

**μC<sup>2</sup>**  
electronic controller

**CAREL**



**GB** User manual

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

T e c h n o l o g y & E v o l u t i o n





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Without excluding proper compliance with further warnings present in the manual, it is stressed that in any case it is necessary, for each Product of CAREL:

- To avoid getting the electrical circuits wet. Rain, humidity and all types of liquids or condensation contain corrosive mineral substances that can damage the electrical circuits. In any case, the product should be used and stored in environments that respect the range of temperature and humidity specified in the manual.
- Do not install the device in a particularly hot environment. Temperatures that are too high can shorten the duration of the electronic devices, damaging them and distorting or melting the parts in plastic. In any case, the product should be used and stored in environments that respect the range of temperature and humidity specified in the manual.
- Do not try to open the device in any way different than that indicated in the manual.
- Do not drop, hit or shake the device, because the internal circuits and mechanisms could suffer irreparable damage.
- Do not use corrosive chemical products, aggressive solvents or detergents to clean the device.
- Do not use the product in application environments different than those specified in the technical manual.

All the above reported suggestions are valid also for the control, serial unit, programming key or nevertheless for any other accessory in the product portfolio of CAREL.

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### Disposal of the product

In reference to European Community directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:

1. we cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. the public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment.
3. the equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
4. the symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
5. in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.



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# 1. INTRODUCTION

## 1.1 General description

The  $\mu C^2$  is a new compact CAREL electronic controller, the same size as a normal thermostat, for the complete management of chillers and heat pumps: it can control air-air, air-water, water-water and condensing units.

### 1.1.1 Main functions

- control of the water inlet and evaporator outlet temperature;
- defrost management by time and/or by temperature or pressure;
- fan speed control;
- complete alarm management;
- connection to serial line for supervision/telemaintenance;
- elimination of the expansion vessel.

#### - Driver function

- Management of electronic expansion valves.

### 1.1.2 Controlled devices

- compressor;
- condenser fans;
- reversing valve;
- water pumps for evaporator and/or condenser, and outlet fan (air-air);
- antifreeze heater;
- alarm signal device.

### 1.1.3 Programming

CAREL offers the possibility to configure all the unit parameters not only from the keypad on the front panel, but also using:

- a hardware key;
- a serial line.

## 1.2 User interface

### 1.2.1 Display

The display features 3 digits, with the display of the decimal point between -99.9 and 99.9.

Outside of this range of measurement, the value is automatically displayed without the decimal (even if internally the unit still operates considering the decimal part).

In normal operation, the value displayed corresponds to the temperature read by probe B1, that is, the evaporator water inlet temperature (for water chillers) or the ambient air temperature for direct expansion units.

Fig. 1.a show the symbols present on the display and on the keypad and their meanings.

### 1.2.2 Symbols on the display

Display with 3 green digits (plus sign and decimal point), amber symbols and red alarm symbols.

symbol	colour	meaning	reference refrigerant circuit
		<b>with LED ON</b>	<b>con LED lampeggiante</b>
1; 2	amber	compressor 1 and/or 2 ON	start up request
1; 3	amber	compressor 3 and/or 3 ON	start up request
A	amber	at least one compressor ON	1/2
B	amber	pump/air outlet fan ON	start up request
C	amber	condenser fan ON	1/2
D	amber	defrost active	defrost request
E	amber	heater ON	1/2
F	red	alarm active	1/2
G	amber	heat pump mode (P6=0)	heat pump mode request (P6=0)
H	amber	chiller mode (P6=0)	chiller mode request (P6=0)

Table 1.a

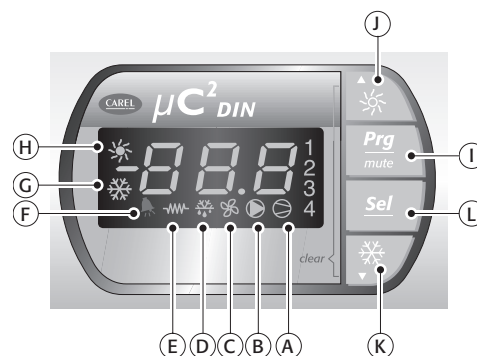
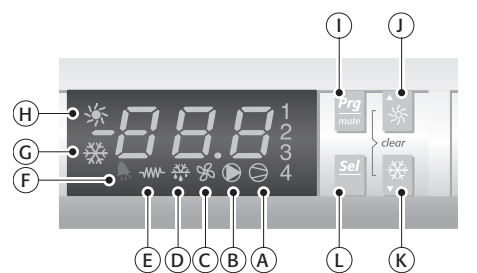


Fig. 1.a

### 1.2.3 Funzioni associate ai tasti

tasto	stato della macchina	modalità pressione
I	Loading default values	press at power ON
	Go up a sub-group inside the programming area, until exiting (saving changes to EEPROM)	press once
	In the event of alarms, mute the buzzer (if present) and deactivate the alarm relay	press once
L	Access the direct parameters	press for 5 s
	Select item inside the programming area and display value of direct parameters/confirm the changes to the parameters	press once
I + L	Program parameters afters entering password	press for 5 s
J	Select top item inside the programming area	press once or press and hold
	Increase value	press once or press and hold
	Switch from standby to chiller mode (P6=) and vice versa	press for 5 s
K	Select bottom item inside the programming area	press once or press and hold
	Decrease value	press once or press and hold
	Switch from standby to heat pump mode (P6=0) and vice versa	press for 5 s
J + K	Manual alarm reset	press for 5 s
	Immediately reset the hour counter (inside the programming area)	press for 5 s
L + J	Force manual defrost on both circuits	press for 5 s

Table 1.b

### 1.2.4 Programming and saving the parameters

1. press "**Prg**" and "**sel**" for 5 seconds;
2. the heating and cooling symbol and the figure "00" are displayed;
3. use "**↶**" and "**↷**" to set the password (page 28) and confirm by pressing "**sel**";
4. use "**↶**" and "**↷**" to select the parameter menu (S-P) or levels (L-P) and then press "**sel**";
5. use "**↶**" and "**↷**" to select the parameter group and then press "**sel**";
6. use "**↶**" and "**↷**" to select the parameter and then press "**sel**";
7. after making the changes to the parameter, press "**sel**" to confirm or "**Prg**" to cancel the changes;
8. press "**Prg**" to return to the previous menu;
9. to save the modifications, press "**Prg**" repeatedly until reaching the main menu.

#### Note:

- a. the parameters that have been modified without being confirmed using the "**sel**" button return to the previous value;
- b. if no operations are performed on the keypad for 60 seconds, the controller exits the parameter modification menu by timeout and the changes are cancelled.

### 1.2.5. Keypad

The keypad is used to set the unit operating values (see Parameters/alarms - Keypad combinations)



## 2. CONNECTIONS

### 2.1 General diagram

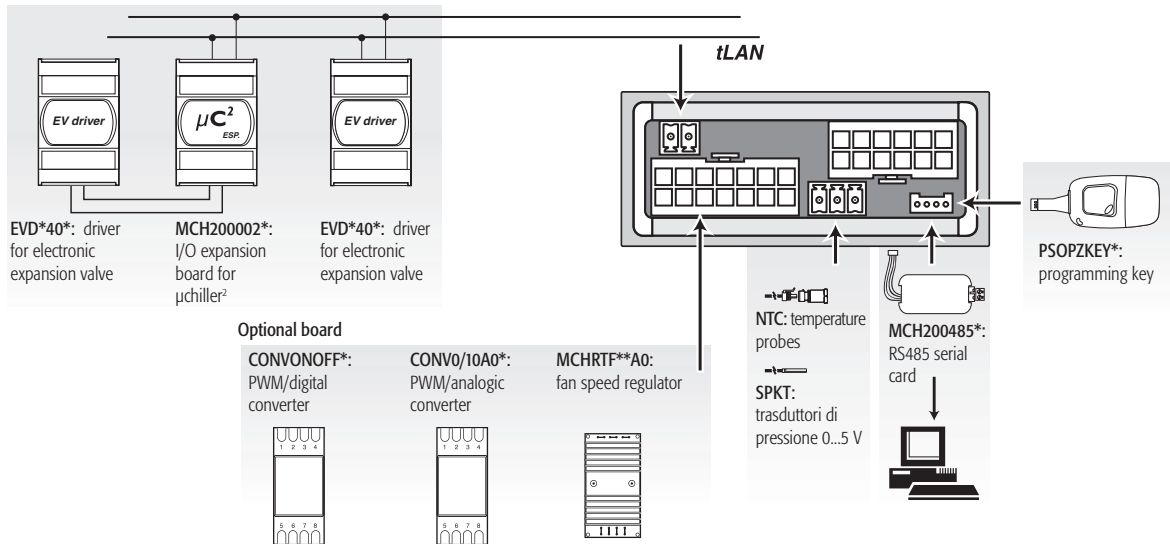


Fig. 2.a

### 2.2 Network layout

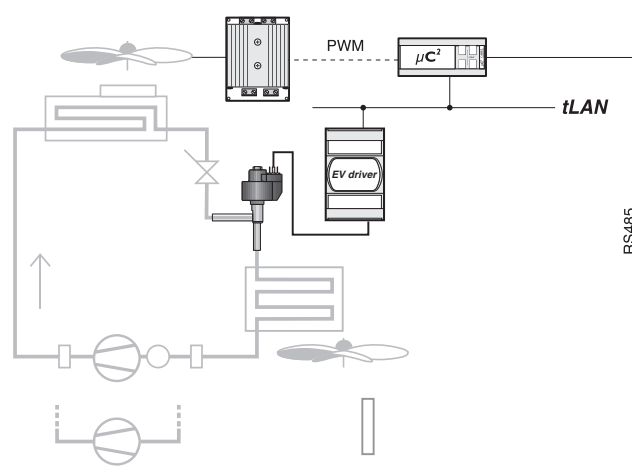


Fig. 2.b

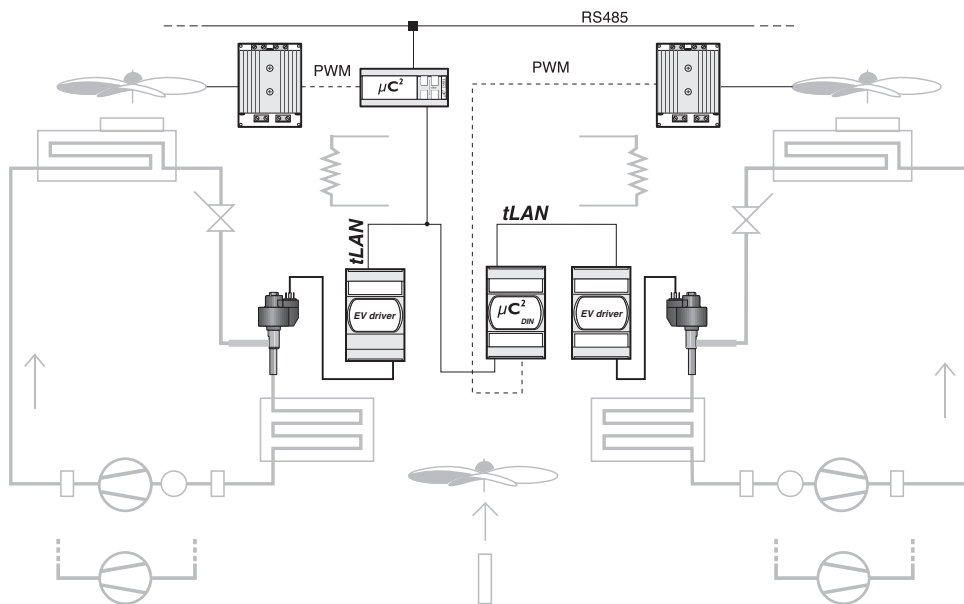


Fig. 2.c

### 3. APPLICATIONS

#### 3.1 Air/air unit

##### 3.1.1 Single circuit

Key:

1	condenser fan overload
2	fan
3	condenser probe
4	supply probe
5	electrical heater
6	evaporator
7	supply fan overload
8	supply fan
9	compressor 1
10	high pressure
11	compressor overload
12	low pressure
13	ambient probe
14	compressor 2

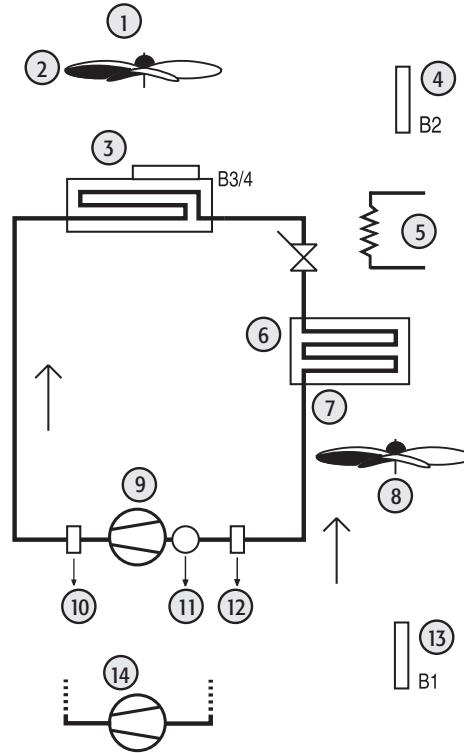


Fig. 3.a.a

##### 3.1.2 Two circuits

Key:

1	condenser fan overload 1 and 2
2	fan
3	condenser probe
4	supply probe
5	electrical heater 1 and 2
6	evaporator 1 e 2
7	supply fan overload
8	supply fan
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	ambient probe
14	compressor 2
15	compressor 3
16	compressor 4

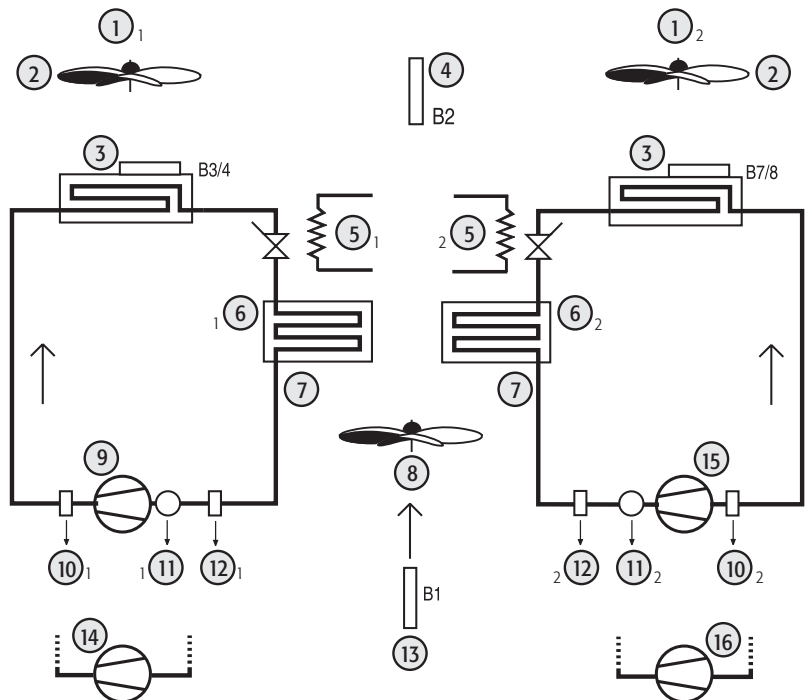
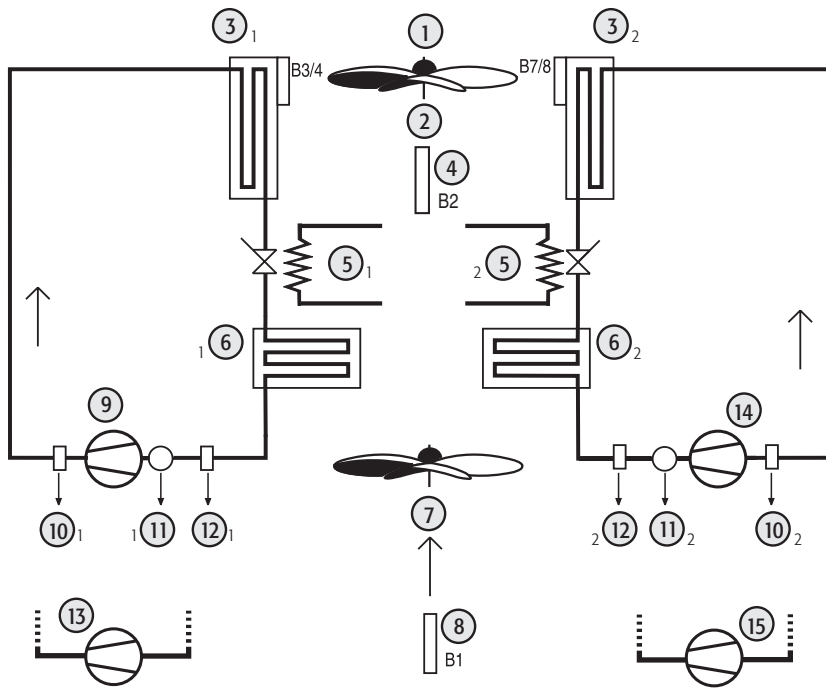


Fig. 3.a.b

### 3.1.2 Two circuits, 1 condenser fan circuit



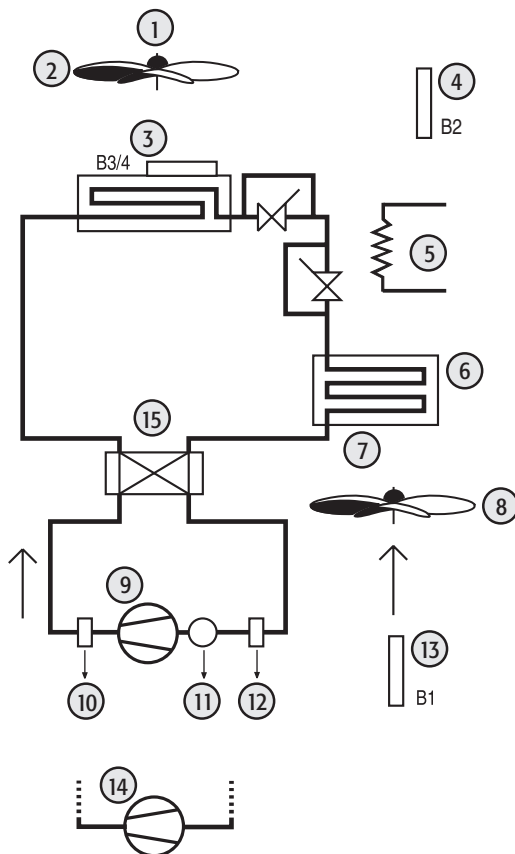
**Key:**

1	condenser fan overload
2	fan
3	condenser probe 1 and 2
4	supply probe
5	electrical heater 1 and 2
6	evaporator 1 and 2
7	supply fan
8	ambient probe
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	compressor 2
14	compressor 3
15	compressor 4

Fig. 3.a.c

## 3.2 AIR/AIR heat pump

### 3.2.1 Single circuit



**Key:**

1	condenser fan overload
2	fan
3	condenser probe
4	supply probe
5	electrical heater
6	evaporator
7	supply fan overload
8	supply fan
9	compressor 1
10	high pressure
11	compressor overload
12	low pressure
13	ambient probe
14	compressor 2
15	reversing valve

Fig. 3.b.a

### 3.2.2 Two circuits

**Key:**

1	condenser fan overload 1 and 2
2	fan
3	condenser probe
4	supply probe
5	electrical heater 1 e 2
6	evaporator 1 and 2
7	supply fan overload
8	supply fan
9	compressor 1
10	high pressure 1 e 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	ambient probe
14	compressor 2
15	reversing valve 1 and 2
16	compressor 3
17	compressor 4

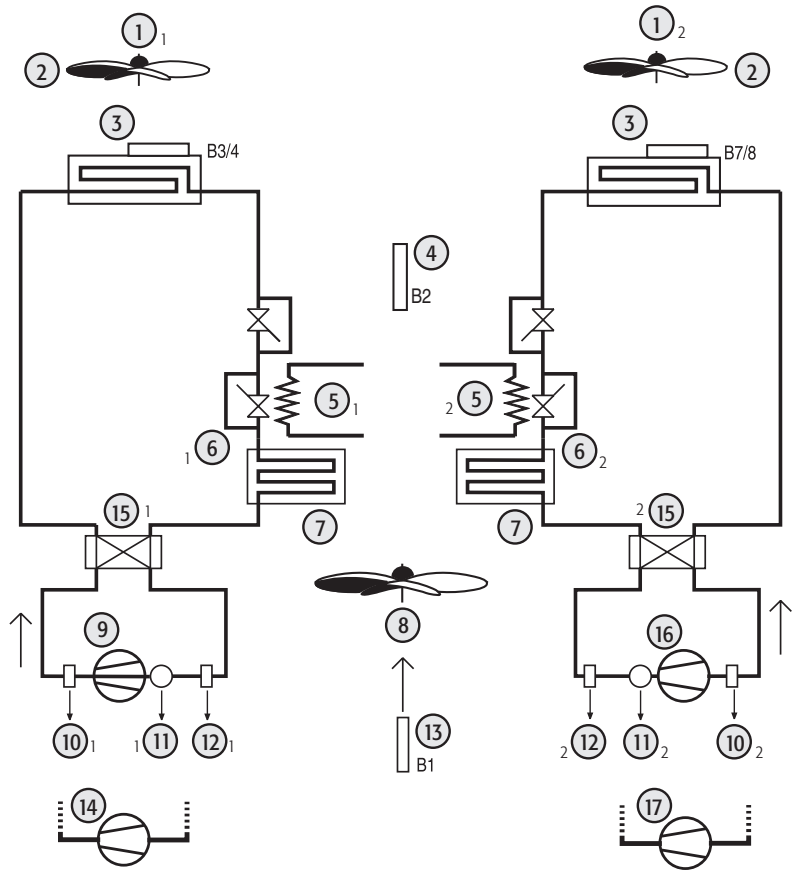


Fig. 3.b.b

### 3.2.3 Two circuits, 1 condenser fan circuit

**Key:**

1	condenser fan overload
2	fan
3	condenser probe 1 and 2
4	supply probe
5	electrical heater 1 e 2
6	evaporator 1 e 2
7	supply fan overload
8	supply fan
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	ambient probe
14	compressor 2
15	reversing valve 1 and 2
16	compressor 3
17	compressor 4

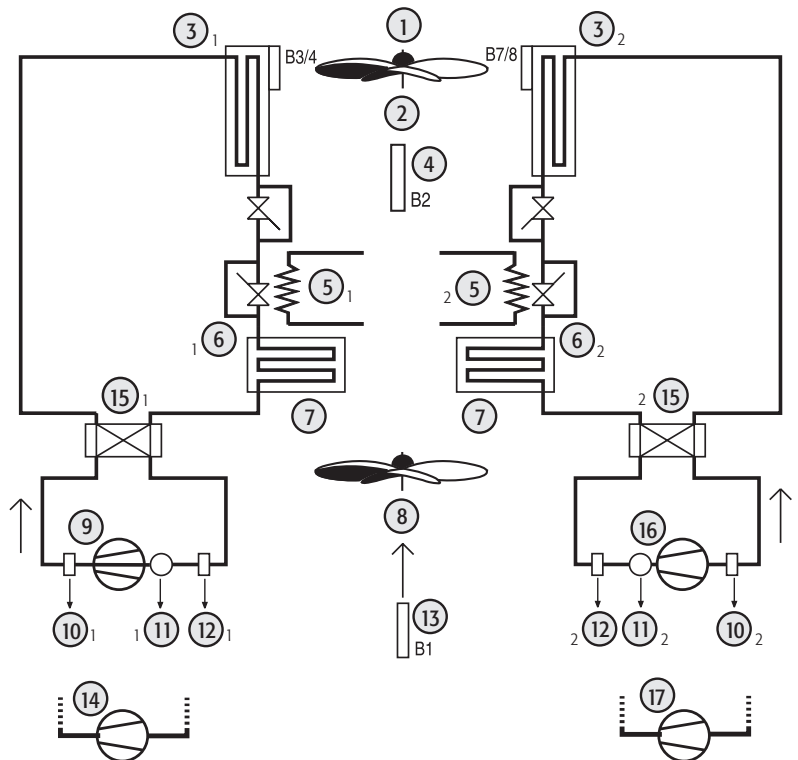


Fig. 3.b.c

### 3.3 AIR/WATER chiller

#### 3.3.1 Single circuit

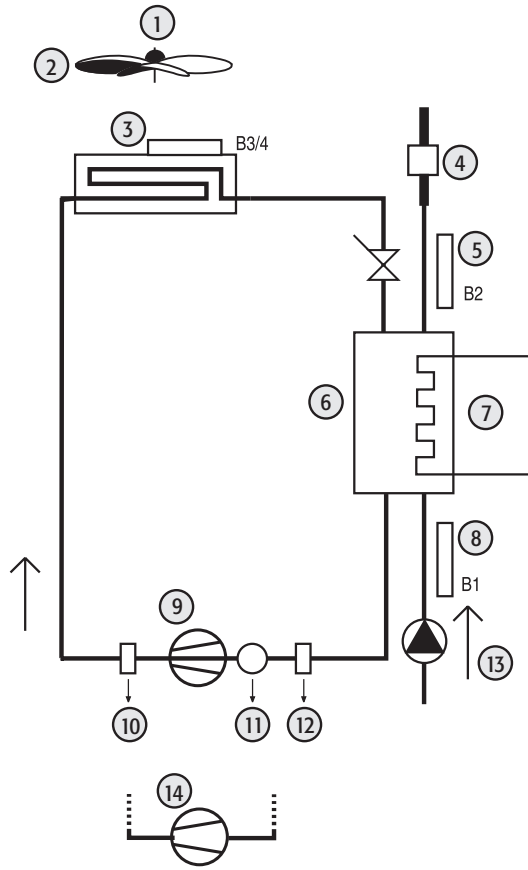


Fig. 3.c.a

#### Key:

1	condenser fan overload
2	fan
3	condenser probe
4	flow switch
5	outlet evaporator probe
6	fan
7	antifreeze heater
8	inlet evaporator probe
9	compressor 1
10	high pressure
11	compressor overload
12	low pressure
13	water pump
14	compressor 2

#### 3.3.2 two circuits, 2 condenser fan circuits and 2 evaporators

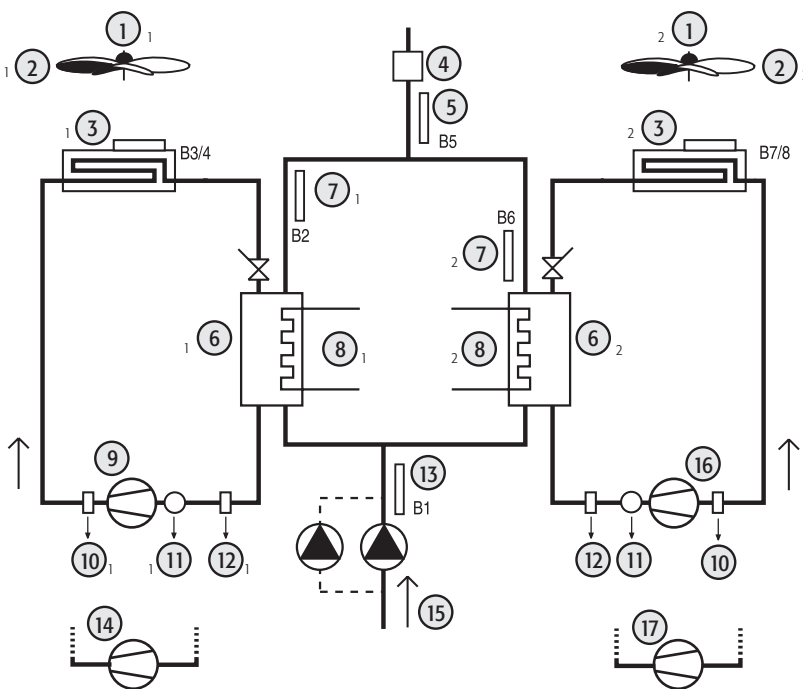


Fig. 3.c.b

#### Key:

1	condenser fan overload 1 and 2
2	fan 1 and 2
3	condenser probe 1 and 2
4	flow switch
5	outlet temperature probe
6	evaporator 1 and 2
7	outlet evaporator probe 1 and 2
8	antefreeze heater 1 and 2
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	inlet evaporator probe
14	compressor 2
15	water pump
16	compressor 3
17	compressor 4

### 3.3.2 two circuits, 1 condenser fan circuit

Key:

1	condenser fan overload
2	fan
3	condenser probe 1 and 2
4	flow switch
5	outlet temperature probe
6	evaporator 1 and 2
7	outlet evaporator probe 1 and 2
8	antifreeze heater 1 and 2
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	inlet evaporator probe
14	compressor 2
15	water pump
16	compressor 3
17	compressor 4

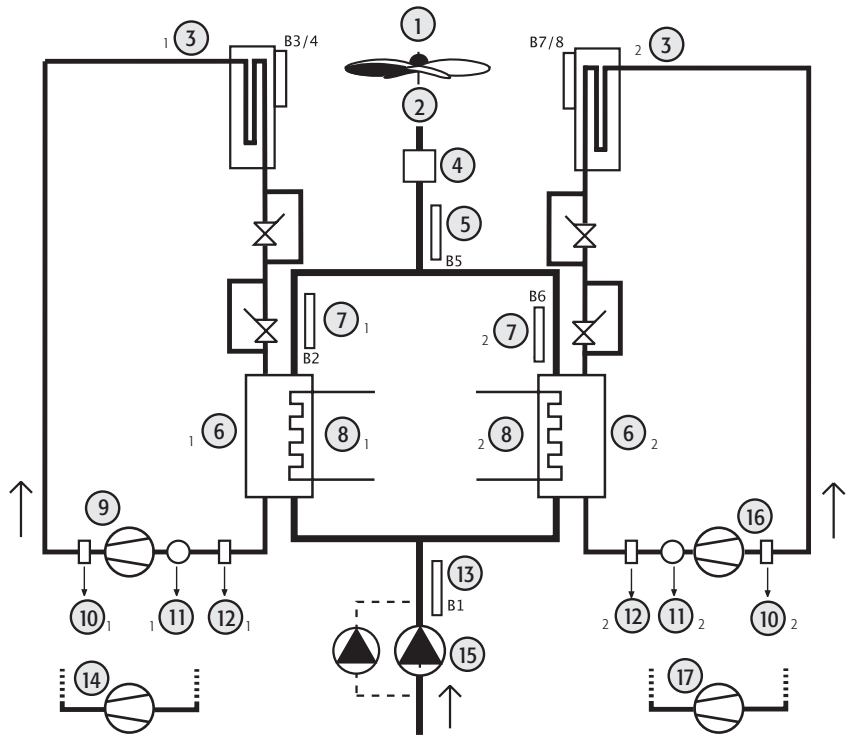


Fig. 3.c.c

### 3.4 AIR/WATER heat pump

#### 3.4.1 Single circuit

Key:

