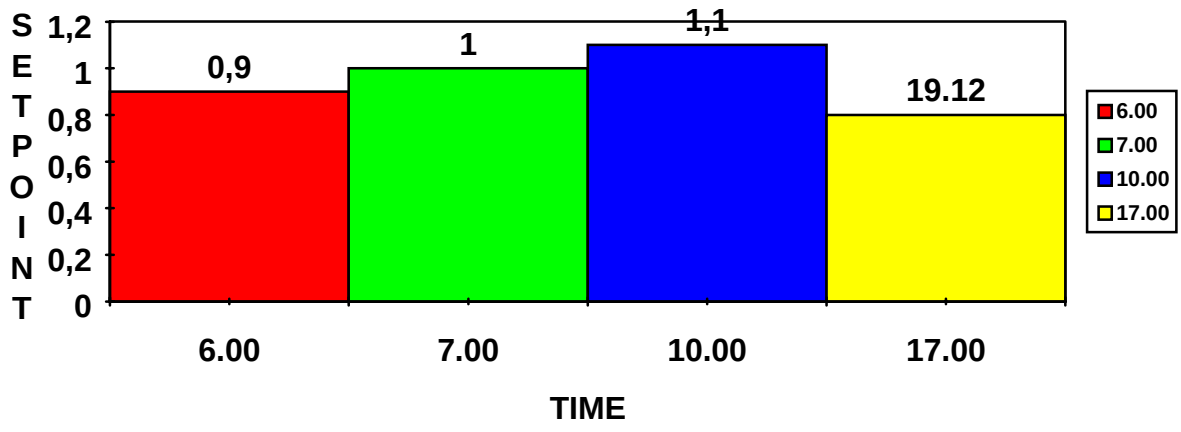


Time-zones

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

Eg:

HOUR/MINUTE	SETPOINT	EFFECT
06:00	0,9 bar	from 06:00 to 07:00 set-point = 0,9 bar
07:00	1 bar	from 07:00 to 10:00 set-point = 1 bar
10:00	1,1 bar	from 10:00 to 17:00 set-point = 1,1 bar
17:00	0,8 bar	from 17:00 to 6:00 set-point = 0,8 bar



In order to set time-zones, it is necessary to provide pCO with a clock card. It is possible to program up to 4 time-zones. Should you need less than 4, it is necessary to give the unused time-zones the same values.

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

WRONG		RIGHT	
HOUR/MINUTES	**SETPOINT**	**ORE/MINUTI**	**SETPOINT**
07:30	1 bar	07:30	1 bar
18:00	0,8 bar	18:00	0,8 bar
00:00	0	18:00	0,8 bar
00:00	0	18:00	0,8 bar

All time-zones can be programmed according to your application requirements; if you do not select any time-zone and relative set-point, the reference set-point will be that set through the M_SET1 mask.

Default values

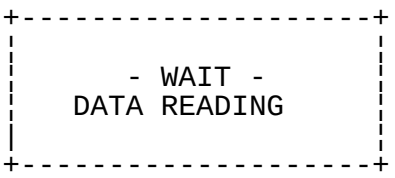
Default values can be automatically loaded through the 'DEFAULT' mask. The table below indicates a list of default parameters (1st column), the mask where you can set/modify their value (2nd column) and the default value given to each specific parameter (3rd column).

PARAMETER	MASk	VALUE
Number of compressors	CONF_MACCHINA1	3
Compressors shift enabled	CONF_MACCHINA1	yes
Number of fans	CONF_MACCHINA2	3
Fans shift enabled	CONF_MACCHINA2	yes
High pressure probe min. limit	CONF_MACCHINA3	0 bar
High pressure probe max. limit	CONF_MACCHINA3	30 bar
Low pressure probe min. limit	CONF_MACCHINA3	-0,5 bar
Low pressure probe max. limit	CONF_MACCHINA3	7 bar
Button OFF enabled	CONF_MACCHINA4	yes
Unit turns OFF in the event of low pressure probe failure	CONF_MACCHINA4	No
Autostart	CONF_MACCHINA5	yes
High pressure threshold (delivery side)	M_SERVIZIO	20 bar
High pressure threshold (suction side)	M_SERVIZIO	3 bar
Low pressure threshold (suction side)	M_SERVIZIO1	0 bar
Oil differential alarm delay	M_SERVIZIO2	120 s
Coolant level alarm delay	M_SERVIZIO2	90 s
Relay energization delay (alarm no. 16)	M_SERVIZIO3	600 s
Time-delay between consecutive requests for compressors ON	M_SERVIZIO4	20 s
Time-delay between consecutive requests for compressors OFF	M_SERVIZIO4	10 s
Compressors' min. ON routine	M_SERVIZIO5	60 s
Compressors' min. OFF routine	M_SERVIZIO5	180 s
Min. time-interval between 2 consecutive ON routines of the same compressor	M_SERVIZIO6	360 sec
Time-delay between ON routines of different fans	M_SERVIZIO7	2 sec
Compressors set-point	M_SET1	1 bar
Compressors differential	M_SET1	0,5 bar
Fans set-point	M_SET2	15,5 bar
Fans differential	M_SET2	1,5 bar
Compressors max. threshold	M_MANUT3	10.000 hour

