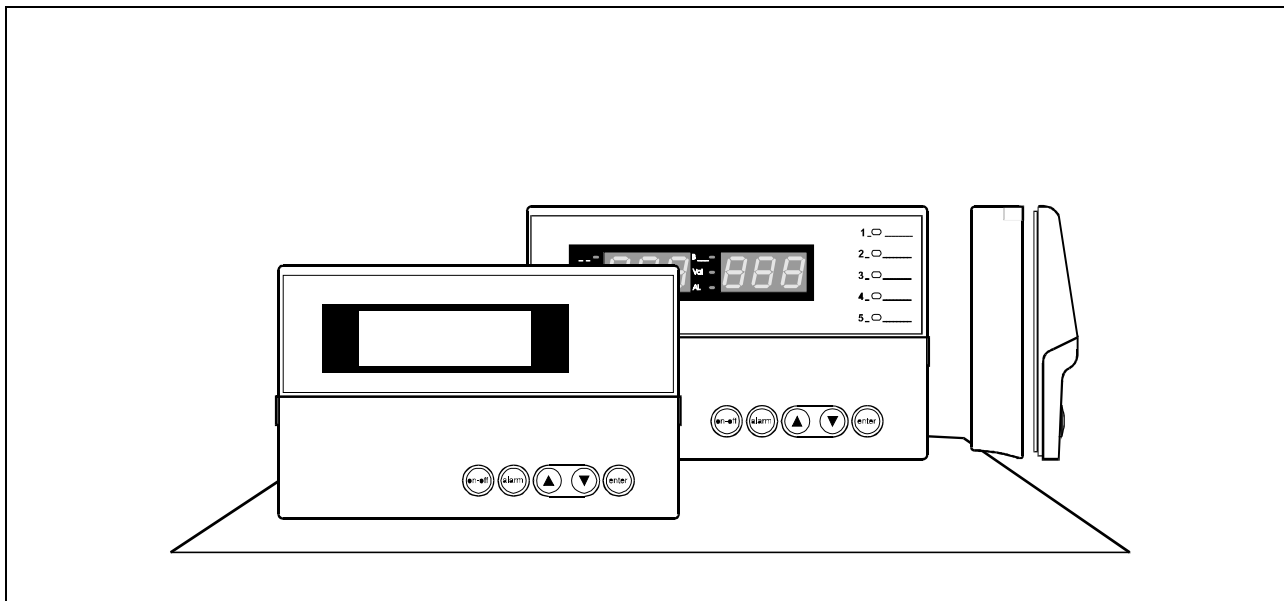




Modular Chiller-HP pLAN for screw compressors, 1/4 compressors

Program code: **EPSTDEMSCA**

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

CAREL
Technology & Evolution



We wish to save you time and money!
We can assure you that 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

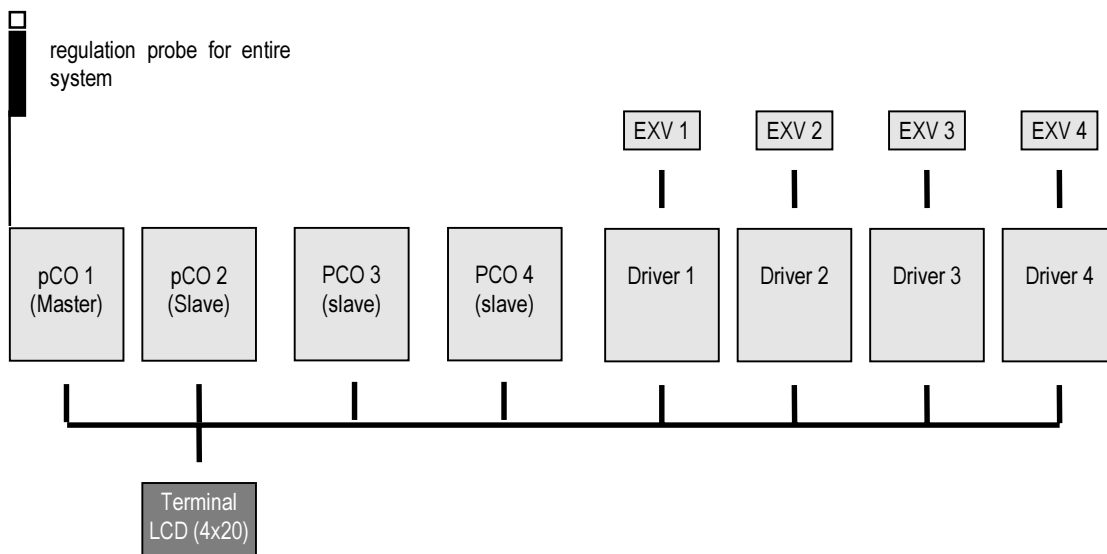
Management of maximum 1 screw compressor (start-up , shut-down , alarms, EXV).

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	Condens. 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	Condens. 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:

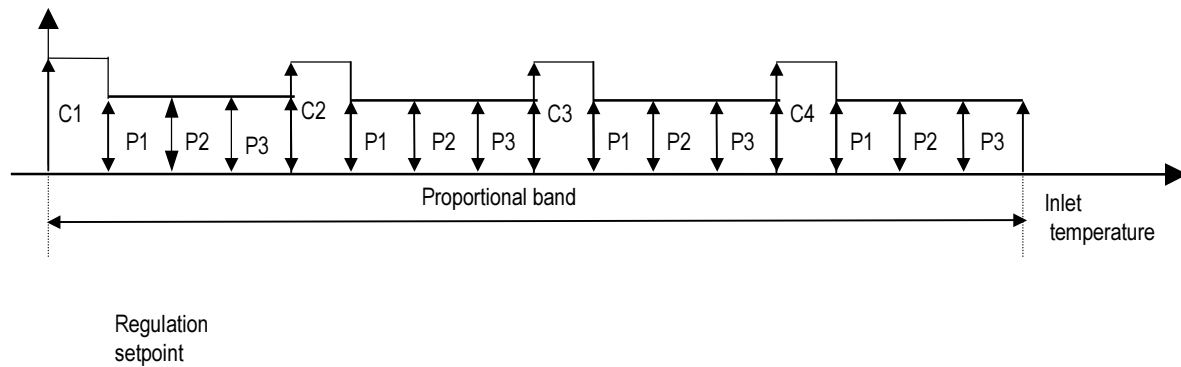
LOAD IN %	SOLENOID A	SOLENOID B	SOLENOID C
100%	CLOSED	CLOSED	CLOSED
75%	CLOSED	OPEN	CLOSED
50%	CLOSED	CLOSED	OPEN
25% (Start)	OPEN	CLOSED	CLOSED

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:

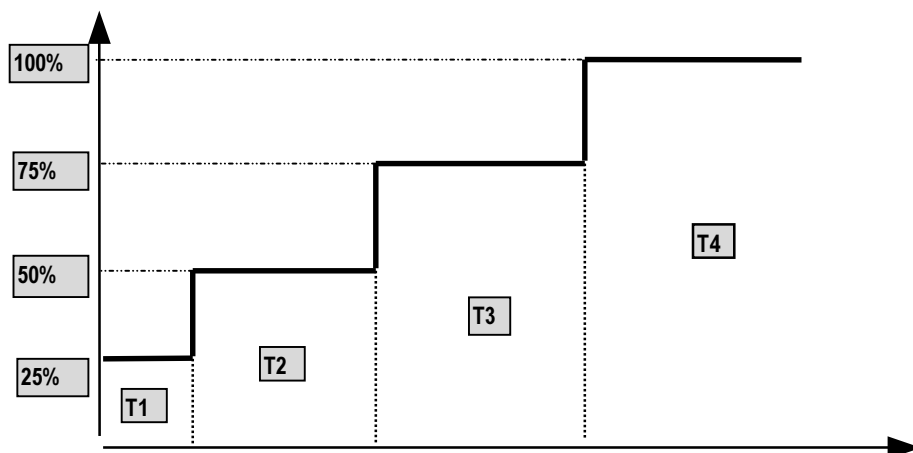
LOAD IN %	SOLENOID A	SOLENOID B	SOLENOID C
100%	CLOSED	CLOSED	CLOSED
75%	OPEN	OPEN	CLOSED
50%	OPEN	CLOSED	OPEN
25%	CLOSED	OPEN	OPEN

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

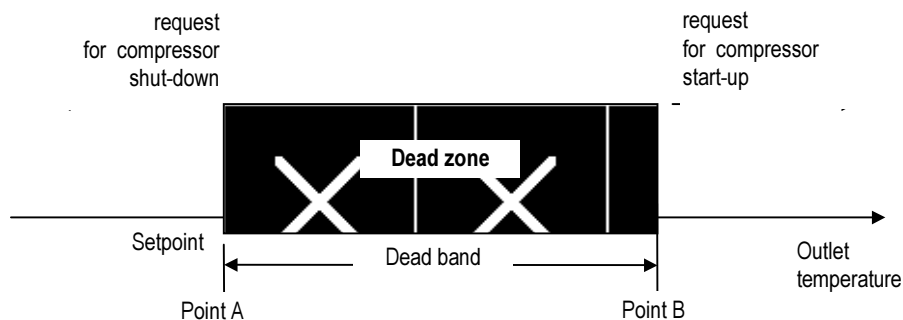
Used outputs :

- Compressors
- Capacity control step solenoids

Used parameters:

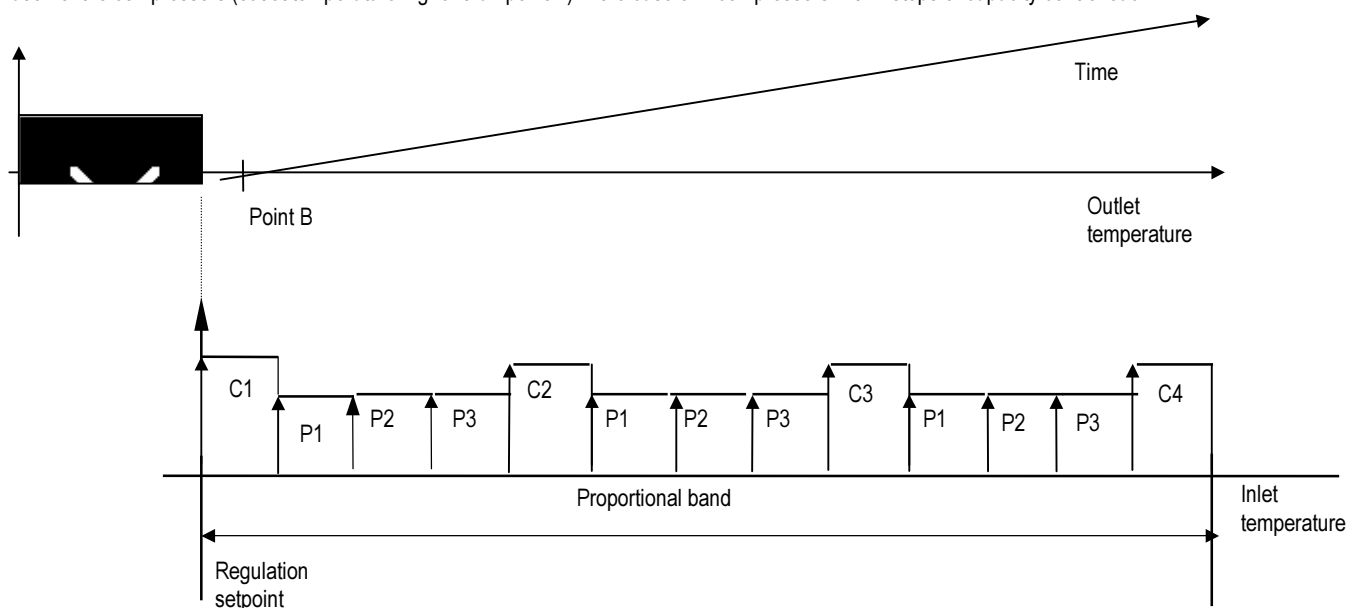
- Regulation setpoint
- Neutral zone for outlet regulation
- Step activation time
- Step deactivation time
- Minimum limit of outlet temperature (it switches off all the compressors without respecting the deactivation time)
- Maximum limit of outlet temperature (it switches off all the compressors without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

Outlet temperature regulation diagram:



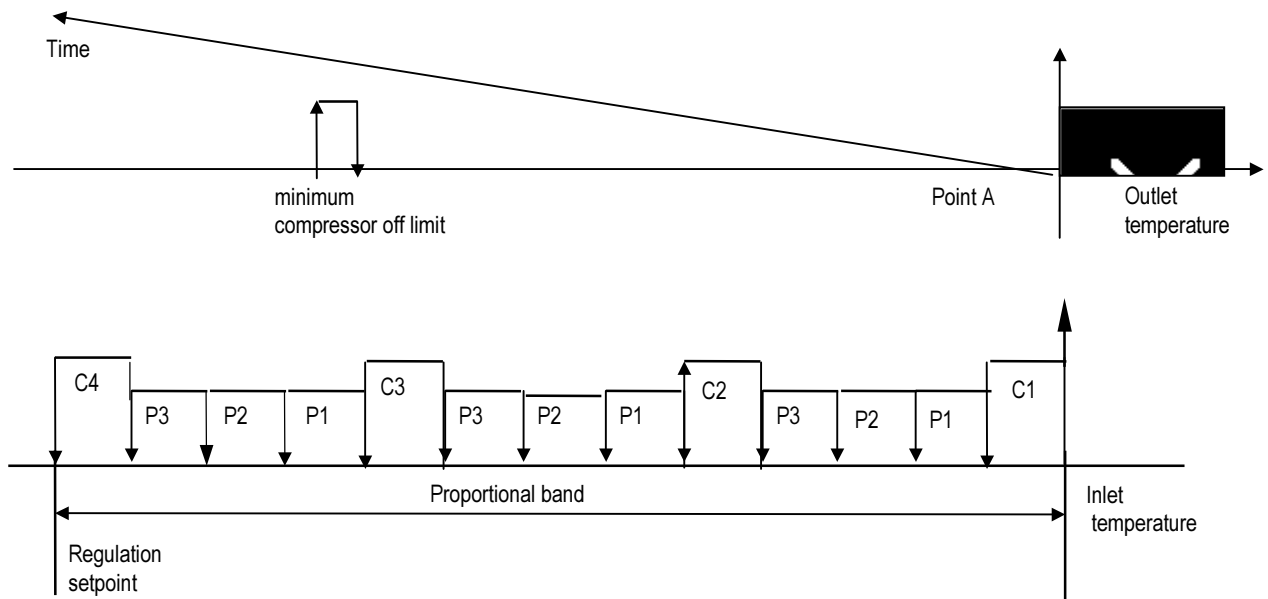
On the basis of the set up values of the set point and the band a neutral zone of temperature is located. Temperature values between the setpoint and the setpoint + band won't cause any start-up or shutdown of the compressors.
 Temperature values higher than the setpoint + band will cause the start up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