1	condenser fan overload
2	fan
3	sonda condensatore
4	flow switch
5	outlet evaporator probe
6	evaporator
7	antifreeze heater
8	inlet evaporator probe
9	compressor 1
10	high pressure
11	compressor overload
12	low pressure
13	water pump
14	compressor 2

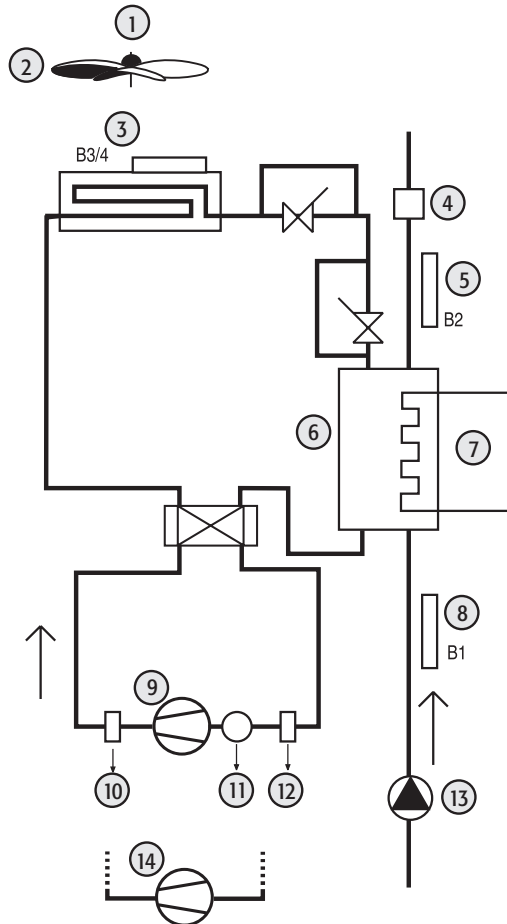


Fig. 3.d.a

### 3.4.2 2 condenser fan circuits

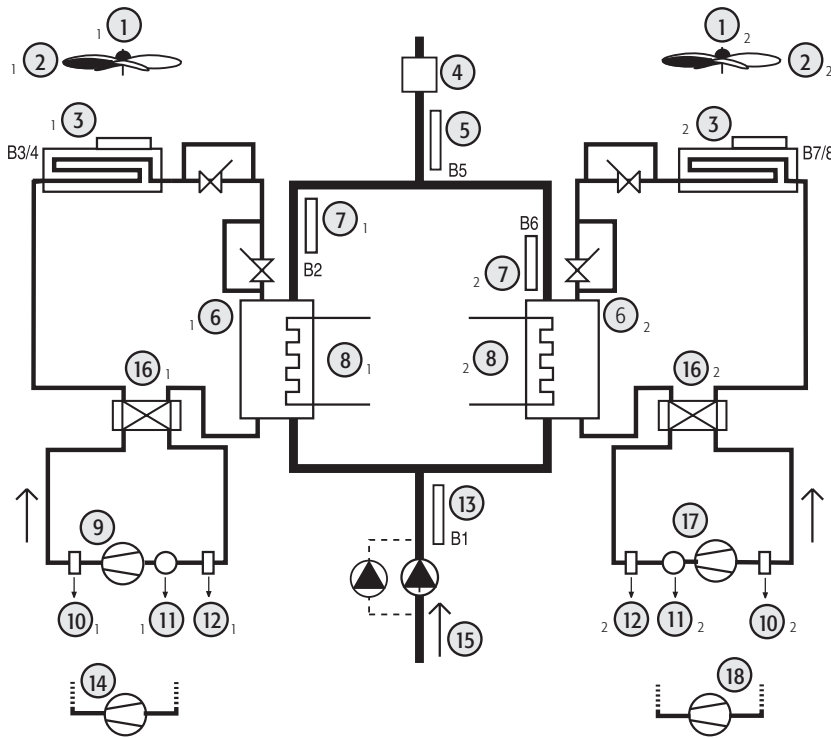


Fig. 3.d.b

#### Key:

1	condenser fan overload 1 and 2
2	fan 1 and 2
3	condenser probe 1 and 2
4	flow switch
5	outlet temperature probe
6	evaporator 1 and 2
7	outlet evaporator probe 1 and 2
8	antifreeze heater 1 and 2
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	inlet evaporator probe
14	compressor 2
15	water pump
16	reversing valve 1 and 2
17	compressor 3
18	compressor 4

### 3.4.3 two circuits, 1 condenser fan circuit

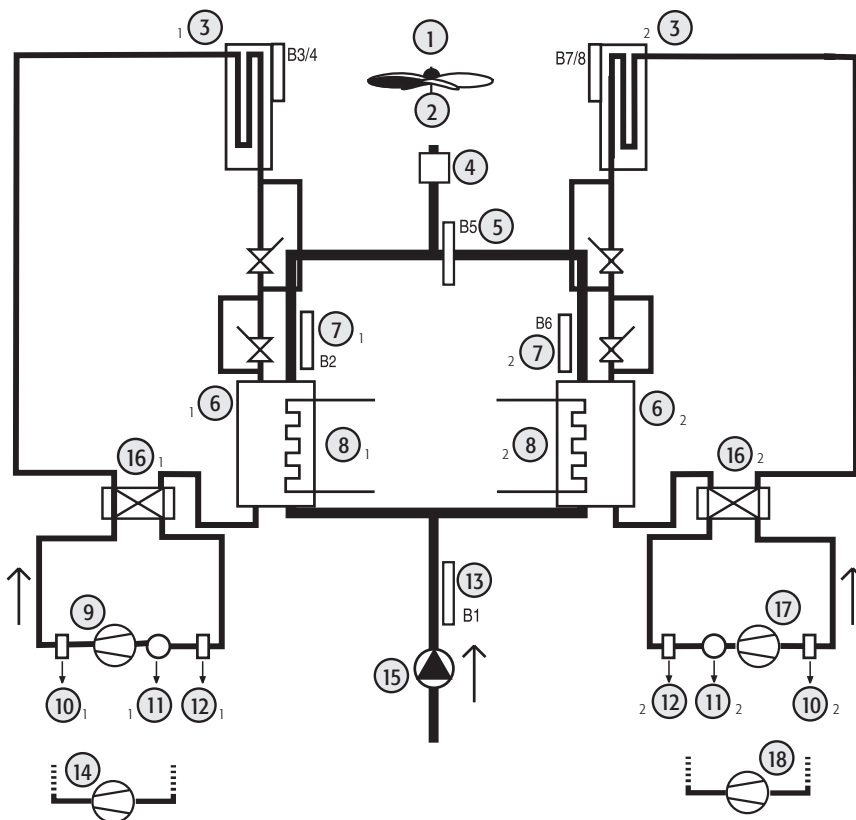


Fig. 3.d.c

#### Key:

1	condenser fan overload
2	fan
3	condenser probe 1 and 2
4	flow switch
5	outlet temperature probe
6	evaporator 1 and 2
7	outlet evaporator probe 1 and 2
8	antifreeze heater 1 and 2
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	inlet evaporator probe
14	compressor 2
15	water pump
16	reversing valve 1 and 2
17	compressor 3
18	compressor 4

### 3.5 WATER/WATER chiller

#### 3.5.1 Single circuit

Key:

1	water condensing temperature probe
2	condensator
3	flow switch
4	outlet evaporator probe
5	evaporator
6	antifreeze heater
7	inlet evaporator probe
8	compressor 1
9	high pressure
10	compressor overload
11	low pressure
12	water pump
13	compressor 2

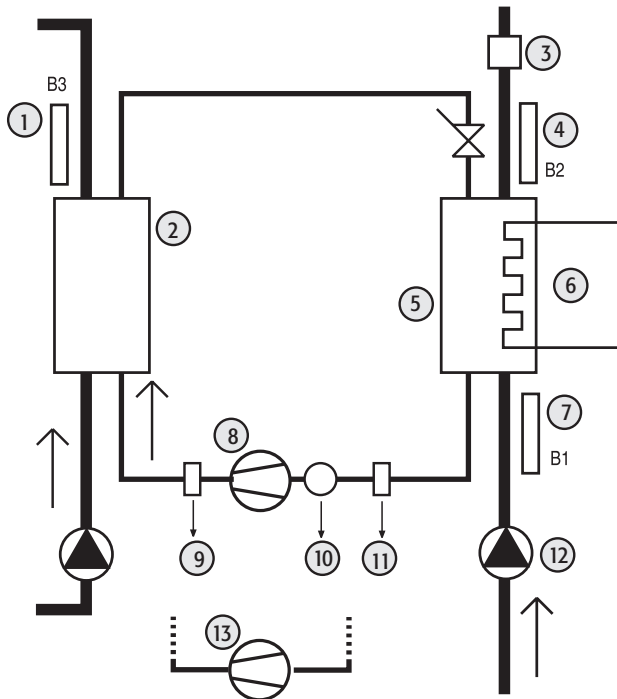


Fig. 3.e.a

#### 3.5.2 Two circuits

Key:

1	water condensing temperature probe 1 and 2
2	condensator 1 and 2
3	flow switch
4	outlet evaporator probe
5	evaporator
6	antifreeze heater 1 and 2
7	compressor 1
8	high pressure 1 and 2
9	compressor overload 1 and 2
10	low pressure 1 and 2
11	inlet evaporator probe
12	water pump
13	compressor 2
14	compressor 3
15	compressor 4

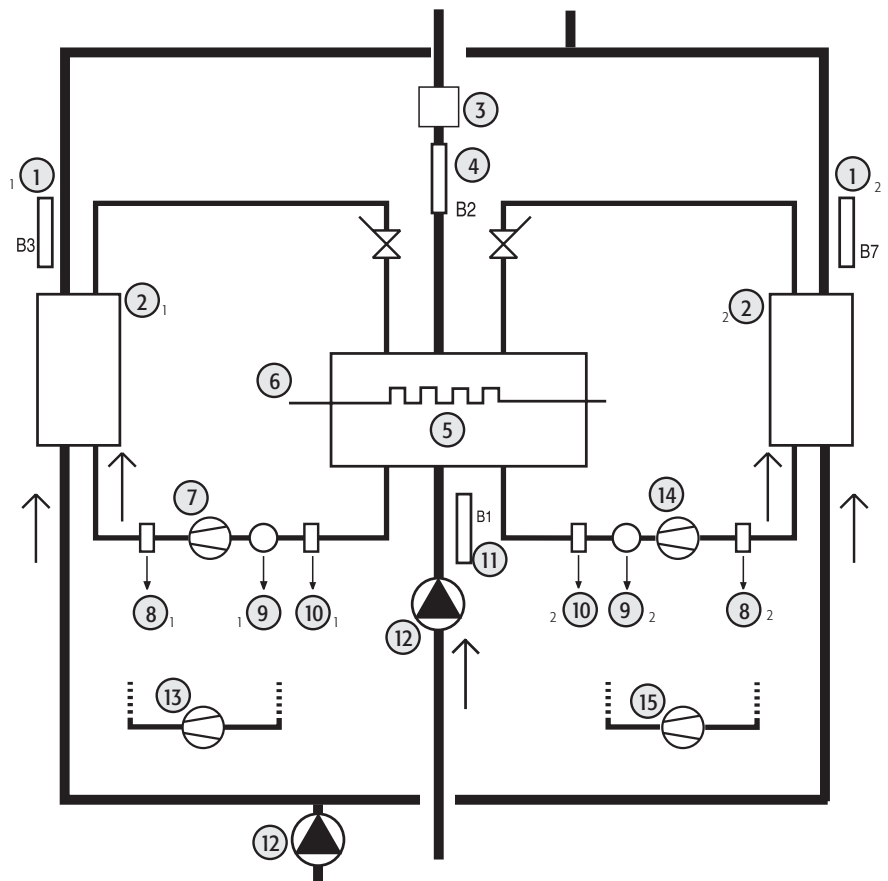


Fig. 3.e.b



### 3.5.3 Two circuits, 2 evaporators

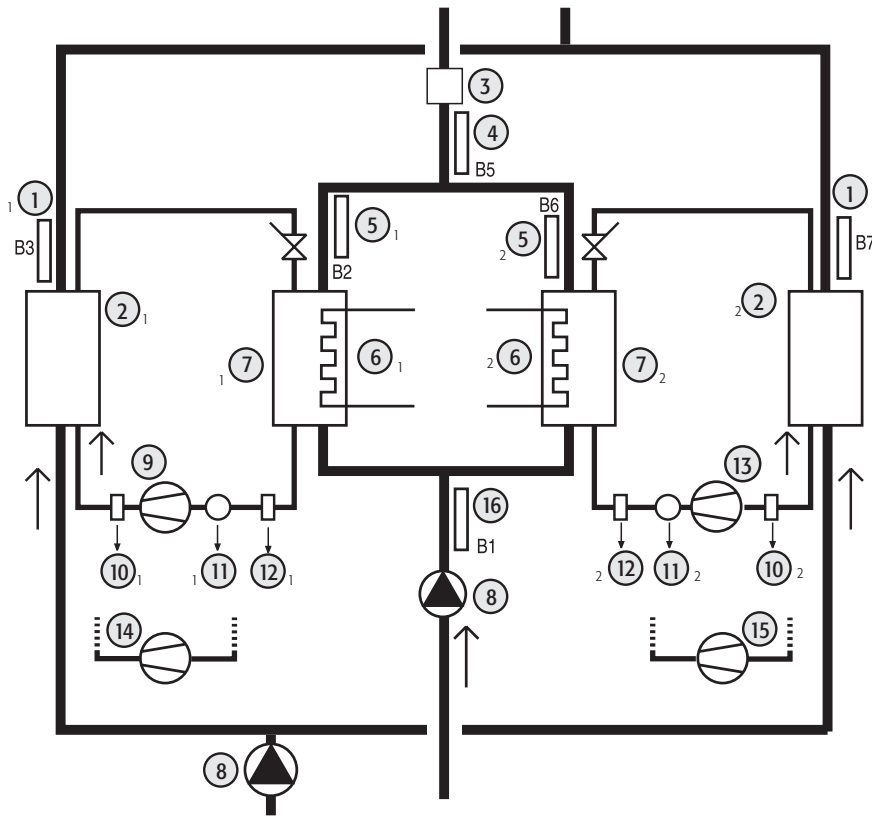


Fig. 3.e.c

#### Key:

1	water condensing temperature probe 1 and 2
2	condensator 1 and 2
3	flow switch
4	outlet temperature probe
5	outlet evaporator probe 1 and 2
6	antifreeze heater 1 and 2
7	evaporator
8	water pump
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	compressor 3
14	compressor 2
15	compressor 4
16	inlet evaporator pressure

## 3.6 WATER/WATER heat pump with reversal on gas circuit

### 3.6.1 Single circuit

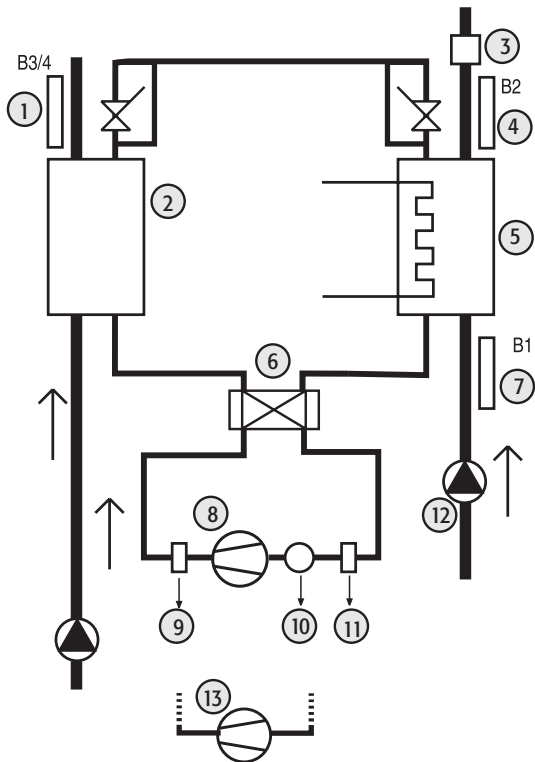


Fig. 3.f.a

#### Key:

1	condenser probe
2	condenser
3	flow switch
4	outlet evaporator probe
5	antifreeze heater
6	reversing valve
7	inlet evaporator probe
8	compressor 1
9	high pressure
10	compressor overload
11	low pressure
12	water pump
13	compressor 2

### 3.6.2 Two circuits

Key:

1	water condensing temperature probe 1 and 2
2	condensator 1 and 2
3	flow switch
4	outlet evaporator probe
5	outlet evaporator probe 1 and 2
6	evaporator 1 and 2
7	antifreeze heater 1 and 2
8	water pump
9	compressor 1
10	high pressure 1 and 2
11	compressor overload 1 and 2
12	low pressure 1 and 2
13	inlet evaporator probe
14	compressor 2
15	compressor 3
16	reversing valve 1 and 2
17	compressor 4

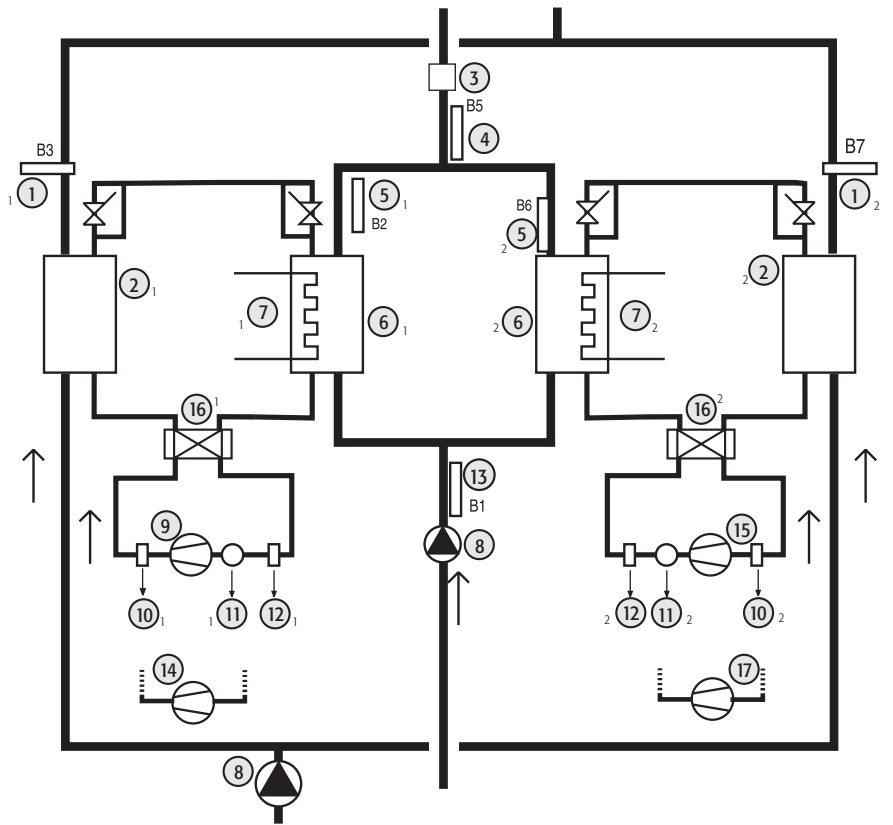


Fig. 3.f.b

### 3.6.3 Two circuits, 1 evaporator

Key:

1	condenser probe 1 and 2
2	condenser 1 and 2
3	flow switch
4	outlet evaporator probe
5	evaporator
6	antifreeze heater 1 and 2
7	compressor 1
8	high pressure 1 and 2
9	compressor overload 1 and 2
10	low pressure 1 and 2
11	inlet evaporator probe
12	water pump
13	compressor 2
14	reversing valve 1 and 2
15	compressor 3
16	compressor 4

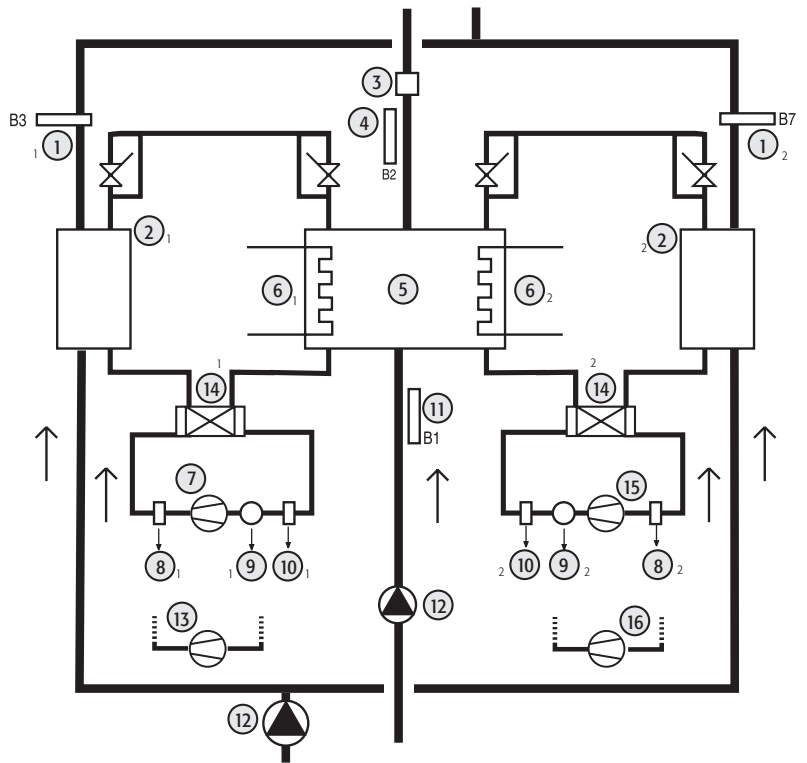


Fig. 3.f.c

### 3.7 WATER/WATER heat pump with reversal on water circuit

#### 3.7.1 Single circuit

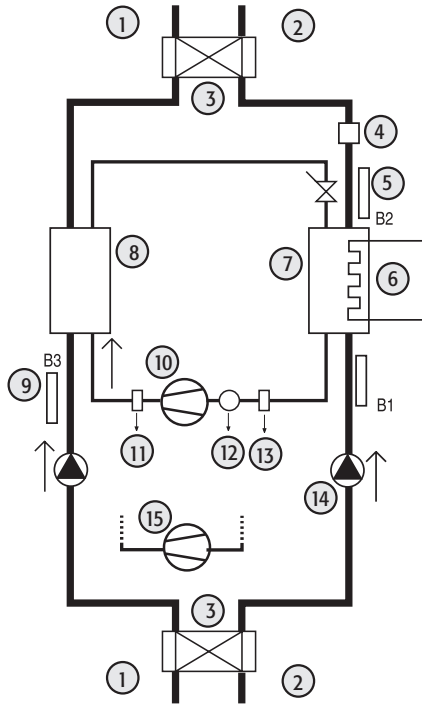


Fig. 3.g.a

#### Key:

1	external
2	internal
3	reversing valve
4	flow switch
5	outlet evaporator probe
6	antifreeze heater
7	evaporator
8	condenser
9	condenser probe
10	compressor 1
11	high pressure
12	compressor overload
13	low pressure
14	water pump
15	compressor 2

#### 3.7.2 Two circuits, H02= 1 and H21= 4

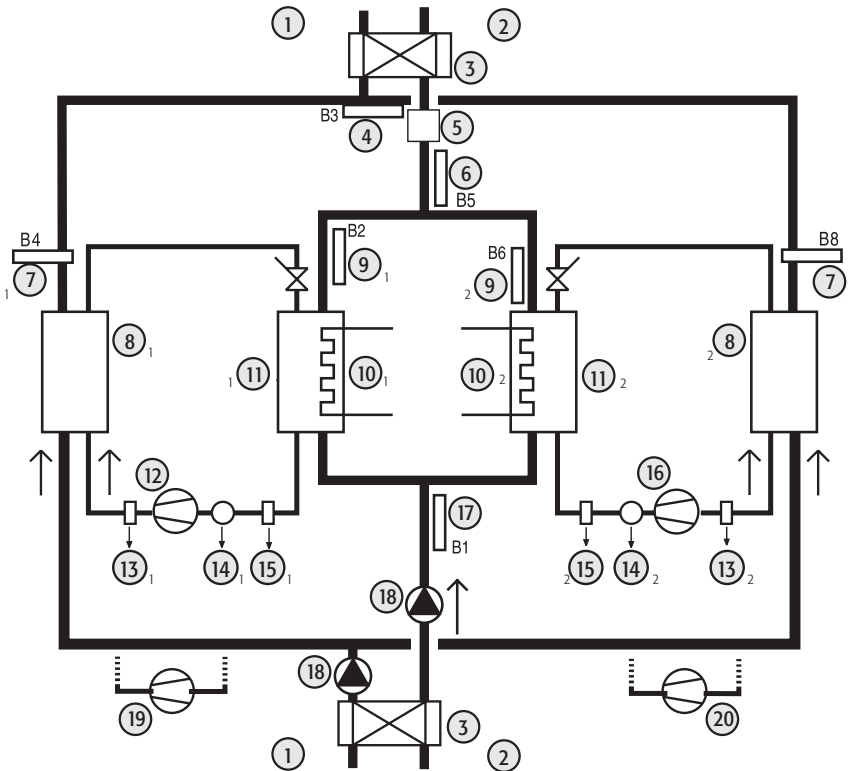


Fig. 3.g.b

#### Key:

1	external
2	internal
3	reversing valve 1 and 2
4	condenser probe
5	flow switch
6	outlet evaporator probe
7	condenser probe 1 and 2
8	condenser 1 and 2
9	outlet evaporator probe 1 and 2
10	antifreeze heater 1 and 2
11	evaporator 1 and 2
12	compressor 1
13	high pressure 1 and 2
14	compressor overload 1 and 2
15	low pressure 1 and 2
16	compressor 3
17	inlet evaporator probe
18	water pump
19	compressor 2
20	compressor 4

### 3.7.3 Two circuits, 1 evaporator H02= 1 e H21= 4

Key:

1	external
2	internal
3	reversing valve 1 and 2
4	condenser probe
5	flow switch
6	outlet evaporator probe
7	condenser probe 1 and 2
8	condenser 1 and 2
9	outlet evaporator probe 1 and 2
10	antifreeze heater 1 and 2
11	evaporator 1 and 2
12	compressor 1
13	high pressure 1 and 2
14	compressor overload 1 and 2
15	low pressure 1 and 2
16	compressor 3
17	inlet evaporator probe
18	water pump
19	compressor 2
20	compressor 4

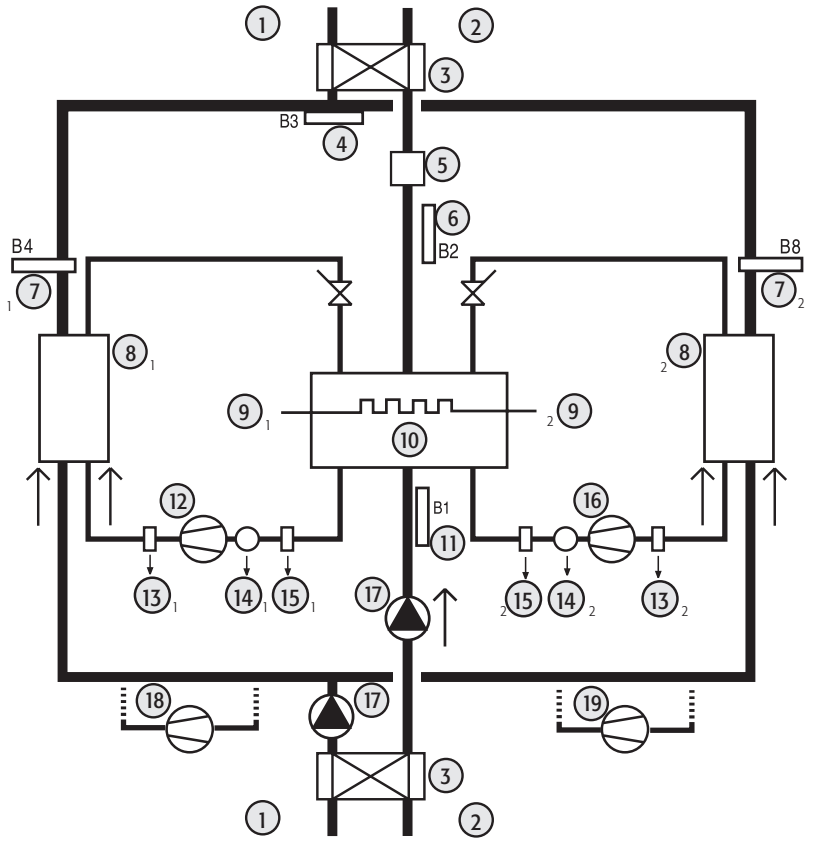


Fig. 3.g.c

### 3.8 Air-cooled condensing unit without reverse cycle

#### 3.8.1 Single circuit

Key:

1	condenser fan overload
2	fan
3	condenser probe
4	compressor 1
5	high pressure
6	compressor overload
7	low pressure
8	compressor 2