Mask Tree

General features

In the event of off-normal conditions, the 'AL' message flashes on the right-hand corner of the display. The left-hand corner of the display represents the 'HOME' position.



This mask appears when you turn On the system. After about 5 seconds the main mask - MENU_MASK - will be displayed.

You can display pCO's masks by pressing the dedicated buttons on its front panel keypad (See 'Keypad' above).

MENU Masks

MENU_MASK

```
+--------------------+
¦00/00/0000  00:00 AL¦
¦In  Pres.   00.0 bar¦
¦Out Pres.   00.0 bar¦
¦UNIT OFF           *¦
+--------------------+
```

This mask shows the values measured by the transducers. The second row indicates the low pressure value relative to the suction side of the compressor, the third row indicates the high pressure value (relative to the delivery side of the compressor).

MENU_MASK1

```
+--------------------+
¦Neutral zone      AL¦
¦Compressors         ¦
¦Insertions  00.0 bar¦
¦Stop        00.0 bar¦
+--------------------+
```

This mask indicates the limit values of the neutral zone: the first row indicates the suction pressure value above which there is a request for compressor ON, the third row shows the suction pressure value under which one of the compressor will be forced to stop.

MENU2_MASK

```
+--------------------+
¦        On     Of AL¦
¦Step 1  00.0   00.0 ¦
¦Step 2  00.0   00.0 ¦
¦Step 3  00.0   00.0 ¦
+--------------------+
```

This mask shows the values which determine the ON and OFF routines of the fans' steps.

INFO Masks

M_INFO1

```
+--------------------+
|00/00/0000  00:00 AL|
|      C.AR.EL.      |
| REFRIGERATION UNIT |
|     CONTROL   BT   |
+--------------------+
```

The first row of this mask shows date (day/month/year) and time (hour/minute) and - in case of off-normal condition - an alarm message. This mask can be customized, depending on the type of refrigeration unit pCO will control. To change LT (Low Temperature) into HT (High Temperature) just press the ENTER button and then act on the UP or DOWN keys.

M_INFO2

```
+--------------------+
|CAREL STANDARD    AL|
|COD. EPSTDEFC2A     |
|Ver. 1.012 - ZAG    |
|June 06 1994        |
+--------------------+
```

The mask above shows the code of the eprom, as well as the program's version and date.

M_INFO3

```
+--------------------+
|Test              AL|
|date:     00/00/00  |
|Refrigerant =  R12  |
|                    |
+--------------------+
```

This mask allows you to set the time of the general test as well as the type of refrigerant the system requires.

MAINTENANCE Masks

```
M_MAINT1
+--------------------+
¦Work hours        AL¦
¦Compressor  1  00000¦
¦Compressor  2  00000¦
¦Compressor  3  00000¦
+--------------------+
```

The 'Maint1' mask displays the working hours of each single compressor.

```
M_MAINT2
+--------------------+
¦Insert             ¦
¦Password:      0000 ¦
¦WRONG PASSWORD     ¦
¦                   ¦
+--------------------+
```

Some maintenance masks can only be accessed by a password. Digit it correctly to enter the dedicated section (MANUFACTURER password: '123').

```
M_MAINT3
+--------------------+
¦Maintenance alarm AL¦
¦maximun work hours  ¦
¦for compressor.     ¦
¦(Nr.of hours): 00000¦
+--------------------+
```

The 'Maint3_M' mask allows you to set the max. threshold (hours) for each single compressor. When the compressor exceeds the set threshold, the maintenance alarm will alert operating personnel that maintenance is required.

```
M_MAINT4
+--------------------+
¦Reset hours:      AL¦
¦Compressor  1:    N ¦
¦Compressor  2:    N ¦
¦Compressor  3:    N ¦
+--------------------+
```

The 'Maint4' mask allows you to zero down the working hours of each compressor.

```
M_MAINT5
+--------------------+
¦Adjust probes:    AL¦
¦Inlet           00.0¦
¦Outlet          00.0¦
¦                   ¦
+--------------------+
```

The 'Maint5' mask allows you to calibrate the connected pressure probes. It is possible to set either positive or negative values that will be respectively added to or subtracted from the pCO's input value.

