c-pro 3 *nano CHILL*

Programmable controllers for chillers/heat pumps with single or dual circuit

Application manual ver. 3.0 August 2024 | ENGLISH
Codice 144CP3NCE304

IMPORTANT WARNING	
	Read the User Manual carefully before installation and before use and follow all the instructions concerning installation and electrical connections. This manual must be kept for future consultation.
	**All the devices must be disposed of according to local regulations governing the disposal of electrical and electronic devices.**

SUMMARY

1 INTRODUCTION

1.1 Introduction

The programmable controllers in the ***c-pro 3*** *nano CHILL* line are devices designed to manage chillers/heat pumps with single and dual circuit with a maximum of three scroll compressors per circuit.
They use programmable controllers, the expansions of I/O, and the remote user interfaces of the ***c-pro 3*** line and are programmed with a software application implemented with the UNI-PRO 3 development environment.
The controllers can manage chillers/heat pumps with air/water and water/water; thanks to the CAN communication port the controllers can also communicate with an external driver (EVDRIVE03) for bipolar stepper electronic expansion valves.
They can be powered with alternating current (12 VAC). The programming port allows upload and download of the configuration parameters (using a regular pen drive); using the RS-485 port with the MODBUS communication protocol instead you can connect the devices to the Parameters Manager software setup system or to that for monitoring and supervising the systems with Internet CloudEvolution. Lastly, with the CAN communication port you can connect the devices to the expansion of I/O, to the remote user interface, and to the external driver of the electronic expansion valves.

The application programme can manage air/water and water/water, single-circuit, or dual-circuit units.
Some of the numerous control functions offered are listed below:

Functions Available
Management of a maximum of three scroll compressors per circuit
Management compressors with cooling – heating mode
Fan management with phase cutting speed module
EVDRIVE03 management with electronic valve for each circuit
Free-cooling management
Defrost and anti-freeze function
Double setpoint that can be enabled through an external contact
Compensation of the dynamic setpoint
Pump-down management
Integrated programming with 2 daily programmes
Control of the linear or step condensation/evaporation pressure
Operation with one, two, or no circulation pump
One, two, or no source circulation pump

2 APPLICATIONS

The controllers can manage the following types of unit:

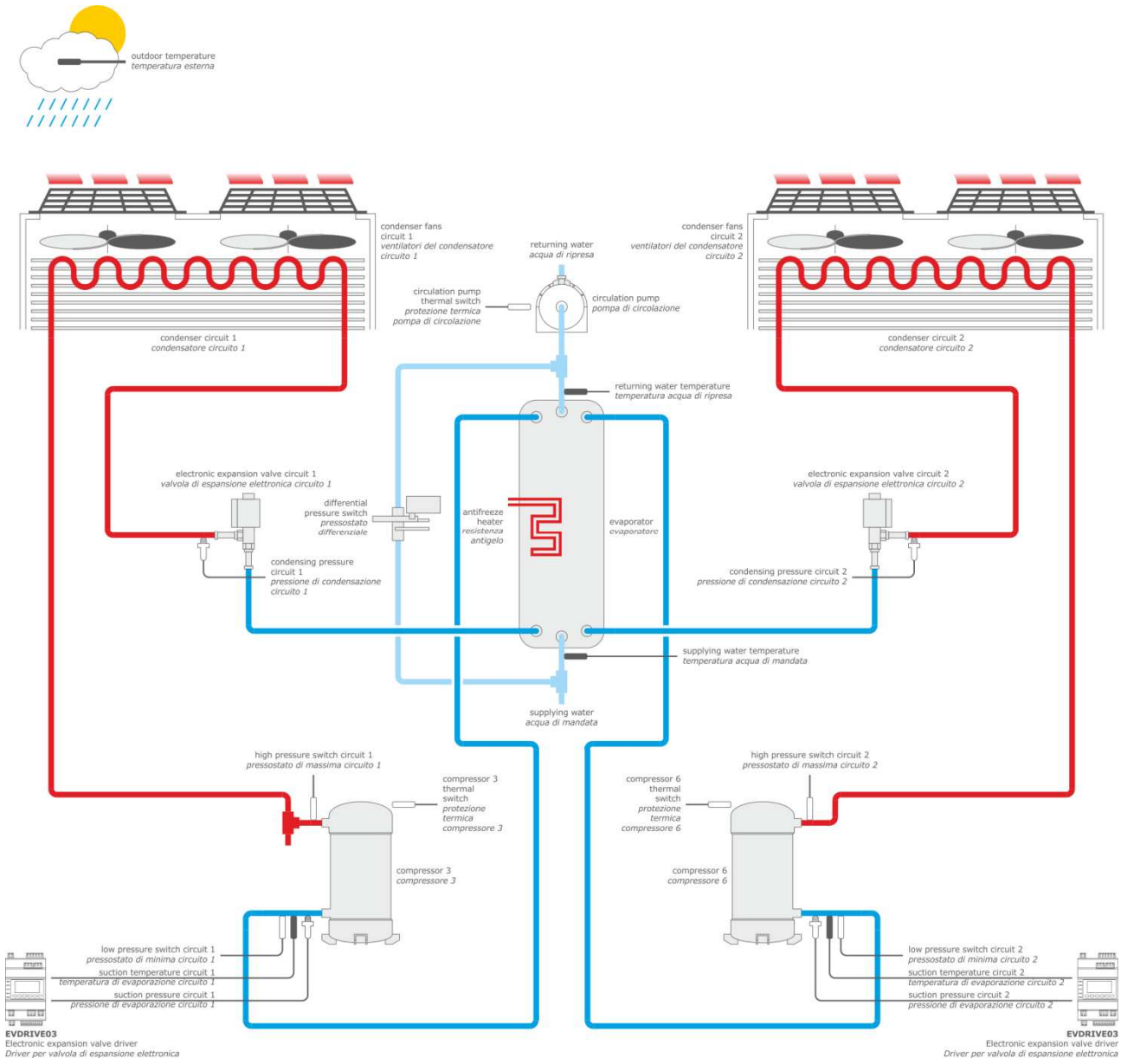
Air/water single-circuit
Air/water single-circuit chiller
Air/water single-circuit chiller with EEV driver
Air/water single-circuit chiller + Heat pump
Air/water single-circuit chiller + Heat pump with EEV driver

Water/water single-circuit
Water/water single-circuit chiller
Water/water single-circuit chiller with EEV driver
Water/water single-circuit chiller + Heat pump
Water/water single-circuit chiller + Heat pump with EEV driver

Air/water dual-circuit
Air/water dual-circuit chiller
Air/water dual-circuit chiller with EEVdriver
Air/water dual-circuit chiller + Heat pump
Air/water dual-circuit chiller + Heat pump with EEVdriver

Water/water dual-circuit
Water/water dual-circuit chiller
Water/water dual-circuit chiller with EEV driver
Water/water dual-circuit chiller + Heat pump
Water/water dual-circuit chiller + Heat pump with EEV driver

2.1 Basic scheme of application of an air/water dual-circuit chiller



3 HARDWARE SOLUTIONS

Hardware	Item	Code
Controller	***c-pro 3*** *nano CHILL*	EPN2LXP
I/O expansion	***c-pro 3*** *EXP micro+*	EPU2EXP
EEV driver (built-in version)	EVDRIVE03	EPD4DF3
EEV driver (blind version)	EVDRIVE03	EPD4BC3

You can increase the number of inputs and outputs using a ***c-pro 3*** *EXP micro+* I/O expansion.

You can manage a bipolar stepper electronic expansion valve with the designated EVDRIVE03 driver module.

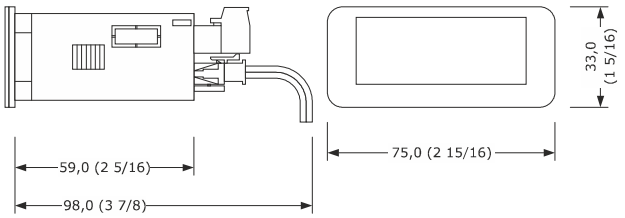
4 MEASUREMENTS

4.1 Controller and user interface measurements

Below we show the measurements, assembly, and electrical connections of the ***c-pro 3*** *nano CHILL* device.

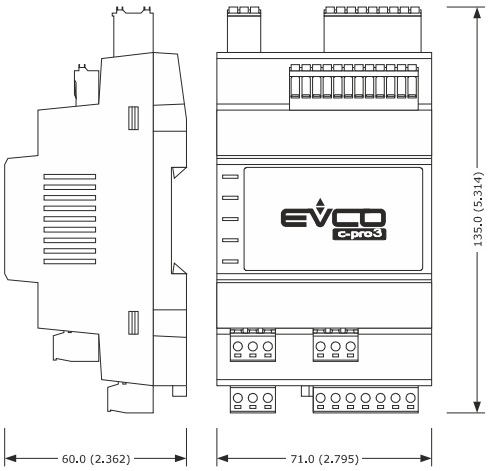
4.1.1 *c-pro 3 nano CHILL control module measurements*

To be fitted to a panel; measurements are in mm (in).



4.1.2 *c-pro 3 EXP micro*+ control module measurements

4 DIN modules, installation with assembly on DIN rail; measurements are in mm(in).

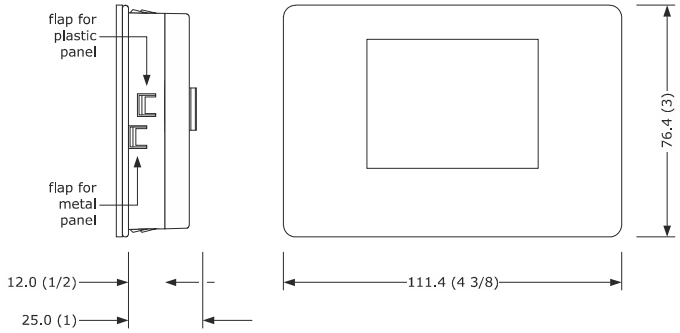


4.1.1 EPJgraph remote user interface measurements

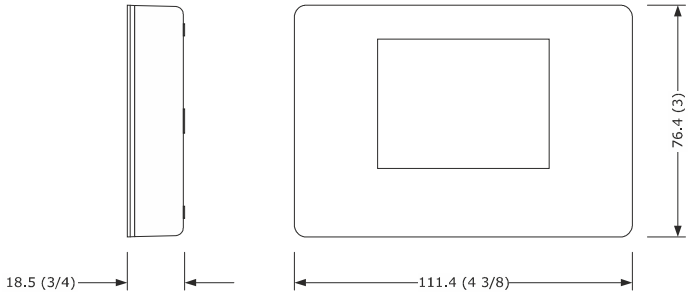
Models for panel mounting; measurements are in mm (in).

	N.B. - the thickness of a metal panel must be between 0.8 and 1.5 mm (1/32 and 1/16 in), while that for a plastic panel must be between 0.8 and 3.4 mm (1/32 and 1/8 in) - the measurements of rilling template must be 107.6 x 72.6 mm (3 15/16 x 2 7/8 in), with rounded corners R 3.0 mm (1/8 in).

To be fitted to a panel, with elastic holding flaps.



Models for wall mounting; measurements are in mm (in).



Wall mounting (with bolts and fastening screws) or in the most common flush mounting boxes (with fastening screws).

1. Unhook the back shell from the front through a screwdriver and the proper seat.

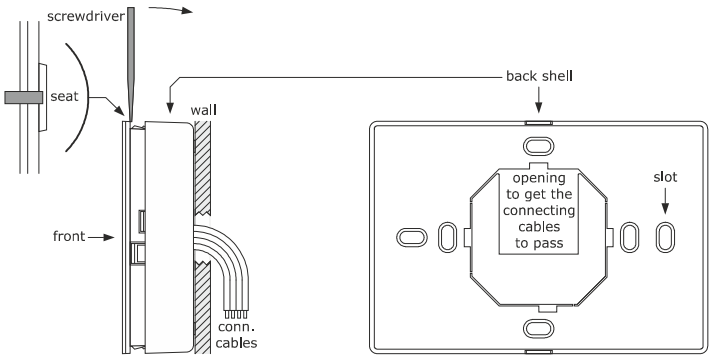
2.1 In case of wall mounting:

- 2.1.1 Lean the back shell against the wall in a position suitable to get the connecting cable to pass through the proper opening.
- 2.1.2 Use the slots of the back shell as template to drill 4 holes having a diameter suitable to the bolt.
  5.0 mm (3/16 in) diameter bolts are suggested.
- 2.1.3 Insert the bolts in the holes drilled in the wall.
- 2.1.4 Fasten the back shell at the wall with 4 screws.

Countersunk head screws are suggested.

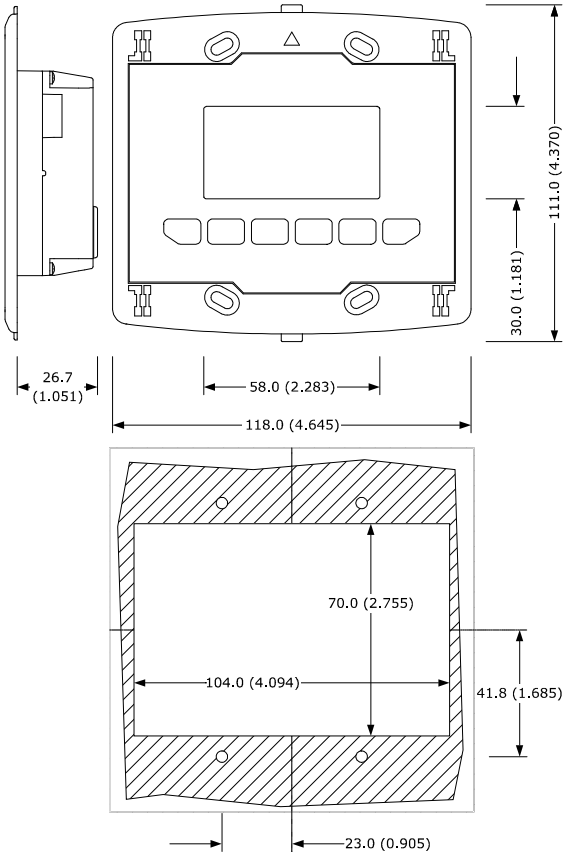
2.2 In case of flush mounting box, fasten the back shell at the box with 4 screws.
Countersunk head screws are suggested.

3. Make the electrical connection as shown in the section ELECTRICAL CONNECTION without powering up the device.
4. Fasten the front of the device at the back shell.



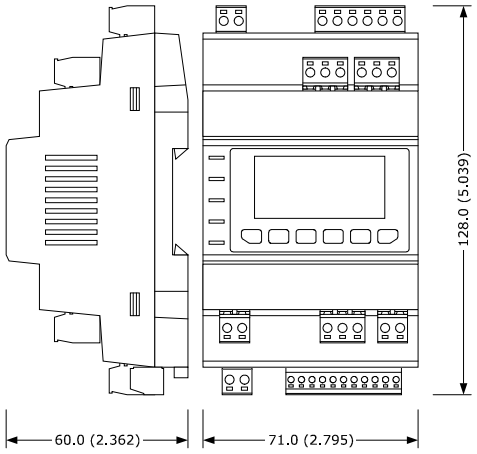
4.1.2 Vgraph remote user interface measurements

To be fitted to a panel; measurements are in mm (in).



4.1.3 EVDRIVE03 module measurements

4 DIN modules, installation with assembly on DIN rail; measurements are in mm(in).



5 USER INTERFACE

Two types of interface are provided for the application:

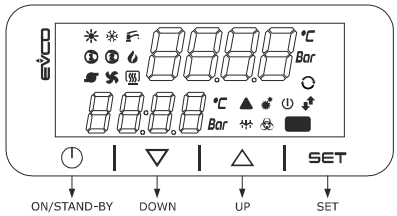
- interface with built-in LED display (4 keys)
- remote interface with **EPJgraph** LCD display (6 keys)
- remote interface with **Vgraph** LCD display (6 keys).

Both the interfaces are equipped with navigation/page editing keys and only differ in the viewing mode of certain associated states; that is, with icons.

For both versions, a description of the keys used by the application is provided. In fact, depending on the interface in use, you can manage a different number of keys.

5.1 Viewing and Keyboards

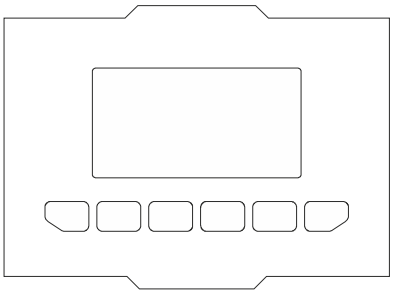
5.1.1 *C-pro 3 nano*+ controller user interface:



Key	Description
	movement keys (hereinafter called the UP and/or DOWN keys)
	confirm key (hereinafter called the SET key)
	On key, (hereinafter also called the ON/STANDBY key)

5.1.2 Vgraph user interface:

The terminal's main characteristics are the chance to communicate a remarkable amount of information to the user and how extremely easy it is to use; these characteristics derive from a graph viewer and a six-key membrane keyboard (with preset functions) and the CAN bus (to connect to the controllers).



The table below describes the main parts of the keypad.

Key	Description
esc	cancel key (hereinafter called the ESC key)
◁	move left key (hereinafter called the LEFT key)
△	increase key (hereinafter called the UP key)
▽	decrease key (hereinafter called the DOWN key)
▷	move right key (hereinafter called the RIGHT key)
↵	confirm key (hereinafter called the ENTER key)

6 LIST OF THE PAGES

This chapter describes the main pages and the menus in the application. As described above, the general menu is divided up into four levels of submenu: user, maintenance operator, installation operator, and configuration.
The menu is structured as follows:

Menu	Function of the menu
General Menu	RTC Menu
	Alarm Menu
	User Menu (level 1)
Maintenance Menu (Level 2)	Operation
	Manual
	Calibration
	Input/Output
Installer Menu (Level 3)	Compressors
	Regulation
	Fans
	Defrost
	Pumps
	Antifreeze
	Free-cooling
	Safety devices of the equipment
	Modbus
	Various parameters
Manufacturer Menu (Level 4)	Configuration
	Hardware Configuration
	EVDRIVE03 (circuit 1, circuit 2)

6.1 Passwords

Each menu is assigned a level that represents the accessibility to the different menus.
A password is assigned to each level that grants access to the different functions offered by the menu; after having entered the correct password, the protected functions become accessible. The entry of the correct password has two consequences:

- unlocking of the relative level;
- unlocking of its sub levels.

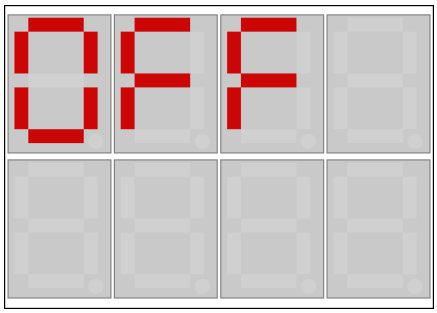
All the level passwords may be modified from the same level or higher levels. For example, from the manufacturer level you can change all the passwords of the lower levels using the appropriate page.
The range of values that can be set for a password is -999/9999
Once four minutes have elapsed without having pressed any key, the password expires and you have to reset it.

6.2 Unit OFF Main screen

The main viewing screen varies based on the machine state, that is on (ON) or off (OFF): if the machine is OFF Unit OFF will be viewed together with the cause of the switch-off (keyboard, DI, Supervisor, Scheduler, Alarm, Change).

Display Vgraph/EPJgraph

Display c-pro 3 nano CHILL



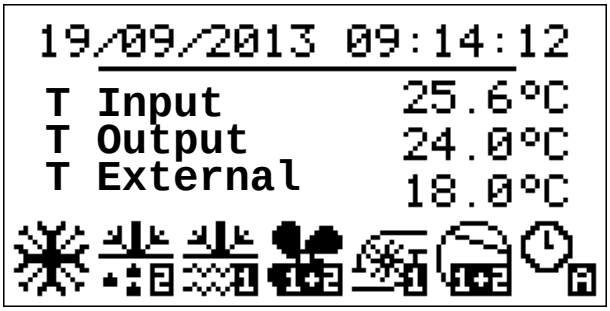
The display of c-pro 3 nano will show: "OFF" in the upper row and the reason il the lower row: keyboars (), DI (dI), Supervisor (SUP), Scheduler (bAnd), Alarm (ALrM), Change (MOdE).

By pressing the ESC key from this page, the user accesses the Alarms page.

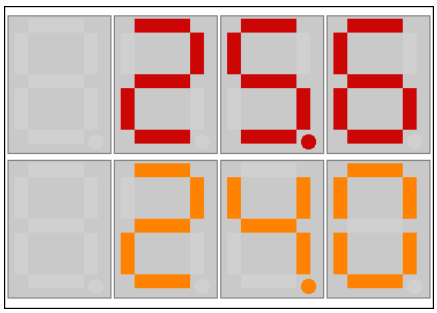
6.3 Unit ON Main screen

When you switch on the unit, the following main screen will be viewed:

Display Vgraph/EPJgraph



Display c-pro 3 nano CHILL



The display of c-pro 3 nano CHILL will show: in the upper row the inlet temperature of the utility exchanger and in the lower row the outlet temperature of the utility exchanger.

At the bottom of the page some icons are shown to indicate some operating modes of the circuit.

The table below shows the individual icons, their operating state, and what is verified.
From left to right:

Icon	Operating mode	Event shown
	Summer/Winter/Alarm Icon	If there is an active alarm, the alarm icon will be shown in place of the operating mode icon (summer/winter)
	Defrost Icon	Means that a defrost is underway in the circuit (1,2). If it is blinking the dripping phase is underway
	Anti-freeze Icon	Means that the antifreeze heaters are active (plant or source) in the circuit indicated (1,2 1+2)
	Fan Icon	Means that the circuit fans (1,2, 1+2) are active
	Pump Icon	Indicates which circulation pump (1,2) is active
	Compressor Icon	Means that at least one compressor in the circuit (1,2, 1+2) is active
	Timer Settings Icon	Indicates which timer setting is active (A,B)

From this page, by pressing the RIGHT or LEFT key you can view other information concerning pumps, fans, compressors, defrost, circuit state, RTC, and all probes configured. If one of the probes is in error, the value field of the corresponding probe shows "**----**", or "**----**" if the probe is disabled.
By pressing the ESC key from this page, the user accesses the Alarms page.

On the two-line display, the top line shows the Heat sink exchanger input temperature, while on the bottom display the Heat sink exchanger output temperature is shown for circuit 1 if there is 1 circuit. If instead there are two circuits, the average of the two temperatures output from the exchangers is shown (if one of the two probes is in alarm, the value of the one not in alarm is shown).

6.4 StAt Menu

If you choose the Stat item from the general menu you enter the screen of certain main modes of the system (which you can browse with the Left/Right keys) on the page of reference:

Table with examples of system modes viewable from Page 1

Page of reference	Mode shown	System mode
Page 1	**Unit**	Indicates the mode the machine is operating in (**OFF**, **ChIL, pdC, dEFr, dRIp, F-C**)
Page 1	**ModE**	Indicates the machine operating mode (**ChIL, pdC**)
Page 1	**tdF1**	Accumulation of the wait time for a defrost circuit 1
Page 1	**dFr1**	Duration time of defrost circuit 1
Page 1	**tdF2**	Accumulation of the wait time for a defrost circuit 2
Page 1	**dFr2**	Duration time of defrost circuit 2
Page 1	**SEtC**	Current setpoint summer operation
Page 1	**SEtH**	Current setpoint winter operation

Page 1	**rEGP**	Main regulation probe
Page 1	**PREq**	Power requested [%]
Page 1	**PSup**	Power supplied [%]

Table with examples system modes viewable from Page 2

Page of reference	Mode viewed	System mode
Page 2	**CMP1, CMP2 .. CMP6**	Compressor mode (**dIS, OFF**, **tOn**, **On**, **tOFF**, **ALAr**, **MAnU**)
Page 2	**FAn1, FAn 2**	Fan mode (**dIS, OFF**, **tOn**, **On**, **tOFF**, **ALAr**, **MAnU**)
Page 2	**InF1,InF2**	Speed of the condensation fans [%]
Page 2	**PMP1, PMP2**	Pump mode (**dIS, OFF**, **On**, **ALAr, MAnU**)
Page 2	**PMS1, PMS2**	Source pump mode (**dIS, OFF**, **On**, **ALAr, MAnU**)
Page 2	**F-C**	Free-cooling activation state
Page 2	**vF-C**	Free-cooling valve
Page 2	**FF-C**	Free-cooling regulation
Page 2	**vpC1**	C1 parcelling valve mode for free cooling
Page 2	**vpC2**	C2 parcelling valve mode for free cooling

Table with examples system modes viewable from Page 3

Page of reference	Mode viewed	System mode
Page 3	**tExt**	External temperature probe
Page 3	**tAux**	Remote temperature probe
Page 3	**tiFc**	system input temperature probe (Free-cooling)
Page 3	**tin**	Heat sink exchanger input temperature probe
Page 3	**toC1/2**	Sink heat exchanger output temperature probe (circuit 1,2)
Page 3	**toS1/2**	Heat source exchanger output temperature probe (circuit 1,2)
Page 3	**tCo1/2**	Coil temperature probe (circuit 1,2)
Page 3	**GAS1/2**	Compressor discharge gas temperature probe (circuit 1,2)
Page 3	**tSu1/2**	compressor intake temperature probe (circuit 1,2)
Page 3	**PCO1/2**	condensation pressure probe (circuit 1,2)
Page 3	**PEV1/2**	evaporation pressure probe (circuit 1,2)
Page 3	**Pun1/2**	single pressure probe (circuit 1,2)

By pressing SET on the label you view the value of the relative mode, by pressing ON/STANDBY you go back to the general menu window. This menu is not protected by password.

6.4.1 LED Meaning

The display offers some icons for viewing of certain unit modes:

The LED warnings are:

LED	COLOUR	DESCRIPTION
☀	GREEN	Hot/winter mode controller LED If on, summer/winter operation (see parameter PH53).
❄	GREEN	Cold/summer mode controller LED If on, summer/winter operation (see parameter PH53); if on and blinking, the free cooling function is active
①	GREEN	LED compressor1/step 1 If on, it means that at least one compressor in the circuit 1 is active; if off, it means that no compressors in the circuit are active; if on and blinking slowly, it means that a compressor in the circuit is in alarm;

		if on and blinking back, it means that a compressor in the circuit is on in manual
	GREEN	LED compressor2 /step 2 If on, it means that at least one compressor in the circuit 2 is active; if off, it means that no compressors in the circuit are active; if on and blinking slowly, it means that a compressor in the circuit is in alarm; if on and blinking back, it means that a compressor in the circuit is on in manual
	GREEN	Hydraulic pump LED If on, it means that a plant pump is active; if off, it means no pumps are active; if on and blinking slowly, it means that a pump is in alarm; if on and blinking fast, it means that a pump is on in manual
	GREEN	Fan LED If on, it means that a fan is active; if off, it means that a fan is active; if on and blinking slowly, it means that a fan is in alarm; if on and blinking fast, it means that a fan is on in manual
	GREEN	LED Heaters If on, it means that the anti-freeze heaters (plant or source) are active; if off, it means no antifreeze heaters are active; if on and blinking slowly, it means that an antifreeze heater is in alarm;
	AMBER	LED for the unit of measurement of the value shown on the bottom display when the probe is configured for temperature
	AMBER	Defrost LED If on, it means that a defrost is active in one of the two circuits; if on and blinking, it means that a dripping is active in one of the two circuits;
	RED	LED communication - BLINK if a communication on the IB or RS485 is underway - OFF otherwise
	RED	Alarm LED If on, it means there are alarms; if on and blinking, it means there are new alarms, not yet viewed; if off, there is no alarm
	RED	Maintenance LED If on, it means that at least one device is in manual operation; if on and blinking, it means that a "device operating hours" alarm is on
	RED	On/stand-by LED If on, it means that the unit is off; if off, it means that the unit is on; if on and blinking slowly, it means that the unit is off from Scheduler; if on and blinking fast, it means that the unit is off from Supervisor or Digital Input
LED Play	AMBER	- ON if the programme is in release mode
	RED	LED for the unit of measurement of the value shown on the top display when the probe is configured for temperature

6.5 General Menu

The general menu doesn't have levels and represents the access point for all the other menus in the system.

EPJgraph / Vgraph Display	LED display
USER	**USEr**
MAINTENANCE	**MAin**
INSTALLER	**InSt**
MANUFACTURER	**CoSt**
RTC	**rTC**
ALARMS	**ALrm**
HISTORY	**HiSt**
None	**StAt**

You can view this menu from any point within the user interface by pressing SET for about two seconds. You can select the menu you want to view from this menu by pressing the UP and DOWN keys followed by the SET key to confirm.
In the upper right corner of the image a "v" appears which represents the active mode.
This indication tells the user that it contains further information that may be viewed by pressing the DOWN key (or the UP based on the direction of the active mode), scrolling to view the content that is not visible on the current page.

6.6 User Menu

The user menu is a Level 1 menu; this means that you must type the User level (or higher) password to be able to view/change the parameters in this branch.

6.7 Maintenance Menu

The maintenance menu is a Level 2 menu; this means that you must type the Maintenance operator level (or higher) password to be able to view/change the parameters in this branch.

EPJgraph / Vgraph Display	LED display
OPERATION	**OPEr**
MANUAL	**MAnU**
CALIBRATION	**CAL**
IN/OUT	**I-O**
PASSWORD	**PSd2**

In this menu you can view the mode of the different devices, inputs, and outputs used by the application.
In this OPERATING menu you can view/enable the functions for the operation of compressors, fans, and pumps. Some examples are represented by the operating hours, by the threshold of maximum hours permitted.
In the MANUAL menu you can set the manual/automatic operation of compressors, pumps, and fans, whose outputs may be forced to test their operation.
In the CALIBRATION menu you can set the corrections to be applied to the analogue outputs to compensate the offsets due to the cabling and the positioning of the probe.
In the I/O MODE menu you can directly view the physical inputs and outputs of the board.

6.8 Installer Menu

The installation menu is a Level 3 menu; this means that you must type the installation level (or higher) password to be able to view/change the parameters in this branch.

EPJgraph / Vgraph Display	LED display
COMPRESSORS	**CoMP**
REGULATION	**rEG**
FANS	**FANS**
DEFROST	**dEFr**
PUMPS	**PuMP**
ANTI-FREEZE	**A-F**
FREE-COOLING	**F-C**
SAFETY DEVICES	**SAFE**
MODBUS	**MdbS**
MISCELLANEOUS	**Par**
SAVE/RESTORE	**MAp**
PASSWORD	**PSd3**

The installation operator menu contains all the parameters on configuration of all the functions (alarms, settings, logic, type of rotation, etc.) of the machine.
In the REGULATION menu you can set the parameters for temperature control of the compressors in the lateral band and in the zero energy band.
In the COMPRESSOR menu you can set the parameters for management of the devices:

- rotation
- timing
- Maximum number of start-ups.

In the FANS menu you can set the parameters relative to condensation pressure control with the fans.
In the DEFROST menu you can set the parameters for activation and duration of heat pump defrost.
In the PUMP menu you can set the parameters for operation and protection of the pumps.
In the ANTI-FREEZE menu you can set the parameters for thermal control of the resistors and control of the anti-freeze alarm.
In the FREE-COOLING menu you can set the parameters for the free-cooling function and its damper.
The SAFETY DEVICE menu contains all the parameters relative to the alarms and management of the safety devices, which protect the refrigerator circuit:

- activations
- delay reports
- type of reset.

In the MODBUS menu you can set the parameters for the Modbus.
The MISCELLANEOUS PARAMETERS menu contains other general parameters for management of the Modbus communications, end of scale values of the transducer, and other configurable activations.
From the SAVE/RESTORE menu you can restore the preset values of all the application's parameters and save them or download them from the programming key or from the controller's internal memory.

6.9 Manufacturer Menu

The configuration menu is a Level 4 menu; this means that you must type the configuration level password to be able to view/change the parameters in this branching. Furthermore, this level may only be accessed with the machine in OFF mode.

EPJgraph / Vgraph Display	LED display
CONFIGURATION	**ConF**
HARDWARE	**H-AI**
	H-dI
	H-AO
	H-dO
EVCM C1-C2	**vCM1**
	vCM2
PASSWORD	**PSd**

This menu lists all the machine's configuration parameters, which determine its operating mode and whose functions must be enabled or disabled.

The CONFIGURATION menu contains the parameters for machine configuration.
The HARDWARE menu lets you configure the unit's I/O.
The ECM menu lets you configure the main parameters of the EVDRIVE03 for each circuit.

6.10 RTC Menu

This menu covers the functions of the Real-Time Clock System, like setting the real-time clock and the daily scheduler (parameters *PTxx*).

6.11 Alarm Menu

This menu lets you view and turn off the alarms.

EPJgraph / Vgraph Display	LED display
Show alarms	**ALrm**
Show history	**HiSt**

The SHOW ALARMS menu shows the active alarms. Every time you press the DOWN key, the next active alarm is shown. If there aren't any alarms, the "NO ALARM" message is shown.
The alarm can be turned off by pressing the SET key for two seconds, when the alarm state is no longer active.
The ALARM HISTORY page shows the last alarm. To view the previous alarms, press the SET key. This operation can be repeated until the first alarm is viewed. The history is viewed in a circular manner.

If you press the ON/STANDBY key, or once 60 seconds have gone by without activating the keys, the main page is shown.

7 LIST OF PARAMETERS

Below is a list of the parameters managed by the application. Every parameter is accompanied by a brief description, the range of its admissible values, the units of measure, the preset value and the menu in which the parameter is contained. Menus are structured based on the following logic:

Menu Code	Menu of Reference	State
OR	RTC Menu	
UT	User menu	
MA	Maintenance Menu	
MA-F	Maintenance Menu	Operation
MA-M	Maintenance Menu	Manual
MA-C	Maintenance Menu	Calibration
MA-IO	Maintenance Menu	Input/Output
IS	Installation Menu	
IS-C	Installation Menu	Compressors
IS-R	Installation Menu	Regulation
IS-F	Installation Menu	Fans
IS-D	Installation Menu	Defrost
IS-P	Installation Menu	Pumps
IS-AF	Installation Menu	Antifreeze
IS-FC	Installation Menu	Free-cooling
IS-S	Installation Menu	Safety devices
IS-M	Installation Menu	Modbus
IS-V	Installation Menu	Miscellaneous
CO	Configuration menu	
CO-W	Configuration menu	Configuration
CO-HW	Configuration menu	Hardware
CO-V	Configuration menu	**EVDRIVE03** circuit 1 and **EVDRIVE03** circuit 2

7.1 List of Configuration Parameters

Code	Parameter description	Preset	Min.	Max.	U.M.	Menu	Notes
	MEN RTC–This menu may be accessed if PG03=1						
PT01	Workday 1 enables zone 1	0	0	1		OR	
PT02	Workday 1 zone 1 start time	0	00:00:00	23:59:59		OR	
PT03	Workday 1 zone 1 end time	0	00:00:00	23:59:59		OR	
PT04	Workday 1 zone 1 cooling offset	0	-20.0	20.0	°C	OR	
PT05	Workday 1 zone 1 heating offset	0	-20.0	20.0	°C	OR	
PT06	Workday 1 enables zone 2	0	0	1		OR	
PT07	Workday 1 zone 2 start time	0	00:00:00	23:59:59		OR	
PT08	Workday 1 zone 2 end time	0	00:00:00	23:59:59		OR	
PT09	Workday 1 zone 2 cooling offset	0	-20.0	20.0	°C	OR	
PT10	Workday 1 zone 2 heating offset	0	-20.0	20.0	°C	OR	

PT11	Workday 2 enables zone 1	0	0	1		OR	
PT12	Workday 2 zone 1 start time	0	00:00:00	23:59:59		OR	
PT13	Workday 2 zone 1 end time	0	00:00:00	23:59:59		OR	
PT14	Workday 2 zone 1 cooling offset	0	-20.0	20.0	°C	OR	
PT15	Workday 2 zone 1 heating offset	0	-20.0	20.0	°C	OR	
PT16	Workday 2 enables zone 2	0	0	1		OR	
PT17	Workday 2 zone 2 start time	0	00:00:00	23:59:59		OR	
PT18	Workday 2 zone 2 end time	0	00:00:00	23:59:59		OR	
PT19	Workday 2 zone 2 cooling offset	0	-20.0	20.0	°C	OR	
PT20	Workday 2 zone 2 heating offset	0	-20.0	20.0	°C	OR	
PT21	Monday schedule 0 = no work day 1 = workday 1 2 = workday 2	1	0	2		OR	
PT22	Tuesday schedule 0 = no work day 1 = workday 1 2 = workday 2	1	0	2		OR	
PT23	Wednesday schedule 0 = no work day 1 = workday 1 2 = workday 2	1	0	2		OR	
PT24	Thursday schedule 0 = no work day 1 = workday 1 2 = workday 2	1	0	2		OR	
PT25	Friday schedule 0 = no work day 1 = workday 1 2 = workday 2	1	0	2		OR	
PT26	Saturday schedule 0 = no work day 1 = workday 1 2 = workday 2	0	0	2		OR	
PT27	Sunday schedule 0 = no work day 1 = workday 1 2 = workday 2	0	0	2		OR	
Level 1	**USER MENU**						
ModE	Set the operating mode: 0: Cold, (chiller/summer) 1: Hot (heat pump/winter)	0	0	1		UT	Modifiable only if the unit is a chiller + heat pump: (PG00=2,4)
SPC1	Set the value of the summer setpoint (chiller)	8.5	PC21	PC22	°C	UT	
SPH1	Set the value of the winter setpoint (heat pump)	44.0	PC23	PC24	°C	UT	
PUC1	Offset for the summer setpoint from digital input	2.0	-20.0	20.0	°C	UT	
PUH1	Offset for the winter setpoint from	-2.0	-20.0	20.0	°C	UT	

	digital input						
PSd1	Change the password at User level.	0	-999	9999		UT	
Level 2	**MAINTENANCE MENU**						
	FUNCTION MODES						
PM00	Set the maximum number of operating hours of the compressors. When this limit is exceeded, the relative alarm goes off.	2000	0	9999	Hours x10	MA-F	
PM01, PM02 PM03 PM04 PM05 PM06	View the number of operating hours of the compressors. A parameter for each compressor.	0	0	9999	Hours x10	MA-F	
PM30	Set the maximum number of operating hours of the pumps. When this limit is exceeded, the relative alarm goes off.	2000	0	9999	Hours x10	MA-F	
PM31	View the number of operating hours of the first pump.	0	0	9999	Hours x10	MA-F	
PM32	View the number of operating hours of the second pump.	0	0	9999	Hours x10	MA-F	
PM33	View the number of operating hours of the first source pump.	0	0	9999	Hours x10	MA-F	
PM34	View the number of operating hours of the second source pump.	0	0	9999	Hours x10	MA-F	
PM40	Set the maximum number of operating hours of the fans. When this limit is exceeded, the relative alarm goes off.	2000	0	9999	Hours x10	MA-F	
PM41	View the number of operating hours of the first fan or inverter in Circuit # 1.	0	0	9999	Hours x10	MA-F	
PM42	View the number of operating hours of the second fan or inverter in Circuit # 2.	0	0	9999	Hours x10	MA-F	
PM43	View the number of operating hours of the free-cooling fan	0	0	9999	Hours x10	MA-F	
PM90	Date of last maintenance job				-	MA-F	
	MANUAL						
PM11, PM12 PM13 PM14 PM15 PM16	Enable manual/automatic operation of the compressor. 0: Auto – normal operation 1: Manu – manual operation One for each compressor.	0	0	1		MA-M	
PM21 PM22 PM23 PM24 PM25 PM26	During manual operation, force the start-up/shutdown of the compressor. 0: turn off compressor (OFF) 1: turn on compressor (ON) One for each compressor.	0	0	1		MA-M	
PM35	Enable manual/automatic operation of	0	0	1		MA-M	

	the pump # 1. 0: Auto – normal operation 1: Manu – manual operation						
PM36	Enable manual/automatic operation of the pump # 2. 0: Auto – normal operation 1: Manu – manual operation	0	0	1		MA-M	
PM37	During manual operation, force the start-up/shutdown of the pump #1	0	0	1		MA-M	
PM38	During manual operation, force the start-up/shutdown of the pump #2	0	0	1		MA-M	
PM45	Enable manual/automatic operation of the pump # 1. 0: Auto – normal operation 1: Manu – manual operation	0	0	1		MA-M	Only for the water/water unit
PM46	Enable manual/automatic operation of the source pump # 2. 0: Auto – normal operation 1: Manu – manual operation	0	0	1		MA-M	Only for the water/water unit
PM47	During manual operation, force the start-up/shutdown of the source pump #1	0	0	1		MA-M	Only for the water/water unit
PM48	During manual operation, force the start-up/shutdown of the source pump #2	0	0	1		MA-M	Only for the water/water unit
PM51	Enable the manual/automatic operation of the condensation fan in Circuit # 1. 0: Auto – normal operation 1: Manu – manual operation	0	0	1		MA-M	
PM52	Enable the manual/automatic operation of the condensation fan in Circuit # 2. 0: Auto – normal operation 1: Manu – manual operation	0	0	1		MA-M	
PM61	During the manual operation, force the start-up/shutdown of the condensation fan in Circuit # 1.	0	0	100	%	MA-M	With PF01=1 (Modulating control)
PM62	During the manual operation, force the start-up/shutdown of the condensation fan in Circuit # 2.	0	0	100	%	MA-M	With PF01=1 (Modulating control)
PM63	During the manual operation, force the start-up/shutdown of the condensation fan in Circuit # 1.	0	0	1		MA-M	With PF01=0 (Single phase control)
PM64	During the manual operation, force the start-up/shutdown of the condensation fan in Circuit # 2.	0	0	1		MA-M	With PF01=0 (Single phase control)
PM65	Enable the manual/automatic operation of the free-cooling fan: 0: Auto – normal operation 1: Manu – manual operation	0	0	1		MA-M	Only for the air/water chillers when PG13>0
PM66	During the manual operation, force the value of the free-cooling fan	0	0	100	%	MA-M	Only for the air/water chillers when PG13=1

PM67	During the manual operation, force the value of the free-cooling fan	0	0	1		MA-M	Only for the air/water chillers when PG13=2
	CALIBRATION						
PM71	External temperature probe calibration	0.0	-10.0	10.0	°C	MA-C	
PM72	Free-cooling input temperature probe calibration	0.0	-10.0	10.0	°C	MA-C	
PM73	Input temperature probe calibration	0.0	-10.0	10.0	°C	MA-C	
PM74	Output temperature probe calibration circuit 1	0.0	-10.0	10.0	°C	MA-C	
PM75	Output temperature probe calibration circuit 2	0.0	-10.0	10.0	°C	MA-C	
PM76	Output source temperature probe calibration circuit 1	0.0	-10.0	10.0	°C	MA-C	
PM77	Output source temperature probe calibration circuit 2	0.0	-10.0	10.0	°C	MA-C	
PM78	Temperature probe calibration of the coil circuit 1	0.0	-10.0	10.0	°C	MA-C	
PM79	Temperature probe calibration of the coil circuit 2	0.0	-10.0	10.0	°C	MA-C	
PM80	Calibration of the temperature probe of the discharge compressors circuit 1	0.0	-10.0	10.0	°C	MA-C	
PM81	Calibration of the temperature probe of the discharge compressors circuit 2	0.0	-10.0	10.0	°C	MA-C	
PM82	Remote auxiliary temperature probe calibration	0.0	-10.0	10.0	°C	MA-C	
PM83	Condensation pressure probe calibration circuit 1	0.0	-20.0	20.0	Bar	MA-C	
PM84	Condensation pressure probe calibration circuit 2	0.0	-20.0	20.0	Bar	MA-C	
PM85	Evaporation pressure probe calibration circuit 1	0.0	-20.0	20.0	Bar	MA-C	
PM86	Evaporation pressure probe calibration circuit 2	0.0	-20.0	20.0	Bar	MA-C	
PM87	Single pressure sensor calibration circuit 1	0.0	-20.0	20.0	Bar	MA-C	
PM88	Single pressure sensor calibration circuit 2	0.0	-20.0	20.0	Bar	MA-C	
PSd2	Change the password at maintenance operator level.	0	-999	9999		MA-F	
Level 3	**INSTALLATION MENU**						
	COMPRESSORS						
PC01	Type of rotation used for compressor management: 0: FIFO 1: LIFO 2: FIFO + hours 3: LIFO + hours	0	0	3		IS-C	
PC02	Enable compressors in the two circuits:	0	0	1		IS-C	Only on the double circuits

	0: Balancing of the circuit 1: Saturation of the circuit						
PC04	Min. period during which the compressor has to stay on, even if switch-off has been requested.	20	0	999	Sec.	IS-C	
PC05	Min. period during which the compressor has to stay off, even if switch-on has been requested.	120	0	999	Sec.	IS-C	
PC06	Min. period that must elapse between two start-ups of the same compressor.	360	0	999	Sec.	IS-C	
PC07	Min. period that must elapse between two start-ups of two different compressors.	360	0	999	Sec.	IS-C	
PC08	Min. period that must elapse between the shutdowns of two different compressors.	180	0	999	Sec.	IS-C	
PC09	Max. number of start-ups per each hour (only for adaptive control).	8	4	12		IS-C	
PC10	Number of compressors per circuit that will be forced in the event of regulation probe alarm.	1	0	PG03		IS-C	
	REGULATION						
PC11	Set the type of control for compressor management: 0: Lateral band 1: Zero energy band	1	0	1		IS-R	
PC12	Proportional band for compressor lateral band control	2.5	1.0	20.0	°C	IS-R	
PC14	Value of the zone for compressor neutral zone control	3.0	PC15	PC16	°C	IS-R	
PC15	Min. value of the compressor zero energy band	1.0	0.1	10.0	°C	IS-R	
PC16	Max. value of the compressor zero energy band	5.0	0.1	10.0	°C	IS-R	
PC17	Enable/release time for the next step of the compressor outside the zero energy band	20	0	999	Sec.	IS-R	
PC18	Enable self-adapting control of the compressor zero energy band	No (0)	No (0)	Yes (1)		IS-R	
PC19	Release time for the subsequent compressor step outside the neutral zone	60	0	999	Sec.	IS-R	
PC21	Min. value of the summer setpoint (chiller)	5.0	-15.0	SPC1	°C	IS-R	
PC22	Max. value of the summer setpoint (chiller)	20.0	SPC1	23.0	°C	IS-R	
PC23	Min. value of the winter setpoint (heat pump)	30.0	23.0	SPH1	°C	IS-R	
PC24	Max. value of the winter setpoint (heat pump)	44.0	SPH1	70.0	°C	IS-R	
PC31	Power limitation for the summer	50	0	100	%	IS-R	
PC32	Power limitation for the winter	50	0	100	%	IS-R	
PC35	Enable forced switch-off of the	No (0)	No (0)	Yes (1)		IS-R	

	compressors						
PC36	Forced summer switch-off setpoint	3.5	-30.0	23.0	°C	IS-R	
PC37	Forced winter switch-off setpoint	52.0	26.0	75.0	°C	IS-R	
PC41	Enable pump-down 0: No 1: Yes, with timing 2: Yes, with relative threshold	1	0	2		IS-R	
PC42	Compressor switch-off time in pump-down	5	0	240	Sec.	IS-R	
PC43	Relative threshold for disabling pump-down	1.5	0.0	5.0	Bar	IS-R	
PC45	Enable high temperature pressure switch control (chiller)	No (0)	No (0)	Yes (1)		IS-R	
PC46	Pressure setpoint for high temperature pressure switch control	27.0	0.0	45.0	Bar	IS-R	
PC47	Pressure differential for high temperature pressure switch control	2.0	0.0	5.0	Bar	IS-R	
PC48	High temperature external threshold for pressure switch control	12.0	-30.0	23.0	°C	IS-R	
PC49	Min. temp to maintain the parcelling of the pressure switch	10	0	99	Min.	IS-R	
PC50	Enable low temperature pressure switch control (heat pump)	No (0)	No (0)	Yes (1)		IS-R	
PC51	Pressure setpoint for low temperature pressure switch control	3.2	0.0	10.0	Bar	IS-R	
PC52	Pressure differential for low temperature pressure switch control	2.0	0.0	10.0	Bar	IS-R	
PC53	Low temperature external threshold for pressure switch control	-5.0	-10.0	5.0	°C	IS-R	
PC54	Output water high-temperature threshold for pressure switch control	48.0	30.0	70.0	°C	IS-R	
PC55	Delay for parcelling of the low-pressure alarm	900	0	999	Sec.	IS-R	
PC61	Summer reversal setpoint	20.0	PC62	70.0	°C	IS-R	
PC62	Winter reversal setpoint	10.0	0.0	PC61	°C	IS-R	
PC64	Max. dynamic offset in comparison to the summer setpoint (chiller)	-10.0	-20.0	20.0	°C	IS-R	
PC65	Start compensation temperature for dynamic summer setpoint	30.0	-15.0	PC66	°C	IS-R	
PC66	End compensation temperature for dynamic summer setpoint	60.0	PC65	70.0	°C	IS-R	
PC67	Max. dynamic offset in comparison to the winter setpoint (heat pump)	10.0	-20.0	20.0	°C	IS-R	
PC68	Start compensation temperature for dynamic winter setpoint	0.0	-15.0	PC69	°C	IS-R	
PC69	End compensation temperature for dynamic winter setpoint	30.0	PC68	70.0	°C	IS-R	
PC70	Operation limit management: 0 = Heat pump only 1 = Auxiliary output 2 = Auxiliary output and heat pump	0	0	2		IS-R	
PC71	Operation limit setpoint	-7.0	-30.0	30.0	°C	IS-R	
PC72	Operation limit differential	4.0	0.1	10.0	°C	IS-R	
PC80	Enable control by Request	No (0)	No (0)	Yes (1)		IS-R	

PC81	Summer Control by Request Setpoint	15.0	-15.0	70.0	°C	IS-R	
PC82	Winter Control by Request Setpoint	45.0	-15.0	70.0	°C	IS-R	
PC83	Summer Control by Request Differential	4.0	0.1	10.0	°C	IS-R	
PC84	Winter Control by Request Differential	4.0	0.1	10.0	°C	IS-R	
PC85	Control by Request Delay	5	0	999	Sec	IS-R	
	FANS						
PF01	Type of condenser control	0	0	1		IS-F	0=Modulating control 1=Single phase control
PF02	Lets you choose whether to enable only in fan control if at least one compressor is on.	Yes (1)	No (0)	Yes (1)		IS-F	
PF03	Establishes whether the fans must be turned off or not during the defrost cycles.	No (0)	No (0)	Yes (1)		IS-F	
PF07	Min. period that must elapse between the start-up of two different fans.	10	0	999	Sec.	IS-F	
PF08	Min. period that must elapse between the shutdowns of two different fans.	20	0	999	Sec.	IS-F	
PF09	Forcing of fans in the event of condensation probe alarm	No (0)	No (0)	Yes (1)		IS-F	With PF01=0 (Single phase control)
PF10	Forcing of fans in the event of condensation probe alarm	0.0	0.0	100.0	%	IS-F	With PF01=1 (Modulating control)
PF11	Condensation control setpoint for summer operation (chiller)	20.0	5.0	45.0	Bar	IS-F	
PF12	Linear control band for condensation in summer operation (chiller)	12.0	0.1	50.0	Bar	IS-F	
PF13	Enable forcing to the maximum	Yes (1)	No (0)	Yes (1)		IS-F	
PF14	Enable forcing in summer operation (chiller) max. setpoint	26.0	15.0	100.0	Bar	IS-F	
PF15	Disable differential for maximum forcing in summer operation (chiller)	2.0	0.1	5.0	Bar	IS-F	
PF16	Integral period for valve control (cooling)	0	0	999	Sec	IS-F	SePF16=0 Full action not present
PF21	Condensation control setpoint in winter operation (heat pump)	9.0	0.5	15.0	Bar	IS-F	
PF22	Linear control band for condensation in winter operation (heat pump)	2.0	0.1	15.0	Bar	IS-F	
PF24	Max. setpoint activation forcing in winter operation (heat pump, inverter)	3.2	0.5	20.0	Bar	IS-F	
PF25	Max. differential deactivation forcing in winter operation (heat pump, inverter)	0.5	0.1	5.0	Bar	IS-F	
PF26	Integral period for valve control (heat pump)	0	0	999	Sec	IS-F	If PF26 = 0 Full action not present
PF27	Min. value for forcing condenser (inverter)	0.0	0.0	100.0	%	IS-F	
PF28	Acceleration time upon fan start-up (inverter)	4	0	999	Sec.	IS-F	
PF31	Lower limit for linear control of condensation (inverter)	30.0	0	PF32	%	IS-F	
PF32	Upper limit for linear control of	100.0	PF31	100.0	%	IS-F	

	condensation (inverter)						
PF33	Enable control below the minimum limit of condensation (inverter)	Yes (1)	No (0)	Yes (1)		IS-F	
PF34	Switch-off differential below the minimum limit of condensation (inverter)	2.0	0.0	5.0	Bar	IS-F	
PF36	Enable pre-ventilation 0: No 1: Only Winter 2: Always	0	0	2		IS-F	
PF38	Pre-ventilation speed	50.0	0.0	100.0	%	IS-F	With PF01=1 (Modulating control)
PF39	Pre-ventilation time	10	0	999	Sec	IS-F	
PF41	Value x1 of the fan linearisation table	25.0	0.0	PF42	%	IS-F	
PF42	Value x2 of the fan linearisation table	50.0	PF41	PF43	%	IS-F	
PF43	Value x3 of the fan linearisation table	75.0	PF42	100.0	%	IS-F	
PF45	Value y1 of the fan linearisation table	25.0	0.0	PF46	%	IS-F	
PF46	Value y2 of the fan linearisation table	50.0	PF45	PF47	%	IS-F	
PF47	Value y3 of the fan linearisation table	75.0	PF46	100.0	%	IS-F	
PF48	Derivative time for valve control (chiller)	0	0	999	Sec.	IS-F	If PF48=0, no derivative action
PF49	Derivative time for valve control heat pump)	0	0	999	Sec.	IS-F	If PF49=0, no derivative action
	DEFROST						Only for the air/water unit
Pd01	Pressure setpoint at the start of defrost	6.0	0.0	Pd02	Bar	IS-D	
Pd02	Pressure setpoint at the end of defrost	12.0	Pd01	45.0	Bar	IS-D	
Pd03	Waiting interval at start of defrost	1200	60	Pd23	Sec.	IS-D	
Pd05	Max. duration of defrost	300	10	600	Sec.	IS-D	
Pd06	Drip duration	120	0	600	Sec.	IS-D	
Pd07	Min. defrost waiting interval after restarting the compressor	60	0	600	Sec.	IS-D	
Pd20	Enable compensation of the defrost cycle	No (0)	No (0)	Yes (1)		IS-D	
Pd21	External air temperature setpoint for defrost compensation start	5.0	Pd22	70.0		IS-D	
Pd22	External air temperature setpoint for defrost compensation end	0.0	-30.0	Pd21		IS-D	
Pd23	Max. waiting interval at end of defrost	3600	Pd03	9600		IS-D	
	PUMPS						
PP01	Pump operation: 0 = Continuous operation 1 = Operation with request from thermostat 2 = Cyclical operation	0	0	2		IS-P	
PP02	ON period in cyclical operation	120	1	999	Sec.	IS-P	
PP03	OFF period in cyclical operation	120	1	999	Sec.	IS-P	
PP04	Min. interval that can elapse between the start-up of the pump and the first compressor	60	1	999	Sec.	IS-P	
PP05	Min. interval that can elapse between circuit and pump switch-off	60	1	999	Sec.	IS-P	
PP07	Pump switch-off during defrost	No (1)	No (0)	Yes (1)		IS-P	

PP08	Difference in the operating hours between the two pumps which request to be exchanged.	4	1	240	Hours	IS-P	
PP09	Pump operation period with low water capacity (flow alarm)	15	0	999	Sec.	IS-P	
PP10	Pump operation period with low water temperature in outflow (antifreeze alarm)	15	0	999	Sec.	IS-P	
PP21	Source pump operation: 0 = Continuous operation 1 = Operation with requests from thermostat 2 = Cyclical operation	0	0	2		IS-P	Only for the water/water unit
	ANTI-FREEZE						
Pr01	Enable the anti-freeze heaters	Yes (1)	No (0)	Yes (1)		IS-AF	
Pr02	Anti-freeze heater setpoint	5.0	Pr05	10.0	°C	IS-AF	
Pr03	Anti-freeze heater differential	2.0	0.1	10.0	°C	IS-AF	
Pr04	Forcing of the anti-freeze heaters with probe error	No (0)	No (0)	Yes (1)		IS-AF	
Pr05	Anti-freeze alarm threshold	3.0	-30.0	Pr02	°C	IS-AF	
Pr06	Antifreeze alarm differential	2.0	0.1	10.0	°C	IS-AF	
Pr11	Enable the anti-freeze heaters on the heat source exchanger	Yes (1)	No (0)	Yes (1)		IS-AF	Only for the water/water unit
Pr12	Anti-freeze heater on heat source exchanger setpoint	5.0	Pr15	10.0	°C	IS-AF	
Pr13	Anti-freeze heater on heat source exchanger differential	2.0	0.1	10.0	°C	IS-AF	
Pr14	Forcing of the anti-freeze heaters with error of probe on heat source exchanger	No (0)	No (0)	Yes (1)		IS-AF	
Pr15	Threshold of anti-freeze alarm on heat source exchanger	3.0	-30.0	Pr12	°C	IS-AF	
Pr16	Anti-freeze alarm on heat source exchanger differential	2.0	0.1	10.0	°C	IS-AF	
	FREE-COOLING						Only for the air/water unit of the chiller
PS01	Enable free-cooling	No (0)	No (0)	Yes (1)		IS-FC	
PS02	Free-cooling modulation band	3.0	0.1	20.0	°C	IS-FC	
PS03	Minimum fan speed	0.0	0.0	PS04	%	IS-FC	
PS04	Maximum fan speed	100.0	PS03	100.0	%	IS-FC	
PS05	Enable free-cooling when the compressors are on	Yes (1)	No (0)	Yes (1)		IS-FC	
PS06	Free-cooling activation differential setpoint	3.0	0.5	10.0	°C	IS-FC	
PS07	Free-cooling activation differential	2.0	0.5	5.0	°C	IS-FC	
PS08	ON/OFF valve hysteresis	0.5	0.1	5.0	°C	IS-FC	
PS09	Three-way valve maximum aperture differential	2.0	0.1	PS02	°C	IS-FC	
PS10	Minimum free-cooling enablement period	30	0	240	Sec	IS-FC	
PS15	Enable condensation parcelling valves in free-cooling	Yes (1)	No (0)	Yes (1)		IS-FC	
PS16	Parcelling valves setpoint	11.0	0.5	20.0	Bar	IS-FC	

PS17	Parcelling valves differential	3.0	0.1	10.0	Bar	IS-FC	
	SAFETY DEVICES						
PA01	Machine start-up capacity alarm delay	10	1	999	Sec.	IS-S	
PA02	Capacity alarm bypass period during normal operation	1	1	999	Sec.	IS-S	
PA03	Number of capacity alarms activated with autoreset before the alarm becomes manual	3	0	9		IS-S	
PA04	Interval of delay for probe error warning	10	0	240	Sec.	IS-S	
PA05	High-temperature alarm threshold during summer operation (chiller)	30.0	10.0	40.0	°C	IS-S	
PA06	Low-temperature alarm threshold during winter operation (heat pump)	15.0	10.0	40.0	°C	IS-S	
PA07	Temperature alarm activation delay	30	1	999	Sec.	IS-S	
PA08	Action taken after temperature alarm: 0 = Warning only 1 = Machine arrest	0	0	1	Sec.	IS-S	
PA09	Temperature alarm rearm differential	0.5	0.1	10.0	°C	IS-S	
PA10	Inhibition of temperature alarm interval from system start-up	15	0	999	Sec.	IS-S	
PA11	Low-pressure alarm threshold during winter operation (heat pump)	3.6	0.1	9.9	Bar	IS-S	
PA12	Low-pressure alarm rearm differential during winter operation (heat pump)	1.0	0.1	4.0	Bar	IS-S	
PA13	Low-pressure alarm bypass interval from first compressor start-up	120	0	999	Sec.	IS-S	
PA14	Number of low-pressure alarms activated with autoreset before the alarm becomes manual	3	0	5		IS-S	
PA16	Enable low-pressure control at start-up and low temperatures	Yes (1)	No (0)	Yes (1)		IS-S	
PA17	Threshold of the low-pressure alarm at start-up and low temperatures	1.0	0.1	9.9	Bar	IS-S	

PA18	Low-pressure alarm rearm differential at start-up and low temperatures	0.5	0.1	4.0	Bar	IS-S	
PA19	Duration of the control upon activation of the low-pressure alarm at low temperatures	120	10	PA13	Sec.	IS-S	
PA20	Min. duration of the delay of the alarm for low-pressure alarm activation at compressor start-up	240	0	999	Sec.	IS-S	
PA21	High-pressure alarm threshold	28.0	0.0	100.0	Bar	IS-S	
PA22	High-pressure alarm rearm differential	5.0	0.1	30.0	Bar	IS-S	
PA23	Low pressure threshold during summer operation (chiller)	3.0	0.1	9.9	Bar	IS-S	
PA24	Low pressure alarm differential during summer operation (chiller)	1.0	0.1	4.0	Bar	IS-S	
PA25	Enable the primary exchanger efficiency alarm	No (0)	No (0)	Yes (1)		IS-S	
PA26	Min. threshold difference for primary exchanger	2.0	0.1	20.0	°C	IS-S	

PA27	Bypass period for primary exchanger efficiency alarm	120	0	999	Sec.	IS-S	
PA30	Enable RTC alarm	Yes (1)	No (0)	Yes (1)		IS-S	
PA31	Set type of rearm for RTC alarm reset 0: Auto - Automatic 1: Manu - Manual	M	A (0)	M (1)		IS-S	
PA32	Set the activation delay for the free-cooling fan's thermal alarm	10	0	999	Sec.	IS-S	
PA33	Set the rearm type for the free-cooling fan's thermal alarm 0: A - Automatic 1: M – Manual	M	A (0)	M (1)		IS-S	
PA40	Enable the alarm for the compressor operating hours	Yes (1)	No (0)	Yes (1)		IS-S	
PA41	Set the activation delay for the compressor's thermal alarm	10	0	999	Sec.	IS-S	
PA42	Set the rearm type for the compressor's thermal alarm 0: A - Automatic 1: M – Manual	M	A (0)	M (1)		IS-S	
PA50	Enable source flow alarm	No (0)	No (0)	Yes (1)		IS-S	Only for the water/water unit
PA51	Source flow alarm delay from machine start-up	10	1	999	Sec.	IS-S	Only for the water/water unit
PA52	Source flow alarm bypass period during normal operation	1	1	999	Sec.	IS-S	Only for the water/water unit
PA53	Minimum water valve aperture to test the flow of the heat source exchanger	5.0%	0.0%	100.0%	%	IS-S	Only for the water/water unit
PA60	Enable the alarm for the pump operating hours	Yes (1)	No (0)	Yes (1)		IS-S	
PA61	Enable the alarm for the source pump operating hours	No (0)	No (0)	Yes (1)		IS-S	Only for the water/water unit
PA62	Set the rearm type for the water pump's thermal alarm 0: Auto - Automatic 1: Manu - Manual	M	A (0)	M (1)		IS-S	
PA63	Set the rearm type for the source water pump's thermal alarm 0: Auto - Automatic 1: Manu - Manual	M	A (0)	M (1)		IS-S	Only for the water/water unit
PA71	Set the rearm type of the high-pressure alarm reset 0: Auto - Automatic 1: Manu - Manual	M	A (0)	M (1)		IS-S	
PA80	Enable the alarm for the condensation fan operating hours	Yes (1)	No (0)	Yes (1)		IS-S	
PA81	Set the activation delay for the condensation fan's thermal alarm	10	0	999	Sec.	IS-S	
PA82	Set the rearm type for the condensation fan's thermal alarm 0: A - Automatic 1: M – Manual	M	A (0)	M (1)		IS-S	
PA85	Circuit 1 Discharge gas high-temperature alarm setpoint	90.0	70.0	140.0	°C	IS-S	
PA86	Circuit 1 Discharge gas high-	20.0	10.0	30.0	°C	IS-S	

	temperature alarm differential						
PA87	Set the activation delay for the discharge gas high-temperature alarm	30	0	999	Sec.	IS-S	
PA88	Set the rearm type for the high-temperature alarm of the discharge gas 0: A - Automatic 1: M – Manual	M	A (0)	M (1)		IS-S	
PA89	Circuit 2 Discharge gas high-temperature alarm setpoint	90.0	70.0	140.0	°C	IS-S	
PA90	Circuit 2 Discharge gas high-temperature alarm differential	20.0	10.0	30.0	°C	IS-S	
PA91	Water level alarm delay from unit start	10	1	999	Sec	IS-S	
PA92	Water level alarm bypass time during the normal operation	1	1	999	Sec	IS-S	
PA93	Water level alarms number with self-resetting before becoming with manul resetting	3	0	9		IS-S	
PA99	Expansion alarm warning delay interval	5	0	999	Sec.	IS-S	
	MODBUS PARAMETERS						
PH11	MODBUS board address	1	1	247		IS-M	
PH12	Transmission speed of the communication board (1=2400, 2=4800, 3=9600, 4=19200)	3	1	4		IS-M	
PH13	ModBus Parity (0=none, 1=Odd, 2=Even)	2	0	2		IS-M	
PH14	Modbus arrest bit (0=1 bit, 1=2 bit)	0	0	1		IS-M	
	MISCELLANEOUS PARAMETERS						
PH01	Set the minimum scale end value for the low-pressure probe.	0.0	-10.0	PH02	Bar	IS-V	
PH02	Set the maximum scale end value for the low-pressure probe.	20.0	PH01	60.0	Bar	IS-V	
PH03	Set the minimum scale end value for the high-pressure probe.	0.0	-10.0	PH04	Bar	IS-V	
PH04	Set the maximum scale end value for the high-pressure probe.	50.0	PH03	45.0	Bar	IS-V	
PH05	Enable start-up/shutdown of the machine by pressing the ESC/Standby key.	Yes (1)	No (0)	Yes (1)		IS-V	
PH06	Enable the winter/summer operating mode change: automatic change.	No (0)	No (0)	Yes (1)		IS-V	
PH07	Enable start-up/shutdown of the machine from a digital input.	No (0)	No (0)	Yes (1)		IS-V	
PH08	Enable the winter/summer operating mode change from a digital input.	No (0)	No (0)	Yes (1)		IS-V	
PH09	Enable start-up/shutdown of the machine with supervisor.	No (0)	No (0)	Yes (1)		IS-V	
PH10	Enable the winter/summer operating mode change with supervisor.	No (0)	No (0)	Yes (1)		IS-V	
PH15	Reset the preset factory parameters.	No (0)	No (0)	Yes (1)		IS-V	Wait for the 0 value to be reread at the end of reset.
PH16	Enable start-up/shutdown of the	No (0)	No (0)	Yes (1)		IS-V	

	machine with scheduler						
PH27	Set enablement of the dynamic setpoint function.	No (0)	No (0)	Yes (1)		IS-V	
PH28	Set enablement of the secondary setpoint function with scheduler.	No (0)	No (0)	Yes (1)		IS-V	
PH30	Delete alarm history	NO (0)	NO (0)	YES (1)	-	IS-V	Set YES (1) and wait for the value NO (0)
PH31	Set the type of coolant used (temperature-pressure conversion) 0: No coolant 1: R22 2: R134a 3: R404A 4: R407C 5: R410A 6: R507	5 R410A	0	6		IS-V	
PH32	Set the temperature measurement unit: 0: ° Celsius 1: ° Fahrenheit	0 (°C)	0	1		IS-V	

PH33	Set the pressure measurement unit: 0: Bar 1: psi	0 (Bar)	0	1		IS-V	
PH52	Enable the EVCO icon	1	0	1		IS-V	
PH53	Set the description of the Summer and Winter icons. 0: Summer = Cooling (chiller mode) Winter = Heating (heat pump mode) 1: Summer = Heating (heat pump mode) Winter = Cooling (chiller mode)	0	0	1		IS-V	
PH90	Language	Eng	Eng	Ita		IS-V	
PH99	CANbus transmission speed: (1=20K; 2=50K; 3=125K; 4=500K)	2 (50K)	1	4		IS-V	
PSd3	Change the password of installation operator level.	0	-999	9999		IS-V	
Level 4	**CONFIGURATION MENU**						
	CONFIGURATION						
PGUT	Setting unit type	10	1	16		CO-W	
PG00	Set the unit type: 1: Air/water chiller 2: Air/water chiller + Heat pump 3: Water/water chiller 4: Water/water chiller + Heat pump	1	1	4		CO-W	
PG01	Number of circuits	2	1	2		CO-W	
PG02	Enable the presence of IO expansion	No (0)	No (0)	Yes (1)		CO-W	
PG03	Set the number of compressors per circuit.	3	1	3		CO-W	
PG04	Enable the Real Time Clock RTC	1	0	1		CO-W	
PG05	Enable the presence of the EVCM modules (1 per circuit)	Yes (1)	No (0)	Yes (1)		CO-W	
PG09	Set the number of pumps.	1	1	2		CO-W	

PG10	Set the number of source pumps (for the water/water unit).	1	1	2		CO-W	Only for the water/water unit
PG11	Enable single condensation: 0: No (2 fans) 1: Yes (1 fan)	No (0)	No (0)	Yes (1)		CO-W	For the water/water unit determines whether there are 1/2 heat source exchangers
PG12	Enable loads single/dual exchanger: 0: No (2) 1: Yes (1)	Yes (1)	No (0)	Yes (1)		CO-W	Determine whether there are 1/2 heat sink exchangers
PG13	Set the air circuit type for free-cooling 0: Single with the condensation 1: Separate with AO fan 2: Separate with DO fan	1	0	2		CO-W	Only for the air/water unit of the chiller
PG14	Enable the single/dual heat source exchanger: 0: No (2) 1: Yes (1)	Yes (1)	No (0)	Yes (1)		CO-W	Determine whether there are 1/2 heat source exchangers
PSd4	Manufacturer level password	0	-999	9999		CO	
	HARDWARE CONFIGURATION NANO+						
HA01 HA02 HA08 HA09	Set the probes linked to the analogue inputs 1, 2, 3, 7, 8, 9 of the controller	3 4 15 13	0	72		CO-HW	See Table Config. AI
HA03 HA04 HA05 HA06 HA07	Set the probes linked to the analogue inputs 4,5,6 of the manufacturer	0 10 0 37 11	0	60		CO-HW	
HA11 HA12 HA13 HA17 HA18 HA19	Set the probes linked to the analogue inputs 1, 2, 3, 7, 8, 9 of the expansion	0	0	72		CO-HW	
HA14 HA15 HA16	Set the probes linked to the analogue inputs 4,5,6 of the expansion	0 0 0	0	60		CO-HW	
HB01 … HB05	Set which digital resources to link to the controller's digital inputs	27 7 31 23 21	0	48		CO-HW	See Table Config. DI
HB06 … HB14	Set which digital resources to link to the expansion's digital inputs	0	0	48		CO-HW	
HC01 HC02 HC03 HC04	They set which analogue resources to connect to the analogue outputs 1, 2, 3, 4 of the controller	8 9 0 0	0	9		CO-HW	See Table Config. AO
HC05 HC06 HC07 HC08	They set which analogue resources to connect to the analogue outputs 1, 2, 3, 4 of the expansion	0	0	9		CO-HW	
HC09	Set which analogue resources to	0	0	6		CO-	

HC10	connect to the analogue outputs 5, 6 of the expansion					HW	
HCF1	Set the frequency of operation of the free-cooling fan's PWM	1000	10	2000	Hz	CO-HW	
HCF2	Set the frequency of operation of the PWM of the fan of circuit 1	1000	10	2000	Hz	CO-HW	
HCF3	Set the frequency of operation of the PWM of the fan of circuit 2	1000	10	2000	Hz	CO-HW	
HD01 … HD07	Set which digital resources to link to the controller's digital outputs	2 12 14 26 20 22 40	0	48		CO-HW	See Table Config. DO
HD08 … HD16	Set which digital resources to link to the expansion's digital outputs	0	0	48		CO-HW	
	ELECTRONIC VALVE MODULES						
	EVDRIVE03 circuit 1						
PV01	SH set-point (1)	6.0	3.0	25.0	K	CO-V	
PV02	LoSH set-point (1)	2.0	1.0	3.0	K	CO-V	
PV03	HiSH set-point (1)	15.0	10.0	40.0	K	CO-V	
PV04	LOP set-point (1)	-40.0	-40.0	40.0	K	CO-V	
PV05	MOP set-point (1)	40.0	-40.0	40.0	K	CO-V	
PV06	PID – proportional band (1)	7.0	1.0	100.0	K	CO-V	
PV07	PID – integral time (1)	120	0	999	sec	CO-V	
PV08	PID – derivative time (1)	120	0	999	sec	CO-V	
PV09	Start-up delay (1)	5	1	255	sec	CO-V	
PV10	Start-up position (1)	50.00	00:00	100.00	%	CO-V	
PV11	SH set-point (2)	6.0	3.0	25.0	K	CO-V	
PV12	LoSH set-point (2)	2.0	1.0	3.0	K	CO-V	
PV13	HiSH set-point (2)	15.0	10.0	40.0	K	CO-V	
PV14	LOP set-point (2)	-40.0	-40.0	40.0	K	CO-V	
PV15	MOP set-point (2)	40.0	-40.0	40.0	K	CO-V	
PV16	PID – proportional band (2)	7.0	1.0	100.0	K	CO-V	
PV17	PID – integral time (2)	120	0	999	sec	CO-V	
PV18	PID – derivative time (2)	120	0	999	sec	CO-V	
PV19	Start-up delay (2)	5	1	255	sec	CO-V	
PV20	Start-up position (2)	50.00	00:00	100.00	%	CO-V	
PV21	Stabilisation period	0	0	255	sec	CO-V	
PV22	Stabilisation position	100.00	00:00	100.00	%	CO-V	
PV23	Operating mode: 0= SH algo 1= Manual	0	0	1		CO-V	
PV24	Manual position	00:00	00:00	100.00	%	CO-V	
PV25	SH parameter setpoint: 0= set1 1= set2	0	0	1		CO-V	
PV26	Relay function:	6	0	8		CO-V	

	0= Disabled 1= Enabled: any alarm 2= Enabled: probe error 3= LoSH alarm 4= MOP alarm 5= valve alarm 6= solenoid valve 7= solenoid valve + alarms 8= resynchronisation						
PV27	Probe type 3: 0= NTC 1= PT1000	0	0	1		CO-V	
PV28	Probe type 4: 0= 4..20mA (0.5 – 8) 1= 4..20mA (0 – 30) 2= 0-5V (0 – 7) 3= 0-5V (0 – 25) 4= 0-5V (0 – 60) 5= scaling	0	0	1		CO-V	
PV29	Probe type 1: 1= PTC 2= NTC 3= 0..20mA 4= 4..20mA 5= 0-5V 6= 0-10V 7= PT1000 8= NTC K2 9= NTC K3	5	1	9		CO-V	
PV30	Probe type 2: 1= PTC 2= NTC 3= 0..20mA 4= 4..20mA 5= 0-5V 6= 0-10V 7= PT1000 8= NTC K2 9= NTC K3	2	1	9		CO-V	
PV31	Offset Ts	0.0	-10.0	10.0	K	CO-V	
PV32	Offset Te	0.0	-10.0	10.0	K	CO-V	
PV33	Minimum neutral zone DSH	4.0	0.0	50.0	K	CO-V	
PV34	Relay logic	N.O. (0)	N.O. (0)	N.C. (1)		CO-V	
PV35	DI1 Logic	N.O. (0)	N.O. (0)	N.C. (1)		CO-V	
PV36	DI2 Logic	N.O. (0)	N.O. (0)	N.C. (1)		CO-V	
PV37	DI3 Logic	N.O. (0)	N.O. (0)	N.C. (1)		CO-V	
PV38	Minimum neutral zone DSH	4.0	0.0	50.0	K	CO-V	
PV39	Negative variation SH above the neutral zone	0.2	0.1	2.0	K	CO-V	
PV40	Positive variation SH below the neutral zone	1.0	0.1	2.0	K	CO-V	
PV73	Delay variation SH outside the neutral zone	5	1	60	Min	CO-V	
PV80	Enable superheating modulating	Yes (1)	No (0)	Yes (1)		CO-V	

	setpoint circuit 1						
PV81	Max. superheating circuit 1	15.0	3.0	25.0	°K	CO-V	
PV82	Min. superheating circuit 1	2.0	1.0	25.0	°K	CO-V	
PV83	Max. discharge superheating circuit 1	35.0	0.0	50.0	°K	CO-V	
PV84	Min. discharge superheating circuit 1	5.0	0.0	50.0	°K	CO-V	
PV90	Enable discharging probe EVDRIVE03 circuit 1	Si (1)	No (0)	Si (1)		CO-V	
PV91	Enable condensing pressure probe EVDRIVE03 circuit 1	Si (1)	No (0)	Si (1)		CO-V	
PV92	Enable evaporating pressure probe EVDRIVE03 circuit 1	Si (1)	No (0)	Si (1)		CO-V	
	EVDRIVE03 circuit 2						
PV41	SH set-point (1)	6.0	3.0	25.0	K	CO-V	
PV42	LoSH set-point (1)	2.0	1.0	3.0	K	CO-V	
PV43	HiSH set-point (1)	15.0	10.0	40.0	K	CO-V	
PV44	LOP set-point (1)	-40.0	-40.0	40.0	K	CO-V	
PV45	MOP set-point (1)	40.0	-40.0	40.0	K	CO-V	
PV46	PID – proportional band (1)	7.0	1.0	100.0	K	CO-V	
PV47	PID – integral time (1)	120	0	999	sec	CO-V	
PV48	PID – derivative time (1)	120	0	999	sec	CO-V	
PV49	Start-up delay (1)	5	1	255	sec	CO-V	
PV50	Start-up position (1)	50.00	00:00	100.00	%	CO-V	
PV51	SH set-point (2)	6.0	3.0	25.0	K	CO-V	
PV52	LoSH set-point (2)	2.0	1.0	3.0	K	CO-V	
PV53	HiSH set-point (2)	15.0	10.0	40.0	K	CO-V	
PV54	LOP set-point (2)	-40.0	-40.0	40.0	K	CO-V	
PV55	MOP set-point (2)	40.0	-40.0	40.0	K	CO-V	
PV56	PID – proportional band (2)	7.0	1.0	100.0	K	CO-V	
PV57	PID – integral time (2)	120	0	999	sec	CO-V	
PV58	PID – derivative time (2)	120	0	999	sec	CO-V	
PV59	Start-up delay (2)	5	1	255	sec	CO-V	
PV60	Start-up position (2)	50.00	00:00	100.00	%	CO-V	
PV61	Stabilisation period	0	0	255	sec	CO-V	
PV62	Stabilisation position	100.00	0.00	100.00	%	CO-V	
PV63	Operating mode: 0= SH algo 1= Manual	0	0	1		CO-V	
PV64	Manual position	0.00	0.00	100.00	%	CO-V	
PV65	SH parameter setpoint: 0= set1 1= set2	0	0	1		CO-V	
PV66	Relay function: 0= Disabled 1= Enabled: any alarm 2= Enabled: probe error 3= LoSH alarm 4= MOP alarm 5= valve alarm 6= solenoid valve 7= solenoid valve + alarms 8= resynchronisation	6	0	8		CO-V	
PV67	Probe type 3:	0	0	1		CO-V	

	0= NTC 1= PT1000						
PV68	Probe type 4: 0= 4..20mA (0.5 – 8) 1= 4..20mA (0 – 30) 2= 0-5V (0 – 7) 3= 0-5V (0 – 25) 4= 0-5V (0 – 60) 5= scaling	0	0	1		CO-V	
PV69	Probe type 1: 1= PTC 2= NTC 3= 0..20mA 4= 4..20mA 5= 0-5V 6= 0-10V 7= PT1000 8= NTC K2 9= NTC K3	5	1	9		CO-V	
PV70	Probe type 2: 1= PTC 2= NTC 3= 0..20mA 4= 4..20mA 5= 0-5V 6= 0-10V 7= PT1000 8= NTC K2 9= NTC K3	2	1	9		CO-V	
PV71	Offset Ts	0.0	-10.0	10.0	K	CO-V	
PV72	Offset Te	0.0	-10.0	10.0	K	CO-V	
PV74	Relay logic	N.O. (0)	N.O. (0)	N.C. (1)		CO-V	
PV75	DI1 Logic	N.O. (0)	N.O. (0)	N.C. (1)		CO-V	
PV76	DI2 Logic	N.O. (0)	N.O. (0)	N.C. (1)		CO-V	
PV77	DI3 Logic	N.O. (0)	N.O. (0)	N.C. (1)		CO-V	
PV78	Minimum neutral zone DSH	4.0	0.0	50.0	K	CO-V	
PV79	Maximum neutral zone DSH	4.0	0.0	50.0	K	CO-V	
PV89	Enable superheating modulating setpoint circuit 2	Yes (1)	No (0)	Yes (1)		CO-V	
PV85	Max. superheating circuit 2	15.0	3.0	25.0	°K	CO-V	
PV86	Min. superheating circuit 2	2.0	1.0	25.0	°K	CO-V	
PV87	Max. discharge superheating circuit 2	35.0	0.0	50.0	°K	CO-V	
PV88	Min. discharge superheating circuit 2	5.0	0.0	50.0	°K	CO-V	
PV93	Enable discharging probe EVDRIVE03 circuit 2	Si (1)	No (0)	Si (1)		CO-V	
PV94	Enable condensing pressure probe EVDRIVE03 circuit 2	Si (1)	No (0)	Si (1)		CO-V	
PV95	Enable evaporating pressure probe EVDRIVE03 circuit 2	Si (1)	No (0)	Si (1)		CO-V	
PV96	Delay variation SH outside the neutral zone	5	1	60	Min	CO-V	
PV97	Negative variation SH above the neutral zone	0.2	0.1	2.0	K	CO-V	
PV98	Positive variation SH below the	1.0	0.1	2.0	K	CO-V	

	neutral zone						

Note: Once the machine's parameters have been configured and every time that the configuration parameters are changed, it is recommended to turn off the machine and restart the system so that the board can configure itself correctly.

7.2 AI Configuration

Below is the table of values for configuration of the positions of the analogue inputs of the controller and the expansion. The analogue inputs may also be configured as digital inputs.

Parameters		**Analogue Input**
HA01-HA02; HA08-HA09 HA11-HA13; HA17-HA19	**HA03-HA07 HA14-HA16**	
0	0	Disabled
1	1	External room temperature
2	2	System input temperature (Free-cooling)
3	3	Heat sink exchanger input temperature
4	4	Heat sink exchanger output temperature Circuit 1
5	5	Heat sink exchanger output temperature Circuit 2
6	6	Heat source exchanger output temperature Circuit 1
7	7	Heat source exchanger output temperature Circuit 2
8	8	Coil temperature Circuit 1
9	9	Coil temperature Circuit 2
10	10	Compressor discharge temperature Circuit 1
11	11	Compressor discharge temperature Circuit 2
12	12	Remote temperature (Storage tank)
13	-	Condensation pressure Circuit 1 (4-20mA)
14	-	Condensation pressure Circuit 1 (0-5V)
15	-	Condensation pressure Circuit 2 (4-20mA)
16	-	Condensation pressure Circuit 2 (0-5V)
17	-	Evaporation pressure Circuit 1 (4-20mA)
18	-	Evaporation pressure Circuit 1 (0-5V)
19	-	Evaporation pressure Circuit 2 (4-20mA)
20	-	Evaporation pressure Circuit 2 (0-5V)
21	-	Single pressure Circuit 1 (4-20mA)
22	-	Single pressure Circuit 1 (0-5V)
23	-	Single pressure Circuit 2 (4-20mA)
24	-	Single pressure Circuit 2 (0-5V)
25-26	13-14	Summer/Winter NC-NO
27-28	15-16	On/Off NC-NO
29-30	17-18	Change setpoint NC-NO
31-32	19-20	Heat sink exchanger flow switch NC-NO
33-34	21-22	Heat source exchanger flow switch NC-NO
35-36	23-24	Pump 1 thermal switch heat sink exchanger NC-NO
37-38	25-26	Pump 2 thermal switch heat sink exchanger NC-NO
39-40	27-28	Pump 1 thermal switch heat source exchanger NC-NO
41-42	29-30	Pump 2 thermal switch heat source exchanger NC-NO
43-44	31-32	Free-cooling external fan thermal switch NC-NO
45-46	33-34	High-pressure Circuit 1 NC-NO
47-48	35-36	Low-pressure Circuit 1 NC-NO
49-50	37-38	Compressor thermal switch 1 NC-NO
51-52	39-40	Compressor thermal switch 2 NC-NO
53-54	41-42	Compressor thermal switch 3 NC-NO

55-56	43-44	Fan thermal switch Circuit 1 NC-NO
57-58	45-46	High-pressure Circuit 2 NC-NO
59-60	47-48	Low-pressure Circuit 2 NC-NO
61-62	49-50	Compressor thermal switch 4 NC-NO
63-64	51-52	Compressor thermal switch 5 NC-NO
65-66	53-54	Compressor thermal switch 6 NC-NO
67-68	55-56	Fan thermal switch Circuit 2 NC-NO
69-70	57-58	Phases sequence NC-NO
71-72	59-60	Water level NC-NO

7.3 DI Configuration

Below is the table of values for configuration of the positions of the digital inputs of the controller and the expansion.

HB01-HB14 Parameters	nano+ Digital Input
0	Disabled
1-2	Summer/Winter NC-NO
3-4	On/Off NC-NO
5-6	Change setpoint NC-NO
7-8	Heat sink exchanger flow switch NC-NO
9-10	Heat source exchanger flow switch NC-NO
11-12	Pump 1 thermal switch heat sink exchanger NC-NO
13-14	Pump 2 thermal switch heat sink exchanger NC-NO
15-16	Pump 1 thermal switch heat source exchanger NC-NO
17-18	Pump 2 thermal switch heat source exchanger NC-NO
19-20	Free-cooling external fan thermal switch NC-NO
21-22	High-pressure Circuit 1 NC-NO
23-24	Low-pressure Circuit 1 NC-NO
25-26	Compressor1 thermal switch NC-NO
27-28	Compressor2 thermal switch NC-NO
29-30	Compressor3 thermal switch NC-NO
31-32	Fan thermal switch Circuit 1 NC-NO
33-34	High-pressure Circuit 2 NC-NO
35-36	Low-pressure Circuit 2 NC-NO
37-38	Compressor thermal switch 4 NC-NO
39-40	Compressor thermal switch 5 NC-NO
41-42	Compressor thermal switch 6 NC-NO
43-44	Fan thermal switch Circuit 2 NC-NO
45-46	Phases sequence NC-NO
47-48	Water level NC-NO

7.4 AO Configuration

Below is the table of values for configuration of the positions of the analogue outputs of the controller and the expansion.

Parameters			Analogue Output
HC01 HC02 HC05 HC06	HC03 HC04 HC07 HC08	HC09 HC10	
0	0	0	Disabled

1	1	1	Free-cooling three-way valve (0-10V)
2	2	2	Free-cooling external fan (0-10V)
3	3	3	Ventilation Circuit 1 (0-10V)
4	4	4	Water valve Circuit 1 (0-10V)
5	5	5	Ventilation Circuit 2 (0-10V)
6	6	6	Water valve Circuit 2 (0-10V)
7	-	-	Free-cooling external fan (PWM)
8	-	-	Ventilation Circuit 1 (PWM)
9	-	-	Ventilation Circuit 2 (PWM)
-	7	-	Free-cooling external fan (4-20mA)
-	8	-	Ventilation Circuit 1 (4-20mA)
-	9	-	Ventilation Circuit 2 (4-20mA)

7.5 DO Configuration (HD01-HD18 parameters)

Below is the table of values for configuration of the positions of the digital outputs of the controller and the expansion.

Parameters HD01-HD18	**Digital Output**
0	Disabled
1-2	Pump 1 plant NC-NO
3-4	Pump 2 plant NC-NO
5-6	Pump 1 source NC-NO
7-8	Pump 2 source NC-NO
9-10	Free-cooling external fan NC-NO (On/Off or Enable)
11-12	Compressor 1 NC-NO
13-14	Compressor 2 NC-NO
15-16	Compressor 3 NC-NO
17-18	Reversing valve Circuit 1 NC-NO
19-20	Ventilation step (enable) Circuit 1 NC-NO
21-22	Solenoid valve Circuit 1 NC-NO
23-24	Coil parcelling valve Circuit 1 (free-cooling) NC-NO
25-26	Anti-freeze heater heat sink exchanger Circuit 1 NC-NO
27-28	Anti-freeze heater heat source exchanger Circuit 1 NC-NO
29-30	Compressor 4 NC-NO
31-32	Compressor 5 NC-NO
33-34	Compressor 6 NC-NO
35-36	Reversing valve Circuit 2 NC-NO
37-38	Ventilation step (enable) Circuit 2 NC-NO
39-40	Solenoid valve Circuit 2 NC-NO
41-42	Coil parcelling valve Circuit 2 (free-cooling) NC-NO
43-44	Anti-freeze heater heat sink exchanger Circuit 2 NC-NO
45-46	Anti-freeze heater heat source exchanger Circuit 2 NC-NO
47-48	Free-cooling On/Off valve NC-NO
49-50	General alarm NC-NO

8 REGULATIONS

8.1 Machine State

There are various procedures for turning the machine on and off:

1) use the designated ON/OFF key (this function is enabled with the PH05 parameter).
   Switch-on – Press the designated key for about 2 seconds: if all the other enabled functions are present, the machine turns on. Switch-off – Press the designated key for about 2 seconds: the machine turns off.

2) use the ON/OFF command from the digital input (this function is enabled with the PH07 parameter).
   Switch-on – Closes the ON/OFF remote contact; if all the other enabled functions are present, the machine turns on.
   Switch-on – If the ON/OFF remote contact is open, the machine "turns off from the digital input" indicated by "OFF D".

3) use the supervision protocol (this function is enabled with the PH09 parameter).
   Switch-on – Using the protocol, activate the ON status: if all other functions enabled are present, the machine switches on. Switch-off – If the protocol deactivates the ON status, the machine "switches off from supervision protocol", which is indicated by "OFF S".

4) use a programme (this function is enabled with the PH16 parameter).
   Switch-on – If the date and time of the RTC indicate an ON statues: if all the other functions enabled are present, the machine switches on. Switch-off – If the date and time of the RTC indicate an OFF status, the machine switches off.

The OFF status from digital input, supervision protocol, and programme are only accessible if the machine has been enabled by pressing the key.
The ON/OFF key of the machine is the ON/STANDBY key.

8.2 Type of Unit

With the machine in OFF status, using the ***PGUT*** parameter from the MANUFACTURER/CONFIGURATION menu, you can select the type of unit to use. The control and the other parameters that correspond to the different functions must be changed manually based on the requirements of the user. The preset dual circuit units do not have the expansion. To use it, just enable it (PG02=1) and configure one or more of the I/O available).

Below we list some examples of machines managed, together with the respective input and output configurations.

8.2.1 Water/water and air/water chillers with EVDRIVE03

	PGUT=1 and 5 (1 Circuit)	**PGUT=9 and 13 (2 Circuit)**
Analogue inputs Controller		
A/I 1	Heat sink exchanger input temperature	Heat sink exchanger input temperature
A/I 2	Heat sink exchanger output temperature C1	Heat sink exchanger output temperature C1
A/I 3	Not used	Not used
A/I 4	Not used	Not used
A/I 5	Not used	Not used
A/I 6	Not used	Not used
A/I 7	Not used	Not used
A/I 8	Not used	Not used
A/I 9	Not used	Not used
Analogue inputs EVDrive03 circuit 1		
A/I 1 VCM1	Condensation pressure C1 (4-20mA)	Condensation pressure C1 (4-20mA)
A/I 2 VCM1	Compressor discharge temperature C1	Compressor discharge temperature C1
A/I 3 VCM1	Compressor intake temperature C1	Compressor intake temperature C1
A/I 4 VCM1	Evaporation pressure C1 (4-20mA)	Evaporation pressure C1 (4-20mA)
Analogue inputs EVDrive03 circuit 2		
A/I 1 VCM2	*None*	Condensation pressure (4-20mA) C2
A/I 2 VCM2	*None*	Compressor discharge temperature C2
A/I 3 VCM2	*None*	Compressor intake temperature C2
A/I 4 VCM2	*None*	Evaporation pressure (4-20mA) C2
Digital Inputs Controller		
D/I 1	On/Off (NC)	On/Off (NC)
D/I 2	Heat sink exchanger flow switch (NC)	Heat sink exchanger flow switch (NC)
D/I 3	Fan thermal switch C1 (NC)	Fan thermal switch C1 (NC)
D/I 4	Thermal switch pump 1 plant (NC)	Thermal switch pump 1 plant (NC)
D/I 5	Not used	Fan thermal switch C2 (NC)

Digital inputs EVDRIVE03 circuit 1		
D/I 1 VCM1	High pressure C1	High pressure C1
D/I 2 VCM1	Low pressure C1	Low pressure C1
D/I 3 VCM1	Compressor 1 thermal switch	Compressor1 thermal switch
Digital inputs EVDRIVE03 circuit 2		
D/I 1 VCM2	*None*	High pressure C2
D/I 2 VCM2	*None*	Low pressure C2
D/I 3 VCM2	*None*	Compressor 4 thermal switch
Analogue Outputs Controller		
A/O 1	VentilationC1 (PWM)	Ventilation C1 (PWM)
A/O 2	*Not used*	Ventilation C2 (PWM)
A/O 3	*Not used*	*Not used*
A/O 4	*Not used*	*Not used*
Digital Outputs Controller		
D/O 1	Pump 1 plant (NO)	Pump 1 plant (NO)
D/O 2	Compressor 1 (NO)	Compressor 1 (NO)
D/O 3	Compressor 2 (NO)	Compressor 4 (NO)
D/O 4	Anti-freeze heater plant C1 (NO)	Anti-freeze heater plant C1 (NO)
D/O 5	Ventilation C1 (Enable) (NO)	Ventilation C1 (Enable) (NO)
D/O 6	Compressor 3 (NO)	Ventilation C2 (Enable) (NO)
D/O 7	*Not used*	*Not used*
Digital Outputs EVDRIVE03 circuit 1		
D/O VCM 1	Solenoid valve C1	Solenoid valve C1
Digital Outputs EVDRIVE03 circuit 2		
D/O VCM 2	None	Solenoid valve C2

8.2.2 Water/water and air/water chillers (NO EVDRIVE03)

	PGUT=2 and 6 (1 Circuit)	**PGUT=10 and 14 (2 Circuits)**
Analogue inputs Controller		
A/I 1	Heat sink exchanger input temperature	Heat sink exchanger input temperature
A/I 2	Heat sink exchanger output temperature Circuit 1	Heat sink exchanger output temperature Circuit 1
A/I 3	Not used	Not used
A/I 4	Compressor discharge temperature C1	Compressor discharge temperature C1
A/I 5	Not used	Not used
A/I 6	Compressor thermal switch 1 (NC)	Compressor thermal switch 1 (NC)
A/I 7	Thermal switch pump 1 plant (NC)	Compressor discharge temperature C2
A/I 8	Not used	Condensation pressure C2 (4-20mA)
A/I 9	Pressure pressure C1 (4-20mA)	Condensation pressure C1 (4-20mA)
Digital Inputs Controller		
D/I 1	On/Off	Compressor thermal switch 2 (NC)
D/I 2	Heat sink exchanger flow switch (NC)	Heat sink exchanger flow switch (NC)
D/I 3	Fan thermal switch C1 (NC)	Fan thermal switch C1 (NC)
D/I 4	Low pressure C1 (NC)	Low pressure C11 (NC)
D/I 5	High pressure C1 (NC)	High pressure C1 (NC)

Analogue Outputs Controller		
A/O 1	VentilationC1 (PWM)	VentilationC1 (PWM)
A/O 2	*Not used*	Not used
A/O 3	*Not used*	*Not used*
A/O 4	*Not used*	*Not used*
Digital Outputs Controller		
D/O 1	Pump 1 plant (NO)	Pump 1 plant (NO)
D/O 2	Compressor 1 (NO)	Compressor 1 (NO)
D/O 3	*Not used*	Compressor 4 (NO)
D/O 4	Anti-freeze heater plant C1 (NO)	Anti-freeze heater plant C1 (NO)
D/O 5	Ventilation C1 (Enable) (NO)	Ventilation (Enable) (NO)
D/O 6	Solenoid valve C1 (NO) (NO)	Solenoid valve C1
D/O 7	*Not used*	Solenoid valve C2

8.2.3 Water/water and air/water heat pump with EVDRIVE03

	PGUT=3 and 7 (1 Circuit)	**PGUT=11 and 15 (2 Circuits)**
Analogue inputs Controller		
A/I 1	Heat sink exchanger input temperature	Heat sink exchanger input temperature
A/I 2	Heat sink exchanger output temperature Circuit 1	Heat sink exchanger output temperature Circuit 1
A/I 3	External room temperature	External room temperature
A/I 4	Not used	Not used
A/I 5	Not used	Not used
A/I 6	Not used	Not used
A/I 7	Not used	Not used
A/I 8	Not used	Not used
A/I 9	Not used	Not used
Analogue inputs EVDrive03 circuit 1		
A/I 1 VCM1	Condensation pressure C1 (4-20mA)	Condensation pressure C1 (4-20mA)
A/I 2 VCM1	Compressor discharge temperature C1	Compressor discharge temperature C1
A/I 3 VCM1	Compressor intake temperature C1	Compressor intake temperature C1
A/I 4 VCM1	Evaporation pressure C1 (4-20mA)	Evaporation pressure C1 (4-20mA)
Analogue inputs EVDrive03 circuit 2		
A/I 1 VCM2	*None*	Condensation pressure (4-20mA) C2
A/I 2 VCM2	*None*	Compressor discharge temperature C2
A/I 3 VCM2	*None*	Compressor intake temperature C2
A/I 4 VCM2	*None*	Evaporation pressure (4-20mA) C2

Digital Inputs Controller		
D/I 1	On/Off (NC)	On/Off
D/I 2	Heat sink exchanger flow switch (NC)	Heat sink exchanger flow switch (NC)
D/I 3	Fan thermal switch C1 (NC)	Fan thermal switch C1 (NC)
D/I 4	Compressor thermal switch 1 (NC)	Thermal switch pump 1 plant (NC)
D/I 5	Summer/Winter (NC)	Summer/Winter (NC)
Digital inputs EVDRIVE03 circuit 1		
D/I 1 VCM1	High pressure C1	High pressure C1
D/I 2 VCM1	Low pressure C1	Low pressure C1
D/I 3 VCM1	Compressor 1 thermal switch	Compressor1 thermal switch
Digital inputs EVDRIVE03 circuit 2		
D/I 1 VCM2	*None*	High pressure C2
D/I 2 VCM2	*None*	Low pressure C2
D/I 3 VCM2	*None*	Compressor 4 thermal switch
Analogue Outputs Controller		
A/O 1	VentilationC1 (PWM)	Ventilation C1 (PWM)
A/O 2	*Not used*	Not used
A/O 3	*Not used*	*Not used*
A/O 4	*Not used*	*Not used*
Digital Outputs Controller		
D/O 1	Pump 1 plant (NO)	Pump 1 plant (NO)
D/O 2	Compressor 1 (NO)	Compressor 1 (NO)
D/O 3	Compressor 2 (NO)	Compressor 4 (NO)
D/O 4	Anti-freeze heater plant C1 (NO)	Anti-freeze heater plant C1 (NO)
D/O 5	Ventilation C1 (Enable) (NO)	Ventilation C1 (single - Enable) (NO)
D/O 6	*Not used*	Reversing valve C2 (NO)
D/O 7	Reversing valve C1 (NO)	Reversing valve C1 (NO)
Digital Outputs EVDRIVE03 circuit 1		
D/O VCM 1	Solenoid valve C1	Solenoid valve C1
Digital Outputs EVDRIVE03 circuit 2		
D/O VCM 2	*None*	Solenoid valve C2

8.2.4 Water/water and air/water heat pump no EVDRIVE03

	PGUT=4 and 8 (1 Circuit)	**PGUT=12 and 16 (2 Circuits)**
Analogue inputs Controller		
A/I 1	Heat sink exchanger input temperature	Heat sink exchanger input temperature
A/I 2	Heat sink exchanger output temperature Circuit 1	Heat sink exchanger output temperature Circuit 1
A/I 3	External room temperature	Not used
A/I 4	Compressor discharge temperature C1	Not used
A/I 5	Coil temperature C1	Coil temperature C1
A/I 6	Compressor thermal switch 1 (NC)	Compressor thermal switch 1 (NC)
A/I 7	Summer/Winter (NC)	Coil temperature C2
A/I 8	Evaporation pressure C1 (4-20mA)	Single pressure C1 (4-20mA)
A/I 9	Condensation pressure C1 (4-20mA)	Single pressure C2 (4-20mA)

Digital Inputs Controller		
D/I 1	On/Off	Compressor thermal switch 2 (NC)
D/I 2	Heat sink exchanger flow switch (NC)	Heat sink exchanger flow switch (NC)
D/I 3	Fan thermal switch C1 (NC)	Fan thermal switch C1 (NC)
D/I 4	Low pressure C1 (NC)	Low pressure C1 (NC)
D/I 5	High pressure C1 (NC)	High pressure C1 (NC)
Analogue Outputs Controller		
A/O 1	VentilationC1 (PWM)	Single ventilation (PWM)
A/O 2	*Not used*	*Not used*
A/O 3	*Not used*	*Not used*
A/O 4	*Not used*	*Not used*
Digital Outputs Controller		
D/O 1	Pump 1 plant (NO)	Pump 1 plant (NO)
D/O 2	Compressor 1 (NO)	Compressor 1 (NO)
D/O 3	*Not used*	Compressor 2 (NO)
D/O 4	Anti-freeze heater plant C1 (NO)	Anti-freeze heater plant C1 (NO)
D/O 5	Ventilation C1 (Enable) (NO)	Single ventilation (Enable) (NO)
D/O 6	Solenoid valve C1 (NO)	Reversing valve C2 (NO)
D/O 7	Reversing valve C1 (NO)	Reversing valve C1 (NO)

WARNING! When you change type of machine, it's necessary to disconnect from the mains and then supply the tool with power again, to allow the unit to correctly configure itself so that the board can assign all the relevant parameters. It is recommended to wait a few seconds (three seconds are more than enough), before reconnecting the unit to the mains.

8.3 Configuration of the Circuits

If there is a dual circuit of the coolant (*PG01=2*), it's necessary to set certain basic functions:

1. single or dual condensation unit (parameter *PG11*)

This configuration has an effect on:

- condenser control - in the event of a single fan, the control is based on maximum value of condenser pressure/temperature.
- heat pump unit during defrost control – in the event of single fan, it's not possible to perform defrost of each circuit separately.

2. In the event of control of the ZERO ENERGY BAND (*PC11=1*), the control of the compressor is based on the average value of the two output evaporation temperature probes. Using parameter *PC02* you can select the distribution of the cooling steps requested when you control the two compressor circuits:
    a. *PC02=0*i 2 circuits are balanced
    b. *PC02=1*saturates the steps of a circuit, before sending a request to the other.

3. If no compressors are in operation, the two evaporation temperature probes will decide which compressor circuit will start up first
    a. If *mode=Cold(chiller)*, the circuit with the higher output evaporation temperature will start first
    b. If *mode=Hot(heat pump)*, the circuit with the lower output evaporation temperature will start first

4. Single or separate evaporation (*PG12*)
    In the event of single evaporation (*PG12=1*), management, resistors and anti-freeze alarm are single. The control is performed by reading the value of the highest temperature of the two output probes.
    With single evaporation, the resistors and the antifreeze alarm activated are always those relative to the Circuit # 1, Circuit # 2 is not controlled.

8.4 Operating Mode Control

The operating mode can take on the following values:

"MOdE" Parameter	Operation mode	Description
0 = Cold	Chiller	Summer mode
1 = Hot	Heat pump(*)	Winter operation

(*) The operation of the heat pump is possible only if the machine has been configured as *chiller+* heat pump (parameter PG00=2,4).

If the machine is only configured as a chiller *(parameter PG00=1,3)*, the parameter *MOdE* cannot be modified, so the operating mode is fixed on 0 (that is, **Cold**).

There are different procedures that allow configuration of the operating mode of the machine:

With the *MOdE* **parameter**, accessible from the user menu.

Setting – Position yourself on the parameter, then press the SET key, change the value using the UP and DOWN keys. Confirm by pressing SET again: the corresponding icon will confirm that the change has been made successfully.

Using the **Summer/Winter command from the digital input** (this function is enabled with the *PH08* parameter).

Setting – With the contact open, the unit is set for winter operation, while with the contact closed, for summer operation. The reversal of the digital input makes the unit switch off, changes its operating mode, and then turns the unit back on.

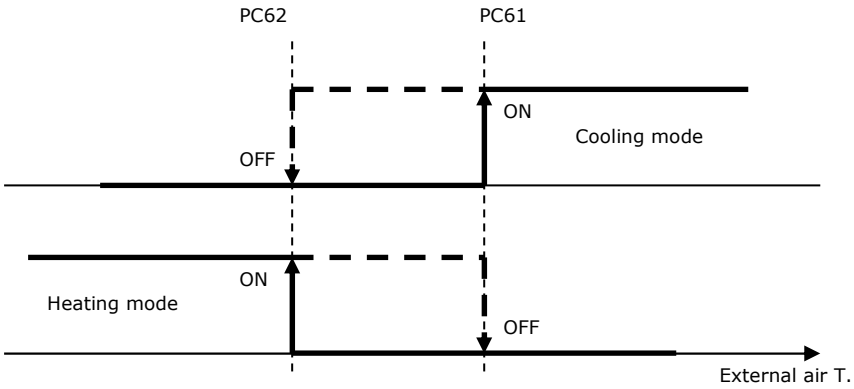
Using a **supervision protocol** (this function is enabled with the PH10 parameter).

Setting – Send the operating mode change command from the protocol: the icon relative to the operating mode will confirm that the change has successfully been made.

Using the **Change** automatic function (this function is enabled with the *PH06* parameter).

Setting – When the value of the external air temperature is higher than the *Summer reversal setpoint PC61*, the unit reverses into summer operating mode. Vice versa, when the value of the external air temperature is lower than the *Winter reversal setpoint PC62*, the unit reverses into winter operating mode.

To enable this function, you must enable the external air temperature probe.



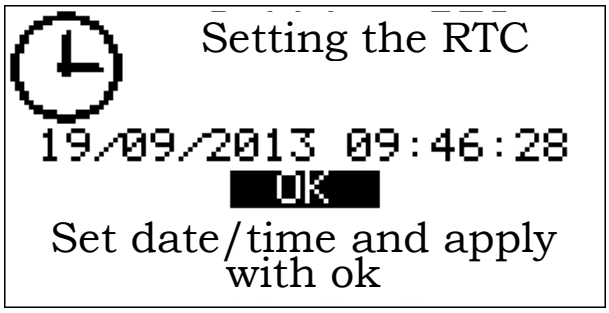
WARNING – Change of operating mode can also take place while the machine is on: in this case, the machine turns off by itself – in its own time – then it reverses and then it turns back on automatically.

Note: During reversal, the high and low temperature controls are enabled.

Note: Reversal is disabled during defrost cycles.

8.5 Setting the RTC

If the controller is not connected to the mains for several days, the RTC (Real-Time Clock) System clock loses its settings. When the power is supplied again, you have to reset the RTC alarm (enabled by PA30=1) and set the correct date and time. In this case, when the machine is started up, the "Set RTC" screen appears to set the time.
After having configured the clock, press **OK** to update the RTC time. The main application page will be shown. Press **OK** to confirm clock alarm (ERTC) reset.



You access the SEt rtc menu on the LED display
day and month are shown on the top display and hour and minute on the bottom display
If you want to change the date, press the Set key:
set the day of the month; press the Set key
set the month; press the Set key
set the year; press the Set key
set the hour; press the Set key
set the minute; press the Set key

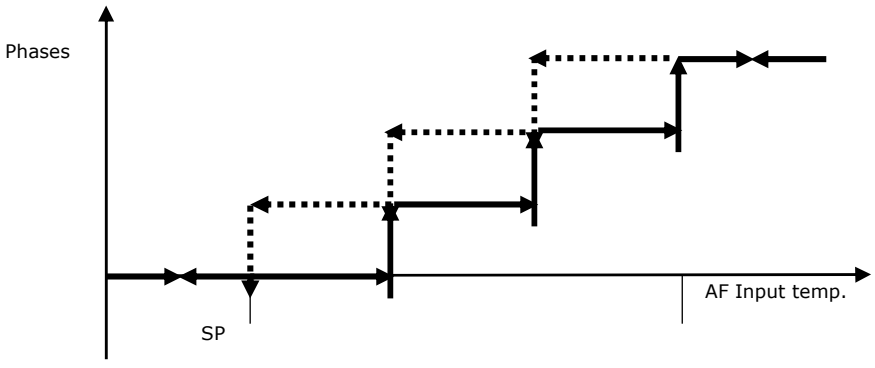
If the alarm doesn't disappear: connect and disconnect the controller from the mains and then manually reset the alarm.
Note: This function is enabled only if parameter *PG04=1*, that is if the system's clock is enabled.

8.6 Compressor Control

The control of water temperature (air/water or water/water machine) takes place with the control of the mechanical components, that is, compressors and/or fans. There are two types of control: lateral band control when you enter the input water temperature and zero energy band control on the output water temperature.

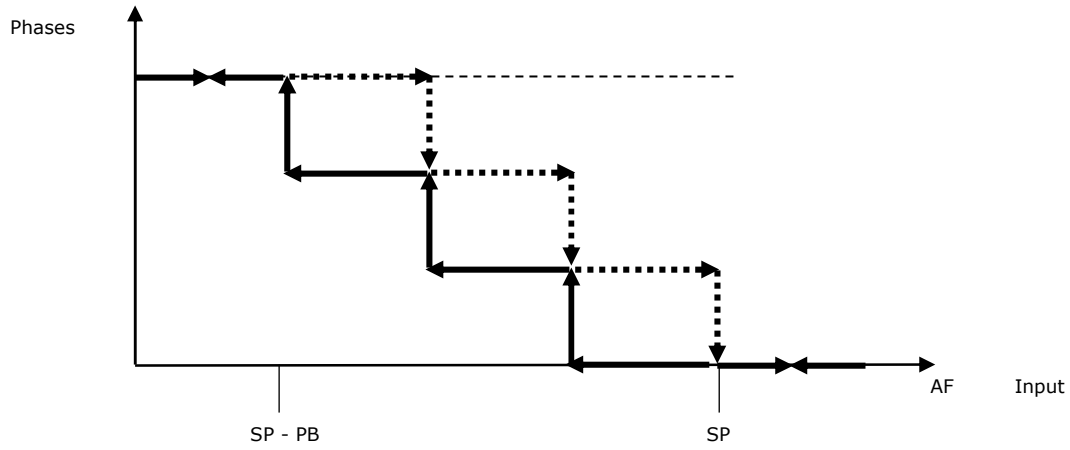
8.6.1 Lateral Band (LB) Control

The lateral band control is a function of proportional control. The temperature of the cold air is controlled by switching the compressors on and off.
The figure below shows the behaviour of lateral band control (setpoint, setpoint + proportional band) in the event of summer operation (chiller). The number of compressors (steps) increases or decreases in function of the input water temperature. In this control mode, the entire band is moved above the setpoint.



Mode = Operating mode (0 = summer)
SPC1 = Summer LB setpoint
PC11 = Type of control (0 = Lateral band)
PC12 = Proportional band
PC21 = Lower limit chiller setpoint
PC22 = Upper limit chiller setpoint

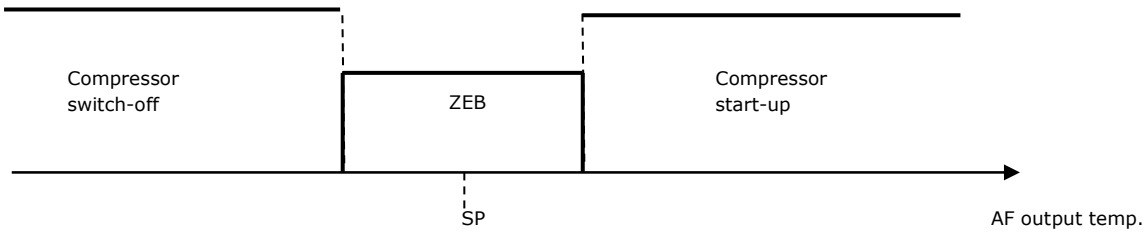
Vice versa, in the winter operating mode (heat pump), the entire band is moved below the setpoint:



Mode = Operating mode (1 = winter)
SPH1 = Winter setpoint LB
PC11 = Type of control (0 = Lateral band)
PC12 = Proportional band
PC23 = Lower limit heat pump setpoint
PC24 = Upper limit heat pump setpoint

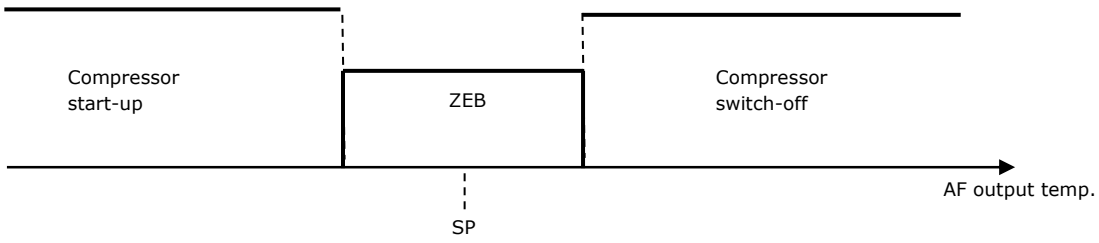
8.6.2 Zero energy band (ZEB) Control

This type of control requires definition of a zero energy band (ZEB) around the set point. In the zero energy band, the compressors will not be turned on or turned off.
If the output temperature of the AF is outside the zero energy band, the compressors activate/deactivate to bring the output temperature of the AF within the zero energy band.
The switch-on/switch-off requests for the various power steps provided by the compressors in the summer operating mode (chiller) follow this logic:
Switch-on: when the output temperature of the AF exceeds the zero energy band.
Switch-off: when the output temperature of the AF falls back within the zero energy band.



Mode = Operating mode (0 = summer)
SPC1 = Summer setpoint NZ
PC11 = Type of control (1 = zero energy band)
PC 14 = Zero energy band
PC17 = Extra time for outside zone request
PC19 = Release time for neutral zone
PC21 = Lower limit chiller setpoint
PC22 = Upper limit chiller setpoint

The switch-on/switch-off requests for the various power steps provided by the compressors in the winter operating mode (heat pump) follow this logic:
Switch-on: when the output temperature of the AF is below the zero energy band.
Switch-off: when the output temperature of the AF exceeds the zero energy band.



Mode = Operating mode (1 = winter)
SPH1 = Winter setpoint NZ
PC11 = Type of control (1 = zero energy band)
PC 14 = Zero energy band
PC17 = Extra time for outside zone request
PC19 = Release time for neutral zone
PC23 = Lower limit heat pump setpoint
PC24 = Upper limit heat pump setpoint

8.6.3 Self-adapting Control

If the CHW leaving temperature still remains outside the zero energy band, even after the extra-time interval set in parameter PC17 has elapsed or the interval set in parameter PC19, the switching ON or OFF of a further power step will be requested.
The setting of parameter *PC18 = 1* activates a self adapting control function of the output temperature in which the zero energy band is calculated in a way so as to take into account the dynamic properties of the system and the load variations. Specifically, the zero energy band can vary taking into consideration the compressor timing and number of start-ups per hour. In this case, the value of parameter PC14 (zero energy band) only makes sense upon unit start-up, while it will be recalculated – within the minimum limit PC15 and the maximum limit PC16 – to "adapt" to an intermediate operating circumstance, if compared to the maximum number of hourly start-ups (parameter PC09).

PC09 = maximum number of hourly start-ups
PC14 = Zero energy band
PC15 = minimum limit
PC16 = maximum limit
PC17 = extra time for outside zone request
PC18 = enables self adapting control
PC19 = Release time for neutral zone

Note: In the event of a dual circuit system (*PG01=2*), the control is done *on the average value of the two output water temperature probes*.
If a probe doesn't work, the control is performed by the probe that is intact.
If both probes don't work, it is not possible to perform the control. Parameter PC10 defines the number of compressors that will be activated in each circuit.

8.7 Compressor Management

The programme is capable of managing up to a maximum of three compressors of equal power per circuit, so six compressors in total. Each compressor has a digital input for the protection devices and a digital output for switch-on/switch-off.
The compressors are regulated by the lateral band or zero energy band control (see last chapter) for that which concerns their timing.

8.7.1 Compressor State

The state of each compressor is shown in the HMI operator. A compressor can have the following states:
Disabled: The compressor has not been configured, the display shows "**-**".

On: The state display shows"ON".
Awaiting switch-on: The compressor waits for the protection periods to elapse before switching on. The state display shows "ON".
Off: The state display shows "OFF".
Awaiting switch-off: The compressor waits for the protection periods to elapse before switching off. The state display shows "OFF".
Alarm: The compressor is in alarm. The state display shows "ALARM".
Manual: The compressor is in manual operating mode. The state display shows "MANUAL".
In the maintenance operator menu, with parameters *PM01, PM02, PM03, and PM04*, you can read the number of operating hours of the relative compressors. To zero out these hours, you can type the value "0" using the SET key.

8.7.2 Compressor Rotation

The rotation of the compressors is a procedure that allows for balancing – to the extent possible – of the number of operating hours and start-ups of each compressor.
In the event of dual circuits, the rotation must balance the operating hours of both circuits. The rotation does not concern any compressor in the state of alarm or manual operating mode, and can dynamically switch on other compressors if one or more compressors should be in alarm state.
With parameter *PC01*, the programme can manage four types of rotation: FIFO, LIFO, FIFO + number of hours, LIFO + number of hours.

1. FIFO

This method follows the *"First In First Out"* logic, that is, the first compressor that turns on must be the first to turn off. This operation logic could initially entail a huge difference in the number of operating hours between the various compressors, but after the initial phase, the hours should be more or less equal.
This type of rotation has a particular characteristic in cases when not all compressors configured in the system are on; in fact, if for example you switch on and then the switch off the first compressor, the next compressor to switch on will be the second. The last compressor to turn off is stored in the memory, then the next compressor in the sequence switches on in order to keep from always using the same compressor, thus taking best advantage of all configured elements.

2. LIFO

This method follows the *"Last In First Out" logic*, that is, the last compressor to be SWITCHED ON will be the first to be SWITCHED OFF.

3. FIFO + number of operating hours

This type of rotation favours comparison of the number of operating hours of the different compressors. Upon switch-on, the compressor with the least number of operating hours will be given precedence, while upon switch-off precedence will be given to the compressor with the greatest number of hours.
If it's necessary to choose between compressors with the same number of operating hours, a FIFO rotation is activated to guarantee rotation in any event, also in the presence of the same number of hours (see the FIFO case above).

4. LIFO + number of operating hours

This type of rotation favours comparison of the number of operating hours of the different compressors. Upon switch-on, the compressor with the least number of operating hours will be given precedence, while upon SWITCH OFF precedence will be given to the compressor with the greatest number of hours.

If it's necessary to choose between compressors with the same number of operating hours, a classic LIFO rotation is activated.
On dual circuit machines you can decide – based on parameter *PC02* – in what way the steps requested by the thermal control must be shared by the two circuits:

PC02 = 0. Circuit balancing: the system requires one step per circuit alternately, so as to balance the loads between the two circuits, as long as no alarms have gone off.
PC02 = 1. Circuit Saturation: the system requests all steps available from the first circuit, and then all those available from the second circuit so that there is always a circuit with full load, as long as no alarms have gone off.

8.7.3 Pump-down Switch-off Procedure

On the machines with power supply above a certain limit and in which there is a substantial quantity of coolant, the pump-down procedure is necessary to partially empty the evaporator of excess coolant. Thus, the solenoid valve located at the start of the relative

evaporator is controlled so that the compressor remains on for the time interval *Compressor switch-off delay in pump-down* (parameter *PC42*). The solenoid valve opens in the same instant the compressor starts up. To enable this function, you must set the following parameters:

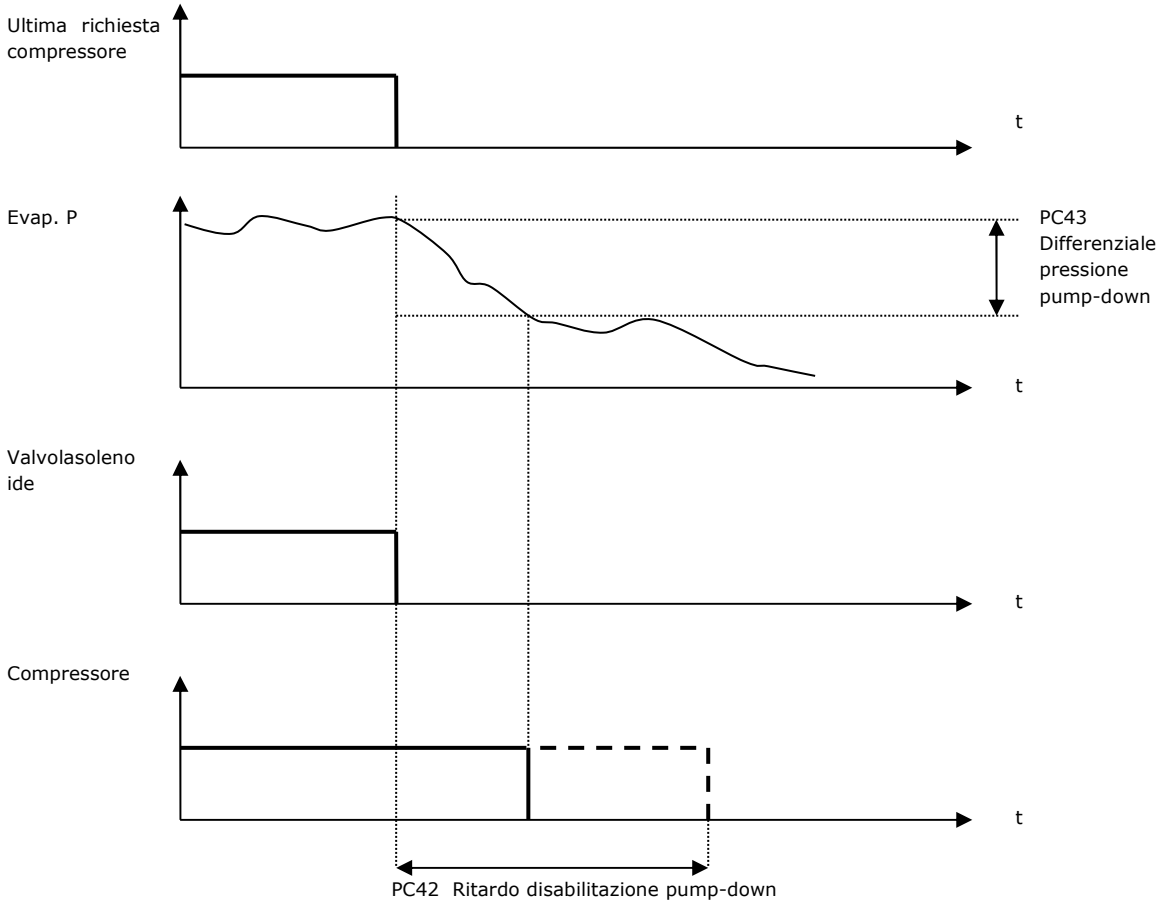
PC41 = 1. Enable function

PC42: Pump-down time

Note: In the event of an alarm, the system must ignore the compressor switch-off delay.

8.7.4 Relative Pump-down Threshold

If low pressure transducers are available, you can perform the pump-down procedure by leaving the compressor on just for the time needed to properly discharge part of the coolant. At the end of the last compressor's request to be turned on by the relevant evaporator, the value of the evaporation pressure is memorised, the solenoid valve disabled, and when the value of the evaporation pressure has dropped to the *Pump-down pressure differential PC43*, the compressor switches off.



In the event that the switch-off pressure threshold is not reached or if the evaporation probes don't work, there is always a Compressor switch-off delay in pump-down.

To enable this function, you must set the following parameters:

PC41 = 2. Enable function

PC42: Pump-down time

PC43: Pump-down differential

Note: In the event of an alarm, the system must ignore the compressor switch-off delay.

8.7.5 Protection Periods

The purpose of these periods is to protect the mechanical units from the different start-up voltages they are subjected to.

PC04 = Minimum compressor switch-on time. Once activated, a compressor must remain on for this time interval before being able to be turned off again.

PC05 = Minimum compressor switch-off time. This is a minimum time interval that must go from the last switch-off, before the compressor can be turned on again.
PC06 = Minimum time between two switch-ons of the same compressor. Determines the min. period that must elapse between two start-ups of the same compressor.
PC07 = Minimum time between two switch-ons of different compressors. Determines the minimum time that must elapse between switch-on of a compressor and that of the next compressor.
PC08 = Minimum time between two switch-offs of different compressors. Determines the minimum time that must elapse between switch-off of a compressor and that of the next compressor.
PC09 = Maximum number of start-ups of the compressor in an hour. Determines the maximum number of start-ups in a time interval of an hour: if this limit is reached, the regulator waits until the conditions form before turning on the compressor again.

Neutral Zone Periods
These parameters are used to determine the switch-on/switch-off timing of different compressors.
PC17 = Extra time for switch-on/switch-off request
PC19 = Release time for neutral zone outside the neutral zone

8.7.6 Thermal switch Inputs

The programme sees to the management of a thermal safety switch input for each compressor. For this input you can set the type of reset (manual or automatic) in the parameters, as well as activation delay.

8.8 Management liquid injection to the compressor

It is managed via 2 modulating valves with slow PWM control (1 valve for each circuit) to enable the injection according to the discharging temperature.
To use this function set the analog output as "injection" and parameters PC90 "Injection setpoint", PC91 "Injection differential", PC92 "Slow PWM time for injection" and PC93 "Maximum Volt slow PWM output for injection".
The operation logis is the following:

- if the discharging temperature is lower than setpoint PC90, the PWM output will not be active
- if the discharging temperature is between the setpoint PC90 and the setpoint + differential PC91, the PWM output will be between 0% and 100%
- if the discharging temperature is above the setpoint PC90 + differential PC91, the output will always be active to the voltage set with parameter PC93.

8.9 Condenser Control

The condenser control regulates the condensation pressure modulating the airflow through an analogue output (inverter or phase cut), or with a single-phase fan for each circuit. The condenser control is set with parameter PF01:

- PF01 = 0. Single-phase control
- PF01 = 1. Modulating control.

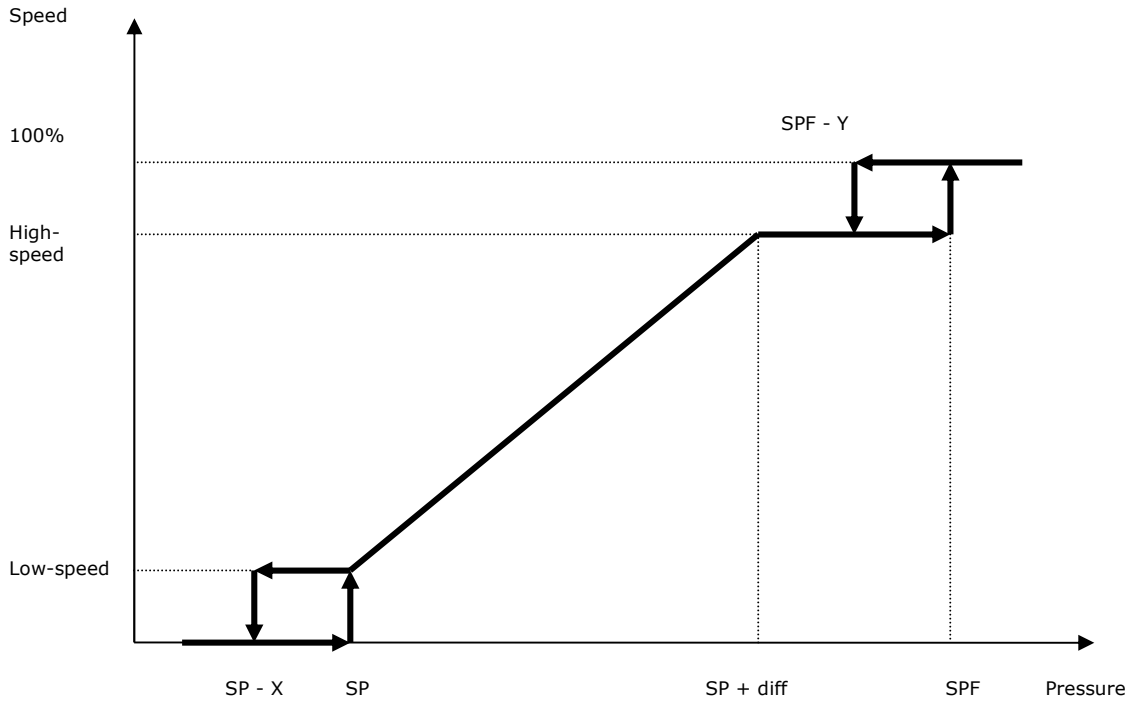
If parameter *PF02* is set on 0, the control will be independent from the temperature control; otherwise, the fan will turn on only if the control requests switch-on of at least one compressor.
Whether or not the fan must be turned off during the defrost cycle is a condition to be set with parameter PF03: if PF03 is set on 1, the fans stop during defrost.
If parameter F09 is set on 1, if there is an condensation probe alarm with single-phase control, the fans will be forced.

8.9.1 Modulating Fan Control

Thanks to continuous control of the fans with an inverter (output A03, type 0-10 V) or with a phase-cutting module (pulsed output A01), you can perform a proportional control (or proportional/integral/derivative) of the condensation.
The control of fan speed provides a minimum speed value to manage the start-ups in a way so as to keep the fan's motors from operating at an RPM speed that is too slow. Also, you can set an *Acceleration Time PF28* upon start-up, during which the fan will reach maximum speed.
You also have the option to maintain the fans at minimum speed, also below the setpoint value. If the pressure should drop very far below the setpoint of a certain threshold, the fan will be forced to switch off.
Lastly, there is a high-speed value beyond which the speed remains constant. If the maximum forcing has been enabled, if the pressure should continue to increase beyond a certain threshold, the fan speed would be forced to 100%.

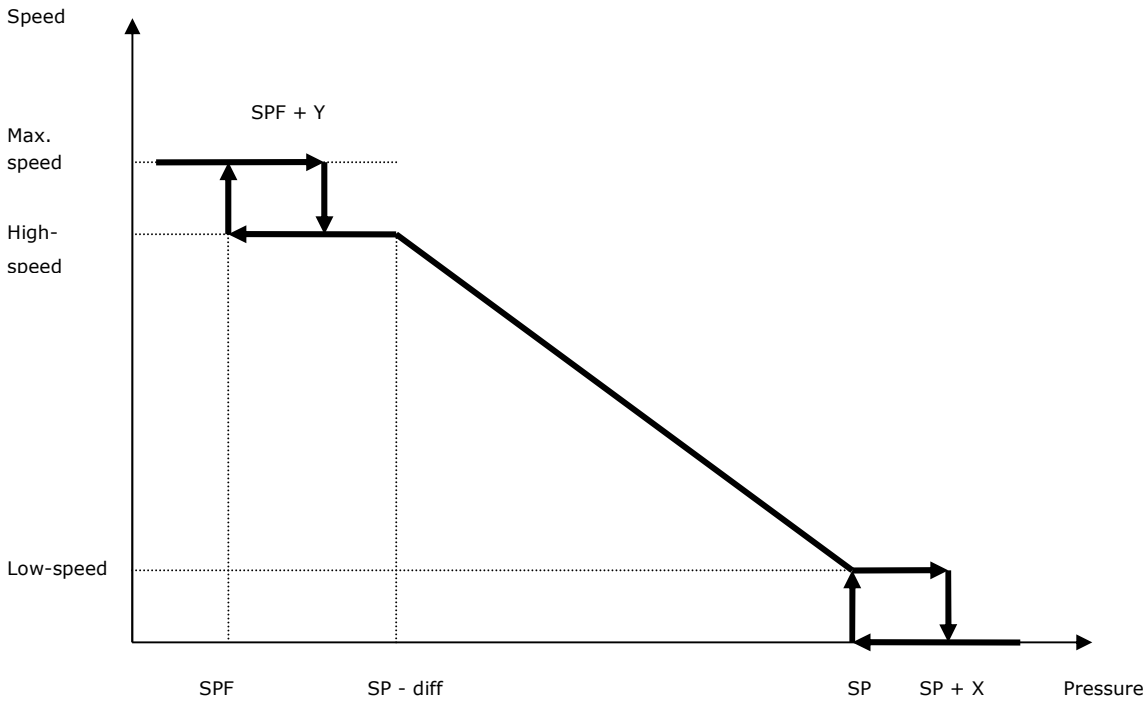
The figure below shows the behaviour of continuous control in the event of summer operation (chiller). In this specific control, the proportional band is moved completely above the setpoint.

Note: Both A01 and A03 outputs will have the same control signal. The A01 output has a type in PWM output and can be used with the single phase cutting module EVFan. The A03 output has a type in output 0..10V and can be used with Schneider Electric ATV motor.



Mode= Operating mode (0 = summer)
PF11 = Summer Setpoint (SP) condensation control
PF12 = Summer differential condensation control
PF13 = Enable maximum speed forcing
PF14 = Summer Setpoint (SPF) maximum speed forcing
PF15 = Summer differential (Y) maximum speed forcing
PF16 = PI Regulator of integral time
PF27 = Minimum value inverter forcing
PF28 = Acceleration time
PF31 = Fan low speed limit
PF32 = Fan high speed limit
PF33 = Enable fan control below the setpoint
PF34 = Fan switch-off differential below the setpoint (X)
PF48 = Derivative time for valves control (chiller)

The figure below shows the behaviour of continuous control in the event of winter operation (heat pump). In this specific control, the proportional band is moved completely below the setpoint.



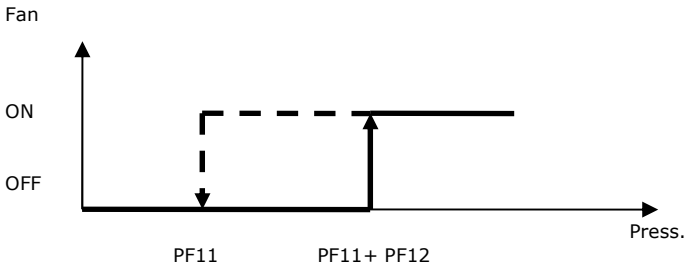
Mode = Operating mode (1 = winter)
PF21 = Winter setpoint (SP) condensation control
PF22 = Winter differential condensation control
PF13 = Enable maximum speed forcing
PF24 = Winter Setpoint (SPF) maximum speed forcing
PF25 = Winter differential (Y) maximum speed forcing
PF26 = PI Regulator of integral time
PF27 = Minimum value inverter forcing
PF28 = Acceleration time
PF31 = Fan low speed limit
PF32 = Fan high speed limit
PF33 = Enable fan control above the setpoint
PF34 = Fan switch-off differential above the setpoint (X)
PF49 = Derivative time for valves control (heat pumps)

Note: with parameters PF41, PF42, PF43, PF45, PF46, and PF47 you can linearise the analogue output.

8.9.2 Mono phase Fan Control

Management of mono phase control of the condensers' fans with a digital output for each fan.

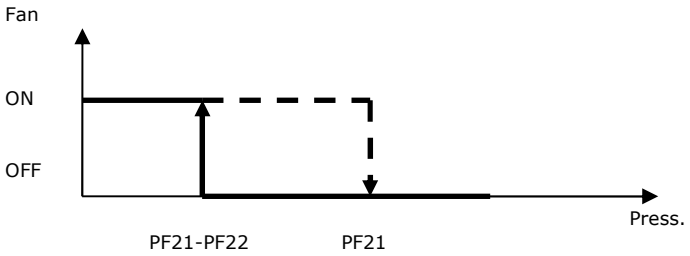
The condenser's fan switches on when the condenser pressure exceeds the condenser setpoint + condenser pressure differential. The condenser fan switches off when the condenser pressure drops below the condenser setpoint, also see the figure below.



PF11 = Summer Setpoint condensation control
PF12 = Summer differential condensation control

Mode = Operating mode (0 = summer)
PF11 = Summer Setpoint (SP) condensation control
PF12 = Summer differential condenser control

The condenser fan switches on when the condenser pressure drops below the condenser setpoint – condenser pressure differential. The condenser fan switches off when the pressure exceeds the condenser setpoint.



PF21 = Winter setpoint condensation control

PF22 = Winter differential condensation control

Mode = Operating mode (1 = winter)
PF21 = Winter setpoint (SP) condenser control
PF22 = Winter differential condenser control

8.9.3 Condenser Valve Control

On the water/water machine, during summer operation, the water that supplies the condensation circuit is controlled by the condensation pressure with a valve (that can be a two-way solenoid valve or a motorised pressure valve, which performs modulation with a 0-10 V signal generated by the control). Control of the condenser is performed in a way similar to that of fan speed. Control of the condenser valve is the proportional integral derivative type.

To be able to use just a proportional control you just need to set the integral time and the derivative time to zero (*PF16=0, PF26=0*). By setting an integral time greater than zero you will get a more precise control, the integral part has the task of bringing the output rapidly, reducing the error introduced by the saline solution proportional component (the integral component is disabled by default).

8.9.4 Single Condenser

On the dual circuit machines you can choose to use just one circuit to manage condensation. To enable dysfunction you must set *PG11=1*. Condensation is done by the fan in the Circuit #1, using the maximum condensation pressure/temperature values acquired by the respective transducers.

The analogue/digital output is always relative to Circuit #1.

8.10 Fan Management

The programme is capable of managing up to two fans, that is one per circuit. You can associate a digital input and a digital safety output for switch-on/switch-off to each fan.

8.10.1 Fan Mode

Each fan is associated to an operating mode in the mode configuration of the main menu. A fan can have the following modes:
Disabled: The fan has not been configured, the display shows "**-**" mode.
On: The state display shows "ON".
Awaiting switch-on: The fan waits for the protection periods to elapse before switching on. The mode display shows "ON".
Off: The mode display shows "OFF".
Awaiting switch-off: The fan waits for the protection periods to elapse before switching off. The mode display shows "OFF".
Alarm: The fan is in alarm. The mode display shows "ALARM".
Manual: The fan is in manual operating mode. The mode display shows "MANUAL".
In the maintenance operator menu, with parameters *PM41 and PM42*, you can read the number of operating hours of the two compressors. To zero out these hours when required, you can type the value "0" using the SET key.

8.10.2 Fan Periods

Below is a list of all the periods linked to fan management.
Protection Periods
The purpose of these delays is to protect the fans from the different start-up voltages they are subjected to and to prevent simultaneous start-ups.
PF07 = Minimum period between start-ups of different fans. Determines the minimum period that must elapse between the start-up of a fan and that of the next fan.
PF08 = Minimum time between two switch-offs of different fans. Determines the minimum time that must elapse between switch-off of a fan and that of the next fan.

8.10.3 Thermal Switch Inputs

The programme sees to the management of a single thermal switch for each fan configured in the application.

8.11 Circulation Pump Management

On the AIR/WATER or WATER/WATER machines you can control one or two water circulation pumps, set in parameter *PG09*. The *Pump operation PP01*parameter defines how the pump will work:

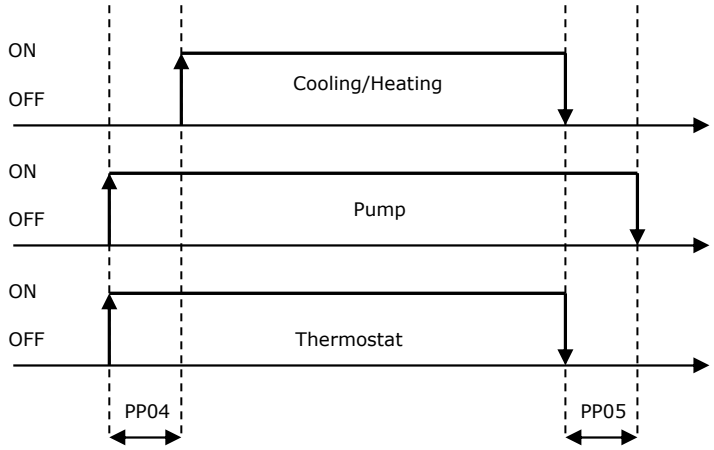
PP01 = 0. Continuous operation

PP01 = 1: Operation with request from thermostat

PP01 = 2: Cyclical operation

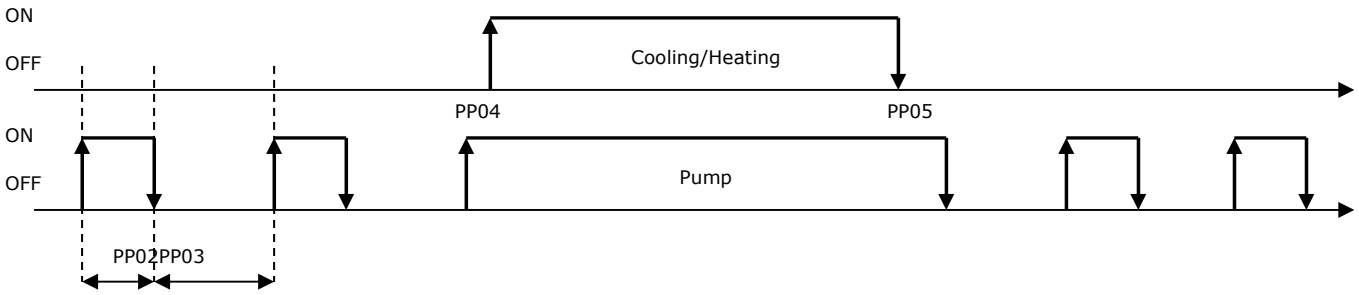
In *continuous operation*, the circulation pump is activated when the unit is on, and once the delay interval has elapsed (parameter PP04), the compressors can be energised. When the unit is off, the pump deactivates after the delay interval (parameter PP05).

In *operation with thermostat request*, the pump enters into operation as a consequence of a request for heat or cold. At the moment of the request, first the pump output activates and then – after the PP04 delay – the cooling/heating compressor switches on.



Similarly, following a thermostat switch-off request, the compressor switches off, while the pump stays on for the duration of PP05.

In the *cyclical operation, t*he pump is controlled by the definition of the start-up/switch-off times: if during pump activation time the thermostat function activates a cooling or heating request, the pump stays active for the entire duration of this request, plus any delay interval between compressor switch-off and pump switch-off.



PP02 = Pump cycle ON period.

PP03 = Pump cycle OFF period.

Parameter PP07 sets pump behaviour during the defrost cycle. After having modified PP01 and PP07, you need to disconnect the machine from the mains and then reconnect it to prevent risk of malfunctioning.

If two pumps have been configured (*PG09 = 2)*, the operating hours of both must be equalised. Thus, every *PP08* number of operating hours, the switch-off of the active pump and switch-on of the other pump is ordered.

If there is a thermal alarm of one of the pumps, the control must activate the second pump. On the other hand, if both pumps don't work, or if the only pump configured has a failure, the alarm stops the unit.

8.11.1 Pump Mode

An operating mode is associated to each pump, visible from the relative LED or in the mode configuration from the main menu. Each pump can have the following modes:

Disabled: The pump has not been configured, the display shows "**-**" mode.

On: The mode display shows "ON".

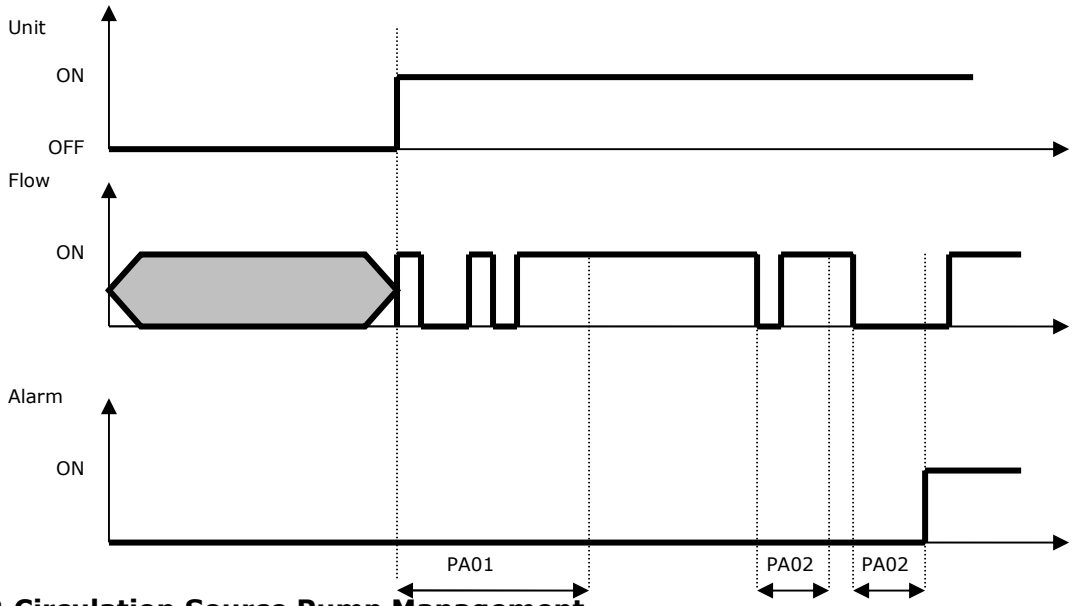
Off: The mode display shows "OFF".
Alarm: The pump is in alarm mode. The mode display shows "ALARM".

In the maintenance operator menu, with parameters *PM31 and PM32*, you can read the number of operating hours of the pumps. To zero out these hours when required, you can type the value "0" using the SET key.

8.11.2 Flowmeter Management

The flowmeter is constantly monitored once the chiller has been started and the *Flowmeter start-up delay PA01* has elapsed. If the contact indicates a lack of flow, the flowmeter alarm goes off immediately. The compressors do not receive commands when there is a flowmeter alarm.
During normal operation, the flowmeter is constantly monitored; if the contact reports lack of flow for a period exceeding the value of the *Flowmeter alarm bypass PA02* parameter, the associated alarm activates immediately and all the active compressors switch off.

If the alarm should persist for a time equal to the value of the *Period of pump operation with low water level PP09* parameter, the pump turns off, too, and the alarm becomes a manual reset The pump is therefore protected against operation without water. The pump starts back up when the alarm is reset.
The flowmeter alarm is an alarm with manual reset, unless it exceeds a certain number of events in an hour (*max. number of flow alarms with automatic reset PA03*), circumstance in which it becomes a manual reset.



8.12 Circulation Source Pump Management

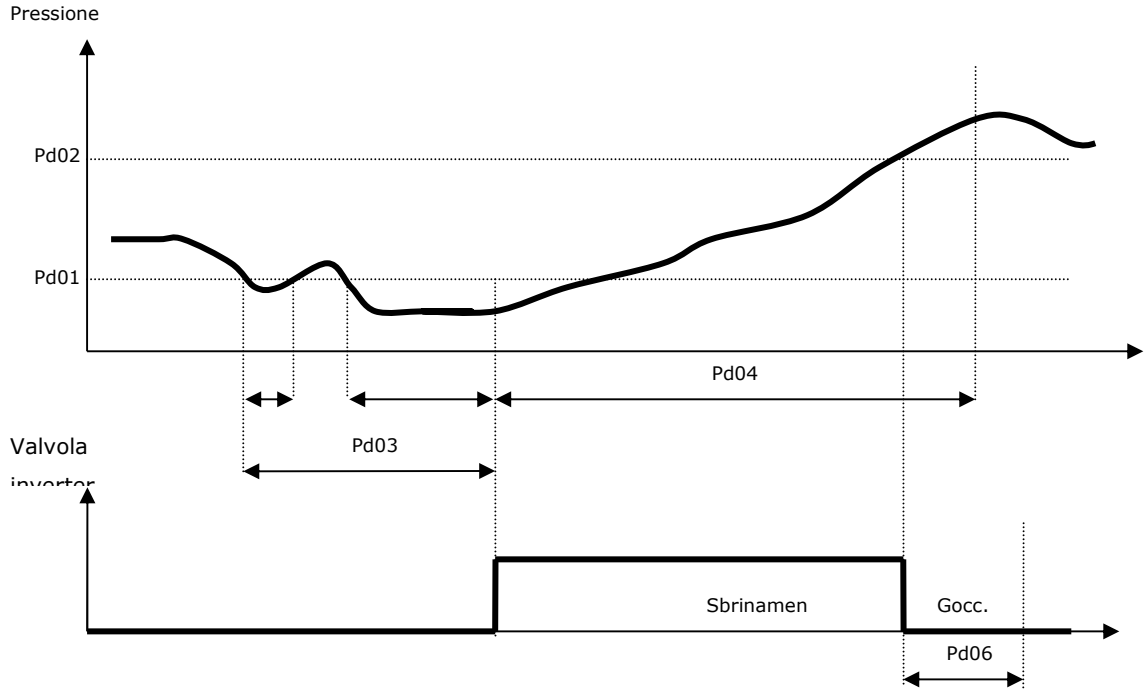
On the WATER/WATER machines you can control one or two water circulation source pumps, which are set in parameter *PG10*. The *Pump operation PP21* parameter sets how the pump will work.
The controls for regulations, modes, flowmeter, and safeties of these devices are the same as those of the circulation pumps described above.

8.13 Defrost Management

This procedure is activated only in winter operating mode (heat pump), and when at least one compressor is on. Defrost takes place by acting on the coolant circuit inverter's valve.
If for a time interval equal to the value of the *Enable defrost delay Pd03* parameter, the evaporation pressure remains (even if not constantly) below the *Defrost start-up setpoint Pd01* threshold and at least one compressor is in function, the inverter's valve is reversed and the defrost cycle starts. During this stage, the compressors are forced to maximum power and the low pressure alarm is bypassed.
Defrost stops for one of the following causes:

- when the pressure reaches the end of defrost setpoint Pd02;
- when the max. defrost duration Pd05 has elapsed;
- when the machine's or the circuits' alarms have activated;
- when the unit has been switched off.

At the end of the defrost cycle, the unit stays stopped for the entire duration of the *Dripping period Pd06*.

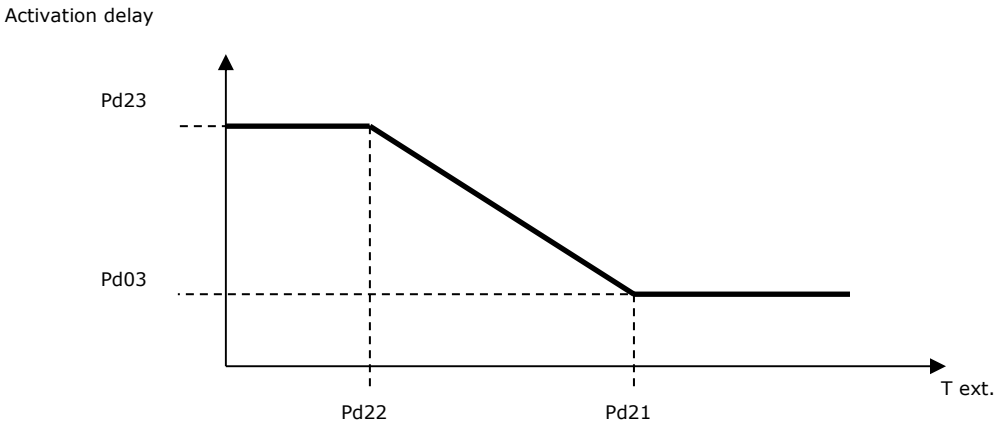


To avoid immediate start-up of a defrost cycle after all the compressors have been stopped, a *Minimum circuit restart delay Pd07* is used which guarantees at least a period of heat pump operation before entering the defrost cycle.

Note: In the event of a unit with dual circuit, the defrost cannot be simultaneous; so if a circuit is performing defrost, the other cannot launch a defrost cycle until the first has completely finished its own cycle.

8.13.1 Defrost Cycle Compensation

With a drop in the external temperature, the aqueous vapour content in the air (which causes the formation of frost on the evaporation coil, thus creating a need to perform defrost), decreases and it could therefore be advantageous to increase the defrost activation delay in relation to reduction of the external air temperature to improve efficiency of the entire system. If enabled from parameter *Pd20*, this function is activated with an *External air temperature setpoint for defrost compensation start-up Pd21*, below which the compensation starts, with increase of the defrost activation delay up to a maximum value (*Maximum defrost delay Pd23*) to reaching of the *External air temperature setpoint for defrost compensation arrest Pd22*.



To enable this function, the external air temperature probe must be enabled

8.14 Anti-Freeze/Auxiliary Heating Heaters Management

On the air/water or water/water machines, the anti-freeze control is active even when the machine is off.

There are two thresholds with respective differentials: one is used to activate the heaters and the other to sound the alarm and stop the compressors in the relative circuit.

If the antifreeze alarm should persist for the duration of the *Period of pump operation with low-temperature PP10*, the pump will switch off until the next alarm reset.
If the anti-freeze is in OFF mode, only the heaters activate, while the alarm is not reported.
To enable the heaters as well as set the associated parameter (*Pr01=1*).

8.15 Single Evaporation

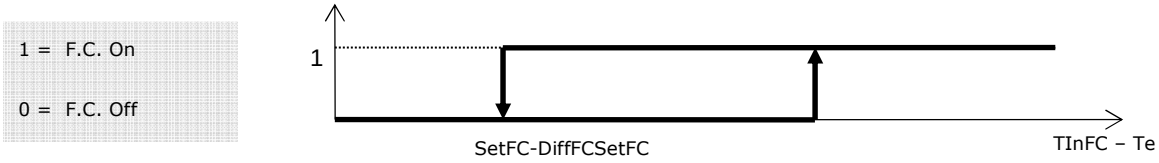
On the dual circuit machines you can choose to use just one circuit to manage evaporation. To enable this function you must set *PG12=1*. Evaporation is performed by the anti-freeze and the resistors in Circuit # 1, using the values of the evaporation temperature acquired by the respective transducers.
The resistors activated and the antifreeze alarm are also relative to Circuit # 1.

8.16 Free-cooling Management

To obtain a sensible energy savings in system management, the chiller has the option to use external air when it has favourable thermal characteristics to exploit it's energy content and obtain free cooling called "free-cooling".
In the versions with free-cooling, a water coil is generally placed in front of the condensing coil (so that the air passes through this coil first and then through the condensation one); when the external air temperature is lower than that of the water (and therefore it is possible to cool the water "at the external air's expense") the water (or glycol mix) that enters the machine is deviated to the water coil by way of a three-way valve or with a specific pump before going through the evaporator.
There is also the option to have a separate circuit for free-cooling with a designated fan (*PG13=1,2*), a condition which thus allows you to optimally control condensation even with compressors on and simultaneously regulate the free-cooling fan.

8.16.1 Free-cooling Enablement

The free-cooling (FC) function for free cooling, if configured in parameter *PS01*, is enabled when the ΔTfree-cooling (or the difference between the input water temperature TInFC and the external temperature that hits the free-cooling exchanger Te) reaches the set setpoint value (SetFC, parameter *PS06*). To avoid any oscillations in the state of free-cooling enablement, you can even set a differential (DiffFC, parameter *PS07*).

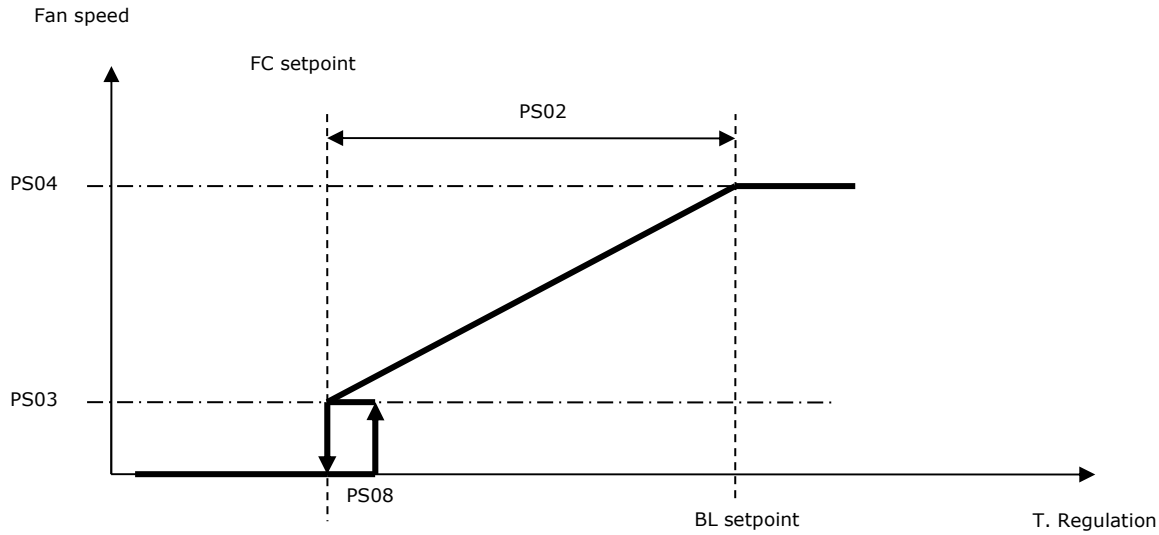


The condition of the step must persist for at least a *Minimum enablement period PS10* (default 30 seconds) before enabling/disabling free-cooling.
In the event that the external probe is in error, free-cooling is disabled and the free-cooling command valve is disabled.
Even the condition of intervention of anti-freeze heaters (and therefore, the intervention of the relative alarm) will switch off the free-cooling devices.
Other system safeties like: regulation probe broken, antifreeze control probe broken, evaporator flowmeter alarm, circulation pump thermal switch, cause the unit to switch off and therefore the arrest of free-cooling control.

8.16.2 Free cooling Regulation

The enablement of the free-cooling lets you activate regulation proportional to the fan speed.

In the event of regulation of compressors both in input (lateral band), or in output (neutral zone) the setpoint of the free-cooling always corresponds to the setpoint for regulation of the loads.



When the temperature reaches the FC setpoint and stays below it for more than *PS10* seconds, the free-cooling is deactivated; the step indicated in the diagram, of hysteresis PS*08* (default 0.5°C), re-enables the free-cooling and the ramp (if the ON mode is maintained for more than *PS10* seconds).
When the regulation of the free-cooling is on the ramp, the call of the steps of the compressors is inhibited; when the temperature reaches the upper limit of the proportional band and stays in that state for at least *PS10* seconds, it enables the call of the compressor steps by action of primary regulation.
The fan can also be ON/OFF type.

Depending on the configuration of parameters *PG13* and *PG11* the free-cooling can behave in different ways:

PG13=0: SINGLE AIR CIRCUIT

In the event of single condensation (PG11=1), with free-cooling active, the condensation fan will be controlled by the above-mentioned regulation based on the input temperature. After a load increase, the compressors are turned on then the regulation of the fan will go to condensation control and remain this way until at least one compressor is active in the relevant circuit.
In this configuration, the fan used is unique and it is that referred to in circuit 1. This fan will handle condensation and free-cooling (any free-cooling coil must be put in this position).

In the case of separate condensation (PG11=0), a circuit normally regulates the condensation, while the other condensation fan is regulated with the above-mentioned free-cooling regulation.
In this configuration the fan used exclusively for condensation is the fan of circuit 2. The fan of circuit 1 will handle condensation of the relative circuit and of free-cooling if the conditions subsist (any free-cooling coil must be put in this position).

PG13=1: SEPARATE AIR CIRCUIT

In the case of single condensation (PG11=1), or ***in the case of separate condensation (PG11=0)*** having two independent air circuits there is no need to make any distinction; the behaviour is identical. In this situation it makes sense to use parameter *PS05* (enablement of pre-cooling with compressors):

- *PS05 = 0*. If at least one compressor is on, the free-cooling is disabled, otherwise normal ramp regulation follows.
- *PS05 = 1*. If there is at least one compressor on, the free-cooling ramp is forced to the maximum value (100% or other value set in parameter *PS04*), otherwise normal ramp regulation follows.

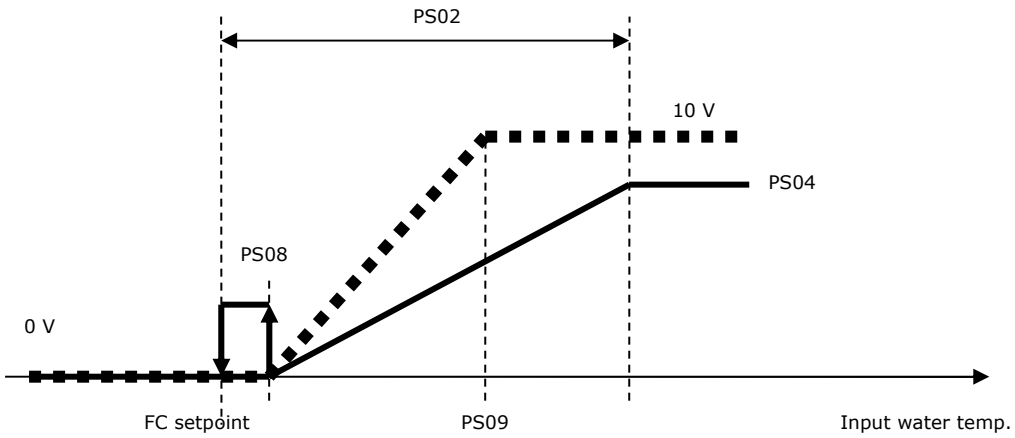
The condensation fans are independent from free-cooling.

To activate the fan associated to free-cooling you must also set the associated analogue output.

8.16.3 Free-cooling Regulation Valve

If the valve is ON/OFF type, the activation command will follow the consent step on the *FC* setpoint with *PS08* hysteresis described above.
To enable operation of the ON/OFF valve you need to set the associated digital output.

Alternatively, you can have a 0-10V modulating three-way valve to allow mixing of the water entering the evaporator for a combined free-cooling action.
In this case, the valve is regulated proportionately starting from the consent step up until the maximum valve aperture threshold, which corresponds to a percentage of the FC band
(parameter *PS09*):



To enable operation of the valve you also need to set the associated analogue output.

8.17 Temperature Alarm Check

8.17.1 High and Low Temperature Alarm Management

Based on the operating mode, a check is performed on the input temperature to the exchanger, activating an alarm when necessary.

- In winter operation (heat pump), if the temperature falls below the threshold for a settable timeframe, a "low-temperature" alarm is generated: ***AL01***.
- In summer operation (chiller), if the input temperature exceeds a certain threshold for a settable timeframe, a "high-temperature" alarm is generated: ***AL02***

With a configuration parameter you can set the alarms in a way that they are only shown, or stop the machine.
You can also set a delay to inhibit the temperature alarm upon system start-up, in order to give the machine a chance to reach full power.

- PA05 = High temperature alarm set point
- PA06 = Low temperature alarm set point
- PA07 = Temperature alarm enablement delay
- PA08 = Temperature alarm management means (only shown / machine arrest)
- PA09 = Temperature alarm differential
- PA10 = System start-up alarm inhibition period.

These alarms are detected only when the machine is on.

8.17.2 Management of the primary exchanger efficiency alarm

If this alarm ***AL03*** (and ***AL13*** for Circuit # 2) is enabled (*PA25 = 1*), a check is performed to verify whether the difference between the input and output temperatures of the cold water on the primary exchanger are below the *Primary exchanger minimum difference threshold PA26* for a P*rimary exchanger efficiency alarm bypass period PA27*.
This alarm is not managed during defrost if the probes are in alarm mode and this alarm is the manual reset type.
This alarm is detected only when the machine is on.

8.18 Pressure Alarm Control

8.18.1 High pressure switch alarm management

Using the digital input connected to an external pressure switch, you can monitor whether the maximum condensation pressure value is exceeded. The *high-pressure alarm* ***AL11*** (and ***AL12*** for Circuit # 2) causes the immediate arrest of the coolant circuit, also switching off any compressor that might be on and keeping the others from starting up.
This alarm is detected only when the machine is on.
This is a manual reset alarm.

8.18.2 High-pressure transducer management

If the condensation pressure exceeds a certain threshold, *a high-pressure alarm* ***AL31*** **(**and ***AL32*** for Circuit # 2) is generated. The alarm causes the immediate arrest of the coolant circuit, also switching off any compressor that might be on and keeping the others from starting up.
This alarm is detected only when the machine is on.
This is a manual reset alarm and can be reset if in the meantime the pressure has dropped below the maximum threshold of a certain differential value.

- PA21 = High pressure alarm set point
- PA22 = High pressure alarm differential

8.18.3 Low pressure switch alarm management

With a digital input connected to an external pressure switch, you can monitor whether there is minimum supply of pressure in the coolant circuit. The *low-pressure alarm* ***AL41*** (and ***AL42*** for Circuit # 2) causes the immediate arrest of the coolant circuit, also switching off any compressor that might be on and keeping the others from starting up.
Upon start-up of the first compressor, the alarm is delayed for a certain interval to allow the compressors to take the coolant circuit to maximum pressure.
At first the alarm is the autoresetting type, unless it exceeds a certain number of events in an hour (*PA14*), circumstance in which it switches to manual reset.

- PA13 = Low-pressure alarm bypass period
- PA14 = Maximum number of autoresetting low-pressure alarms

If with the machine on and when there is a request from the control, low pressure is detected, compressor start-up is inhibited and the *Low-pressure start alarm* ***AL21*** (and ***AL22*** for Circuit # 2) is shown. The purpose of this condition is to inhibit compressor start-up when there isn't any Freon® gas in the circuit (there could be a coolant leak from the pipes).

8.18.4 Low pressure transducer alarm management

If the supply of pressure drops below a certain threshold, *a low-pressure alarm* ***AL41*** **(**and ***AL42*** for Circuit # 2) is generated. The alarm causes the immediate arrest of the coolant circuit, also switching off any compressor that might be on and keeping the others from starting up.

Upon start-up of the first compressor, the alarm is delayed for a certain interval to allow the compressors to take the coolant circuit to maximum pressure.

At first the alarm is the autoresetting type, unless it exceeds a certain number of events in an hour (*PA14*), circumstance in which it switches to manual reset; it can be reset if in the meantime the pressure has increased to a certain differential value over the minimum threshold.

PA11 = Low pressure alarm set point heating

PA12 = Low pressure alarm differential heating

PA13 = Low-pressure alarm bypass period

PA14 = Maximum number of autoresetting low-pressure alarms

PA23 = Low pressure alarm set point cooling

PA24 = Low pressure alarm differential cooling

In the presence of *low external air temperatures*, the supply of pressure could drop below the minimum pressure threshold, thus stopping compressor start-up. In such circumstances, you can activate a control that moves the alarm control threshold to a higher value for a certain interval of time from start-up of the first compressor, however leaving all the protection devices and controls preliminary to start-up in place.

PA16 = Enable low pressure control with low external temperature

PA17 = Low pressure alarm setpoint at low external temperature

PA18 = Low pressure alarm differential at low external temperature

PA19 = Low pressure alarm duration at low external temperature

This control can be enabled only in heat pump operating mode.

8.18.5 Low pressure start alarm

In the condition of low pressure (pressure switch or induced by transducer) or when it's impossible to activate the compressors by its request, a *Low-pressure start alarm* ***AL51*** (and ***AL52*** for Circuit # 2) activates. This is an autoresetting alarm and therefore it should disappear, unless there is a Freon® gas leak from the circuit.

When the compressor is switched off after a low-pressure alarm, this alarm is delayed for a certain time interval *PA20* to allow the coolant circuit to enable compressor start-up.

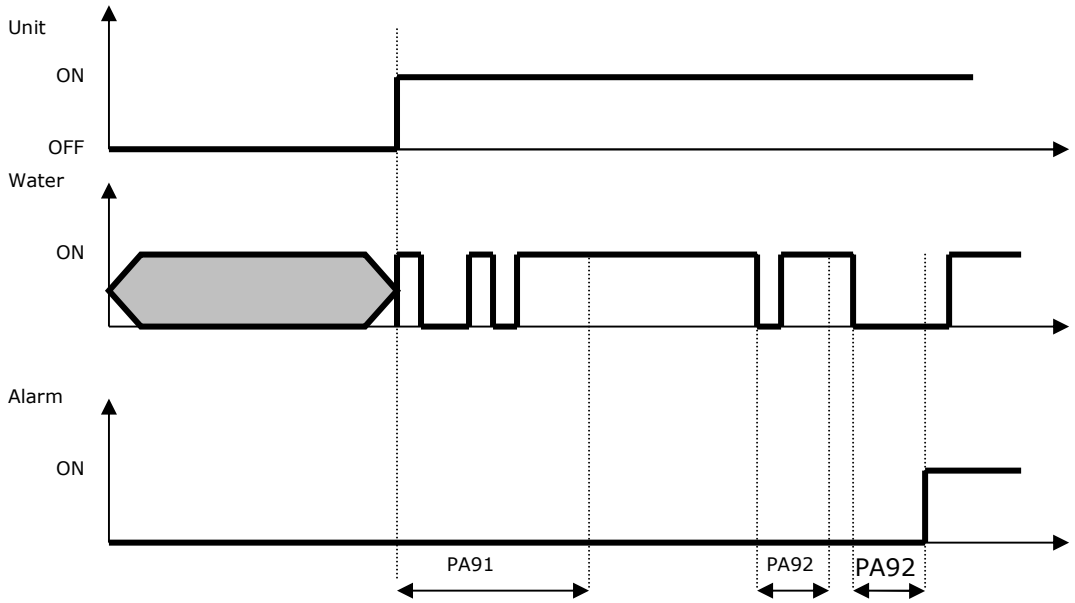
8.19 Water level alarm

The water level is under control once the chiller is on and elapsed the *Water level alarm delay since the unit start PA91*, if the contact detects the level is too low, the water level alarm **AL08** will be activated. The compressors do not work during this alarm.

If the contact detects a too low level for a time over the *Bypass time water level alarm during the normal operation PA92*, the larm is activated and all the compressors are turned off.

If the larm lasts for the time *Pump operation time with water low level PP09*, also the pump is turned off and the alarm becomes a manual-resetting alarm. The pump works again after the reset.

The water level alarm is an automatic-resetting alarm, provided that the alarm does not overtake the number of alarms allowed in 1 hour (*Number of water level alarm with aotomatic-resetting before the alarm becomes a manual-reetting alarm PA93*).



8.20 Phases sequence alarm

It is possible to manage the phase loosing or the wrong sequence configuring a digital input as "Phases sequence" and connecting a relay detecting this condition.

If the digital input is active, the unit will switch off the compressors and show the alarm code **AL07**.

8.21 Time Schedule

The real-time clock lets the worker set a weekly schedule for the unit.

You can set two different daily schedules. Each daily schedule can have two zones with separate heating and cooling offset values.

Every day of the week can be assigned to daily schedule 1, daily schedule 2, or can be identified as a non-workday.

Below are the parameters for this function:

PARAMETERS	FUNCTION
PT01	Workday 1 enables zone 1
PT02	Workday 1 zone 1 start time
PT03	Workday 1 zone 1 end time
PT04	Workday 1 zone 1 cooling offset
PT05	Workday 1 zone 1 heating offset
PT06	Workday 1 enables zone 2
PT07	Workday 1 zone 2 start time
PT08	Workday 1 zone 2 end time
PT09	Workday 1 zone 2 cooling offset
PT10	Workday 1 zone 2 heating offset
PT11	Workday 2 enables zone 1
PT12	Workday 2 zone 1 start time
PT13	Workday 2 zone 1 end time
PT14	Workday 2 zone 1 cooling offset
PT15	Workday 2 zone 1 heating offset
PT16	Workday 2 enables zone 2
PT17	Workday 2 zone 2 start time
PT18	Workday 2 zone 2 end time
PT19	Workday 2 zone 2 cooling offset
PT20	Workday 2 zone 2 heating offset
PT21	Monday schedule
PT22	Tuesday schedule
PT23	Wednesday schedule
PT24	Thursday schedule
PT25	Friday schedule
PT26	Saturday schedule
PT27	Sunday schedule
PH16	Enables start-up/shutdown of the machine as per the schedule

8.22 Management of Other Parameters

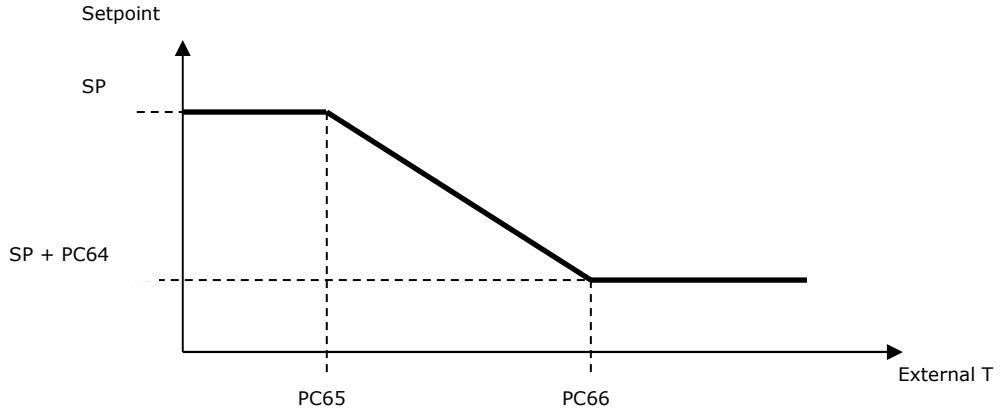
8.22.1 Variation of setpoint with timer scheduler

With parameter *PH28* you can adjust the setpoint with timer scheduler (settings parameter for the scheduler). The real control setpoint depends on the workday and the relative offset.

8.22.2 Dynamic setpoint

With the parameter *Enable dynamic setpoint PH27*, you can perform compensation of the dynamic setpoint on the external temperature. In this case, the control setpoint will take on a value between the standard setpoint (equivalent to the *Initial external temperature threshold*) and the **plus** setpoint on *Dynamic offset* (equivalent to the *Final external temperature threshold*), both for chiller operation and for that of the heat pump. Between the two compensation points, the movement is linear and the curve takes on a different meaning depending on the offset mark.

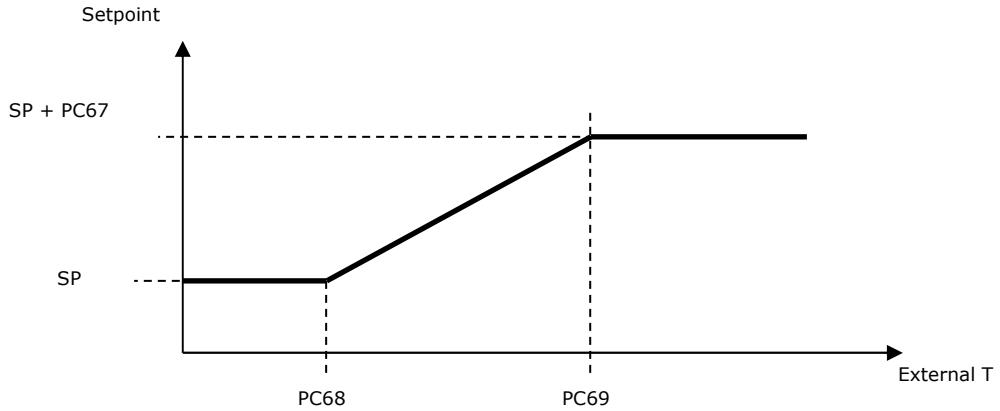
With offsets that have a value below zero, the behaviour is the following:



The parameters for this function are:

- PC64 = Maximum dynamic offset for summer operation (chiller)
- PC65 = Start compensation temperature for dynamic summer setpoint
- PC66 = End compensation temperature for dynamic summer setpoint.

With offsets that have a value above zero, the behaviour is the following:



The parameters for this function are:

- PC67 = Maximum dynamic offset for winter operation (heat pump)
- PC68 = Start compensation temperature for dynamic winter setpoint
- PC69 = End compensation temperature for dynamic winter setpoint

8.22.3 Forced Switch-off

This function allows forced switch-off of all compressors when the AF output temperature falls below the *Summer forced switch-off set point* (if operating with chiller), or exceeds/goes over the *Winter forced switch-off set point* (if operating with heat pump). The compressors may be started back up only when the temperature crosses the setpoint again.

- PC35 = Enable forced switch-off
- PC36 = Summer forced switch-off set point
- PC37 = Winter forced switch-off set point.

8.22.4 High pressure reduction at high temperatures (chiller)

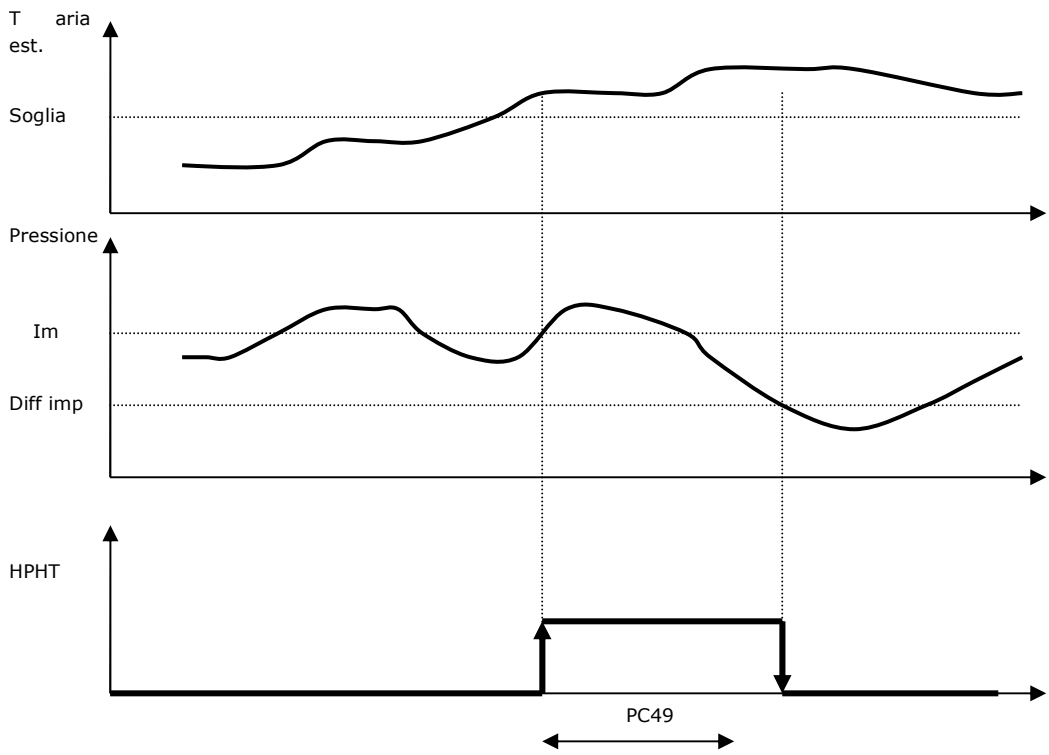
This control makes it possible for the coolant circuit to operate at high external temperatures as well. The change of high-pressure alarm decreases with the decrease in the active power in the circuit.

- PC45 = Enable pressure reduction at high temperatures
- PC46 = Pressure reduction setpoint at high temperatures
- PC47 = Pressure reduction differential at high temperatures
- PC48 = High external temperature threshold
- PC49 = Min. period to maintain pressure reduction.

Depending on the number of compressors configured, the percentage of energy limitation is calculated based on this parameter:

- PC31 = Energy limitation for summer operation

To enable this control, the external air temperature probe must be enabled



This control can be enabled only in summer operating mode (chiller).

8.22.5 Low pressure parcelling at low temperatures (heat pump)

This control makes it possible to parcel the coolant circuit's energy when the external temperature and coolant water temperature conditions lead to activation of the minimum pressure alarms. If *less than 15 minute*s have gone by from the minimum pressure alarm, and the pressure drops below a certain threshold, parcelling of the power active in the circuit is forced, up until when the pressure goes back above the threshold by a certain differential.

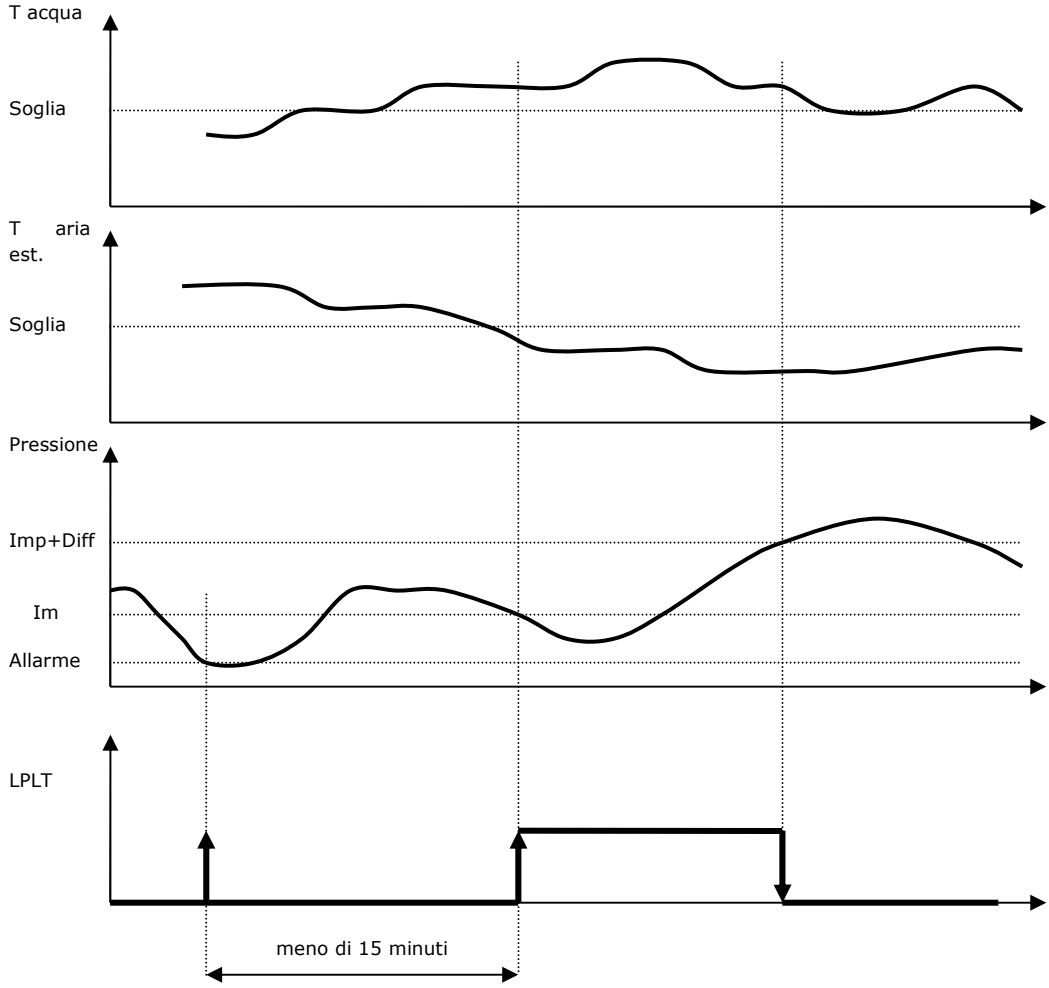
- PC50 = Enable pressure parcelling at low temperatures

- PC51 = Pressure parcelling setpoint at low temperatures
- PC52 = Pressure parcelling differential at low temperatures
- PC53 = Low external temperature threshold
- PC54 = Refrigerated water high temperature threshold
- PC55 = Parcelling delay from low pressure alarm.

Depending on the number of compressors configured, the percentage of power limitation is calculated based on this parameter:

- PC32 = Power limitation for winter operation

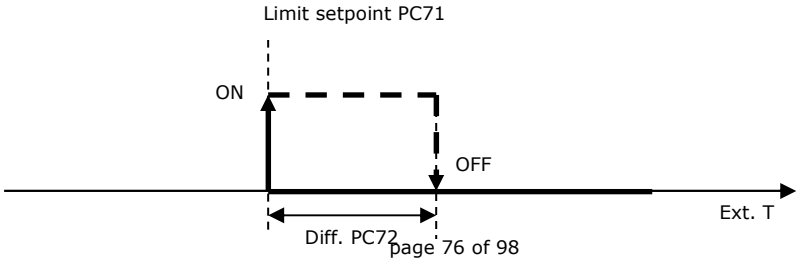
To enable this control, the external air temperature probe must be enabled



This control can be enabled only in winter operating mode (heat pump).

8.22.6 Operating limit management (heat pump)

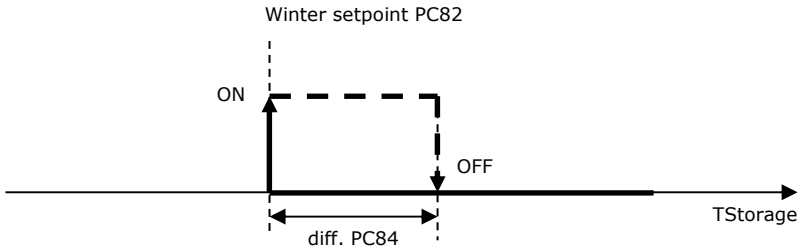
When the external temperature drops to particularly low levels, it might no longer be cheap or sufficient to heat using the heat pump. The *Limit setpoint PC17* on the external temperature is used to disable the heat pump. Reactivation occurs when the external temperature exceeds the *limit setpoint* plus a configurable *Limit differential PC72.*



To enable this function, the external air temperature probe must be enabled

8.22.7 Cooling/Heating Function by Request

If enabled in the *Enablement Control by Request PC80* parameter, this function requires a specific temperature probe, remote (generally located in a storage tank): upon reaching of a specific setpoint (in the cooling function the *Summer Control by Request Setpoint PC81*, in the heating function the *Winter Control by Request Setpoint PC82*) and after a *Control by RequestDelay PC85* determines activation of the circulation pump and the compressor to perform the function requested with classic temperature regulation selected (regulation of the return or supply temperature). The unit switches off when the storage tank is "satisfied", that is, once the *Summer Control by Request Setpoint PC81 – Summer Control by Request Differential PC83* (if cooling) or the *Winter Control by Request Setpoint PC82 + Winter Control by Request Differential PC84* (if heating) have been reached.



To use this function you need to enable the auxiliary regulation probe in the *HAxx* parameters.

8.22.8 Setpoint variation from digital input

You can change the working setpoint by using a digital input. To use this function, set the offsets of the setpoint in parameters *PUC*1 (summer operation) and *PUH1* (winter operation).

It is also necessary to configure the digital input to be used by configuring the *HBxx* parameters.

8.23 Management of the EVDRIVE03 built into the system

The management of the electronic valve must be optimised and not limited to a classical overheating control.
There are several conditions and regulations that must consider other system variables as a whole, as well as the overheating variables (evaporation temperature and pressure) in a way to limit the problems due to the delays introduced by the temperature probe in the same and its positioning. These functions must be enabled from parameter in a way that the manufacturer can exclude them. If parameter PG05 has value 1, the external module EVDRIVE03 will be enabled (1 for each circuit). In this case the I/O of the module is used for regulation and in case there is no communication with EVDRIVE03 the alarm EVM1 (circuit 1) or EVM2 (circuit 2) is shown, after a delay PA99 in seconds.
It is possible, using parameters *PV90, PV91* and *PV92* for circuit 1 and parametrs *PV93*, *PV94* and *PV95* for circuit 2, to enable and use (for regulations) the temperature discharging probes of compressors, condensing pressure and evaporation.

8.23.1 Enablement of EEV Operation

The controller knows when it's time to activate the unit (turn on a compressor) and consequently must enable the operation of the EVDRIVE 03 driver via CAN bus.
Enablement of operation must come a few seconds before compressor start-up. The valve must be "prepared" open a percentage adequate to the compressor being turned on.

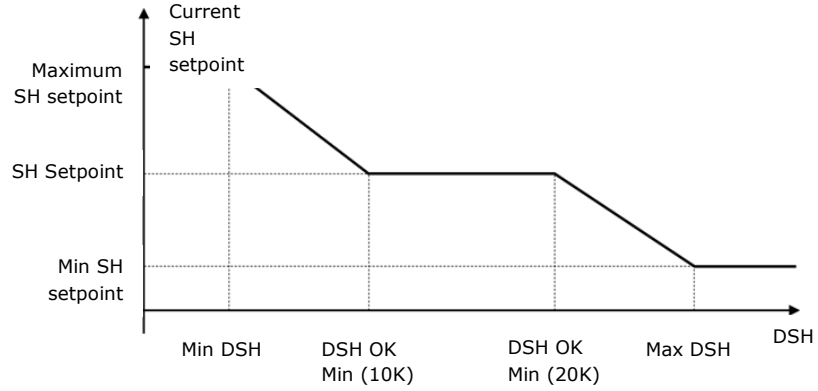
8.23.2 PID Parameter Settings

The EVDRIVE03 has two sets of independent parameters to be used in the cooling (and defrost) and heating operating modes. The controller must be able to choose the most appropriate set of parameters based on the operating mode. The set can be selected among the two available or the parameters can be added directly (PV parameters can be obtained from the manufacturer menu).

8.23.3 Modulation of the SH set

- If the DSH is below 10 K, there may be liquid returned to the compressor – to prevent this, it helps to increase the SH set.
- If the differential is higher than 20K, there is no risk of liquid return – given the "favourable" condition as far as safety of the compressor you can lower the SH set to increase the system's efficiency (reduction of the condensation pressure and increase of the evaporation pressure).

These variations will have a minimum and maximum and will be parametrisable as shown in the figure.



This way the risk of liquid return to the compressor is limited and system efficiency increases based on the machine's working conditions.

8.23.4 CAN Configuration

To properly configure the valves of the two circuits, you have to set the CAN address and the transmission speed of each EVDRIVE03.
The valve of Circuit 1 must have CAN address=11, while the valve of Circuit 2 must have CAN address=12.
The transmission speed for CAN communication must be set based on parameter PH99.

8.24 Manual Operation

The programme lets you set the manual operation of compressors, fans, and pumps. In this condition, the devices are not involved in the rotations or the calculations of thermal control, although they are still sensitive to any alarm.
Manual operation of the devices turns out to be useful when you have to perform run tests outside the machine to ascertain the integrity and correct operation.

8.24.1 Compressors

Manual operation of compressors is guaranteed by parameter *Enable compressor PM1x*:
If set on *Auto*, it sets the normal behaviour of the device.
If set on *Manu*, it disables the compressor, reversing it to manual function.
A compressor in manual operation mode does not take part in the controls and it's possible to force the number of steps that it can provide, acting on the property *Force compressor PM2x* (in the *MAin->MAnu menu*).
In any event, as already stated, the compressor stays sensitive to any alarm and relative consequences.
To bring the compressor to normal operation, you have to refresh the *Enable compressor PM1x* parameter to the *Auto* (Automatic) value; otherwise the compressor in question would continue to operate manually, not complying with the request for switch-on/switch-off calculated by the configured control.

8.24.2 Fans

Manual or automatic operation of two condensation fans and one dedicated to free-cooling is guaranteed by the parameters *PM51* (Circuit # 1) , *PM52* (Circuit # 2), and PM65 (free-cooling fan):

- If set on *Auto*, it sets the normal behaviour of the device;
- If set on *Manu*, it disables the fan, reversing it to manual function.

A manually activated fan does not take part in the controls and can be forced in ON/OFF mode setting it in the parameters *PM63*,*PM64*,*PM67* and modulated setting it in the parameters *PM61*, *PM62, and PM66.*
In any event, as already stated, the fan stays sensitive to any alarm and relative consequences.
To bring the fan to normal operation, you have to refresh the *parameter PM51/PM52/PM65* parameter to the *"A"* (Automatic) value; otherwise the fan in question would continue to operate manually, not complying with the request for switch-on/switch-off calculated by the configured control.

8.24.3 Pumps

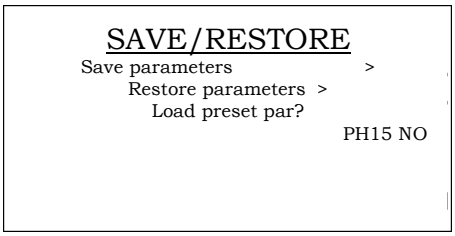
Manual or automatic operation of the circulation pump and source pumps is guaranteed by parameters *PM35* (Pump# 1), *PM36* (Pump# 2) e*PM45* (Source Pump# 1), *PM46* (Source Pump# 2):

- If set on *Auto*, it sets the normal behaviour of the device;
- If set on *Manu*, it disables the fan, reversing it to manual function.

A manually activated pump does not take part in the controls and can be forced in ON/OFF mode setting it in the parameters *PM37*,*PM38*, and in parameters PM47, PM48 for the source pumps.
In any event, as already stated, the pump stays sensitive to any alarm and relative consequences.
To bring the pump to normal operation, you have to restore the *parameters PM35/PM36/PM45/PM56* to the *"A"* (Automatic) value; otherwise the pump in question would continue to operate manually, not complying with the request for switch-on/switch-off calculated by the configured control.

8.25 Restoring the Preset Parameters

Using the "Restore Parameters" procedure you can restore the original preset values of all system parameters. After accessing the *InSt->MAP* menu by LED display or INSTALLER->SAVE/RESTORE via V-Graph – accessible only with the machine switched off – set parameter PH15=1 and wait for the "0" value to appear on the display again; the system will automatically restore the parameters to the preset values.

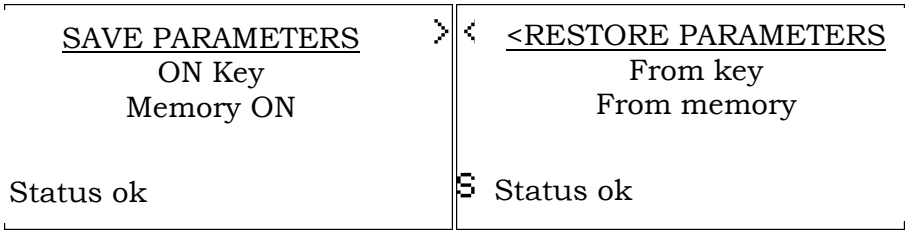


After this operation you must disconnect the machine from the mains and then reconnect it to prevent risk of malfunctioning.

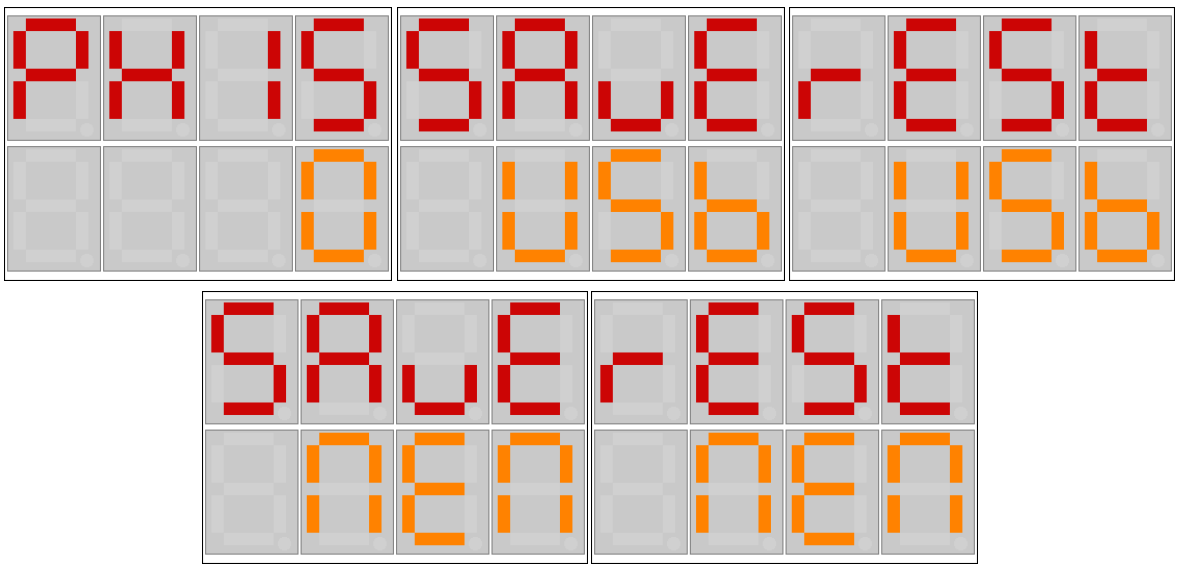
8.26 Parametrisation Pen drive

The values of all the system parameters can be saved on the Parametrisation pen drive to later be copied onto one or more compatible devices or in a dedicated area of the controller's memory. This function is available from the *InSt->MAP* menu by LED display or INSTALLER->SAVE/RESTORE via V-Graph

Display Vgraph/EPHgrapg



Display c-pro 3 nano



LED display	
PH15	**0/1**
SAvE	**USb**
rESt	**USb**
SAvE	**MEM**
rESt	**MEM**

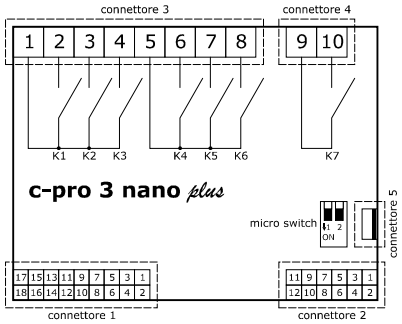
Note: The information concerning the product and product version are memorised on the parametrisation pen drive, making it possible to transfer the maps of the parameters only between the devices compatible with one another.

9 ELECTRICAL DIAGRAM

9.1 Layout *c-pro 3 nano+ connection*

9.1.1 Connectors

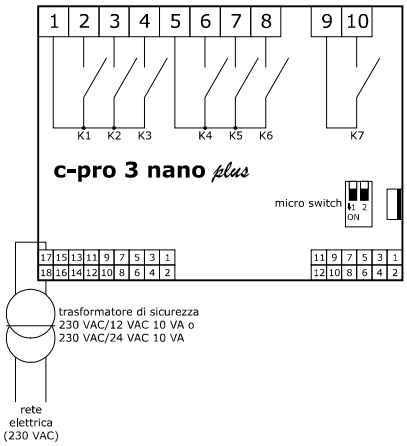
The picture below shows the c-pro 3 nano plus connectors.