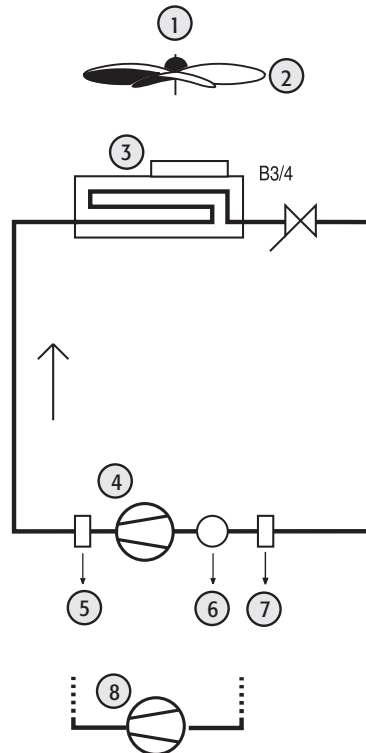


Fig. 3.h.a

### 3.8.2 Two circuits

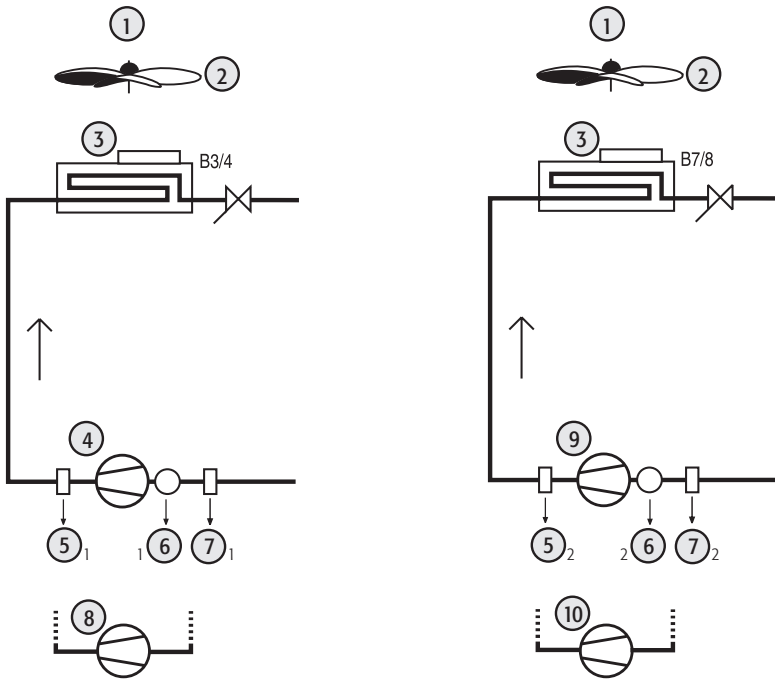


Fig. 3.h.b

#### Key:

1	condenser fan overload
2	fan
3	condenser probe
4	compressor 1
5	high pressure 1 and 2
6	compressor overload 1 and 2
7	low pressure 1 and 2
8	compressor 2
9	compressor 3
10	compressor 4

## 3.9 Reverse-cycle air-cooled condensing unit

### 3.9.1 Single circuit

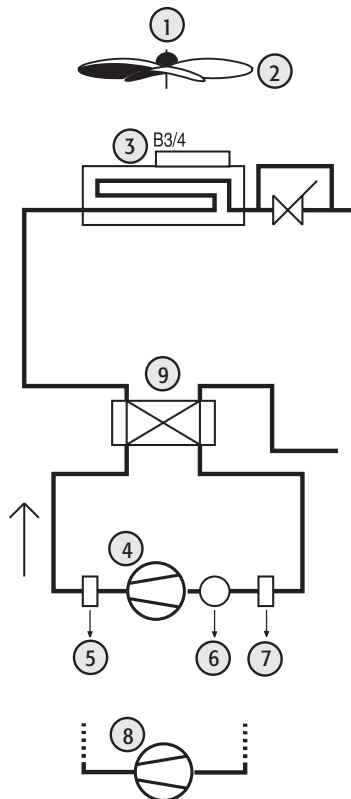


Fig. 3.i.a

#### Key:

1	condenser fan overload
2	fan
3	condenser probe
4	compressor 1
5	high pressure
6	compressor overload
7	low pressure
8	compressor 2
9	reversing valve

### 3.9.2 Two circuits with one condenser fan circuit

**Key:**

1	condenser fan overload
2	fan
3	condenser probe
4	compressor 1
5	high pressure 1 and 2
6	compressor overload 1 and 2
7	low pressure 1 and 2
8	compressor 2
9	compressor 3
10	compressor 4
11	reversing valve

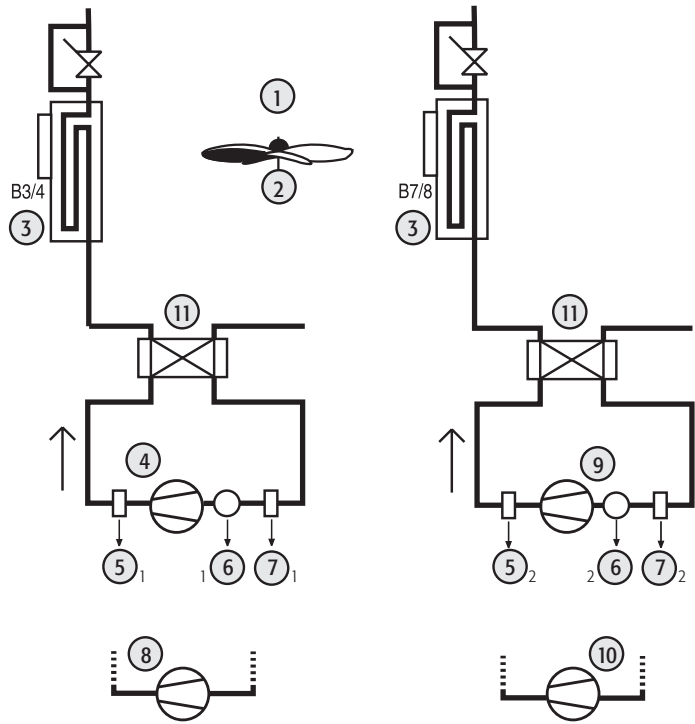


Fig. 3.i.b

### 3.10 Water-cooled condensing unit without reverse cycle

#### 3.10.1 Single circuit

**Key:**

1	flow switch
2	water cond. temperature probe
3	condenser
4	compressor 1
5	high pressure
6	compressor overload
7	low pressure
8	compressor 2

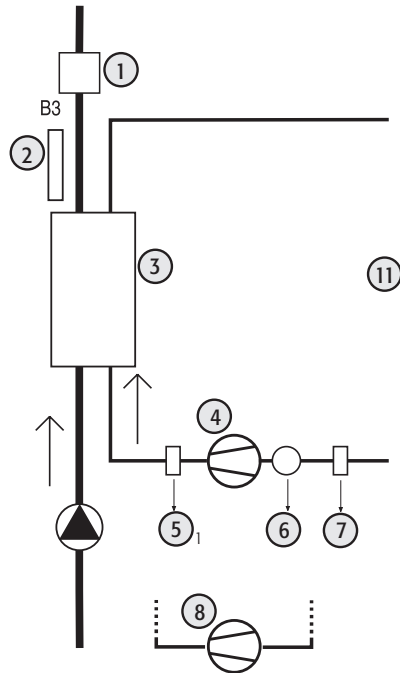


Fig. 3.j.a

### 3.10.2 Two circuits

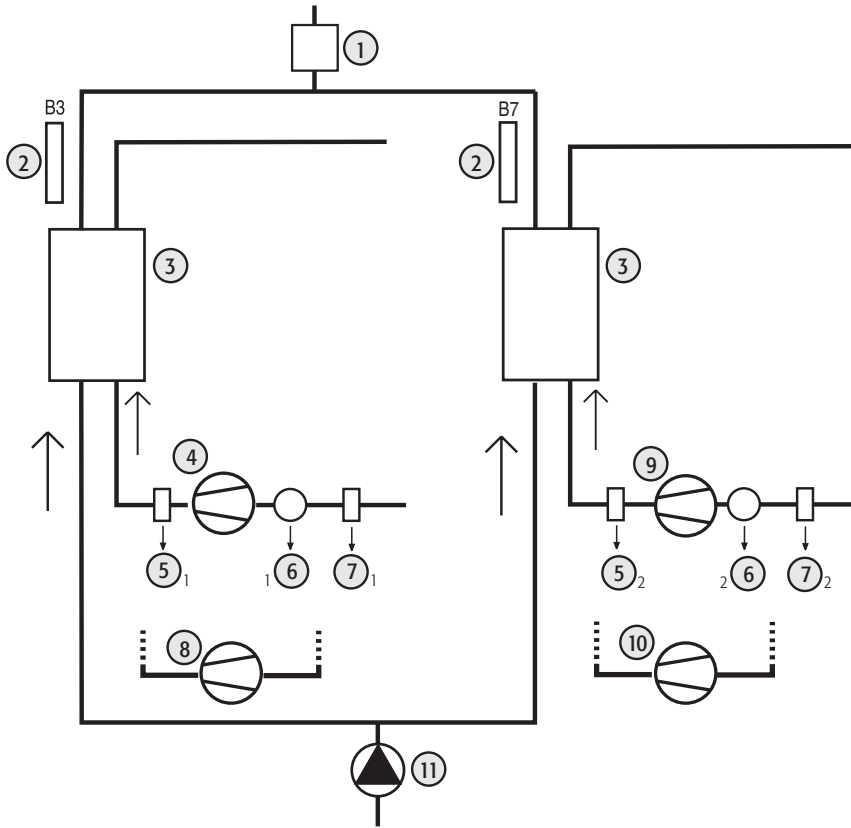


Fig. 3.j.b

#### Key:

1	flow switch
2	water cond. temperature probe
3	condenser
4	compressor 1
5	high pressure
6	compressor overload
7	lw pressure
8	compressor 2
9	compressor 3
10	compressor 4
11	water pump

## 3.11 Reverse-cycle water-cooled condensing unit

### 3.11.1 Single circuit

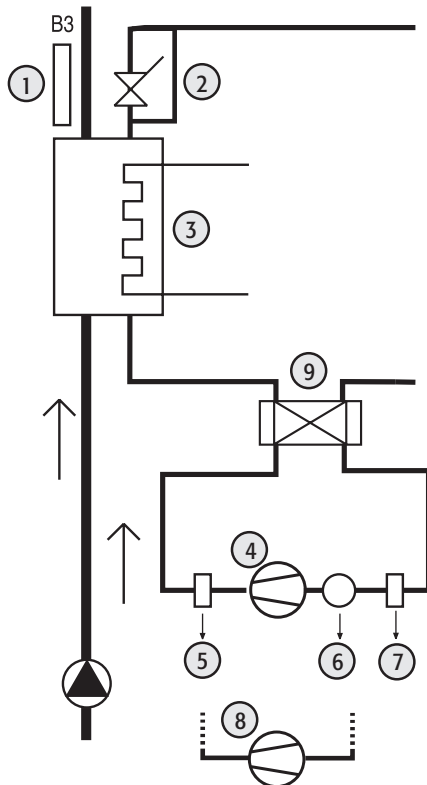


Fig. 3.k.a

#### Key:

1	condenser probe
2	condenser
3	antifreeze heater
4	compressor 1
5	high pressure
6	compressor overload
7	low pressure
8	compressor 2
9	reversing valve

3.11.2 Two circuits

Key:

1	condenser probe
2	condenser 1 and 2
3	antifreeze heater 1 and 2
4	reversing valve
5	compressor 1
6	high pressure 1 and 2
7	compressor overload 1 and 2
8	low pressure 1 and 2
9	compressor 3
10	compressor 2
11	compressor 4
12	water pump

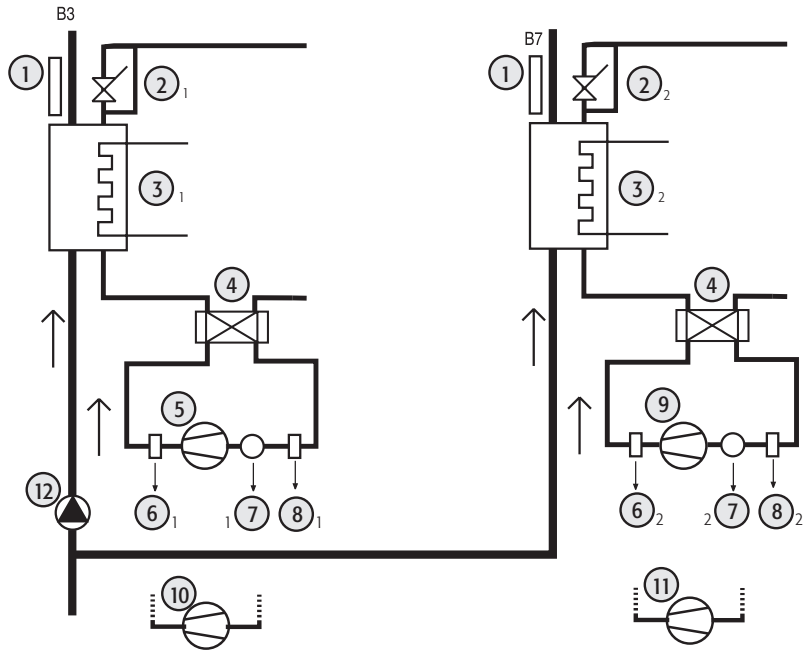


Fig. 3.k.b

ENGLISH



# 4. PARAMETERS

## 4.1 General parameters

The parameters are divided into 4 different types, according to their level of access by the user (password) and their function.

For each level, only the access to the parameters of the same or lower level can be set.

This means that through "factory" password, accessing the menu "levels" (L-P), it is possible to set the desired level for each parameter.

- **Factory parameters:** Accessible with the 66 "Factory" password, allow the configuration of all the unit parameters.
- **Super User parameters:** Accessible with the 11 "Super User" password, allow the configuration of the Super User, User and Direct parameters.
- **User parameters:** Accessible with password 22, allow the configuration of the parameters that typically can be set by the user (User parameters) and the Direct parameters, consequently relating to the options.
- **Direct parameters:** Accessible without password, this are used to read the probe measurements and any data, by any user, without compromising the operation of the unit.

► **N.B.:** The modifications to the parameters regarding the configuration of the unit (type, number of compressors,...) must be performed with the controller in Standby.

level	level name	password
d	direct	no password
U	user	22
S	super user	11
F	factory	66

## 4.2 Menu structure

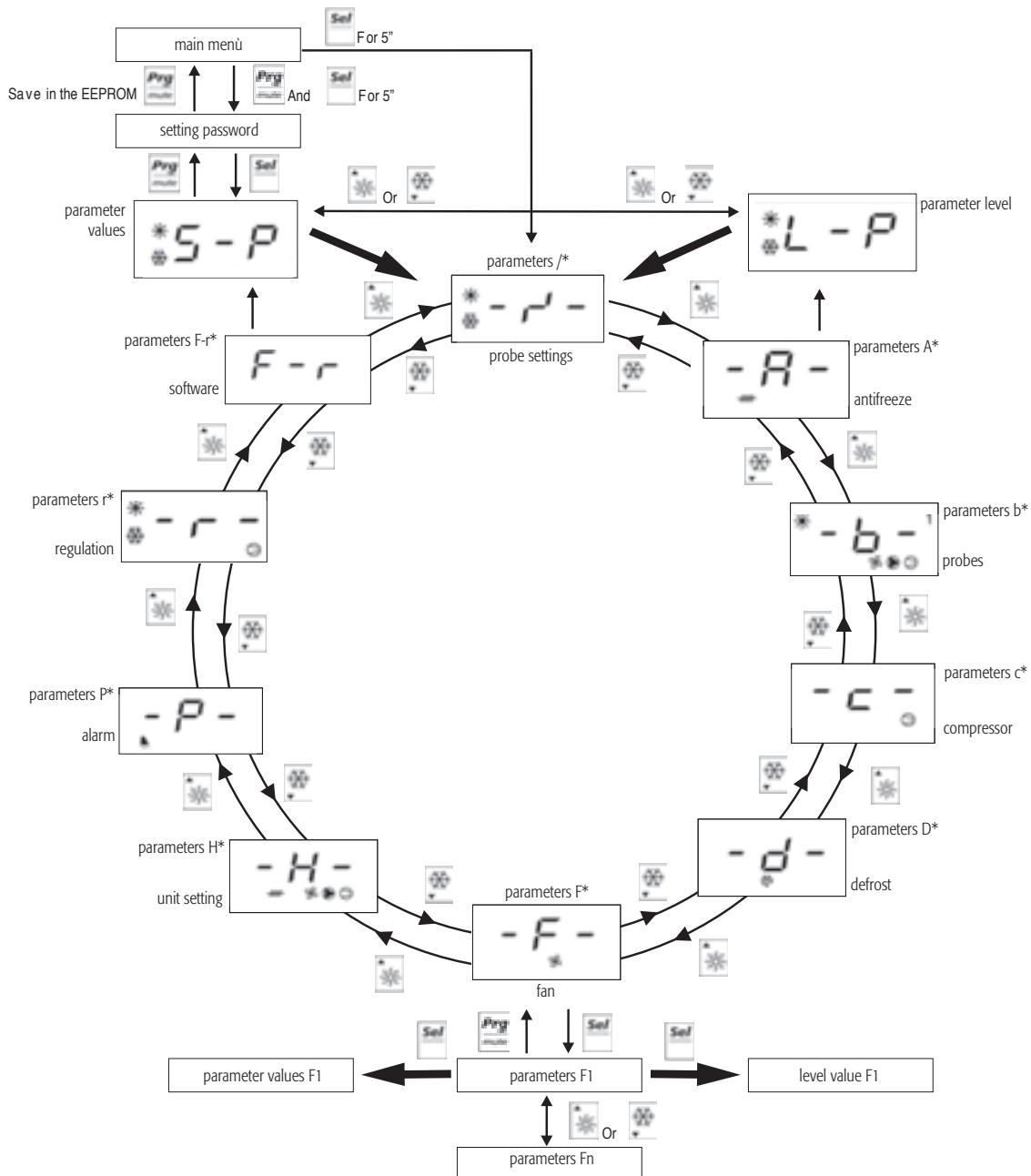


Fig. 4.a

### 4.3 Parameter tables

The following tables show of the parameters divided by type/family (e. g. compressor, probes, fans etc.).

#### • Key to the parameter tables

Level (default)

S= super user

F= factory

D= direct

#### Visibility:

The visibility of some groups depends on the type of controller and the value of the parameters.

D= defrost (if D01=1)

F= fan (if F01=1)

N= NTC probe (if /04-/08=2)

P= pressure (if /04-/08=3)

V= driver (if H08 =1-3)

X= expansion (if H08=2-3)

- = always present

#### Supervisor variables:

R/W = supervisor read/write parameter

R= supervisor read-only parameter

#### 4.3.1 Probe setting parameters: (/\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	default	visibility	supervis. variable	Modbus	variable type
/01	Probe type B1 0= not present 1= present	F	0	1	Flag	1	1	-	1 (R/W)	1	Digital
/02	Probe type B2 0= not present 1= present	F	0	1	Flag	1	0	-	2 (R/W)	2	Digital
/03	Probe type B3 0= not present 1= NTC Cond. Probe 2= NTC Out. Probe	F	0	2	flag	1	0	-	14 (R/W)	142	Integer
/04	Probe type B4 0= not present 1= ON/OFF (D.I) 2= NTC Out. Probe 3= ratiometric cond. Probe, 5 Vdc	F	0	3	flag	1	0	-	15 (R/W)	143	Integer
/05	Probe type B5 0= not present 1= present	F	0	1	Flag	1	0	X	3 (R/W)	3	Digital
/06	Probe type B6 0= not present 1= present	F	0	1	Flag	1	0	X	4 (R/W)	4	Digital
/07	Probe type B7 0= not present 1= NTC Cond. Probe 2= NTC Out. Probe	F	0	2	flag	1	0	X	16 (R/W)	144	Integer
/08	Probe type B8 (expansion) 0= not present 1= ON/OFF 2= NTC Out. Probe 3= ratiometric cond. Probe, 5 Vdc	F	0	4	int	1	0	X	17 (R/W)	145	Integer
/09	Min. value voltage input	F	0	/10	0.01 Vdc	1	50	P	18 (R/W)	146	Integer
/10	Max. value voltage input	F	/09	500	0.01 Vdc	1	450	P	19 (R/W)	147	Integer
/11	Pressure min. value	F	0	/12	bar	1	0	P	1 (R/W)	1	Analog
/12	Pressure max. value	F	/11	99.9	bar	1	34.5	P	2 (R/W)	2	Analog
/13	Probe B1 calibration	F	-12.0	12.0	°C/°F	0.1	0.0	-	3 (R/W)	3	Analog
/14	Probe B2 calibration	F	-12.0	12.0	°C/°F	0.1	0.0	-	4 (R/W)	4	Analog
/15	Probe B3 calibration	F	-12.0	12.0	°C/°F	0.1	0.0	-	5 (R/W)	5	Analog
/16	Probe B4 calibration	F	-12.0	12.0	°C/bar/°F	0.1	0.0	-	6 (R/W)	6	Analog
/17	Probe B5 calibration	F	-12.0	12.0	°C/°F	0.1	0.0	X	7 (R/W)	7	Analog
/18	Probe B6 calibration	F	-12.0	12.0	°C/°F	0.1	0.0	X	8 (R/W)	8	Analog
/19	Probe B7 calibration	F	-12.0	12.0	°C/°F	0.1	0.0	X	9 (R/W)	9	Analog
/20	Probe B8 calibration	F	-12.0	12.0	°C/bar/°F	0.1	0.0	X	10 (R/W)	10	Analog
/21	Digital filter	U	1	15	-	1	4	-	20 (R/W)	148	Integer
/22	Input limitation	U	1	15	-	1	8	-	21 (R/W)	149	Integer
/23	Unit of measure 0= °C 1= °F	U	0	1	Flag	1	0	-	5 (R/W)	5	Digital

Table 4.a

### 4.3.2 Antifreeze/auxiliary heater setting parameters (A\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	default	visibility	supervis. variable	Modbus	variabile type
A01	Antifreeze/low ambient temp. (air/air) alarm set point	U	A07	A04	°C/°F	0.1	3.0	-	11 (R/W)	11	Analog
A02	Differential for antifreeze/low ambient temperature alarm	U	0.3	122.0	°C/°F	0.1	5.0	-	12 (R/W)	12	Analog
A03	Bypass time for antifreeze alarm/low ambient temp. when turning on the unit in heating mode	U	0	150	S	1	0	-	22 (R/W)	150	Integer
A04	Set point for the activation of antifreeze heater/auxiliary heater	U	A01	r16	°C/°F	0.1	5.0	-	13 (R/W)	13	Analog
A05	Diff. for antifreeze heater/auxiliary heater	U	0.3	50.0	°C/°F	0.1	1.0	-	14 (R/W)	14	Analog
A06	Auxiliary heater probe 0= Control probe see (Table 5.a) 1= Antifreeze probe see (Table 5.a)	F	0	1	Flag	1	0	-	6 (R/W)	6	Digital
A07	Antifreeze alarm set point limit	F	-40.0	176.0	°C/°F	0.1	-40.0	-	15 (R/W)	15	Analog
A08	Auxiliary heater set point in heating mode	U	A01	r16	°C/°F	0.1	25.0	-	16 (R/W)	16	Analog
A09	Auxiliary heater differential in heating mode	U	0.3	50.0	°C/°F	0.1	3.0	-	17 (R/W)	17	Analog
A10	Antifreeze automatic start up 0= disabled function 1= Heaters and pump on at the same time on A4/A8 2= Heaters and pump on independently on A4/A8 3= Heaters ON on A4/A8	U	0	3	Flag	1	0	-	23 (R/W)	151	Integer

Table 4.b

### 4.3.3 Probe reading parameters (B\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	default	visibility	supervis. variable	Modbus	variabile type
b00	Config. of probe to be shown on the display 0= probe B1 1= probe B2 2= probe B3 3= probe B4 4= probe B5 5= probe B6 6= probe B7 7= probe B8 8= set point without compensation 9= dynamic set point with possible compensation 10= remote ON/OFF digital input status	U	0	10	Flag	1	0	-	24 (R/W)	152	integer
b01	Value read by probe B1	D	-	-	°C/°F	-	-	-	70 (R)	70	Analog
b02	Value read by probe B2	D	-	-	°C/°F	-	-	-	71 (R)	71	Analog
b03	Value read by probe B3	D	-	-	°C/°F	-	-	-	72 (R)	72	Analog
b04	Value read by probe B4	D	-	-	°C/°F/bar	-	-	-	73 (R)	73	Analog
b05	Value read by probe B5	D	-	-	°C/°F	-	-	X	74 (R)	74	Analog
b06	Value read by probe B6	D	-	-	°C/°F	-	-	X	75 (R)	75	Analog
b07	Value read by probe B7	D	-	-	°C/°F	-	-	X	76 (R)	76	Analog
b08	Value read by probe B8	D	-	-	°C/°F bar	-	-	X	77 (R)	77	Analog
b09	Driver 1 evaporator temperature	D	-	-	°C/°F	-	-	V	78 (R)	78	Analog
b10	Driver 1 evaporator pressure	D	-	-	bar	-	-	V	79 (R)	79	Analog
b11	Driver 1 superheating	D	-	-	°C/°F	-	-	V	80 (R)	80	Analog
b12	Driver 1 saturation temperature	D	-	-	°C/°F	-	-	V	81 (R)	81	Analog
b13	Driver 1 valve position	D	0	100.0	%	-	-	V	82 (R)	82	Analog
b14	Driver 2 evaporator temperature	D	-	-	°C/°F	-	-	XV	83 (R)	83	Analog
b15	Driver 2 evaporator pressure	D	-	-	bar	-	-	XV	84 (R)	84	Analog
b16	Driver 2 superheating	D	-	-	°C/°F	-	-	XV	85 (R)	85	Analog
b17	Driver 2 saturation temperature	D	-	-	°C/°F	-	-	XV	86 (R)	86	Analog
b18	Driver 2 valve position	D	0	100.0	%	-	-	XV	87 (R)	87	Analog
b19	Temp. probe at the outlet of the external coil c1	D	-	-	°C/°F	-	-	V	88 (R)	88	Analog
b20	Temp. probe at the outlet of the external coil c12	D	-	-	°C/°F	-	-	XV	89 (R)	89	Analog

Table 4.c

### 4.3.4 Compressor setting parameters (c\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	def.	visibi- lity	supervis. variable	Modbus	variabile type
c01	Min. compressor ON time	U	0	999	s	1	60	-	25 (R/W)	153	Integer
c02	Min. OFF time compressor	U	0	999	s	1	60	-	26 (R/W)	154	Integer
c03	Delay between 2 starts of the same compressor	U	0	999	s	1	360	-	27 (R/W)	155	Integer
c04	Delay between starts of the 2 compressors	U	0	999	s	1	10	-	28 (R/W)	156	Integer
c05	Delay between 2 shut-downs of the 2 compressors	U	0	999	s	1	0	-	29 (R/W)	157	Integer
c06	Delay at start-up	U	0	999	s	1	0	-	30 (R/W)	158	Integer
c07	Delay in switching on the compressor after switching on the pump/inlet fan (air/air)	U	0	150	s	1	20	-	31 (R/W)	159	Integer
c08	Delay in switching OFF the compressor after switching OFF the pump/ inlet fan (air/air)	U	0	150	min	1	1	-	32 (R/W)	160	Integer
c09	Maximum compressor operating time in tandem	U	0	60	min	1	0	-	33 (R/W)	161	Integer
c10	Compressor 1 timer	D	0	800.0	100 hours	0.1	0	-	90 (R)	90	Analog
c11	Compressor 2 timer	D	0	800.0	100 hours	0.1	0	-	91 (R)	91	Analog
c12	Compressor 3 timer	D	0	800.0	100 hours	0.1	0	-	92 (R)	92	Analog
c13	Compressor 4 timer	D	0	800.0	100 hours	0.1	0	-	93 (R)	93	Analog
c14	Operation timer threshold	U	0	100	100 hours	1	0	-	34 (R/W)	162	Integer
c15	Hour counter evaporator pump/fan 1	D	0	800.0	100 hours	0.1	0	-	94 (R)	94	Analog
c16	Hour counter condenser backup pump/fan 2	D	0	800.0	100 hours	0.1	0	-	95 (R)	95	Analog
c17	Minimum time between 2 pump starts	U	1	150	min	1	30	-	35 (R/W)	163	Integer
c18	Minimum pump ON time	U	1	15	min	1	3	-	36 (R/W)	164	Integer

Table 4.d

### 4.3.5 Defrost setting parameters (d\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	def.	visibility	supervis. variable	Modbus	variabile type
d01	Defrosting cycle/Condenser antifreeze 0= no; 1= si, con sbrinamento unificato yes, with shared defrosting	U	0	1	Flag	1	0	-	7 (R/W)	7	Digital
d02	Time or temp.- press. based defrosting 0= time 1= temp. - press 2= pressure start, temperature end	U	0	2	Flag	1	0	D	90 (R/W)	218	Integer
d03	Start defrosting temperature Condenser antifreeze alarm set point	U	-40.0	d04	°C/°F	0.1	-5.0	DN	19 (R/W)	19	Analog
d04	Start defrosting pressure		/11	d04	bar	0.1	3.5	DP	18 (R/W)	18	Analog
	End defrosting temperature	U	d03	176	°C	0.1	20.0	DN	21 (R/W)	21	Analog
	End defrosting pressure		d03	/12	bar	0.1	14.0	DP	20 (R/W)	20	Analog
d05	Min. time to start a defrosting cycle	U	10	150	s	1	10	D	37 (R/W)	165	Integer
d06	Min. duration of a defrosting cycle	U	0	150	s	1	0	D	38 (R/W)	166	Integer
d07	Max. duration of a defrosting cycle	U	1	150	min	1	5	D	39 (R/W)	167	Integer
d08	Delay between 2 defrosting cycle requests within the same circuit	U	10	150	min	1	30	D	40 (R/W)	168	Integer
d09	Defrosting delay between the 2 circuits	U	0	150	min	1	10	D	41 (R/W)	169	Integer
d10	Defrost by external contact 0= disables function 1= external contact start 2= external contact end 3= external contact start and end	F	0	3	Flag	1	0	D	42 (R/W)	170	Integer
d11	Antifreeze heaters activated while defrosting 0= Non present/Not present; 1= Present/Present	U	0	1	Flag	1	0	D	9 (R/W)	9	Digital
d12	Waiting time before defrosting	F	0	3	min	1	0	D	43 (R/W)	171	Integer
d13	Waiting time after defrosting	F	0	3	min	1	0	D	44 (R/W)	172	Integer
d14	End defrosting with 2 refrigerating circuits 0= Independent 1= If both at end defrost 2= If at least one at end defrost	F	0	2	Flag	1	0	D	45 (R/W)	173	Integer
d15	Start defrost with 2 circuits 0= Independent 1= If both at start defrost 2= If at least one at start defrost	F	0	2	Flag	1	0	D	46 (R/W)	174	Integer
d16	Forced ventilation time at the end of the defrosting	F	0	360	s	1	0	D	47 (R/W)	175	Integer
d17	Defrost with compressors OFF	F	0	80.0	°C/°F	0.1	0	D	22 (R/W)	22	Analog