M_MAINT6 M_MAINT7

Should your system require maintenance, you can use the manual function to check the status of each single device connected to pCO (compressors and fans). In this way you can directly operate any device ignoring their previously set time-delays . In the event of off-normal conditions during the manual stage, the relative alarms will be automatically displayed.

I/O Masks

```
IN_OUT1
+--------------------+
¦Digital inputs    AL¦
¦1-12 Open Close     ¦
¦01: CCCCC 6: CCCCC  ¦
¦11: CC              ¦
+--------------------+
```

The 'IN_OUT1' mask displays the status of the digital inputs numbered 1 - 12. 'C' stands for closed, 'O' stands for open input.

```
IN_OUT2
+--------------------+
¦Analog inputs     AL¦
¦05:   00000         ¦
¦06:   00000         ¦
¦                    ¦
¦                    ¦
+--------------------+
```

This mask displays the status of current inputs no. 5 and 6.

```
IN_OUT3
+--------------------+
¦digital outputs   AL¦
¦1-11 Open Close     ¦
¦01: OOOOO 6: OO--O  ¦
¦11: O               ¦
+--------------------+
```

The 'IN_OUT3' mask displays the status of the digital outputs numbered 1-11. 'C' stands for closed, 'O' stands for open input.

```
IN_OUT4
+--------------------+
¦Analog output     AL¦
¦01:  00000          ¦
¦                    ¦
¦                    ¦
¦                    ¦
+--------------------+
```

This mask displays the status of the inverter analogue output.

CLOCK Masks

```
OROLOGIO1
+--------------------+
¦Clock is present? AL¦
¦Hour   00:00        ¦
¦Date   00/00/0000   ¦
¦       dd/mm/yyyy   ¦
+--------------------+
```

If your unit has been equipped with clock card, enable it by digiting 'Yes' in the first row. If the clock card has been enabled but it is not properly connected, an alarm message will be displayed (no clock or damaged clock). Set the time in the second row (hour and minutes) and the current date in the third one.

```
OROLOGIO2
+--------------------+
¦Daily time-zone   AL¦
¦with set variation  ¦
¦enabled: N          ¦
¦                    ¦
+--------------------+
```

This mask allows you to select a daily time-zones control with set-point variation.

```
OROLOGIO3
+--------------------+
¦1 00:00h  Set = 0 AL¦
¦2 00:00h  Set = 00.0¦
¦3 00:00h  Set = 00.0¦
¦4 00:00h  Set = 00.0¦
+--------------------+
```

When the time-zones control action has been enabled, use this mask to set the times of the 4 time-zones. If one or more time-zones remain unused, give it/them the same value as the previous one. See also 'Time-Zones' above in this manual.

SET-POINT Masks

```
M_SET1
+--------------------+
¦Compressors       AL¦
¦Set point   00.0 bar¦
¦Differ.     00.0 bar¦
¦                    ¦
¦                    ¦
+--------------------+
```

The M_SET1 mask allows you to set the compressors set-point and differential. The set-point determines the OFF routine of the compressors whilst the 'set-point + differential' value determines the ON routine of the compressors.

```
M_SET2
+--------------------+
¦Fans               AL¦
¦Set point   00.0 bar¦
¦Differ.     00.0 bar¦
¦                    ¦
¦                    ¦
+--------------------+
```

The M_SET2 mask allows you to set the fans set-point and differential. The values of the fans' steps will be calculated within the set-point and set-point + differential ranges and will also depend on the number of fans.

```
M_SET3
+--------------------+
¦Inverter           AL¦
¦Set point   00.0 bar¦
¦Differ.     00.0 bar¦
¦                    ¦
¦                    ¦
+--------------------+
```

The M_SET3 mask allows you to set the inverter set-point and differential. When delivery pressure = set point, then inverter output = 0 Volt (max. 10 Volt when the pressure equals or exceeds set-point + differential).

PROG Masks

PASSWORD

```
+--------------------+
¦Insert the password ¦
¦                0000¦
¦                   ¦
¦                   ¦
+--------------------+
```

All programming masks can only be accessed by a password (MANUFACTURER password, that is '1234' or SERVICE password, selected via the CONF_MACHINE6 mask). If pCO does not accept the Service password, use the Manufacturer password to gain access to the CONF_MACHINE6 mask, then select again the Service password.

