

# Modular Chiller-HP pLAN for screw compressors, 1/4 compressors

Program code: **EPSTDEMSCA**

→ **LEGGI E CONSERVA  
QUESTE ISTRUZIONI** ←  
**READ AND SAVE  
THESE INSTRUCTIONS**





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

## **IMPORTANT**



**BEFORE INSTALLING OR OPERATING ON THE DEVICE, CAREFULLY READ THE INSTRUCTIONS IN THIS MANUAL.**

**The instrument, to which this software has been dedicated, has been designed to operate without risks for the fixed purposes provided that:**

- Installation, operation and maintenance are performed according to the instructions of this manual;
- Environmental conditions and supply voltage fall within the values indicated here below;

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



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## Applications and functions performed by the system

### **Typology of the controlled units**

#### **AIR / WATER CHILLER**

- Chiller only.
- Chiller + Heat pump
- Chiller + Free cooling

#### **WATER / WATER CHILLER**

- Chiller only
- Chiller + Heat pump with gas reversal
- Chiller + Heat pump with water reversal

### **Maximum number of compressors**

From 1 to 4 with max 4 capacity controls each compressor (1 compressor for each pCO)

### **Typology of the compressors**

Screw compressors with 4 capacity controls

### **Call rotation of the compressors**

Rotation of all compressors with FIFO logic in capacity control and modulating capacity control.

### **Type of defrosting**

Global defrosting of all the pCO units connected to the network: Independent/simultaneous/separate.

### **Safety devices for each refrigerator circuit**

High pressure (pressure switch)  
Low pressure (pressure switch)  
Oil differential pressure switch / Oil level  
Compressor cut-off  
Condensation fan cut-off  
High compressor supply temperature

### **System safety devices**

One serious alarm input (which switches off the entire unit) , available both on MASTER and SLAVE units .  
One flow controller input (which switches off the entire unit) , available both on MASTER and SLAVE units .  
One pump cut-off input (which switches off the entire unit)  
Remote on/off input without alarm signal

### **Type of regulation**

Proportional or proportional + integral regulation on the evaporator inlet probe.

### **Condensation**

Condensation can be effected according to temperature or pressure  
the fans can be managed in ON/OFF mode  
or using a modulating 0/10V signal

### **Number of accessories**

Supervision with RS422/RS485 serial board

## Structure of the master/slave system

The system is made up of two pCOs, which are connected in a local network, the first acts as master, and the second as slave.

### Functions of the master

- Temperature regulation
- Calling of all the compressors
- Management of the alarms of the system
- Management of maximum 4 refrigerator circuits (start-up , shut-down , alarms, EXV)
- Possibility to communicate with an external supervisor

### Functions of the slave

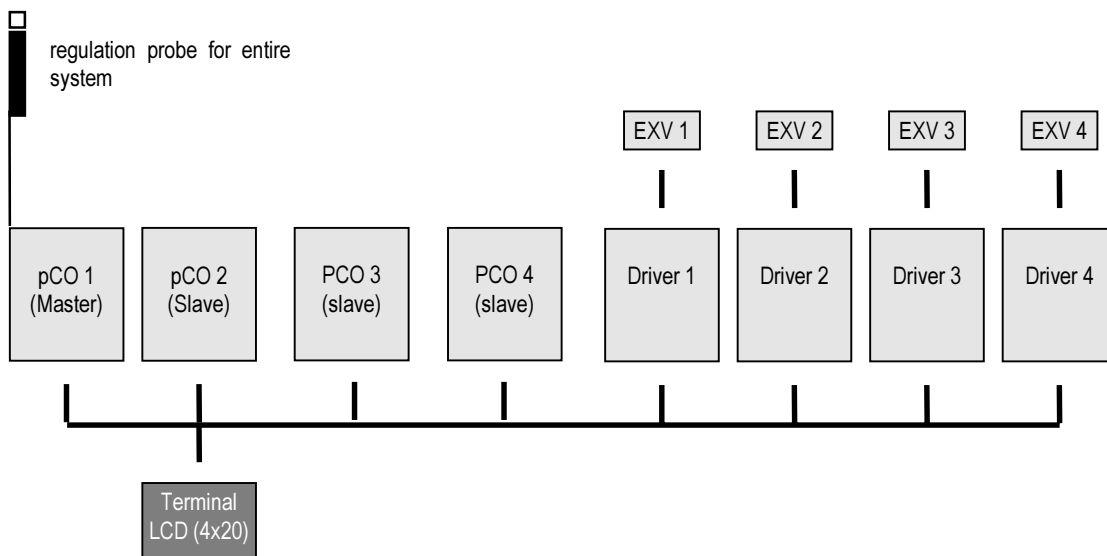
Management of maximum 1 screw compressor (start-up , shut-down , alarms, EXV).

### Common functions

Both the master and the slave manage (configuration and regulation) max. 1 EVD drivers and thus max. 1 EXV valve each.

### Regulation probe

The regulation probe must be connected only to the pCO master.



Each pCO board, driver board and terminal are identified by an address.

The address of the terminals is selected using the dip-switches located in the rear of the terminal themselves, while the address of the I/O boards is selected using the dip-switches located on a board, code PCOADR0000 (without clock option) or alternatively PCOCLKMEM0 (with clock option); this board must be inserted in the plug-in connector available for the clock. The dipswitches, which set the address of the EVD driver, are on the rear of the (removable) front panel of the driver itself.

The pCO master must have address 1

The pCO slave must have addresses 2/3/4

Driver 1 must have address 5 (connected with the Master Board)

Driver 2 must have address 7 (connected with the Slave Board 1)

Driver 3 must have address 9 (connected with the Slave Board 2)

Driver 4 must have address 1 (connected with the Slave Board 4)

The local terminal must have address 16 (shared terminal, the only one for all the boards)



## List of inputs/outputs

Following is a list of the inputs and outputs for each the type of unit.

Each type of machine has been given a number. This number identifies the configuration of the inputs and outputs.

The configuration of the machine is performed by choosing the list of inputs and outputs required and selecting the associated number in the configuration screen of the program.

### AIR/WATER unit with maximum 4 screw compressors (up to 4 cap-cont. each comp.)

#### CHILLER ONLY ( MACHINE TYPE "0" )

##### Digital inputs

| Chiller unit only |   |   |   |   |
|-------------------|---|---|---|---|
| n                 | UNIT 1 (Master)                             | UNIT 2 (Slave no. 1)                        | UNIT 3 (Slave no. 2)                        | UNIT 4 (Slave no. 3)                        |
| 1                 | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              |
| 2                 | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) |
| 3                 | Remote on/off                               |   |   |   |
| 4                 | Pump cut-off                                |   |   |   |
| 5                 | Low pressure switch 1                       | Low pressure switch 2                       | Low pressure switch 3                       | Low pressure switch 4                       |
| 6                 | Oil differential 1/ Oil level 1             | Oil differential 2/ Oil level 2             | Oil differential 3/ Oil level 3             | Oil differential 4/ Oil level 4             |
| 7                 | Phase monitor                               | Phase monitor (can be enabled)              | Phase monitor (can be enabled)              | Phase monitor (can be enabled)              |
| 8                 | Double setpoint                             |   |   |   |
| 9                 | Fan cut-off 1 circuit 1                     | Fan cut-off 1 circuit 2                     | Fan cut-off 1 circuit 3                     | Fan cut-off 1 circuit 4                     |
| 10                | Fan cut-off 2 circuit 1                     | Fan cut-off 2 circuit 2                     | Fan cut-off 2 circuit 3                     | Fan cut-off 2 circuit 4                     |
| 11                | High pressure switch 1                      | High pressure switch 2                      | High pressure switch 3                      | High pressure switch 4                      |
| 12                | Compressor cut-off 1                        | Compressor cut-off 2                        | Compressor cut-off 3                        | Compressor cut-off 4                        |

##### Analogue inputs

| Chiller unit only |                                  |                                  |                                  |                                  |
|-------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| n                 | UNIT 1 (Master)                  | UNIT 2 (Slave no. 1)             | UNIT 3 (Slave no. 2)             | UNIT 4 (Slave no. 3)             |
| 1                 | Inlet water temp.                |                                  |                                  |                                  |
| 2                 | Outlet water temp. 1             | Outlet water temp. 2             | Outlet water temp. 3             | Outlet water temp. 4             |
| 3                 | Condens. temp. Circuit 1         | Condens. temp. Circuit 2         | Condens. temp. Circuit 3         | Condens. temp. Circuit 4         |
| 4                 |                                  |                                  |                                  |                                  |
| 5                 | Voltage / Current / External Set | Voltage / current                | Voltage / current                | Voltage / current                |
| 6                 | Supply temp. comp. 1             | Supply temp. comp. 2             | Supply temp. comp. 3             | Supply temp. comp. 4             |
| 7                 | High press. transducer circuit 1 | High press. transducer circuit 2 | High press. transducer circuit 3 | High press. transducer circuit 4 |
| 8                 | Low press. transducer circuit 1  | Low press. transducer circuit 2  | Low press. transducer circuit 3  | Low press. transducer circuit 4  |

##### Digital outputs

| Chiller unit only |                                |                                |                                |                                |
|-------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| n                 | UNIT 1 (Master)                | UNIT 2 (Slave no. 1)           | UNIT 3 (Slave no. 2)           | UNIT 4 (Slave no. 3)           |
| 1                 | Circulation pump               |                                |                                |                                |
| 2                 | Line contactor comp.1          | Line contactor comp.2          | Line contactor Comp.3          | Line contactor Comp.4          |
| 3                 | Star contactor comp.1          | Star contactor comp.2          | Star contactor comp.3          | Star contactor comp.4          |
| 4                 | Delta contactor comp.1         | Delta contactor comp.2         | Delta contactor comp.3         | Delta contactor comp.4         |
| 5                 | Liquid solenoid 1              | Liquid solenoid 2              | Liquid solenoid 3              | Liquid solenoid 4              |
| 6                 | Capacity control 1 comp.1      | Capacity control 1 comp.2      | Capacity control 1 comp.3      | Capacity control 1 comp.4      |
| 7                 | Capacity control 2 comp.1      | Capacity control 2 comp.2      | Capacity control 2 comp.3      | Capacity control 2 comp.4      |
| 8                 | Capacity control 3 comp.1      | Capacity control 3 comp.2      | Capacity control 3 comp.3      | Capacity control 3 comp.4      |
| 9                 | Liquid Inj./econ./oil cooler 1 | Liquid Inj./econ./oil cooler 2 | Liquid Inj./econ./oil cooler 3 | Liquid Inj./econ./oil cooler 4 |
| 10                | Antifreeze heater 1            | Antifreeze heater 2            | Antifreeze heater 3            | Antifreeze heater 4            |
| 11                | General alarm                  | General alarm                  | General alarm                  | General alarm                  |
| 12                | Fan 1 circuit 1                | Fan 1 circuit 2                | Fan 1 circuit 3                | Fan 1 circuit 4                |
| 13                | Fan 2 circuit 1                | Fan 2 circuit 2                | Fan 2 circuit 3                | Fan 2 circuit 4                |

##### Analogue outputs

| Chiller unit only |                           |                           |                           |                           |
|-------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| n                 | UNIT 1 (Master)           | UNIT 2 (Slave no. 1)      | UNIT 3 (Slave no. 2)      | UNIT 4 (Slave no. 3)      |
| 1                 | Condens. fan speed reg. 1 | Condens. fan speed reg. 2 | Condens. fan speed reg. 3 | Condens. fan speed reg. 4 |
| 2                 |                           |                           |                           |                           |

**CHILLER + HEAT PUMP ( MACHINE TYPE "1" )**

**Digital inputs**

| Chiller with Heat pump |   |   |   |   |
|------------------------|---|---|---|---|
| n                      | UNIT 1 (Master)                             | UNIT 2 (Slave no. 1)                        | UNIT 3 (Slave no. 2)                        | UNIT 4 (Slave no. 3)                        |
| 1                      | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              |
| 2                      | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) |
| 3                      | Remote on/off                               |   |   |   |
| 4                      | Pump cut-off                                |   |   |   |
| 5                      | Low pressure switch 1                       | Low pressure switch 2                       | Low pressure switch 3                       | Low pressure switch 4                       |
| 6                      | Oil differential 1/ Oil level 1             | Oil differential 2/ Oil level 2             | Oil differential 3 / Oil level 3            | Oil differential 4 / Oil level 4            |
| 7                      | Phase monitor                               |   |   |   |
| 8                      | Double setpoint                             |   |   |   |
| 9                      | Fan cut-off 1 circuit 1                     | Fan cut-off 1 circuit 2                     | Fan cut-off 1 circuit 3                     | Fan cut-off 1 circuit 4                     |
| 10                     | Cooling / Heating                           |   |   |   |
| 11                     | High pressure switch 1                      | High pressure switch 2                      | High pressure switch 3                      | High pressure switch 4                      |
| 12                     | Compressor cut-off 1                        | Compressor cut-off 2                        | Compressor cut-off 3                        | Compressor cut-off 4                        |

**Analogue inputs**

| Chiller unit with Heat pump |                                  |                                  |                                  |                                  |
|-----------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| n                           | UNIT 1 (Master)                  | UNIT 2 (Slave no. 1)             | UNIT 3 (Slave no. 2)             | UNIT 4 (Slave no. 3)             |
| 1                           | Inlet water temperature          |                                  |                                  |                                  |
| 2                           | Outlet water temperature 1       | Outlet water temp. 2             | Outlet water temp. 3             | Outlet water temperature 4       |
| 3                           | Condens. temp. Circuit 1         | Condens. temp. Circuit 2         | Condens. temp. Circuit 3         | Temp. Condens. Circuit 4         |
| 4                           |                                  |                                  |                                  |                                  |
| 5                           | Voltage / Current / External Set | Voltage / Current                | Voltage / Current                | Voltage / Current                |
| 6                           | Supply temp. comp. 1             | Supply temp. comp. 2             | Supply temp. comp. 3             | Supply temp. comp. 4             |
| 7                           | High press. transducer circuit 1 | High press. transducer circuit 2 | High press. transducer circuit 3 | High press. transducer circuit 4 |
| 8                           | Low press. transducer circuit 1  | Low press. transducer circuit 2  | Low press. transducer circuit 3  | Low press. transducer circuit 4  |

**Digital outputs**

| Chiller unit with Heat pump |                                   |                                   |                                   |                                   |
|-----------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| n                           | UNIT 1 (Master)                   | UNIT 2 (Slave no. 1)              | UNIT 3 (Slave no. 2)              | UNIT 4 (Slave no. 3)              |
| 1                           | Circulation pump                  |                                   |                                   |                                   |
| 2                           | Line contactor comp. 1            | Line contactor comp. 2            | Line contactor comp. 3            | Line contactor comp. 4            |
| 3                           | Star contactor comp. 1            | Star contactor comp. 2            | Star contactor comp. 3            | Star contactor comp. 4            |
| 4                           | Delta contactor comp. 1           | Delta contactor comp. 2           | Delta contactor comp. 3           | Delta contactor comp. 4           |
| 5                           | Liquid solenoid circuit 1         | Liquid solenoid circuit 2         | Liquid solenoid circuit 1         | Liquid solenoid circuit 4         |
| 6                           | Capacity control 1 comp.1         | Capacity control 1 comp.2         | Capacity control 1 comp.3         | Capacity control 1 comp.4         |
| 7                           | Capacity control 2 comp.1         | Capacity control 2 comp.2         | Capacity control 2 comp.3         | Capacity control 2 comp.4         |
| 8                           | Capacity control 3 comp.1         | Capacity control 3 comp.2         | Capacity control 3 comp.3         | Capacity control 3 comp.4         |
| 9                           | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler |
| 10                          | Antifreeze heater 1               | Antifreeze heater 2               | Antifreeze heater 3               | Antifreeze heater 4               |
| 11                          | General alarm                     | General alarm                     | General alarm                     | General alarm                     |
| 12                          | 4-way valve circuit 1             | 4-way valve circuit 2             | 4-way valve circuit 3             | 4-way valve circuit 4             |
| 13                          | Fan 1 circuit 1                   | Fan 1 circuit 2                   | Fan 1 circuit 3                   | Fan 1 circuit 4                   |

**Analogue outputs**

| Chiller unit with Heat pump |                           |                           |                           |                           |
|-----------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| n                           | UNIT 1 (Master)           | UNIT 2 (Slave no. 1)      | UNIT 3 (Slave no. 2)      | UNIT 4 (Slave no. 3)      |
| 1                           |                           |                           |                           |                           |
| 2                           | Condens. fan speed reg. 1 | Condens. fan speed reg. 2 | Condens. fan speed reg. 1 | Condens. fan speed reg. 2 |

**CHILLER + FREECOOLING ( MACHINE TYPE "2" )**

**Digital inputs**

| Chiller with Freecooling |   |   |   |   |
|--------------------------|---|---|---|---|
| n                        | UNIT 1 (Master)                             | UNIT 2 (Slave no. 1)                        | UNIT 3 (Slave no. 2)                        | UNIT 4 (Slave no. 3)                        |
| 1                        | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              |
| 2                        | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) |
| 3                        | Remote on/off                               |   |   |   |
| 4                        | Pump cut-off                                |   |   |   |
| 5                        | Low pressure switch 1                       | Low pressure switch 2                       | Low pressure switch 3                       | Low pressure switch 4                       |
| 6                        | Oil differential 1/ Oil level 1             | Oil differential 2/ Oil level 2             | Oil differential 3/ Oil level 3             | Oil differential 4/ Oil level 4             |
| 7                        | Phase monitor                               | Phase monitor (Enabling)                    | Phase monitor (Enabling)                    | Phase monitor (Enabling)                    |
| 8                        | Double setpoint                             |   |   |   |
| 9                        | Fan cut-off 1 circuit 1                     | Fan cut-off 1 circuit 2                     | Fan cut-off 1 circuit 3                     | Fan cut-off 1 circuit 4                     |
| 10                       |   |   |   |   |
| 11                       | High pressure switch 1                      | High pressure switch 3                      | High pressure switch 1                      | High pressure switch 3                      |
| 12                       | Comp. cut-off 1                             | Comp. cut-off 3                             | Comp. cut-off 1                             | Comp. cut-off 3                             |

**Analogue inputs**

| Chiller with Freecooling |                                  | MACHINE TYPE "2"                 |                                  |                                  |
|--------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| n                        | UNIT 1 (Master)                  | UNIT 2 (Slave no. 1)             | UNIT 3 (Slave no. 2)             | UNIT 4 (Slave no. 3)             |
| 1                        | Inlet water temperature          |                                  |                                  |                                  |
| 2                        | Outlet water temp.               | Outlet water temp circ. 2        | Outlet water temp. circ. 3       | Outlet water temp. circ. 4       |
| 3                        | External temperature             |                                  |                                  |                                  |
| 4                        | Freecooling coil inlet temp.     |                                  |                                  |                                  |
| 5                        | Voltage / Current / External Set | Voltage / Current                | Voltage / Current                | Voltage / Current                |
| 6                        | Supply temp. comp. 1             | Supply temp. comp. 2             | Supply temp. comp. 3             | Supply temp. comp. 4             |
| 7                        | High press. transducer circuit 1 | High press. transducer circuit 2 | High press. transducer circuit 1 | High press. transducer circuit 2 |
| 8                        | Low press. transducer circuit 1  | Low press. transducer circuit 2  | Low press. transducer circuit 3  | Low press. transducer circuit 4  |

**Digital outputs**

| Chiller with Freecooling |                           |                           |                            |                           |
|--------------------------|---------------------------|---------------------------|----------------------------|---------------------------|
| n                        | UNIT 1 (Master)           | UNIT 2 (Slave no. 1)      | UNIT 3 (Slave no. 2)       | UNIT 4 (Slave no. 3)      |
| 1                        | Circulation pump          |                           |                            |                           |
| 2                        | Line contactor comp.1     | Line contactor comp.2     | Line contactor comp.3      | Line contactor comp.4     |
| 3                        | Star contactor 1          | Star contactor 2          | Star contactor 3           | Star contactor 4          |
| 4                        | Delta contactor 1         | Delta contactor 2         | Delta contactor 3          | Delta contactor 4         |
| 5                        | Liquid solenoid circuit 1 | Liquid solenoid circuit 2 | Liquid solenoid circuit 3  | Liquid solenoid circuit 4 |
| 6                        | Capacity control 1 comp.1 | Capacity control 1 comp.2 | Capacity control 1 comp. 1 | Capacity control 1 comp.4 |
| 7                        | Capacity control 2 comp.1 | Capacity control 2 comp.2 | Capacity control 2 comp. 1 | Capacity control 2 comp.4 |
| 8                        | Capacity control 3 comp.1 | Capacity control 3 comp.2 | Capacity control 3 comp. 1 | Capacity control 3 comp.4 |
| 9                        | Condens. fan 2 Circ. 1    | Condens. fan 2 Circ. 2    | Condens. fan 2 Circ. 1     | Condens. fan 2 Circ. 4    |
| 10                       | Antifreeze heater         | Antifreeze heater         | Antifreeze heater          | Antifreeze heater         |
| 11                       | General alarm             | General alarm             | General alarm              | General alarm             |
| 12                       | Condens. fan 1 Circ. 1    | Condens. fan 1 Circ. 2    | Condens. fan 1 Circ. 3     | Condens. fan 1 Circ. 4    |
| 13                       | Freecooling ON / OFF      |                           |                            |                           |

**Analogue outputs**

| Chiller with Freecooling |                             |                         |                         |                         |
|--------------------------|-----------------------------|-------------------------|-------------------------|-------------------------|
| n                        | UNIT 1 (Master)             | UNIT 2 (Slave no. 1)    | UNIT 3 (Slave no. 2)    | UNIT 4 (Slave no. 3)    |
| 1                        | Condens. fan speed reg.     | Condens. fan speed reg. | Condens. fan speed reg. | Condens. fan speed reg. |
| 2                        | 3-way valve for freecooling |                         |                         |                         |

**WATER / WATER unit with maximum 4 semi-hermetic screw compressors (up to 4 cap-cont. each comp.)**

**CHILLER ONLY ( MACHINE TYPE "3" )**

**Digital inputs**

| Chiller only |   |   |   |   |
|--------------|---|---|---|---|
| n            | UNIT 1 (Master)                             | UNIT 2 (Slave no. 1)                        | UNIT 3 (Slave no. 2)                        | UNIT 4 (Slave no. 3)                        |
| 1            | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              |
| 2            | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) |
| 3            | Remote on/off                               |   |   |   |
| 4            | Evaporator pump cut-off                     |   |   |   |
| 5            | Low pressure switch 1                       | Low pressure switch 2                       | Low pressure switch 3                       | Low pressure switch 4                       |
| 6            | Oil differential 1/ Oil level 1             | Oil differential 2/ Oil level 2             | Oil differential 3/ Oil level 3             | Oil differential 4/ Oil level 4             |
| 7            | Phase monitor                               | Phase monitor                               | Phase monitor                               | Phase monitor                               |
| 8            | Double setpoint                             |   |   |   |
| 9            | Condenser flow controller                   | Flow controller condens. (Enable.)          | Flow controller condens. (Enable.)          | Flow controller condens. (Enable.)          |
| 10           | Condenser pump cut-off                      |   |   |   |
| 11           | High pressure switch 1                      | High pressure switch 2                      | High pressure switch 3                      | High pressure switch 4                      |
| 12           | Compressor cut-off 1                        | Compressor cut-off 2                        | Compressor cut-off 3                        | Compressor cut-off 4                        |