Table 4.e

### 4.3.6 Fan setting parameters (F\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	def.	visibility	supervis. variable	Modbus	variabile type
F01	Fan output 0= absent 1= present	F	0	1	Flag	1	0	-	10 (R/W)	10	Digital
F02	Fan operating mode 0= always ON 1= depending ON the compressor (in parallel operation mode) 2= depending ON the compressors in ON/OFF control 3= depending ON the compressors in speed control mode	U	0	3	Flag	1	0	F	48 (R/W)	176	Integer
F03	Min. voltage threshold for Triac	F	0	F04	step	1	35	F	49 (R/W)	177	Integer
F04	Max. voltage threshold for Triac	F	F03	100	step	1	75	F	50 (R/W)	178	Integer
F05	Temp. value for min. speed Cooling	U	-40.0		°C	0.1	35.0	FN	24 (R/W)	24	Analog
F06	Pressure value for min. speed Cooling		/11	/12	bar	0.1	13.0	FP	23 (R/W)	23	Analog
	Differential value for max. speed Cooling	U	0	50.0	°C/°F	0.1	10.0	FN	26 (R/W)	26	Analog
F07	Pressure value for max. speed Cooling		0	50	bar	0.1	3.0	FP	25 (R/W)	25	Analog
	Fan shut-down differential in Cooling mode	U	0	50.0	°C/°F	0.1	15.0	FN	28 (R/W)	28	Analog
F08	Fan shut-down pressure in Cooling mode		0	F5	bar	0.1	5.0	FP	27 (R/W)	27	Analog
	Temperature value for max speed in Heating mode	U	-40.0		°C	0.1	35.0	FN	30 (R/W)	30	Analog
F09	Pressure value for max speed in Heating		/11	/12	bar	0.1	13.0	FP	29 (R/W)	29	Analog
	Temperature value for max. speed in Heating mode	U	0	50.0	°C/°F	0.1	5.0	FN	32 (R/W)	32	Analog
F10	Pressure value for max speed in Heating		0	F08	bar	0.1	4.0	FP	31 (R/W)	31	Analog
	Temp. to turn OFF the fan in Heating 0.1	U	0	F08	°C/°F	0.1	5.0	FN	34 (R/W)	34	Analog
F11	Pressure to turn OFF the fan in Heating		0	30.0	bar	0.1	3.0	FP	33 (R/W)	33	Analog
	Fan starting time	U	0	120	s	1	0	F	51 (R/W)	179	Integer
F12	Triac impulse duration (fan start)	F	0	10	s	1	2	F	52 (R/W)	180	Integer
F13	Fan management in defrost mode 0= Disabled fans 1= Fan in chiller mode 2= Max. speed after defrost	F	0	2	Flag	1	0	F	53 (R/W)	181	Integer
F14	Fan on time when starting in high condensing temperature	U	0	999	S	1	0	FN	91 (R/W)	219	Integer

Table 4.f

### 4.3.7 Unit setting parameters (H\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variatio.	def.	visibility	supervis. variable	Modbus	variable type
H01	Unit model 0= air_air unit 1= air_air heat pump 2= air_water chiller 3= air_water heat pump 4= water_water chiller 5= water_water heat pump with reversal on gas circuit 6= water_water heat pump with reversal on water circuit 7= condensing unit 8= reverse-cycle condensing unit 9= water-cooled condensing unit 10= reverse-cycle water-cooled condensing unit	F	0	10	Flag	1	2	-	54 (R/W)	182	Integer
H02	Number of condensers 0=1 circuit; 1=2 circuits	F	0	1	Flag	1	0	F	12 (R/W)	12	Digital
H03	Number of evaporators 0=1 evaporator 1=2 evaporators	F	0	1	Flag	1	0	-	13 (R/W)	13	Digital
H04	Number of compressors per circuit 0=1 comp. ON 1 circuit (single circuit) 1=2 comp. in tandem ON 1 circuit (single circuit) 2=1 comp. per circuit, 2 circuits (two circuits) 3=2 comp. in Tandem, 2 circuits (two circuits) 4=1 compressor and 1 Capacity step in one circuit 5=1 compressor and 1 capacity Step per circuit	F	0	5	Flag	1	0	-	55 (R/W)	183	Integer
H05	Pump/outlet fan (Air/Air) mode (output N2) 0= absent 1= always ON 2= ON upon request of the controller 3= ON upon request of the controller and for set time	F	0	5	Flag	1	1	-	56 (R/W)	184	Integer
H06	Cooling/Heating digital input 0= absent 1= present	U	0	1	Flag	1	0	-	14 (R/W)	14	Digital
H07	ON/OFF digital input 0= absent 1= present	U	0	1	Flag	1	0	-	15 (R/W)	15	Digital
H08	$\mu C^2$ network configuration 0= $\mu C^2$ only 1= $\mu C^2$ + valve 2= $\mu C^2$ + exp. 3= $\mu C^2$ +exp.+valve	F	0	3	Flag	1	0	-	57 (R/W)	185	Integer
H09	Lock keypad 0= disabled 1= enabled	U	0	1	Flag	1	1	-	16 (R/W)	16	Digital
H10	Serial address	U	1	200	-	1	1	-	58 (R/W)	186	Integer
H11	Output modes (see Table 5.3 and following pag. 56)	F	0	12	Flag	1	0	-	59 (R/W)	187	Integer
H12	Capacity- control logic valve and inversion valve 0= Both normally closed 1= Both normally open 2= Inversion valve normally open and capacity-control valve normally closed 3= Inversion valve normally closed and capacity-control valve normally open	F	0	3	Flag	1	1	-	60 (R/W)	188	Integer
H21	Second pump function 0= Disabled 1= Backup and weekly rotation 2= Backup and daily rotation 3= Condensing control on corresponding set point 4= Condensing control always on	F	0	4	int	1	0	-	62 (R/W)	269	Integer
H22	Disable load default values 0= Function disabled 1= Function enabled	F	0	1	Flag	1	0	-	18 (R)	18	Digital
H23	Enable Modbus protocol	F	0	1	Flag	1	0	-	11	11	Digital

Table 4.g

### 4.3.8 Alarm setting parameters (P\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	def.	visibility	supervis. variable	Modbus	variable type
P01	Flow switch alarm delay when starting the pump	U	0	150	s	1	20	-	63 (R/W)	191	Integer
P02	Flow switch alarm delay during steady operation	U	0	120	s	1	5	-	64 (R/W)	192	Integer
P03	Low pressure alarm delay at start-up	U	0	200	s	1	40	-	65 (R/W)	193	Integer
P04	Enable part load in high pressure	U	0	3	int	1	0	P	66 (R/W)	194	Integer
P05	Alarm reset 0= HP1-2/LP1-2/A1-2/Lt manual 1= HP1-2/LP1-2/A1-2/Lt automatic 2= HP1-2/A1-2/Lt manual LP1-2 automatic 3= HP1-2 manual LP1-2/A1-2/Lt automatic 4= HP1-2/LP1-2 manual A1-2/Lt automatic 5= HP1-2/LP1-2 (thrice per hour) manual A1-2/Lt automatic 6= HP1-2/LP1-2 (thrice per hour) manual; A1-2/Lt manual	F	0	6	Int	1	0	-	67 (R/W)	195	Integer
P06	Cooling/heating logic 0= ❄️ Chiller, ❄️ Heat pump 1= ❄️ Heat pump, ❄️ Chiller	F	0	1	Flag	1	0	-	19 (R/W)	19	Digital
P07	Low pressure alarm from transducer 0= Disabled 1= Enabled	F	0	1	Flag	1	0	P	68 (R/W)	196	Integer
P08	Digital input 1 selection 0= N 1=FL man. 2=FL auto. 3=TP man. 4=TP auto 5= TC1 man. 6= TC1 auto. 7= TC2 man. 8= TC2 auto. 9= Cool/Heat. 10= Cool/Heat. Delayed 11= LA man. 12= LA auto. 13= 2° Set 14= 2° Set timer 15= stop defrost c. 1 16= stop defrost c. 2 17= start defrost c. 1 18= start defrost c. 2 19= step 1 20= step 2 21= step 3 22= step 4	F	0	22	Flag	1	0	-	69 (R/W)	197	Integer
P09	Digital input 2 selection	F	0	22	Flag	1	0	-	70 (R/W)	198	Integer
P10	Digital input 6 selection	F	0	22	Flag	1	0	X	71 (R/W)	199	Integer
P11	Digital input 7 selection	F	0	22	Flag	1	0	X	72 (R/W)	200	Integer
P12	Digital input 10 selection	F	0	22	Flag	1	0	X	73 (R/W)	201	Integer
P13	Configuration of B4 as P8 if /4=1 (digital input)	F	0	22	Flag	1	0	-	74 (R/W)	202	Integer
P14	Configuration of B8 as /8=1 (digital input)	F	0	22	Flag	1	0	X	75 (R/W)	203	Integer
P15	low pressure alarm configuration L 0= not active with compressor OFF 1= active with compressor OFF	F	0	1	Flag	1	0	-	76 (R/W)	204	Integer
P16	High temperature alarm set	U	-40.0		°C	0.1	80.0	-	38 (R/W)	38	Analog
P17	High temperature alarm delay at start-up	U	0	250	min	1	30	-	77 (R/W)	205	Integer
P18	High pressure alarm set from transducer	F	0	99.9	bar	0.1	20.0	P	39 (R/W)	39	Analog
P19	System low temperature alarm set point	U	-40.0		°C	0.1	10.0	-	40 (R/W)	40	Analog
P20	Enable system start-up protection 0= Disabled 1= Enabled	U	0	1	Flag	1	0	-	20 (R/W)	20	Digital
P21	Alarm relay management 0= normally de-activated 1= normally activated	F	0	1	Flag	1	0	-	8 (R/W)	8	Digital

Table 4.h

### 4.3.9 Control setting parameters (r\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	def.	visibility	supervis. variable	Modbus	variable type
r01	Cooling set point	D	r13	r14	°C/°F	0.1	12.0	-	41 (R/W)	41	Analog
r02	Cooling differential	D	0.3	50.0	°C/°F	0.1	3.0	-	42 (R/W)	42	Analog
r03	Heating set point	D	r15	r16	°C/°F	0.1	40.0	-	43 (R/W)	43	Analog
r04	Heating differential	D	0.3	50.0	°C/°F	0.1	3.0	-	44 (R/W)	44	Analog
r05	Compressor rotation 0= disabled; 1= FIFO type 2= con controllo ore/hour control 3= direct relation between (D.I. and compressors D.O.)	F	0	3	flag	1	0	-	78 (R/W)	206	Integer
r06	Type of compressor control 0= proportional on inlet 1= proportional on inlet + dead zone 2= proportional on outlet 3= proportional on outlet + dead zone 4= time on outlet with dead zone	F	0	4	flag	1	0	-	79 (R/W)	207	Integer
r07	Dead zone differential	F	0.1	50.0	°C/°F	0.1	2.0	-	45 (R/W)	45	Analog
r08	Activation delay at lower limit of r07	F	0	999	s	1	120	-	80 (R/W)	208	Integer
r09	Activation delay at upper limit of r07	F	0	999	s	1	100	-	81 (R/W)	209	Integer
r10	Deactivation delay at lower limit of r12	F	0	999	s	1	120	-	82 (R/W)	210	Integer
r11	Deactivation delay at upper limit of r12	F	0	999	s	1	100	-	83 (R/W)	211	Integer
r12	Compressor deactivation differential	F	0	50.0	°C/°F	0.1	2.0	-	46 (R/W)	46	Analog
r13	Min. Cooling set point	U	-40.0	r14	°C/°F	0.1	-40.0	-	47 (R/W)	47	Analog
r14	Max. Cooling set point	U	r13		°C	0.1	80.0	-	48 (R/W)	48	Analog
r15	Min. Heating set point	U	-40.0	r16	°C/°F	0.1	-40.0	-	49 (R/W)	49	Analog
r16	Max. Heating set point	U	r15	176.0	°C	0.1	80.0	-	50 (R/W)	50	Analog



r17	Cooling compensation constant	U	-5.0	+5.0	-	0.1	0.0	-	51 (R/W)	51	Analog
r18	Maximum distance from the set point	U	0.3	20.0	°C/°F	0.1	0.3	-	52 (R/W)	52	Analog
r19	Start compensation temperature in cooling mode	U	-40	176.0	°C/°F	0.1	30.0	-	53 (R/W)	53	Analog
r20	Start compensation temperature in heating mode	U	-40	176.0	°C/°F	0.1	0	-	54 (R/W)	54	Analog
r21	Second cooling set point from external contact	D	r13	r14	°C/°F	0.1	12.0	-	55 (R/W)	55	Analog
r22	Second heating set point from external contact	D	r15	r16	°C/°F	0.1	40.0	-	56 (R/W)	56	Analog
r27	Enable accumulation vessel suppression 0= Disabled 1= Enabled in cool 2= Enabled in Heat 3= Always enabled	F	0	3	flag	1	0	-	88 (R/W)	216	Integer
r28	Minimum time to determine low load conditions	F	0	999	s	1	60	-	89 (R/W)	217	Integer
r29	Low load differential in chiller mode	F	0.3	50.0	°C/°F	0.1	3.0	-	58 (R/W)	58	Analog
r30	Low load differential in heat pump mode	F	0.3	50.0	°C/°F	0.1	3.0	-	59 (R/W)	59	Analog
r31	Heating compensation constant	U	-5.0	+5.0	-	0.1	0.0	-	60 (R/W)	60	Analog

Table 4.i

#### 4.3.10 Firmware parameters (F-r\*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	def.	visibility	supervis. variable	Modbus	variabile type
H96	Software version Driver 2	D	0	999	flag			XV	4 (R)	132	Integer
H97	Software version Driver 1	D	0	999	flag			V	3 (R)	131	Integer
H98	Expansion software version	D	0	999	flag			X	2 (R)	130	Integer
H99	Software version (to be displayed after instrument start-up)	D	0	999	flag			-	1 (R)	129	Integer

Table 4.j

#### 4.3.11 Supervisor only variables

display indicat.	parameter and description	default level	min.	max.	U.O.M.	vari.	def.	visibility	supervis. variable	Modbus	variabile type
-	Digital input 1	-	0	1	Flag	1	-	-	43 (R)	43	Digital
-	Digital input 2	-	0	1	Flag	1	-	-	44 (R)	44	Digital
-	Digital input 3	-	0	1	Flag	1	-	-	45 (R)	45	Digital
-	Digital input 4	-	0	1	Flag	1	-	-	46 (R)	46	Digital
-	Digital input 5	-	0	1	Flag	1	-	-	47 (R)	47	Digital
-	probe B4 digital input	-	0	1	Flag	1	-	-	48 (R)	48	Digital
-	Digital output 1	-	0	1	Flag	1	-	-	49 (R/W)	49	Digital
-	Digital output 2	-	0	1	Flag	1	-	-	50 (R/W)	50	Digital
-	Digital output 3	-	0	1	Flag	1	-	-	51 (R/W)	51	Digital
-	Digital output 4	-	0	1	Flag	1	-	-	52 (R/W)	52	Digital
-	Digital output 5	-	0	1	Flag	1	-	-	53 (R/W)	53	Digital
-	Unit status, 1= ON or 0= standby	-	0	1	Flag	1	0	-	54 (R/W)	54	Digital
-	1= Cooling or 0= Heating	-	0	1	Flag	1	1	-	55 (R/W)	55	Digital
-	Digital input 6, 2nd circuit	-	0	1	Flag	1	-	-	56 (R)	56	Digital
-	Digital input 7, 2nd circuit	-	0	1	Flag	1	-	-	57 (R)	57	Digital
-	Digital input 8, 2nd circuit	-	0	1	Flag	1	-	-	58 (R)	58	Digital
-	Digital input 9, 2nd circuit	-	0	1	Flag	1	-	-	59 (R)	59	Digital
-	Digital input 10, 2nd circuit	-	0	1	Flag	1	-	-	60 (R)	60	Digital
-	Probe B8 digital inputs, 2nd circuit	-	0	1	Flag	1	-	-	61 (R)	61	Digital
-	Digital output 6	-	0	1	Flag	1	-	-	62 (R/W)	62	Digital
-	Digital output 7	-	0	1	Flag	1	-	-	63 (R/W)	63	Digital
-	Digital output 8	-	0	1	Flag	1	-	-	64 (R/W)	64	Digital
-	Digital output 9	-	0	1	Flag	1	-	-	65 (R/W)	65	Digital
-	Digital output 10	-	0	1	Flag	1	-	-	66 (R/W)	66	Digital
-	Enable digital output from Supervisor	-	0	8000	Flag	1	-	-	13 (R)		Integer
-	Defrost status 0= no Defrost 1= Def. circuit 1 2= Def. circuit 2 3= Def. circuit 1 and 2 5= Fan Def. circuit 1 10= Fan Def. circuit 2 15= Fan Def. circuit 1 and 2	-	-	-	-	-	-	104 (R)	stato defrost		Integer

Table 4.l

## 5. DESCRIPTION OF THE PARAMETERS

To modify the parameters, see chapter 4 "Parameters."

- **Probe settings: parameters (/\*)** (see Table 4.a)
  - Type of probe: from /01 to /08: enables the reading of the corresponding analogue input or sets the function
- **Functions of the probes**

Type of unit	Parameter H01	Temp. control probe 1 <sup>st</sup> circuit	Antifreeze probe 1 <sup>st</sup> circuit	Cond. temp. probe	Press probe 1 <sup>st</sup> circuit 2 <sup>nd</sup> evaporator	Antifreeze probe 2 <sup>nd</sup> circuit	Cond. temp. probe	Press. probe 2 <sup>nd</sup> circuit
0=	air/air	B1	B2 (low outlet temperature)	B3	B4	Not used	B7	B8
1=	air/air heat pump (cooling/heating)	B1	B2 (low outlet temperature)	B3	B4	Not used	B7	B8
2=	air/water Chiller	B1/B2 single circuit (B1/B5 two circuits)	B2	B3	B4	B6	B7	B8
3=	air/water heat pump (cooling/heating)	B1/B2 single circuit (B1/B5 two circuits)	B2	B3	B4	B6	B7	B8
4=	water/water Chiller	B1/B2 single circuit (B1/B5 two circuits)	B2	Not used	Not used	B6	Not used	Not used
5=	water/water heat pump rev. on gas cooling	B1/B2 single circuit (B1/B5 two circuits)	B2	B3	B4	B6	B7	B8
	heating	B1/B2 single circuit (B1/B5 two circuits)	B3	B3	B4	B7	B7	B8
6=	water/water heat pump rev. on H <sub>2</sub> O cooling	B1/B2 single circuit (B1/B5 two circuits)	B2	Not used	B4	B6	Not used	B8
	heating	B3	B2	Not used	B4	B6	Not used	B8
7=	Air-cooled condensing unit	-	-	B3	B4	-	B7	B8
8=	Air-cooled condensing unit rev. on gas	-	-	B3	B4	-	B7	B8
9=	Water-cooled condensing unit	-	-	B3	B4	-	B7	B8
10=	Water-cooled condensing unit rev. on gas	-	B3	B3	B4	B7	B7	B8

Table 5.a

### - Min/max voltage and pressure values

**From /09 to /12:** sets the minimum/maximum voltage and pressure for the ratiometric signal.

### - Probe calibration

**From /13 to /20:** calibrates the corresponding sensor (from B1 to B8).

### - Digital filter

**/21:** Establishes the coefficient used in the digital filtering of the value measured. High values for this parameter will eliminate any continuous disturbance at the analogue inputs (however decrease the promptness of measurement). The recommended value is 4 (default).

### - Input limit

**/22:** Establishes the maximum variation that can be measured by the probes in one unit program cycle; in practice, the maximum variations allowed in the measurement are between 0.1 and 1.5 units (bars, °C or °F, depending on the probe and the unit of measure) approximately every one second. Low values for this parameter will limit the effect of impulsive disturbance. Recommended value 8 (default).

### - Unit of measure

**/23:** Selects the unit of measure as degrees centigrade or Fahrenheit. When the parameter is modified, the  $\mu\text{C}^2$  automatically converts the values read by the NTC temperature probes B1, B2, B3 into the new unit of measure; while all the other parameters set (set point, differential etc.) remain unchanged.

### • Antifreeze, auxiliary heater: parameters (A\*)

#### - Antifreeze alarm set point (low ambient temp. for air/air units)

**A01:** This represents the temperature (antifreeze set point) of the water at the evaporator outlet below which an antifreeze alarm is activated; in this condition the compressors corresponding to the circuit in question are stopped, while the pump remains on to decrease the possibility of freezing. The alarm is reset manually (or automatically, depending on parameter P05) only when the water temperature returns within the operating limits (that is, above A01+A20).

In the Air/Air units (H1=0,1) the value represents the low room temperature warning threshold; this alarm, activated according to value read by probe B1 or B2 (depending on parameter A06) is signal only, and is reset depending on the value of P05.

#### - Antifreeze/low room temperature (air/air) alarm differential

**A02:** This represents the differential for the activation of the antifreeze alarm (low room temperature in air/air units); the alarm condition cannot be reset until the temperature exceeds the set point + differential (A01+A02).



**- Antifreeze alarm bypass time low room temperature from unit start in heating mode**

**A03:** This represents the delay in the activation of the antifreeze alarm when starting the system. In the case of air/air units, this parameter represents the delay time for the low room temperature (return-intake air) signal, only in heating mode. This means that the room being heated is too cold (threshold set by the user).

**- Antifreeze heater/auxiliary heater set point in cooling**

**A04:** Determines the threshold below which the antifreeze heater is switched on. In the air/air units (H01=0, 1) this parameter represents the temperature value below which the auxiliary heater is activated. In the air/air heat pumps (H01=1) the auxiliary heaters are not used in cooling mode.

**- Antifreeze heater/auxiliary heater differential**

**A05:** Differential for the activation and deactivation of the antifreeze heaters (auxiliary heaters in air/air units).

Operating diagram of the antifreeze alarm and the antifreeze heaters for air/water and water/water chillers and heat pumps.

**Key:**

- 1. antifreeze alarm differen. (A2)
- 2. antifreeze heater differen (A5)
- 3. heaters
- 4. antifreeze alarm
- 5. antifreeze heater set point (A4)
- 6. antifreeze alarm set point (A1)

**- Auxiliary heater probe in heating**

**A06:** This determines which probe is used for control the auxiliary heater. The meaning of the parameter is the following:

A06 = 0 => Control probe see Table 5.a.a

A06 = 1 => Antifreeze probe see Table 5.a.a

If H1=1 the heaters are disabled in cooling mode.

See Functions of the probes.

**- Antifreeze alarm set point limit**

**A07:** Establishes the minimum limit for setting the antifreeze alarm set point (A01).

**- Antifreeze heater in defrost/auxiliary heater in heating set point**

**A08:** Represents the threshold below which the auxiliary heater is ON in defrost and in heating mode. In the heat pumps (H01=1-3-6), during heating mode, it represents the set point for the auxiliary heater; during the defrost cycle, it represents the set point for the activation of the antifreeze heaters.

In the air/air units (H01=0) it only represents the set point for the heating heaters.

In heat pump mode (H1=5-10) this represents the set point for the antifreeze heater and the antifreeze probe becomes B3/B7

**- Antifreeze heater/auxiliary heater differential in heating**

**A09:** Represents the differential for the activation/deactivation of the antifreeze heater in defrost/auxiliary heater in heating.

**- Automatic start for antifreeze**

**A10:** This parameter is valid when the unit is in standby. The operating mode switchover delay times are ignored.

A10=0: function not enabled

A10=1: Auxiliary heater and pump are ON at the same time, based to the respective set: points, A04 or A08, according to the settings of the antifreeze or auxiliary heaters; the exception is when H01=1 in cooling, in which case not even the pump will be activated. Each circuit, in the case of two evaporators, will be controlled based on its own probe (B2, B6).

A10=2: pump and auxiliary heater ON independently based on the respective set point, A04 or A08. If the temperature falls below the antifreeze alarm set point A01, the unit is started in heating mode, controlling the steps (compressors) based on the set point A01 and differential A02, in proportional mode. Each circuit, when there are 2 evaporators, will be controlled using its own probe (B2, B6). A10=2: pump and support heaters activated together, based on the set point A04.

This mode ends automatically when the antifreeze set point A01 + the differential A02 is reached (returning to the previous mode); in any case, the function can be terminated manually by modifying the parameters or disconnecting the power supply to the device.

In this case, the display will be as follows:

- operating mode LED OFF;
- cooling heating flag not switched (not detected by the supervisor);
- antifreeze alarm A01 (remains active even at the end of the special operation if the unit was previously ON, deactivated by manual reset or in standby).

A10=3: heaters ON based on the respective set point A04 and A08.

- Do not use with H1= 6

CAREL NTC probes (mode H1= 2, 3, 4, 5 e 6)

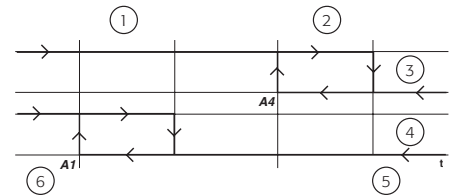


Fig. 5.a.a

- Probe readings: parameters (B\*)
- Select probe to be shown on display.
- b00: Sets the probe reading to be displayed.
  - 0= probe B1
  - 1= probe B2
  - 2= probe B3
  - 3= probe B4
  - 4= probe B5
  - 5= probe B6
  - 6= probe B7
  - 7= probe B8
  - 8= set point without compensation
  - 9= dynamic set point with possible compensation
  - 10= remote ON/OFF digital input status

For the list of parameter-probe associations see Table 4.d

► **Note:** probes that are not present cannot be selected.

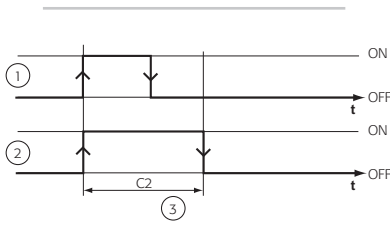


Fig. 5.a.b

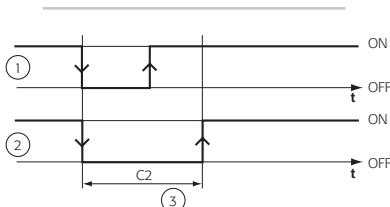


Fig. 5.a.c

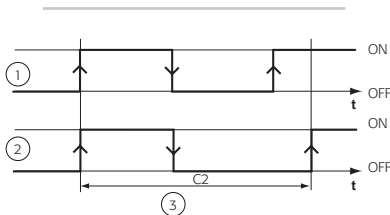


Fig. 5.a.d

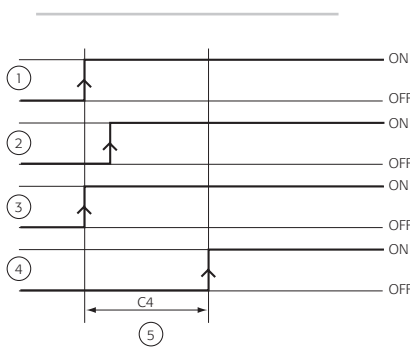


Fig. 5.a.e

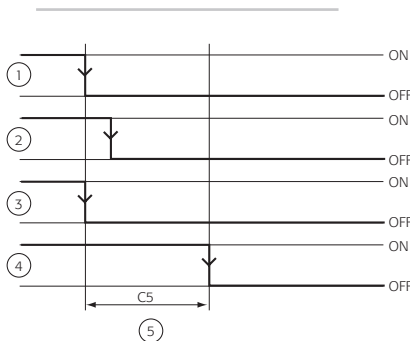


Fig. 5.a.f

• Compressor settings: parameters (c\*)

- Minimum ON time

c01: This establishes the time that the compressor must remain ON for when started, even if the stop signal is sent.

Key:

1. signal;
2. compressor;
3. min. ON time-interval.

- Minimum OFF time

c02: This establishes the time that the compressor must remain OFF for when stopped, even if the start signal is sent. The compressor LED flashes in this phase.

Key:

1. signal;
2. compressor;
3. min. OFF time-interval.

- Delay between 2 starts of the compressor

c03: This sets the minimum time that must elapse between two successive starts of the same compressor (determines the maximum number of starts per hour for the compressor). The compressor LED flashes in this phase. If by mistake the user enters a value lower than the sum of C01 + C02, this parameter will be ignored and only the times C01 and C02 will be considered.

Key:

1. signal;
2. compressor;
3. min. time-interval between two ON routines.

- Start delay between compressors

c04: This sets the delay between the starts of the two compressors, so as to reduce the peak power input and make the compressors start more smoothly. The compressor LED flashes in this phase.

- In the event of capacity control, the delay c04 between compressor and valve becomes c04/2;
- In the event of defrost operation, the delay between compressor and compressor is 3 seconds, and between compressor and valve is 2 seconds.

Key:

1. 1<sup>st</sup> signal;
2. 2<sup>nd</sup> signal;
3. 1<sup>st</sup> compressor;
4. 2<sup>nd</sup> compressor;
5. time delay between two compressors ON routines/time-delay of the capacity-controlled routine.

- Stop delay between compressors

c05: This sets the stop delay between the compressors.

Legenda:

1. 2<sup>nd</sup> signal;
2. 1<sup>st</sup> signal;
3. 2<sup>nd</sup> compressor;
4. 1<sup>st</sup> compressor;
5. time delay between two compressors OFF routines/time-delay before the capacity-controlled routine.

**- Delay on power-up (reset power supply)**

**c06:** At power ON (when the controller is physically switched ON) the activation of all the outputs is delayed so as to distribute the power input and protect the compressor against repeated starts in the event of frequent power failures. This means that after the delay time, the controller will start to manage the outputs based on the other times and the other normal functions.

**- Compressor start delay from pump/outlet fan (air/air) ON.**

**c07:** In cooling and heating operation, if the operation of the pump (outlet fan) is subject to the controller (parameter H05=2), the compressor is started when required after the set time from the activation of the water pump (or outlet fan in air/air units).

If the pump/outlet fan is always ON (H05=1) and consequently does not depend on the control logic, the compressor is started after the set time from when the unit starts.

**Key:**

- 1. inlet fan;
- 2. pump;
- 3. compressor;
- 4. time-delay between pump-inlet fan and compressor.