M_SERVIZIO

```
+--------------------+
¦High threshold    AL¦
¦Inlet      00.0  bar¦
¦Outlet     00.0  bar¦
¦                   ¦
+--------------------+
```

This mask allows you to set the max. suction and delivery pressure values. When pressure exceeds the selected thresholds, the relative alarm will be displayed and the buzzer will sound.

M_SERVIZIO1

```
+--------------------+
¦Low threshold     AL¦
¦Inlet      00.0  bar¦
¦                   ¦
¦                   ¦
+--------------------+
```

This mask allows you to set the min. suction pressure threshold. When suction pressure goes below the selected threshold, the relative alarm will be displayed and the buzzer will sound.

M_SERVIZIO2

```
+--------------------+
¦Alarm action      AL¦
¦delayed:           ¦
¦Oil Differ.  000 sec¦
¦Liquid level 000 sec¦
+--------------------+
```

This mask allows you: to set the time-delay before the activation of the oil differential alarm following the compressor's action;
- to set the time-delay before the activation of the coolant level alarm.

```
M_SERVIZIO3
+--------------------+
¦Alarm relay       AL¦
¦delayed for  000 sec¦
¦                    ¦
¦                    ¦
+--------------------+
```

Digital output no. 10 can be used to signal any alarm condition. The Operator will be informed of the off-normal condition after the time-delay selected in this mask.

```
M_SERVIZIO4
+--------------------+
¦Compressors       AL¦
¦Time among two req.:¦
¦Start       0000 sec¦
¦Stop        0000 sec¦
+--------------------+
```

This mask allows you to set the time-interval between two consecutive requests for compressors ON/OFF.

```
M_SERVIZIO5
+--------------------+
¦Compressor        AL¦
¦Minimum time of:    ¦
¦Start       0000 sec¦
¦Stop        0000 sec¦
+--------------------+
```

This mask allows you to set the minimum time-interval relative to each ON and OFF routine of the same compressor.

```
M_SERVIZIO6
+--------------------+
¦Compressor        AL¦
¦Time among following¦
¦starts of the same  ¦
¦compressor.  000 sec¦
+--------------------+
```

This mask allows you to set the time-interval relative to consecutive ON routines of the same compressor.

```
M_SERVIZIO7
+--------------------+
¦Fans              AL¦
¦Time among following¦
¦starts       000 sec¦
¦                    ¦
¦                    ¦
+--------------------+
```

This mask allows you to set the time-interval between two consecutive requests for fans ON.

```
M_SERVIZIO8
+--------------------+
¦Supervisor call:  AL¦
¦Enabled:           N¦
¦Hour           00:00¦
¦                    ¦
¦                    ¦
+--------------------+
```

In this mask you can set the time when pCO will call the supervisory pc, even though there are no alarms.

```
CONF_MACCHINA1
+--------------------+
¦Compressors       AL¦
¦N. comp. enabled   0¦
¦Automatic rotat.  N ¦
¦                    ¦
+--------------------+
```

This mask allows you to: set the number of compressors per circuit; set the number of capacity-controlled routines for each compressor; enable the automatic compressors shift.

```
CONF_MACCHINA2
+--------------------+
¦Fans              AL¦
¦N. fans. enabled   0¦
¦Automatic rotat.  N ¦
¦                    ¦
+--------------------+
```

This mask allows you to set the number of fans to be controlled as well as the automatic fans shift.

```
CONF_MACCHINA3
+--------------------+
¦Out.press. end sc AL¦
¦Min: 00.0 Max: 00.0 ¦
¦In. press. end scale¦
¦Min: 00.0 Max: 00.0 ¦
+--------------------+
```

This mask allows you to set the operative parameters of delivery and suction pressure transducers.

```
CONF_MACCHINA4
+--------------------+
¦Unit off          AL¦
¦for maintenance:    ¦
¦Key  OFF          Y ¦
¦Faulty probe      N ¦
+--------------------+
```

This mask allows you to select the mode for turning off the unit: by pressing the OFF button or in the event of damaged/broken probe.