**Analogue inputs**

| Chiller only |                                  |                                  |                                  |                                  |
|--------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| n            | UNIT 1 (Master)                  | UNIT 2 (Slave no. 1)             | UNIT 3 (Slave no. 2)             | UNIT 4 (Slave no. 3)             |
| 1            | Inlet water temperature          |                                  |                                  |                                  |
| 2            | Outlet water temp. 1             | Outlet water temp. 2             | Outlet water temp. 3             | Outlet water temp. 4             |
| 3            | Inlet water temp. cond. 1        | Inlet water temp. cond. 2        | Inlet water temp. cond. 3        | Inlet water temp. cond. 4        |
| 4            | Outlet water temp. cond. 1       | Outlet water temp. cond. 2       | Outlet water temp. cond. 3       | Outlet water temp. cond. 4       |
| 5            | Voltage / Current / External Set | Voltage / Current                | Voltage / Current                | Voltage / Current                |
| 6            | Supply temp. comp. 1             | Supply temp. comp. 2             | Supply temp. comp. 3             | Supply temp. comp. 4             |
| 7            | High press. transducer circuit 1 | High press. transducer circuit 2 | High press. transducer circuit 3 | High press. transducer circuit 4 |
| 8            | Low press. transducer circuit 1  | Low press. transducer circuit 2  | Low press. transducer circuit 3  | Low press. transducer circuit 4  |

**Digital outputs**

| Chiller only |                                   |                                   |                                   |                                   |
|--------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| n            | UNIT 1 (Master)                   | UNIT 2 (Slave no. 1)              | UNIT 3 (Slave no. 2)              | UNIT 4 (Slave no. 3)              |
| 1            | Evaporat. circulation pump        |                                   |                                   |                                   |
| 2            | Line contactor comp. 1            | Line contactor comp. 2            | Line contactor comp. 3            | Line contactor comp. 4            |
| 3            | Star contactor comp. 1            | Star contactor comp. 2            | Star contactor comp. 3            | Star contactor comp. 4            |
| 4            | Delta contactor comp. 1           | Delta contactor comp. 2           | Delta contactor comp. 3           | Delta contactor comp. 4           |
| 5            | Liquid solenoid circuit 1         | Liquid solenoid circuit 2         | Liquid solenoid circuit 3         | Liquid solenoid circuit 4         |
| 6            | Capacity control 1 comp.1         | Capacity control 1 comp.2         | Capacity control 1 comp.3         | Capacity control 1 comp.4         |
| 7            | Capacity control comp.1           | Capacity control 2 comp.2         | Capacity control 2 comp.3         | Capacity control 2 comp.4         |
| 8            | Capacity control 3 comp.1         | Capacity control 3 comp.2         | Capacity control 3 comp.3         | Capacity control 3 comp.4         |
| 9            | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler |
| 10           | Antifreeze heater                 | Antifreeze heater                 | Antifreeze heater                 | Antifreeze heater                 |
| 11           | General alarm cumul.              | General alarm cumul.              | General alarm cumul.              | General alarm cumul.              |
| 12           | Conden. circulation pump          |                                   |                                   |                                   |
| 13           |                                   |                                   |                                   |                                   |

**Analogue outputs**

| Chiller only |                 | MACHINE TYPE "3"     |                      |                      |
|--------------|-----------------|----------------------|----------------------|----------------------|
| n            | UNIT 1 (Master) | UNIT 2 (Slave no. 1) | UNIT 3 (Slave no. 2) | UNIT 4 (Slave no. 3) |
| 1            |                 |                      |                      |                      |
| 2            |                 |                      |                      |                      |

**CHILLER + HEAT PUMP WITH GAS REVERSAL ( MACHINE TYPE “4”)**

**Digital inputs**

| Chiller + Heat pump with gas reversal |   |   |   |   |
|---------------------------------------|---|---|---|---|
| n                                     | UNIT 1 (Master)                             | UNIT 2 (Slave no. 1)                        | UNIT 3 (Slave no. 2)                        | UNIT 4 (Slave no. 3)                        |
| 1                                     | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              |
| 2                                     | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) |
| 3                                     | Remote on/off                               |   |   |   |
| 4                                     | Pump cut-off evaporator                     |   |   |   |
| 5                                     | Low pressure switch 1                       | Low pressure switch 2                       | Low pressure switch 3                       | Low pressure switch 4                       |
| 6                                     | Oil differential 1/ Oil level 1             | Oil differential 2/ Oil level 2             | Oil differential 3/ Oil level 3             | Oil differential 4/ Oil level 4             |
| 7                                     | Phase monitor                               | Phase monitor (can be enabled)              | Phase monitor (can be enabled)              | Phase monitor (can be enabled)              |
| 8                                     | Double setpoint                             |   |   |   |
| 9                                     | Condenser flow controller                   | Flow controller cond. (can be enabled)      | Flow controller cond. (can be enabled)      | Flow controller cond. (can be enabled)      |
| 10                                    | Cooling / Heating                           |   |   |   |
| 11                                    | High pressure switch 1                      | High pressure switch 2                      | High pressure switch 3                      | High pressure switch 4                      |
| 12                                    | Compressor cut-off 1                        | Compressor cut-off 2                        | Compressor cut-off 3                        | Compressor cut-off 4                        |

**Analogue inputs**

| Chiller + Heat pump with gas reversal |                                  |                                  |                                  |                                  |
|---------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| n                                     | UNIT 1 (Master)                  | UNIT 2 (Slave no. 1)             | UNIT 3 (Slave no. 2)             | UNIT 4 (Slave no. 3)             |
| 1                                     | Inlet water temperature          |                                  |                                  |                                  |
| 2                                     | Outlet water temp. 1             | Outlet water temp. 2             | Outlet water temp. 3             | Outlet water temp. 4             |
| 3                                     | Inlet water temp. cond. 1        | Inlet water temp. cond. 2        | Inlet water temp. cond. 3        | Inlet water temp. cond. 4        |
| 4                                     | Outlet water temp. cond. 1       | Outlet water temp. cond. 2       | Outlet water temp. cond. 3       | Outlet water temp. cond. 4       |
| 5                                     | Voltage / Current / External Set | Voltage / Current                | Voltage / Current                | Voltage / Current                |
| 6                                     | Supply temp. comp. 1             | Supply temp. comp. 2             | Supply temp. comp. 3             | Supply temp. comp. 4             |
| 7                                     | High press. transducer circuit 1 | High press. transducer circuit 2 | High press. transducer circuit 3 | High press. transducer circuit 4 |
| 8                                     | Low press. transducer circuit 1  | Low press. transducer circuit 2  | Low press. transducer circuit 3  | Low press. transducer circuit 4  |

**Digital outputs**

| Chiller + Heat pump with gas reversal |                                   |                                   |                                   |                                   |
|---------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| n                                     | UNIT 1 (Master)                   | UNIT 2 (Slave no. 1)              | UNIT 3 (Slave no. 2)              | UNIT 4 (Slave no. 3)              |
| 1                                     | Evaporat. circulation pump        |                                   |                                   |                                   |
| 2                                     | Line contactor comp. 1            | Line contactor comp. 2            | Line contactor comp. 3            | Line contactor comp. 4            |
| 3                                     | Star contactor comp. 1            | Star contactor comp. 2            | Star contactor comp. 3            | Star contactor comp. 4            |
| 4                                     | Delta contactor comp. 1           | Delta contactor comp. 2           | Delta contactor comp. 3           | Delta contactor comp. 4           |
| 5                                     | Liquid solenoid circuit 1         | Liquid solenoid circuit 2         | Liquid solenoid circuit 3         | Liquid solenoid circuit 4         |
| 6                                     | Capacity control 1 comp.1         | Capacity control 1 comp.2         | Capacity control 1 comp.3         | Capacity control 1 comp.4         |
| 7                                     | Capacity control 2 comp.1         | Capacity control 2 comp.2         | Capacity control 2 comp.3         | Capacity control 2 comp.4         |
| 8                                     | Capacity control 3 comp.1         | Capacity control 3 comp.2         | Capacity control 3 comp.3         | Capacity control 3 comp.4         |
| 9                                     | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler |
| 10                                    | Antifreeze heater 1               | Antifreeze heater 2               | Antifreeze heater 3               | Antifreeze heater 4               |
| 11                                    | General alarm cumul.              | General alarm cumul.              | General alarm cumul.              | General alarm cumul.              |
| 12                                    | Conden. circulation pump          |                                   |                                   |                                   |
| 13                                    | 4-way valve circuit 1             | 4-way valve circuit 2             | 4-way valve circuit 3             | 4-way valve circuit 4             |

**Analogue outputs**

| Chiller + Heat pump with gas reversal |                 |                      |                      |                      |
|---------------------------------------|-----------------|----------------------|----------------------|----------------------|
| n                                     | UNIT 1 (Master) | UNIT 2 (Slave no. 1) | UNIT 3 (Slave no. 2) | UNIT 4 (Slave no. 3) |
| 1                                     |                 |                      |                      |                      |
| 2                                     |                 |                      |                      |                      |

**CHILLER + HEAT PUMP WITH WATER REVERSAL ( MACHINE TYPE “5” )**

**Digital inputs**

| Chiller + Heat pump with water reversal |   |   |   |   |
|---|---|---|---|---|
| n                                       | UNIT 1 (Master)                             | UNIT 2 (Slave no. 1)                        | UNIT 3 (Slave no. 2)                        | UNIT 4 (Slave no. 3)                        |
| 1                                       | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              | Serious alarm (can be enabled)              |
| 2                                       | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) | Evaporator flow controller (can be enabled) |
| 3                                       | Remote on/off                               |   |   |   |
| 4                                       | Pump cut-off evaporator                     |   |   |   |
| 5                                       | Low pressure switch 1                       | Low pressure switch 2                       | Low pressure switch 3                       | Low pressure switch 4                       |
| 6                                       | Oil differential 1/ Oil level 1             | Oil differential 2/ Oil level 2             | Oil differential 3/ Oil level 3             | Oil differential 4/ Oil level 4             |
| 7                                       | Phase monitor                               | Phase monitor (can be enabled)              | Phase monitor (can be enabled)              | Phase monitor (can be enabled)              |
| 8                                       | Double setpoint                             |   |   |   |
| 9                                       | Cond. flow controller (can be enabled)      | Cond. flow controller (can be enabled)      | Cond. flow controller (can be enabled)      | Cond. flow controller (can be enabled)      |
| 10                                      | Cooling / Heating                           |   |   |   |
| 11                                      | High pressure switch 1                      | High pressure switch 2                      | High pressure switch 3                      | High pressure switch 4                      |
| 12                                      | Compressor cut-off 1                        | Compressor cut-off 2                        | Compressor cut-off 3                        | Compressor cut-off 4                        |

**Analogue inputs**

| Chiller + Heat pump with water reversal |                                  |                                  |                                  |                                  |
|---|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| n                                       | UNIT 1 (Master)                  | UNIT 2 (Slave no. 1)             | UNIT 3 (Slave no. 2)             | UNIT 4 (Slave no. 3)             |
| 1                                       | Inlet water temperature          |                                  |                                  |                                  |
| 2                                       | Outlet water temp. 1             | Outlet water temp. 2             | Outlet water temp. 3             | Outlet water temp. 4             |
| 3                                       | Inlet water temp. cond.1         | Inlet water temp. cond.2         | Inlet water temp. cond.3         | Inlet water temp. cond.4         |
| 4                                       | Outlet water temp. cond. 1       | Outlet water temp. cond. 2       | Outlet water temp. cond. 3       | Outlet water temp. cond. 4       |
| 5                                       | Voltage / Current / External Set | Voltage / Current                | Voltage / Current                | Voltage / Current                |
| 6                                       | Supply temp. comp. 1             | Supply temp. comp. 2             | Supply temp. comp. 3             | Supply temp. comp. 4             |
| 7                                       | High press. transducer circuit 1 | High press. transducer circuit 2 | High press. transducer circuit 3 | High press. transducer circuit 4 |
| 8                                       | Low press. transducer circuit 1  | Low press. transducer circuit 2  | Low press. transducer circuit 3  | Low press. transducer circuit 4  |

**Digital outputs**

| Chiller + Heat pump with water reversal |                                   |                                   |                                   |                                   |
|---|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| n                                       | UNIT 1 (Master)                   | UNIT 2 (Slave no. 1)              | UNIT 3 (Slave no. 2)              | UNIT 4 (Slave no. 3)              |
| 1                                       | Evaporat. circulation pump        |                                   |                                   |                                   |
| 2                                       | Line contactor comp. 1            | Line contactor comp. 2            | Line contactor comp. 3            | Line contactor comp. 4            |
| 3                                       | Star contactor comp. 1            | Star contactor comp. 2            | Star contactor comp. 3            | Star contactor comp. 4            |
| 4                                       | Delta contactor comp. 1           | Delta contactor comp. 2           | Delta contactor comp. 3           | Delta contactor comp. 4           |
| 5                                       | Liquid solenoid circuit 1         | Liquid solenoid circuit 2         | Liquid solenoid circuit 3         | Liquid solenoid circuit 4         |
| 6                                       | Capacity control 1 comp.1         | Capacity control 1 comp.2         | Capacity control 1 comp.3         | Capacity control 1 comp.4         |
| 7                                       | Capacity control 2 comp.1         | Capacity control 2 comp.2         | Capacity control 2 comp.3         | Capacity control 2 comp.4         |
| 8                                       | Capacity control 3 comp.1         | Capacity control 3 comp.2         | Capacity control 3 comp.3         | Capacity control 3 comp.4         |
| 9                                       | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler | Liquid inj./economizer/oil cooler |
| 10                                      | Antifreeze heater 1               | Antifreeze heater 2               | Antifreeze heater 3               | Antifreeze heater 4               |
| 11                                      | General alarm                     | General alarm                     | General alarm                     | General alarm                     |
| 12                                      | Circulation pump Conden.          |                                   |                                   |                                   |
| 13                                      | 4-way valve                       | 4-way valve                       | 4-way valve                       | 4-way valve                       |

**Analogue outputs**

| Chiller + Heat pump with water reversal |                 |                      |                      |                      |
|---|-----------------|----------------------|----------------------|----------------------|
| n                                       | UNIT 1 (Master) | UNIT 2 (Slave no. 1) | UNIT 3 (Slave no. 2) | UNIT 4 (Slave no. 3) |
| 1                                       |                 |                      |                      |                      |
| 2                                       |                 |                      |                      |                      |

# Regulation

## Inlet temperature regulation

Inputs used:

- Inlet temperature

Outputs used:

- All the compressors and their connected capacity control

Parameters used:

- Regulation setpoint
- Proportional band for inlet regulation.
- Type of regulation (proportional or proportional + integral)
- Integration time (if proportional + integral regulation enabled)
- Time between start-up and the first capacity control
- Time between the first and the second capacity control
- Time between the second and the third capacity control
- Time between the third and fourth capacity control
- Type of unit
- Total number of compressors
- Number of capacity controls

### CAPACITY CONTROL STEPS

The management of the capacity control step foresees the control of 4 steps (at most) with configurable logic through 4 outlet relays. The program by default pre-sets the following configuration :

- Default configuration:

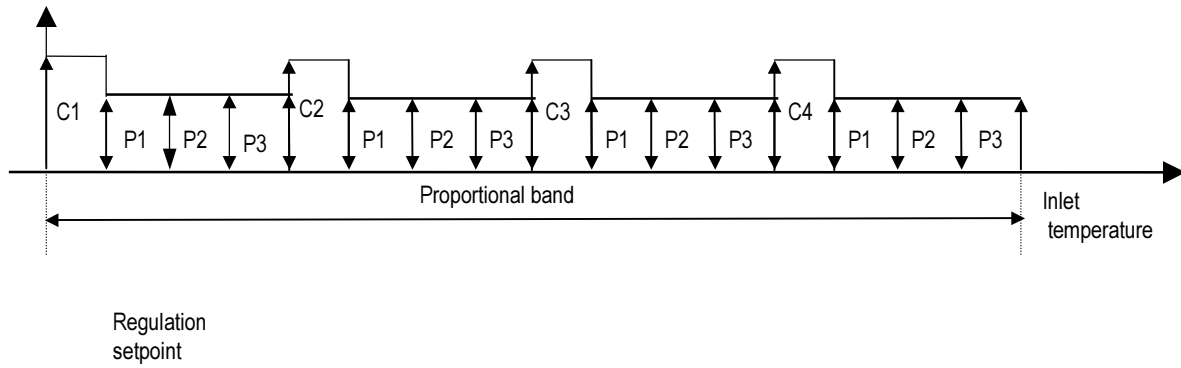
| LOAD IN %   | SOLENOID A | SOLENOID B | SOLENOID C |
|-------------|------------|------------|------------|
| 100%        | CLOSED     | CLOSED     | CLOSED     |
| 75%         | CLOSED     | OPEN       | CLOSED     |
| 50%         | CLOSED     | CLOSED     | OPEN       |
| 25% (Start) | OPEN       | CLOSED     | CLOSED     |

It is possible to change both the number of capacity control steps and the logic of starting up the relays acting upon the dedicated screens. The setting on the master board is valid for each of the shaped slave board.

- Example of configuration:

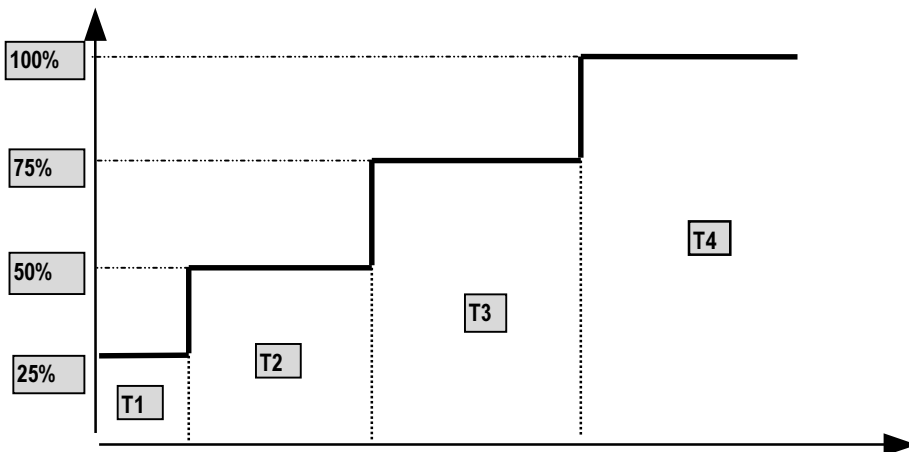
| LOAD IN % | SOLENOID A | SOLENOID B | SOLENOID C |
|-----------|------------|------------|------------|
| 100%      | CLOSED     | CLOSED     | CLOSED     |
| 75%       | OPEN       | OPEN       | CLOSED     |
| 50%       | OPEN       | CLOSED     | OPEN       |
| 25%       | CLOSED     | OPEN       | OPEN       |

Description of the working of the capacity control step in case of 4 compressors with 4 steps of capacity control.



All the compressors and the connected capacity control steps will be positioned proportionally in the band. The increasing values of the temperature will cause the subsequent starting up of the regulation steps. Each step will be inserted in accordance with the time lags set up.

Graph of the timings of the capacity control with 4 steps:



**Recommended timings:**

- T1 : 30 seconds are required to reach the conditions of 25% of the total load.
- T2 : Bring the compressor to 50% for about 3 or 5 minutes.
- T3 : Bring the compressor to 75% for further 3 or 5 minutes.
- T4 : About 7 minutes are required to bring the compressor to full load.



## Outlet temperature regulation

### CAPACITY CONTROL STEP

Used inputs :

- Outlet temperature

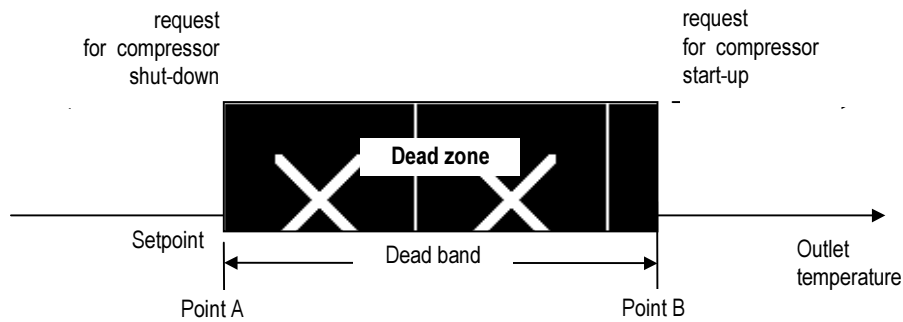
Used outputs :

- Compressors
- Capacity control step solenoids

Used parameters:

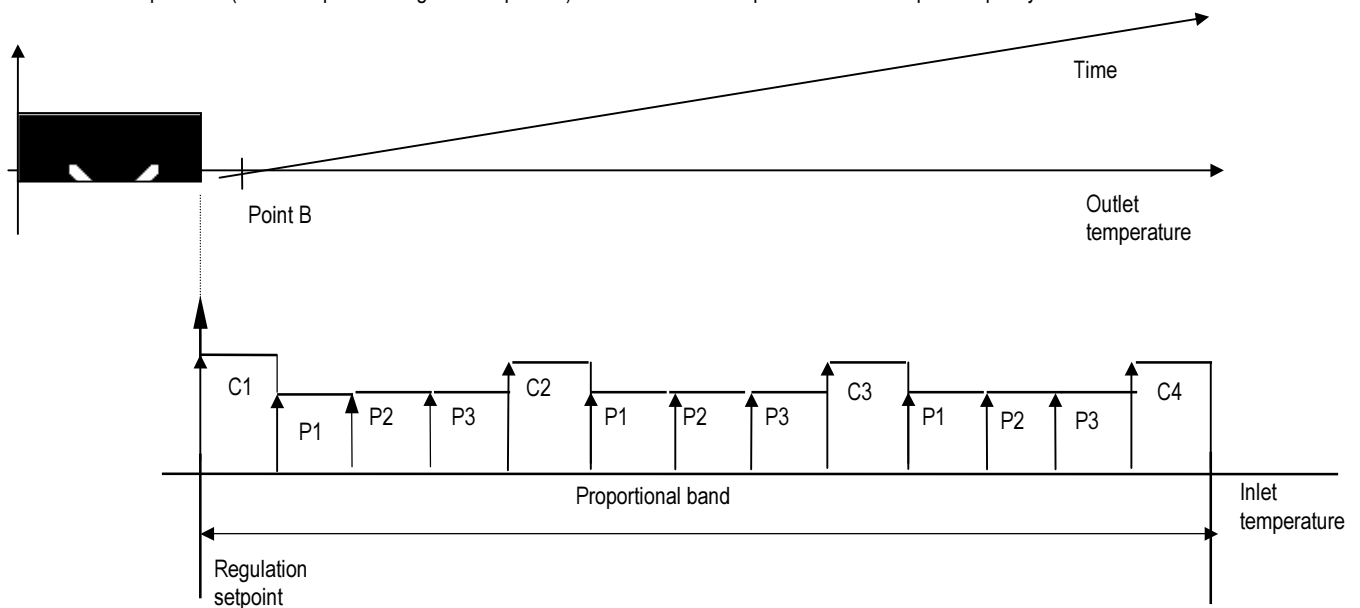
- Regulation setpoint
- Neutral zone for outlet regulation
- Step activation time
- Step deactivation time
- Minimum limit of outlet temperature (it switches off all the compressors without respecting the deactivation time)
- Maximum limit of outlet temperature (it switches off all the compressors without respecting the deactivation time)

Outlet temperature regulation diagram:



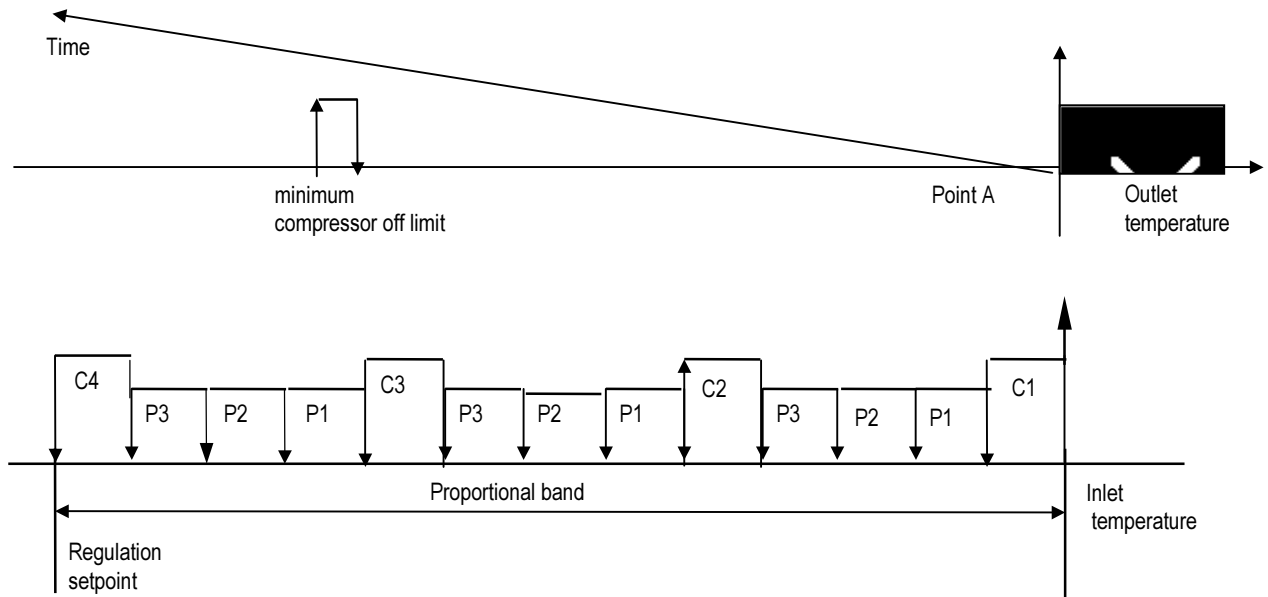
On the basis of the set up values of the set point and the band a neutral zone of temperature is located. Temperature values between the setpoint and the setpoint + band won't cause any start-up or shutdown of the compressors. Temperature values higher than the setpoint + band will cause the start up of the compressors. Temperature values lower than the setpoint will cause the shutdown of the compressors.