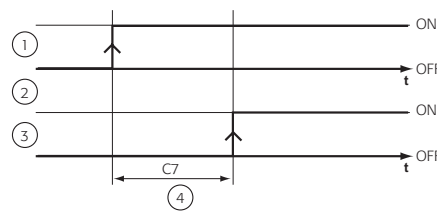


Fig. 5.a.g

**- Pump/outlet fan (air/air) start delay from compressor OFF**

**c08:** In cooling and heating operation, if the operation of the pump (outlet fan) is subject to the controller (parameter H05=2), when the compressor is requested to stop, the control first stops the compressor and the pump (outlet fan).

If the pump/outlet fan is always ON (H05=1), it is only stopped in standby mode.

**Key:**

- 1. compressor;
- 2. pump;
- 3. inlet fan;
- 4. time-delay between pump-inlet fan and compressor.

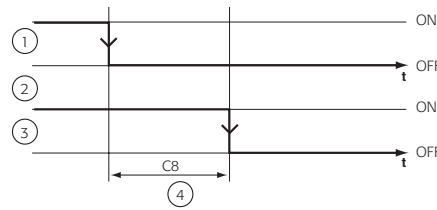


Fig. 5.a.h

**- Maximum tandem compressor operating time**

**c09:** In the case of two compressors in tandem per circuit, one compressor should not operate for longer than the time set for c09 while the other compressor in the circuit is OFF. This prevents the oil shared in common from migrating over the allowed limit towards the active compressor, and consequently avoids damage when inactive compressor next starts (FIFO logic) due to poor lubrication. As a result, compressor 1 (or 2) in circuit 1, if requested to operate continuously, will actually stop OFF after the time c09 and hand over to compressor 2 (or 1) that was previously OFF.

This function always considers the compressor times. Any value lower than the time set for c03 will be ignored, and the compressors (if the above condition is satisfied) will switch over after the time c03.

When C9=0, the function is disabled (the compressors will not switch over).

**- Hour counter compressor 1-2-3-4**

**c10, c11, c12, c13:** These indicate the number of operating hours of compressor 1, 2, 3, 4, expressed in hundreds of hours.

Pressing ▲ and ▼ together, when the hour counter is displayed, resets the hour counter and, consequently, cancels any maintenance requests in progress.

- c10= operating hours comp. 1
- c11= operating hours comp. 2
- c12= operating hours comp. 3
- c13= operating hours comp. 4

**- Compressor operating hour counter threshold**

**c14:** This sets the number of compressors operating hours, expressed in hundreds of hours, above which the maintenance request signal is sent.

c14= 0: function disabled.

**- Evaporator pump/fan 1 hour counter**

**c15:** This indicates the number of operating hours for the evaporator pump or fan 1, expressed in hundreds of hours.

Pressing ▲ and ▼ together, when the hour counter is displayed, resets the hour counter and, consequently, cancels any maintenance requests in progress.

**- Condenser or backup pump/fan 2 hour counter**

**c16:** This indicates the number of operating hours for the condenser pump (or backup) or fan 2, expressed in hundreds of hours.

Pressing ▲ and ▼ together, when the hour counter is displayed, resets the hour counter and, consequently, cancels any maintenance requests in progress.

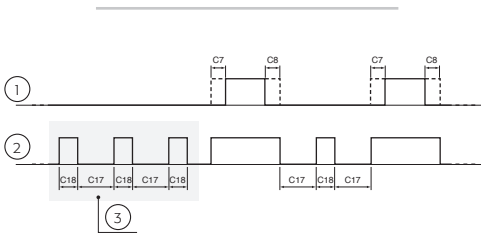


Fig. 5.a.i

**- Minimum OFF time before the next pump start**

**c17:** The diagram below shows an example of the operation of the pump and with burst (active when H05=3, see parameter H05).

The dashed areas on the compressor line indicate the pump-compressor and compressor-pump delay times.

Burst mode is disabled in standby and during an alarm when the pump is OFF.

At power ON the delay c17 must elapse before burst can start.

**- Minimum pump ON time**

**c18:** This represents the minimum time that the pump remains ON for, see Fig. 5.i (active with H05=3 see parameter H05).

**• Defrost settings: parameters (d\*)**

The defrost has priority over the compressor times.

For the defrost function the compressors times are ignored, with the exception of C04 (see C04 description for the exceptions).

**Key:**

- 1. compressor;
- 2. pump;
- 3. burst.

**- Enable condenser defrost/antifreeze**

**d01:** For heat pumps with air-cooled condensers (H01=1, 3, 8), this establishes whether defrost control must be performed on the outdoor exchanger (evaporator in heating mode).

On the other hand, for water/water heat pumps with reversal on the gas circuit (H01=5-10), it enables antifreeze control on the cooling water for the outdoor exchanger, which becomes the evaporator in heating mode, see d03. If the fan is not present, the function is not enabled for air/water units.

d01=0: condenser defrost/antifreeze disabled;

d01=1: condenser defrost/antifreeze enabled.

If defrosting is enabled, the LED corresponding to the condensate symbol on the display will come O.

**- Type of defrost**

**d02:** establishes the type of defrost.

d02=0: the defrost has a fixed duration that depends on 007

d02=1: the defrost starts and ends according to the temperature or pressure thresholds, see d03 and d04;

d02=2: the pressure transducer and temperature probe are both located on the outside exchanger; the defrost starts when the value read by the pressure transducer is below the threshold d03 and ends when the value read by the temperature probe is above the threshold d04; during the defrost, the pressure probe controls the fan speed, as in chiller mode, so as to limit the pressure, even if the NTC probe, caked by ice, delays the end defrost. In any case, after the maximum time allowed for the defrost, the unit will always exit the defrost procedure.

**- Start defrost temperature/pressure or condenser antifreeze alarm set point**

**d03:** For heat pumps with air-cooled condensers (H01=1, 3, 8, 10, 12), this sets the temperature or pressure below which the defrost cycle starts. To start the defrost cycle, the condition must be valid for the time d05. For water/water heat pumps with reversal on the gas circuit (H01=5, 10), it defines the set point for the activation of the antifreeze alarm for the outdoor exchanger cooling water (evaporator in heating mode, on probe B3).

**- End defrost temperature/pressure**

**d04:** Establishes the temperature or pressure above which the defrost cycle ends.

**- Minimum start defrost time**

**d05:** Establishes the time that temperature/pressure must remain below the start defrost threshold d03, while the compressor is ON, for the defrost cycle to be activated.

**Key:**

- 1. end defrost T/P ;
- 2. start defrostT/P;
- 3. start defrostT;
- 4. end defrost;
- 5. min. time-interval to start a def. cycle (d6);
- 6. min defrost interval (d5);
- 7. timer reset.

Temperature-based defrost (d2= 1)

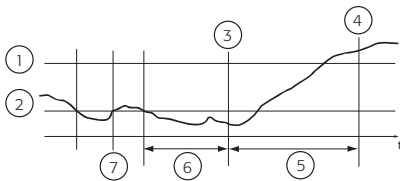


Fig. 5.a.j

#### - Minimum defrost duration

**d06:** Represents the minimum duration of the defrost cycle (the defrost continues even if the value read by the condenser probe exceeds the end temperature/pressure). If set to 0, the minimum defrost time function is disabled.

d06=0: control disabled.

#### - Maximum defrost duration

**d07:** If timed defrost is set (d02=0), this establishes the duration of the cycle.

If, on the other hand, the defrost ends at a set temperature/pressure, it represents the maximum duration (being in this case a safety feature, an alarm is signalled, "dF1" or "dF2").

#### - Delay between two defrost requests in the same circuit

**d08:** Represents the minimum delay between two successive defrost cycles.

#### - Defrost delay between the 2 circuits

**d09:** Represents the minimum delay between the defrost cycles on the 2 circuits.

#### - Defrost management from external contact

**d10:** This enables or disables defrost control from an external contact.

This function is typically used to end the defrost based on a signal from a thermostat/pressure switch connected to the corresponding digital input. In this case, the defrost times are ignored.

d10 = 0: function disabled.

► **Note:** for the other settings, the start and end defrost are enabled for temperature and pressure values between the Defrost start and end set points

d10= 1: start defrost from external contact enabled therefore:

- if the contact of the input is open, the start of the defrost is enabled;
- if the contact of the input closed, the defrost follows the normal procedure.

d10= 2: end defrost from external contact enabled therefore:

- if the contact of the input is open, the end of the defrost is enabled;
- if the contact of the input is closed, the defrost follows the normal procedure.

d10= 3: start and end defrost from external contact enabled therefore:

- if the contact of the input is open, the end/start of the defrost is enabled;
- if the contact of the input is closed, the defrost follows the normal procedure.

#### - Antifreeze/auxiliary heaters in defrost

**d11:** This parameter determines whether, during the defrost cycle, the antifreeze/auxiliary heaters should be activated to limit the flow of cold water/air into the room.

d11 = 0: antifreeze/auxiliary heater not activated in defrost;

d11 = 1: antifreeze/auxiliary heater activated in defrost.

#### - Waiting time before defrost/delay in switching from heating to cooling

**d12:** As soon as the defrost condition arises, but before the actual cycle starts, the unit stops the compressor for the time d12 (selectable from 0 to 3 minutes). When the compressor stops, the four-way valve is switched (reversing of the cycle), after a time equal to d12/2; this waiting time allows the pressure to balance before starting the defrost cycle. In this procedure the compressor protection times are ignored, and consequently the compressor is stopped, and subsequently restarted, immediately.

If d12=0, the compressor is not stopped and the reversing valve is switched immediately.

#### - Waiting time after defrost/delay in switching from cooling to heating

**d13:** At the end of the defrost cycle, the unit stops the compressor for a time d13 (selectable from 0 to 3 minutes). When the compressor stops, the four-way valves is switched (reversing of the cycle), after a time equal to d13/2; this waiting time allows the pressure to balance and the outdoor coil to drip. In this procedure the compressor protection times are ignored, and consequently the compressor is stopped, and subsequently restarted, immediately.

If d13=0, the compressor is not stopped and the reversing valve is switched immediately.

#### - End defrost with two gas circuits/1 fan circuit

**d14:** This parameter is used to select, in units with two refrigerant circuits and one fan circuit, the end defrost mode.

d14 = 0 (default): the two circuits end the defrost independently (each according to their own temperature or pressure probe reading), only if H2= 1;

d14 = 1: when both the circuits have reached the defrost condition;

d14 = 2: when one of the two circuits has reached the end defrost condition.

**- Start defrost with 2 circuits**

**d15:** This parameter is used to select whether to defrost the two circuits together or separately.

d15 = 0 (default): the two circuits start defrosting independently (each according to their own temperature or pressure probe reading), only if H2=1;

d15 = 1: the two circuits start defrosting when both have reached the start defrost conditions;

d15 = 2: the two circuits start defrosting when at least one of the two has reached the defrost conditions.

	<b>d14= 0</b>	<b>d14= 1</b>	<b>d14= 2</b>
d15= 0	OK	OK	OK
d15= 1	OK	OK	OK
d15= 2	Not possible	OK	Not possible

Tab 5.b

**- Forced ventilation time at end defrost**

**d16:** If the parameter F13 = 2, as soon as the end defrost temperature or pressure is reached, the fans are activated at maximum speed for the set time, before the change in operating mode.

Only at the end of this time will the cycle switch back to heat pump mode, with the normal management of the fans.

**- Defrost with compressors OFF (Fan Defrost)**

**d17:** This function allows the outside temperature to be exploited, when sufficient, to defrost the condenser (outdoor evaporator).

In these conditions, the unit, rather than reverse the cycle, simply turns OFF the compressors and activates the fans at maximum speed.

The start and end defrost conditions remain unchanged, as does the use of any auxiliary heaters.

The parameter has the following settings: d17=0: function disabled, d17>0: function enabled with relative set point (which represents the minimum defrost temperature set by the manufacturer). Above the set point, the unit performs the Fan Defrost.

**• Fan settings: parameters (F\*)**

**- Fan output**

**F01:** Enables the operation of the fans.

F01=0: fans absent;

F01=1: fans present.

The PWM output (1 or 2, depending on the value of parameter H02) requires the presence of the optional fan control cards (ON/OFF for the CONVONOFF module or speed variation for MCHRTF or FCS three-phase).

**- Fan operating mode**

**F02:** This establishes the operating logic for the fans:

F02=0: always ON at maximum speed, independently from the compressors. The fans are only switched OFF when the unit is in standby.

F02=1: ON at maximum speed when at least one compressor in the corresponding circuit is ON (parallel operation in each circuit).

F02=2: ON when the corresponding compressor is ON, with ON/OFF control based on the temperature/pressure settings for the minimum and maximum speed (parameters F05-F06-F08 and F09). When the compressors are stopped, the corresponding fans are also stopped, irrespective of the condensing temperature/pressure.

**Key:**  
 1. speed %;  
 2. condensing temperature/pressure;  
 3. hysteresis.

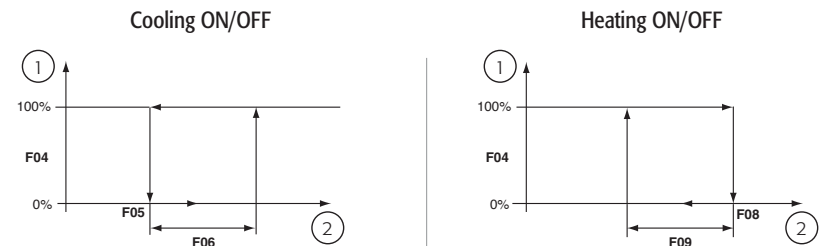


Fig. 5.a.k

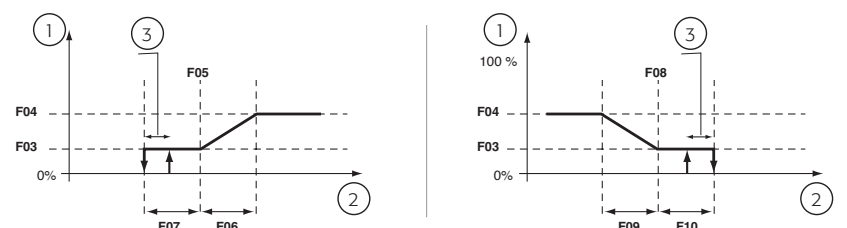


Fig. 5.a.l

F02=3: ON when the corresponding compressor is ON, with speed control. When the compressors are stopped the corresponding fans are also stopped, irrespective of the condensing temperature/pressure.

With F02=3 and an NTC condenser probe, when the compressor starts the fans are started at maximum speed for the time F11, irrespective of the temperature measured.

In the event of a condenser probe fault, the fans will be switched OFF.

#### - Minimum voltage threshold for Triac

**F03:** In the event of fan speed control, the optional phase cutting cards (MCHRTF\*) are required, fitted with a triac. The voltage delivered by the triac to the electric fan motor corresponding to the minimum speed must be set. The set value does not correspond to the actual voltage in Volts applied, but rather to an internal unit of calculation in the  $\mu\text{C}^2$ .

If using FCS controllers, set this parameter to 0.

F03 = Represents the minimum threshold for the triac

#### - Maximum voltage threshold for Triac

**F04:** In the event of fan speed control, the optional phase cutting cards (MCHRTF\*) are required, fitted with a triac. The voltage delivered by the triac to the electric fan motor corresponding to the maximum speed must be set. The set value does not correspond to the actual voltage in Volts applied, but rather to an internal unit of calculation in the  $\mu\text{C}^2$ .

If using FCS controllers, set this parameter to 100.

F04 = Represents the maximum threshold for the triac

#### - Temperature/pressure set point for minimum speed in cooling

**F05:** This represents the temperature or pressure below which the fans remain ON at minimum speed. In the case of ON/OFF control, it represents the temperature or pressure below which the fans are switched OFF (Fig. 5.a.k).

#### - Temperature/pressure differential for maximum speed in cooling

**F06:** This represents the temperature or pressure differential in reference to F05 above which the fans are started at maximum speed; in the case of ON/OFF control, this represents the differential above which the fans are started (Fig. 5.a.k).

#### - Temperature/pressure differential for fans Off in cooling

**F07:** This represents the temperature or pressure differential in reference to F05 below which the fans are stopped. The fans are started 1 °C "lower" when using NTC temperature probes, or 0.5 bars if using pressure probes. (Fig. 5.a.l)

When using NTC temperature or pressure probes for condenser control, the fans are started with an hysteresis of 1 °C or 0.5 bar.

#### - Temperature/pressure set point for minimum speed in heating

**F08:** Determina la temperatura o la pressione sopra la quale i ventilatori devono essere attivati alla minima velocità (Fig 5.a.n).

Nel caso di regolazione ON/OFF rappresenta la temperatura o la pressione sopra la quale i ventilatori vengono spenti (Fig 5.a.m).

#### - Differenziale temperatura/pressione massima velocità ventilatori in modalità Inverno (riscaldamento)

**F09:** This represents the temperature or pressure above which the fans are started at minimum speed (Fig 5.a.l).

In the case of ON/OFF control, it represents the temperature or pressure above which the fans are switched OFF (Fig.5.a.k).

#### - Temperature/pressure differential for fans Off in heating

**F10:** If fan speed control is used, this represents the temperature or pressure differential in reference to F08 above which the fans are stopped. The fans are started 1 °C "lower" if using NTC temperature probes or 0.5 bars lower if using pressure probes.

When using NTC temperature or pressure probes for condenser control, the fans are started with an hysteresis of 1 °C or 0.5 bar.

#### - Fan start time

**F11:** This establishes the operating time at maximum speed when the fans are started, so as to overcome the mechanical inertia of the motor.

The same times are observed in reference to the start of the compressor (irrespective of the condensing temperature/pressure), if NTC temperature probes are used on the condenser and speed control is enabled, F02=3; this is done to bring forward the sudden increase in pressure (which does not necessarily correspond to a likewise rapid increase in temperature in the area where the probe is located) and consequently to improve control

**F11=0:** the function is disabled, that is, the fans are activated at the minimum speed and then controlled based on the condensing temperature/pressure.



**- Triac impulse duration**

**F12:** This represents the duration in milliseconds for the impulse applied to the triac. For induction motors, set the parameter to 2 (default). On the other hand, when using the CONVONOFF0, CONVO/10A0 modules or FCS controllers, set the parameter to 0.

Cooling + compressor ON

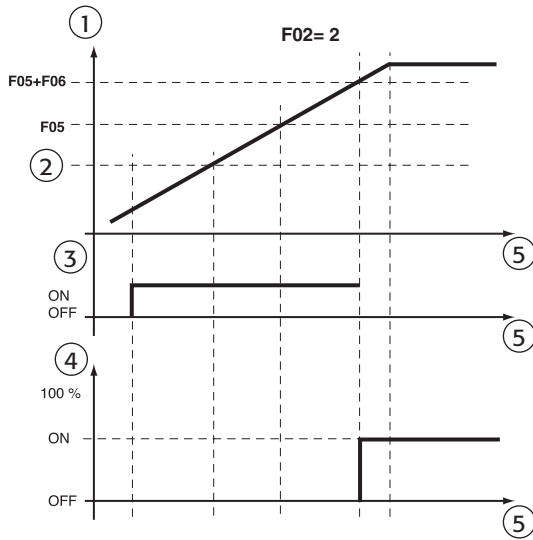


Fig. 5.a.o

Cooling + compressor ON + NTC cond. probe

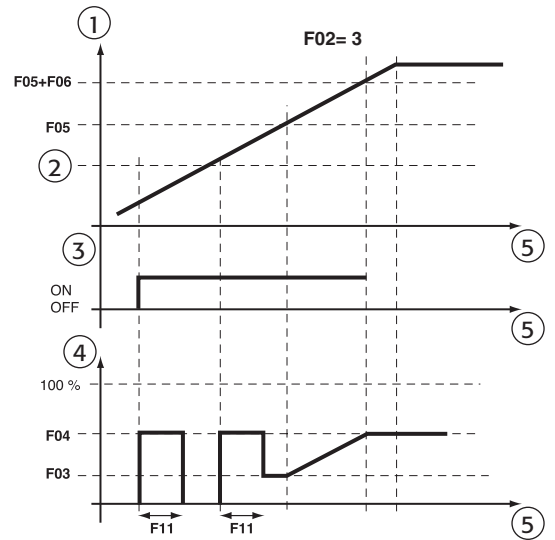


Fig. 5.a.p

**Key:**

- |    |                                 |
|----|---------------------------------|
| 1. | condensing temperature pressure |
| 2. | F05-F07+ hysteresis             |
| 3. | compressor                      |
| 4. | speed %                         |
| 5. | time                            |

Heating + compressor ON + NTC probe (F11≠0)

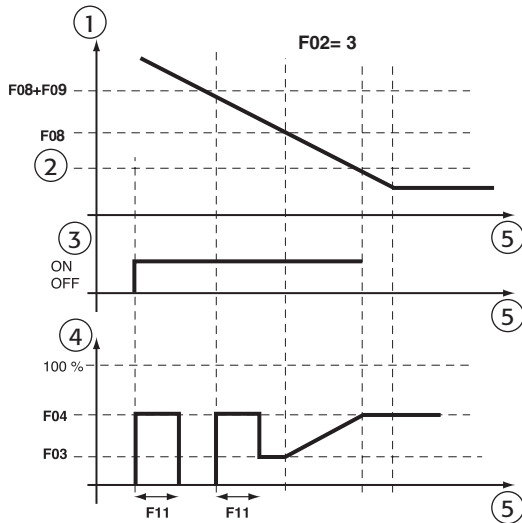


Fig. 5.a.q

Cooling + compressor ON + NTC cond. probe

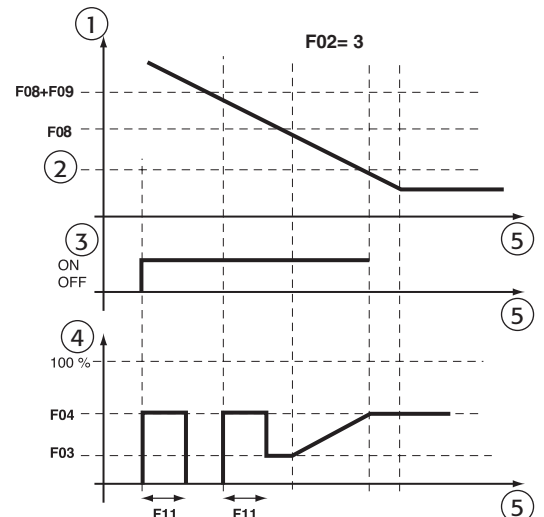


Fig. 5.a.r

**- Fan management mode in defrost**

**F13:** This parameter sets the operating logic for the condensing fans during the defrost phase:

F13 = 0: (default) the fans are OFF.

F13 = 1: the fans are ON as in cooling mode, based on the temperature or pressure.

F13 = 2: the fans are OFF until the end defrost temperature or pressure is reached, above which they are started at maximum speed for the time set for parameter d16. Only at the end of this time will the cycle return to heat pump mode with the normal management of the fans.



**Note:** If the unit is running the Fan Defrost function (parameter d17), the fan management selected by F13 is disabled.



### - Fan on time when starting in high condensing temp.

**F14:** establishes the time the fans are operated at maximum speed if starting with a high condensing temperature.

F14 = 0: function disabled.

F14 > 0: fan on time (in seconds).

The function is operational only in chiller mode, if the probe on the condenser is a temperature sensor and only for air-cooled units. When the first compressor in the circuit in question starts, it is assumed that the temperature of the environment is close to the temperature of the condenser; if the value read by the condenser probe is higher than the value of F05-F07, as well as starting the compressor, the fans in the circuit in question are forced on at maximum speed for the time set by F14.

### • Unit settings: parameters: (H\*)

#### - Unit model

**H01:** Used to select the type of unit being controlled:

H01= 0: air/air units

H01= 1: AIR/AIR heat pump

H01= 2: AIR/WATER Chiller

H01= 3: AIR/WATER heat pump

H01= 4: WATER/WATER Chiller

H01= 5: water/water heat pump with rev. on gas (\*)


H01= 6: water/water heat pump with rev. on water (\*)

H01= 7: air-cooled condensing unit

H01= 8: air-cooled condensing unit with reversal on gas circuit

H01= 9: water-cooled condensing unit

H01= 10: water-cooled unit condensing with reversal on gas circuit

 (\*) **Note:** Set H21= 4 (Condenser pump always on), if H02= 1 (Two condensers).

#### - Number of condenser fan circuits/water condensers

**H02:** This establishes the number of fan circuits present in the configurations with two circuits. With one fan circuit (H02=0) the unit may have 1 or 2 refrigerant circuits:

- with one refrigerant circuit, the fans are exclusively controlled based on the pressure or temperature read by the sensor in the first circuit;
- with two refrigerant circuits, the fans are controlled based on the higher temperature/pressure of the two circuits. In heat pump mode, the output depends on the lower temperature or pressure. The output used is Y1. Vice-versa, with 2 ventilation circuits (H02=1) each PWM output is independent and depends on its own condenser probe (B3 or B4 for circuit 1 and B7 or B8 for circuit 2).

#### - Number of evaporators

**H03:** This establishes the number of evaporators present when there are 2 or 4 compressors, obviously with 2 circuits (including the expansion). With one evaporator (H03=0), the management of the heaters and the antifreeze function is performed only on B2. Vice-versa, with 2 evaporators (H03=1) antifreeze control will be performed using B2 and B6, while input B5 is used to control the water outlet temperature.

#### - Number of compressors/circuits

**H04:** This establishes the number of compressors per circuit and the number of circuits. For further details see Table 4.g.

#### - Evaporator pump/fan operating mode


**H05:** This establishes the operating mode for the evaporator water pump or the outlet fan (in air/air units).

H05 = 0: pump disabled, (the flow switch alarm is ignored)

H05 = 1: always ON (the alarm is managed)

H05 = 2: ON when called by compressor (the alarm is managed)

H05 = 3: the pump will be started and stopped at regular intervals (independently from the compressors) as per the Burst setting (see parameters c17 and c18). When the heating or cooling signal is received, first the evaporator pump/outlet fan starts (always ON), and then the compressor, after the set times (c07, c08). The pump will not be stopped until all the compressors are Off.

 **Note:** with air/air units (H01=0,1), if heaters are used as the heating device, the fan must not be stopped while heating is active. This would cause the risk of fire. Therefore, if H01=0 or 1, H05 must be set to 1.

#### - Cooling/heating digital input

**H06:** Establishes whether the cooling/heating selection from digital input is enabled. see parameters P08, P09, P10, P11, P12 and P13). The open status places the unit in cooling operation, vice-versa, in heating.

D-IN Open = Cooling

D-IN Closed = Heating

#### - ON/OFF digital input

**H07:** Establishes whether the ON/OFF selection from digital input is enabled or disabled. If the selection is enabled (H07= 1), the "open" status switches the unit Off, while in the "closed" status, the unit may be OFF or ON, as controlled by the keypad.

### - $\mu C^2$ network configuration

**H08:** Establishes the layout of the tLan network.

0=  $\mu C^2$  only

1=  $\mu C^2$  + valve

2=  $\mu C^2$  + exp.

3=  $\mu C^2$  + exp. + valve

### - Enable keypad

**H09:** Used to disable the modification of the DIRECT and USER parameters from the keypad. The value of the parameters can always be displayed. The enable/disable cooling, heating and reset counter functions are also available.

Values:

0: keypad disabled

1: keypad enabled (default)

### - Serial address

**H10:** Establishes the address of the instrument for the serial connection, via an optional board, to a PC for supervision and/or telemaintenance.

### - Selection map outputs

**H11:** This parameter is used to arbitrarily associate some digital outputs to the devices on the unit.

**H11= 0:** standard (default); for units with one compressor per circuit (H04=0, 2).

**H11= 1:** For cooling only units with two compressors (H01=0, 2, 4, 7, 9 and H04=1, 3, 5)

**H11= 2:** The outputs of the expansion follow the same logic for the 2nd circuit. For H01= 1, 3, 5, 6, 8, 10 and H04= 1, 3, 5

**H11= 3:** The outputs of the expansion follow the same logic for the 2nd circuit. For H01= 1, 3, 5, 6, 8, 10 and H04= 1, 3, 5

**H11= 4:** For H01= 1, 3, 5, 6, 8, 10 and H04= 0, 1

**H11= 5:** For cooling only units with two compressors (H01= 0, 2, 4, 7, 9, and H04= 0)

#### associazione agli organi dell'unità

uscite	H11=0	H11= 1	H11= 2	H11= 3	H11= 4	H11= 5
C1	compressor 1	compressor 1	compressor 1	compressor 1	compressor 1	compressor 1
C2	heater 1	heater 1	heater 1	reversing valve 1	reversing valve 1	heater 1
C3	Pump/evaporator (fan) (on air/air units)	Pump/evaporator (fan) (on air/air units)	Pump/evaporator (fan) (on air/air units)	Pump/evaporator (fan) (on air/air units)	evaporator pump	Pump/evaporator (fan) (on air/air units)
C4	reversing valve 1	Compressor 2 (or capacity control comp. 1)	Compressor 2 (or capacity control comp. 1)	Compressor 2 (or capacity control comp. 1)	Compressor 2 (or capacity control comp. 1)	condenser fan 1
C5	alarm	alarm	reversing valve 1	alarm	alarm	alarm
C6	compressor 2	compressor 3	compressor 3	compressor 3	not used	compressor 2
C7	heater 2	heater 2	heater 2	reversing valve 2	heater 1	heater 2
C8	Condenser pump/backup	Condenser pump/backup	Condenser pump/backup	Condenser pump/backup	Condenser pump/backup	Condenser pump/backup
C9	reversing valve 2	Compressor 4 (or capacity control comp. 2)	Compressor 4 (or capacity control comp. 2)	Compressor 4 (or capacity control comp. 2)	not used	condenser fan 2
C10	Warning	Warning	reversing valve 2	Warning	Warning	Warning

### - Capacity-control logic


**H12:** Specifies the logic for the activation of the capacity-control steps for the compressors and the 4-way reversing valve.

H12 = 0: 4-way reversing valve and capacity-control normally energised

H12 = 1: 4-way reversing valve and capacity-control normally de-energised. Default value.

H12 = 2: 4-way reversing valve normally de-energised and capacity-control normally energised

H12 = 3: 4-way reversing valve normally energised and capacity-control normally de-energised.

 **Note:** in the event of capacity-control, the rotation between compressor and corresponding valve is disabled. FIFO or time logic can be used between the 2 circuits to optimise the starts or the operating hours of the 2 compressors (1 per circuit).

### - Function of the second pump

**H21:** This parameter defines how the output dedicated to the second pump must be managed.

H21= 0: the second pump is disabled.

H21= 1: the second pump is used only as a backup.