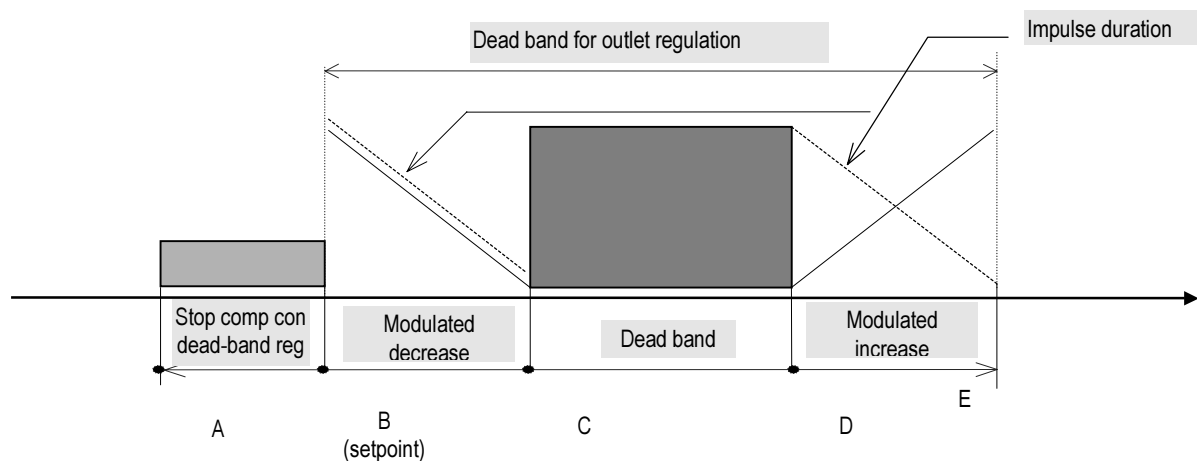
Always OFF = Solenoid is always OFF (not modulating)

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):

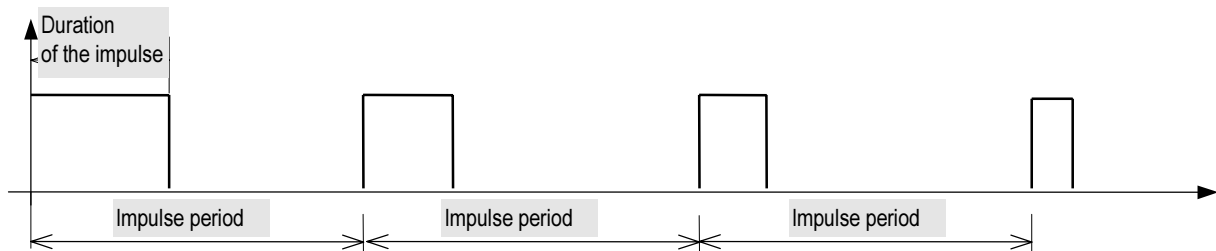
When the temperature falls below point B (regulation setpoint) the compressors begin decreased modulation with impulses of maximum duration, the effective shut-down occurs with an interval of time which can be set, and after which it is assumed that the compressor is at minimum power.

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 chillerUsed 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 pumpUsed 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 :

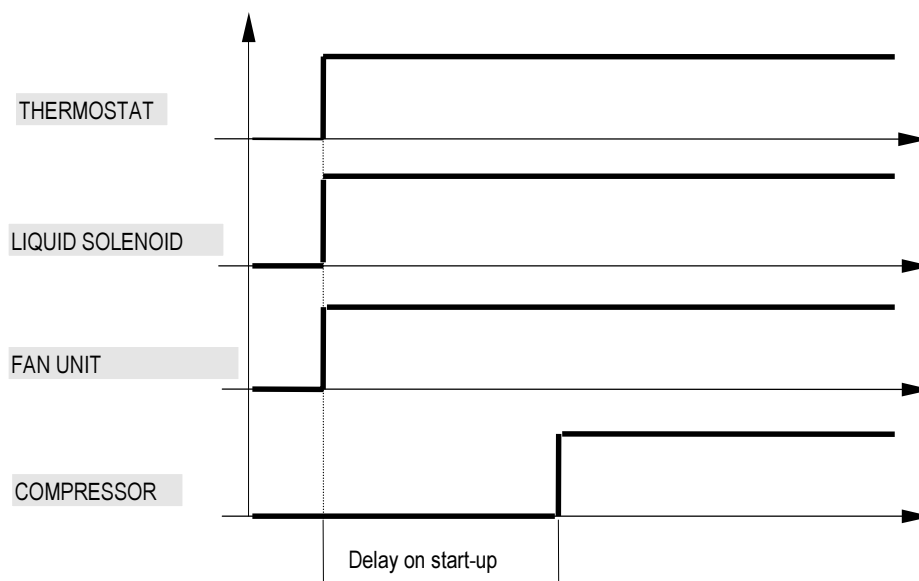
- Delay time on start-up.

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:

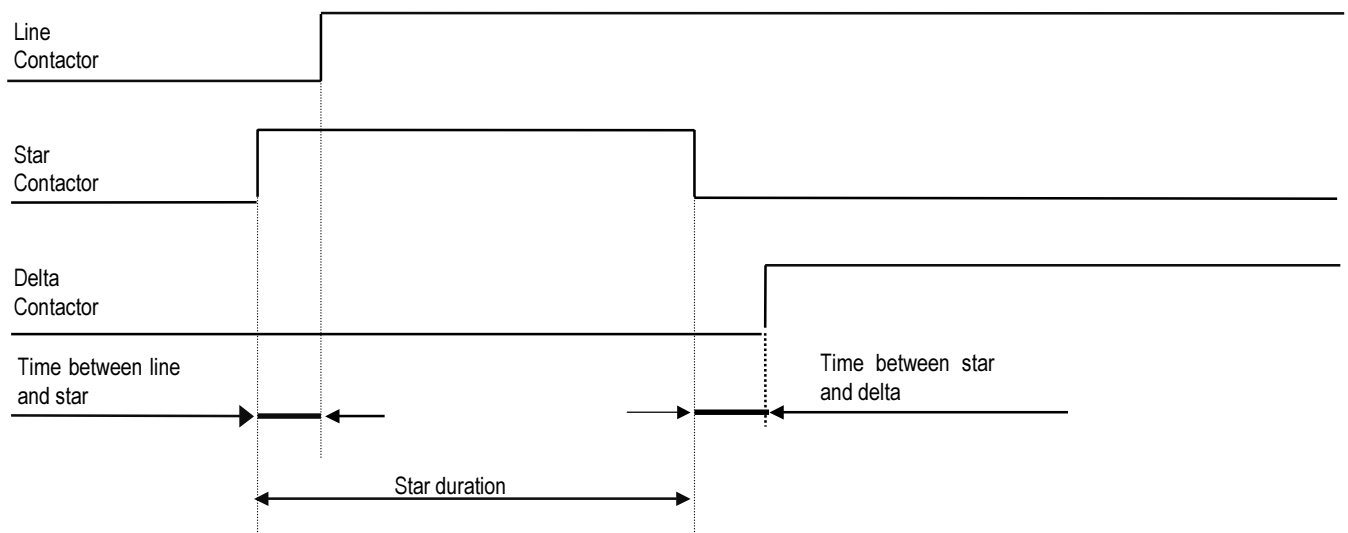
- Time between star and line
- Star impulse duration
- Time between star and delta