Activation of the compressors (outlet temperature higher than point B) in the case of 4 compressors with 4 steps of capacity control each:



While the temperature is higher than point B the compressors are activated with a delay between one activation and the next equal to the parameter "delay between start-ups in neutral zone".

Deactivation of the compressors (outlet temperature lower than point A) in the case of 4 compressors with capacity control of 4 steps each:



When the temperature is lower than point B, the compressors are deactivated, with a delay between one deactivation and the next equal to the parameter "delay between shut-downs in dead zone".

If the temperature falls below the minimum limit of the forced shutdown set up by the screen, the compressors are shut down, even if the corresponding times have not elapsed (this control is featured to avoid the activation of the antifreeze alarm).

### MANAGEMENT OF THE FIRST STAGE OF CAPACITY CONTROL STEP

The first stage of capacity control has its own specific management, due to the requirements of the compressor when working at low power. The management differs whether the compressor is in the start-up or shutdown phase, and in both cases it is not allowed to work at 25% for an extended period.

- **Start-up:** if the compressor does not receive a temperature request to pass to the second stage of capacity control, the software forces this passage after a time which can be set on the screen.
- **Shut-down:** If the temperature request stops at the first capacity control, the compressor is shut-down automatically after a time which can be set, and which is the same as the previous one.

This control can be enabled on the screen; when it is not enabled, normal operation will occur, that is the compressor will work according to the temperature request, thus theoretically if due to a problem the request stops at 25%, the compressor will be able to work at this level for an indefinite period.

### MODULATING CAPACITY CONTROL

Used inputs:

- Outlet temperature

Used parameters:

- Regulation setpoint
- Neutral zone for outlet regulation
- Neutral zone for modulating capacity-control
- Neutral band
- Impulse period
- Minimum duration of the impulse for solenoid 1
- Maximum duration of the impulse for solenoid 1
- Minimum duration of the impulse for solenoid 2
- Maximum duration of the impulse for solenoid 2
- Enabling of continuous power increase
- Force ON time of solenoids before compressor start-up

Used outputs:

- Digital output no. 6 for solenoid 1
- Digital output no. 7 for solenoid 2

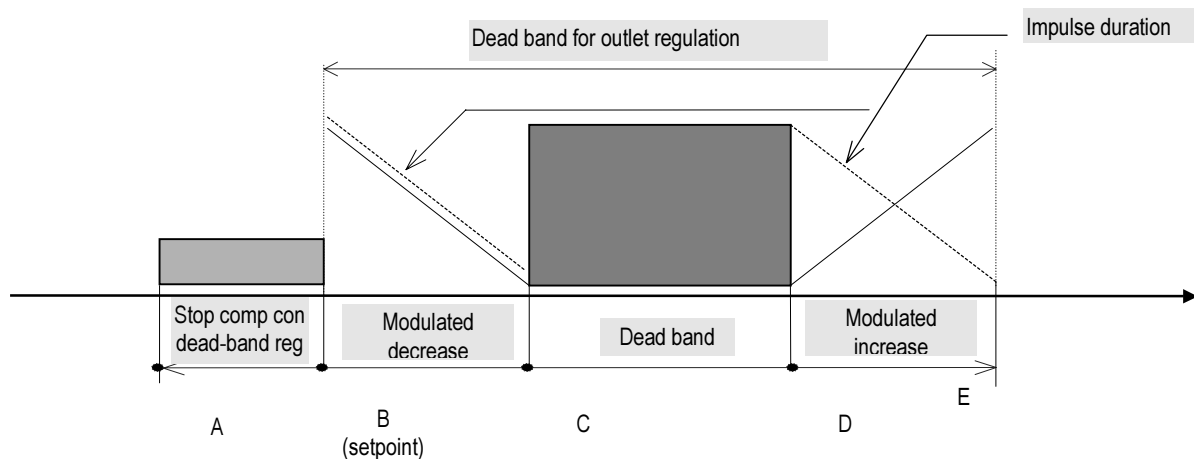
#### Operating description

The modulating capacity control uses 2 solenoids, thanks to which it controls the compressor screw unloader valve and as a consequence its power. **The control is performed using the outlet temperature.** The logic of the two solenoids can be set on the screen; the following table shows the default configuration:

| SOLENOID 1 | SOLENOID 2 | COMPRESSOR BEHAVIOUR                                |
|------------|------------|---|
| Always ON  | Always ON  | Compressor just started or in forced power decrease |
| ON         | Always ON  | Modulated power decrease                            |
| Always OFF | Always ON  | Neutral zone with system in pause                   |
| Always OFF | OFF        | Modulated power increase                            |

Always ON = Solenoid is always ON (not modulating)  
 Always OFF = Solenoid is always OFF (not modulating)  
 ON = Solenoid modulates with tendency to always ON status  
 OFF = Solenoid modulates with tendency to always OFF status

The following graph shows the operation of the capacity control solenoids, which move the compressor unloader valve using impulses of increasing or decreasing duration, depending on whether system is in the increase or decrease power zone. The only temperature data, which must be entered by the user, is the neutral zone within the normal outlet regulation band, the software automatically calculates the other bands.



## Modulating capacity control step operation in accordance with the points on the graph:

The compressors are turned on when the temperature is above that of the normal outlet regulation neutral zone (setpoint + band). As a consequence, the compressors will start working after point E, and the increase impulses will have the maximum duration.

At the start-up of the compressor the exhaust is forced for a time that can be set up.

### Temperature higher than point E (the start-up of the compressors):

The start-up of the compressors is controlled by the values of the temperature the outlet of the water. They start-up in sequence at intervals of time, which can be set, and modulating the power with impulses of maximum duration. After this slot, the compressor reaches the maximum of its power and, as a consequence, each machine will go on working at the reached power.

### Temperature between D and E (modulated increase zone):

In this band of temperature the increase in power is modulated only for the last compressor on, for an indefinite time, unless it has reached the full capacity. The other compressors continue operating at the reached working power. The duration of the modulation impulses will vary in accordance with the variability of the temperature.

### Temperature between D and C (neutral zone):

In the neutral zone, the compressors stay in stand-by and continue operating at the previously reached power.

### Temperature between C and B (modulated decrease zone):

- With the rotation of the compressors: all the compressors go to the stand-by position except the first one that is on and which will start modulating decreasing with impulses whose duration increase as the temperature falls.
- Without the rotation of the compressors: all compressors go to the stand-by position except the last one which is on and which will start modulating decreasing with impulses whose duration increase as the temperature falls.

### Temperature lower than point B (shut-down of the compressor):

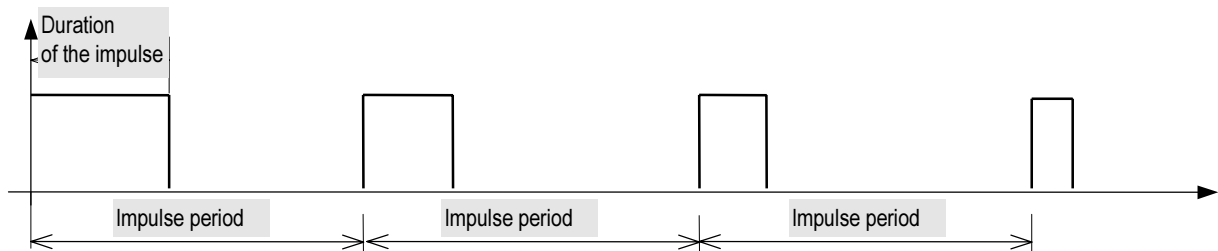
When the temperature falls below point B (regulation setpoint) the compressors begin decreased modulation with impulses of maximum duration, the effective shut-down occurs with an interval of time which can be set, and after which it is assumed that the compressor is at minimum power.

## Description of operation in accordance with variations in temperature

- **As the temperature rises:** When the outlet temperature rises above point E, the first compressor is turned on, and begins increasing modulation with maximum impulse duration. Provided that the temperature remains above point E, the increase will last for a set time, at the end of which the software assumes that the compressor is working at full capacity.  
At this point, the second compressor is required to be turned on and will work in accordance with the method described above; while the first compressor goes to stand-by, at the reached power (in theory 100%). If the temperature remains above point E the software will turn on all four compressors gradually.
- **As the temperature falls:** Suppose that all compressors are on and working at full capacity. When the outlet temperature falls to the modulated increase zone, nothing happens, as the compressors are working at full capacity and thus no increase can be made.  
If the temperature keeps on falling it will pass through the neutral zone where the compressors will keep the operation in stand-by, until it reaches the modulated decrease zone.  
In this zone, the first or the last compressor on, according to rotation, will begin decreasing modulation. The decrease phase will last for a time which can be set, at the end of which the compressors supposed to be completely unloaded, and as a consequence will be shut-down. Then, the next compressor will be shutdown, with maximum duration of the decreasing impulses.  
If the temperature remains low, all the compressors will be shutdown gradually, in accordance with the method described above.
- **Specific cases:**
  - (a) Suppose that the temperature is above point E and one of the compressors is in the increase phase. If the temperature falls to the modulated increase zone, the compressor, which did not reach the full capacity, will continue to increase its power with impulses of varying and no longer fixed duration. If the temperature continues to fall, it first enters the dead zone, where all compressors go to the stand-by position, then the modulated decrease zone, where the partially loaded compressor will start to decrease in power. Once off, the other compressors will be shut down, as already described.
  - (b) Suppose that the temperature is in the modulated decrease zone, and that a compressor is in the decrease phase. If the temperature rises quickly above point E, that compressor will begin to increase even if it had first reached the maximum working power; as a matter of fact, the increase time is reset.

**The following can be set in the program screens:**

- Outlet regulation setpoint (User menu) → **Point B**
- Outlet regulation neutral zone (User menu) → **between B and E**
- Modulating capacity control neutral zone (User menu) → **between C and D**
- Solenoid configuration for the stand-by phase
- Solenoid configuration for the increase phase
- Solenoid configuration for the decrease phase
- Impulse period (Manufacturer menu)
- Maximum and minimum duration of the impulses on solenoids 1 and 2 (Manufacturer menu)
- Forcing time for solenoids ON at the compressor start-up (Manufacturer menu).



The MASTER controls the real start-up and shutdown of the compressors, with the corresponding rotation, through the normal outlet regulation; the type of management described here involves each SLAVE, and controls the modulation of the power of the corresponding compressor.

**Regulation of water/water units only chiller**

Used inputs :

- Evaporator inlet water temp. B1
- Evaporator outlet water temp. B2
- Condenser inlet water temp. B3
- Condenser outlet water temp. B4

Used outputs :

- Compressors
- Capacity-control solenoids

Used parameters :

- type of unit

**Operating description :**

The inlet or outlet temperature of the evaporator controls the activation of the compressors. Since there are no fans the condenser is cooled by water.

**Regulation of water/water chiller units with gas reversal heat pump**

Used inputs :

- Evaporator inlet water temp. B1
- Evaporator outlet water temp. B2
- Condenser inlet water temp. B3
- Condenser outlet water temp. B4

Used outputs :

- relay output for gas reversal
- compressors
- capacity control solenoids

Used parameters :

- type of unit
- minimum evaporator outlet threshold (if exceeded, it inhibits heating operation)
- reversing valve logic

**Operating description:**

In this case, during the reversal of the cycle that is changing from cooling to heating and vice-versa, there is no exchange between the functions of the evaporator and the condenser. In this way, the gas cycle is reversed, and as a consequence the inlet and outlet temperature of the evaporator always controls the compressors.

## **Regulation of water/water chiller units with water reversal heat pump**

### Used inputs :

- Evaporator inlet water temp. B1
- Evaporator outlet water temp. B2
- Condenser inlet water temp. B3
- Condenser outlet water temp. B4

### Used outputs :

- relay output for water reversal
- compressor
- capacity control solenoids

### Used parameters :

- type of unit
- minimum evaporator outlet threshold (if exceeded inhibits heating operation)
- reversing valve logic

### **Operating description:**

In cooling operation the start-up of the compressors is subordinate to the evaporator inlet or outlet temperature B1/B2, while in heating operation the condenser inlet controls the compressors or outlet temperature. Heating operation is allowed only if the evaporator outlet temperature is higher than the minimum evaporator outlet threshold.

Relay output for water reversal:

cooling operation      relay energised  
heating operation      relay de-energised

(the manufacturer parameters allow the operating logic of the valve to be selected)

## Start-up of a single compressor

Used inputs :

- Thermostat (inlet temperature)

Used parameters :

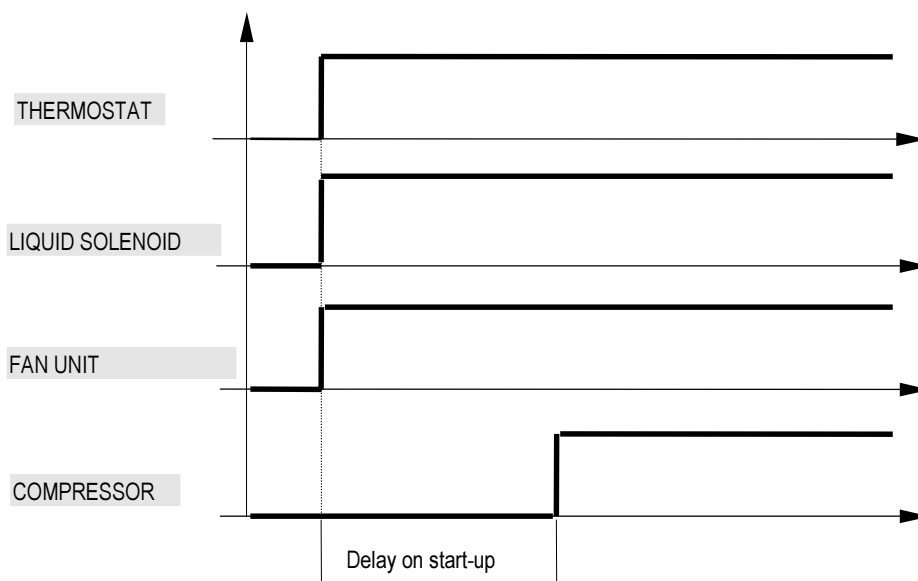
- Delay time on start-up.

Used outputs :

- Ventilation unit.
- Liquid solenoid valve.
- Compressor.

**Operating description:**

The start-up phases are described in the following graph:



## Compressor motor start-up

### START-UP OF STAR DELTA

Inputs used:

- Inlet temperature

Parameters used:

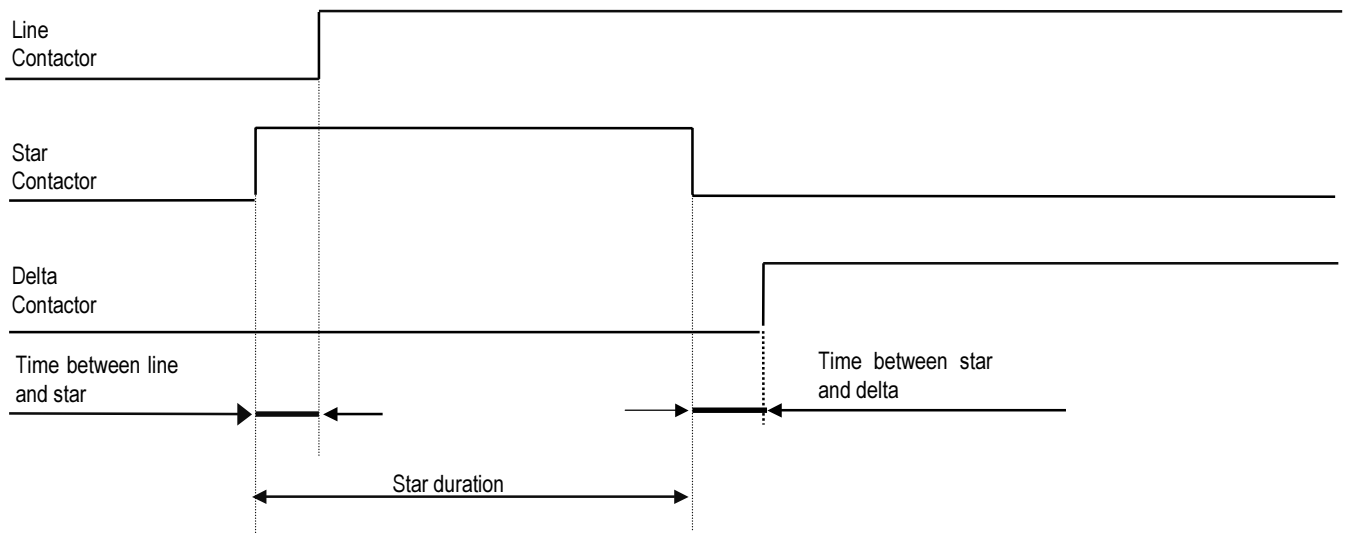
- Time between star and line
- Star impulse duration
- Time between star and delta

Outputs used:

- Line contactor
- Star contactor
- Delta contactor

**Operating description:**

The start-up of the motor is described in the following diagram:



### START-UP WITH PART-WINDING

Used inputs :

Inlet temperature

Used parameters :

Time between star and line

Star impulse duration

Time between star and delta

Used outputs :

Line contactor

Delta contactor

**Operating description:**

In order to start up the compressor with part-winding, it is necessary to zero the star time and star-delta time, setting the necessary part-winding time as star-delta time.

The used outputs will be those that are related to the line and delta relays, which are used respectively as relays A and B of part-winding.

Example:

Star-line time                    0/100s

Star time                         0/100s

Star-delta time                 100/100s                    for a part-winding time of 1s



## Forced capacity control

### Used inputs

- Outlet temperature (B2)
- Compressor supply temperature (B6)
- High pressure (B7)

### Used parameters

- Preventive high supply temperature threshold
- Supply temperature differential
- High-pressure threshold
- High-pressure differential
- Antifreeze temperature threshold
- Antifreeze differential

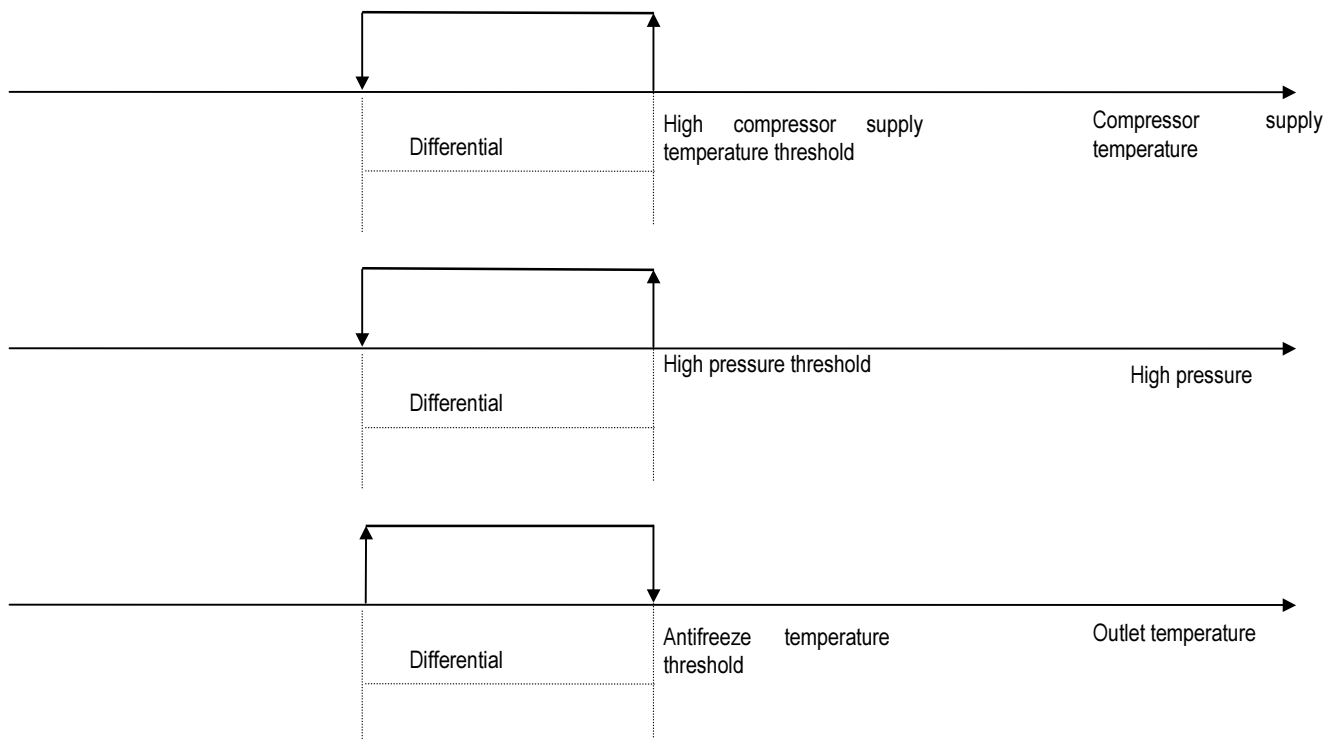
### Used outputs

- Capacity control solenoids

### Operating description:

The forced capacity control is used to avoid the compressor reaching temperature and pressure conditions that would keep it blocked because of the alarm. The compressor is forced to capacity control when:

- It reaches the high supply temperature threshold.
- It reaches the high-pressure threshold.
- It reaches the antifreeze temperature threshold.
- Intervention of the pump-down.