The tables below describe the connectors.

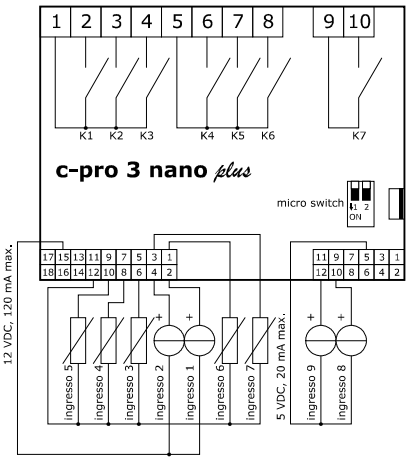
9.1.2 Connection to the power supply

The picture below shows the c-pro 3 nano plus connection to the power supply.



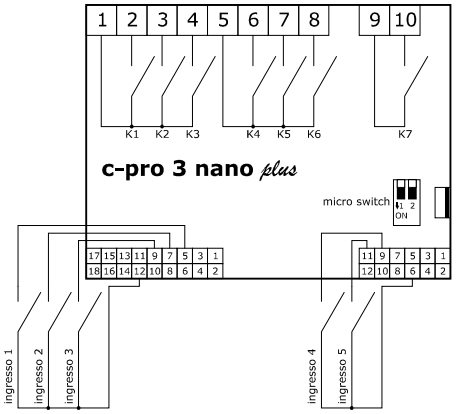
9.1.3 Analogue input connection

The picture below shows an example of c-pro 3 nano plus analogue input connection.



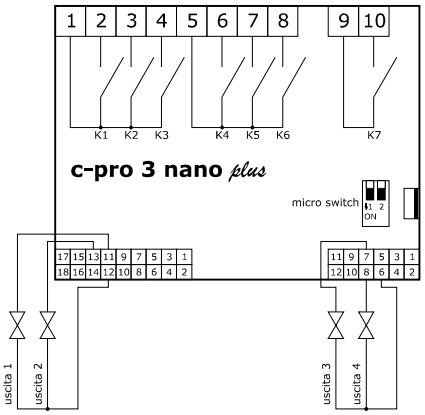
9.1.4 Digital input connection

The picture below shows the c-pro 3 nano plus digital input connection.



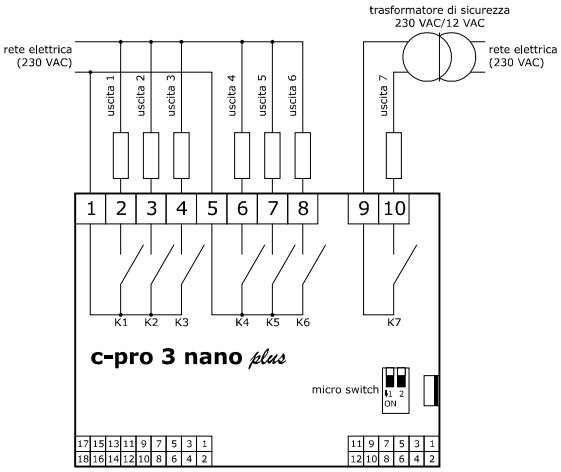
9.1.5 Analogue output connection

The picture below shows the c-pro 3 nano plus analogue output connection.



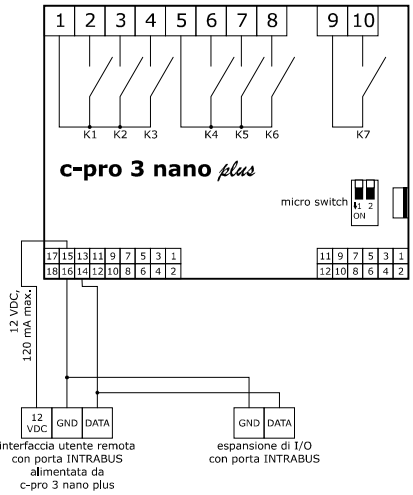
9.1.6 Digital output connection

The picture below shows an example of c-pro 3 nano plus digital output connection.



9.1.7 INTRABUS port connection

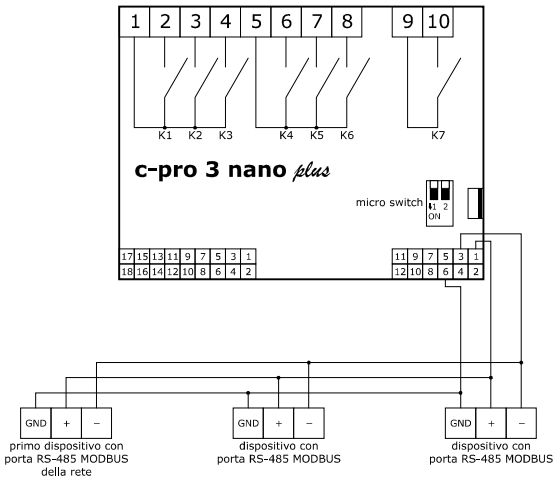
The picture below shows an example of c-pro 3 nano plus INTRABUS port connection.



The maximum configuration of the INTRABUS network permits 1 programmable controller and 1 remote repeater.

9.1.8 RS-485 MODBUS port connection

The picture below shows an example of c-pro 3 nano plus RS-485 MODBUS port connection.

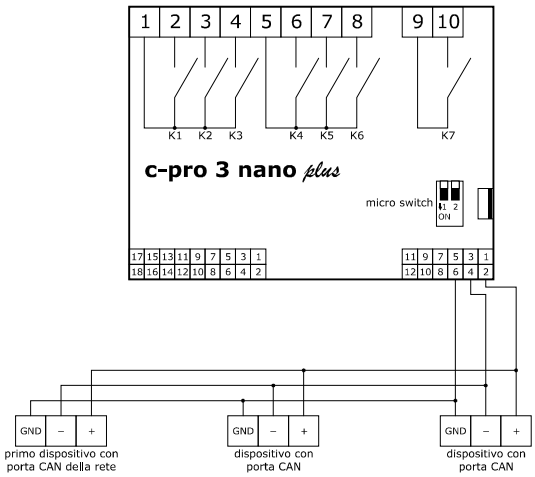


In the example, the c-pro 3 nano plus is the last device on the network with an RS-485 MODBUS port.

Note: The connection cables to the main back must be as short as possible.

9.1.9 CAN port connection

The picture below shows an example of c-pro 3 nano plus CAN port connection.



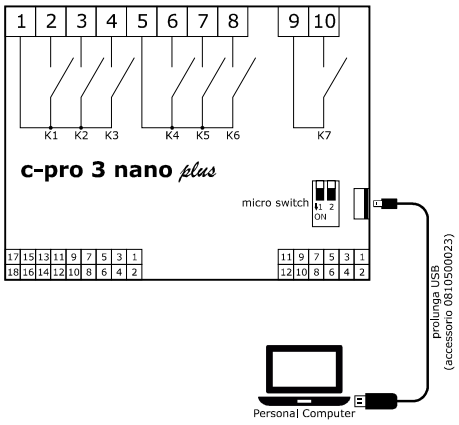
The maximum CAN network configuration includes:

- 1 programmable controller
- 1 I/O expansion
  - 2 driver for EEV (EVDRIVE03)
- 1 remote user interface

Note: The connection cables to the main back must be as short as possible.

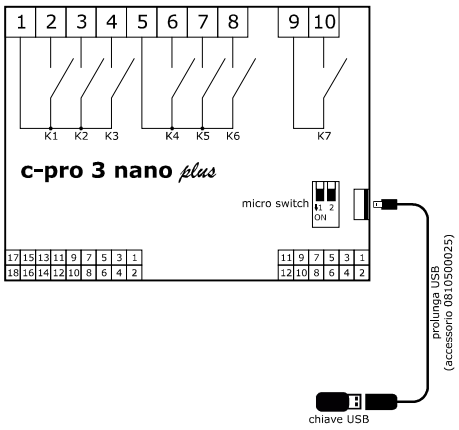
9.1.10 USB port connection to a personal computer

The picture below shows the c-pro 3 nano plus USB port connection to a personal computer.



9.1.11 USB flash drive connection

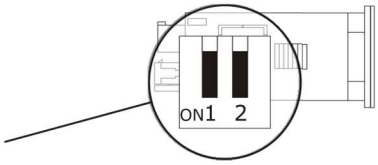
The picture below shows a USB flash drive connection to the c-pro 3 nano plus.



9.1.12 Fitting the termination resistor for the RS-485 MODBUS and CAN networks

To reduce any reflections on the signal transmitted along the cables connecting the devices to a RS-485 MODBUS network and/or a CAN network it is necessary to fit a termination resistor to the first and last device in the network.

The picture below shows the left side of the devices.

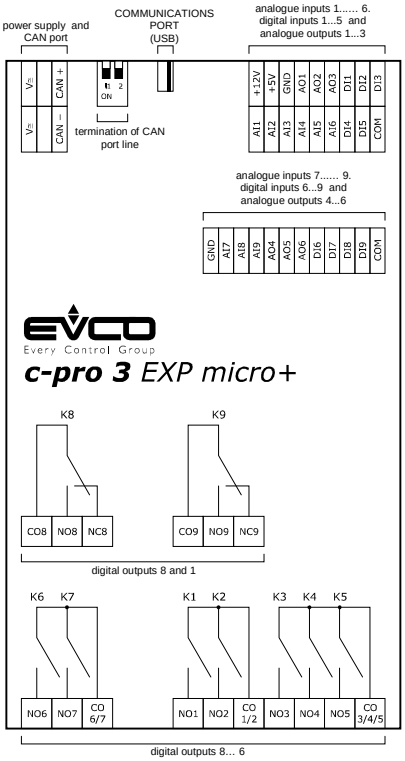


To fit the RS-485 MODBUS network termination resistor, place micro-switch 1 in position ON. To fit the CAN network termination resistor, place micro-switch 2 in position ON.

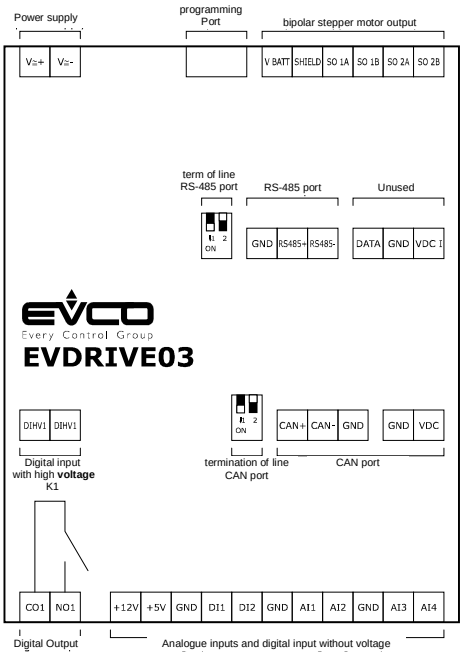
PRECAUTIONS FOR ELECTRICAL CONNECTION

- if using an electrical or pneumatic screwdriver, adjust the tightening torque
- if the device has been moved from a cold to a warm place, the humidity may have caused condensation to form inside. Wait about an hour before switching on the power
- make sure that the supply voltage, electrical frequency and power are within the set limits. See the section TECHNICAL SPECIFICATIONS
- disconnect the power supply before doing any type of maintenance
- do not use the device as safety device
- for repairs and for further information, contact the EVCO sales network.

9.2 Layout *c-pro 3 EXP micro+ connection*



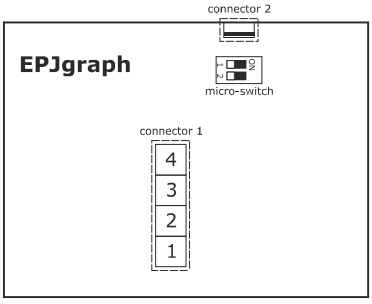
9.3 EVDRIVE03 Connection Layout



9.4 EPJgraph connection Layout

	N.B. - Use cables of an adequate section for the current running through them - To reduce any electromagnetic interference connect the power cables as far away as possible from the signal cables and connect to a CAN network by using a twisted pair.

9.4.1 Models for panel mounting



Connector 1

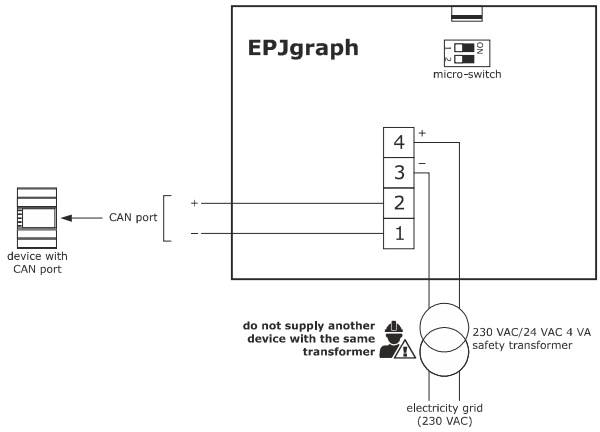
N.	DESCRIPTION
1	CAN port reference -
2	CAN port reference +
3	device power supply (24 VAC/12... 30 VDC). If the device is fed by DC power, connect terminal minus
4	device power supply (24 VAC/12... 30 VDC). If the device is fed by DC power, connect terminal plus

Connector 2: reserved EVCO.

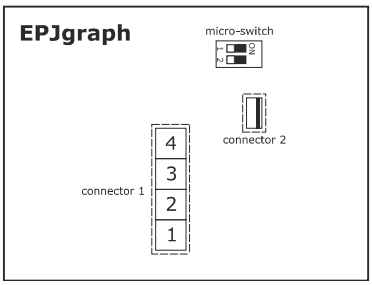
Micro-switch to insert the CAN port termination resistor.

9.4.2 Electrical connection with independent power supply

	N.B. Do not supply another device with the same transformer.



9.4.3 Models for wall mounting



Connector 1

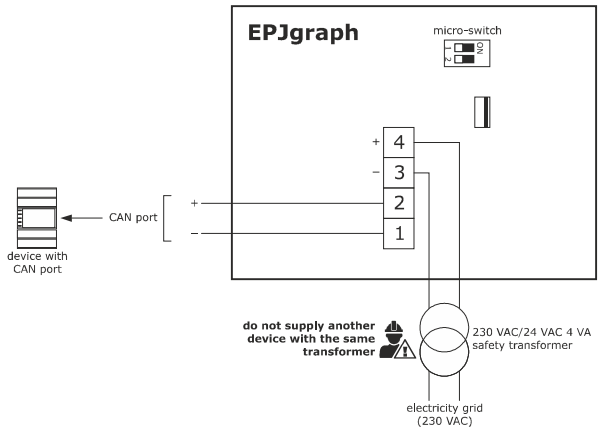
N.	DESCRIPTION
1	CAN port reference -
2	CAN port reference +
3	device power supply (24 VAC/12... 30 VDC). If the device is fed by DC power, connect terminal minus
4	device power supply (24 VAC/12... 30 VDC). If the device is fed by DC power, connect terminal plus

Connector 2: reserved EVCO.

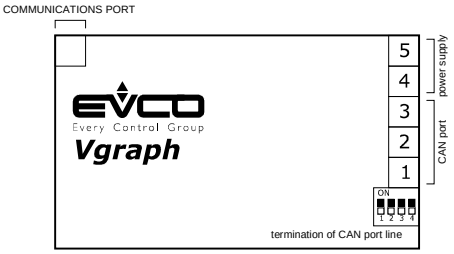
Micro-switch to insert the CAN port termination resistor.

9.4.4 Electrical connection

	N.B. Do not supply another device with the same transformer.



9.5 Vgraph Connection Layout



The table below shows the ***Vgraph*** connection layout

Vgraph	
Connector 1: CAN port	
PIN	**DESCRIPTION**
1	Reference
2	Signal -
3	Signal +
Connector 2: supply	
PIN	**DESCRIPTION**
4	Power supply
5	Power supply

10 DIAGNOSTICS

The application can manage a whole series of alarms concerning compressors, fan, circuit, and functions. Based on the different types of alarms, you can configure their reset (manual or automatic), any delay in warning, and any action to be implemented in that particular case.

When one or more alarm is active, the alarm icon blinks on the displays.

To view the different alarms, you have to view the "Alarm" menu from the main page, using the ESC key followed by SET. By pressing the ON/STAND BY key from an alarm page, or waiting for 60 seconds to elapse, the user goes back to the application's main page.

To scroll through the different alarms active, press the SET key again: the alarms are listed in order of priority, exactly as shown in the Alarm Table in chapter 10.4

10.1 Manual and Automatic Alarms

There are two types of alarms: manual reset and automatic reset. These alarms offer the end-user the option to choose the means of reset most suitable to the user's needs in the associated parameters.

10.2 Manual Reset Alarms

When a manual reset alarm activates:

- The alarm icon starts blinking.

Press the SET key () in the "Alarm" menu; the code of the first active alarm is shown.

When the conditions that set off the alarm return to normal, the alarm can be reset manually. To perform this operation:

- go to the page of the alarm to be reset;
- hold down the SET key for about two seconds.

At this point, if there aren't any other alarms, the page that says "none" is shown, the alarm icon turns off, and the machine starts operating normally again; otherwise, the code of the next active alarm is shown.

The consequences that derive from an active manual alarm still stand until the user deletes the alarm message.

10.3 Automatic Reset Alarms

When an automatic reset alarm activates:

- The alarm icon starts blinking.

Press the SET key () in the "Alarm" menu; the code of the first active alarm is shown.

When the conditions that set off the alarm have gone back to normal, reset and deletion of the alarm message occur automatically, without the user having to do anything

The consequences that derive from an active automatic alarm still stand until the causes that set off the alarm have been resolved.

10.4 Alarm Table

All the alarms managed by the application are listed in the table below. The order of listing is the same order that the alarms are listed when active.

Code	Alarm description	Type	Result	Notes
AL01	Low temperature input	S/A	Warning only or compressors and pump OFF.	Heat pump only Settable delay
AL02	High temperature input	S/A	Warning only or compressors and pump OFF.	Chiller only Settable delay
AL03	Primary exchanger efficiency Circuit #1	Manu	Keeps circuit compressors in OFF mode	Settable delay
AL13	Primary exchanger efficiency Circuit #2	Manu	Keeps circuit compressors in OFF mode	
AL05	Evaporator flowmeter	A/M	Compressors OFF Pump ON for T-sec.	Settable delay In manual arrest, pump OFF
AL11	High pressure switch Circuit #1	Manu	All the compressors of the circuit OFF	
AL12	High pressure switch Circuit #2	Manu	All the compressors of the circuit OFF	
AL21	Low pressure switch Circuit #1	A/M	All the compressors and fans of the circuit OFF	Start-up delay and settable rpm
AL22	Low pressure switch Circuit #2	A/M	All the compressors and fans of the circuit OFF	
AL31	Transducer High Pressure Circuit #1	Manu	All the compressors of the circuit OFF	
AL32	Transducer High Pressure Circuit #2	Manu	All the compressors of the circuit OFF	
AL41	Transducer Low Pressure Circuit #1	A/M	All the compressors of the circuit OFF	Start-up delay and settable rpm
AL42	Transducer Low Pressure Circuit #2	A/M	All the compressors of the circuit OFF	
AL51	Start-up failed due to low pressure Circuit #1	Auto	Keeps all OFF circuit compressors in OFF mode	
AL52	Start-up failed due to low pressure Circuit #2	Auto	Keeps all OFF circuit compressors in OFF mode	
AL61	Compressor gas discharge high temperature Circuit #1	A/M	All the compressors of the circuit OFF	Settable delay
AL62	Compressor gas discharge high temperature Circuit #2	A/M	All the compressors of the circuit OFF	
AL81	Evaporator anti-freeze Circuit #1	Manu	Circuit compressors OFF and pump ON for T-sec.	
AL82	Evaporator anti-freeze Circuit #2	Manu	Circuit compressors OFF and pump ON for T -sec.	
AF20	Free-cooling external fan thermal switch	A/M	FC Fan OFF	Settable delay
AC21	Compressor thermal switch #1	A/M	Compressor # 1 OFF	Settable delay
AC22	Compressor thermal switch #2	A/M	Compressor # 2 OFF	
AC23	Compressor thermal switch #3	A/M	Compressor # 3 OFF	
AC24	Compressor thermal switch #4	A/M	Compressor # 4 OFF	
AC25	Compressor thermal switch #5	A/M	Compressor # 5 OFF	

AC26	Compressor thermal switch #6	A/M	Compressor # 6 OFF	
AP21	Pump thermal switch #1	A/M	Pump # 1 OFF	*If the single pump switches off all the compressors and fans, otherwise it tries to switch on the other pump*
AP22	Pump thermal switch #2	A/M	Pump # 2 OFF	
AP23	Source pump thermal switch #1	A/M	Source pump # 1 OFF	*If the single pump switches off all the compressors and fans, otherwise it tries to switch on the other pump*
AP24	Source pump thermal switch #2	A/M	Source pump # 2 OFF	
AF21	Fan thermal switch Circuit #1	A/M	Fan # 1 OFF	Settable delay
AF22	Fan thermal switch Circuit #2	A/M	Fan # 2 OFF	
AC01	Compressor operating hours #1	Auto	Only shown	
AC02	Compressor operating hours #2	Auto	Only shown	
AC03	Compressor operating hours #3	Auto	Only shown	
AC04	Compressor operating hours #4	Auto	Only shown	
AC05	Compressor operating hours #5	Auto	Only shown	
AC06	Compressor operating hours #6	Auto	Only shown	
AP01	Pump operating hours #1	Auto	Only shown	
AP02	Pump operating hours #2	Auto	Only shown	
AP03	Source pump operating hours #1	Auto	Only shown	
AP04	Source pump operating hours #2	Auto	Only shown	
AF01	Fan operating hours Circuit #1	Auto	Only shown	
AF02	Fan operating hours Circuit #2	Auto	Only shown	
AL06	Source flowmeter	A/M	Compressors OFF Pump ON for T-sec.	Settable delay In manual arrest, pump OFF
AL83	Source anti-freeze Circuit #1	Manu	Circuit compressors OFF and pump ON for T-sec.	
AL84	Source anti-freeze Circuit #2	Manu	Circuit compressors OFF and pump ON for T -sec.	
ERTC	RTC down/broken alarm	A/M	Blocks management of the RTC	-
EN01	Expansion communication alarm	Auto	Only shown	Settable delay
EVM1	EVCM Circuit #1 communication alarm	Auto	All the compressors of the circuit OFF	Settable delay
EVM2	EVCM Circuit #2 communication alarm	Auto	All the compressors of the circuit OFF	Settable delay
ES01	External room temperature probe	Auto	Inhibits the functions that use it	
ES02	System input temperature probe (FC)	Auto	Inhibits the functions that use it	
ES03	Aux remote temperature probe (storage tank)	Auto	Inhibits the functions that use it	
ES04	Heat sink exchanger input temperature probe	Auto	Number of compressors ON settable	Settable delay
ES05	Heat sink exchanger output temperature probe circuit 1	Auto	Number of compressors ON settable	
ES06	Heat source exchanger output temperature probe circuit 1	Auto	Inhibits the functions that use it	
ES07	Coil temperature probe circuit 1	Auto	Inhibits the functions that use it	
ES08	Condensation pressure probe circuit 1	Auto	Fan forcing settable	
ES09	Evaporation pressure probe circuit 1	Auto	Fan forcing settable	
ES10	Single pressure probe circuit 1	Auto	Fan forcing settable	

ES11	Compressor discharge temperature probe circuit 1	Auto	Inhibits the functions that use it	
ES12	Compressor intake temperature probe circuit 1	Auto	Inhibits the functions that use it	
ES13	Heat sink exchanger output temperature probe circuit 2	Auto	Number of compressors ON settable	
ES14	Heat source exchanger output temperature probe circuit 2	Auto	Inhibits the functions that use it	
ES15	Coil temperature probe circuit 2	Auto	Inhibits the functions that use it	
ES16	Condensation pressure probe circuit 2	Auto	Fan forcing settable	
ES17	Evaporation pressure probe circuit 2	Auto	Fan forcing settable	
ES18	Single pressure probe circuit 2	Auto	Fan forcing settable	
ES19	Compressor discharge temperature probe circuit 2	Auto	Inhibits the functions that use it	
ES20	Compressor intake temperature probe circuit 2	Auto	Inhibits the functions that use it	
AHW1	Duplicated configuration of analogue inputs	Auto	Only shown	
AHW2	Duplicated configuration of digital inputs	Auto	Only shown	
AF03	Free-cooling fan operating hours	Auto	Only shown	
AL07	Phases sequence	Manu	unit OFF	
AL08	Water level	A/M	Compressors OFF Pump ON for T-sec	Delay can be set With manual-resetting alarm, pump OFF
AL09	Master communication alarm	A/M	Showing	Fixed 5 min

Note: (*1) If it's the only pump, it switches off all the compressors and fans, otherwise it tries to switch on the other pump.

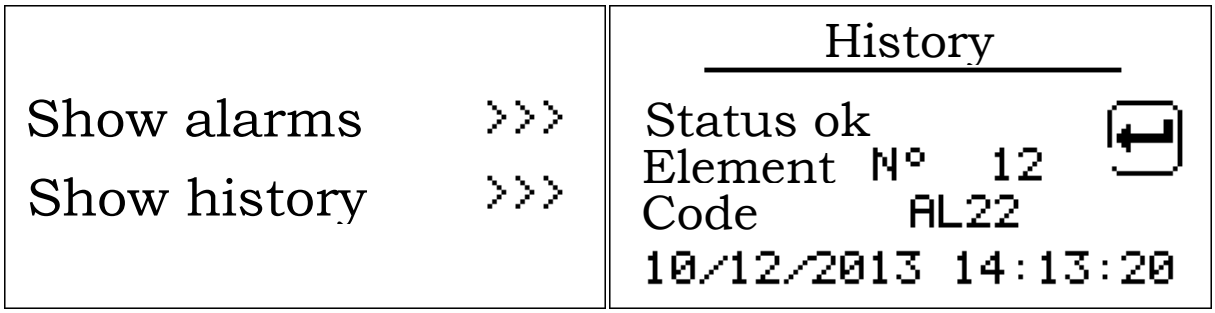
S/A = Warning –only for autoresetting alarm (settable in the parameters).

A/M = Autoresetting or manual alarm (settable in the parameters or due to number of events/hour).

10.5 Alarm History

The controller memorises the ALARM HISTORY in an adequate memory zone (not volatile) organised like a FIFO queue, or it could be a list of the latest alarms that have gone off.

To view the alarm history from V-Graph, select *"ShowHISTORY"* from the general menu or from the main page by pressing ESC.



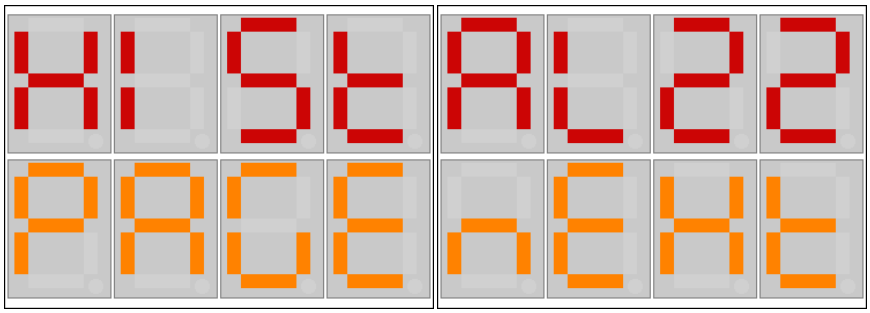
Each element in the history is associated to the following information:

- progressive number of the alarm
- mnemonic code of the alarm (AL01, AL03, …)
- date and time that the alarm went off.

To view the alarm history on the LED display, select HiSt from the main menu or press esc on the main page.

Each element is associated just to the mnemonic code of the alarm (AL01, AL03, …), by pressing the Set key you see the next element.

Display c-pro 3 nano CHILL



The code for each alarm is that shown in the table of alarms. The history can memorise 100 events.

Using parameter *PH30 (Delete Alarm History)* you can delete all the elements memorised from the history; set the parameter on YES (1) and wait a few seconds until the preset value NO (0) is read again.

Note 1. In the event that the memory capacity has reached its limit (that is, 100 events recorded), and you want to memorise/record another event, the first event initially saved in the memory overwritten by the new one. The same goes for the following elements.

Note 2. The history is enabled only if parameter *PG04=1*, or if the system clock is enabled.

c-pro 3 *nano CHILL*
Programmable controller for single-and two circuits chillers-heat pumps
Application manual ver. 3.0
PT - 48/19
Codice 144CP3NCE304

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