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

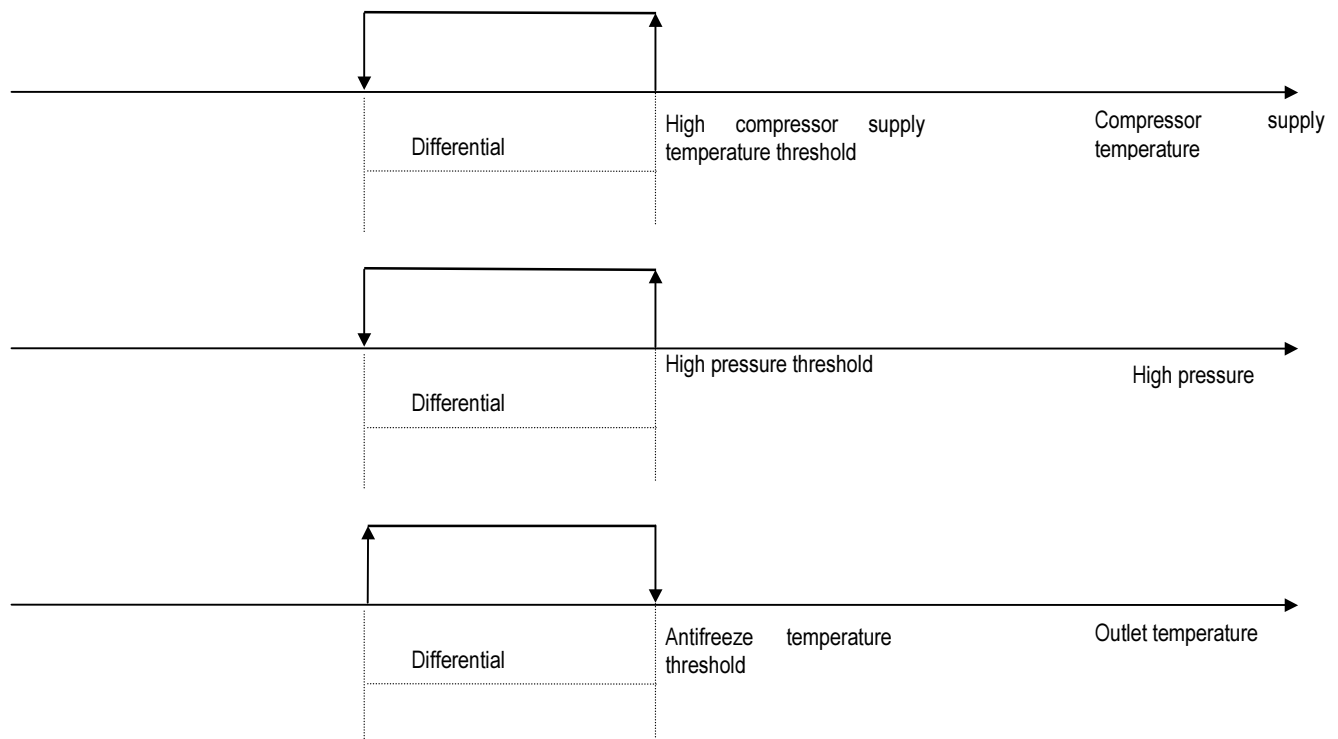
Used outputs

- 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

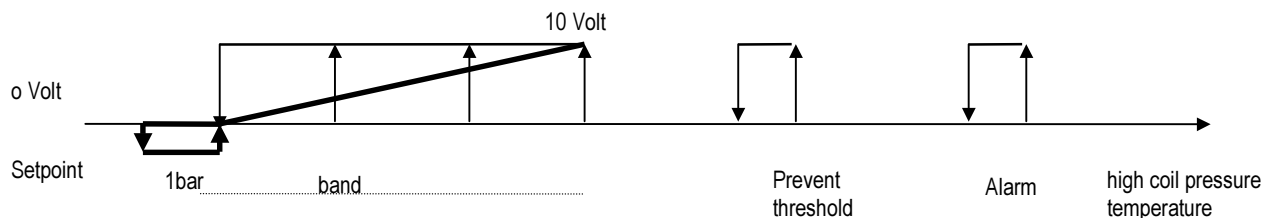
Compressor on = fan on

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.

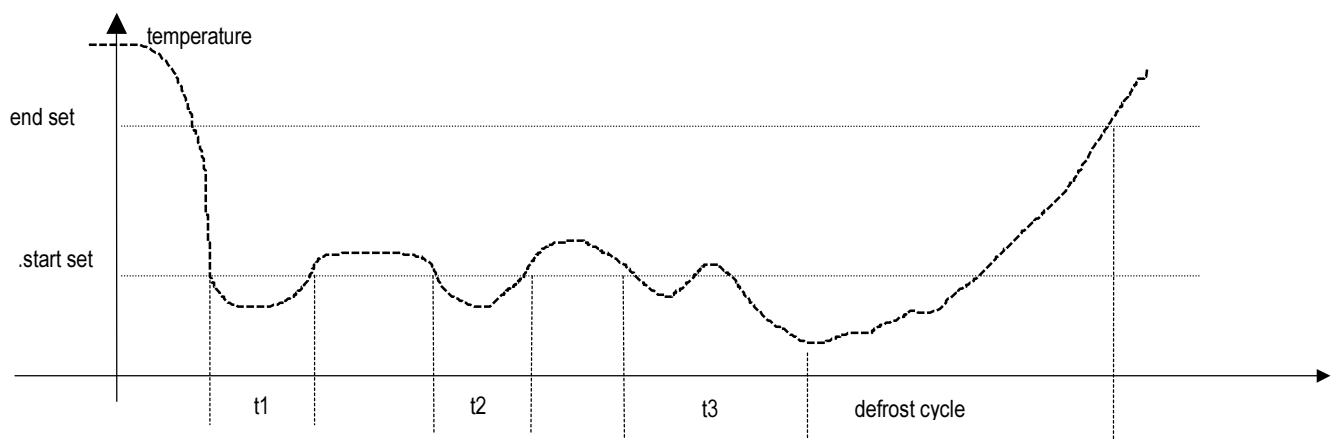
Type of end and start defrost:

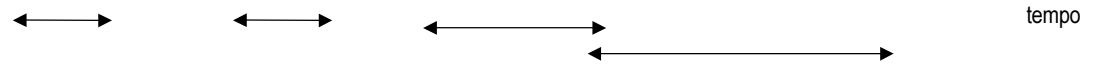
Defrosting can be managed either by the coil temperature probe B3 or alternatively by the high pressure probe B7; the user can choose one of the two probes, on the screen.