### COMPRESSORS WITH CAPACITY CONTROL STEP

When dealing with compressors with capacity control step, the forced capacity control forces the operation of the compressor to the 25% of the power.

### COMPRESSORS WITH MODULATING CAPACITY CONTROL

When dealing with compressors with modulating capacity control, the forced capacity control forces the operation of the compressor at exhaust mode:

S1: Always ON      S2: Always ON (see the table of the default configuration)

Suppose that before getting in the forced capacity control the compressor whether was increasing its power or was working at full capacity yet. Going back to the normal operation, the compressor will start again to increase in accordance with the set up time.

## Limits at the start-up of the compressor

Two types of limits have been applied to start-up, both ensure the compressor starts directly from the delta contactor, by-passing the star contactor. Enabling is the same for both of the following cases:

1. When set high and low pressure values are exceeded; these values can be set on the screen.
2. When the equalised pressure threshold is exceeded; this value can also be set on the screen. In the software, this pressure is the result of the average between the low and the high-pressure value.

## Management of the differential pressure alarm

### Used inputs

Low pressure transducer  
High-pressure transducer

### Used parameters

Alarm start-up  
Differential pressure setpoint  
Delay of the alarm start-up

The alarm bases on the differential between the readings of the high and low pressure probes. When this falls below the set setpoint, on the basis of the set delay, the alarm is turned on and the compressor is shut down.

## Pumpdown

### Used inputs

Low-pressure transducer

### Used parameters

Type of pump-down  
Enabling of pump-down with machine off from ON/OFF  
Pump-down setpoint in fixed mode (deactivation)  
Maximum pump-down time

### Used outputs

Liquid solenoid valve

If enabled, the pump-down works both to shutdown the compressor by thermostat and to shutdown the machine by ON/OFF. Its duration can be set and may end because of maximum time or the intervention of the high-pressure switch. If any alarm intervenes to switch off the machine or just the compressor, the pump-down ends immediately.

If modulating capacity-control is used, during pumpdown, the compressor is put in forced blow-down mode. In case of the compressors with capacity control step, their operation is forced to the 25% of the maximum load. In case of the compressors with modulating capacity control, the exhaust of the compressor is forced.

## Rotation of the compressors

The compressor calls are rotated so that the number of hours and the number of start-stops of the different compressors are equal. Rotation is effected following FIFO logic, which means the compressor which starts first it is the first one which stops. This behaviour can lead to large initial differences in the operating hours of the various compressors, yet at working power the latter have very similar values.

Rotation occurs only between compressors and not between capacity controls, and in any case it is effected only with the compressors with capacity control step.

Management without rotation:

- Start-up : C1,C2,C3,C4.
- Shutdown : C4,C3,C2,C1.

Management with FIFO rotation (the first compressor to start is the first to stop):

- Start-up : C1,C2,C3,C4.
- Shutdown : C1,C2,C3,C4.

## Condensation regulation

Condensation control can be effected in the following ways:

- On/off linked to the operation of the compressor (without the pressure transducers)
- On/off or modulating linked to the reading of the pressure transducer (if the high pressure transducers have been enabled)
- On/off or modulating linked to the reading of the coil temperature probes (if the coil temperature probes have been enabled).

Used inputs:

- High pressure probe B7
- Coil temperature probe B3

Used outputs:

- Fan 1
- Fan 2
- Fans' speed regulation AOUT1

Used parameters:

- Condensation control selection: none/pressure/temperature
- Condensation setpoint
- Condensation band
- Number of fans
- Enable of the prevent function
- Prevent threshold
- Prevent differential
- Output voltage corresponding to minimum inverter speed
- Output voltage corresponding to maximum inverter speed
- Speed-up time inverter

### Condensation on/off linked to the operation of the compressor:

With this type of condensation, the operation of the fans is subordinate only to the operation of the compressors:

Compressor off = fan off

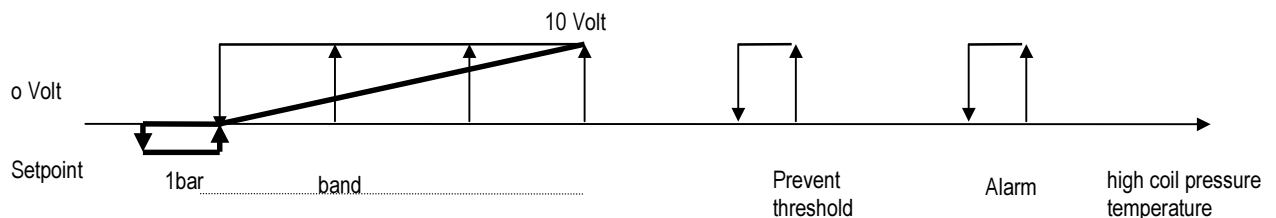
Compressor on = fan on

### Condensation on/off linked to the pressure or temperature sensor:

With this type of condensation, the operation of the fans is subordinate to the operation of the compressors and to the value read by the pressure or temperature sensors, in accordance with a setpoint and a band. When the pressure/temperature is lower than the setpoint or equal to it, all the fans are off; when the pressure/temperature rises to the setpoint + band, all the fans are on.

### Modulating condensation linked to the pressure or temperature sensor:

With this type of condensation, the fans are controlled by a 0/10V analogue output that is proportional to the request of the pressure/temperature sensors. If the lower limit of the ramp is higher than 0V, the line is not proportional but rather one step below the setpoint-diff, as in the first section on the graph.



### Prevent function:

This function can be selected through the manufacturer's password, and it is used to avoid the circuits being blocked because of the high pressure. With the compressor on, when this threshold is reached the compressor is forced to capacity control, until the pressure falls below the set-point minus a differential value that can be set.

With the compressor off, when this threshold is reached the fans are forced on, until the pressure falls below the set-point minus a differential value that can be set.

## Defrost management for water / air units

### Used inputs:

- Coil temperature B3 (used as pressure switch)
- High pressure B7
- Defrost pressure switch 1 input

### Used parameters:

- Inputs used for defrosting
- Type of global defrosting (simultaneous/separate/independent)
- Type of start and end defrost (compressor behaviour)
- Start defrost setpoint
- End defrost setpoint
- Defrost delay time
- Maximum defrost time
- Type of operation of the compressor during the phase of the inversion of the cycle of the refrigerator
- Dripping time

### Used outputs:

- Compressor 1
- Reverse cycle electrovalve 1
- Fan

### Type of defrosting:

- *Global simultaneous*

When only one circuit needs to enter in the defrost cycle all the circuits are forced to defrost; the circuits which do not require defrost (temperature higher than the end defrost set-point) stop and go to stand by; as soon as all the circuits end their defrost cycle the compressors can start again in the heat pump operation.

- *Global separate*

The first pCO unit, which requires defrosting, start defrosting (simultaneous within the unit), while the other units, even if they require defrost, go to stand-by (continue to work in heat pump operation) until the first ends its defrost. When the first one ends its defrost, the next one require defrost and starts defrosting (simultaneous within the unit) while the other ones go to stand-by.

- *Global independent*

The various units can start defrosting independently at random. In this way, a series of machines can go to freecooling at the same time.

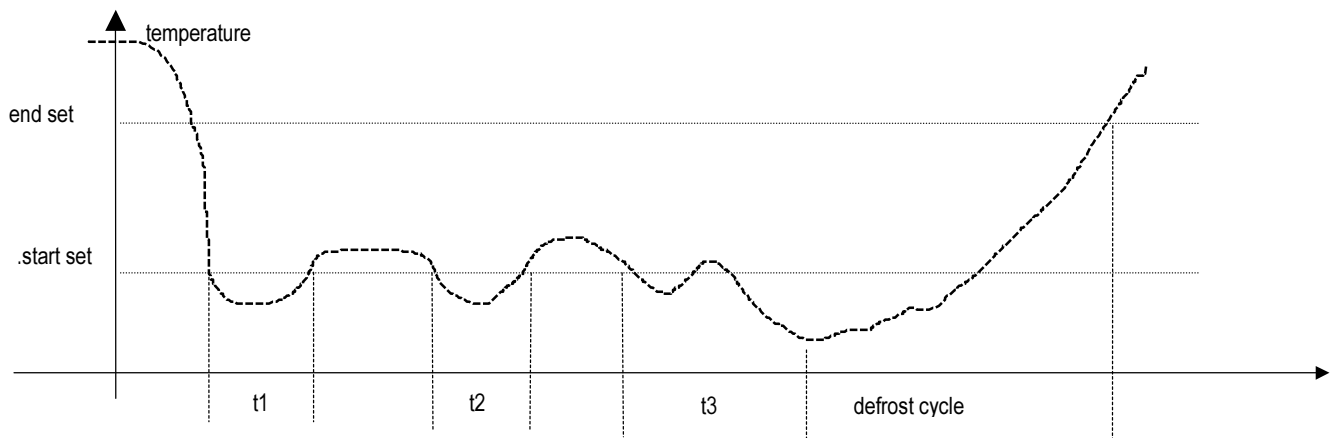
### Type of end and start defrost:

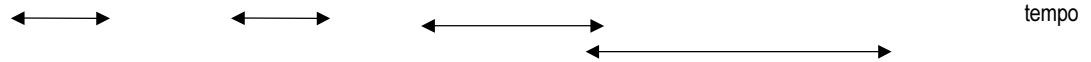
Defrosting can be managed either by the coil temperature probe B3 or alternatively by the high pressure probe B7; the user can choose one of the two probes, on the screen.

The compressor can have four different start/end defrost actions. This offers the possibility to protect the compressor from rapid reversals of cycle, if necessary. The other compressor times are not considered in these shutdowns and start-ups.

- *None*: The compressor is not off before the reversing of the cycle.
- *Start defrost*: The compressor is off, before the reversing of the cycle, only at the start of the defrost
- *End defrost*: The compressor is off, before the reversing of the cycle, only at the end of the defrost
- *Start/end defrost*: The compressor is off, before the reversing of the cycle, both at the start and at the end of the defrost

### Defrosting of a circuit with time/temperature control





If the temperature/pressure of a coil remains below the start defrost set-point for a cumulative time equal to the defrost delay time, the circuit in question will start a defrost cycle:

- the system is taken to maximum refrigeration capacity
- refrigerator circuit is reversed using 4-way valve
- the fan in question is switched off (if the pressure probes are present, the fan can be activated at a certain threshold, to avoid the circuit high pressure alarm being activated)

The circuit exits the defrost cycle by temperature/pressure (if the coil temperature exceeds the end defrost set-point) or at a maximum time, if the defrost cycle exceeds the maximum set threshold time.

**Defrosting a circuit with time/pressure switch control:**

the control is exactly the same, the only difference consists in the fact that the temperature/pressure is no longer counted, but rather the status of the pressure-switches.

**Operation of the fans during defrost.**

During the defrost cycle, the fans are normally off, and are supplied with power only in case where the pressure probes have been installed and the pressure exceeds the prevent threshold, to avoid the alarm high pressure being activated.

## Freecooling control

Freecooling allows us to exploit the external temperature conditions in order to cool the utility water.

### Used outputs:

- Evaporator inlet water temp. B1
- Evaporator outlet water temp. B2
- External air temp. B3
- Freecooling coil inlet water temp. B4

### Used outputs:

- Condensation fans
- On/off freecooling valve
- Modulating freecooling valve

### Used parameters:

- Type of the used valve, on/off or modulating
- Delta temperature for activation of freecooling operation
- Freecooling differential for fan control

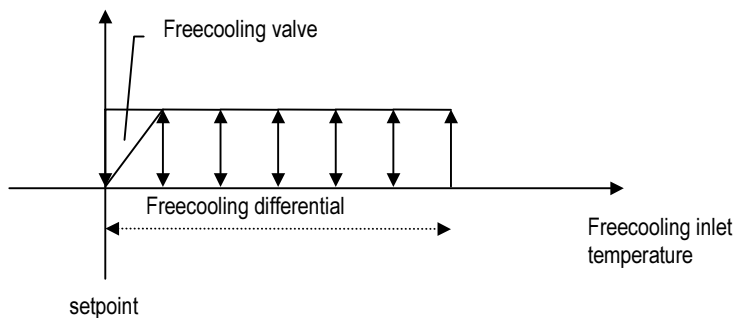
### Operating description:

The freecooling operation is active while the following conditions are always true:

$$\text{External temp.} < (\text{Freecooling coil inlet temp.} - \text{Freecooling delta})$$

When the freecooling is active, the operation of the condensation fans of the entire chiller (pCO master and pCO slave) is subordinate to the inlet temperature of the freecooling coil; the reference setpoint is still the compressor setpoint, while the differential must be set on the screens dedicated to the parameters of the freecooling. The compressors continue to follow the standard regulation.

Here is the diagram of a fan regulation in accordance with the freecooling inlet temperature:



The freecooling valve is completely closed at the setpoint and completely open at setpoint + (freecooling differential / total number of fans).  
 If a modulating valve is selected, the control signal will be proportional between the setpoint and (freecooling differential / total number of fans).  
 If an on/off valve is selected, the valve will be off at setpoint and on at the setpoint + 8% freecooling differential.

## Antifreeze control

Used inputs:

- Outlet temperature probe B2

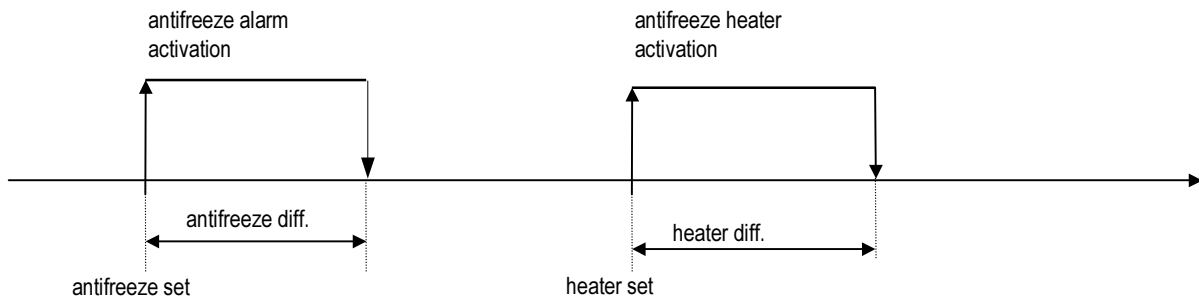
Used parameters:

- Enable outlet probe
- Antifreeze heater setpoint
- Antifreeze heater differential
- Antifreeze alarm setpoint
- Antifreeze alarm differential

Used outputs

- Antifreeze heater

Each pCO unit can manage the antifreeze function provided that the outlet temperature probe is connected and enabled.



The antifreeze function is always active even if the machine is off, in cooling and in heating operation.

Note. The antifreeze alarm on any pCO unit blocks the entire machine.

## Solenoid valve management

The program can manage only one of the following solenoid valves  
Solenoid valve economizer, oil-cooler, liquid-injection

Used inputs

Supply temperature B6

Used parameters

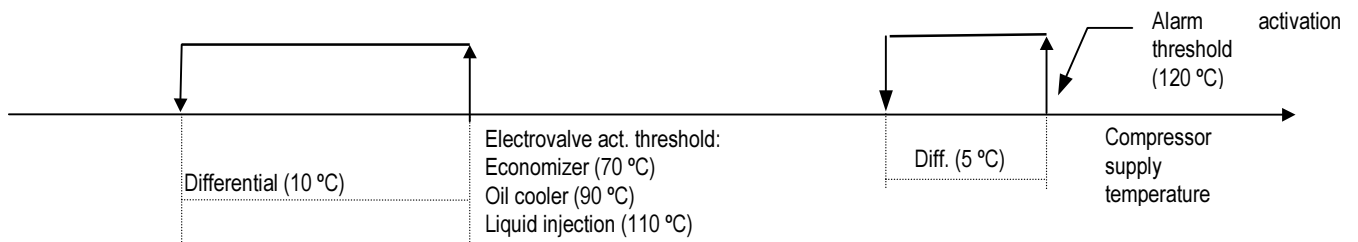
solenoid valve activation temperature  
solenoid valve differential

Used outputs

economizer, oil-cooler, liquid injection solenoid valve

### Operating description

The solenoid valves are activated in accordance with the supply temperature of the compressor, (see the graph):



## Valve pre-position management

The regulation algorithm of the EXV is based on the pre-positioning of the valve in accordance with the number of the stages of the active compressors.

The value of the parameters to be set depends on the type of the chosen unit.

### Chiller unit only

- Total number of compressors for the unit
- Number (P) of capacity controls per compressor
- Number of stages per pCO board =  $N * P + N$
- Number of stages per driver =  $1/2 * (N * P + N)$

Example: Chiller unit with 4 circuits, 4 compressors with 4 capacity controls each. Four 4 pCO boards and 4 drivers are used (1 driver per pCO board).

A total of 4 compressors are configured, 1 local, 4 capacity controls per compressor and 2 stages per driver.

On the pCO: Compressor configuration

```
m_manuf_45
+-----+
|Compressors config |
|Enable driver      4|= Enable the use of the driver
|N. of compressors  0|= N = total no. of compressors (on the master)/local comps. (slave)
|Rotation comp.     y|= P = Enable compressor rotation
+-----+
```

On Driver #1: Configuration driver 1

```
m_Manuf_C1
+-----+
|Manufacturer D:1 U:1|
|Type of regulation |
|NO (OFF)            |
|Present stages 002|= (N*P+N) = no. of stages per driver
+-----+
```

### Chiller unit + heat pump

In the EX7 and EX8 valves the flow is one-way, and thus in the event of chiller + heat pump, 2 valves (and consequently 2 drivers) are required per circuit.

**At the present moment, the software doesn't manage the second driver for the configurations with heat pump.**



# Alarms

## General description

The alarms are divided into three categories

Signal-only alarms (signal on the display and buzzer , signal on the display, buzzer, and alarm relay)

Circuit alarms (deactivate only the corresponding circuit, signal on the display, buzzer, alarm relay)

Grave alarms (deactivate the entire system , signal on the display, buzzer, alarm relay)

### Signal-only alarms :

- Unit maintenance alarm
- Compressor maintenance alarm
- Fault or disconnected clock board alarm
- Alarm of the units disconnected from the network

### Circuit alarms:

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• High pressure/pressure switch alarm</li> <li>• Low pressure alarm</li> <li>• Compressor cut-off alarm</li> <li>• Oil differential alarm</li> <li>• Fan cut-off alarm</li> </ul> | <p>immediate shut-down of the compressor, manual reset</p> <p>delayed at the start-up of the compressor immediate at full capacity with manual reset</p> <p>immediate shut-down of the compressor with manual reset</p> <p>delayed at acquisition with manual reset</p> <p>immediate shut-down of the fan with manual reset</p> |
|--|---|

### Grave alarms

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• No water flow alarm</li> <li>• Evaporator antifreeze alarm</li> <br/> <li>• Grave alarm from digital input</li> <li>• Phase monitor alarm</li> <li>• Pump cut-off</li> <li>• Compressor cut-off</li> </ul> | <p>Digital input delayed at the start-up and at full capacity</p> <p>Function of the evaporator outlet probe, with set-point for intervention and differential for reset with manual reset</p> <p>Immediate shutdown of the unit with manual reset</p> <p>Immediate shutdown of the unit with automatic reset.</p> <p>Immediate shutdown of the unit with manual reset.</p> <p>Immediate shutdown of the unit with manual reset</p> |
|---|---|

Pressing the alarm button twice resets the alarms.

**Table of alarms for each pCO**

| Cod e | Alarm Description                  | Compress ors Off | Fans Off | Pump Off | Syste m Off | Auto/Man Reset | Delay      |   |
|-------|------------------------------------|------------------|----------|----------|-------------|----------------|------------|---|
|       | Grave alarm                        | *                | *        | *        | *           | man            | no         | can be enabled either from master or slave      |
|       | Phase monitor alarm                |                  | *        | *        | *           | auto           | no         | can be enabled from slave                       |
|       | Evaporator pump cut-off            | *                | *        | *        | *           | man            | no         |   |
|       | Condenser pump cut-off             | *                | *        | *        | *           | man            | no         |   |
|       | Evaporator flow controller         | *                | *        | *        | *           | man            | can be set | can be enabled either from master or from slave |
|       | Condenser flow controller          | *                | *        | *        | *           | man            | can be set |   |
|       | Antifreeze alarm                   | *                | *        |          | *           | man            | no         |   |
|       | Unit 1 offline                     | *                | *        | *        | *           | auto.          | 30 sec.    |   |
|       | Unit 2 offline                     | *                | *        | *        | *           | auto.          | 30 sec.    |   |
|       | Unit 3 offline                     | *                | *        | *        | *           | auto.          | 30 sec.    |   |
|       | Unit 4 offline                     | *                | *        | *        | *           | auto.          | 30 sec.    |   |
|       | Compressor cut-off                 |                  |          |          |             | man            | no         |   |
|       | Oil differential pressure switch 1 |                  |          |          |             | man            | can be set |   |
|       | Low oil press diff.                | *                |          |          |             | man            | can be set |   |
|       | Low pressure switch 1              |                  |          |          |             | man            | can be set |   |
|       | High pressure switch 1             |                  |          |          |             | man            | no         |   |
|       | Low press. transducer 1            |                  |          |          |             |                |            |   |
|       | High press. transducer 1           |                  | *        |          |             | man            | no         |   |
|       | Fan cut-off 1                      |                  | *        |          |             | man            | no         |   |
|       | Fan cut-off 2                      |                  | *        |          |             | man            | no         |   |
|       | High voltage                       |                  |          |          |             | man            | no         |   |
|       | High current                       |                  |          |          |             | man            | no         |   |
|       | Maintenance pump                   |                  |          |          |             | man            | no         |   |
|       | Maintenance compressor 1           |                  |          |          |             | man..          | no         |   |
|       | Probe fault B1                     |                  | *        | *        | *           | auto.          | 60 sec.    |   |
|       | Probe fault B2                     |                  | *        | *        | *           | auto.          | 60 sec.    |   |
|       | Probe fault B3                     |                  |          |          |             | auto.          | 60 sec.    |   |
|       | Probe fault B4                     |                  |          |          |             | auto.          | 60 sec.    |   |
|       | Probe fault B5                     |                  |          |          |             | auto.          | 60 sec.    |   |
|       | Probe fault B6                     |                  |          |          |             | auto.          | 60 sec.    |   |
|       | Probe fault B7                     |                  |          |          |             | auto.          | 60 sec.    |   |
|       | Probe fault B8                     |                  |          |          |             | auto.          | 60 sec.    |   |
|       | Limit insertion error              |                  |          |          |             | man.           | No         |   |
|       | 32k clock board fault              |                  |          |          |             | man.           | No         |   |

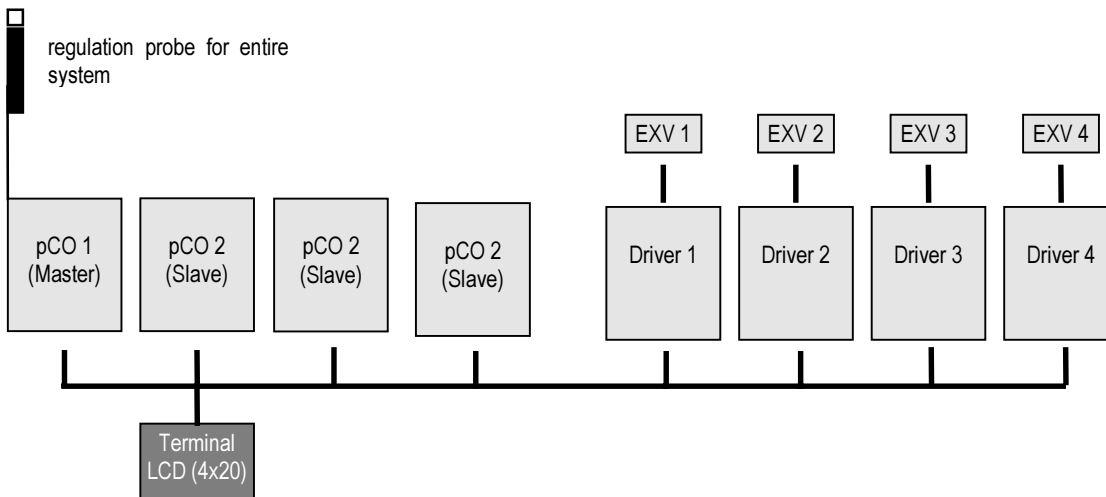
## Driver Alarms

The alarms for the driver boards also indicate the driver that generated the alarm (example: "D: 3").