If the flow switch and corresponding alarm are activated, the pumps are switched over:

- if the alarm passes, a warning is shown on the display and the warning relay is activated, while the unit continues to operate with the Backup pump. When the next alarm is activated the pumps will be switched over.
- if the alarm remains active even with the second pump on for longer than the time set for P1, the generic alarm is generated and the unit is switched OFF.

**H21= 2:** the second pump represents a backup pump. The two pumps are never used at the same time but each 24 hours, are switched over. In the event of flow alarms, the logic is the same as for setting 1. After being switched over due to the flow alarm, the 24-hour timer is set to zero.

**H21= 3:** the second pump is used as an ON/OFF device in the same way as the condenser fan (which in this case is not present), in ON/OFF mode, with the same settings (in fact in this case the pump replaces the fan, including the symbol).

**H21= 4:** the second pump is used for the condenser but is always ON. In this case the pump symbol is

not managed.

► **Note:** In the event of flow alarms with automatic reset, 10 attempts are made to restart the pump every 90 seconds, for a maximum time of P02; after the 10 attempts, the alarm becomes manual reset. With the second pump, the attempt consists in switching over the pump that is on, with the same logic.

**- Disable load default values**

**H22:** If this parameter is set to 1, it disables the possibility of restoring the default parameters using the PRG button at power ON.

**- select supervisor protocol**

**H23:** establishes the protocol used for the connection to the supervisor from the serial board RS485

H23 = 0: CAREL protocol (baud rate 19200,...)

H23 = 1: Modbus protocol

**• Alarm settings: parameters (P\*)**

**- Flow switch alarm delay when starting pump**

**P01:** Establishes a delay in the recognition of the flow switch alarm when starting the pump (this allows the flow-rate to stabilise). In the event of alarms, the compressors are stopped immediately, ignoring the times.

**- Flow switch alarm delay in steady operation**

**P02:** Establishes a delay in the recognition of the flow switch alarm in steady operation, so as to filter any variations in flow-rate or air bubbles present in the water circuit. In the event of alarms, the compressors are stopped immediately, ignoring the times.

**- Low pressure alarm delay at compressor start**

**P03:** Establishes a delay in the recognition of the low pressure alarm when the compressor starts, so as to allow stable operating conditions to be reached. This delay is also counted when reversing the 4-way valve in the refrigerant circuit.

**- Part load in high pressure**

**P04:** enable or disable the part load operation of the circuit in high pressure.

The function is valid if the unit is fitted with tandem or capacity controlled compressors and pressure transducers. In the event of high pressure alarms, that is, for values over P18 (hysteresis 0.5 bar), the controller deactivates a load step in the circuit in question and waits 10 seconds. After this interval, if the alarm is still active, the unit is stopped, otherwise it continues to operate in part load mode. In this situation, the display shows the message PC1 and/or PC2, depending on the circuit. This condition remains active until the pressure falls below the value corresponding to the maximum speed of the condenser fans (F05+F06). Below this value, the unit reactivates the load step that had previously been deactivated.

**- Alarm reset**

**P05:** Enables automatic reset for all those alarms that normally feature manual reset (high pressure, low pressure, flow switch/antifreeze) as per the following table:

**P05= 0:** (default) high pressure, low pressure and antifreeze (low temperature) with manual reset;

**P05= 1:** all the alarms with automatic reset;

**P05= 2:** high pressure and antifreeze (low temperature) manual, low pressure automatic;

**P05= 3:** high pressure manual, low pressure and antifreeze (low temperature) automatic;

**P05= 4:** high and low pressure manual, antifreeze (low temperature) automatic;



**P05= 5:** high and low pressure manual after the third activation in one hour\*, antifreeze (low temperature) automatic;

**P05= 6:** high and low pressure manual after the third activation in one hour\*, antifreeze (low temperature) manual.

\*: the high and low pressure alarms are managed in the same way both for the transducers and the pressure switches (digital input); if the unit is in standby the count (3 times in one hour) is reset.

**- Cooling/Heating logic**

**P06:** If this parameter is set to 1, the operating logic of the Cooling/Heating logic is reversed (from the keypad, the remote control and the digital input).

Symbol	P06= 0	P06= 1
	Cooling (Chiller)	Heating (heat pump)
	Heating (heat pump)	Cooling (Chiller)

**- Low pressure alarm with pressure probes**

**P07:** P07=0: this function is disabled.

P07=1: if in heat pump mode the evaporator (external exchanger) pressure is less than 1 bar (and if the presence of the condenser pressure probe is enabled), the low pressure alarm is activated (while still considering the delay P03).

► **Note:** P07=1 the LP digital inputs in heat pump are ignored.

**- Select digital input ID1**

P08= 0:	none;
P08= 1:	flow switch with manual reset (normally closed);
P08= 2:	flow switch with automatic reset (N.C.);
P08= 3:	general thermal overload with manual reset (N.C.);
P08= 4:	general thermal overload with automatic reset (N.C.);
P08= 5:	thermal overload circuit 1 with manual reset (N.C.);
P08= 6:	thermal overload circuit 1 with automatic reset (N.C.);
P08= 7:	thermal overload circuit 2 with manual reset (N.C.);
P08= 8:	thermal overload circuit 2 with automatic reset (N.C.);
P08= 9:	cooling/heating (open = Cooling, closed = Heating) if H06= 1;
P08= 10:	cooling/heating with delays d12 and d13 (open = Cooling, closed = Heating) if H06= 1;
P08= 11:	alarm signal with manual reset (N.C.);
P08= 12:	alarm signal with automatic reset (N.C.);
P08= 13:	second set point from external contact (cooling and heating), (normally open);
P08= 14:	second cooling set point from external contact and heating from time band (N.O.);
P08= 15:	end defrost from external contact circuit 1 (N.C.);
P08= 16:	end defrost from external contact circuit 2 (N.C.);
P08= 17:	end defrost from external contact circuit 1 (N.C.);
P08= 18:	end defrost from external contact circuit 2 (N.C.);
P08= 19:	condenser step 1 (N.O.);
P08= 20:	condenser step 2 (N.O.);
P08= 21:	condenser step 3 (N.O.);
P08= 22:	condenser step 4 (N.O.);

➡ **note 1:** if P08 is set to 10, the change in state considers the times d12 and d13, and respects the compressor protection times, both from the digital input and the keypad.

➡ **note 2:** if the digital input is used to switch the unit ON/OFF or change the operating mode, these functions are disabled on the keypad.

**- Select digital inputs ID2, ID6, ID7, ID10**

**P09, P10, P11, P12:** Configuration of digital inputs ID2, ID6, ID7 and ID10 respectively (as per the above table for digital input ID1).

➡ **Nota:** cooling/heating (9,10) cannot be set on P10, P11, P12, and P14.

**- Select input B4 if /04 = 1**

**P13:** If input B4 is used as ON/OFF (/04 = 1) the same options are valid as for P08.

**- Select input B8 if /08 = 1**

**P14:** If input B8 is used as ON/OFF (/08 = 1) the same options are valid as for P08.

**- Select low pressure alarm**

**P15:** Used to select whether the low pressure alarm is detected when the compressor is OFF (P15=1) or alternatively only when the compressor is ON (P15=0, default).

When the compressor starts the alarm is in any case ignored for the time P03.

**- High temperature/high system start-up temperature alarm delay**

**P16:** Represents the high temperature alarm threshold detected by probe B1; the differential is set at 2 °C and the alarm is reset automatically (the warning relay is activated, signal only, and the message "Ht" is shown).

When starting the system, this alarm is ignored for the time P17. If the system start-up protection is enabled (see parameter P20) and the alarm is activated, the time P17 is ignored and the alarm has no hysteresis.

**- High temperature alarm delay on power-up**

**P17:** High temperature alarm delay when the control is switched on (power ON), from the remote ON/OFF contact or from the keypad.

**- High pressure alarm from transducer set point**

**P18:** Sets the value beyond which the high pressure alarm is generated. Each circuit will be managed by its own transducer.

**P18= 0:** the function is disabled.

For all other values greater than 3.0, due to the hysteresis (3 bars), the alarm is managed according to the set value.

**- Low system start-up temperature alarm set point**

**P19:** Represents a threshold for the low temperature (measured by probe B1) alarm, without hysteresis; it is reset automatically (the alarm relay is not activated and the display shows the message "ALt").

**- System start-up protection for high/low temperature**

**P20:** If set to 1, this parameter enables the system protection function when starting, both at power ON and when switching ON from Standby.

In chiller mode (cooling), for values of B1 greater than the set point P19, an alarm is activated and the unit is not started (display "AHt").

In heat pump mode (heating), for values lower than the set point P19, an alarm is activated and the unit is not started (display "ALt").

The alarm is reset automatically.

**P20=0:** the function is not enabled.

• Control settings: parameters (r\*)

- Cooling set point

r01: between r13 and r14

r02: cooling differential

- Heating set point (heat pump)

r03: between r15 and r16

r04: heating differential

- Compressor rotation

r05: The rotation of the compressors allows the operating hours to be balanced either statistically, using FIFO logic, or absolutely, by counting the effective operating hours.

Settings:

r05=0: rotation disabled; The customer can use compressors with different power ratings according to the desired logic or manage the capacity-control functions. The compressors are started/stopped in proportional mode.

r05=1: rotation with FIFO logic (first ON, first OFF, and vice-versa first OFF, first ON); in this mode the operating hours are optimised together with the number of starts, even if the compressor safety times are always respected.

r05=2: rotation with control of operating hours; in this way the compressors will have the same operating hours, as the compressor with the least operating hours is always started first, again observing the safety times. This does not however consider FIFO logic and does not optimise the starts and stops.

In the case of capacity controlled compressors (1 per circuit), FIFO logic or timed operation will refer to the actual circuit and not the compressor valves. If, for example, when capacity is required from circuit 1, compressor 1 starts first, capacity controlled (not at full capacity), and then the valve is managed as a second step, so that the compressor will work at maximum efficiency. If less capacity is required, the second step will be deactivated first, and then the compressor. There is no rotation between the compressor and the valve. If extra capacity is required, the second circuit will start with compressor 2 and then, if required, the valve is operated.

When stopping, the valve is managed first and then the actual compressor as a whole. Both FIFO logic and timed operation will involve either one circuit or the other. The activation and deactivation of the valves are not subject to timers, but rather only a hysteresis that is equal to the set point and the differential of the step (in fact the valve performs the same function as a hermetic compressor).

r05=3: direct correspondence between the digital inputs and the compressor relays (condensing units only).

- Type of compressor control

r06: This parameter is used to set the logic for maintaining the set point:

r06= 0: proportional on inlet

r06= 1: proportional on inlet + dead zone (see Dead zone, below)

r06= 2: proportional on outlet

r06= 3: proportional on outlet with dead zone

r06= 4: on outlet by time with dead zone (see timed outlet temperature control)

DEAD ZONE

The dead zone essentially shifts the proportional band from the set point by the value set for the parameter r07. This parameter is valid in all configurations if enabled (for r07≠0: dead zone set and enabled).

Key Figure 5.b.c:

r06: enable the dead zone (enabled if r06=1 or 3)

r07: dead zone

r01: cooling set point

r02: cooling differential

In chiller (cooling) mode, the dead zone moves the cooling proportional band above the set point by the value r07.

Key Figure 5.b.d:

r06: enable the dead zone (enabled if r06=1 or 3)

r07: dead zone

r03: heating set point

r04: heating differential

In heat pump (heating) mode, the dead zone moves the heating proportional band below the set point by the value r07.

Outlet temperature control by time r06 = 4 (only chiller)

This type of control is based on the need to maintain the outlet temperature as constant as possible, despite the load being variable or the reduced inertia of the system.

The logic has the aim of keeping the temperature inside the dead zone.

If outside the zone, the compressors will be activated with the logic described below, so as to return inside the dead zone, neither too quickly (using an integral or derivative), nor too slowly, with fixed time logic. There are two logical times involved: the activation time and deactivation time.

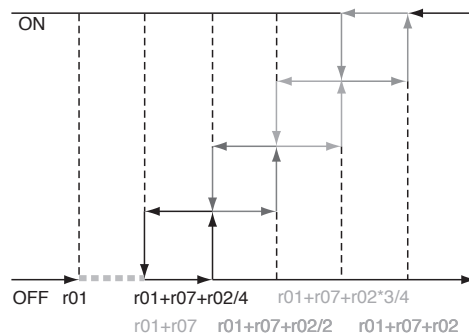


Fig. 5.b.c

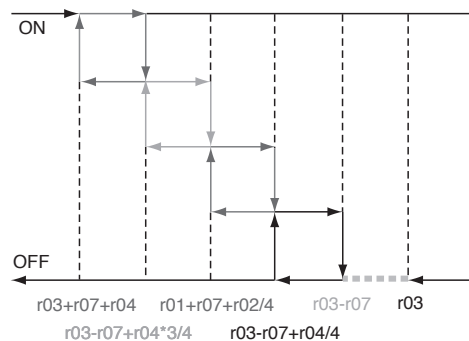


Fig. 5.b.d

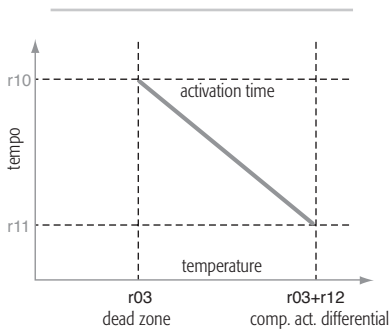


Fig. 5.b.e

- Dead zone differential

r07: (see dead zone)

- Activation delay at lower limit of r07 (if r06 = 4)

r08: The value set is used in the control algorithm (see timed outlet temperature control) as the maximum time (at the start of the differential) for the activation of the compressors.

- Activation delay at upper limit of r07 (if r06 = 4)

r09: The value set is used in the control algorithm (see timed outlet temperature control) as the minimum time (at the end of the differential) for the activation of the compressors.

Activation time (cooling)

The activation time is not a set parameter, but rather the combination of two set parameters, that is, r08 and r09. When the temperature leaves the dead zone, the activation time is equal to r08, while at the end of the differential r02 the activation time is equal to r09.

Inside the differential r02, the activation time varies linearly between r08 and r09.

This means that as the temperature moves away from the set point, the times are reduced and the response of the process becomes more dynamic.

- Deactivation delay at upper limit of r12 (if r06 = 4)

r10: The value set is used in the control algorithm (see timed outlet temperature control) as the maximum time (at the set point) for the deactivation of the compressors.

- Deactivation delay at lower limit of r12 (if r06 = 4)

r11: The value set for this parameter is used in the control algorithm (see timed outlet temperature control) as the minimum time (at the end of the deactivation differential) for the deactivation of the compressors.

- Compressor deactivation differential (if r06 = 4)

r12: This represents the temperature differential for the deactivation of the compressors, according to the procedure described in "Deactivation time".

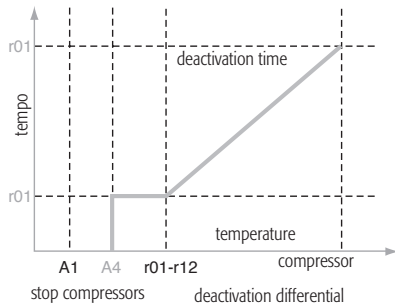


Fig. 5.b.f

Deactivation time (cooling) Fig. 5.b.f

In the same way as for the activation time, the deactivation time also varies between a maximum value, set for the parameter r10 and corresponding to the set point temperature, and a minimum, set for the parameter r11 corresponding to the end of the differential for the deactivation of the compressors, set by the parameter r12.

Below this value, the deactivation time will be equal to the minimum set until reaching the temperature A04, after which all the compressors will be switched OFF, irrespective of the times. As the temperature moves away from the set point, the response of the process becomes more dynamic.

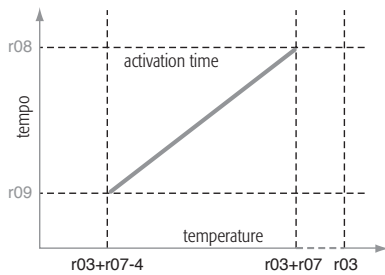


Fig. 5.b.g

Activation time (heating) Fig. 5.b.g

In heating mode, the activation time will increase as the deviation from the set point increases. The set point is the heating set point r03 with the corresponding differential r04. The parameters for setting the activation times are always r08 and r09.

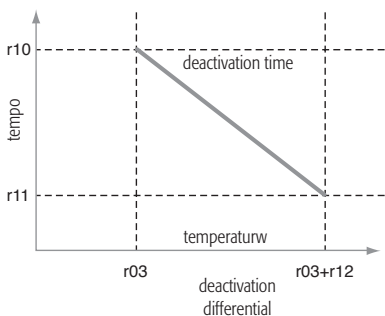


Fig. 5.b.h

Deactivation time (heating)

In heating mode, if the temperature rises above the set point, the deactivation time will decrease more the further the temperature moves away from the heating set point r03. At the end of the differential r12, the time will be the minimum set by parameter r11.

**- Minimum Cooling set point**

**r13:** Establishes the minimum limit for setting the Cooling set point.

**- Maximum Cooling set point**

**r14:** Establishes the maximum limit for setting the Cooling set point.

**- Minimum heating set point**

**r15:** Establishes the minimum limit for setting the heating set point.

**- Maximum heating set point**

**r16:** Establishes the maximum limit for setting the heating set point.

**- Cooling compensation constant (chiller mode):**

**r17:** Sets the coefficient that controls the cooling compensation algorithm. In cooling mode, if r17 is positive, the set point increases as the outside temperature increases (measured by the outside probe); if on the other hand r17 is negative the set point decreases as the outside temperature increases. This difference in the set point from the set value can have a maximum absolute value equal to the setting of r18. The values for the parameters shown on the graph are:  $r17=\pm 2$ ,  $r01=25$ ,  $r19=32$  and  $r18=5$ .

**Key:**

1. temperature;
2. time;
3. external temperature (probe B3/B4);
4. comp. start temperature (r19);
5. positive compensation ( $r17=2$ );
6. set point (r1);
7. negative compensation ( $r17=-2$ ).

**- Maximum deviation from the set point**

**r18:** Indicates the maximum deviation from the set point beyond which compensation is stopped (maximum and minimum limits in reference to the set point).

**- Start compensation temperature in cooling (outside probe)**

**r19:** Sets the temperature (measured by the outside probe) above which the compensation function starts (cooling), value between  $-40$  and  $80$  °C.

**- Start compensation temperature in heating (outside probe)**

**r20:** Sets the temperature (measured by the outside probe) below which the compensation function starts (heating), the value must be between  $-40$  and  $80$  °C.

**- Second cooling set point from external contact**

**r21:** Represents the alternative to r01 if an associated digital input is closed (see parameter P08), between r13 and r14.

**- Second heating set point from external contact**

**r22:** Represents the alternative to r03 if an associated digital input is closed (see parameter P08), between r15 and r16.

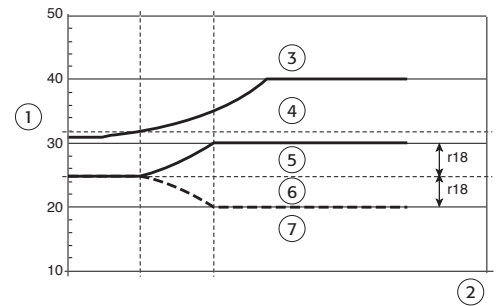


Fig. 5.b.i



**- Buffer tank suppression (low load)**

**r27:** The low load condition is determined when only one compressor is started and then is stopped after operating for less than the time set for parameter r28.

The settings are:

- r27=0: the function is disabled;
- r27=1: enabled only in chiller mode;
- r27=2: enabled only in heat pump mode;
- r27=3: enabled in chiller and heat pump modes.

**- Minimum compressor on time to determine low load condition**

**r28:** This parameter represents the minimum compressor on time below which the low load condition is determined. Whenever the compressor stops, the controller analyses the load status.

If already in low load condition, the time considered by the controller for the analysis becomes "r28 x r29" in chiller mode, or "r28 x r30 : r04" in heat pump mode.

**- Differential during the low load condition in chiller mode**

**r29:** This parameter represents the new differential considered by the controller in chiller mode during the low load condition.

Specifically, r02 is replaced by r29.

**- Differential during the low load condition in heat pump mode**

**r30:** This parameter represents the new differential considered by the controller in heat pump mode during the low load condition.

Specifically, r04 is replaced by r30.

**Key:**

- 1. chiller;
- 2. chiller in low load;
- 3. heat pump;
- 4. heat pump in low load;
- 5. temperature.

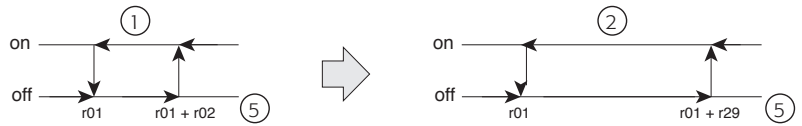


Fig. 5.b.m

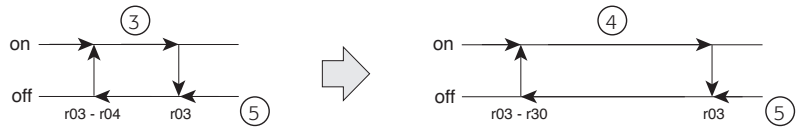


Fig. 5.b.n

**- Heating compensation constant (mode Heat pump)**

**r31:** Sets the coefficient that controls the heating compensation algorithm. In heating mode, if r31 is positive, the set point decreases as the outside temperature decreases (measured by the outside probe); if, on the other hand, r31 is negative, the set point increases as the outside temperature decreases.

This maximum deviation of the set point from the set value is equal to parameter r18. See, for example, parameter r17.

**• Firmware parameters: (F-r\*)**

These parameters cannot be set (display only):

- H96-H97:** software version of Driver 1, 2;
- H98:** software version of the expansion;
- H99:** software version of the  $\mu C^2$  controller.



## 6. TABLE OF ALARMS

Key to the table of alarms:

\*: if the probe is set for the compensation function, in the event of probe faults, the unit continues to operate.


ON\*: if the expansion card is not present.

EVD 1= EVD400 connected to  $\mu C^2$  (1st circ.)

EVD 2= EVD400 connected to the expansion (2nd circ.)

alarm display	alarm type	resetting	Compressor	pump	fan	heater	Valve	alarm	warning	superv. variable	superv. variab. description	variab. type
HP1	High pressure	Depends on P05	OFF C1-2	-	ON(60")	-	-	ON	-	31 (R)	Circuit 1 alarm	Digital
HP2	High pressure	Depends on P05	OFF C3-4	-	ON(60")	-	-	ON	-	32 (R)	Circuit 2 alarm	Digital
LP1	Low pressure	Depends on P05	OFF C1-2	-	OFF 1	-	-	ON	-	31 (R)	Circuit 1 alarm	Digital
LP2	Low pressure	Depends on P05	OFF C3-4	-	OFF 2	-	-	ON	-	32 (R)	Circuit 2 alarm	Digital
TP	General overload	Depends on P08	OFF	OFF	OFF	-	-	ON	-	35 (R)	General warning	Digital
tC1	Circuit 1 overload	Depends on P08	OFF C1-2	-	OFF 1	-	-	ON	-	31 (R)	Circuit 1 alarm	Digital
tC2	Circuit 2 overload	Depends on P08	OFF C3-4	-	OFF 2	-	-	ON	-	32 (R)	Circuit 2 alarm	Digital
LA	advice	Depends on P08	-	-	-	-	-	ON*	ON	40 (R)	General advice	Digital
FL	Flow controller alarm	Depends on P08	OFF	OFF	OFF	-	-	ON	-	35 (R)	General alarm	Digital
FLb	Backup pump warning	Automatic	-	-	-	-	-	-	ON	40 (R)	General advice	Digital
E1	Probe B1 alarm	Automatic	OFF	OFF	OFF	OFF	-	ON	-	36 (R)	Probe alarm	Digital
E2	Probe B2 alarm	Automatic	OFF	OFF	OFF	OFF	-	ON	-	36 (R)	Probe alarm	Digital
E3*	Probe B3 alarm	Automatic	OFF	OFF	OFF	OFF	-	ON	-	36 (R)	Probe alarm	Digital
E4*	Probe B4 alarm	Automatic	OFF	OFF	OFF	OFF	-	ON	-	36 (R)	Probe alarm	Digital
E5	Probe B5 alarm	Automatic	OFF	OFF	OFF	OFF	-	ON	-	36 (R)	Probe alarm	Digital
E6	Probe B6 alarm	Automatic	OFF	OFF	OFF	OFF	-	ON	-	36 (R)	Probe alarm	Digital
E7*	Probe B7 alarm	Automatic	OFF	OFF	OFF	OFF	-	ON	-	36 (R)	Probe alarm	Digital
E8*	Probe B8 alarm	Automatic	OFF	OFF	OFF	OFF	-	ON	-	36 (R)	Probe alarm	Digital
Hc1-4	Hour warning C1-4	Automatic	-	-	-	-	-	-	ON	37 (R)	Compressor advice	Digital
EPr	EEPROM error during operation	Automatic	-	-	-	-	-	-	ON	40 (R)	General advice	Digital
EPb	EEPROM error at the start-up	Automatic	OFF	OFF	OFF	OFF	OFF	OFF	OFF	35 (R)	General alarm	Digital
ESP	Expansion Error	Automatic	OFF	OFF	OFF	OFF	OFF	ON	-	35 (R)	General alarm	Digital
EL1-2	Zero cross	Automatic	-	-	100%	-	-	ON*	ON	42 (R)	Fan advice	Digital
dF1-2	Defrosting error	Automatic	-	-	-	-	-	-	ON	40 (R)	General warning	Digital
d1-2	Defrost on circuit in question	-	-	-	-	-	-	-	-	-	Signal on display	-
A1	Frost alarm circ. 1	Depends on P05	OFF C1-2	-	OFF 1	-	-	ON	-	31 (R)	Circuit 1 alarm	Digital
A2	Frost alarm circ. 2	Depends on P05	OFF C3-4	-	OFF 2	-	-	ON	-	32 (R)	Circuit 2 alarm	Digital
Ht	High temperature	Automatic	-	-	-	-	-	ON*	ON	41 (R)	Temperature advice	Digital
Lt	Low ambient temp.	Depends on P05	-	-	-	-	-	ON*	ON	41 (R)	Temperature advice	Digital
AHt	High temperature at the start-up	Automatic	OFF	-	OFF	OFF	-	-	ON	40 (R)	General warning	Digital
ALt	Low temperature at the start-up	Automatic	OFF	-	OFF	OFF	-	-	ON	40 (R)	General warning	Digital
ELS	Low supply voltage	Automatic	-	-	-	-	-	-	ON	40 (R)	General warning	Digital
EHS	High supply voltage	Automatic	OFF	OFF	OFF	OFF	OFF	OFF	OFF	35 (R)	General alarm	Digital
Ed1	EVD 1 tLAN error	Automatic	OFF C1-2	-	OFF	-	-	ON	-	33 (R)	EVD 1 warning	Digital
Ed2	EVD 2 tLAN error	Automatic	OFF C3-4	-	OFF	-	-	ON	-	34 (R)	EVD 2 warning	Digital
SH1	EVD 1 superheat alarm	-	OFF C1-2	-	OFF-	-	-	ON	-	33 (R)	EVD 1 warning	Digital
SH2	EVD 2 superheat alarm	-	OFF C3-4	-	OFF-	-	-	ON	-	34 (R)	EVD 2 warning	Digital
nO1	MOP 1 warning	Automatic	-	-	-	-	-	-	ON	38 (R)	EVD 1 advice	Digital
nO2	MOP 2 warning	Automatic	-	-	-	-	-	-	ON	39 (R)	EVD 2 advice	Digital
LO1	LOP 1 warning	Automatic	-	-	-	-	-	-	ON	38 (R)	EVD 1 advice	Digital
LO2	LOP 1 warning	Automatic	-	-	-	-	-	-	ON	39 (R)	EVD 2 advice	Digital
HA1	High inlet temperature warning circ.1	Automatic	-	-	-	-	-	-	ON	38 (R)	EVD 1 advice	Digital
HA2	High inlet temperature warning circ. 2	Automatic	-	-	-	-	-	-	ON	39 (R)	EVD 2 advice	Digital
EP1	EVD 1 Eeprom error	Automatic	OFF C1-2	-	OFF-	-	-	ON	-	33 (R)	EVD 1 warning	Digital
EP2	EVD 2 Eeprom error	Automatic	OFF C3-4	-	OFF-	-	-	ON	-	34 (R)	EVD 2 warning	Digital
ES1	EVD 1 probe error	Automatic	OFF C1-2	-	OFF-	-	-	ON	-	33 (R)	EVD 1 warning	Digital
ES2	EVD 2 probe error	Automatic	OFF C3-4	-	OFF-	-	-	ON	-	34 (R)	EVD 2 warning	Digital
EU1	Open valve EVD 1 error at the start-up	Automatic	OFF C1-2	-	OFF	-	-	ON	-	33 (R)	EVD 1 warning	Digital
EU2	Open valve EVD 2 error at the start-up	Automatic	OFF C3-4	-	OFF	-	-	ON	-	34 (R)	EVD 2 warning	Digital
Eb1	EVD 1 battery alarm	Automatic	OFF C1-2	-	OFF	-	-	ON	-	33 (R)	EVD 1 warning	Digital
Eb2	EVD 2 battery alarm	Automatic	OFF C3-4	-	OFF	-	-	ON	-	34 (R)	EVD 2 warning	Digital
L	Low load warning	Automatic	-	-	-	-	-	-	-	-	Signal on display	-
Ed1	tlan EVD 1 communication error	Automatic	OFF C1-2	-	OFF	-	-	ON	-	33 (R)	EVD 1 warning	Digital
Ed2	tlan EVD 2 communication error	Automatic	OFF C3-4	-	OFF	-	-	ON	-	34 (R)	EVD 2 warning	Digital
PH1	Low pressure circ. 1 warning	-	-	-	-	-	-	-	-	-	Signal on display	-
PH2	Low pressure circ. 2 warning	-	-	-	-	-	-	-	-	-	Signal on display	-

Table 6.a

 **Note:** The warning relay differs from the alarm relay as it is only activated for warnings, that is, signals only, which have no direct effect on the operation of the unit, and the display does not show the alarm symbol (bell).

### Compressor

**N.B.** The alarm relating to the circuit with the fault must not interact with the operation of the other circuit, as long as the condenser is not shared in common.

**HP1: High pressure circuit 1**

The alarm is detected irrespective of the status of the pump and the compressors. The compressors corresponding to circuit 1 are immediately stopped (ignoring the set protection times), the buzzer and alarm relay are activated, and the display starts flashing.