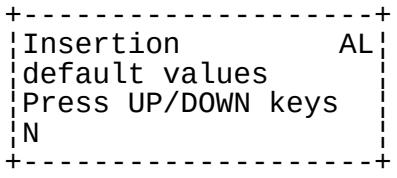
```
CONF_MACCHINA5
+--------------------+
¦Identification Nr AL¦
¦pCO for supervisor  ¦
¦network:         000¦
¦Automatic start   N ¦
+--------------------+
```

This mask allows you to set pCO's identification number (only when pCO is network-connected into a supervisory system). The last row allows you to set the type of starting mode in case of power failure: automatic or manual.

```
CONF_MACCHINA6
+--------------------+
¦New Password:     AL¦
¦                    ¦
```

This mask allows you to set a second SERVICE password to be used instead of the MANUFACTURER password.

CONF_MACCHINA7



This mask allows you to automatically set factory-set parameters so as to make the installation procedure very fast and easy. Each parameter has been given a specific value on the basis of the most common applications requirements in this field but - should it be inadequate - modify it by simply entering the dedicated mask.

ALARM Masks

Important: use the UP/DOWN buttons to read all the masks relative to active alarms or alarms that still have to be reset. (See 'Keyboard' above).

```
NOAL
+--------------------+
¦                    ¦
¦     No active      ¦
¦       alarm        ¦
¦                    ¦
¦                    ¦
+--------------------+
```

This mask indicates that there are no active alarms.

```
AL1/AL3
+--------------------+
¦                    ¦
¦Overload Klixon /   ¦
¦pressure X high     ¦
¦                    ¦
+--------------------+
```

These alarm masks indicate either a klixon circuit breaker or the intervention of the high pressure pressurestat. As a consequence, the relative compressor will be stopped.

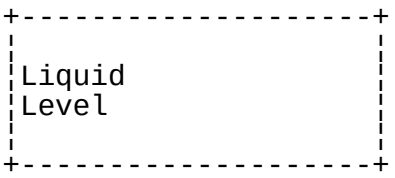
```
AL4/AL6
+--------------------+
¦                    ¦
¦Overload            ¦
¦Fan x               ¦
¦                    ¦
+--------------------+
```

In the event of fan circuit breaker, the relative fan will be stopped.

```
AL7/AL9
+--------------------+
¦Pressostat          ¦
¦oil differential x  ¦
¦or Demand Cooling   ¦
¦                    ¦
+--------------------+
```

Intervention of the oil differential pressurestat. The compressor relative to the circuit under alarm will be stoppped.

AL10



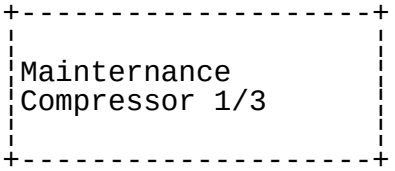
High level of the coolant.

AL11

AL12

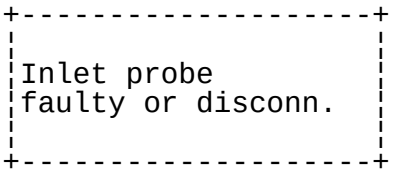
A general high pressure condition makes all compressors stop.

AL13/15



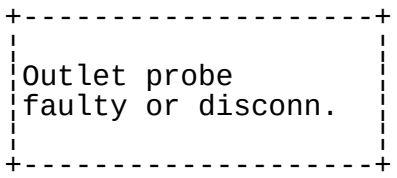
This alarm mask informs the Operator that the working hours of the compressors exceed the previously set threshold. Contact maintenance service.

AL16



This alarm mask informs the Operator that the inlet probe is broken. The unit turns off automatically - if such an option has been previously selected via dedicated mask.

AL17

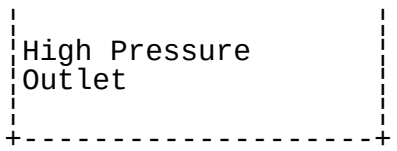


Faulty outlet probe.

AL18

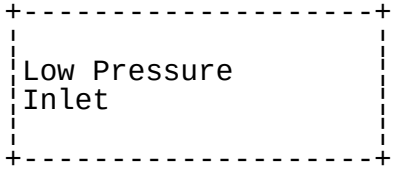
The suction probe measures too high pressure values in the circuit.

AL19



The delivery probe measures too high pressure values in the circuit.

AL20

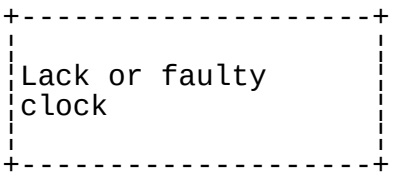


The suction probe measures too low pressure values.

AL30

pCO's eeprom must be replaced. Contact qualified service personnel.

AL31



The clock card has been erroneously selected or it is damaged.