Example:

```
m_Drv_AL60
+-----+
|AL:066      D:3 U:2|
| Superheat alarm|
+-----+
```

As soon as an alarm screen, which is related to one of the driver boards, appears, the message "Driver" appears in the upper left. Moreover, the "D:" on the right indicates the driver, while the "U:" indicates that the pCO board is connected to the indicated driver. In the example, the alarm is from driver no. 3, which is connected via plan to pCO board no. 3. This numbering refers to the layout of the connection that was previously described and summarised below.



### Alarms of the Driver boards

- probe error (malfunctioning or breakage of the temperature and/or pressure probe)
- stepper motor error (defective valve motor connections)
- EEPROM error (malfunctioning of EEPROM when reading or writing)
- battery error (battery malfunction)
- high pressure on EXV driver (the operating pressure has exceeded the max. threshold MOP)
- low pressure on EXV driver (the operating pressure has exceeded the min. threshold LOP)
- super-heat alarm (super-heating alarm)
- valve not closed during shut-down (not completely closed valve after the previous blackout)
- wait reopening of valve (warning! wait the complete closure of the valve for correct re-start)
- wait battery recharge (warning! wait for the battery to recharge)
- wait EEPROM reboot (warning! wait for the EEPROM to reboot)

(See the list of the screens at the end of the manual for further information).

The compressor(s) in the circuit can be shutdown when the corresponding driver shows the "battery error" and/or "low pressure on EXV driver" (LOP mode) alarm. A delay can also be entered for the latter alarm (the default is: alarm enabled with a delay of 0 seconds).

```
m_manuf_246_Drv
+-----+
|Driver alarms|
|Switch off driver 2|
|compressors if|
|battery error  N|
+-----+
```

## PLAN network

All the devices connected to the pLAN network are identified by their own address.

If the same address is given to more than one unit, the network will not work

Since the terminals and pCO I/O boards use the same type of addressing system, terminals and pCO boards cannot have the same identifier.

The values used for the address range from 1 to 32 for both the terminals and the I/O boards. The total number of peripherals, which can be connected to the network, is 32.

The addresses of the terminals are set using the dip-switches located on the rear, while for the I/O boards the optional network board is required.

### I/O board address

Optional network board (PCOADR0000 / PCOCLKMEM0)

The optional network boards are available in two versions:

Dipswitches and LEDs only

Code: PCOADR0000

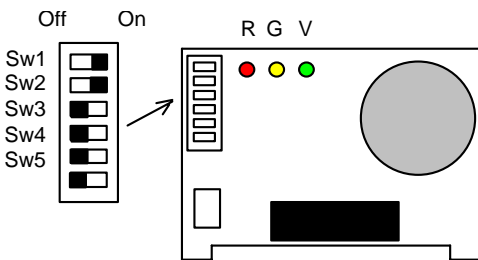
Dipswitches, LEDs and calendar-clock

Code: PCOCLKMEM0

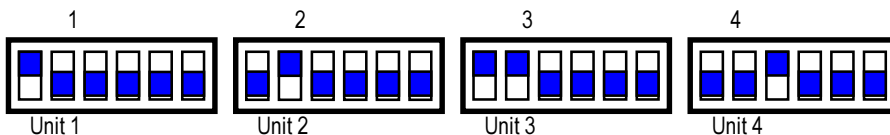
This board is essential for the network operation of the pCO I/O boards. Without these boards the local regulation cycle of the control will continue to be performed, and no connection can be made to the other devices in the network.

| Add  | Sw1         | Sw2  | Sw3  | Sw4  |
|------|-------------|------|------|------|
| 0    | not allowed |      |      |      |
| 1    | on          | off  | off  | off  |
| 2    | off         | on   | off  | off  |
| 3    | on          | on   | off  | off  |
| 4    | off         | off  | on   | off  |
| .... | ....        | .... | .... | .... |
| 15   | off         | on   | on   | on   |
| 16   | on          | on   | on   | on   |

|        | Sw1                         | Sw2 | Sw3 | Sw4 |
|--------|-----------------------------|-----|-----|-----|
| Status | off                         | on  | off | on  |
| P      | 0                           | 1   | 0   | 2   |
| Addr   | P(Sw1)+P(Sw2)+P(Sw3)+P(Sw4) |     |     |     |

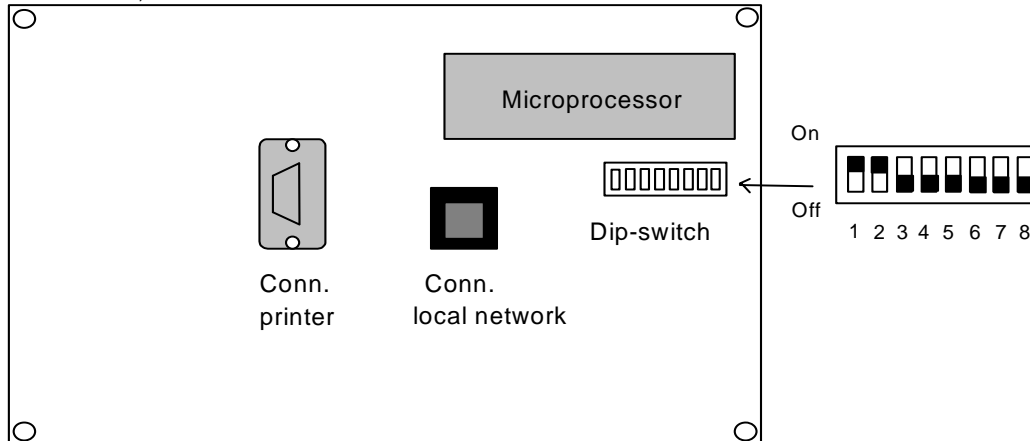


In the standard modular chiller application EPSTDEMCHA, the addresses for the pCO units:



### Terminal addresses

Terminal board, rear view

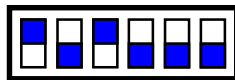


The address of the terminals is set using the dip-switches located on the rear. The addresses set must be in the range 1-32, using the 1-6 dip-switches. The value of the address is set using the following table (see the previous paragraph too):

|   | Sw1 |    | Sw2 |    | Sw3 |    | Sw4 |    | Sw5 |    |
|---|-----|----|-----|----|-----|----|-----|----|-----|----|
| Status                                  | off | on | off | on | off | on | off | on | off | on |
| P                                       | 0   | 1  | 0   | 2  | 0   | 4  | 0   | 8  | 0   | 16 |
| Addr=P(Sw1)+P(Sw2)+P(Sw3)+P(Sw4)+P(Sw5) |     |    |     |    |     |    |     |    |     |    |

The terminals of the 4 pCO relay units must have address 16.

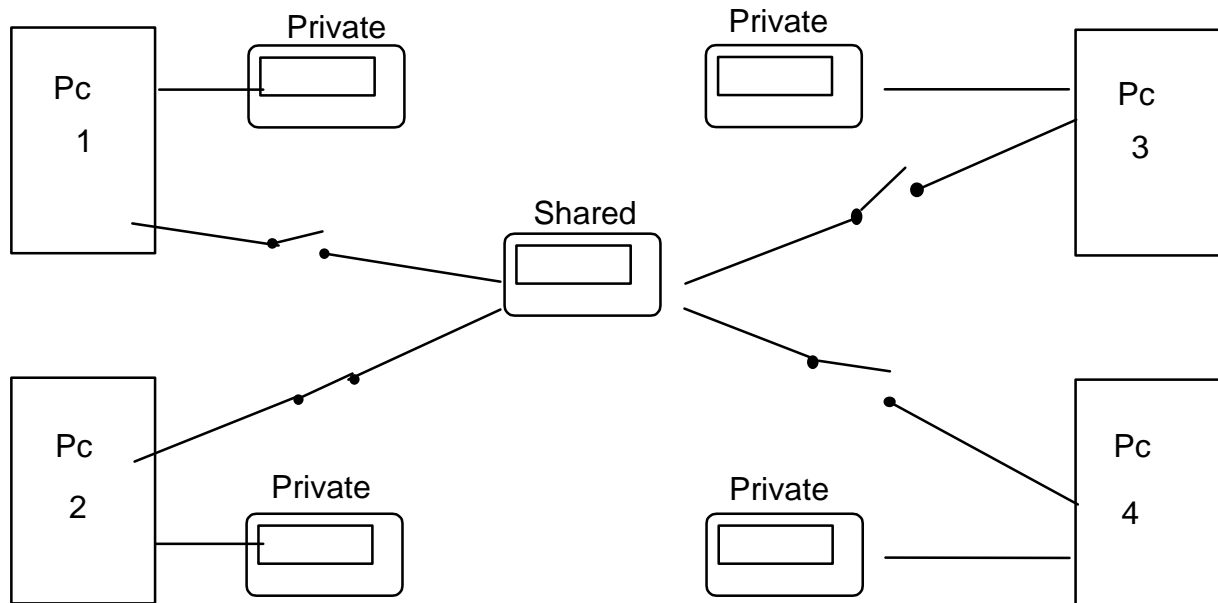
Terminal of units  
1,2,3,4.



5

### Terminal management

- Each pCO board, which is connected to the network, can manage more than 1 terminal (max 3). The display on these occurs simultaneously and not independently, like having the keypad and display connected in parallel.
- Each terminal associated to a specific board, can be *private* or *shared*.
- A terminal is *private* if it shows only the output of one I/O board.
- A terminal is *shared* if, automatically or using the keypad, it can be switched between a series of control boards.
- Each pCO constantly updates the display of the private terminals; on the other hand, shared terminals, are updated only if the pCO in question currently has the control. The following diagram is valid from a logical point of view:



- In this example, the shared terminal is associated to 4 I/O boards yet, currently, only no. 2 can display data and receive the commands from the keypad. The switching between boards occurs in a cyclical sequence (1→2→3→4→1...), pressing the button (or combination of two buttons) which has been assigned this function
- The switching can also be handled automatically, upon direct request of the program. For example, an I/O board can request the control of the shared terminal to display alarms or, on the contrary, transfer possession to the following board at the end of a pre-set time (cyclical rotation).

**The number and the type of terminals is set during the initial configuration of the network. The relative data is saved in the EEPROM memory of each individual I/O board.**

### Terminal configuration procedure

There is an auto-configuration procedure of the Plan network, which is made by the software, every time in which the installation of the default value is made.

If correctly set, the addresses of the boards and terminals, at the first installation of the EPROM, after the procedure of the automatic installation of the default values, the Plan network turns out to be configured with only one terminal and which is shared between the boards with address 16. Thanks to this shared terminal, it is possible to access to the different units that are connected to the network.

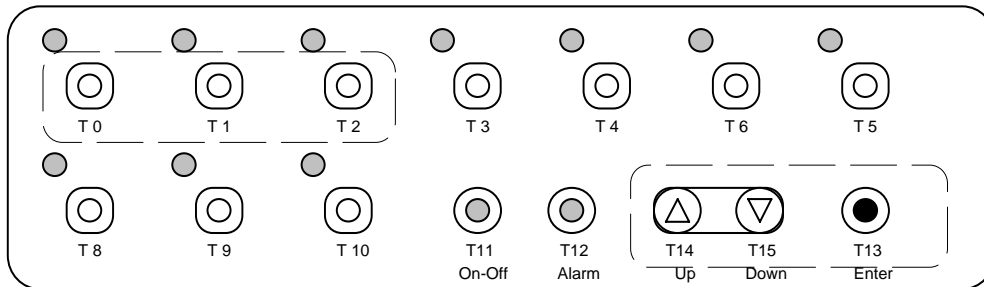
In case the addresses are wrong or the EPROM is replaced by another one with the same version and date, and if you cannot access to anyone of the present units from the terminal, it is necessary to proceed in accordance with what is described later on.

The following procedure must be followed when you want to modify the Pan configuration of the system, perhaps in order to add a private terminal to each board.

- The first operation to be performed, when a pLAN network is set-up for the first time or an I/O board is replaced, involves the configuration of the terminals.
- Before starting this procedure, check that each I/O board and each terminal have been "baptised" with the correct address, which established during the planning of the network. It should be remembered that the address, which was set using the dipswitches, is valid only if the device is reset. Furthermore, it is good practice to perform a global reset of all the devices in the network, when realising any mistaken configuration of the addresses (more than one board with the same address).
- The configuration procedure must be activated for each I/O board and must involve all the terminals in the network. This procedure can be activated from any terminal, which can also have been connected temporarily just to perform the configuration operation, and removed at the end of this.
- The operations to be effected are the following:

**Step 1: selection of the I/O board**

- Pressing buttons 0-1-2 simultaneously for at least 5 secs activates the procedure. (for compatibility, the buttons ▲ ▼ -Enter perform the same function):



- If the display is LCD, the following screen is displayed:

```
Terminal Adr: nn
I/O Board Adr: 12
```

- The field *Terminal Adr* is fixed and represents the address of the terminal that is being operated on and set using the rear dip-switches.
- At first, the field *I/O Board Adr* shows the address of the pCO board currently connected to the terminal. If the terminal is not connected to any pCO board, the characters '-' are displayed. Use the arrow buttons to modify the setting to force the connection to another control. The values displayed during the selection are the addresses of the pCO boards that are effectively connected to the network. If no pCO is active, the display '-' cannot be changed.
- Pressing the Enter button we go out of the first phase of the procedure, which takes place in the terminal, and enter the real configuration screen of the terminals, see step 2.
- If the terminal remains inactive (no button pressed) for more than 15 seconds, it goes out of the configuration procedure automatically.

**Step 2: selection of the associated terminals**

For LCD displays, the displayed screens are:

```
Terminal Config
Press ENTER
to continue
```

Enter  
↓

```
P:12 Adr Priv/Shared
Trm1 02 Sh
Trm2 03 Pr
Trm3 None -- Ok? No
```

- In this screen the Enter button moves the cursor from one field to the next, while the arrow buttons change the current value of the field. In this case, the message P:12 indicates that the I/O board with address 12 has been selected.
- To exit the configuration procedure and save the values, select the field 'Ok ? no' and using the cursor buttons bring up the message 'Yes', then press Enter. To exit without saving, wait 30 secs without pressing any button.

**Display of the status of the connection of the terminal**

- If the terminal shows a status of inactivity of the CPU board whose output is being displayed, the display is cancelled and the following message appears:

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

- If the terminal does not receive the network synchronisation message (token) for more than 10 sec, the display is cancelled and the following message appears:

```
NO LINK
```

- this is the same as the green LED off for the I/O boards.

**Display of the status of the network: NetSTAT**

- The program includes a procedure, which can be activated only in the LCD version, that allows the display in real time of the status and the type of the currently connected peripherals.
- This procedure is activated by pressing buttons 0-1-2 simultaneously (or Up-Down-Enter) for at least 10 secs. (after the first 5 secs, obviously the terminal configuration procedure is accessed). The following screen is displayed:

```
NetSTAT 1  0  0  1  1  _ _ _ _ 8
T: xx    9  _ _ _ _ _ _  1  _ 16
Enter   17  _ _ _ _ _ _  24
To Exit 25  _ _ _ _ _ _  32
```

- The number after T: shows the address of the terminal on which the procedure is activated, the symbols indicate the type of peripheral (terminal/pCO) and the corresponding address.
- In the example, the network is made up of 2 pCO boards with addresses 1, 2, and 3 terminals with addresses 3, 4, and 15.



## First start-up

Only one program EPROM is foreseen. This is valid both for the master board and the slave board, and on the basis of the address of the board on which it is installed, the program EPROM recognize the right operation modality.

When a new EPROM is installed in the pCO board, **it is necessary to install the default values.**

There is a procedure for the automatic installation of the default values. It is based on the difference between the stored values of date and version of the software. However, it is suggested to install the default values by hand gaining access to the M\_MANUF245 screen.

If CAREL's drivers are used for the ALCO valve, during the procedure for the installation of the default values it is necessary that the drivers are supplied with power and connected to plan network, otherwise they cannot be initiated.

## Installation of the default values

This procedure foresees the complete erasure of the memory of the pCO board and the installation of the values established by Carel for the initial operation of the machine.

**WARNING ! This operation should also be repeated if the EPROM or pCO board are replaced, or in case of any other modifications to the system hardware which may compromise the software.**

Before making this operation, be sure of having supply with power the possible drivers, which are connected to the network, because if not supplied during this phase, the drivers won't be initialised and so could work anomalously

Press the buttons MENU and PROG simultaneously.

```
M_Pw_Manuf
+-----+
|Manufacturer|
|Insert password|
|                |
|                | 0000
+-----+
```

After having entered the correct password, the following screen is displayed:

```
m_manuf245
+-----+
|Reset all parameters|
|to default values N|
+-----+
```

Move to the Y/N field pressing ENTER, and using the arrow buttons change N to Y and wait for the automatic installation of the default values.

When the message "Please wait.." disappears, it means that the default values have been installed.

**At this point it is suggested to switch the pCO board off and on again, (disconnecting and then reconnecting the power supply).** So, all of the counters, which are within the board, will be set at zero and the set values will become effective.

## Driver software configuration

### Branches of configuration

The software has numerous branches of configuration / display which are divided as follows (the left column shows the headings of the screens in the branch, while the right column briefly describes the function of the branch itself):

- EXV manufacturer → configuration Driver 1 (manufacturer parameters)
- EXV Carel → configuration Driver 1 (CAREL parameters)
- EXV maintenance → configuration Driver 1 (maintenance parameters)

### User interface (Driver)

#### Password screens

Here are the password screens that allow access to the branches of configuration.

```
m_manuf_PW_C1
+-----+
|Manufacturer D:1 U:1|
|Insert password    |
|                   |
|                   | 0000 |
+-----+
```

Once the password has been entered, the software skips to the "manufacturers" configuration branch of driver 1. Once this branch has been accessed, pressing the MENU it is possible to return to this screen.

```
m_CAREL_PW_C1
+-----+
|CAREL           D:1 U:1|
|Insert password    |
|                   |
|                   | 0000 |
+-----+
```

Once the password has been entered, the software skips to the "CAREL's" configuration branch of driver 1. Once this branch has been accessed, pressing the MENU it is possible to return to this screen.

```
m_manuf_PW_C2
+-----+
|Manufacturer D:2 U:1|
|Insert password    |
|                   |
|                   | 0000 |
+-----+
```

Once the password has been entered, the software skips to the "manufacturers" configuration branch of driver 2. Once this branch has been accessed, pressing the MENU it is possible to return to this screen.

```
m_CAREL_PW_C2
+-----+
|CAREL           D:2 U:1|
|Insert password    |
|                   |
|                   | 0000 |
+-----+
```

Once the password has been entered, the software skips to the "CAREL's" configuration branch of driver 2. Once this branch has been accessed, pressing the MENU it is possible to return to this screen.

### Manufacturer's parameters

| No | Parameter  | Meaning   |
|----|--|---|
| 1  | Type of regulation                                 | no (off) → no regulation (the valve is kept closed)<br>self-adapting → automatic regulation<br>from user config. → manual regulation (the PID parameters are set by the user)<br>forced opening → force the total opening of the valve  |
| 2  | Stages present                                     | Number of stages present in the circuit = no. compressors* (1+no. capacity-controls per comp.)  |
| 3  | Type gas   | Type of gas used in the circuit   |
| 4  | Type valve   | Type of valve used (EX6, EX7, EX8)  |
| 5  | Comp. Refrig. Cap.                                 | Refrigerating capacity of the compressor (in kW)  |
| 6  | Enable. probe error                                | Enables signal with the alarm relay of the driver in the event of driver probe fault  |
| 7  | Enable. step motor error                           | Enables signal with the alarm relay of the driver in the event of poor connection of the stepper motor  |
| 8  | Enable. EEPROM err.                                | Enables signal with the alarm relay of the driver in the event of damaged EEPROM  |
| 9  | Enable. battery Error                              | Enables signal with the alarm relay of the driver in the event of faulty battery  |
| 10 | Enable. high press err.                            | Enables signal with the alarm relay of the driver in the event of high pressure (above MOP)   |
| 11 | Enable. low press err.                             | Enables signal with the alarm relay of the driver in the event of low pressure (below LOP)  |
| 12 | Enable low superheat alarm                         | Enables signal with the alarm relay of the driver in the event of low super-heat (below parameter number 26)  |
| 13 | Enable valve not closed alarm                      | Enables signal with the alarm relay of the driver in the event of valve not completely closed during the previous black-out   |
| 14 | Super-heat setpoint                                | Super-heat setpoint (required super-heating temperature)  |
| 15 | Set Min. Operating pressure                        | Low operating pressure threshold (below which the "low pressure alarm" is signalled) (LOP, Lowest Operating Pressure)   |
| 16 | Set Max. Operating pressure                        | High operating threshold pressure (above which the "high pressure alarm" is signalled) (MOP, Maximum Operating Pressure)  |
| 17 | Prop. factor                                       | Proportional factor (P)   |
| 18 | Deriv. factor                                      | Integrative factor (I)  |
| 19 | Diff. factor                                       | Differential factor (D)   |
| 20 | Posit. adjust.                                     | Reserved  |
| 21 | Max valve steps                                    | Max. no. of valve steps   |
| 22 | Config. press. probe 0/4mA - 20mA                  | Calibration of pressure probe: number of barg read at 4mA and at 20mA   |
| 23 | Set. evaporator outlet press.                      | Operating set-point for the evaporator outlet pressure  |
| 24 | Super-heat hysteresis after high pressure alarm    | Super-heat hysteresis after the high pressure alarm   |
| 25 | Super-heat hysteresis after low pressure alarm     | Super-heat hysteresis after the low pressure alarm  |
| 26 | Close valve at min. pos. when super-heat less than | Super-heat threshold below which the valve is closed at the minimum position (the minimum position refers to parameter 37) and the "low superheat" alarm is signalled (if enabled).   |
| 27 | Valve reg.   | Extra information on the regulation (used only when parameter 1 is in "forced opening" mode).<br>Valve off .....: the valve is kept closed<br>Manual position...: in "forced opening" the valve is forced completely open   |
| 28 | Type of compressor input status                    | Allows the selection of the input which provides the status of the compressors:<br>pLAN → supplies the exact status of the compressors (number of compressors on and number of capacity-controls inserted, if any); this information allows the pre-positioning of the valve.<br>DIGITAL INPUT → provides the status of the compressors simply as 0="all off" and 1="at least one on". This information <b>does not allow pre-positioning</b> . When the input is equal to 0, the valve is kept closed, while if equal to 1 the valve is open and then, based on the pressure and super-heat, the driver starts regulating. |
| 29 | Press. probe                                       | Type of pressure probe: 4-20mA or alternatively 0-20mA  |
| 30 | Type of temp. probe                                | Type of temperature probe: NTC 103-AT (CAREL) or alternatively NTC 103-ETB  |
| 31 | Presence pLAN                                      | Informs the driver of the presence or otherwise of the pLAN network. If the pLAN is not present, the driver does not manage the pLAN alarm, furthermore it signals the following alarms for just 10 secs:<br><ul style="list-style-type: none"> <li>• wait valve restart</li> <li>• wait battery restart</li> <li>• wait EEPROM reboot</li> </ul>   |
| 32 | Presence battery                                   | Informs the software of the presence or otherwise of the battery<br>If the battery is not present, the driver no longer manages the corresponding alarms, tests, etc.   |

### CAREL's parameters

| No | Parameter   | Meaning  |
|----|---|--|
| 33 | No. of samples for calculating the input average        | Minimum number of samples used to calculate the average of the analogue inputs (pressure, temperature, ...) of the driver.<br>A high number of samples increases the accuracy of the regulation, which is thus more stable, but at the same time makes it slower to respond to variations in the conditions of the system.                               |
| 34 | Up limit stab. index                                    | Upper limit of the stability index of the system   |
| 35 | Low limit stab. index                                   | Lower limit of the stability index of the system   |
| 36 | Pos. err. av. time                                      | Average time of the positioning error  |
| 37 | No. of steps below which the valve is considered closed | The number of steps below which the valve is considered closed   |
| 38 | Stepper motor - frequency                               | Operating frequency of the valve motor   |
| 39 | Stepper motor - max. current                            | Max. operating current of the valve motor<br>Two values can be selected: 0.75A and 1.5A  |
| 40 | Calculated valve position                               | Calculated position of the valve (expressed in steps): this does not indicate the effective position of the valve, but rather the desired pos. (to which it will arrive in a certain time).  |
| 41 | Sample time   | Sampling time: the inputs of the driver are filtered digitally. This parameter allows the sampling time of the digital filters to be set.  |
| 42 | System stability  | Stability index of the system  |
| 43 | Reserved (INT37)  | Currently reserved. LEAVE THE DEFAULT VALUE.<br>Allows changing the max. operating current of the motor of the valve.<br>The default is 1000. Each unit represents a current value equal to "max. current for valve motor"/1000.<br>E.g.: if set to 2000, the max. current is 1.5A, the max. current used for regulation will be: $1.5/1000 * 2000 = 3A$ |
| 44 | Test (INT44)  | Reserved. LEAVE THE DEFAULT VALUE.   |

### Maintenance parameters

| No | Parameter   | Meaning  |
|----|---|--|
| 45 | Battery status                                    | Informs on the battery status: <ul style="list-style-type: none"> <li>• battery disconnected (signalled by an int. res. of 255 Ohm)</li> <li>• high internal resistance (&gt;15 Ohm) when the battery is not sufficiently charged to close the valve in the event of a blackout</li> <li>• not rechargeable (when the battery cannot be recharged any longer)</li> <li>• discharged (but rechargeable)</li> <li>• battery charged and working correctly</li> </ul> |
| 46 | Enable. alarm if valve stays open after shut-down | Enables the "valve open" alarm in the event of a blackout  |
| 47 | Restart after shut-down/black-out                 | After a blackout the driver can restart with regulation <ul style="list-style-type: none"> <li>• always</li> <li>• only if the battery is charged (If the battery is discharged or faulty the valve is kept closed and the system will not restart until the battery is recharged)</li> </ul>  |
| 48 | Batt. resistance                                  | Internal resistance of the battery (Ohm)   |
| 49 | Time since last battery test                      | Time elapsed since the last test of the battery status<br>The test is performed every 255 hours and involves the discharge of 10% of the battery's capacity. Other tests are also performed, yet these are invisible to the user, and are not described here   |
| 50 | Time since last battery use                       | Time elapsed since the last time the battery was used to close the valve after a blackout  |
| 51 | Capacity  | Request (percentage) sent to driver<br>The driver calculates the percentage of the request in the following way:<br>$\text{no. of stages required} / \text{present stages} * 100$<br>(see chap. "Request management" for more information)   |
| 52 | Valve pos.  | Effective position of the valve (in steps)   |
| 53 | Intake, temperature                               | Temperature of the intake of the gas   |
| 54 | Intake, pressure                                  | Temperature of the intake of the gas   |
| 55 | Evaporator - temperature                          | Evaporator temperature (equal to the gas saturation temperature: based on the type of gas and the measurement of the pressure of the gas itself)   |
| 56 | Evaporator - Super-Heat                           | Calculated evaporator super-heating  |

## Special “Ignore” function

```

+-----+
|WARNING!   D:1 U:1|
|SYSTEM WAITING|
|VALVE OPENING|
|Ignore? N  |
+-----+
    
```

There are three alarm conditions that prevent the driver from performing normal regulation:

- valve reopening → during the last blackout the valve was not closed completely
- battery recharge → the battery does not work correctly or is discharged or not connected
- EEPROM reboot → EEPROM malfunction

The “Ignore” function allows these alarms to be ignored, so as to allow the control of the valve by the driver (which otherwise would keep it closed) until the alarm ends.

**WARNING!** cancelling the alarms means ignoring them; thus, it is recommended to check carefully that the system will not be damaged, malfunctioned or become unreliable (e.g.: if “battery recharge” is signalled, it probably means that the battery is not charged or alternatively is not connected, etc. This, in the event of a blackout, could not allow the valve to close. Thus, the valve would stay open even when the system restarts).

If none of the three alarms above are present, the screen changes as follows:

```

+-----+
|Maintenance D:1 U:1|
|NO PROBLEM   |
|Ignore? N    |
+-----+
    
```

## Operation of the valves in “Chiller” and “Heat pump” modes

The “heat pump” mode features a different hardware configuration in accordance with the type of valve used.

For EX-7 and EX-8 valves, the configuration features max. 1 operative valve each pCO board. In practice, two valves are connected, but they are never used at the simultaneously: in chiller mode, valve 1 is operative, while valve 2 is kept closed; in heat pump mode, valve 2 is operating, while valve 1 is kept closed.

This problem does not exist for the EX-6 valve, which is bi-directional in refrigerant gas flow. Each pCO board can thus control at last 2 EX-6 valves, even in heat pump configuration.

(For the time being, the software manages the valve only in configuration no. 0, which is simple chiller)

## Driver Regulation

The regulation algorithm offers the following functions:

- *super-heating control (super-heat mode)*, in normal operating conditions of the system superheating is always maintained fixed and at the set-point;
- *intake pressure control (pressure mode)*, in over-load or under-load conditions. These conditions are detected when the pressure exceeds the set limits of the MOP (Maximum Operating Pressure) or LOP (Lowest Operating Pressure). In these conditions, the driver tries to take the pressure back within the limits of the MOP and LOP.

In these circumstances, superheating is in any case controlled.

- *Diagnostics, alarms*. The driver can recognise various alarm situations (see the corresponding paragraph).

The regulation algorithm allows the pCO board, which manages the circuit, to communicate the capacity control status of the compressors to the driver whenever these are varied. In this way, the driver knows the active refrigerating capacity and can thus pre-position the valve in the position that *nominally* corresponds to this capacity (in accordance with the typical curve of the valve itself). As a result, the algorithm is able to react quickly to rapid variations (=activation of the capacity control of the compressors) in the refrigerating capacity. Once pre-positioned, the valve is regulated automatically in accordance with the measurements made by the regulation probes.

For more details, please refer to the following paragraphs. All the parameters quoted below are described in the table of driver parameters.

### Management request - "Capacity" parameter

"Capacity" is the parameter with which the pCO board that manages the circuit communicates the number of active stages of the compressor to the driver whenever these are varied. This information is sent in the form of a percentage:

$$\text{Capacity} = \text{number of active stages} / \text{"stages present"} * 100$$

"Stages present" is the total number of stages present in the refrigerator circuit, and is a driver configuration parameter.

NB: if the "Capacity" is equal to zero, the valve is closed.

The regulation of the valve is influenced by the "Capacity" only in the initial pre-positioning phase. Subsequently, the valve is opened/closed in accordance with the measured values of the super-heating or pressure.

### Regulation algorithm

Besides the pre-positioning, the aim of the regulation algorithm is to ensure that the super-heat value is as constant as possible. The required value is set with the "super-heat setpoint" parameter.

The correction to the error effected during operation is made thanks to a PID-type algorithm (proportional + integral + differential).

The values of the three parameters ("P", "I", "D") can be set manually by the user (parameter "Type of regulation" = manual reg.; in this case the regulation will maintain the set PID values) or adjusted in real time by the software (parameter "Type of regulation" = "self-adapting"; in this case, the regulation is self-adapting).

As well as the super-heat value, during regulation there is another fundamental parameter: the gas pressure.

There are two parameters ("Max set operating pressure" and "Min set operating pressure") that identify the range of operating pressure, within which the regulation is effected, returning the superheating to the set-point value (**Super-heat mode**).

Outside of the range of values identified by the "Min set operating pressure" and "Max set operating pressure", the operating conditions are considered critical, and the priority of the regulation moves from superheating to pressure. In other words, the pressure becomes the main regulated value (**Pressure mode**), and the valve is managed so as to return the pressure within the operating range. During this phase, in any case the regulation evaluates the superheating, to avoid it reaches such values critical for the system.

"Superheating hysteresis after high pressure alarm" is the parameter that allows the setting of the safety range, which must be satisfied, to cancel the high or low pressure alarm and return to "normal" regulation. In other words:

- in case of the high-pressure alarm, the alarm is called off when the super-heat value falls below the "super-heat setpoint"-*"Superheating hysteresis after high pressure alarm"*.
- in case of the low-pressure alarm, the alarm is called off when the super-heat value rises above the "super-heat setpoint" + *" Superheating hysteresis after low pressure alarm"*.

Other interesting parameters used during the regulation are:

- "Close valve at min. pos. when super-heat is lower than": allows the setting of a minimum threshold below which the valve is closed at the minimum position (see parameter: "No. steps below which the valve is considered closed").
- "System stability": provides an index of the stability of the system. The values, which represent the stability of the system, are "Up sys. stab. limit." and "Low sys. stab. limit". The external values inform that the regulation has not yet reached a point of equilibrium.
- "valve pos.", "super-heat, evaporator", "temperature, evaporator" and "intake, pressure": these are display-only parameters that respectively provide information on the position of the valve (expressed in steps), super-heat, evaporation temperature and intake pressure. All these values are shown on a screen (one for each driver) at the end of the I/O branch.

## User interface

**Table of Parameters**

| no                             | Description  | level        | Master/Slave | default   | limits        |
|--------------------------------|--|--------------|--------------|-----------|---------------|
| <b>Manufacturer parameters</b> |  |              |              |           |               |
| 1                              | Configuration (see inputs/outputs table)   | Manufacturer | Mst/slv      | 16        | 0..23         |
| 6                              | Enable probe B1  | Manufacturer | Mst/slv      | s         | y/n           |
| 7                              | Enable probe B2  | Manufacturer | Mst/slv      | s         | y/n           |
| 8                              | Enable probe B3  | Manufacturer | Mst/slv      | s         | y/n           |
| 9                              | Enable probe B4  | Manufacturer | Mst/slv      | n         | y/n           |
| 10                             | Enable probe B5  | Manufacturer | Mst/slv      | s         | y/n           |
| 11                             | Enable probe B6  | Manufacturer | Mst/slv      | n         | y/n           |
| 12                             | Enable probe B7  | Manufacturer | Mst/slv      | s         | y/n           |
| 13                             | Enable probe B8  | Manufacturer | Mst/slv      | n         | y/n           |
| 14                             | Selection of type of probe no. 5 (None/External setpoint/voltage/current)        | Manufacturer | Mst/slv      | None      |               |
| 15                             | Minimum limit of probe no. 5   | Manufacturer | Mst/slv      | 0         |               |
| 16                             | Maximum limit of probe no 5  | Manufacturer | Mst/slv      | 0         |               |
| 17                             | Selection of type of supply temp. probe (0/1V; 4/20mA )                          | Manufacturer | Mst/slv      | 0/1 V     |               |
| 18                             | Start scale supply temperature probes  | Manufacturer | Mst/slv      | -30 °C    |               |
| 19                             | Full scale supply temperature probes   | Manufacturer | Mst/slv      | 150 °C    |               |
| 21                             | Start scale high pressure probes (4mA)   | Manufacturer | Mst/slv      | 0 bar     | 0...999.9bar  |
| 22                             | Full scale high pressure probes (20mA)   | Manufacturer | Mst/slv      |           | 0...999.9bar  |
| 23                             | Start scale low pressure probes (4mA)  | Manufacturer | Mst/slv      | -0.5 bar  |               |
| 24                             | Full scale low pressure probes (20mA)  | Manufacturer | Mst/slv      | 7 bar     |               |
| 25                             | Enable double setpoint   | Manufacturer | Mst/slv      | n         |               |
| 26                             | Enable driver  | Manufacturer | Mst/slv      | n         |               |
| 27                             | Total number of compressors  | Manufacturer | Mst          | 1         | 0...4         |
| 28                             | Enable compressor rotation (FIFO logic)  | Manufacturer | Mst          | s         |               |
| 29                             | Type of (step / modulating) capacity control                                     | Manufacturer | Mst          | Step      |               |
| 30                             | Number capacity controls per compressor  | Manufacturer | Mst          | 3         | 0...3         |
| 31                             | Time between Line and Star   | Manufacturer | Mst/slv      | 100 s/100 | 0...999 s/100 |
| 32                             | Star time  | Manufacturer | Mst/slv      | 500 s/100 | 0...999 s/100 |
| 33                             | Time between Star and Delta  | Manufacturer | Mst/slv      | 100 s/100 | 0...999 s/100 |
| 34                             | Enable limits to compressor at start-up  | Manufacturer | Mst/slv      | n         |               |
| 35                             | Low pressure limit at start-up   | Manufacturer | Mst/slv      | 6 bar     | 0...99.9 bar  |
| 36                             | High pressure limit at start-up  | Manufacturer | Mst/slv      | 18 bar    | 0...99.9 bar  |
| 37                             | Threshold for equalised pressure   | Manufacturer | Mst/slv      | 13bar     | 0...99.9 bar  |
| 38                             | Minimum compressor start-up time   | Manufacturer | Mst/slv      | n         |               |
| 39                             | Minimum compressor shut-down time  | Manufacturer | Mst/slv      | n         |               |
| 40                             | Time between start-ups of different compressors                                  | Manufacturer | Mst/slv      | 10 sec.   |               |
| 41                             | Time between two starts of same compressor                                       | Manufacturer | Mst/slv      | 450 sec.  |               |
| 42                             | Enable forcing of first capacity control at start-up                             | Manufacturer | Mst/slv      | n         |               |
| 43                             | Configuration of solenoid valves for first capacity-control                      | Manufacturer | Mst/slv      | y/n/n     |               |
| 44                             | Configuration of solenoid valves for second capacity control                     | Manufacturer | Mst/slv      | n/n/y     |               |
| 45                             | Configuration of solenoid valves for third capacity control                      | Manufacturer | Mst/slv      | n/y/n     |               |
| 46                             | Configuration of solenoid valves for fourth capacity control                     | Manufacturer | Mst/slv      | n/n/n     |               |
| 47                             | Enable special management of first capacity control                              | Manufacturer | Mst/slv      | n         |               |
| 48                             | Time between the opening of the liquid solenoid and the compressor               | Manufacturer | Mst/slv      | 10 sec.   | 0..9999 sec.  |
| 49                             | Time between the start-up of the compressor and the first capacity control       | Manufacturer | Mst/slv      | 25 sec.   | 0..9999 sec.  |
| 50                             | Time between first and second capacity control                                   | Manufacturer | Mst/slv      | 300 sec.  | 0..9999 sec.  |
| 51                             | Configuration of relay 6,7 for the stand-by phase in modulating capacity control | Manufacturer | Mst/slv      | off-on    |               |
| 52                             | Configuration of relay 6,7 for the decrease phase in modulating capacity control | Manufacturer | Mst/slv      | on-on     |               |
| 53                             | Configuration of relay 6,7 for the increase phase in modulating capacity control | Manufacturer | Mst/slv      | off-off   |               |
| 54                             | Time between second and third capacity control                                   | Manufacturer | Mst/slv      | 300 sec.  | 0..9999 sec.  |
| 55                             | Period of impulse (modulating capacity control )                                 | Manufacturer | Mst/slv      | 6 sec.    |               |

|     |   |              |         |          |               |
|-----|---|--------------|---------|----------|---------------|
| 56  | Minimum impulse duration of solenoid 1  | Manufacturer | Mst/slv | 1 sec.   |               |
| 57  | Maximum impulse duration of solenoid 1  | Manufacturer | Mst/slv | 3 sec.   |               |
| 58  | Minimum impulse duration of solenoid 2  | Manufacturer | Mst/slv | 1 sec.   |               |
| 59  | Maximum impulse duration of solenoid 2  | Manufacturer | Mst/slv | 3 sec.   |               |
| 60  | Force ON time of solenoids before start-up of the comp.                                 | Manufacturer | Mst/slv | 30 sec.  |               |
| 61  | Enable force ON of solenoids with compressor off  | Manufacturer | Mst/slv | n        |               |
| 62  | Enable pump-down  | Manufacturer | Mst/slv | n        |               |
| 63  | Maximum pump-down time  | Manufacturer | Mst/slv | 60 sec.  |               |
| 64  | High pressure threshold for forced capacity control                                     | Manufacturer | Mst/slv | 20 bar   |               |
| 65  | High pressure differential for forced capacity control                                  | Manufacturer | Mst/slv | 2 bar    |               |
| 66  | High supply temperature threshold for forced capacity control                           | Manufacturer | Mst/slv | 90°C     |               |
| 67  | High supply temperature differential for forced capacity control                        | Manufacturer | Mst/slv | 5°C      |               |
| 68  | Antifreeze temperature threshold for forced capacity control                            | Manufacturer | Mst/slv | 6°C      |               |
| 69  | Antifreeze temperature differential for forced capacity control                         | Manufacturer | Mst/slv | 1°C      |               |
| 70  | Enable condensation (none / pressure / temperature)                                     | Manufacturer | Mst/slv | pressure |               |
| 71  | Type of condensation (steps / inverter)   | Manufacturer | Mst/slv | inverter |               |
| 72  | Number of condensation fans   | Manufacturer | Mst/slv | 1        |               |
| 73  | Condensation setpoint   | Manufacturer | Mst/slv | 14 bar   | 0...999.9 bar |
| 74  | Condensation differential   | Manufacturer | Mst/slv | 2 bar    | 0...999.9 bar |
| 75  | Voltage in volts at maximum inverter speed  | Manufacturer | Mst/slv | 10V      |               |
| 76  | Voltage in volts at minimum inverter speed  | Manufacturer | Mst/slv | 0V       |               |
| 77  | Speed-up inverter time  | Manufacturer | Mst/slv | 10       |               |
| 78  | Percentage of opening of Alco valve upon compr. start-up                                | Manufacturer | Mst/slv | 5 %      |               |
| 79  | Enable shut-down of the compressor from battery error                                   | Manufacturer | Mst/slv | n        |               |
| 80  | High pressure alarm delay (driver probe)  | Manufacturer | Mst/slv | 0 sec.   |               |
| 81  | Super-heat alarm delay  | Manufacturer | Mst/slv | 0 sec.   |               |
| 82  | Probe fault alarm delay (driver probe)  | Manufacturer | Mst/slv | 0 sec.   |               |
| 83  | EEPROM error alarm delay  | Manufacturer | Mst/slv | 0 sec.   |               |
| 84  | Enable shut-down of the compressor in the event of battery fault alarm (driver battery) | Manufacturer | Mst/slv | n        |               |
| 85  | Battery fault alarm delay   | Manufacturer | Mst/slv | 0 sec.   |               |
| 86  | Enable shut-down of compressor for low pressure alarm                                   | Manufacturer | Mst/slv | n        |               |
| 87  | Low pressure alarm delay  | Manufacturer | Mst/slv | 30 sec.  |               |
| 88  | Enable serious alarm  | Manufacturer | Mst/slv | n        |               |
| 89  | Enable evaporator flow controller alarm   | Manufacturer | Mst/slv | n        |               |
| 90  | Enable condenser flow controller alarm  | Manufacturer | Mst/slv | n        |               |
| 91  | Enable phase monitor alarm  | Manufacturer | Mst/slv | n        |               |
| 92  | Enable high pressure prevention threshold   | Manufacturer | Mst/slv | s        |               |
| 93  | Evaporator flow controller alarm delay at start-up                                      | Manufacturer | Mst     | 15 sec.  |               |
| 94  | Evaporator flow controller alarm delay at working power                                 | Manufacturer | Mst     | 3 sec.   |               |
| 95  | Condenser flow controller alarm delay at start-up                                       | Manufacturer | Mst     | 15 sec.  |               |
| 96  | Condenser flow controller alarm delay at working power                                  | Manufacturer | Mst     | 3        |               |
| 97  | High supply temperature alarm setpoint  | Manufacturer | Mst/slv | 120°C    |               |
| 98  | High supply temperature alarm differential  | Manufacturer | Mst/slv | 50°C     |               |
| 99  | Low oil differential alarm setpoint   | Manufacturer | Mst/slv | 6bar     |               |
| 100 | Low oil differential alarm differential   | Manufacturer | Mst/slv | 2bar     |               |
| 101 | Setpoint of the alarm of high pressure  | Manufacturer | Mst/slv | 21 bar   |               |
| 102 | High pressure alarm differential  | Manufacturer | Mst/slv | 2 bar    |               |
| 103 | Low pressure alarm setpoint   | Manufacturer | Mst/slv | 1 bar    |               |
| 104 | Low pressure alarm differential   | Manufacturer | Mst/slv | 0.5 bar  |               |
| 105 | Differential between high and low pressure alarm setpoint                               | Manufacturer | Mst/slv | 6 bar    |               |
| 106 | Diff. between high and low pressure alarm delay at start-up                             | Manufacturer | Mst/slv | 20 sec.  |               |
| 107 | Logic of the 4-way valve  | Manufacturer | Mst     | N.O.     |               |
| 108 | Low pressure alarm delay at start-up  | Manufacturer | Mst/slv | 40       |               |
| 109 | Low pressure alarm delay at working power   | Manufacturer | Mst/slv | 0        |               |
| 110 | Oil differential alarm delay at start-up  | Manufacturer | Mst/slv | 120      |               |
| 111 | Oil differential alarm delay at working power   | Manufacturer | Mst/slv | 10       |               |
| 112 | High voltage alarm setpoint   | Manufacturer | Mst/slv | 440V     |               |
| 113 | High voltage alarm differential   | Manufacturer | Mst/slv | 5V       |               |
| 114 | High current alarm setpoint   | Manufacturer | Mst/slv | 90A      |               |
| 115 | High current alarm differential   | Manufacturer | Mst/slv | 5A       |               |



|     |   |              |         |          |         |
|-----|---|--------------|---------|----------|---------|
| 116 | Antifreeze alarm setpoint   | Manufacturer | Mst/slv | 3°C      |         |
| 117 | Antifreeze alarm differential   | Manufacturer | Mst/slv | 1°C      |         |
| 118 | Electrovalve activation threshold (Economizer/oil-cooler/liquid-injection)                                    | Manufacturer | Mst/slv | 80°C     |         |
| 119 | Electrovalve activation differential  | Manufacturer | Mst/slv | 10°C     |         |
| 120 | Antifreeze heater activation setpoint   | Manufacturer | Mst/slv | 5 °C     |         |
| 121 | Antifreeze heater differential  | Manufacturer | Mst/slv | 1 °C     |         |
| 122 | Type of freecooling valve ( on/off, modulating 0/10V )  | Manufacturer | Mst     | 0/10V    |         |
| 123 | Logic of reverse cycle valve  | Manufacturer | Mst/slv | N.O.     |         |
| 124 | Defrost probe configuration<br>pressure switch<br>temperature<br>pressure                                     | Manufacturer | Mst/slv | temp.    |         |
| 125 | Configuration of global defrosting<br>independent<br>simultaneous<br>separate                                 | Manufacturer | Mst/slv | simult.  |         |
| 126 | Enable 32K clock board  | Manufacturer | Mst/slv | n        |         |
| 127 | Reset all parameters and install default values   | Manufacturer | Mst/slv | n        |         |
| 128 | Select other manufacturer password  | Manufacturer | Mst/slv | 1234     |         |
|     |   |              |         |          |         |
|     | <b>User parameters</b>  |              |         |          |         |
| 129 | Cooling setpoint upper limit  | User         | Mst     | 7 °C     |         |
| 130 | Cooling setpoint lower limit  | User         | Mst     | 17 °C    |         |
| 131 | Heating setpoint upper limit  | User         | Mst     | 40 °C    |         |
| 132 | Heating setpoint lower limit  | User         | Mst     | 50 °C    |         |
| 133 | Type of water inlet regulation (proportional/prop. + integral)  | User         | Mst     | Prop.    |         |
| 134 | Temperature regulation band   | User         | Mst     | 3 °C     |         |
| 135 | Select probe for regulation:<br>water inlet (P/PI)<br>water outlet (dead zone)                                | User         | Mst     | inlet    |         |
| 136 | Integration time (PI inlet regulation)  | User         | Mst     | 600 sec. |         |
| 137 | Cooling threshold to force off steps with outlet regulation<br>(chiller operation, prevents antifreeze alarm) | User         | Mst     | 10       |         |
| 138 | Heating threshold to force off steps with outlet regulation<br>(heat pump operation)                          | User         | Mst     | 47       |         |
| 139 | Minimum setpoint modification value (0 Volt.)   | User         | Mst     | 0        |         |
| 140 | Maximum setpoint modification value (1 Volt)  | User         | Mst     | 5        |         |
| 141 | Neutral zone for the control of modulating capacity-control   | User         | Mst/slv | 1°C      |         |
| 142 | Minimum time between pump/fan activation and compressor activation  | User         | Mst     | 5        |         |
| 143 | Pump/fan shut-down delay  | User         | Mst     | 5        |         |
| 144 | Enable on/off from digital input  | User         | Mst     | n        |         |
| 145 | Enable cooling/heating from digital input   | User         | Mst     | n        |         |
| 146 | Temperature delta for the activation of freecooling   | User         | Mst     | 2        |         |
| 147 | Temperature differential for fan control in freecooling   | User         | Mst     | 3        |         |
| 148 | Minimum time between defrosts   | User         | Mst/slv | 1800     | 1.9999  |
| 149 | Maximum defrost time  | User         | Mst/slv | 300      | 1.9999  |
| 150 | Start defrost threshold   | User         | Mst/slv | 2        | -99/99  |
| 151 | End defrost threshold   | User         | Mst/slv | 12       | -99/99  |
| 152 | Select other user password  | User         | Mst/slv | 1234     |         |
|     |   |              |         |          |         |
|     | <b>Service parameters</b>   |              |         |          |         |
| 153 | Set maintenance hours compressor 1  | service      | Mst/slv | 10000    | 0/99999 |
| 154 | Set maintenance hours compressor 2  | service      | Mst/slv | 10000    | 0/99999 |
| 155 | Set maintenance hours compressor 3  | service      | Mst/slv | 10000    | 0/99999 |
| 156 | Set maintenance hours compressor 4  | service      | Mst/slv | 10000    | 0/99999 |
| 157 | Set unit maintenance hours  | service      | Mst/slv | 20000    | 0/99999 |
| 158 | Enable software filter to protect against electromagnetic disturbance   | service      | Mst/slv | n        |         |
| 159 | Filter delay on analogue inputs   | service      | Mst/slv | 5        |         |
| 160 | Filter delay on digital inputs  | service      | Mst/slv | 1        |         |
| 161 | Calibration probe B1  | service      | Mst/slv | 0        | -9/9    |
| 162 | Calibration probe B2  | service      | Mst/slv | 0        | -9/9    |
| 163 | Calibration probe B3  | service      | Mst/slv | 0        | -9/9    |

|     |                                   |          |         |      |      |
|-----|-----------------------------------|----------|---------|------|------|
| 164 | Calibration probe B4              | service  | Mst/slv | 0    | -9/9 |
| 165 | Calibration probe B5              | service  | Mst/slv | 0    | -9/9 |
| 166 | Calibration probe B6              | service  | Mst/slv | 0    | -9/9 |
| 167 | Calibration probe B7              | service  | Mst/slv | 0    | -9/9 |
| 168 | Calibration probe B8              | service  | Mst/slv | 0    | -9/9 |
| 169 | Enable compressor no.1            | service  | Mst     | s    |      |
| 170 | Enable compressor no.2            | service  | Mst     | s    |      |
| 171 | Enable compressor no.3            | service  | Mst     | s    |      |
| 172 | Enable compressor no.4            | service  | Mst     | s    |      |
| 173 | Select other maintenance password | service  | Mst/slv | 1234 |      |
|     |                                   |          |         |      |      |
|     | <b>Setpoint parameters</b>        |          |         |      |      |
| 174 | Cooling regulation setpoint       | setpoint | Mst     | 12   |      |
| 175 | Heating regulation setpoint       | setpoint | Mst     | 45   |      |
|     |                                   |          |         |      |      |
|     | <b>Clock parameters</b>           |          |         |      |      |
| 176 | Hour adjustment                   | clock    | Mst/slv |      | 0/23 |
| 177 | Minute adjustment                 | clock    | Mst/slv |      | 0/59 |
| 178 | Day adjustment                    | clock    | Mst/slv |      | 0/31 |
| 179 | Month adjustment                  | clock    | Mst/slv |      | 0/12 |
| 180 | Year adjustment                   | clock    | Mst/slv |      | 0/99 |

## Supervisor

It is possible to interface the unit with a system of local or remote supervision/tele-assistance.

Among the fittings of the pCO board, an optional board for the serial communication through RS422 or RS485 interface is foreseen, and it is supplied separately from the pCO board.

If the values of serial communication (i.e. serial address and communication speed) are correctly set, the parameters, which are transferred from the unit, will be those contained in the following table.

### Key

A Analogical variable  
 D Digital variable  
 I Integer variable

IN Inlet variable                                      pCO ← Supervisor  
 Out Outlet variable                                  pCO → Supervisor  
 IN/OUT Inlet/outlet variable                      pCO ↔ Supervisor

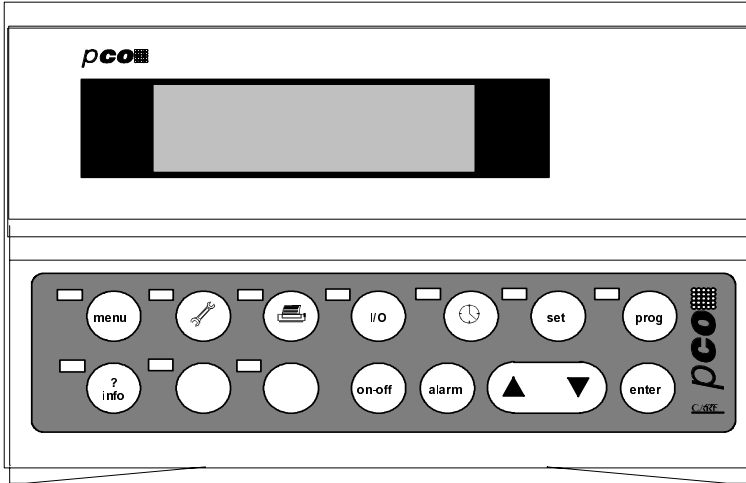
| Type | Direction | address | Description                              |
|------|-----------|---------|--|
| A    | OUT       | 1       | Analogical value of the inlet 1          |
| A    | OUT       | 2       | Analogical value of the inlet 2          |
| A    | OUT       | 3       | Analogical value of the inlet 3          |
| A    | OUT       | 4       | Analogical value of the inlet 4          |
| A    | OUT       | 5       | Analogical value of the inlet 5          |
| A    | OUT       | 6       | Analogical value of the inlet 6          |
| A    | OUT       | 7       | Analogical value of the inlet 7          |
| A    | OUT       | 8       | Analogical value of the inlet 8          |
| A    | OUT       | 9       | Analogical value of the outlet 1         |
| A    | OUT       | 10      | Analogical value of the outlet 2         |
| A    | IN / OUT  | 11      | Temperature cooling setpoint             |
| A    | IN / OUT  | 12      | Temperature heating setpoint             |
| A    | IN / OUT  | 13      | Condensation setpoint                    |
| A    | IN / OUT  | 14      | Regulation temperature board             |
| I    | OUT       | 1       | Status of the unit                       |
| I    | OUT       | 2       | Plan address of the unit                 |
| I    | IN / OUT  | 3       | Management type of the fans              |
| I    | IN / OUT  | 4       | Configuration type of unit               |
| I    | IN / OUT  | 5       | Number of the compressors                |
| I    | IN / OUT  | 6       | Number of the fans                       |
| D    | OUT       | 1       | Status of the unit                       |
| D    | OUT       | 2       | Status of the digital outlet 1           |
| D    | OUT       | 3       | Status of the digital outlet 2           |
| D    | OUT       | 4       | Status of the digital outlet 3           |
| D    | OUT       | 5       | Status of the digital outlet 4           |
| D    | OUT       | 6       | Status of the digital outlet 5           |
| D    | OUT       | 7       | Status of the digital outlet 6           |
| D    | OUT       | 8       | Status of the digital outlet 7           |
| D    | OUT       | 9       | Status of the digital outlet 8           |
| D    | OUT       | 10      | Status of the digital outlet 9           |
| D    | OUT       | 11      | Status of the digital outlet 10          |
| D    | OUT       | 12      | Status of the digital outlet 11          |
| D    | OUT       | 13      | Status of the digital outlet 12          |
| D    | OUT       | 14      | Status of the digital outlet 13          |
| D    | IN / OUT  | 15      | Enable of the evaporator flow controller |
| D    | IN / OUT  | 16      | Enable of the probe 1                    |
| D    | IN / OUT  | 17      | Enable of the probe 2                    |
| D    | IN / OUT  | 18      | Enable of the probe 3                    |

|   |          |    |   |
|---|----------|----|---|
| D | IN / OUT | 19 | Enable of the probe 4                             |
| D | IN / OUT | 20 | Enable of the probe 5                             |
| D | IN / OUT | 21 | Enable of the probe 6                             |
| D | IN / OUT | 22 | Enable of the probe 7                             |
| D | IN / OUT | 23 | Enable of the probe 8                             |
| D | IN / OUT | 24 | On/Off from supervisor                            |
| D | IN / OUT | 25 | Enable limits at the start-up                     |
| D | IN / OUT | 26 | Type of capacity control of the compressor        |
| D | OUT      | 27 | Cooling/heating selection from digital inlet      |
| D | OUT      | 28 |   |
| D | OUT      | 29 | Cooling/heating operation                         |
| D | OUT      | 30 | Condensation selection with inverter              |
| D | OUT      | 45 |   |
| D | OUT      | 46 | Antifreeze alarm\                                 |
| D | OUT      | 47 | Thermal compressor alarm                          |
| D | OUT      | 48 | Evaporator flow controller alarm                  |
| D | OUT      | 49 | Condenser flow controller alarm                   |
| D | OUT      | 50 | High pressure alarm from pressure switch          |
| D | OUT      | 51 | Oil level alarm                                   |
| D | OUT      | 52 | Low pressure alarm from pressure switch           |
| D | OUT      | 53 | High pressure alarm from transducer               |
| D | OUT      | 54 | Grave alarm from digital inlet                    |
| D | OUT      | 55 | Thermal alarm fan 1                               |
| D | OUT      | 56 | Thermal alarm fan 2                               |
| D | OUT      | 57 | Thermal alarm evaporator pump                     |
| D | OUT      | 58 | Board alarm 1 offline                             |
| D | OUT      | 59 | Slave alarm 1 offline                             |
| D | OUT      | 60 | Slave alarm 2 offline                             |
| D | OUT      | 61 | Slave alarm 3 offline                             |
| D | OUT      | 62 | Probe alarm 1 broken or not connected             |
| D | OUT      | 63 | Probe alarm 2 broken or not connected             |
| D | OUT      | 64 | Probe alarm 3 broken or not connected             |
| D | OUT      | 65 | Probe alarm 4 broken or not connected             |
| D | OUT      | 66 | Probe alarm 5 broken or not connected             |
| D | OUT      | 67 | Probe alarm 6 broken or not connected             |
| D | OUT      | 68 | Probe alarm 7 broken or not connected             |
| D | OUT      | 69 | Probe alarm 8 broken or not connected             |
| D | OUT      | 70 | Alarm of the time operation of the pump condenser |
| D | OUT      | 71 | Alarm of the time operation of the compressor     |
| D | OUT      | 72 | Thermal alarm of the pump condenser               |
| D | OUT      | 73 | Clock alarm                                       |
| D | OUT      | 74 | Phase monitor alarm                               |
| D | OUT      | 75 | Low pressure alarm from transducer                |
| D | OUT      | 76 | High tension alarm                                |
| D | OUT      | 77 | High current alarm                                |
| D | OUT      | 78 | Working hours alarm of the evaporator pump        |
| D | OUT      | 79 | Data entry error                                  |
| D | OUT      | 80 | High supply temperature alarm                     |
| D | OUT      | 81 | Differential pressure alarm                       |
| D | OUT      | 82 | Driver probe alarm                                |
| D | OUT      | 83 | Motor step valve error alarm                      |
| D | OUT      | 84 | Eeprom driver error alarm                         |
| D | OUT      | 85 | Battery error alarm                               |
| D | OUT      | 86 | High pressure driver alarm                        |
| D | OUT      | 87 | Low pressure driver alarm                         |
| D | OUT      | 88 | High superheat alarm                              |
| D | OUT      | 89 | Valve (not closed after block-out) alarm          |
| D | OUT      | 90 | Valve (open at the start up of the unit) alarm    |
| D | OUT      | 91 | Waiting for the battery reloading                 |
| D | OUT      | 92 | Waiting for error Eeprom resetting                |

## Keypad

The figure below shows the *terminal* with the front door open of the control board.

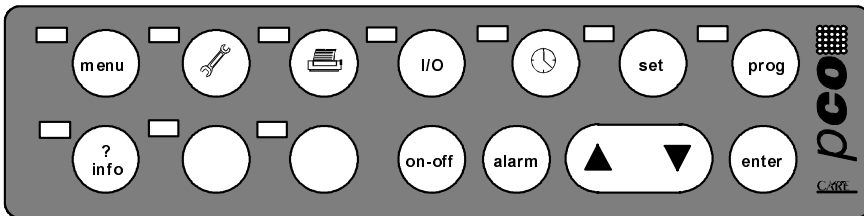
The *terminal*, which is always managed by microprocessor, is fitted with a 4 row x 20 column LCD display, keypad and LEDs, in order to allow the programming of the control parameters (setpoint, differential band, alarm thresholds) and basic operation by the user. It is not necessary that the *terminal* is connected to the *basic board* for the normal operation of the controller.





The terminal is used for the initial programming of the parameters, and the display of the operating data, as a matter of fact it allows:

- the initial programming of the machine, with password protection
- the possibility to modify run-time the fundamental operating parameters
- the display of the detected alarms and the their acoustic signal by 'buzzer'.
- the display of all the values measured

The pCO keypad features 15 buttons, which along with the liquid crystal display represents the interface between the user and the system.



The keypad can be used to access directly the main parameters or one of the loops of the parameters, which are divided as follows:

- |                        |   |  |
|------------------------|---|--|
| <b>ON / OFF button</b> |  | Activates and inhibits the controlled devices.   |
| <b>ALARM button</b>    |  | <p>Goes to the first active alarm screen and switches off the alarm buzzer.</p> <p>When in an alarm screen, pressing the button again resets the alarm and displays the first screen</p> <p>If no alarms are active, the screen NO ALARM ACTIVE is displayed.</p> <p>The sequence of alarm screens is scrolled by pressing the UP / DOWN</p> |



When the cursor is in the HOME position (cursor in position 0,0 of the display) these buttons look through the screens in a group. From the last one it is possible to access the first, and vice-versa. If the cursor is inside a numeric field the buttons increase or decrease the value on which the cursor is positioned. In case of a selection field, pressing the UP / DOWN buttons, the available options are shown (e.g. Yes / No).



In the screens for setting the values, pressing the button once, the cursor moves to the first entry field. Pressing the button again the value entered is confirmed and the cursor is moved to the next field. From the last field it returns to the HOME position.



Goes to the M\_MAINMASK screen.



Switches the control of the terminal from a pCO board to another pCO board.



Goes to the M\_MAINT5 screen.



NOT FEATURED



Goes to the M\_INOUT5 screen



Goes to the m\_CLOCK5 / m CLOCK10 screen, if enabled by the time board



Goes to the M\_SETPOINT5 screen



The password is required. If entered correctly, it is possible to access the screen M\_PW\_USER



The buttons must be pressed and released simultaneously. The password is required. If entered correctly, it is possible to access the screen M\_PW\_MANUFAT

**LED**

A green LED, which lights up when the corresponding button is pressed, is located at the side of each button. This green LED indicates which group of screens the user is in.

When entering the machine configuration group of screens by pressing the MENU+PROG buttons, the LED for the PROG button lights up.

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

- 1. ON / OFF button green LED indicates that the instrument is on and in operation.
- 2. ALARM button red LED indicates the presence of an alarm situation.
- 3. ENTER button yellow LED Indicates that the instrument is powered correctly.

## List of screens

M\_Initing

```

+-----+
|  --  WAIT  PLEASE  --  |
|  --  READING INPUTS  --  |
+-----+
    
```

### **MENU** button group

M\_MainMask

```

+-----+
| 00 00      00 00 00 |
| In water E.  00.0B°C |
| Out water E.  00.0B°C |
| U:00 ON      |
+-----+
    
```

### **MAINT** button group

M\_Maint5

```

+-----+
| Hour counter      U:  |
|                   |
| Pump evap.       000000 |
| Pump cond.       000000 |
+-----+
    
```

M\_Maint10

```

+-----+
| Hour counter      U:  |
|                   |
| Compressor       000000 |
+-----+
    
```

Maint\_PW\_Drv

```

+-----+
| EXV driver        U:  |
| Insert maintenance |
| password          |
|                   |
|                   0000 |
+-----+
    
```

M\_Pw\_Maint

```

+-----+
| Insert            U:  |
| maintenance password |
|                   |
|                   0000 |
+-----+
    
```

M\_Maint20

```

+-----+
| Evaporator pump   U:  |
| hour counter     |
| Threshold         000x1000 |
| Req.reset        N 000000 |
+-----+
    
```

M\_Maint23

```

+-----+
| Condensator pump  U:  |
| hour counter     |
| Threshold         000x1000 |
| Req.reset        N 000000 |
+-----+
    
```

M\_Maint25

```

+-----+
| Compressor        U:  |
| hour counter     |
| Threshold         000x1000 |
| Req.reset        N 000000 |
+-----+
    
```

```
M_Maint45
+-----+
| Filters config.  U: |
| Enable          N  |
| Anal.delay time 0s |
| Dig.delay time  0s |
+-----+
```

```
M_Maint50
+-----+
| Inputs probes   U: |
| offset         |
| B1: 0.0        B2: 0.0 |
| B3: 0.0        B4: 0.0 |
+-----+
```

```
M_Maint55
+-----+
| Inputs probes   U: |
| offset         |
| B5: 0.0        B6: 0.0 |
| B7: 0.0        B8: 0.0 |
+-----+
```

```
M_Maint60
+-----+
| Compressors enable |
| C1:N C2:N C3:N C4:N |
+-----+
```

```
M_Maint100
+-----+
| Insert another   U: |
| maintenance     |
| password        |
|                0000 |
+-----+
```

```
Maint_Drv_10
+-----+
| Maintenance D:1 U: |
| Time after last |
| battery test    000h |
| battery use     000h |
+-----+
```

```
Maint_Drv_20
+-----+
| Maintenance D:1 U: |
| Batt.resistance 0000 |
| Capacity        000% |
| Valve position  0000 |
+-----+
```

```
Maint_Drv_30
+-----+
| Maintenance D:1 U: |
| Suction      |
| Temperature  00.00C |
| Pressure     00.00barg |
+-----+
```

```
Maint_Drv_40
+-----+
| Maintenance D:1 U: |
| Calculated evaporat. |
| Temperature      00.00C |
| Super-heat       00.00C |
+-----+
```

```
Maint_Drv_50
+-----+
| Maintenance D:1 U: |
| NO WARNINGS      |
|                  N |
+-----+
```

```
Maint_Drv_60
+-----+
| Insert another   U: |
| drivers maintenance |
| password        |
|                0000 |
+-----+
```



**PRINT button group**

```
M_Printer5
+-----+
| Printer not |
| available  |
+-----+
```

**I/O button group**

```
M_InOut5
+-----+
| CAREL srl  |
| Brugine (PD) Italy |
| CODE: EPSTDEMSCA |
| Ver. 2.512 17/11/00 |
+-----+
```

```
InOut_Drv
+-----+
| Firmware version U: |
|                   H.W S.W |
| Driver 1          000 000 |
| Driver 2          000 000 |
+-----+
```

```
M_InOut10
+-----+
| Digital inputs  U: |
| CCCCCCCCCC |
| Digital outputs |
| 000000000000 |
+-----+
```

```
M_InOut15
+-----+
| Analog inputs  U: |
| B1:           ----%C |
| B2:           ----%C |
+-----+
```

```
M_InOut20
+-----+
| Analog inputs  U: |
| B3:           ----%C |
| B4:           ----%C |
+-----+
```

```
M_InOut25
+-----+
| Analog inputs  U: |
| B5:           0----%C |
| B6:           0----%C |
+-----+
```

```
M_InOut30
+-----+
| Analog inputs  U: |
| B7:           00.0bar |
| B8:           00.0bar |
+-----+
```

```
M_InOut35
+-----+
| Analog outputs  U: |
| Y0:           00.0V |
| Y1:           00.0V |
+-----+
```

```
M_InOut60
+-----+
| Drv1 Valve Pos. 0000 |
| Super-heat      00.0%C |
| Suct.temp.      00.0%C |
| Suct.press.    00.0barg |
+-----+
```

```
M_InOut65
+-----+
|Drv2 Valve Pos. 0000|
|Super-heat    00.0BC|
|Suct.temp.    00.0BC|
|Suct.press.   00.0barg|
+-----+
```

```
M_InOut70
+-----+
|Drv1 battery state|
|DISCONNECTED      |
|Drv2 battery state|
|DISCONNECTED      |
+-----+
```

**CLOCK button group**

```
M_Clock5
+-----+
|          |
|  Clock not|
|  installed|
|          |
+-----+
```

```
M_Clock10
+-----+
|Clock config.  U:  |
|          |
|Time          00:00|
|Date          00/00/00|
+-----+
```

**SET button group**

```
M_Setpoint5
+-----+
|Actual setpoint  |
|          |
|          00.0BC |
+-----+
```

```
M_Setpoint10
+-----+
|Summer          |
|setpoint        00.0BC|
|Winter          |
|setpoint        ---BC|
+-----+
```

```
M_Setpoint15
+-----+
|Summer double   |
|setpoint        00.0BC|
|Winter double   |
|setpoint        ---BC|
+-----+
```

**PROG button group**

```
M_Pw_User
+-----+
|Insert          U:  |
|user password   |
|          |
|          0000    |
+-----+
```

```
M_User5
+-----+
|Summer temperature|
|setpoint limits  |
|Low              00.0BC|
|High             00.0BC|
+-----+
```

```
M_User15
+-----+
|Winter temperature|
|setpoint limits  |
|Low              00.0BC|
|High             00.0BC|
+-----+
```

```
M_User17
+-----+
|Regulat. temperature|
|Type                |INLET|
+-----+
```

```
M_User20
+-----+
|Inlet regulation    |
|Type                |PROP|
|Integration t.      |0000s|
+-----+
```

```
M_User23
+-----+
|Outlet regulation   |
|force off          |
|Summer             |00.0BC|
|Winter             |00.0BC|
+-----+
```

```
M_User25
+-----+
|Temperature band    |00.0BC|
+-----+
```

```
M_User27
+-----+
|Modulation band     |
|Neutral zone        |00.0BC|
+-----+
```

```
M_User30
+-----+
|Time between main   |
|pump/fan and comp. |
|start                |000s|
+-----+
```

```
M_User35
+-----+
|Delay on switching  |
|the main pump off   |
|                    |000s|
+-----+
```

```
M_User40
+-----+
|Digital input remote|
|on / off            |N|
|Digital input remote|
|Summer / Winter     |N|
+-----+
```

```
M_User42
+-----+
|Supervisory remote  |
|on / off            |N|
|Supervisory remote  |
|Summer / Winter     |N|
+-----+
```

```
M_User45
+-----+
|Freecool. parameters|
|Delta               |00.0BC|
|Diff.               |00.0BC|
+-----+
```

```
M_User50
+-----+
|Defrost parameters  |
|Start               |00.0---|
|Stop                |00.0---|
+-----+
```

```
M_User55
+-----+
|Defrost parameters|
|Drip time      000s|
|Delay time    00000s|
|Maximum time  00000s|
+-----+
```

```
M_User58
+-----+
|Config.reverse cycle|
|mode in defrost    |
|                   |
|NO OFF COMP        |
+-----+
```

```
M_User60
+-----+
|Insert another  U:  |
|user password   |
|               |
|               0000 |
+-----+
```

**MENU+PROG button group**

```
M_Pw_Manuf
+-----+
|Insert          U:  |
|manufacturer   |
|password       |
|               |
|               0000 |
+-----+
```

```
M_Manuf5
+-----+
|Unit config.: 00 U: |
|WATER/AIR          |
|CHILLER            |
+-----+
```

```
Drivers_Menu
+-----+
|Drivers config.  U: |
|Driver 1         ->|
|Driver 2         ->|
+-----+
```

```
M_Manuf10
+-----+
|Probes enable   U:  |
|B1: N B2: N B3: N|
|B4: N B5: N B6: N|
|B7: N B8: N      |
+-----+
```

```
Drivers_Waiting
+-----+
|Maintenance     |
|Driver 1 Unit   |
|               |
|ENTER to continue|
+-----+
```

```
M_Manuf15
+-----+
|Probe 5 type config. |
|NONE                 |
|Discharge probe type |
|0/1V                 |
+-----+
```

```
Carel_PW_Drv
+-----+
|CAREL EXV Driver U: |
|reserved parameters |
|Insert password     |
|                   |
|                   0000|
+-----+
```

```
M_Manuf20
+-----+
|Multiple analog.in 5|
|None                |
|Minimum             000.0|
|Maximum             000.0|
+-----+
```

```
M_Manuf30
+-----+
|Discharge temp.   |
|probe limits      |
|0 Volt            000.0°C|
|1 Volt            000.0°C|
+-----+
```

```
Manuf_Drv_10
+-----+
|Manufacturer D:1 U: |
|Regulation mode    |
|REGULATION OFF     |
|Present stages     000|
+-----+
```

```
M_Manuf35
+-----+
|High pressure probe |
|configuration       |
|4mA                 00.0bar|
|20mA                 00.0bar|
+-----+
```

```
Manuf_Drv_20
+-----+
|Manufacturer D:1 U: |
|Gas type           -----|
|Used valve type    |
|EX-7 OR LOWER CAP. |
+-----+
```

```
M_Manuf40
+-----+
|Low pressure probe |
|configuration       |
|4mA                 00.0bar|
|20mA                 00.0bar|
+-----+
```

```
Manuf_Drv_30
+-----+
|Manufacturer D:1 U: |
|Comp.capacity 0000KW|
|Super-heat       |
|Setpoint         00.0°C|
+-----+
```

|   |  |
|---|--|
| M_Manuf43   | Manuf_Drv_40   |
| Enable double setpoint N  | Manufacturer D:1 U: Valve opening when screw compressor switches ON 000%             |
| M_Manuf45   | Manuf_Drv_50   |
| Unit configuration<br>N. local drivers 0<br>N. compressors 0<br>Comp. rotation N          | Manufacturer D:1 U:<br>En.probe error N<br>En.step motor fail N<br>En.Eeprom error N |
| M_Manuf50   | Manuf_Drv_60   |
| Compressor config<br>Type of unloads STEP<br>Stages per compressor 0                      | Manufacturer D:1 U:<br>En.battery error N<br>En.high pressure N<br>En.low pressure N |
| M_Manuf55   | Manuf_Drv_70   |
| Compressor config.<br>T.Star/Line 000s/100<br>T.Star 000s/100<br>T.Star/Delta000s/100     | Manufacturer D:1 U:<br>En.low super-heat N<br>En.valve not close N                   |
| M_Manuf60   | Manuf_Drv_80   |
| Enable start restrictions N   | Manufacturer D:1 U:<br>Alarms delays<br>High pressure 0000s<br>Super-heat 0000s      |
| M_Manuf63   | Manuf_Drv_90   |
| Start restriction<br>Low press. 00.0bar<br>High press. 00.0bar<br>Equal.press. 00.0bar    | Manufacturer D:1 U:<br>Switch off compress.<br>if probe error<br>Delay ----sec       |
| M_Manuf65   | Manuf_Drv_100  |
| Minimum compressors<br>power-on time 0000s<br>Minimum compressors<br>power-off time 0000s | Manufacturer D:1 U:<br>Switch off compress.<br>if eeprom error<br>Delay ----sec      |
| M_Manuf70   | Manuf_Drv_110  |
| Min time betw. diff.<br>comp. starts 0000s<br>Min time betw. same<br>comp. starts 0000s   | Manufacturer D:1 U:<br>Switch off compress.<br>if battery error N<br>Delay ----sec   |
| M_Manuf75   | Manuf_Drv_120  |
| Stage 1<br>Logic relay 1 N<br>Logic relay 2 N<br>Logic relay 3 N                          | Manufacturer D:1 U:<br>Switch off compress.<br>if low pressure N<br>Delay ----sec    |
| M_Manuf80   | Manuf_Drv_130  |
| Stage 2<br>Logic relay 1 N<br>Logic relay 2 N<br>Logic relay 3 N                          | Manufacturer D:1 U:<br>Enable alarm when<br>valve is open after<br>power failure N   |
| M_Manuf85   | Manuf_Drv_140  |
| Stage 3<br>Logic relay 1 N<br>Logic relay 2 N<br>Logic relay 3 N                          | Manufacturer D:1 U:<br>Operating pressure<br>Min. set 00.0barg<br>Max. set 00.0barg  |

|  |  |
|--|--|
| M_Manuf90  | Manuf_Drv_150  |
| Stage 4<br>Logic relay 1 N<br>Logic relay 2 N<br>Logic relay 3 N                   | Manufacturer D:1 U:<br>Propor. factor 00.0<br>Integr. factor 00.0<br>Differ. factor 00.0 |
| M_Manuf93  | Manuf_Drv_160  |
| Enable particular management of stage 1 N  | Manufacturer D:1 U:<br>Max valve steps 0000<br>Max pos.adjust 00000                      |
| M_Manuf95  | Manuf_Drv_170  |
| Time SOL/S1 0000s<br>Time S1/S2 0000s<br>Time S2/S3 0000s<br>Time S3/S4 0000s      | Manufacturer D:1 U:<br>Pressure probe conf.<br>4mA 00.0barg<br>20mA 00.0barg             |
| M_Manuf97  | Manuf_Drv_180  |
| Standby config.<br>Relay 6 N<br>Relay 7 N  | Manufacturer D:1 U:<br>Evaporator output press. set 00.0barg                             |
| M_Manuf98  | Manuf_Drv_190  |
| Decrement config.<br>Relay 6 N<br>Relay 7 N  | Manufacturer D:1 U:<br>Superheat hysteresis after max pressure alarm 00.0fK              |
| m_manuf99  | Manuf_Drv_200  |
| Increment config.<br>Relay 6 N<br>Relay 7 N  | Manufacturer D:1 U:<br>Superheat hysteresis after low pressure alarm 00.0fK              |
| M_Manuf100   | Manuf_Drv_210  |
| Modulation config.<br>Pulse period 00s<br>Min pulse D. 00.0s<br>Max pulse D. 00.0s | Manufacturer D:1 U:<br>Valve closing to min position when superheat below 00.0fK         |
| M_Manuf105   | Manuf_Drv_220  |
| Modulation config.<br>Min pulse I. 00.0s<br>Max pulse I. 00.0s                     | Manufacturer D:1 U:<br>Valve regulation VALVE OFF  |
| M_Manuf110   | Manuf_Drv_230  |
| Modulation config.<br>Time force decr. for start compress. 000s                    | Manufacturer D:1 U:<br>Compressor status input type pLAN                                 |
| M_Manuf115   | Manuf_Drv_240  |
| Enable force solenoid ON with compressor OFF N                                     | Manufacturer D:1 U:<br>In case of pLAN failure USE 0-1V COMP.STATUS                      |
| M_Manuf120   | Manuf_Drv_250  |
| Pump down config.<br>Enable N<br>Maximum time 000s                                 | Manufacturer D:1 U:<br>Restart after power failure ALWAYS                                |

|  |   |
|--|---|
| M_Manuf125   | Manuf_Drv_260   |
| Transducers high pressure prevent N<br>Setpoint 00.0bar<br>Diff. 00.0bar | Manufacturer D:1 U:<br>Press. probe 4-20mA<br>Temp. probe 1 type<br>NTC 103-AT (CAREL)    |
| M_Manuf130   | Manuf_Drv_270   |
| Discharge temp. prevent N<br>Setpoint 000.0BC<br>Diff. 00.0BC            | Manufacturer D:1 U:<br>pLAN existence N<br>Battery existence N                            |
| M_Manuf135   | Manuf_Drv_280   |
| Freeze prevent<br>Setpoint 00.0BC<br>Diff. 00.0BC                        | Insert another U:<br>drivers manufacturer password<br>0000                                |
| M_Manuf140   |   |
| Condensation Enable NONE<br>Type INV.<br>Number Fans 0                   |   |
| M_Manuf150   | Carel_Drv_10  |
| Condensation<br>Setpoint 00.0---<br>Diff. 00.0---                        | CAREL D:1 U:<br>No. of samples for calculating analog inputs average 0000                 |
| M_Manuf155   | Carel_Drv_20  |
| Inverter<br>Max. speed 00.0V<br>Min. speed 00.0V<br>Speed up time 00s    | CAREL D:1 U:<br>Av. time pos. err. 000<br>Sys. stab. up lim. 00<br>Sys. stab. low lim. 00 |
| M_Manuf160   | Carel_Drv_30  |
| Enable of serious alarm N<br>Evaporator flow alarm N                     | CAREL D:1 U:<br>Steps Nr. below which valve is considered closed 0000                     |
| M_Manuf165   | Carel_Drv_40  |
| Enable condensator flow alarm N<br>Enable phase alarm N                  | CAREL D:1 U:<br>Stepper motor<br>Max. current 0.75A<br>Frequency 0000Hz                   |
| M_Manuf170   | Carel_Drv_50  |
| Evaporat. flow alarm delays<br>Startup delay 00s<br>Run delay 00s        | CAREL D:1 U:<br>Calculated valve position 0000  |
| M_Manuf175   | Carel_Drv_60  |
| Condens. flow alarm delays<br>Startup delay 00s<br>Run delay 00s         | CAREL D:1 U:<br>Sampling time 0000ms<br>System stability 00                               |
| M_Manuf178   | Carel_Drv_70  |
| Discharge temp. alarm<br>Setpoint 000.0BC<br>Diff. 00.0BC                | CAREL D:1 U:<br>INT37-reserved 00000<br>INT44-test 00000                                  |

|  |   |
|--|---|
| M_Manuf180   | Carel_Drv_80  |
| Transducers high pressure alarm<br>Setpoint 00.0bar<br>Diff. 00.0bar | Insert another U:<br>drivers CAREL<br>password 0000 |

M\_Manuf185

|  |
|--|
| Transducer low pressure alarm<br>Setpoint 00.0bar<br>Diff. 00.0bar |
|--|

M\_Manuf187

|   |
|---|
| Low differential pressure alarm N<br>Setpoint 00.0bar<br>Startup delay 000s |
|---|

M\_Manuf190

|   |
|---|
| Low pressure alarm delays<br>Startup delay 000s<br>Run delay 000s |
|---|

M\_Manuf195

|  |
|--|
| Oil level alarm delays<br>Startup delay 000s<br>Run delay 000s |
|--|

M\_Manuf200

|  |
|--|
| High voltage alarm<br>Setpoint 000.0V<br>Diff. 00.0V |
|--|

M\_Manuf205

|  |
|--|
| High current alarm<br>Setpoint 000.0A<br>Diff. 00.0A |
|--|

M\_Manuf210

|   |
|---|
| Antifreeze alarm<br>Setpoint 00.0°C<br>Diff. 00.0°C |
|---|

M\_Manuf215

|   |
|---|
| Electrovalve management<br>Setpoint 000.0°C<br>Diff. 00.0°C |
|---|

M\_Manuf220

|  |
|--|
| Antifreeze heater<br>Setpoint 00.0°C<br>Diff. 00.0°C |
|--|

M\_Manuf230

|  |
|--|
| Logic of valves<br>Reversing (4way)N.C.<br>Freecooling 0/10V |
|--|



```
M_Manuf235
+-----+
|Defrost config.
|
|Probe   PRESSOSTATS
|Global  SIMULTANEOUS
+-----+
```

```
M_Manuf240
+-----+
|Clock board 32k
|Enable           N
+-----+
```

```
M_Manuf242
+-----+
|Supervisor System
|Communication speed:
|1200 (RS485/RS422)
|Identificat. No.:000
+-----+
```

```
Manuf_PW_Drv
+-----+
|EXV driver      U:
|Insert manufacturer
|password
|                0000
+-----+
```

```
M_Manuf245
+-----+
|Reset parameters U:
|to default values N
+-----+
```

```
M_Manuf250
+-----+
|Insert another  U:
|manufacturer
|password
|                0000
+-----+
```

**Gruppo tasto ALARM**

```
M_Alarm0
+-----+
|
|No alarms
|detected
+-----+
```

```
M_Alarm10
+-----+
|AL:001      U:
|Unit n.1
|is offline
+-----+
```

```
M_Alarm20
+-----+
|AL:002      U:
|Unit n.2
|is offline
+-----+
```

```
M_Alarm30
+-----+
|AL:003      U:
|Unit n.3
|is offline
+-----+
```

```
M_Alarm40
+-----+
|AL:004      U:
|Unit n.4
|is offline
+-----+
```

M\_Alarm50

```

+-----+
|AL:011      U:|
|  Serious alarm|
|  by digital input|
+-----+
    
```

M\_Alarm60

```

+-----+
|AL:012      U:|
|  Phase monitor|
|  alarm        |
+-----+
    
```

M\_Alarm70

```

+-----+
|AL:013      U:|
|  Evaporator flow|
|  alarm          |
+-----+
    
```

M\_Alarm80

```

+-----+
|AL:014      U:|
|  Condensator flow|
|  alarm           |
+-----+
    
```

M\_Alarm90

```

+-----+
|AL:015      U:|
|  Oil level      |
|  alarm         |
+-----+
    
```

M\_Alarm100

```

+-----+
|AL:016      U:|
|  High pressure  |
|  alarm         |
|  (pressostat)  |
+-----+
    
```

M\_Alarm110

```

+-----+
|AL:017      U:|
|  Low pressure  |
|  alarm         |
|  (pressostat)  |
+-----+
    
```

M\_Alarm120

```

+-----+
|AL:018      U:|
|  Evaporator pump|
|  overload       |
+-----+
    
```

M\_Alarm130

```

+-----+
|AL:019      U:|
|  Condensator pump|
|  overload       |
+-----+
    
```

M\_Alarm140

```

+-----+
|AL:020      U:|
|  Compressor     |
|  overload       |
+-----+
    
```

M\_Alarm150

```

+-----+
|AL:021      U:|
|  Condensator fan|
|  n.1 overload   |
+-----+
    
```

M\_Alarm160

```

+-----+
|AL:022      U:  |
| Condensator fan |
|   n.2 overload  |
+-----+
    
```

M\_Alarm170

```

+-----+
|AL:031      U:  |
|           |
| Freeze alarm |
+-----+
    
```

M\_Alarm180

```

+-----+
|AL:032      U:  |
| Low differential |
| pressure alarm   |
+-----+
    
```

M\_Alarm190

```

+-----+
|AL:033      U:  |
| High pressure   |
| alarm          |
| (transducer)   |
+-----+
    
```

M\_Alarm200

```

+-----+
|AL:034      U:  |
| Low pressure    |
| alarm          |
| (transducer)   |
+-----+
    
```

M\_Alarm210

```

+-----+
|AL:035      U:  |
| High discharge  |
| temperature alarm |
+-----+
    
```

M\_Alarm220

```

+-----+
|AL:036      U:  |
| High voltage    |
| alarm          |
+-----+
    
```

M\_Alarm230

```

+-----+
|AL:037      U:  |
| High current    |
| alarm          |
+-----+
    
```

M\_Alarm240

```

+-----+
|AL:041      U:  |
| 32k clock board |
| fault or not    |
| connected       |
+-----+
    
```

M\_Alarm250

```

+-----+
|AL:042      U:  |
| ERROR !        |
| Wrong         |
| limits inserted |
+-----+
    
```

M\_Alarm260

```

+-----+
|AL:051      U:  |
| Evaporator pump |
| maintenance     |
+-----+
    
```

M\_Alarm270

```

+-----+
|AL:052      U:  |
| Condensator pump |
| maintenance     |
+-----+
    
```

M\_Alarm280

```

+-----+
|AL:053      U:  |
| Compressor      |
| maintenance     |
+-----+
    
```

M\_Alarm290

```

+-----+
|AL:060      U:  |
| B1 probe fault  |
| or not connected|
+-----+
    
```

M\_Alarm300

```

+-----+
|AL:061      U:  |
| B2 probe fault  |
| or not connected|
+-----+
    
```

M\_Alarm310

```

+-----+
|AL:062      U:  |
| B3 probe fault  |
| or not connected|
+-----+
    
```

M\_Alarm320

```

+-----+
|AL:063      U:  |
| B4 probe fault  |
| or not connected|
+-----+
    
```

M\_Alarm330

```

+-----+
|AL:064      U:  |
| B5 probe fault  |
| or not connected|
+-----+
    
```

M\_Alarm340

```

+-----+
|AL:065      U:  |
| B6 probe fault  |
| or not connected|
+-----+
    
```

M\_Alarm350

```

+-----+
|AL:066      U:  |
| B7 probe fault  |
| or not connected|
+-----+
    
```

M\_Alarm360

```

+-----+
|AL:067      U:  |
| B8 probe fault  |
| or not connected|
+-----+
    
```

M\_Drv1\_Alarm101

```

+-----+
|AL:101      D:1 U:|
| Probe error    |
+-----+
    
```

M\_Drv1\_Alarm102  
 +-----+  
 |AL:102        D:1 U: |  
 |            Step motor error |  
 +-----+

M\_Drv1\_Alarm103  
 +-----+  
 |AL:103        D:1 U: |  
 |            Eeprom error |  
 +-----+

M\_Drv1\_Alarm104  
 +-----+  
 |AL:104        D:1 U: |  
 |            Battery error |  
 +-----+

M\_Drv1\_Alarm105  
 +-----+  
 |AL:105        D:1 U: |  
 |            High pressure |  
 +-----+

M\_Drv1\_Alarm106  
 +-----+  
 |AL:106        D:1 U: |  
 |            Low pressure |  
 +-----+

M\_Drv1\_Alarm107  
 +-----+  
 |AL:107        D:1 U: |  
 |            Super heat alarm |  
 +-----+

M\_Drv1\_Alarm108  
 +-----+  
 |AL:108        D:1 U: |  
 |            Valve not closed |  
 |            during power OFF |  
 +-----+

M\_Drv1\_Alarm109  
 +-----+  
 |AL:109        D:1 U: |  
 |            Waiting for valve |  
 |            open restart |  
 +-----+

M\_Drv1\_Alarm110  
 +-----+  
 |AL:110        D:1 U: |  
 |            Waiting for battery |  
 |            charged restart |  
 +-----+

M\_Drv1\_Alarm111  
 +-----+  
 |AL:111        D:1 U: |  
 |            Waiting for eeprom |  
 |            error restart |  
 +-----+

M\_Drv2\_Alarm201  
 +-----+  
 |AL:201        D:2 U: |  
 |            Probe error |  
 +-----+

M\_Drv2\_Alarm202  
 +-----+  
 |AL:202 D:2 U: |  
 | |  
 | Step motor error |  
 | |  
 +-----+

M\_Drv2\_Alarm203  
 +-----+  
 |AL:203 D:2 U: |  
 | |  
 | Eeprom error |  
 | |  
 +-----+

M\_Drv2\_Alarm204  
 +-----+  
 |AL:204 D:2 U: |  
 | |  
 | Battery error |  
 | |  
 +-----+

M\_Drv2\_Alarm205  
 +-----+  
 |AL:205 D:2 U: |  
 | |  
 | High pressure |  
 | |  
 +-----+

M\_Drv2\_Alarm206  
 +-----+  
 |AL:206 D:2 U: |  
 | |  
 | Low pressure |  
 | |  
 +-----+

M\_Drv2\_Alarm207  
 +-----+  
 |AL:207 D:2 U: |  
 | |  
 | Super heat alarm |  
 | |  
 +-----+

M\_Drv2\_Alarm208  
 +-----+  
 |AL:208 D:2 U: |  
 | Valve not closed |  
 | during power OFF |  
 | |  
 +-----+

M\_Drv2\_Alarm209  
 +-----+  
 |AL:209 D:2 U: |  
 | Waiting for valve |  
 | open restart |  
 | |  
 +-----+

M\_Drv2\_Alarm210  
 +-----+  
 |AL:210 D:2 U: |  
 | Waiting for battery |  
 | charged restart |  
 | |  
 +-----+

M\_Drv2\_Alarm211  
 +-----+  
 |AL:211 D:2 U: |  
 | Waiting for eeprom |  
 | error restart |  
 | |  
 +-----+



# CAREL

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