The fans corresponding to the condenser in circuit 1 are activated at maximum speed for 60 s, so as to oppose the alarm situation, after which they are switched OFF. This alarm may also be generated when the high pressure limit is exceeded (valid only when the pressure transducer is fitted) set by the parameter P18, which to be enabled must be greater than 3.0 bars, due to the corresponding hysteresis.

**HP2: High pressure circuit 2**

As for HP1 but relating to circuit 2.

**LP1: Low pressure circuit 1**

The alarm depends on P15, P7 and P3.

**P15= 0, P07= 0:** the alarm is detected only if the compressors in circuit 1 are ON, and after the time P03 from when the compressors started, otherwise it is immediate.

**P15= 1, P07= 0:** the alarm is detected even if the compressors in circuit 1 are off, after the time P03.

**P15= 0, P07= 1:** the alarm is detected only if the compressors in circuit 1 are ON, and after the time P03 from when the compressors started, otherwise it is immediate, and if in heat pump mode, is activated for pressure values less than 1 bar.

**P15= 1, P07= 1:** the alarm is detected also if the compressors in circuit 1 are Off, after the time P03, and if in heat pump mode, is activated for pressure values lower than 1 bar. The hysteresis for this alarm is 1 bar.

**LP2: Low pressure circuit 2**

As for LP1 but relating to circuit 2.

**PH1: Compressor part load circuit 1**

Indicates the part load of circuit 1 due to high pressure. This situation is signalled by the message "PH1" on the display the activation of the warning relay.

**PH2: Compressor part load circuit 2**

As for PH1, but for circuit 2.

**tP: General thermal overload**

The alarm is detected irrespective of the status of the pump and the compressors. The compressors, the pumps and fans stop (without observing the protection times) or are inhibited from starting, the alarm relay is activated, the display flashes the corresponding message, and the LED flashes. It can be reset either manually or automatically (see par. P08, P09, P10, P11, P12, P13).

**tC1: Thermal overload circuit 1**

As for tP but relating to circuit 1

**tC2: Thermal overload circuit 2**

As for tC1 but relating to circuit 2.

**LA: generic warning**

This represents a generic warning that appears on the display, from digital input, without modifying the operation of the unit. With the 1st circuit module only, the alarm relay is activated, while with the expansion card the warning relay can be used.

**FL: flow alarm**

This alarm is detected only if the pump is ON (excluding the delays when starting P01 and in steady operation P02), irrespective of the status of the compressor. All of the outputs are disabled: pump, compressor (without observing the OFF times), condenser fan, and the buzzer sounds, the alarm relay is activated and the display flashes.

The presence of the utility water pump must be enabled (H5≠0). It can be reset either manually or automatically (see P08, P09, P10, P11, P12, P13).

**FLb: Backup pump warning**

The warning activates the warning relay and displays the message "FLb"; reset is manual. This indicates the operation of the backup pump (if present) due to a probable fault on the main pump, suggesting that maintenance is required. If the flow alarm features automatic reset, the controller will make 10 attempts to re-start the pumps, after which the FL alarm will replace FLb. If the flow alarm features manual reset, when first activated the controller will display the alarm FLb, switching over the pumps; when activated again the FL alarm will replace FLb.

**E1 to E8: probe error detected even when the unit is in Standby**

The presence of a probe alarm causes the deactivation of the compressor, the condenser fans, the pump (outlet fan in AIR/AIR units) and the heaters (so as to avoid fires in the air/air units); the buzzer and alarm relay are activated, and the display starts flashing.

If the probe has a compensation function, the unit will continue to operate correctly, with the exception of the corresponding function, and the warning relay will be activated and a message shown on the display, from E1 to E8 for probes from B1 to B8.

**Hc1 to Hc4: compressor operating hour limit exceeded warning**

When the number of operating hours for the compressor exceeds the maintenance threshold (as default equal to zero, and consequently the function is disabled), the maintenance request signal is activated. The buzzer and the alarm relay are not activated, however the warning relay is activated (with the expansion card fitted).

**Epr, EPb: EEPROM error**

A problem has occurred when saving the parameters to the unit's non-volatile memory (EEPROM); in the event of an Epr error, the  $\mu C^2$  continues to perform the control functions with the data present in the volatile memory (RAM), where there is a physical copy of all of the data. After the first power failure the configuration will be lost.

The buzzer and the alarm relay are not activated. If it occurs when starting the unit, "EPb", the controller will not operate.

**ESP: communication error with expansion card**

If the controller loses communication with the expansion card, the entire system will be stopped to avoid adversely affecting the unit. The alarm relay is activated and the display will show the message, with the red LED on steady.

**EL1-2: warning, zero crossing error circuit 1-2**

If the controller detects errors in the power supply, control may be lost over the fan speed. In this case, the display will show a warning, and the fans will be controlled at maximum speed. The alarm is reset automatically, so as to not affect the operation of the unit. If the expansion card is used, the warning relay is activate)

**dF1-2: warning, end defrost circuit 1-2 due to maximum time**

If the defrost ends after the maximum time when end defrost by temperature or from external contact has been selected, the unit displays the text dF1 for circuit 1 or dF2 for circuit 2. The message is cancelled using the delete alarm procedure or when the next correct defrost cycle is completed. The buzzer and the alarm relay are not activated. If the expansion card is used, the warning relay is activated (if used).

**A1: antifreeze alarm circuit 1**

The alarm is only detected in water chillers (H01= 2, 3, 4, 5 or 6) by the evaporator water outlet probe (B2/B6). The compressors in circuit 1 and the condenser fans in circuit 1 are immediately stopped, the buzzer and alarm relay are activated, and the display starts flashing. If the  $\mu C^2$  is in Standby, the alarm condition is not detected, and only the heaters are managed. Reset depends on parameter P5:

1. in the event of automatic reset, the unit restarts automatically if the temperature is above the value A01 + A02.
  2. in the event of manual reset, the unit can restart manually even if the alarm is active.
- After the time A03, if the alarm persists the unit will stop again.

**A2: antifreeze alarm circuit 2**

As for A1 but relating to circuit 2

**Ht: high temperature warning**

This alarm is activated when the threshold is exceeded (read by B1), set for the parameter P16. It is delayed at power ON by the parameter P17 and causes the activation of the alarm relay and the buzzer, without deactivating the outputs. It is reset automatically when conditions that caused the alarm are no longer present.

**Lt: low temperature warning**

For direct expansion units (H01=0, 1) the alarm is used to measure a low room temperature using probe B1 or B2 (depending on par. A06).

The alarm may be reset manually or automatically, and depends on the parameter P05. If the expansion is present, the corresponding relay is activated; in the event of  $\mu C^2$  module only, the alarm relay will be used.

**AHT: high temperature warning when starting the system**

The advice does not activate the relay, and displays the message "AHT".

**ALT: low temperature warning when starting the system**

The advice does not activate the relay, and displays the message "ALT".

**ELS/EHS: warning, low/high power supply alarm**

If the power supply voltage is too low or too high, the corresponding message is displayed. In these cases, the correct operation of the  $\mu C^2$  is no longer guaranteed. In the low voltage conditions only the requests to deactivate the loads are effected. Any start-up requests remain pending. The high voltage condition involves the deactivation of all the energised relays.

**L: Low load warning**

The warning does not activate the relay and displays the message " L "; reset is automatic.

**D1: defrost signal circuit 1**

When the defrost is on circuit 1, the display shows the message D1.

**D2: defrost signal circuit 2**

When the defrost is on circuit 2, the display shows the message D2.

**Driver**

All the driver alarms on the  $\mu C^2$  that stop the unit feature automatic reset. Consequently, the possibility to select the automatic resetting of the entire system must be selected for the drivers by setting the corresponding parameters. The  $\mu C^2$  can send the Go Ahead command according to the normal procedure for resetting the alarms from the keypad.

**Ed1: tLan communication error with Driver 1**

The alarm is generated after a fixed time (5 s) from when the  $\mu C^2$  loses contact with Driver 1. In this case, circuit 1 is disabled for safety reasons.

**Ed2: tLan communication error with Driver 2 (expansion card)**

As for Ed1, but relating to driver 2.

**SH1: low superheat alarm circuit 1**

The low superheat alarm for circuit 1, after a fixed time (5 s), inhibits the circuit 1 for safety reasons. The risk is that the compressors will flood.

**SH2: low superheat alarm circuit 2**

As for SH1, but relating to driver 2

**nO1: MOP warning (maximum operating pressure) circuit 1**

The warning appears on the display and, if the expansion card is fitted, the corresponding relay is activated.

**nO2: MOP warning (maximum operating pressure) circuit 2**

The warning appears on the display and, if the expansion card is fitted, the corresponding relay is activated.

**LO1: LOP warning (lowest operating pressure) circuit**

The warning appears on the display and, if the expansion card is fitted, the corresponding relay is activated.

**LO2: LOP warning (lowest operating pressure) circuit 2**

As for LO1, but relating to driver 2

**HA1: high evaporator temperature warning circuit 1**

The warning appears on the display and, if the expansion card is fitted, the corresponding relay is activated.

**HA2: high evaporator temperature warning circuit 2**

As for HA1, but relating to driver 2.

**EP1: EEPROM error driver 1**

The circuit 1 is disabled for safety reasons, as the status of Driver 1 is not known.

**EP2: EEPROM error driver 2**

As for EP1, but relating to driver 2.

**ES1: probe error driver 1**

The circuit 1 is disabled for safety reasons, as the status of Driver 1 is not known.

**ES2: probe error driver 2**

As for ES1, but relating to driver 2.

**EU1: EVD 1 error, valve open when starting**

If when starting the system the Driver detects that the valve is still open, an alarm is sent to the  $\mu C^2$  that stops the compressors and the fans in the corresponding circuit.

**EU2: EVD 2 error, valve open when starting**

As for EU1, but relating to EVD 2.

**Eb1: EVD 1 battery alarm**

The EVD 1 battery alarm stops the compressors from starting so as to prevent the risk of liquid returning to circuit 1, and disables the corresponding fans.

**Eb2: EVD 2 battery alarm**

The EVD 2 battery alarm stops the compressors from starting so as to avoid the risk of liquid returning to circuit 2, and disables the corresponding fans.

# 7. CONNECTIONS, ACCESSORIES AND OPTIONS

## 7.1 Connection diagram

The following figure shows the connection diagram for the  $\mu C^2$ , in the panel and DIN rail versions.

### Panel version

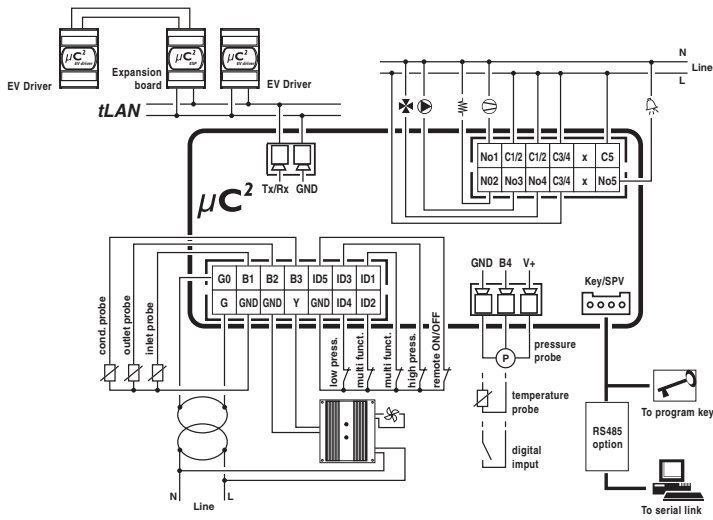


Fig. 7.a

### DIN rail version

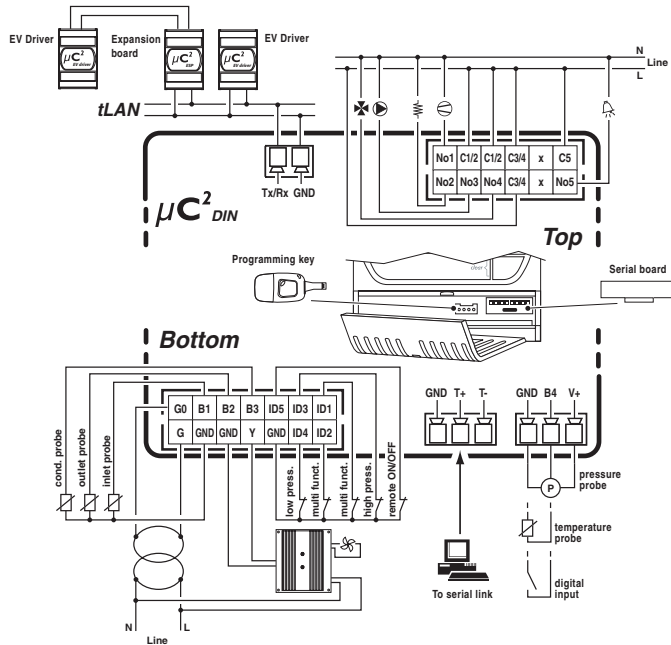


Fig. 7.b

### I/O layout

$\mu C^2$	Description	Expansion	Description
B1	Control probe (Evaporator inlet/ambient)	B5	Output probe in common with 2 evaporators (only with 2 circuits)
B2	Protection probe (evaporator outlet/outlet)	B6	Circuit 2 protection probe (2 <sup>nd</sup> evaporator output)
B3	Condenser/outside temperature probe	B7	2 <sup>nd</sup> condenser temperature probe
B4 (universal)	Condenser pressure probe	B8 (universal)	2 <sup>nd</sup> condenser pressure probe
ID1*	Flow switch – thermal overload circuit 1 – cooling/heating – end defrost circuit 1 – step 1 condensing unit – second set point	ID6**	Flow switch – thermal overload circuit 2 – end defrost circuit 2 – step 4 condensing unit – second set point
ID2*	Flow switch – thermal overload 1 circuit – cooling/heating – end defrost circuit 1 – step 2 condensing unit – second set point	ID7**	Flow switch – thermal overload circuit 2 – end defrost circuit 2 – step 4 condensing unit – second set point
ID3	High pressure circuit 1	ID8	High pressure circuit 2
ID4	Low pressure circuit 1	ID9	Low pressure circuit 2
ID5	Remote ON/OFF – reverse cycle condensing unit if reversible	ID10	
Y1	Ramp circuit 1 (condenser)	Y2	Ramp circuit 2 (condenser)
C1/2-NO1	Compressor 1	C6/7-NO6	Compressor 3 (1 in 2 <sup>nd</sup> circuit)
C1/2-NO2	Heater or reversing valve in 1st circuit	C6/7-NO7	Heater or reversing valve in 2 <sup>nd</sup> circuit
C3/4-NO3	Fan 1/evaporator pump	C8/9-NO8	Fan 2/condenser pump/backup
C3/4-NO4	Compressor 2 (capacity-control compressor 1)	C8/9-NO9	Compressor 4 (capacity-control compressor 2) or reversing valve circuit 1 or reversing valve circuit 2
C5-NO5	Alarm or reversing valve	C10-NO10	Warning or reversing valve circuit 2

\*= Any of the options for P08 can be selected (see Table 5.11)

\*\*= Any of the options for P08 can be selected, except for E/I and E/I delay.

Table 7.a

### 7.2 Expansion card

This device allows the  $\mu C^2$  to manage the second refrigerant circuit on chillers, heat pumps and condensing units with up to 4 hermetic compressors.

The following figure shows the connection diagram for the  $\mu C^2$  expansion card, code MCH200002\*.

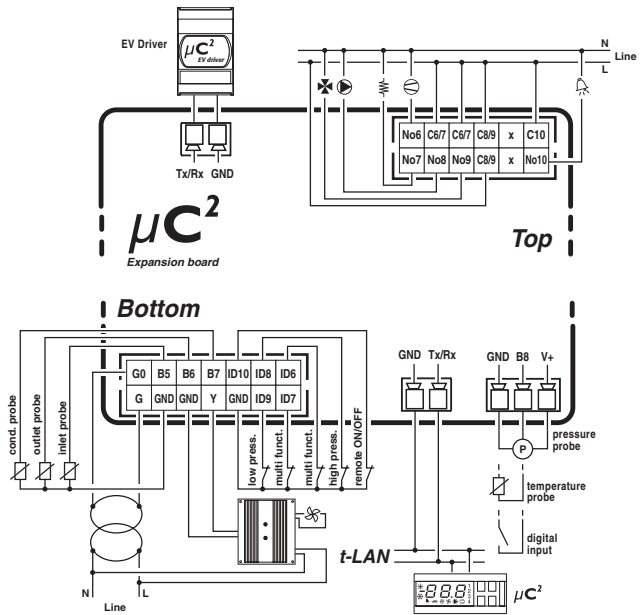


Fig. 7.c

NOTE: The expansion features two LEDs on the main board (to see these, remove the top or bottom door), which display its status by the following messages:

	ON	Flashing
green LED	Board powered	Board powered and serial communication with $\mu C^2$ in progress
red LED		1 flash: Probe fault alarm
		2 flashes: Zero crossing alarm (mains frequency not detected)
		3 flashes: Serial communication alarm with EVD
		4 flashes: Serial communication alarm with $\mu C^2$

Table 7.b

The alarms are displayed in sequence and are separated from each other by pauses.

### 7.3 EVD4\*: Electronic expansion valve driver

This device is used to control electronic expansion valves. The device is connected to the  $\mu C^2$  via a tLAN serial line. The condensing pressure probe must be connected to the  $\mu C^2$ , which then sends the reading to the driver.

Note: for all other information on the connections, refer to the EVD4\* driver manual

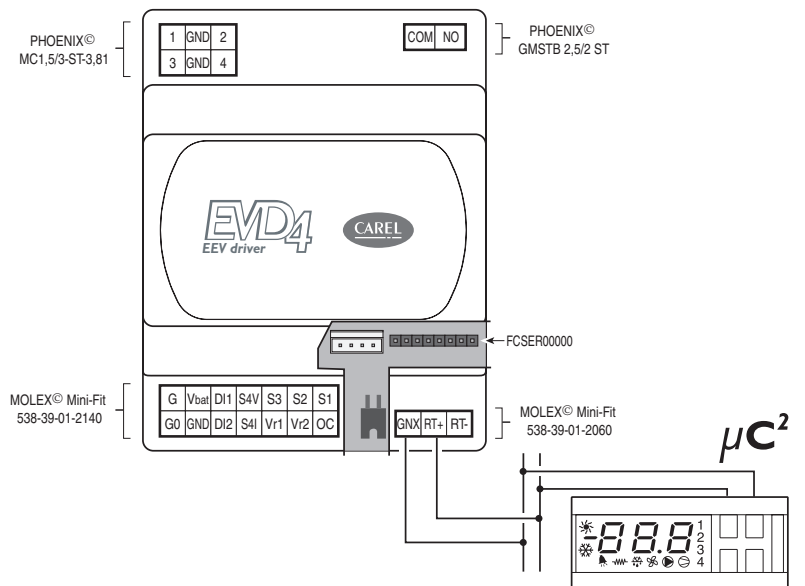


Fig. 7.d

## 7.4 Fan speed control board (code MCHRTF\*)

The phase cutting boards (code MCHRTF\*\*\*\*) are used to control the speed of the condenser fans.

**IMPORTANT:** The power supply to the  $\mu C^2$  (G and G0) and the MCHRTF\*\*\*\* board must be in one phase. If, for example, the power supply to the  $\mu C^2$  system is three-phase, make sure that the primary of the transformer supplying the  $\mu C^2$  board is connected to the same phase that is connected to terminals N and L on the speed control board; therefore, do not use 380 Vac/24 Vac transformers to supply the controller if the phase and neutral are used to directly power the speed control boards.

Connect the earth terminal (where envisaged) to the earth in the electrical panel.

### Key:

1. to  $\mu$ chiller;
2. earth;
3. to motor.

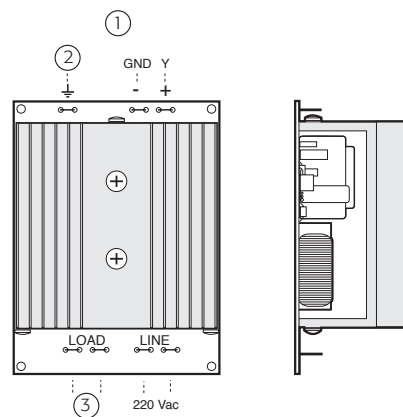


Fig. 7e

## 7.5 Fan ON/OFF control board (code CONVONOFF0)

The relay boards (code CONVONOFF0) are used for the ON/OFF management of the condenser fans. The control relay has a switchable power rating of 10 A at 250 Vac in AC1 (1/3 HP inductive).

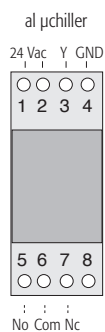


Fig. 7f

## 7.6 PWM to 0 to 10Vdc (or 4 to 20 mA) conversion board for fans (code CONVO/10A0)

The CONVO/10A0 boards convert the PWM signal at terminal Y on the  $\mu C^2$  to a standard 0 to 10 Vdc (or 4 to 20 mA) signal. The FCS series three-phase controllers can be connected to the  $\mu C^2$  without using this module.

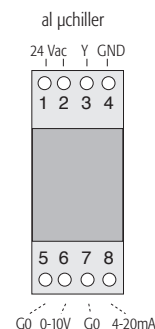


Fig. 7g

## 7.7 Minimum and maximum fan speed calculation

This procedure should only be performed when the fan speed control boards are used (code MCHRTF\*0\*0).

It must be stressed that if the ON/OFF modules (code CONVONOFF0) or alternatively the PWM to 0 to 10 V converters (code CONVO/10A0) are used, parameter F03 should be set to zero, and parameter F04 to the maximum value.

Given the different types of motors existing on the market, the user must be able to set the voltages supplied by the electronic board corresponding to the minimum and maximum speeds. In this regard (and if the default values are not suitable), proceed as follows:

- set parameter F02= 0 (fans always ON) and set F03 and F04 to zero;
- increase F04 until the fan operates at a sufficient speed (make sure that, after having stopped it, it continues to turn if left free);
- "copy" this value to parameter F03; this sets the voltage for the minimum speed;
- connect a voltmeter (set for AC, 250V) between the two "L" terminals (the two external contacts);
- increase F04 until the voltage stabilises at around 2 Vac (inductive motors) or 1.6, 1.7 Vac (capacitive motors). Once the value has been found, it will be evident that even when increasing F04 the voltage no longer decreases. In any case do not increase F04 further so as to avoid damaging the motor;
- F02= 3.

The operation is now completed.

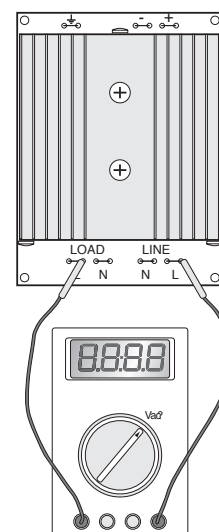


Fig. 7h





Fig. 7i



Fig. 7j

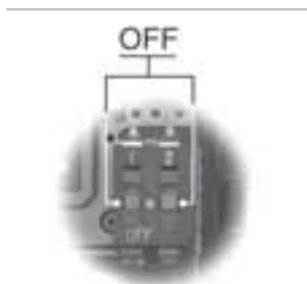


Fig. 7.k.a

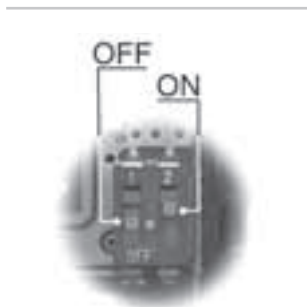


Fig. 7.k.b

## 7.8 Programming key (code PSOPZKEYA0)

The programming keys PSOPZKEY00 and PSOPZKEYA0 for CAREL controllers are used for copying the complete set parameters for  $\mu C^2$ .

The keys must be connected to the connector (4 pin AMP) fitted on the controllers, and can work with the instruments ON or OFF, as indicated in the operating instructions for the specific controller.

The two main functions (upload/download) that can be selected through two dip-switches (which are placed under the battery cover). They are:

- Loading to the key the parameters of a controller (UPLOAD);
- Copying from the key to one or more controllers (DOWNLOAD).

**Warning:** the copying of the parameters is allowed only between instruments with the same code. Data loading operation to the key is always allowed. To make identification of the key easier CAREL has inserted a label on which you can describe the loaded programming or the machine to which you are referring.

**IMPORTANT NOTE:** the key can be used only with controllers  $\mu C^2$  that have the same Firmware version.

### UPLOAD - copying the parameters from an instrument to the key:

- open the rear hatch of the key and place the two dip-switches in the OFF position (see Fig. 7.k.a). Close the hatch;
- connect the key to the connector of the instrument;
- press the button on the key and keep it pressed, checking the LED signal sequence: at first it is red, after a few seconds it becomes green;
- if the sequence of signals is as indicated above, the copying operation has been completed correctly (green LED ON), the button can be released and the key disconnected from the instrument; in case of different signals: if the green LED doesn't turn on or if there are some flashes, there's a problem. Refer to the corresponding table for the meaning of the signals.

### DOWNLOAD - copying the parameters from the key to the instrument:

- open the rear hatch of the key and place the dip-switch n. 1 in the OFF position and the dip-switch n. 2 in the ON position (see Fig. 7.k.b). Close the hatch;
- connect the key to the connector of the instrument;
- press the button on the key and keep it pressed, checking the LED signal sequence: at first it is red, after a few seconds it becomes green;
- if the sequence of signals is as indicated above, the copying operation has been completed correctly (green LED ON), the button can be released; after a few seconds the LED turns off and the key can be disconnected from the instrument;
- in case of different signals: if the green LED doesn't turn on or if there are some flashes there's a problem. Refer to the corresponding table for the meaning of the signals.

The operation takes maximum 10 seconds to complete. If after this period the completed operation signal hasn't yet appeared, i.e. the green LED ON, try releasing and pressing the button again. In the event of flashes, refer to the corresponding table for the meaning of the signals.

LED signal	error	meaning and solution
red LED flashing	Flat batteries at the beginning of the copying	The batteries are flat, the copying cannot be carried out. Replace the battery (only on PSOPZKEY00).
green LED flashing	Flat batteries at the end of the copying (only on PSOPZKEY00)	The copying operation has been carried out correctly but at the end of the operation the voltage of the batteries is low. It is advisable to replace the batteries.
Alternate red/green LED flashing (orange signal)	Not compatible instrument	The setup of the parameters cannot be copied since the model of the connected parameters is not compatible. Such error happens only with the DOWNLOAD function, check the controller code and make the copy only on compatible codes.
red and green LEDs ON	Copying error	Error in the copied data. Repeat the operation; if the problem persists, check the batteries and the connections of the key.
red LED always ON	Data transmission error	The copying operation hasn't been completed because of serious data transmission or copying errors. Repeat the operation, if the problem persists, check the batteries and the connections of the key.
LEDs OFF	Batteries disconnected	Check the batteries (for the PSOPZKEY00)
	Power supply not connected	Check the power supply (for the PSOPZKEYA0)

Table 7.c

### Technical specifications

Power supply to the PSOPZKEY00	- Use three 1.5 V 190 mA batteries (Duracell D357H or equivalent) - Maximum current supplied 50 mA max.
Power supply to the PSOPZKEYA0	- switching power supply: Input 100 to 240 V ~; (-10%, +10%); 50/60 Hz; 90 mA. Output: 5 Vdc; 650 mA
Operating conditions	0T50°C r.H. <90% non-condensing
Storage conditions	-20T70°C r.H. <90% non-condensing
Case	Plastic, dimensions 42x105x18 mm including prod and connector Figs. 1 and 2

Table 7.d

(Here we have dealt only with the base functions of the instrument. For the remaining specific functions, see the manual of the instrument that is being used).



## 7.9 RS485 serial options

### RS485 serial option for $\mu C^2$ panel version (code MCH2004850)

The MCH2004850 serial option is used to connect the  $\mu C^2$  controller to a supervisor network via a standard RS485 serial line.

This option uses the input normally associated with the programming key, which has the dual function of key connector/serial communication port.



Fig. 7.l.a

### RS485 serial option for $\mu C^2$ DIN rail version (code FCSE00000)

The FCSE00000 serial option is used to connect the  $\mu C^2$  controller to a supervisor network via a standard RS485 serial line. To access the connector and insert the serial board, open the cover, as shown in Fig. 7.n.

Fig. 7.n.

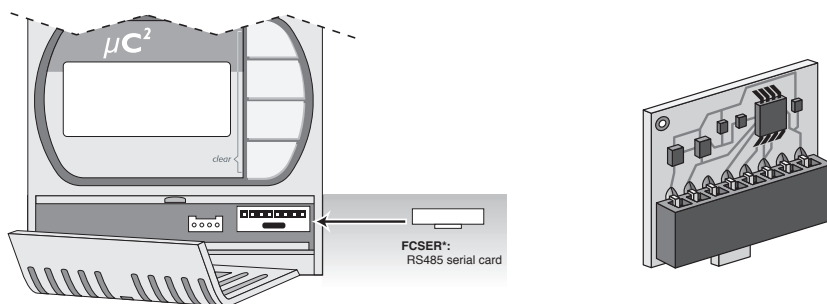


Fig. 7.l.b

## 7.10 Remote terminal for $\mu C^2$

The remote terminal for  $\mu C^2$  (MCH200TP\* panel version and MCH200TW\* wall-mounting version), is an electronic device that allows the remote control of an air-conditioning unit managed by the  $\mu C^2$ . The functions allowed are the same as those available on the display and the local keypad of the  $\mu C^2$ .

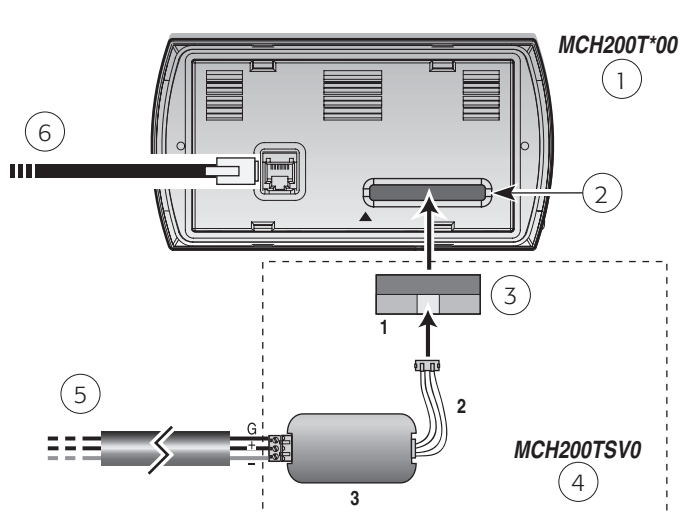


Fig. 7.m

### Key:

1. rear view;
2. 15-way pin strip;
3. adapter for pin strip;
4. optional;
5. RS485 serial line from the supervisor;
6. to the MCH2 through "RJ12 power supply".