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

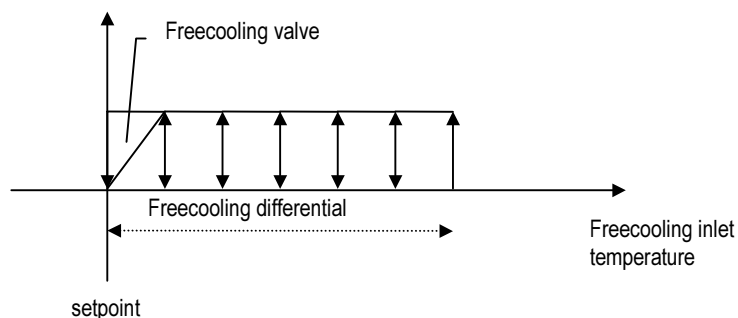
Operating description:

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

External temp. < (Freecooling coil inlet temp. – 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

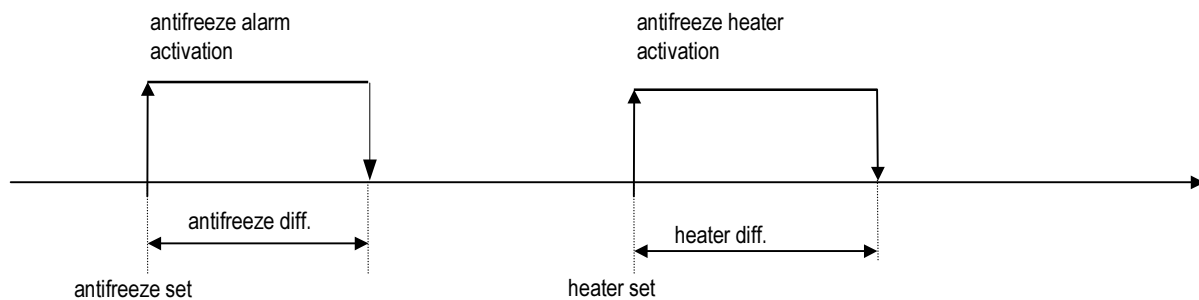
Used parameters:

- 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

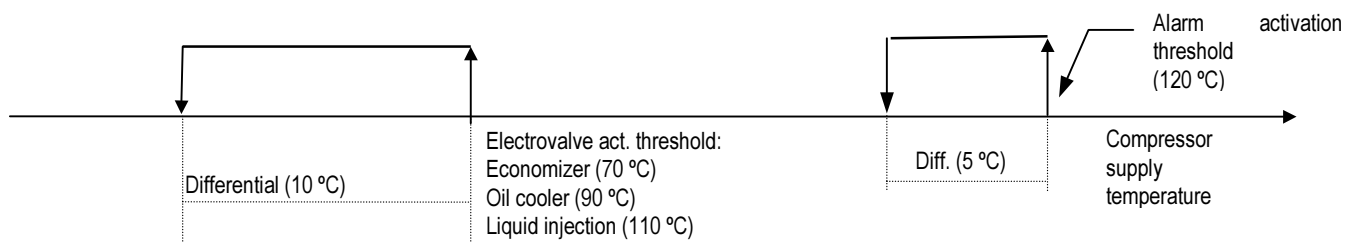
solenoid valve activation temperature
solenoid valve differential

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 = $N \cdot P + N$
- Number of stages per driver = $1/2 \cdot (N \cdot P + N)$

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:

- | | |
|---------------------------------------|--|
| • High pressure/pressure switch alarm | immediate shut-down of the compressor, manual reset |
| • Low pressure alarm | delayed at the start-up of the compressor immediate at full capacity with manual reset |
| • Compressor cut-off alarm | immediate shut-down of the compressor with manual reset |
| • Oil differential alarm | delayed at acquisition with manual reset |
| • Fan cut-off alarm | immediate shut-down of the fan with manual reset |

Grave alarms

- | | |
|----------------------------------|---|
| • No water flow alarm | Digital input delayed at the start-up and at full capacity |
| • Evaporator antifreeze alarm | Function of the evaporator outlet probe, with set-point for intervention and differential for reset with manual reset |
| • Grave alarm from digital input | Immediate shutdown of the unit with manual reset |
| • Phase monitor alarm | Immediate shutdown of the unit with automatic reset. |
| • Pump cut-off | Immediate shutdown of the unit with manual reset. |
| • Compressor cut-off | Immediate shutdown of the unit with manual reset |

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

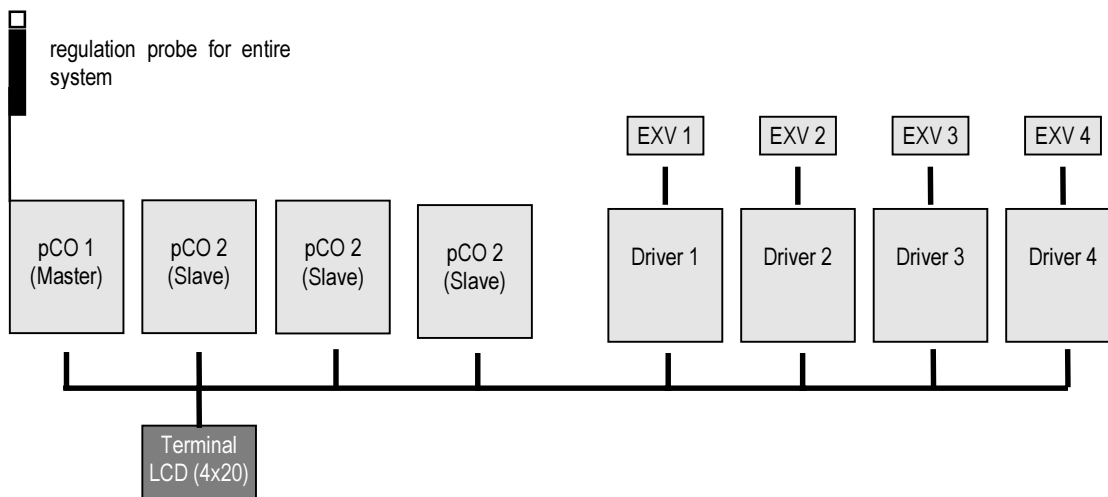
The alarms for the driver boards also indicate the driver that generated the alarm (example: "D: 3").

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

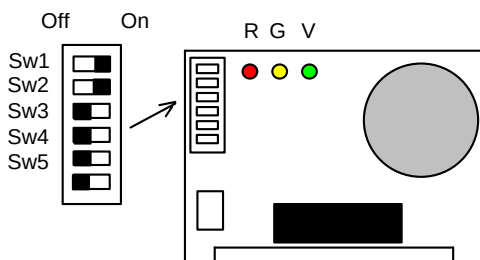
Dipswitches, LEDs and calendar-clock

Code: PCOCLKMEM0

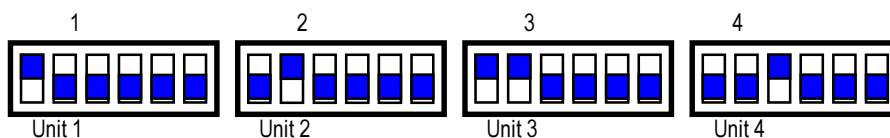
This board is essential for the network operation of the pCO I/O boards. Without these boards the local regulation cycle of the control will continue to be performed, and no connection can be made to the other devices in the network.

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

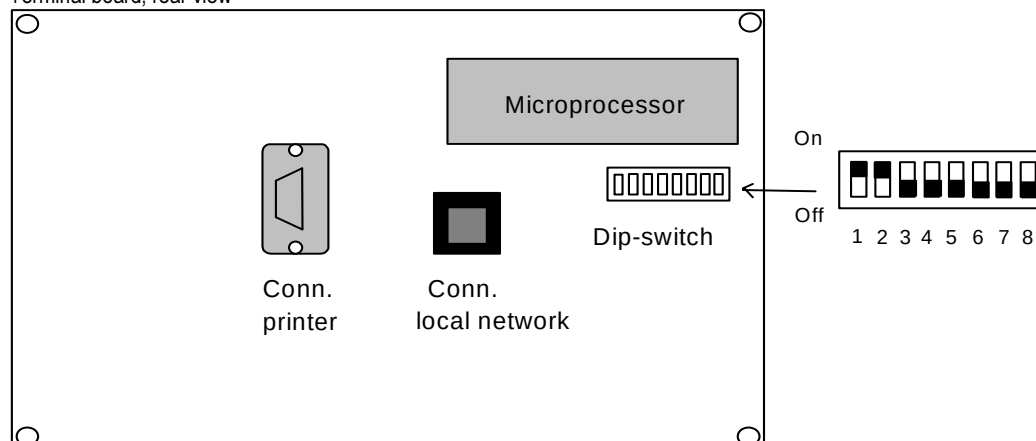


In the standard modular chiller application EPSTDEMCHA, the addresses for the pCO units:



Terminal addresses

Terminal board, rear view



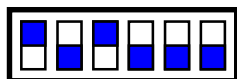
The address of the terminals is set using the dip-switches located on the rear.

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.

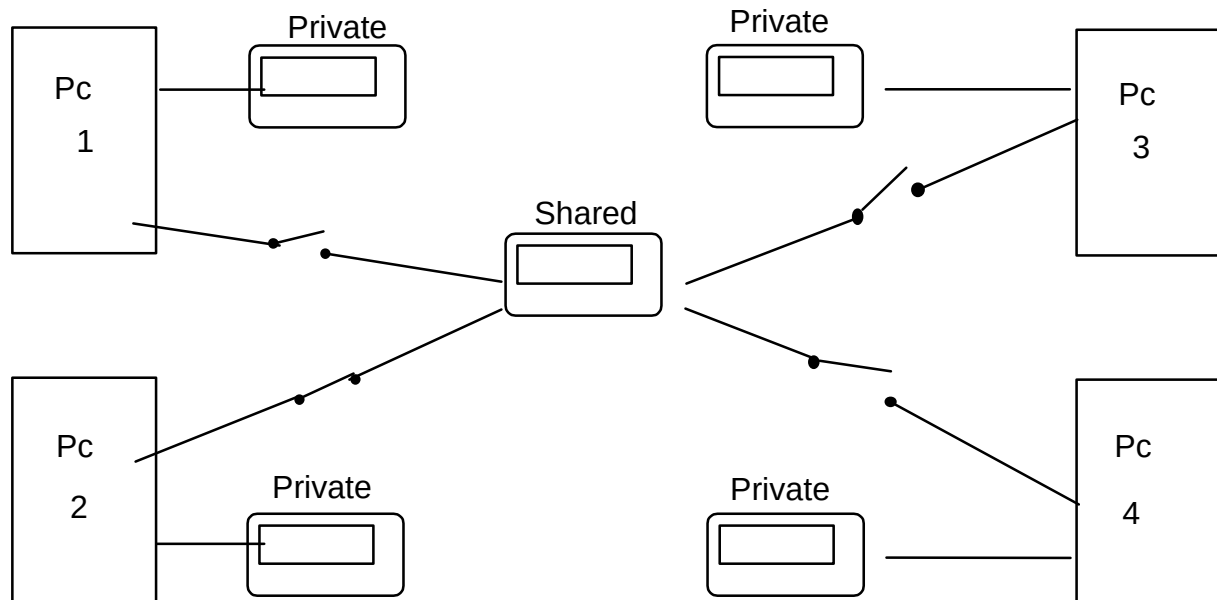
Terminal of units
1,2,3,4.



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.

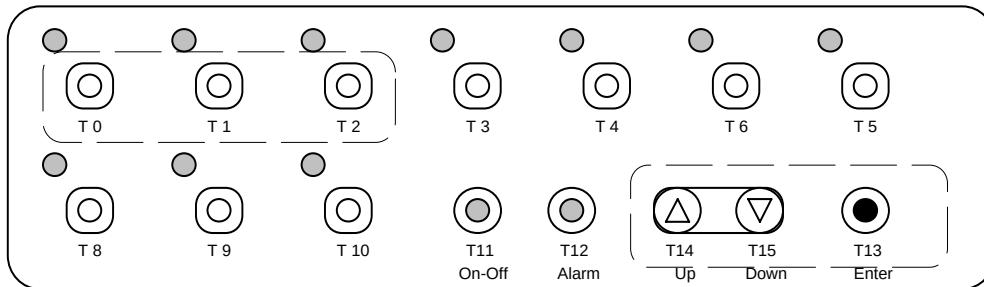
In case the addresses are wrong or the EPROM is replaced by another one with the same version and date, and if you cannot access to anyone of the present units from the terminal, it is necessary to proceed in accordance with what is described later on.

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  □ □ □ □ _ _ _ _ 8
T:  xx    9  _ _ _ _ _ _ □ _ 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.

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.

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.

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.

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

[illegible]

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

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 "manufacturer's" 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 "manufacturer's" 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) self-adapting → automatic regulation from user config. → manual regulation (the PID parameters are set by the user) 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). Valve off: the valve is kept closed 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: 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. DIGITAL INPUT → provides the status of the compressors simply as 0="all off" and 1="at least one on". This information does not allow pre-positioning . 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: - wait valve restart - wait battery restart - wait EEPROM reboot
32	Presence battery	Informs the software of the presence or otherwise of the battery 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. 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 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. Allows changing the max. operating current of the motor of the valve. The default is 1000. Each unit represents a current value equal to "max. current for valve motor"/1000. 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	Inform on the battery status: • battery disconnected (signalled by an int. res. of 255 Ohm) • high internal resistance (>15 Ohm) when the battery is not sufficiently charged to close the valve in the event of a blackout • not rechargeable (when the battery cannot be recharged any longer) • discharged (but rechargeable) • battery charged and working correctly
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 • always • 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)
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 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 The driver calculates the percentage of the request in the following way: $\text{no. of stages required} / \text{present stages} * 100$ (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
	Manufacturer parameters				
1	Configuration (see inputs/outputs table)	Manufacturer	Mst/slvs	16	0..23
6	Enable probe B1	Manufacturer	Mst/slvs	s	y/n
7	Enable probe B2	Manufacturer	Mst/slvs	s	y/n
8	Enable probe B3	Manufacturer	Mst/slvs	s	y/n
9	Enable probe B4	Manufacturer	Mst/slvs	n	y/n
10	Enable probe B5	Manufacturer	Mst/slvs	s	y/n
11	Enable probe B6	Manufacturer	Mst/slvs	n	y/n
12	Enable probe B7	Manufacturer	Mst/slvs	s	y/n
13	Enable probe B8	Manufacturer	Mst/slvs	n	y/n
14	Selection of type of probe no. 5 (None/External setpoint/voltage/current)	Manufacturer	Mst/slvs	None	
15	Minimum limit of probe no. 5	Manufacturer	Mst/slvs	0	
16	Maximum limit of probe no 5	Manufacturer	Mst/slvs	0	
17	Selection of type of supply temp. probe (0/1V; 4/20mA)	Manufacturer	Mst/slvs	0/1 V	
18	Start scale supply temperature probes	Manufacturer	Mst/slvs	-30 °C	
19	Full scale supply temperature probes	Manufacturer	Mst/slvs	150 °C	
21	Start scale high pressure probes (4mA)	Manufacturer	Mst/slvs	0 bar	0...999.9bar
22	Full scale high pressure probes (20mA)	Manufacturer	Mst/slvs		0...999.9bar
23	Start scale low pressure probes (4mA)	Manufacturer	Mst/slvs	-0.5 bar	
24	Full scale low pressure probes (20mA)	Manufacturer	Mst/slvs	7 bar	
25	Enable double setpoint	Manufacturer	Mst/slvs	n	
26	Enable driver	Manufacturer	Mst/slvs	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/slvs	100 s/100	0...999 s/100
32	Star time	Manufacturer	Mst/slvs	500 s/100	0...999 s/100
33	Time between Star and Delta	Manufacturer	Mst/slvs	100 s/100	0...999 s/100
34	Enable limits to compressor at start-up	Manufacturer	Mst/slvs	n	
35	Low pressure limit at start-up	Manufacturer	Mst/slvs	6 bar	0...99.9 bar
36	High pressure limit at start-up	Manufacturer	Mst/slvs	18 bar	0...99.9 bar
37	Threshold for equalised pressure	Manufacturer	Mst/slvs	13bar	0...99.9 bar
38	Minimum compressor start-up time	Manufacturer	Mst/slvs	n	
39	Minimum compressor shut-down time	Manufacturer	Mst/slvs	n	
40	Time between start-ups of different compressors	Manufacturer	Mst/slvs	10 sec.	
41	Time between two starts of same compressor	Manufacturer	Mst/slvs	450 sec.	
42	Enable forcing of first capacity control at start-up	Manufacturer	Mst/slvs	n	
43	Configuration of solenoid valves for first capacity-control	Manufacturer	Mst/slvs	y/n/n	
44	Configuration of solenoid valves for second capacity control	Manufacturer	Mst/slvs	n/n/y	
45	Configuration of solenoid valves for third capacity control	Manufacturer	Mst/slvs	n/y/n	
46	Configuration of solenoid valves for fourth capacity control	Manufacturer	Mst/slvs	n/n/n	
47	Enable special management of first capacity control	Manufacturer	Mst/slvs	n	
48	Time between the opening of the liquid solenoid and the compressor	Manufacturer	Mst/slvs	10 sec.	0..9999 sec.
49	Time between the start-up of the compressor and the first capacity control	Manufacturer	Mst/slvs	25 sec.	0..9999 sec.
50	Time between first and second capacity control	Manufacturer	Mst/slvs	300 sec.	0..9999 sec.
51	Configuration of relay 6,7 for the stand-by phase in modulating capacity control	Manufacturer	Mst/slvs	off-on	
52	Configuration of relay 6,7 for the decrease phase in modulating capacity control	Manufacturer	Mst/slvs	on-on	
53	Configuration of relay 6,7 for the increase phase in modulating capacity control	Manufacturer	Mst/slvs	off-off	
54	Time between second and third capacity control	Manufacturer	Mst/slvs	300 sec.	0..9999 sec.
55	Period of impulse (modulating capacity control)	Manufacturer	Mst/slvs	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 pressure switch temperature pressure	Manufacturer	Mst/slv	temp.	
125	Configuration of global defrosting independent simultaneous 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	
	User parameters				
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: water inlet (P/PI) 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 (chiller operation, prevents antifreeze alarm)	User	Mst	10	
138	Heating threshold to force off steps with outlet regulation (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	
	Service parameters				
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	
	Setpoint parameters				
174	Cooling regulation setpoint	setpoint	Mst	12	
175	Heating regulation setpoint	setpoint	Mst	45	
	Clock parameters				
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
Out Outlet variable
IN/OUT Inlet/outlet variable

pCO ← Supervisor
pCO → Supervisor
pCO ↔ Supervisor

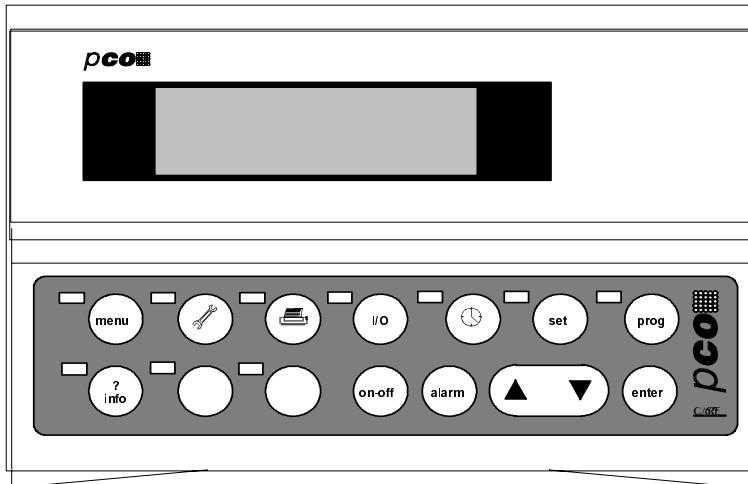
Type	Direction	address	Description
A	OUT	1	Analogical value of the inlet 1
A	OUT	2	Analogical value of the inlet 2
A	OUT	3	Analogical value of the inlet 3
A	OUT	4	Analogical value of the inlet 4
A	OUT	5	Analogical value of the inlet 5
A	OUT	6	Analogical value of the inlet 6
A	OUT	7	Analogical value of 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.

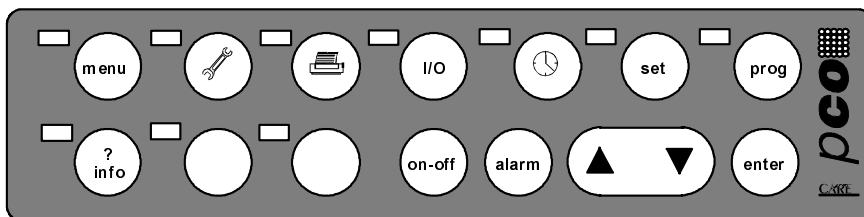
The *terminal*, which is always managed by microprocessor, is fitted with a 4 row x 20 column LCD display, keypad and LEDs, in order to allow the programming of the control parameters (setpoint, differential band, alarm thresholds) and basic operation by the user. It is not necessary that the *terminal*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

ON / OFF button



Activates and inhibits the controlled devices.

ALARM button



Goes to the first active alarm screen and switches off the alarm buzzer.
When in an alarm screen, pressing the button again resets the alarm and displays the first screen
If no alarms are active, the screen NO ALARM ACTIVE is displayed.

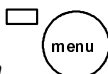
The sequence of alarm screens is scrolled by pressing the UP / DOWN

UP / DOWN buttons

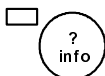
When the cursor is in the HOME position (cursor in position 0,0 of the display) these buttons look through the screens in a group. From the last one it is possible to access the first, and vice-versa. If the cursor is inside a numeric field the buttons increase or decrease the value on which the cursor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

ENTER button

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.

MENU button

Goes to the M_MAINMASK screen.

INFO button

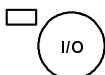
Switches the control of the terminal from a pCO board to another pCO board.

MAINT button

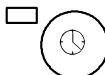
Goes to the M_MAINT5 screen.

PRINT button

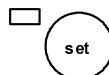
NOT FEATURED

I/O button

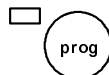
Goes to the M_INOUT5 screen

TIME button

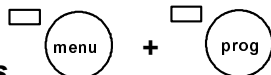
Goes to the m_CLOCK5 / m CLOCK10 screen, if enabled by the time board

SET button

Goes to the M_SETPOINT5 screen

PROG button

The password is required. If entered correctly, it is possible to access the screen M_PW_USER

MENU+PROG buttons

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.  00.00C |
| Out water E.  00.00C |
| 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:          ----βC |
| B2:          ----βC |
+-----+

```

M_InOut20

```

+-----+
| Analog inputs  U: |
| B3:          ----βC |
| B4:          ----βC |
+-----+

```

M_InOut25

```

+-----+
| Analog inputs  U: |
| B5:          0----βC |
| B6:          0----βC |
+-----+

```

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      00.0βC |
| Suct.temp.      00.0βC |
| 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              00.03C|
|Winter              00.03C|
+-----+

M_User25
+-----+
|Temperature band    00.03C|
+-----+

M_User27
+-----+
|Modulation band     |
|Neutral zone 00.03C  |
+-----+

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               00.03C|
|Diff.               00.03C|
+-----+

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

M_Manuf90	Manuf_Drv_150
-----+	-----+
Stage 4	Manufacturer D:1 U:
Logic relay 1 N	Propor. factor 00.0
Logic relay 2 N	Integr. factor 00.0
Logic relay 3 N	Differ. factor 00.0
-----+	-----+
M_Manuf93	Manuf_Drv_160
-----+	-----+
Enable particular	Manufacturer D:1 U:
management of	
stage 1 N	Max valve steps 0000
	Max pos.adjust 00000
-----+	-----+
M_Manuf95	Manuf_Drv_170
-----+	-----+
Time S0L/S1 0000s	Manufacturer D:1 U:
Time S1/S2 0000s	Pressure probe conf.
Time S2/S3 0000s	4mA 00.0barg
Time S3/S4 0000s	20mA 00.0barg
-----+	-----+
M_Manuf97	Manuf_Drv_180
-----+	-----+
Standby config.	Manufacturer D:1 U:
Relay 6 N	Evaporator output
Relay 7 N	press. set 00.0barg
-----+	-----+
M_Manuf98	Manuf_Drv_190
-----+	-----+
Decrement config.	Manufacturer D:1 U:
	Superheat hysteresis
Relay 6 N	after max pressure
Relay 7 N	alarm 00.0K
-----+	-----+
m_manuf99	Manuf_Drv_200
-----+	-----+
Increment config.	Manufacturer D:1 U:
	Superheat hysteresis
Relay 6 N	after low pressure
Relay 7 N	alarm 00.0K
-----+	-----+
M_Manuf100	Manuf_Drv_210
-----+	-----+
Modulation config.	Manufacturer D:1 U:
Pulse period 00s	Valve closing to min
Min pulse D. 00.0s	position when super-
Max pulse D. 00.0s	heat below 00.0K
-----+	-----+
M_Manuf105	Manuf_Drv_220
-----+	-----+
Modulation config.	Manufacturer D:1 U:
Min pulse I. 00.0s	Valve regulation
Max pulse I. 00.0s	VALVE OFF
-----+	-----+
M_Manuf110	Manuf_Drv_230
-----+	-----+
Modulation config.	Manufacturer D:1 U:
	Compressor status
Time force decr. for	input type
start compress. 000s	pLAN
-----+	-----+
M_Manuf115	Manuf_Drv_240
-----+	-----+
Enable force	Manufacturer D:1 U:
solenoid ON with	In case of pLAN
compressor OFF N	failure
	USE 0-1V COMP.STATUS
-----+	-----+
M_Manuf120	Manuf_Drv_250
-----+	-----+
Pump down config.	Manufacturer D:1 U:
	Restart after power
Enable N	failure
Maximum time 000s	ALWAYS
-----+	-----+

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

M_Manuf180	Carel_Drv_80
-----+	-----+
Transducers high	Insert another U:
pressure alarm	drivers CAREL
Setpoint 00.0bar	password
Diff. 00.0bar	0000
-----+	-----+
M_Manuf185	
-----+	
Transducer low	
pressure alarm	
Setpoint 00.0bar	
Diff. 00.0bar	
-----+	
M_Manuf187	
-----+	
Low differential	
pressure alarm N	
Setpoint 00.0bar	
Startup delay 000s	
-----+	
M_Manuf190	
-----+	
Low pressure alarm	
delays	
Startup delay 000s	
Run delay 000s	
-----+	
M_Manuf195	
-----+	
Oil level alarm	
delays	
Startup delay 000s	
Run delay 000s	
-----+	
M_Manuf200	
-----+	
High voltage alarm	
Setpoint 000.0V	
Diff. 00.0V	
-----+	
M_Manuf205	
-----+	
High current alarm	
Setpoint 000.0A	
Diff. 00.0A	
-----+	
M_Manuf210	
-----+	
Antifreeze alarm	
Setpoint 00.0°C	
Diff. 00.0°C	
-----+	
M_Manuf215	
-----+	
Electrovalve	
management	
Setpoint 000.0°C	
Diff. 00.0°C	
-----+	
M_Manuf220	
-----+	
Antifreeze heater	
Setpoint 00.0°C	
Diff. 00.0°C	
-----+	
M_Manuf230	
-----+	
Logic of valves	
Reversing (4way)N.C.	
Freecooling 0/10V	
-----+	

M_Manuf235

```

+-----+
|Defrost config.      |
|Probe   PRESS0STATS |
|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		



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