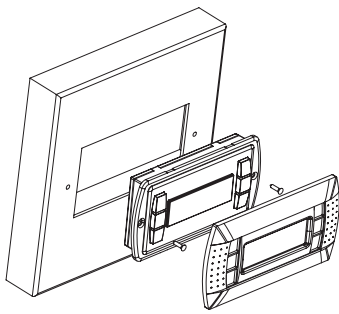


Fig. 7.n.a

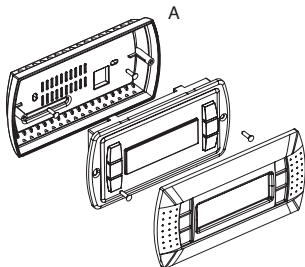


Fig. 7.n.b

**Panel installation (code MCH200TP00)**

This version has been designed for panel installation, with the drilling template measuring 127 x 69 mm with 2 circular holes, diameter 4 mm, as shown in Fig. 7.m. For installation proceed as follows (Fig. 7.n.a):

- connect the telephone cable;
- insert the terminal, without the front frame, in the opening, and use the countersunk screws to fasten the device to the panel;
- finally, apply the click-on frame.

**Wall-mounting (code MCH200TW00)**

The version of the terminal for wall-mounting requires the rear of the case A to be fastened (Fig. 7.n.b) using a standard 3-module switch box.

- fasten the rear of the case to the box using the round-head screws;
- connect the telephone cable;
- rest the front panel on the rear of the case and fasten the assembly using the countersunk screws, as shown in Fig. 7.n.b.;
- finally, apply the click-on frame.

**Electrical connections (Fig. 7.o.a-7.o.b)**

Connect the RS485 serial line leaving the power supply "RJ12 Power supply" to the supervisor input on the  $\mu C^2$ , using a twisted pair cable with shield. Power terminals G-G0 from a transformer with a 250 mA fuse, as shown in the diagram in Fig. 7.o.a-7.o.b. Make the connection between the power supply "RJ12 Power supply" and the terminal using the telephone cable (code S90CONN002 l = 80 cm) supplied. If the cable is not long enough, use a pin-to-pin telephone cable with a maximum length of 40 m.

**Warnings:**

- only use safety transformers;
- for safety reasons a 250 mA slow-blow fuse must be fitted in series with terminal 'G';
- if using the same transformer for the  $\mu C^2$  and the terminal, respect the polarity G-G0 as per the wiring diagram. Reversing the polarity is the same as short-circuiting the secondary of the transformer;
- do not earth the secondary of the transformer.

**24 Vac power supply line (G- G0)**

Typical length	Minimum cross-section
250 m	1,5 mm <sup>2</sup> (AWG16)
100 m	0,5 mm <sup>2</sup> (AWG20)
50 m	0,35 mm <sup>2</sup> (AWG22)

Table7.e

**RS485 serial line to  $\mu C^2$**

Speed	19200 baud
Maximum RS485 distance	1 Km (with 120 ohm terminals)
Cable characteristics	twisted pair + shield
Cross-section	AWG22
Capacitance per metre	< 90 pF/m (for example, BELDEN 8761-8762 cables)

Table7.f

**Key:**

1. alternative: MCH200001\*+FCSE0000 (see Fig. 7.o.b);
2. Insert 120 ohm terminal resistor between Tx/Rx+ and Tx/Rx- for lines longer than 20 m;
3. length max.= 1000 m;
4. RS485 twisted pair + shield Rx/Tx+, Rx/Tx-, GND;
5. fuse 250 mA;
6. 24 Vac 3 VA;
7. telephone cable;
8. length max.= 40 m;
9. RJ12 power supply.

**Connection diagram (local power supply)**

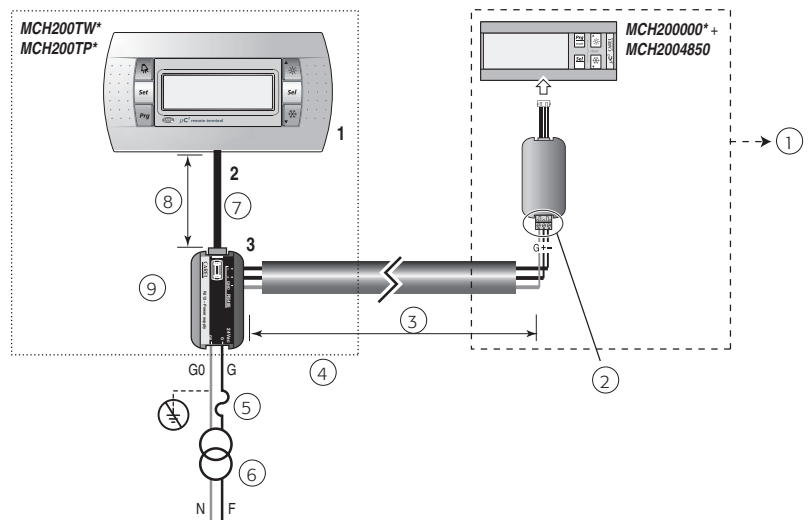


Fig. 7.o.a

## Connection diagram (remote power supply)

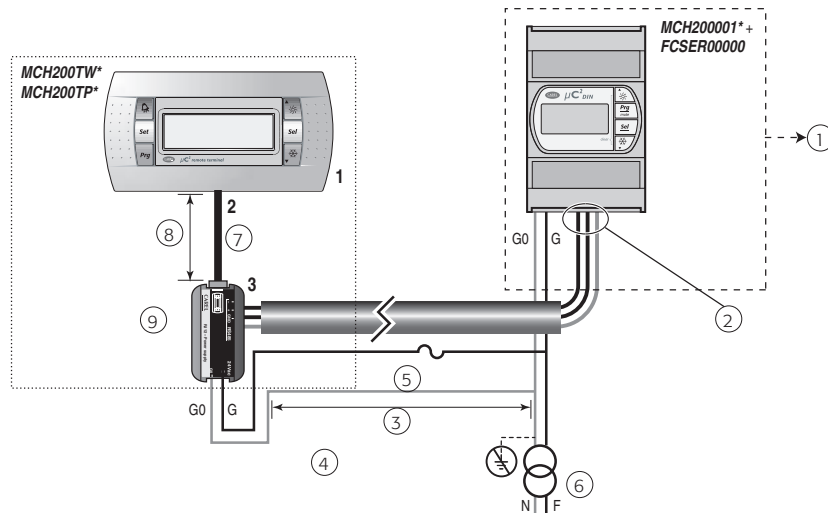


Fig. 7.o.b

### Key:

1. alternative: MCH200000\*+MCH2004850 (see Fig. 7.o.a);
2. Insert 120 ohm terminal resistor between Tx/Rx+ and Tx/Rx- for lines longer than 20 m;
3. length max.= 250 m (min. cross-sect. 1,5 mm<sup>2</sup>/AWG16);
4. RS485 twisted pair + shield Rx/Tx+, Rx/Tx-, GND;
5. fuse 250 mA;
6. 24 Vac 3 VA;
7. telephone cable;
8. length max.= 40 m;
9. RJ12 power supply.

### Installation

To install the remote terminal, no configuration is required on the  $\mu C^2$ , as the terminal works with any serial address set for parameter H10. Check, however, that the  $\mu C^2$  is fitted with the serial interface FCSE00000 (DIN rail version) or MCH2004850 (panel version). When first switched on the display will show the firmware version of the  $\mu C^2$  (Fig. 7.p.a).

After around 4 s the main screen will be displayed, with the symbols that represent the status of the  $\mu C^2$  (Fig. 7.p.b).

In the event where the RS485 connection is not performed correctly or the controller is off, the terminal will clear the display and show the message "OFFLINE" (Fig. 7.p.c).

### Info mode

Pressing the "Up" + "Down" + "Sel" buttons together for more than 6 seconds displays the "INFO" screen (Fig. 7.p.d) containing information on the  $\mu C^2$  system and on the communication. Pressing the "Prg" button returns to the main screen.

### Information displayed (Fig 7.q):

Display row	Meaning
1	Terminal firmware version
2	$\mu C^2$ firmware version
3	Supervisor address of the $\mu C^2$
4	Percentage error rate in the communic. between the term. and $\mu C^2$

Tab 7g

If the RS485 supervisor line is connected via the MCH200TSV0 adapter and the supervisor is active, the "SPUL TX RX" icon is displayed at the top right; the two circles to the right of the Rx, Tx fields indicate respectively the request messages sent by the supervisor to the  $\mu C^2$  with address H10 (Rx) and the response from the  $\mu C^2$  (Tx): empty circle = no data sent (data unchanged), full circle = data sent.

### Connection to the supervisor network (MCH200TSV0)

To connect the  $\mu C^2$  to the remote terminal MC2000TX00 while still maintaining the possibility to connect to the supervisor network, the serial adapter (optional) MCH200TSV0 must be used, as shown in Fig. 7.m.

Disconnect the telephone connector, open the cover on the 15-way pin strip using a small pair of wire cutters, and insert the adapter (pin-strip to 4-pin plug), in the direction shown in Fig. 7.m (pin 1 on the left from the side of the triangle). Connect the RS485 network to the converter and set the parameter H10 (serial address) of the  $\mu C^2$  to the desired value.



Fig. 7.p.a



Fig. 7.p.b



Fig. 7.p.c

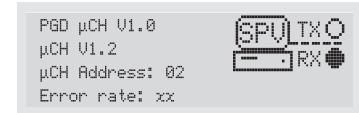


Fig. 7.p.d

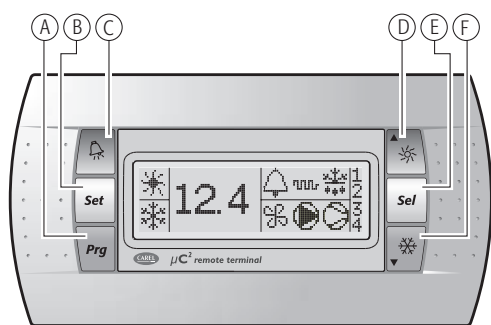


Fig. 7.q

User interface

symbol	ON	meaning	flashing	refrigerant circuit involved
1,2	Compressor 1 and/or 2 ON		Start request	1
3,4	Compressor 3 and/or 4 ON		Start request	2
☉	At least one compressor ON			1 e/o 2
▶	Pump/air outlet fan ON		Start request	1 e/o 2
✂	Condenser fan ON			1 e/o 2
❄	Defrost active		Defrost request	1 e/o 2
🔥	Heater ON		Start request	1 e/o 2
Alarm button Red	Alarm active		1 e/o 2	
LED	Alarm active		EEPROM alarm	1 e/o 2
🔔	Warning relay activated (only with expansion board)			
🔔	Alarm relay activated			
❄	Heat pump mode (P6=0)		Season changeover request	1 e 2
❄	Chiller mode (P6=0)		Season changeover request	

Table7.h

Functions associated with the buttons

button	unit status	button operation
C	Switch off buzzer or alarm relay, if alarm active	Press once
	Manual reset of alarms that are no longer active	Press for 5 s
B	Enter parameter programming mode after entering password	Press once
A	Return to higher subgroup inside the programming environment until exiting, saving to EEPROM	Press once
D	Select higher item inside the programming environment	Press once or hold
	Increase value	
E	Switch from standby to chiller mode (P6= 0) and vice-versa	Press for 5 s
	Access direct parameters: selection (as for button on μC²)	Press once
Select item inside the programming environment and display direct parameter values/confirm the changes to the parameter		
F	Select lower item inside the programming environment	Press once or hold
	Decrease value	
	Switch from standby to heat pump mode (P6= 0) and vice-versa	Press for 5 s
D+F	Immediately reset the hour counter (inside the programming environment)	Press for 5 s
E+D	Start manual defrost on both circuits	Press for 5 s
D+F+E	Display the terminal Info screen	Press for 5 s

Table7.i

Technical specifications of the display

Type	graphic FSTN
Backlighting	green LED
Graphic resolution	120 x 32
Size of active area	71.95 x 20.75
Size of display area	76 x 25.2
Power supply	From "RJ12 power supply"

Materials

Transparent front panel	Transparent PC
Grey case back piece	Charcoal PC+ABS (wall/built-in)
Keypad	Silicon rubber
Transparent glass/frame	Transparent PC

Table7.j

Technical specifications of the power supply "RJ12 Power supply"

Voltage	24 Vac +10/-15% class 2
Current input at 24 Vac	100 mA
Compulsory external fuse	250 mA T
Transformer	3 VA (safety)
Power supply terminals	removable screw, step 5 mm; wire cross-section 0.2 to 2.5 mm <sup>2</sup>
RS485 terminals	removable screw, step 3.5 mm; wire cross-section 0.2 to 2.5 mm <sup>2</sup>
Telephone connector	6-way RJ12
Index of protection	IP20
Self-extinguishing	cat. A/UL94 HB

Table7.k

General characteristics

Front panel index of protection	IP65 with panel mounting (MC200TP00), UL Type 1 IP40 with wall-mounting (MC200TW00), UL Type 1
Operating conditions	-20T60 °C, 90% r.H. non-condensing
Storage conditions	-20T70 °C, 90% r.H. non-condensing
Self-extinguishing	V0 on transparent front panel and rear of case according HB on silicon keypad and remaining parts
PTI of insulating material	250 V
Software class and structure	A
Environmental pollution	normal
Period of electrical stress	long
Classification according to protection against electric shock	to be integrated into class I or II devices
Category of immunity against voltage surges	category II

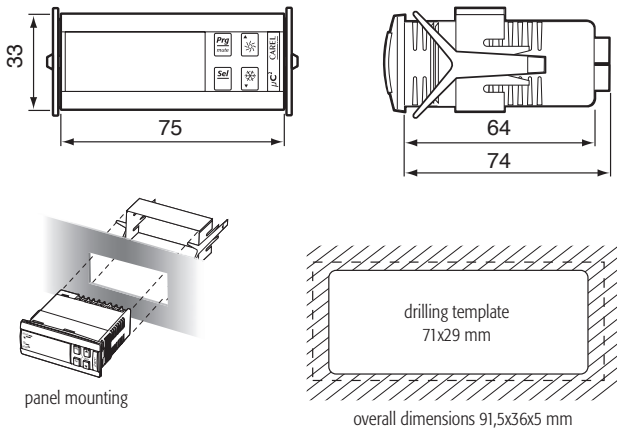
Table7.l

## 8. DIMENSIONS

The following are the mechanical dimensions of each component in the  $\mu C^2$  controller; all the values are expressed in millimetres.

**Note:** the dimensions include the free connectors inserted.

### MCH20000\* $\mu C^2$ panel mounting version



### MCH20001\* $\mu C^2$ din-rail mounting version

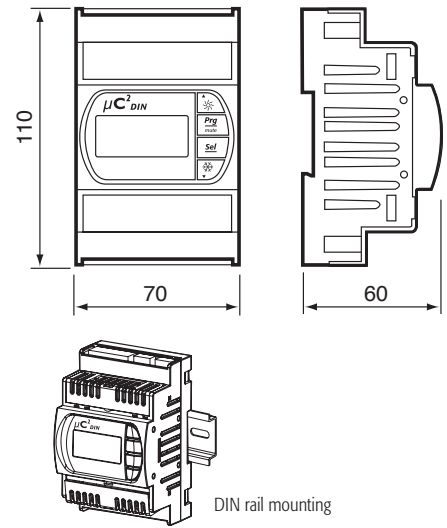
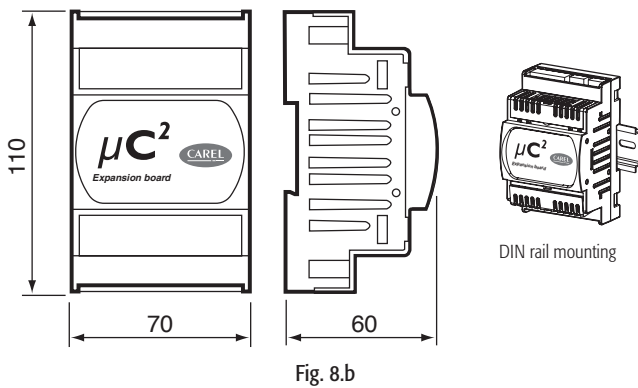
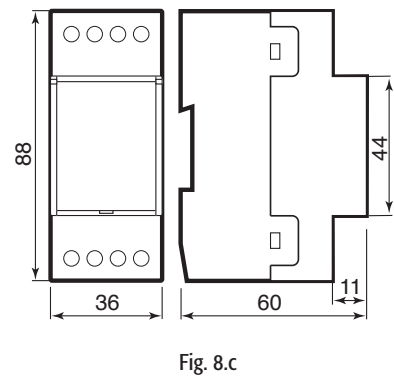


Fig. 8.a

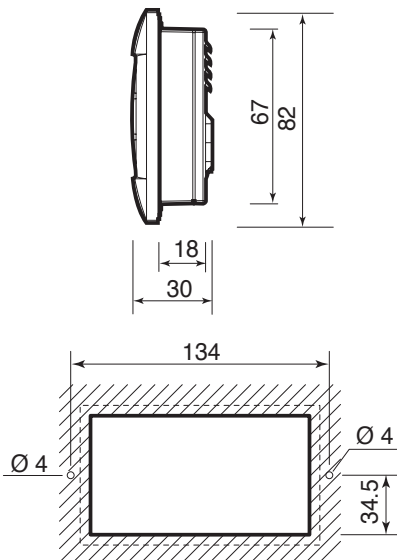
### Expansion board for $\mu C^2$



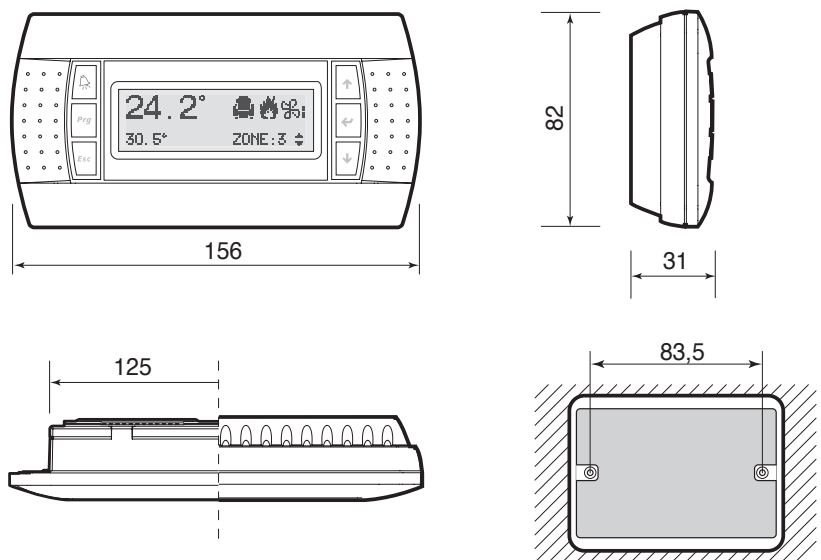
### CONVONOFF0 and CONV0/10 A modules



### MCH200TP\* panel mounting version



### MCH200TW\* wall version



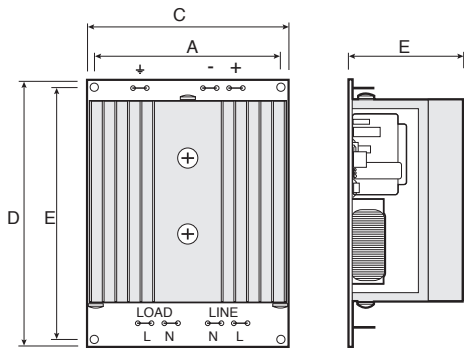


Fig. 8.e

**Condenser fan control modules**

The four holes for fastening the speed control board have a diameter of 4 mm, and the centre is positioned 3.5 mm from the edges of the board.

The boards are supplied with 4 fasteners (H015 mm).

code	A	B	C	D	E
MCHRTF20A0	43	100	50	107	32
MCHRTF40A0	43	100	50	107	46
MCHRTF60A0	75	100	82	107	46
MCHRTF80A0	75	100	82	107	64

RS485 serial card: codeMCH2004850

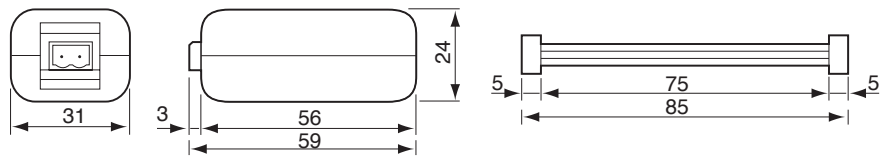


Fig. 8.f

## 9. CODES

Description	Code
μC <sup>2</sup> single circuit, 2 compressors, panel mounting	MCH2000000
μC <sup>2</sup> single circuit, 2 compressors, panel mounting (20 pcs. multiple package)	MCH2000001
μC <sup>2</sup> single circuit, 2 compressors, DIN rail version	MCH2000010
μC <sup>2</sup> single circuit, 2 compressors, DIN rail version (10 pcs. multiple package)	MCH2000011
μC <sup>2</sup> expansion board for 2nd. circuit maximum 4 compressors	MCH2000020
μC <sup>2</sup> expansion board for 2nd. circuit maximum 4 compressors (10 pcs. multiple package)	MCH2000021
RS485 optional board for μC <sup>2</sup> panel version	MCH2004850
RS485 optional board for μC <sup>2</sup> DIN rail version	FCSER00000
Programming key for μC <sup>2</sup>	PSOPZKEY00
ON/OFF fan card (only screw terminals)	CONVONOFF0
PWM-0 to 10 V fan card (only screw terminals)	CONVO/10A0
Fan card, faston terminals	MCHRTF*0A0
Fan card, screw terminals	MCHRTF*0B0
* depending on amperage (2= 2A, 4= 4A, 6= 6A, 8=8A)	
Temperature probes for regulation or condensation control	NTC***WP00
***depending on the length (015= 1.5 m, 030= 3 m, 060=6 m)	
Pressure probes for condensing pressure control	SPK*R*
** depending on the pressure (13= 150 PSI, 23= 75 PSI, 33= 500 PSI)	
Connectors kit for code MCH2000001 (multiple package 20 pcs)	MCH2CON001
Connectors kit for code MCH2000001 (multiple package 10 pcs)	MCH2CON011
Connectors kit for code MCH2000001 (multiple package 10 pcs)	MCH2CON021
Minifit connectors kit + 1-meter length for code MCH20000**	MCHSMLCAB0
Minifit connectors kit + 2-meter length for code MCH20000**	MCHSMLCAB2
Minifit connectors kit + 3-meter length for code MCH20000**	MCHSMLCAB3
Remote terminal for MCH20000** for panel installation MCH200TP0*	MCH200TP0*
Remote terminal for MCH20000** for wall-mounting MCH200TW0*	MCH200TW0*
Supervisor serial connection kit for remote terminal	MCH200TSV0

Table 9.a

# 10. TECHNICAL SPECIFICATIONS AND SOFTWARE UPDATES

## 10.1 Technical specifications

### Electrical specifications

In the following specifications "Group A" defines the grouping of the following outputs: valve, pump, compressor, heater.

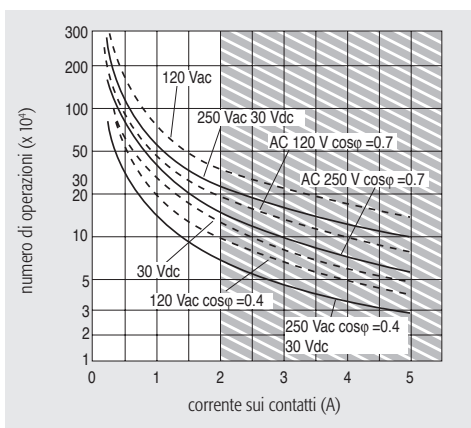


Fig. 10.a

Power supply	24 Vac, range +10/-15 %; 50/60 Hz Maximum power input: 3W Fuse (compulsory) in series with the power supply to the $\mu C$ : 315mA
12 pin connector	Max. current 2 A for each relay output, extendable to 3 A for one single output
Relays	Max current at 250 Vac: EN60730: resistive: 3A, Inductive: 2A $\cos\phi=0.4$ 60,000 cycles  UL: Resistive: 3A, 1 FLA, 6 LRA $\cos\phi=0.4$ 30,000 cycles For further information refer to the characteristics shown in Figure 10.a Minimum interval between communications (each relay): 12 s (the manufacturer of the unit that the device is integrated into must ensure the correct configuration so as to respond to this specification Type of microswitching: 1 C Insulation between relays in group A: functional Insulation between the relays in group A and the very low voltage parts: reinforced Insulation between relays in group A and the signal relays: primary Insulation between the signal relays and the very low voltage parts: reinforced Insulation between the relays and the front panel: reinforced
Digital inputs	Electrical standard: voltage-free contacts Closing current to earth: 5 mA Maximum closing resistance: 50 W
Analogue inputs	B1, B2, B3, B4: NTC CAREL temperature probes (10 kW at 25 °C) The response time depends on the component used, typical value 90 s B4: NTC temp. probes (10 kW at 25 °C) or CAREL 0 to 5 V ratiometric pressure probes SPKT00**R*
Fan output	Control signal for CAREL modules MCHRTF****, CONVONOFF* and CONVO/10A* Phase width modulation (settable width) or modulation of the duty cycle No-load voltage: 5V $\pm$ 10% Short-circuit current: 30 mA Minimum output load: 1 kW
Front panel index of protection	Panel mounting version IP55, DIN-rail version IP40
Storage conditions	-10T70 °C – humidity 80 % rH non-condensing
Operating conditions	-10T55 °C – humidity <90 % rH non-condensing
Degree of pollution	Normal
Cat. of resist. to heat and fire	D (RU94 V0)
PTI of the insulating materials	All the insulating materials have PTI $\geq$ 250 V
Software class and structure	A
Period of electric stress across insulating parts	Long
Homologations	CE/RU (File EI98839 sez.16)

Table 10.a

**Note:** all the relays must have the common terminals (C1/2, C3/4, C6/7, C8/9) connected together.

### Functional characteristics

Resolution of the analogue inputs	Temperature probes: range -40T80 °C, 0.1 °C
Temperature measurement error	Range -20T20 °C, $\pm 0.5$ °C (excluding probe) Range -40T80 °C, $\pm 1.5$ °C (excluding probe)
Pressure measurement error	The % error with a voltage reading with a range of input from 0.5 to 4.5 is $\pm 2\%$ (excluding probe). The error in the converted value may vary according to the settings of parameters /9, /10, /11, /12

Table 10.b

### Characteristics of the connectors

The connectors may be purchased using CAREL code (MCHCON0\*\*\*) or from the manufacturer Molex®

Molex® codes of the connector	Number of pins
39-01-2120	12
39-01-2140	14

Table 10.c

Max. number of insertion/removal cycles for the connectors: 25 cycles

Code of the contacts according to the cross-section of the connection cables to the 12- and 14-pin connectors (use the special Molex® tool code 69008-0724 for crimping)

Molex® code of the contact	Cross-section of cables allowed
39-00-0077	AWG16 (1,308 mm <sup>2</sup> )
39-00-0038	AWG18-24 (0,823...0,205 mm <sup>2</sup> )
39-00-0046	AWG22-28 (0,324...0,081 mm <sup>2</sup> )

Table 10.d

In addition, the pre-wired kits MCHMLC\*\*\* are also available



**⚠ WARNINGS**

- If one transform. is used to supply both the  $\mu$ C2 and the accessories, all the G0 terminals on the various controllers or the various boards must be connected to the same terminal on the secondary, and all the G terminals to the other terminal on the secondary, so as to avoid damaging the instrument;
- For use in residential environments, use shielded cable (2 wires + shield connected to heart both sides type AWG 20-22) for the tLAN connections (EN 55014-1);
- Avoid short-circuits between V+ and GND so as to not damage the instrument;
- Perform all the maintenance and installation operations when the unit is connected to the power supply;
- Separate the power cables (relay outputs) from the cables corresponding to the probes, digital inputs and serial line;
- Use a transformer dedicated exclusively to the electronic controllers for the power supply.

**Protection against electric shock and warnings for maintenance**

The system made up of a control board (MCH200000\*) and the other optional cards (MCH200002\*, MCH200485\*, MCHRTF\*\*\*\*, CONVONOFF\*, CONV0/10A\*, EVD000040\*) represents a control device to be integrated in class I or class II equipment.

The class of protection against electric shock depends on the method with which the control device is integrated into the unit made by the manufacturer.

Disconnect the power supply before working on the board for assembly, maintenance and replacement.

The protection against short-circuits, due to defective wiring, must be guaranteed by the manufacturer of the equipment that the control device is integrated into.

**Maximum cable lengths of the connection cables**

NTC/ratiometric probe connection cable	10 m
digital input connection cable	10 m
power output connection cable	5 m
fan control output connection cable	5 m
power cable	3 m

Tab. 10.e

**11.1 Software updates****11.1.1 Notes for version 1.5**

- improved B00 = 10
- optimized the management of partialization valve with semihermetic compressors.

**11.2 notes for version 1.6**

- added part load in high pressure, see parameter P04;
- added defrost option (start by pressure, end by temperature), see parameter D02=2;
- added preventive fan operation function for high condensing temperature, see parameter F14;
- added integrated Modbus protocol, see parameter H23;
- added direct correspondence between D.I. and compressor D.O. (for condensing units only), see parameter r05=3;
- Added alarm relay management, see parameter P21.

**11.3 Notes for version 1.7**

- refined auto-start function in antifreeze;
- optimised exchange of variables over the Modbus® protocol;
- improved set point compensation based on the outside temperature;
- added minimum pump operating time;
- optimised defrost with semi-hermetic compressors;





# CAREL

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**CAREL S.p.A.**

Via dell'Industria, 11 - 35020 Brugine - Padova (Italy)  
Tel. (+39) 049.9716611 - Fax (+39) 049.9716600  
e-mail: [carel@carel.com](mailto:carel@carel.com) - [www.carel.com](http://www.carel.com)

Agenzia / Agency: