User manual

LEGGI E CONSERVA QUESTE ISTRUZIONI

READ AND SAVE THESE INSTRUCTIONS

CAREL

Technology & Evolution

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

IMPORTANT WARNINGS

BEFORE INSTALLING OR HANDLING THE APPLIANCE PLEASE CAREFULLY READ AND FOLLOW THE INSTRUCTIONS DESCRIBED IN THIS MANUAL.

This instrument has been designed to operate without risks for the specific purpose, only if:
installation, operation and maintenance are performed according to the instructions in this manual;
the environmental conditions and supply voltage fall within the values indicated here below.

Any different use or changes that have not been previously authorised by the manufacturer, are considered improper.

Responsibility for injures or damage caused by improper use will lie exclusively with the user.
Warning: voltage is present in some electrical components of this unit, thus all the service or maintenance operations must be performed by expert and skilled personnel only, aware of the necessary precautions to be taken.

Before accessing the internal parts, disconnect the power supply.

<u>Disposal of the parts of the controller:</u>
The controller is made up of metal and plastic parts and a lithium battery. All these components must be disposed of according to the local legislation in force.

CONTENTS:

1. Introduction

The powercompact series for refrigeration is a complete range of products made up of integrated electronic microprocessor controllers with LED display, designed especially for the control of stand-alone refrigeration units: these controllers are especially suitable in applications that require high load switching power, a considerable number of outputs, functions and control with direct access from the keypad, high front panel IP and at the same time a compact shape that significantly reduces the overall dimensions.
The powercompact range is easy to install and ensures optimisation of production times for the manufacturer in mass production.
Numerous models are available, providing the best solution for each application at the most competitive price.

1.1 Models available

The controllers are available in the configuration with 2, 3, 4 and 5 relays, with one 2HP relay for the compressor and a switching power supply with an extended voltage input range (115/230Vac). The availability of the small version (see the section on the powercompact small connections) ensures considerable flexibility and consequently the possibility to use the controllers in many different applications, without the need to radically change the systems and designs.

1.2 Main characteristics of the powercompact range

Power supply
The models of the powercompact series are available with 115Vac, 115…230Vac (switching) or 230Vac power supply.
All the models, furthermore, feature a low power mode to increase immunity to voltage drops.
When the voltage inside the instrument falls below a certain threshold, the unit switches off the display so as to reduce power consumption, while still continuing to operate normally: the main relays remain energised and, as soon as the voltage returns to the normal level, the display comes on again.

Aesthetics and ergonomics
The appearance of the powercompact series has been designed so as to harmoniously match the new lines of the refrigeration units.
The feature that most stands out is its compactness: the dimensions are in fact 167x36x75.

LED display
powercompact is fitted with a very powerful and aesthetically pleasant display, with 3 digits and decimal point, minus sign and icons to simplify the reading of the values and the operating status.

Alarm buzzer
All models in the powercompact series are fitted with a buzzer to signal the alarms.

Remote control
To simplify the setting and display of the parameters, depending on the model the instrument can be fitted with an infrared receiver to allow the use of the new compact remote control: this device can be used on a series of powercompact controllers located in the same room, without problems of interference. In fact, each controller is identified by a different access code.

Duty setting
This function ensures the operation of the compressor even when the control probe (room probe) is faulty.
If the probe is disconnected or short-circuited, the compressor is operated at set intervals, with a running time (in minutes) equal to the value assigned to the **duty setting** parameter (parameter C4), and a fixed OFF time of 15 minutes.

Smart defrost
All the powercompact series controllers can, as standard, manage the defrost functions in the new modes (see the paragraph on smart defrosts).

Multifunction input
All the powercompact series instruments have two digital inputs that can be used in different modes, depending on the value set for the "digital input configuration" parameters (parameters A4 and A5). These inputs can be used to enable/disable the defrost, to manage serious alarms that require the immediate shut-down of the unit (e.g. high pressure) or delayed shut-down of the unit (e.g. low pressure), or alternatively can be configured to read NTC probes.

Multifunction output
All the powercompact family models (except for models PB00S0EA** and PB00F0EN**) have a fourth relay for sending a remote alarm signal to control auxiliary devices with On/Off operation.

RTC
The wide range of powercompact products also includes models fitted with built-in real time clock.

Pump down
This function ensures the compressor is stopped only when the evaporator is discharged (see the paragraph "Pump down and low pressure).

Condenser
One of the new characteristics offered by these controllers is the possibility to manage, via an NTC probe input, the condensing temperature for both the alarms and control functions, using the auxiliary output configured by parameter H1/H5.

Double evaporator
Two independent evaporators can be managed, connected to the same circuit. The end defrost temperature are independent and can be set by parameters dt1/dt2.

HACCP
This function, increasingly required in the refrigeration market, is included as standard on all models with clock.
This allows the monitoring of critical points by measuring and recording the temperatures in the event of high temperature alarms or power failures.

Light management
The powercompact range has been enhanced by the introduction of the function for managing the light when the door opens.
The controller recognises, according to the status of the light, if the application in question is a cold room or display case.

Keypad protection
The keypad and the remote control can be disabled to avoid tampering by unauthorized persons, above all in the event where the controller is installed in an area open to the public.

Continuous cycle
The "continuous cycle" function ensures the operation of the compressor for the time set by the corresponding parameter.
This function is useful when a rapid reduction in the temperature is required.

Serial connection
The entire range of powercompact models has an RS485 serial port for connection to supervisor or telemaintenance systems using a two wire plus shielded cable across a serial network.

Index of protection
In the powercompact series, the gasket inside the front panel and the material that the keypad is made from guarantee the controller an index of protection of IP65 on the front panel.

Installation
The powercompact series controllers are mounted using the screws at the front, or alternatively using two quick-fit side brackets, with compact dimensions, made from plastic.

In-circuit testing
The powercompact series controllers are made using the most advanced SMD technology. All the controllers undergo "IN-CIRCUIT TESTING" to check the electrical operation of all the components fitted. The tests are performed on 100% of the products.

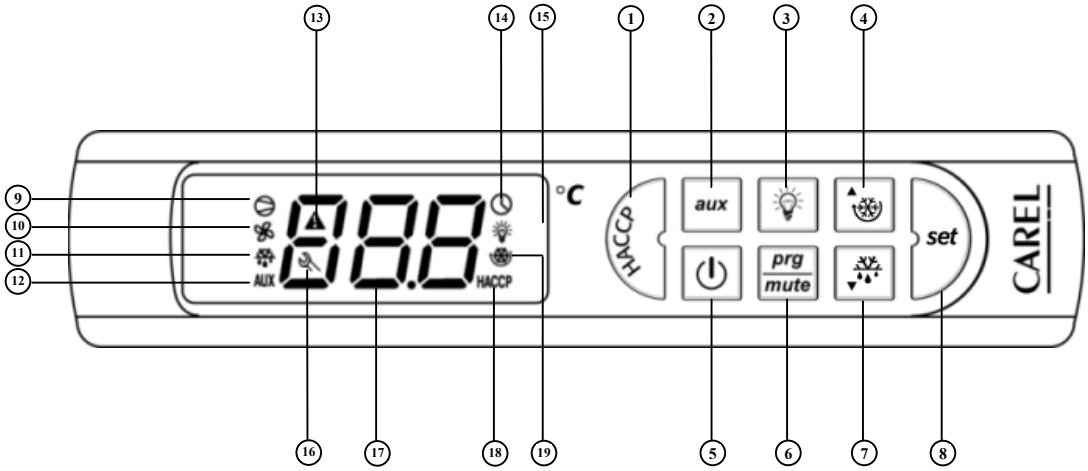
NTC probe
The powercompact series can manage, as standard, two types of NTC probes (see parameter "/P"): standard version –50°C / +90°C (NTC0*HP*) or alternatively the model for high temperatures, up to 150°C (enhanced NTC–40°C/+150°C).

Watch dog
This feature prevents the microprocessor from losing control over the unit even in the presence of considerable electromagnetic disturbance. In the event of abnormal operation, the watchdog function re-establishes the initial operating status. Not all the competitors fit their products with this safety feature.

Electromagnetic compatibility
The powercompact series is compliant with the EU standards on electromagnetic compatibility. The quality and the safety of the powercompact series are ensured by the CAREL ISO 9001 certified design and production system and by the CE mark on the product.

2. User interface

powercompact is fitted with a very powerful and aesthetically pleasant display, with 3 digits and decimal point, minus sign and icons to simplify the reading of the values and the operating status.
The silicon keypad ensures ease of use and reliability, and allows direct access to the HACCP, light, defrost and continuous cycle functions. The display can be customised simply and economically by changing the removable frame.



2.1 Display and icons

⑨ **COMPRESSOR**: ON when the compressor starts. Flashes when the activation of the compressor is delayed by safety times.

⑩ **FAN:** ON when the fan starts. Flashes when the activation of the fan is prevented due to external disabling or procedures in progress.

⑪ **DEFROST:** ON when the defrost is activated. Flashes when the activation of the defrost is prevented due to external disabling or procedures in progress.

⑫ **AUX:** ON when the auxiliary output (1 and/or 2) selected as AUX is activated.

⑬ **ALARM: ON following pre-activation of the delayed external digital input alarm.** Flashes in the event of alarms during normal operation (e.g. high/low temperature) or in the event of alarms from an external digital input, immediate or delayed.

⑭ **CLOCK:** ON if at least one timed defrost has been set. On start-up comes ON for a few seconds to indicate that the Real Time Clock is present.

⑮ **LIGHT:** ON when the auxiliary output (1 and/or 2) selected as the LIGHT is activated.

⑯ **SERVICE:** Flashes in the event of malfunctions, for example E^2PROM errors or probe faults.

⑰ **DISPLAY:** Displays the temperature in the range –50 to +150 °C. The temperature is displayed with resolution to the tenth of a degree between –19.9 and + 19.9 °C. The display of the tenths can be disabled by setting the related parameter.

⑱ **HACCP:** ON if the HACCP function is enabled. Flashes when there are new HACCP alarms stored (HA and/or HF alarm shown on the display).

⑲ **CONTINUOUS CYCLE:** ON when the CONTINUOUS CYCLE function is activated. Flashes if the activation of the function is prevented due to external disabling or procedures in progress (e.g.: minimum compressor OFF time).

ICON	FUNCTION	Normal operation			Start up
		ON	OFF	FLASHING	
	COMPRESSOR	Compressor ON	Compressor OFF	Compressor request	
	FAN	Fan ON	Fan OFF	Fan request	
	DEFROST	Defrost active	Defrost not active	Defrost request	
AUX	AUX	AUX auxiliary output active	AUX auxiliary output not active		
	ALARM	Delayed external alarm (before the expiry of the time 'A7')	No alarm present	Alarms in norm. operation (e.g. High/low temperature) or alarm from external digital input, immediate or delayed	
	CLOCK	If at least 1 timed defrost has been set	No timed defrost has been set		ON if Real time clock present
	LIGHT	LIGHT auxiliary output ON	LIGHT auxiliary output OFF		
	SERVICE		No malfunction	Malfunction (e.g. E^2PROM error or probe fault). Request service	
HACCP	HACCP	HACCP function enabled	HACCP function not enabled	HACCP alarm saved (HA and/or HF)	
	CONTINUOUS CYCLE	CONTINUOUS CYCLE function activated	CONTINUOUS CYCLE function not activated	CONTINUOUS CYCLE function request	

2.2 Keypad

① **HACCP:** Pressing this button displays a sub-menu used to access the parameters relating to the HACCP alarms (**'HA'**, **'HAn'**, **'HF'**, **'HFn'**).

② **ON/OFF:** If pressed for more than 5 seconds switches the controller on/off. If the controller is OFF, the display shows the message "OFF", alternating with the reading from the probe set using the parameter **'/tI'**. The parameters can still be accessed for display and modification.

③ **PRG/MUTE:**

- Mutes the audible alarm (buzzer) and deactivates the alarm relay;
- If pressed for more than 1 second during the reception of the automatic network address assignment request package, starts the address assignment procedure (see paragraph *Automatic serial address assignment procedure*);
- If pressed for more than 5 seconds, accesses the menu for setting the type "F" parameters (frequent);
- If pressed for more than 5 seconds together with set, accesses the menu for setting the type "C" parameters (configuration);
- If pressed for more than 5 seconds when switching the instrument ON, activates the procedure for setting the default parameter values.
  - If pressed for more than 5 seconds together with ▲, resets any active alarms with manual reset (the message 'rES' indicates that the alarm has been reset); any delays relating to the alarms are re-activated.

④ **UP/CC:**

- If pressed for more than 5 seconds, activates/deactivates continuous cycle operation (the messages 'ccb' and 'ccE' indicate, respectively, the start and end continuous cycle request).
- If pressed together with set, for more than 5 seconds, starts the report printing procedure (if the printer interface is connected to the controller).
  - If pressed for more than 5 seconds together with prg/mute, resets any active alarms with manual reset (the message 'rES' indicates that the alarm has been reset); any delays relating to the alarms are re-activated.

⑤ **LIGHT:** If pressed for more than 1 second activates/deactivates auxiliary output 2.

⑥ **AUX:** If pressed for more than 1 second activates/deactivates auxiliary output 1.

⑦ **DOWN/DEF:**

- If pressed for more than 5 seconds, activates/deactivates a manual defrost (the messages ‘dFb’ and ‘dFE’ indicate, respectively, the start and end defrost request);

⑧ **SET:**

- If pressed for more than 1 second displays and/or sets the set point;
- If pressed for more than 5 seconds together with prg/mute, accesses the menu for setting the type “C” parameters (configuration).
- If pressed together with UP/CC for more than 5 seconds, starts the report printing procedure (if the controller is connected to the printer interface).

Note: when the buttons are pressed a brief audible signal is emitted; this signal cannot be disabled.

Icon	Button	Normal operation		Start up	Automatic address assignment request
		Pressing the button alone	**Pressing together with other buttons**		
	HACCP	Enters the menu to display and delete the **HACCP alarms.**			
	ON/OFF	If pressed for more than 5 seconds, **switches the controller ON/OFF.**			
prg/mute	**PRG/MUTE**	If pressed for more than 5 seconds, accesses the menu for setting the **type “F” parameters (frequent).** Mutes the audible alarm (buzzer) and deactivates the alarm relay	**SET:** If pressed for more than 5 seconds together with SET, accesses the menu for setting the **type “C” parameters (configuration).** **UP/CC:** If pressed for more than 5 seconds together with UP/CC **resets any active alarms with manual reset.**	If pressed for more than 5 seconds on start-up, **activates the procedure for setting the default parameter values.**	If pressed for more than 1 second **enters the automatic address assignment procedure.**
	UP/CC	If pressed for more than 5 seconds, **activates/deactivates continuous cycle operation.**	**SET:** If pressed for more than 5 seconds together with SET, **starts the report printing procedure** (if the printer interface is connected to the controller). **PRG/MUTE:** If pressed for more than 5 seconds together with PRG/MUTE **resets any active alarms with manual reset.**		
	LIGHT	If pressed for more than 1 second, **activates/deactivates auxiliary output 2.**			
aux	**AUX**	If pressed for more than 1 second, **activates/deactivates auxiliary output 1.**			
	DOWN/DEF	If pressed for more than 5 seconds, **starts/stops a manual defrost.**			
set	**SET**	If pressed for more than 1 second, **displays and/or sets the set point.**	**PRG/MUTE:** If pressed for more than 5 seconds together with PRG/MUTE, accesses the menu for setting the **type “C” parameters (configuration).** **UP/CC:**: If pressed for more than 5 seconds together with UP/CC, **starts the report printing procedure** (if the controller is connected to the printer interface).		

2.3 Procedure for displaying and deleting the HACCP alarms

1) Press ;
2) The display shows the name of the first parameter relating to the HA and HF alarms;
3) Scroll the menu with the and buttons; the display shows the names of the various parameters relating to the HA and HF alarms;
4) Once having reached the desired parameter press to display the value;
5) If the selected parameter is 'HA' or 'HF', use and to scroll the year, month, day, hour, minutes and duration of the last 'HA' or 'HF' alarm activated.
   Example:
   'y03' 'M07' 'd22' 'h23' 'm57' 't99' start again...

Indicates that the last 'HA' or 'HF' alarm was activated on 22 July 2003 at 23:57 and lasted 99 hours.

6) Press again to return to the list of the parameters relating to the HA and HF alarms;
7) The following functions are always available inside the menu:

- delete the HACCP alarm by pressing for more than 5 seconds (the message 'rES' indicates that the alarm has been deleted, the HACCP LED stops flashing, the HA and/or HF signal is reset, and the monitoring of HA is reinitialised);
- delete the HACCP alarms and the alarms saved (HAn, HA, HA1, HA2, HFn, HF, HF1, HF2) by pressing and for more than 5 seconds (the message 'rES' indicates that the alarms have been deleted, the HACCP LED stops flashing, the HA and/or HF signal is reset, the alarms saved HAn, HA, HA1, HA2, HFn, HF, HF1, HF2 are reset and the monitoring of HA is reinitialised)

8) "Normal operation" can be resumed at any time by pressing for 3 seconds or waiting for the expiry of the session due to Timeout (60 seconds).

2.4 AUX and Light buttons

The and buttons are always assigned to the logical outputs auxiliary 1 and 2 respectively.

In addition, the logical outputs auxiliary 1 ('H1') and 2 ('H5') can also be assigned different functions. By default, auxiliary 1 is and auxiliary 2 is . In relation to the function assigned, the corresponding icon is activated on the display.

Physical output	Button	Function	Icon
auxiliary 1	AUX	AUX (default)	AUX
auxiliary 2	LIGHT	LIGHT (default)	LIGHT

Consequently, a situation may be developed in which, by assigning different functions, pressing switches on the Light, and vice-versa.

Logical output	Button	Function	Icon
auxiliary 1	AUX	LIGHT	LIGHT
auxiliary 2	LIGHT	AUX	AUX

Note that the logical output 1 can be assigned to one or two relays.

logical output	relay 5	relay 4	relay 3	relay 2	relay 1
compressor	0	0	0	0	1
defrost	0	0	0	1	0
fan	0	0	1	0	0
aux1	1	1	0	0	0
aux2	0	0	0	0	0

In this case, pressing activates both relay 4 and relay 5.

3. Installation

To install the controller, proceed as follows, with reference to the connection diagrams shown at the end of the manual.

1) **Connect the probes and power supply:** the probes can be installed up to a maximum distance of 10m from the controller, using cables with a minimum cross-section of 1mm², shielded where possible. To improve the immunity to disturbance, use probes with shielded cables (connect only one end of the shield to the earth on the electrical panel).
2) **Program the instrument:** for a more detailed description see the chapter "Programming the instruments".
3) **Connect the actuators:** the actuators should only be connected after having programmed the controller. In this regard, carefully check the maximum capacities of the relays, indicated in the "technical specifications".
4) **Serial network connection:** all powercompact models are fitted with a serial connector for connection to the supervisory network via the serial interface code IROPZ48500. Take care when earthing the system, in particular the secondary of the transformers that supply the instruments must not be earthed. If a transformer with earthed secondary is required, an insulating transformer must be installed in between. A series of instruments can be connected to the same insulating transformer, nonetheless it is recommended to use a separate insulating transformer for each instrument.

WARNINGS:
Avoid installing the instrument in environments with the following characteristics:
- relative humidity over 90% non-condensing;
- heavy vibrations or knocks;
- exposure to continuous jets of water;
- exposure to aggressive and polluting atmospheric agents (e.g.: sulphur and ammonia gases, saline mist, smoke) which may cause corrosion and/or oxidation;
- high magnetic and/or radio-frequency interference (thus avoid installation near transmitting antennae);
- exposure to direct sunlight and atmospheric agents in general;
- large and rapid fluctuations in ambient temperature;

These warnings must be observed for connection of the controllers:
- Incorrect connection of the power supply may seriously damage the system.
- Use cable ends that are suitable for the terminals. Loosen each screw and insert the cable end, then tighten the screws. On completing the operation, tug the cables lightly to check they are sufficiently tight. When tightening the screws, do not use power devices, or alternatively adjust them to a tightening torque less than 50 Ncm.
- Separate (at least 3 cm) the bottom of the device, the probe signal and digital input cables from inductive loads and power cables as much as possible, to avoid any electromagnetic disturbance. Never lay power cables and probe cables in the same cable conduits (including those for the electrical panels). Do not install the probe cables in the immediate vicinity of power devices (contactors, circuit breakers or the like).
- Reduce the length of the sensor cables as much as possible, and avoid spirals around power devices.
- Only use IP67 probes as end defrost probes; place the probes with the vertical bulb upwards, so as to assist the drainage of any condensate. Remember that the thermistor temperature probes (NTC) have no polarity, so the order of connection of the ends is not important.
- The probes can be installed up to a maximum distance of 10m from the controller. To extend the distance of the probes, use cables with a minimum cross-section of 1mm², shielded where possible. In this case, the shield must be connected to the common of the probe. Do not earth the other end of the shield (the sensor end).

CLEANING THE INSTRUMENT.
When cleaning the instrument do not use ethanol, hydrocarbons (petrol), ammonia and derivatives. Use neutral detergents and water.

4. Programming the instruments

The parameters can be modified using the front keypad.
The operating parameters are divided into two families: frequent parameters (type “F”) and configuration parameters (type “C”).
Access to the configuration parameters is protected by a password that prevents unwanted modifications or access by unauthorised persons.

4.1 How to access the type “F” parameters

Press prg/mute for more than 5 seconds (if an alarm is active, the buzzer is muted), the display shows the code of the first modifiable type “F” parameter.

4.2 How to access the type “C” parameters

1) Press prg/mute and set together for more than 5 seconds; the display will show the number “00”;
2) Press ▲ or ▼ until displaying the number “22” (the code of the password allows access to the parameters);
3) Confirm by pressing set;
4) The display shows the code of the first modifiable type “C” parameter.

4.3 Modifying the parameters

After having displayed the parameter, either type “C” or type “F”, proceed as follows (Fig. 1 and 2):

1) Press ▲ or ▼ until reaching the parameter to be modified, when scrolling, an icon appears on the display representing the category the parameter belongs to;
2) Alternatively, press prg/mute to display a menu that is used to quickly access the “group” of parameters to be modified;
3) Scroll the menu with the ▲ and ▼ buttons; the display shows the codes of the various categories of parameters (*see the “Summary of operating parameters”*), accompanied by the display of the corresponding icon (if present);
4) Once having reached the desired category, press set to move directly to the first parameter in the category (if there are no visible parameters in the selected category, pressing set will have no effect);
5) At this point, continue to scroll the parameters until reaching the parameter to be modified, or return to the “Categories” menu by pressing prg/mute for one second.
6) Press set to display the associated value;
7) Increase or decrease the value with the ▲ or ▼ buttons respectively, until reaching the desired value;
8) Press set to *temporarily* save he new value and return to the display of the parameter code;
9) Repeat the operations from point 1 or point 2;
10) If the parameter has sub-parameters, press set to display the first sub-parameter;
11) Press ▲ or ▼ to display all the sub-parameters;
12) Press set to display the associated value;
13) Increase or decrease the value with the ▲ or ▼ button respectively, until reaching the desired value;
14) Press set to temporarily save the new value and return to the display of the sub-parameter code;
15) Press prg/mute to return to the display of the parent parameter.

4.4 Classification of the parameters

The parameters, as well as being divided by TYPE, are also grouped into logical categories identified by the initial letters or symbols of such parameters. The following table lists the categories and the corresponding letters.

Parameters	Category	Text	Icon
/	Temperature probe parameters	'Pro'	
r	Temperature control parameters	'CtL	
c	Compressor safety time and activation parameters	'CMP'	
d	Defrost parameters	'dEF'	
A	Alarm parameters	'ALM'	
F	Fan parameters	'Fan'	
H configuration	General configuration parameters (addresses, enabling, etc.…)	'CnF'	AUX
H HACCP	HACCP parameters	'HcP'	HACCP
RTC	RTC parameters	'rtc'	

4.5 Saving the new values assigned to the parameters

1) To definitively save the new values of the modified parameters, press prg/mute for more than 5 seconds, thus exiting the parameter setting procedure.

All the modifications made to the parameters, temporarily saved in the RAM, can be cancelled and "normal operation" resumed by not pressing any button for 60 seconds, thus allowing the parameter setting session to expire due to timeout.

Important: if the programming session ends by timeout, the parameters relating to the clock will not be reset, as these parameters are saved immediately when entered.

If the instrument is switched off before pressing prg/mute, all the modifications made to the parameters and temporarily saved will be lost.

4.6 Setting the set point

To display or set the set point, proceed as follows:

1) Press set for more than 1 second to display the set point;
2) Increase or decrease the set point using the ▲ and ▼ buttons respectively, until reaching the desired value;
3) Press set again to confirm the new value.

4.7 Alarms with manual reset

The alarms with manual reset can be reset by pressing prg/mute and ▲ together for more than 5 seconds.

4.8 Procedure for setting the default parameter values

To set the default parameter values for the controller, proceed as follows:

1) Switch the instrument off;
2) Press the prg/mute button;
3) Switch the instrument on again, holding the prg/mute button until the message "_std_" is shown on the display;

Note: the default values are only set for the visible parameters (C or F), in accordance with the models see the tables of "Operating parameters".

4.9 Automatic serial address assignment

The automatic setting of the serial address is a special procedure that allows, using an application installed on a PC connected to the CAREL network, the addresses of all the instruments (that include this feature) connected to the CAREL network to be managed simply.
The procedure is very simple:

1) Using the remote application, start the "Network definition" procedure; the application sends a special message ('<!ADR>') across the network, containing the network address;
2) Pressing the prg mute button on the keypad of the instrument connected to the network, the instrument recognises the message sent by the remote application, automatically setting the address to the required value and sending a message of confirmation to the application, containing the unit code and firmware revision (message 'V');
   When the message sent by the remote application is recognised, the instrument displays the message 'Add' for 1 second, followed by the value of the serial address assigned.
3) The application, on receiving the confirmation message from the units connected to the network, saves the information received in its database, increases the serial address and sends the message '<!ADR>' again;
4) At this point, the procedure starting from point 2 can be repeated on another unit connected to the network, until defining all the network addresses.

Note: once the address has been assigned to an instrument, the operation, for safety reasons, is disabled on the same instrument for 1 minute, preventing a different address from being assigned to the instrument in this period.

5. Accessories

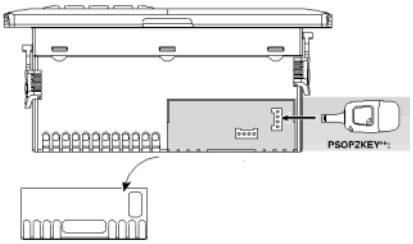
5.1 Parameter copying key

The programming keys **PSOPZKEY00** (Figure 1) and **PSOPZKEYA0** (Figure 2) for CAREL controllers used to copy the complete set of parameters on the CAREL powercompact. The keys must be connected to the connector (4 pin AMP) fitted on the compatible controllers, and work even without switching the controller on, as indicated in the operating instructions for the controller (see the summary diagram in Figure 3).

NOTE: **PJOPZKEY00 to be used ONLY for PJ controllers;**
PSOPZKEY to be used ONLY for powercompact, MasterCella, Power-split, MGE and I/O module.**

(Figure 1)

(Figure 2)



(Figure 3)

Three functions are available, selected using the two dipswitches present; these can be accessed by removing the battery cover:

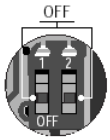
- **Load** the parameters from a controller to the key (UPLOAD);
- **Copy** from the key to a controller (DOWNLOAD);
- **Extended copy** from the key to a controller (EXTENDED DOWNLOAD).

Warning: The parameters can only be copied between instruments with the same code. The upload operation can, however, always be performed. In the specific case of powercompact controllers, the following procedure is used to copy and download the parameters:

5.1.1 Copying and downloading the parameters

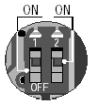
The following operations are used for the UPLOAD and/or DOWNLOAD or EXTENDED DOWNLOAD functions, simply changing the settings of the dipswitches to change the function:

UPLOAD:



DOWNLOAD:

EXTENDED DOWNLOAD:



- open the rear cover on the key and position the 2 dipswitches according to the desired operation;
- close the rear cover on the key and insert the key in the connector of the controller;
- press the button and check the LED: red for a few seconds, then green, indicates the correct completion of the operation. Other signals or the flashing of the LED indicates that problems have occurred: refer to the table below;
- at the end of the operation, release the button, after a few seconds the LED goes OFF;
- remove the key from the controller;

LED signal	Error	Meaning and solution
Red LED flashing	Batteries discharged at start copy	The batteries are discharged, the copy operation cannot be performed. Replace the batteries.
Green LED flashing	Batteries discharged during copy or at end of copy	During the copy operation or at the end of the operation the battery level is low. Replace the batteries and repeat the operation.
Red/green LED flashing	Instrument not compatible	The parameter set-up cannot be copied as the model of controller connected is not compatible. This error only occurs for the DOWNLOAD function; check the code of the controller and run the copy only for compatible codes.
Red and green LED ON	Error in data being copied	Error in the data being copied. The instrument EEPROM is corrupted, and therefore the copy from the key cannot be performed.
Red LED on steady	Data transfer error	The copy operation was not completed due to a serious error when transferring or copying the data. Repeat the operation, if the problem persists check the key connections.
LED OFF	Batteries disconnected	Check batteries.

Note:

1 At the start and the end of the UPLOAD and DOWNLOAD operations (normal or extended), the buzzer on the instrument will emit an audible signal.

2 The DOWNLOAD operation (normal or extended) is possible even if the operating parameters and controller are incorrect. If there is an error in the unit parameters, these will be recovered by the key. Be careful when recovering the unit parameters from a key, as these determine the low-level operation of the controller (unit model, type of interface, assignment of logical relay to physical relay, brightness of the display, level of modulation of the relay control signal …). **The unit parameters from the original model must therefore be restored to ensure the correct operation of the controller.**

5.2 Compact remote control

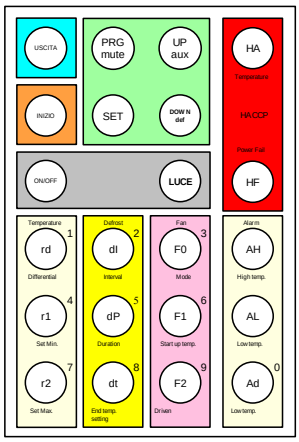
The COMPACT remote control features 20 buttons and allows direct access to the following parameters:

- Temperature;
- Defrost;
- Fans;
- Alarms;
- HACCP.

The following functions can also be controlled:

- Start defrost;
- Aux;
- Light;
- ON/OFF;
- Mute.

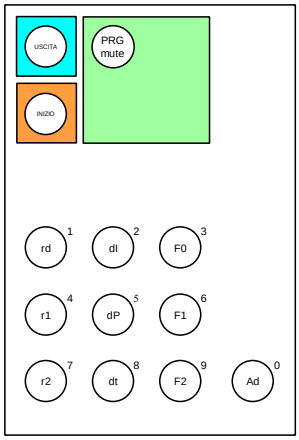
The standard remote control features the four buttons, PRG/MUTE, SET, UP and DOWN, which access almost all the functions provided by the instrument keypad.



The buttons can be divided into three groups, based on their functions:

- Buttons for enabling and disabling the use of the remote control;
- Buttons for the remote simulation of the instrument keypad;
- Buttons for the direct display of the most commonly used parameters.

Activating and deactivating programming from the remote control**.**



Button	Immediate function	Delayed function
START	used to enable the remote control; each instrument displays its own enabling code	
EXIT	ends operation using the remote control, cancelling all changes made to the parameters	
PRG	used to display the configuration parameters	pressing and holding for 5s ends operation with the remote control, saving the parameters modified.
NUMBERS	used to select the instrument, by entering the enabling code displayed.	

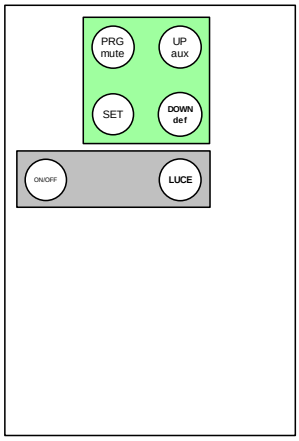
On pressing the START button, each instrument displays its own remote control enabling code (‘H3’).
The NUMERIC keypad is used to enter the enabling code of the instrument in question. At the end of this operation, only the instrument with the selected enabling code will be programmed from the remote control, all the others will resume normal operation.

Assigning the instruments different enabling codes allows, in this phase, only the desired instrument to be programmed using the remote control, without the risk of interference.

The instrument enabled for programming from the remote control will display the reading, alternating with the message ‘rCt’. This status is called **Level 0**.

Once having entered programming mode from the remote control:
pressing PRG for 5 seconds exits programming mode from the remote control, saving the changes made; pressing EXIT exits programming mode from the remote control, without saving the changes made.

Remote simulation of the instrument keypad



The highlighted part is used to simulate the instrument keypad from the remote control. In **Level 0** (display the reading and message 'rCt'), the following functions are active:

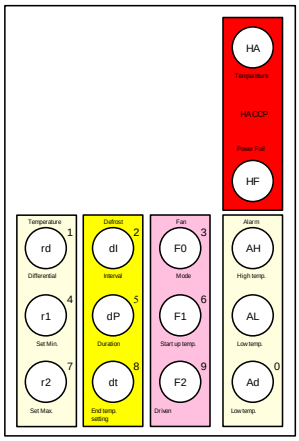
Button	Function
def	Start and stop the defrost
aux	Activation and deactivation of auxiliary relay 1
light	Activation and deactivation of auxiliary relay 2
ON/OFF	Instrument ON/OFF
PRG/mute	Mute the buzzer, if ON, and deactivate the alarm relay

In **Level 0,** the SET and PRG/mute buttons are also active; these are used to set the set point (**Level 1)** and the configuration parameters (**Level 2).**

Button	Immediate function	Delayed function
PRG/mute	used to access parameter configuration mode	pressing and holding for 5s ends operation with the remote control, saving the parameters modified.
SET	used to modify the set point	

In Levels 1 and Level 2, the PRG/MUTE, SEL, UP and DOWN buttons repeat the corresponding functions on the instrument keypad. In this way, all the instrument parameters can be displayed and modified, even those without shortcut buttons.

Buttons for the direct display of the most commonly used parameters



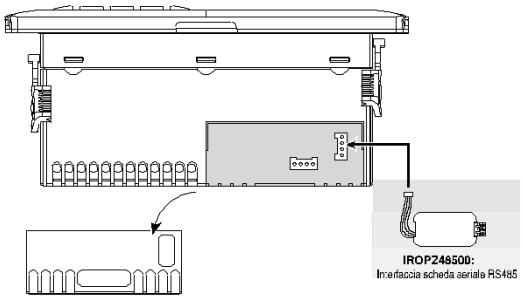
Some parameters, relating to:

- Temperature;
- Defrost;
- Alarms;
- Fans;
- HACCP

are directly accessible using specific buttons.

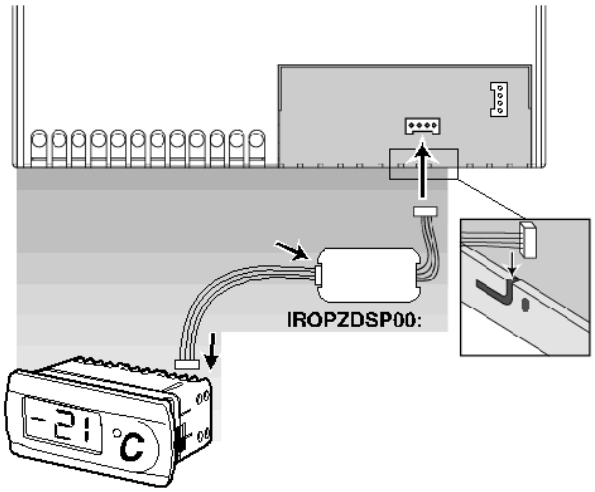
5.3 RS485 serial interface board

The RS485 serial card option (IROPZ48500), shown in the figure below, allows the **powercompact** instrument to be connected to the RS485 serial network for the supervision of the values measured and the modification of the operating parameters.
The connection diagram between the interface and the instrument is shown below. For further details, refer to the instruction sheet enclosed in the packaging of the interface option.



5.4 Repeater display interface option

The repeater display interface option (IROPZDSP00), shown in the figure below, allows the **powercompact** to interface with a repeater display (PST00VR100) to show the temperature measured by the third probe.
The connection diagram between the interface and the instrument is shown below. For further details, refer to the instruction sheet enclosed in the packaging of the interface option.



6. Description of the software functions

6.1 Models

The following is a summary of the functions relating to the various models of controller.

Model M: thermometer
- display temperature;
- display second probe with external contact;
- temperature alarm monitoring;

Model S: static units with defrost by stopping the compressor
- direct and reverse-cycle compressor control;
- defrost by stopping the compressor;
- continuous cycle;
- temperature alarm monitoring;

Model Y: static units with electric heater or hot gas defrost
- direct and reverse-cycle compressor control;
- electric heater or hot gas defrost;
- continuous cycle;
- temperature alarm monitoring;

Model F: ventilated units with electric heater or hot gas defrost
- direct and reverse-cycle compressor control;
- electric heater or hot gas defrost;
- evaporator fan control;
- continuous cycle;
- temperature alarm monitoring;

Model C: differs from model F due to the presence of the 2HP compressor relay
- direct and reverse-cycle compressor control;
- electric heater or hot gas defrost, by time or by temperature;
- evaporator fan control;
- continuous cycle;
- temperature alarm monitoring;

Model H: differs from model C due to the presence of the AUX2 output
- direct and reverse-cycle compressor control;
- electric heater or hot gas defrost, by time or by temperature;
- evaporator fan control;
- continuous cycle;
- temperature alarm monitoring;

Functions disabled according to the model:

Function	M	S	Y	F	C	H
compressor control	☒					
defrost by stopping the compressor	☒					
electric heater or hot gas defrost	☒	☒				
continuous cycle	☒					
duty setting	☒					
evaporator fans	☒	☒	☒			

The controllers can be fitted with a **maximum of two auxiliary relays**. The associated functions are the following:
- alarm output, normally open or closed;
- auxiliary output;
- light output;
- second evaporator output;
- control output for pump down valve;
- control output for condenser fans;
- a second delayed compressor

The controllers can be fitted with a **maximum of three digital inputs** (alternatively three probe inputs). The associated functions are the following:

- immediate alarm;
- delayed alarm;
- select probe displayed (model M);
- enable defrost;
- start defrost;
- door switch with compressor and fan shutdown and management of the light;
- remote ON/OFF;
- curtain switch with variation of the set point and management of the light;
- low pressure alarm;
- door switch with fan shutdown and management of the light;
- direct/reverse-cycle selection;
- light sensor and light management.

The controllers can be fitted with a **maximum of five probes** (three of which as alternatives to the digital inputs). The following functions are associated with the probes:

- room probe (used in the calculation of the virtual control probe);
- product probe (used, when fitted, in the calculation of the virtual control probe);
- defrost probe (main or secondary evaporator);
- condenser probe (used, when fitted, for the control of the condenser fans).

Other functions that enhance the range of the refrigeration controllers include:

- real time clock, for the management of real time defrosts;
- serial interface (optional) for connection to the CAREL Supervision System;
- interface (optional) for the connection of a repeater display;
- possibility of connection to a local printer for the alarm reports.

6.2 Testing the display and keypad on start-up

When the controller is switched on, a special procedure tests the display and the keypad.

Phase	Display	Keypad	Note
First	Display completely OFF per 2 seconds	Press PRG for 2 seconds to set the default values	
Second	Display completely ON for 2 seconds	No effect	
Third	Three lines (‘---’) for 2 seconds	Pressing each button lights up a specific segment	In this phase, the display of the clock indicates the presence of the RTC.
Fourth	Normal operation	Normal operation	

6.3 Switching the controller off

The unit can be switched OFF using the keypad, the digital input or the supervisory system.
In this operating mode, the display will be show the temperature selected for the parameter ‘/tI’, alternating with the message OFF.

Origin	Priority	Note
Digital input	Priority 1	Disables ON/OFF from the keypad and supervisor
Keypad	Priority 2	
Supervisor	Priority 3	

In the OFF status, the following are disabled:

- compressor control (sopped and pump down valve closed);
- defrost (cyclical and manual);
- fan control;
- fan control for low relative humidity (if enabled);
- continuous cycle;
- condenser fan control (if enabled);

- all the alarms listed below:
  - low temperature (LO, alarm reset and monitoring initialised);
  - high temperature (HI, alarm reset and monitoring initialised);
  - immediate alarm from external contact (IA, alarm reset and monitoring initialised);
  - delayed alarm from external contact (from, alarm reset and monitoring initialised);
  - defrost ended by timeout (Ed1 and Ed2, alarm reset);
  - pump down ended by maximum time alarm (Pd, alarm reset);
  - low pressure from external contact (LP, alarm reset and monitoring initialised);
  - autostart in pump down (AtS, alarm reset and non displayed);
  - high condenser temperature pre-alarm (cht, alarm reset and monitoring initialised);
  - high temperature alarm condenser (CHt, alarm reset and monitoring initialised);
  - door open for too long alarm (dor, alarm reset);
  - HACCP alarm, type HA (alarm reset and monitoring initialised);
  - HACCP alarm, type HF (alarm reset and monitoring initialised
- buzzer (OFF) and alarm relay (no-alarm status);
- HACCP control;
- generation of the defrost requests based on the set time bands;
- generation of the defrost requests based on the compressor running time (if enabled);
- generation of the defrost requests from digital input (if enabled);
- generation of the defrost requests from keypad or supervisor;
- enable defrost from digital input (if enabled);
- direct/reverse-cycle operation from digital input (if enabled).

While the following are enabled:

- modification and display of the frequent and configuration parameters and the set point;
- ON/OFF of auxiliary relay 1 (set as LIGHT or AUX);
- ON/OFF of auxiliary relay 2 (set as LIGHT or AUX);
- selection of the probe displayed (model M only);
- compressor autostart in pump down (if enabled);
- door switch (with fan and compressor shutdown) limited to the management of the light;
- remote ON/OFF;
- curtain switch, limited to the management of the light;
- door switch (with fan shutdown only) limited to the management of the light;
- management of the light sensor;
- updating of the defrost interval timer “dI”;
- the alarms listed below:
  - control probe rE error;
  - probe 1 error (E0);
  - probe 2 error (E1);
  - probe 3 error (E2);
  - probe 4 error (E3);
  - probe 5 error (E4);
  - clock alarm (Etc);
  - e²prom alarm, unit parameters (EE);
  - e²prom alarm, operating parameters (EF);

Note: In the OFF status, **the defrost interval ‘dI’ is always updated,** so as to maintain the regularity of the interval. If a defrost interval expires during the OFF status, this event is saved and, when controller is switched back ON, a defrost request is generated.

The controller **switches from ON to OFF** with the following sequence:

- the compressor protection times are observed;
- the pump down procedure is performed (if enabled);
- the defrost is forced OFF and will not resume when switched back ON;
- the continuous cycle is forced OFF and will not resume when switched back ON.

The controller **switches from OFF to ON** with the following sequence:

- the compressor protection times are observed;
- the defrost on start-up (if enabled) is not performed, as this in fact refers to power-up;
- the compressor and fan delays on start-up are not set.

6.4 Defrost

The parameter ‘dC’ establishes the unit of measure for the times set by the parameters ‘dI’ (defrost interval) and ‘dP1’, ‘dP2’ (maximum defrost duration).

If one of the auxiliary relays, 1 or 2, is selected as the auxiliary evaporator defrost output (‘H1’, ‘H5’), the defrost is performed at the same time on both evaporators present.

The parameter ‘d/1’ displays the defrost probe set for the main evaporator (the first probe assigned as a defrost probe).
The parameter ‘d/2’ displays the defrost probe set for the secondary evaporator (the second probe assigned as a defrost probe).

If no probes have been assigned to the defrost function (main or secondary evaporator), the defrost will end by timeout, after the periods ‘dt1’ and ‘dt2’.

6.4.1 Defrost events

The following events activate the defrost function:

Event	Implementation	Condition
Interval between defrosts ‘dI’ expired	Depending on enabling status	At the expiry of the interval
Expiry of RTC trigger	Depending on enabling status	-------
Compressor running time	Depending on enabling status	When the defrost starts
Interval between defrosts ‘dI’ finished with skip defrost algorithm	Depending on enabling status	At the expiry of the interval
On start-up	Depending on enabling status	On start-up + d5
Digital input	Depending on enabling status	When the defrost starts
Supervisor	Always	--------
Keypad	Always	--------

Implementation of the defrost depending on the enabling status:
If a digital input is configured to enable the defrost, the defrost is performed when such input is in the enabling status, otherwise it stays pending.

IMPORTANT: the defrost started from the keypad or by the supervisor is always performed, even when there is a delayed defrost request from external digital input or a defrost enabling input (that is not enabled or delayed).

IMPORTANT: if parameter ‘r3’ is set to 1 (direct) or 2 (reverse), the defrost is never performed.

6.4.2 Defrost request status

This status exists when one of the events that activates the defrost is present, however the defrost cannot be started. It will therefore stay pending, for the following reasons:

- Compressor and fan start delay on start-up (‘c0’), as this delays the activation of the compressor;
- Compressor protection times (‘c1’, ‘c2’, ‘c3’), as this delays the activation of the compressor;
- Low pressure alarm (only with hot gas defrost), as this delays the activation of the compressor;
- Continuous cycle running;
- Pump down procedure running;
- Defrost delay on start-up (‘d5’);
- Defrost delay from digital input configured as start defrost or enable defrost (‘d5’);
- Enable defrost (‘A4’, ‘A5’, ‘A9’);
- Immediate alarm from external digital input (‘A4’, ‘A5’, ‘A9’);
- Alarm from external digital input, delayed by the time ‘A7’ (‘A4’, ‘A5’, ‘A9’);
- High condenser temperature alarm (only with hot gas defrost);
- Opening of the door (only with hot gas defrost if the compressor is subject to the door management algorithm).

6.4.3 Starting the defrost

The defrost is performed by electric heater or hot gas, according to the value of parameter ‘d0’.
If defrost by temperature has been selected, the defrost is performed only if the evaporator probe reading is less than the end defrost temperature (‘dP1’ and ‘dP2’), or if there is a probe error. This is also true in the case of two evaporators.
In the electric heater defrost:

- the compressor stops (Pump down is run, if enabled);
- the time ‘d3’ elapses;
- the defrost relay relating to the main evaporator is activated, to turn the heaters on;
- the defrost relay relating to the auxiliary evaporator is activated, to turn the heaters on;

In the defrost hot gas:

- the compressor starts;
- the time ‘d3’ elapses;
- the defrost relay relating to the main evaporator is activated, to open the hot gas valve;
- the defrost relay relating to the auxiliary evaporator is activated, to open the hot gas valve.

6.4.4 Defrost in progress

During the defrost procedure, the display is controlled according to the setting of parameter ‘d6’. If during the defrost phase, the opening of the door is detected by the external digital contact, the compressor is stopped (running the pump down procedure, if enabled). When the door closes, the compressor resumes the status envisaged for the selected defrost procedure. During the defrost, the status of the fans is determined by setting of parameter ‘F3’

Note 1: if the defrost probe is featured on the second evaporator, but the second evaporator defrost output is not used, the defrost on the second evaporator is performed using the output for the first evaporator.

Note 2 : if the defrost probe is not featured on the second evaporator, but the second evaporator defrost output is used, the defrost on the second evaporator is performed by time or considering the temperature of the first evaporator.

6.4.5 End defrost

The defrost ends by temperature (‘dt1’, ‘dt2’) or by time (‘dP1’, ‘dP2’) according to the setting of parameter ‘d0’.
If defrost by temperature is selected, it may also end by timeout (‘dP1’, ‘dP2’) and, in this case, according to the setting of parameter ‘A8’, the signal ‘Ed1’ or ‘Ed2’ is displayed.
In the case of an error in the probe selected for the defrost (main or auxiliary evaporator), it is always performed by time, with the timeout signal at the end (‘Ed1’ or ‘Ed2’).
In the case of two evaporators, the defrost ends when both the evaporators have reached the end defrost condition. If one evaporator finishes the defrost (by time or by temperature) before the other, the corresponding defrost relay is de-energised, while the compressor remains in the status required by the defrost.
The defrost is ended prematurely in the following situations:

- changeover from Direct operating mode with defrost to Reverse-cycle mode (heating), by parameter (‘r3’) or the digital input (‘A4’, ‘A5’and’A9’);
- end of enabling signal from external digital contact (the defrost request remains pending);
- instrument switched OFF from the keypad or supervisor (the defrost request remains pending);
- end defrost from the supervisor.

If the defrost is terminated prematurely, the dripping and post-dripping (with the fans OFF) phases are not performed, as if the times were 0.

Special case: if the controller is running a hot gas defrost and a low pressure alarm occurs, the compressor will stop due to the low pressure alarm, and the defrost will probably end by timeout.

At the end of the defrost:

- the compressor is stopped (hot gas) and pump down is run (if enabled), if a dripping time is set (‘dd’);
- the fans are stopped, if a dripping time (‘dd’) or fan off for post-dripping (‘Fd’) is set;
- the defrost relay is deactivated;
- the alarm bypass times after defrost are counted (‘d8’);
- any pending defrost requests are reset.

If the dripping time is set to zero, the compressor remains in the previous status, and normal control resumes directly.
If the dripping and post-dripping times are set to zero, the compressor and the fans remain in the previous status, and normal control resumes.

6.4.6 Dripping

The dripping time is set by the parameter ‘dd’. In dripping:

- the compressor is OFF;
- the fans are OFF.

At the end of the dripping time, the post-dripping phase starts (‘Fd’):
- the compressor restarts normal operation;
- the fans are stopped.
If the post-dripping time is set to zero, normal control is resumed directly.

6.4.7 Post-dripping (fans OFF)

The post-dripping time is set by the parameter ‘Fd’.
At the end of the post-dripping time, normal control resumes.

6.4.8 Notes on the defrost function

- If defrost with RTC is selected, the parameter 'dI' has no effect on the days when defrost events are set.
  In any case, the 'dI' timer is updated and the parameter becomes valid on all days only in the event of RTC alarms.

- The timer used to determine the defrost interval 'dI' is updated cyclically when reaching the end of the interval. This allows cyclical defrosts. The timer is also updated when the unit is OFF. If the timer 'dI' expires when the unit is OFF, a defrost is performed when the unit is started. If an "RTC" or manual defrost is run from the keypad or the supervisor, the timer 'dI' is not reset at the start of the defrost. Consequently, at the end of defrost, the timer 'dI' may expire, and another defrost is performed. If a defrost is run from the digital input or by the compressor running time algorithm, the timer "dI" is reset when the defrost request is generated. In this way, the defrost interval represents a timeout for the generation of the defrost requests (used, for example, when the external timer is not working correctly). If defrost on start-up ('d4') has been selected, and a defrost on start-up delay ('d5') has been set, the timer 'dI' must be set to the end of the defrost delay on start-up. This allows, for units programmed in the same way, with the same value of 'dI' and different values of 'd5', the defrosts on start-up to be distributed over time, and subsequently maintain the staggering of the defrosts for the following events.

6.5 New defrost activation modes

This controller offers the possibility to manage the defrosts in three different modes, in addition to the standard mode:

6.5.1 Defrost according to compressor running time

To enable the controller for this operating mode, set a value >0 for parameter d10.
This mode affects start defrost, that is, according to the evaporator temperature (parameter d11), the controller checks the compressor running time (parameter d10) and decides whether to activate the defrost or not.
Two parameters are envisaged:

- **'d10'**: compressor running time, with the evaporation temperature less than the threshold, after which a defrost request is generated.
- **'d11'**: evaporation temperature threshold.

The defrost is generated if the compressor has operated

- for the time **'d10'**.
- with an evaporator probe reading less than **'d11'**.

In the case of two evaporators, there are separate timers for each evaporator. Each timer is started whenever the compressor is ON and the corresponding evaporator probe reading is less than the threshold **'d11'**.
The defrost will start when at least one of the two timers has expired, that is, when at least one of the evaporators has operated for the time **'d10'** below the temperature threshold **'d11'**.

6.5.2 Defrost at variable intervals of dI.

To enable the controller for this operating mode, set parameter d12=1.
In this mode, the control algorithm, according to the duration of the previous defrost, increases or decreases the defrost interval (dI) proportionally for the following defrosts.
The following parameters are associated with this function:

- 'dI': interval between defrosts;
- 'd12': enable the function;
- 'dn': nominal defrost duration, in proportion to the set defrost timeout (value expressed as a %);
- "dP1" and "dP2": maximum defrost duration for evaporator 1 and 2;
- 'dH': control proportional factor.

Using the following formulae: $dn1 = \frac{dn}{100} dP1$ and $dn2 = \frac{dn}{100} dP2$, the algorithm calculates the nominal defrost times 'dn1' and 'dn2' (in the case of the second evaporator) as percentages "dn" of "dP1" and "dP2".

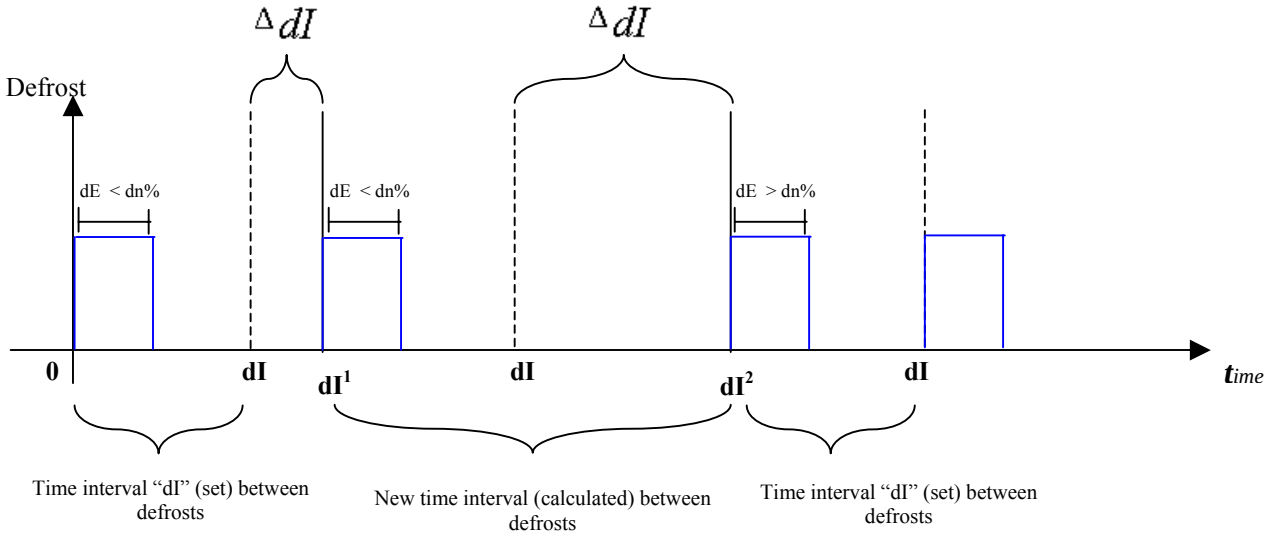
Therefore, if a defrost lasts less than the set time "dn", the algorithm proportionally lengthens (depending on the value assigned to parameter dH) the next defrost interval "dI^{n}".

The parameter 'dH' is a proportional factor that amplifies or attenuates the variation in "dI^n".

$$\Delta dI = \left[\left(\frac{dn}{100} - \frac{dE^*}{dP}\right) \cdot dI \cdot \frac{dH}{50}\right]$$

dE* = effective defrost duration

$$dI^n = dI + \Delta dI$$



Example:
If, for example, the defrost interval (dI) is set to 8 hours and the maximum defrost duration (dP1 or dP2) is set to 30 minutes, however usually the defrost is required for 50% less than the time dP1 or dP2, set parameter dn = 50%. The control algorithm will calculate, using the formula dn/100 ∗ dP1= dn1 or dn/100 ∗ dP2= dn2 (in the case of the second evaporator), the nominal defrost times "dn1" or "dn2", which in the example shown corresponds to 15 minutes, that is, 50% of dP.
The new interval dI^1 for the next defrost is calculated by the algorithm, using the formula:

$$dI^1 = dI + \left[\left(\frac{dn}{100} - \frac{dE}{dP}\right) \cdot dI \cdot \frac{dH}{50}\right]$$

where by setting the parameter dH (proportional factor for the variation in dI) between 0 an 100, a proportional gain from 0 to 2 can be selected. If dH = 50, the proportional factor has no affect.
At this point, if the defrost ends after 10 minutes (dE), replacing the known values in the formula gives:

$$dI^1 = 8 + \left[\left(\frac{50}{100} - \frac{10}{30}\right) \cdot 8 \cdot \frac{dH}{50}\right]$$

consequently

$$dI^1 = 8 \cdot \left[1.167 \cdot \frac{dH}{50}\right]$$

It is therefore clear how the factor dH increases or decreases the new dI^1.

6.5.3 Defrost at intervals calculated according to the duration of the previous defrost: Skip defrost

To enable the controller for this operating mode, set the parameter d12=2.
In this mode, the duration of the defrost performed establishes whether the following defrost will be skipped or not.
The following parameters are associated with this function:

- ‘‘d12’: enable the function;
- ‘d I’: interval between defrosts;
- ‘dn’: nominal duration of the defrost, in proportion to the defrost timeout (value expressed as a %);
- “dP1” and “dP2”: maximum defrost duration for evaporator 1 and 2.

When setting these parameters correctly, the algorithm calculates, using the following formulae: $dn1 = \frac{dn}{100} dP1$ and

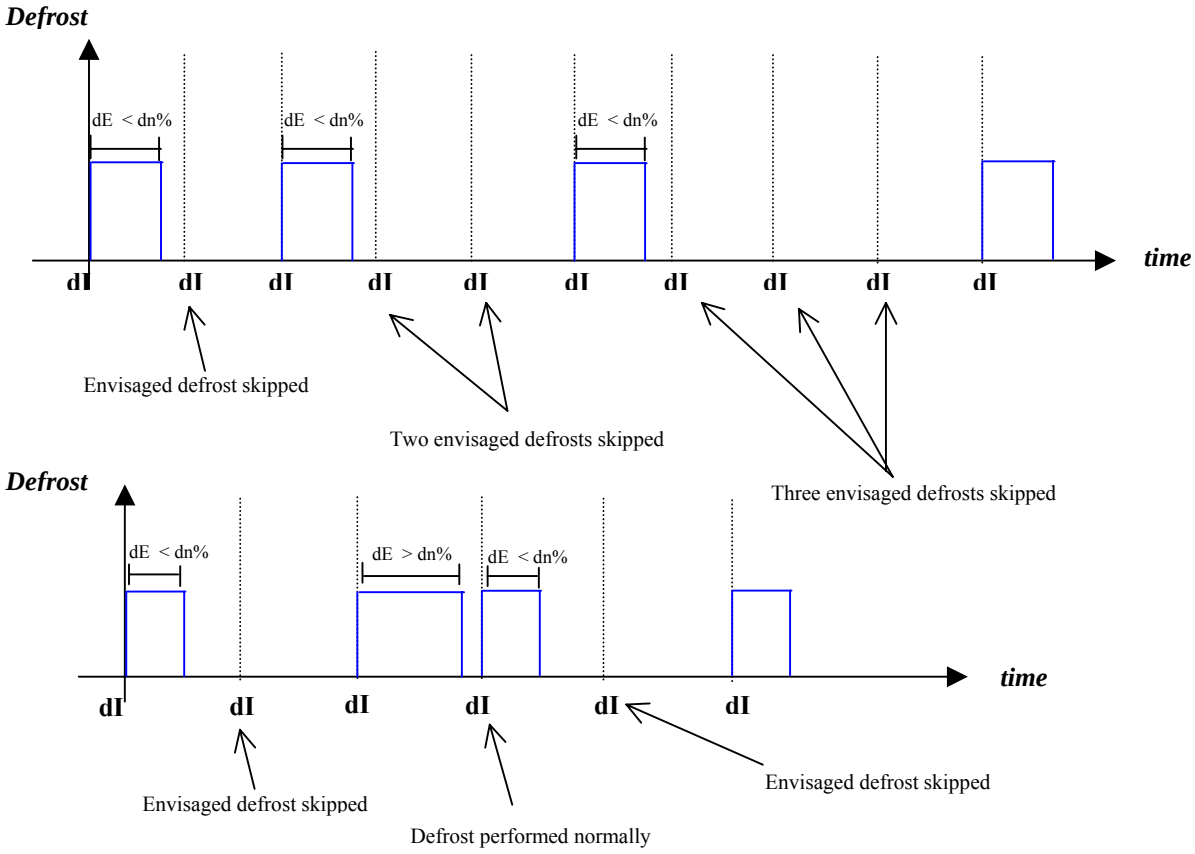
$dn2 = \frac{dn}{100} dP2$

the nominal defrost times ‘dn1’ and ‘dn2’ (in the case of the second evaporator) as percentages “dn” of “dP1” and “dP2”.

This function is based on a very simple but very effective principle. If the defrost lasts less than or equal to the time dn1 or dn2 (calculated with the formulae shown above), the next defrost envisaged after the time “dI” will be skipped.
When the following defrost is performed, the check is repeated, and if the outcome is the same then the following two defrosts envisaged are skipped, and so on according to the criteria described above (maximum 3 successive defrosts skipped).
If 3 consecutive defrosts are skipped and the actual defrosting time is still less than dn%, the cycle is terminated and the controller will skip one more defrost.
As soon as the defrost time exceeds dn% of the time "dP", the following defrost will be performed and the function will start again.
The algorithm counts the defrosts to be skipped.

- if the defrost ends in a time less than dn1, the counter of the defrosts to be skipped is increased by 1. The current value of the counter indicates the number of defrosts to be skipped;
- if the defrost ends normally, the next defrost is performed as normal;
- when the counter reaches the value 3, three defrosts are skipped, and then the counter is reset to 1;
- when the instrument is switched on, the defrost is performed the first 7 times without increasing the counter, after which the counter can be updated (from the eighth defrost on).

The following is a graphical description of the function:



This function should be used with the prog ributed over the day (e.g. cyclical defrosts, parameter "dI"). This prevents skipping defrosts that would be the last before a long period programmed without defrosts (for example, when the clock is used to program the defrosting of the utility at night only).

6.5.4 Defrost according to the duration of the previous defrost with skip defrost and dI variable (combination of 1 and 2)

To enable the controller for this operating mode, set parameter d12=3.
In this mode, the controller performs the defrosts considering both the duration of the previous defrost and the possibility to skip the defrost, and the interval set using parameter dI.

- 'd I': interval between defrosts;
- 'd12': enable the function;
- 'dn': nominal duration of the defrost, in proportion to the set defrost timeout (value expressed as a %);
- "dP1" and "dP2": maximum defrost duration for evaporator 1 and 2;
- 'dH': control proportional factor.

Using the following formulae: $dn1 = \frac{dn}{100} dP1$ and $dn2 = \frac{dn}{100} dP2$, the algorithm calculates the nominal defrost times 'dn1' and 'dn2' (in the case of the second evaporator), as percentages "dn" of "dP1" and "dP2".

The parameter 'dH' is a proportional factor that amplifies or attenuates the variation in "dI^n".

$$dI^n = dI + \left[\left(\frac{dn}{100} - \frac{dE}{dP} \right) \cdot dI \cdot \frac{dH}{50} \right]$$

Consequently, in this operating mode, if a defrost lasts less than the time "dn" established, the algorithm will proportionally add (according to the value assigned to parameter dH) the time remaining from the previous defrost to the following defrost interval "dI^1" (see paragraph 6.5.2). As well as this, the algorithm will skip, using the "skip defrost" principle (see paragraph 6.5.3) the following defrost/defrosts depending on the value reached by the skip defrost counter (from 1 to 3).

6.6 Pump down and low pressure

6.6.1 Enabling the function

The pump down function is activated by setting parameter 'c7' (pump down duration) to any value other than zero.
The pump down valve must be connected to one of the auxiliary outputs, by setting the corresponding parameter ('H1', 'H5') as the pump down valve output.
In addition, one of the digital inputs ('A4', 'A5' or 'A9') must be set as a low pressure input.

6.6.2 Pump down function

When the set point is reached, if the minimum compressor ON time 'c3' has elapsed, the controller closes the pump down valve, stopping the gas refrigerant on the compressor suction side.

Parameter 'c10' can be used to select pump down by pressure. In this case, once the pump down valve closes, the compressor continues to operate until reaching the low pressure value or the time 'c7'. After this time, the compressor is stopped, irrespective of the status of the low pressure input. The alarm 'Pd' (pump down ended by timeout) is deactivated.
In this case, the compressor autostart function in pump down is disabled.

Note: if the shut-down request occurs when the compressor is off and the valve open (since, following the opening of the valve, the compressor has not yet started again), the routine closes the valve and if necessary starts the pump down procedure if not in low pressure (if autostart and pump down by pressure is enabled).

When the controller requests the activation of the compressor, if the minimum OFF time 'c2' and the minimum time between two starts of the compressor 'c1' have elapsed, the pump down valve is opened, allowing the gas refrigerant to return to the compressor intake. The compressor is started after the delay time 'c8' from the opening of the valve.

Note: if the start request occurs when the compressor is on and the valve closed (being in pump down or autostart mode), the valve is opened immediately.

6.6.3 Compressor autostart in pump down

The parameter ‘c9’ is used enable the compressor autostart function in pump down. Once the compressor has been stopped in pump down due to low pressure, if the low pressure switch signals an increase in pressure, due to the faulty seal of the pump down valve, the compressor is started again until reaching the low pressure value.
The compressor autostart function considers the minimum OFF time ‘c2’ and the time between two starts ‘c1’, while minimum ON time is ignored. Consequently, when reaching the low pressure value, the compressor is stopped even the time ‘c2’ has not elapsed.
The activation of a compressor autostart cycle in pump down is signalled by the message ‘AtS’. This message is reset automatically on the following correct pump down cycle.

6.6.4 Low pressure alarm

The low pressure alarm ‘LP’ is signalled when the pressure switch signals a low pressure situation with the pump down valve open and the compressor operating. The low pressure alarm signal is nonetheless delayed by the time set for the parameter ‘A7’.
The low pressure is not signalled during the compressor start-up phase (opening of the pump down valve and subsequent activation of the compressor after the time ‘c8’), during the shutdown of the compressor in pump down and the compressor autostart cycle in pump down.
The low pressure alarm shuts off the pump down valve and the compressor.
The low pressure alarm is reset automatically. The low pressure alarm can be reset in any situation.

6.7 Continuous cycle

Pressing  for more than 5 seconds activates the continuous cycle function.
During continuous cycle operation, the compressor continues to operate, independently of the controller, for the time ‘cc’, so as to lower the temperature even below the set point.
If the time ‘cc’ is set to 0, the continuous cycle is never activated.
The continuous cycle is stopped after the time ‘cc’ or when reaching the minimum temperature envisaged, corresponding to the minimum temperature alarm threshold (‘AL’).
If the temperature, after the end of the continuous cycle, falls due to inertia below the minimum temperature threshold, the low temperature alarm signal can be ignored by suitably setting the alarm bypass delay time after continuous cycle, ‘c6’.
If when the activation of the continuous cycle is requested a low temperature alarm (‘AL’) is present, the continuous cycle is not started.

6.7.1 Events that activate the continuous cycle

- Pressing  for more than 5 seconds.

If the duration of the continuous cycle (‘cc’) is set to 0, the continuous cycle is never activated.
If upon the continuous cycle activation request the temperature is below the lower threshold, the continuous cycle is not started.
If upon the continuous cycle activation request the unit is in reverse (heating) mode, by parameter (‘r3’) or digital input (‘A4’, ‘A5’ and ‘A9’), the continuous cycle is not activated in the off status.

6.7.2 Continuous cycle request status

This status exists when the activation of the continuous cycle is requested, however it cannot be started for one of the following reasons:

- compressor protection times (‘c1’, ‘c2’, ‘c3’), as this delays the activation of the compressor;
- immediate or delayed alarm from external digital input (‘A4’, ‘A5’, ‘A9’), if this delays the activation of the compressor;
- defrost, dripping or post-dripping in progress;
- compressor and fan start delay on start-up;
- door open (*see Continuous cycle in progress, below*);
- pump down running;
- low pressure alarm (‘LP’) active, as this delays the activation of the compressor;
- high condenser temperature alarm (‘CHt’) as this delays the activation of the compressor.

During the continuous cycle request, the icon  flashes.

6.7.3 Continuous cycle in progress

When the continuous cycle is running:

- The compressor is always ON;
- The low temperature alarm is deactivated;
- The icon  is on steady.

If, during the continuous cycle, the door is opened and one of the digital inputs is set to manage the opening of the door, the compressor stops and consequently the continuous cycle is temporarily interrupted. When the door closes the continuous cycle starts from where it left off, and thus in practice the timer relating to the duration of the continuous cycle (‘cc’) is put on hold when the door is opened, and starts again when the door closes.

6.7.4 End of the continuous cycle

The continuous cycle ends by:

- pressing  for more than 5 seconds;
- reaching the minimum temperature envisaged (‘AL);
- reaching the maximum duration of the continuous cycle (‘cc’);
- switching off the instrument (OFF) from the keypad or supervisor;
- switching from Direct or Direct with defrost to Reverse (heating) operating mode, by parameter (‘r3’) or digital input (‘A4’, ‘A5’ and ,‘A9’);

The low temperature alarm is bypassed for a time (‘c6’) from the end of the continuous cycle.

6.7.5 Management of the light

The light can be controlled by a number of sources: Button, Supervisor, Door switch and Curtain switch.
The light is switched on and off in the following events:

Light	Action
Button	Pressing the button
Supervisor	Variation in the value from the supervisor
Door switch	Change in the status of the contact (opening/closing)
Curtain switch	Change in the status of the contact (opening/closing)
Light sensor	On detecting light or darkness

When the digital inputs (selected as door or curtain switches) are stable, the light can always be switched on or off from the keypad or the supervisor. **IMPORTANT**: the door switch features two different algorithms for switching the light on/off.

6.7.6 ON/OFF management

The unit can be switched on/off by a number of sources: Button, Supervisor and Digital input.

The digital input has the priority, and controls the ON/OFF status by level.
The other sources have a lower priority, and act by status:

ON/OFF	Priority	Action
Digital input	Highest	According to the level of the digital input
Button	Lowest	Pressing the button
Supervisor	Lowest	Variation in the value from the supervisor

IMPORTANT: if there is more than one digital input selected for the ON/Off function, the ON status will be activated when all the digital inputs are closed. If just one contact is open, the unit is switched OFF.

6.8 High condensing temperature alarm

If a probe is set as a condenser probe (‘/A2’, ‘/A3’, ‘/A4’, ‘/A5’), the condensing temperature can be monitored and a high temperature condition signalled, probably due to situations of fouling and blockage.
If no condenser probe is selected, the condenser pre-alarm and alarm are disabled. The condenser fan output, if selected, is always OFF.

The high condenser temperature threshold can be set using the parameter ‘Ac’. A hysteresis can be set for the activation of the high condenser temperature alarm and for controlling the condenser fans, using the parameter ‘AE’.

If the condenser temperature is >‘Ac’+ (‘AE’/2), the pre-alarm is signalled, and there is no modification to the status of the loads, but rather the display simply shows the message ‘cht’. If in the pre-alarm situation the condenser temperature falls to <‘Ac’, the pre-alarm ends and the signal ‘cht’ disappears.

If the condenser temperature is >‘Ac’ + ‘AE’, the alarm delay timer is started (this can be set using the parameter ‘Acd’). If at the end of the delay ‘Acd’ the temperature is still above the threshold ‘Ac’ + ‘AE’, the alarm ‘CHt’ is activated, the message ‘CHt’ is shown on the display and the compressor is stopped, without observing the safety times (‘c1’, ‘c2’, ‘c3’). ***The alarm ‘CHt’ is manual reset only***. If, on the other hand, the temperature returns below the threshold, the timer is reset and the pre-alarm status or normal operation resumes.

The auxiliary relays can be set as condenser fan outputs (‘H1’, ‘H5’), which are activated if the condenser temperature >‘Ac’ and are deactivated if the condenser temperature <‘Ac’-’AE’.
In the event of a condenser probe error, the pre-alarm ‘CHt’ and the alarm ‘CHt’ are generated automatically.
In the above situation, any auxiliary outputs configured accordingly are activated.

Condenser probe	Pre-alarm	Alarm	Condenser fan outputs selected
Not present	Not generated	Not generated	OFF
Error	Generated	Generated	ON

6.9 HACCP (Hazard Analysis and Critical Control Point)

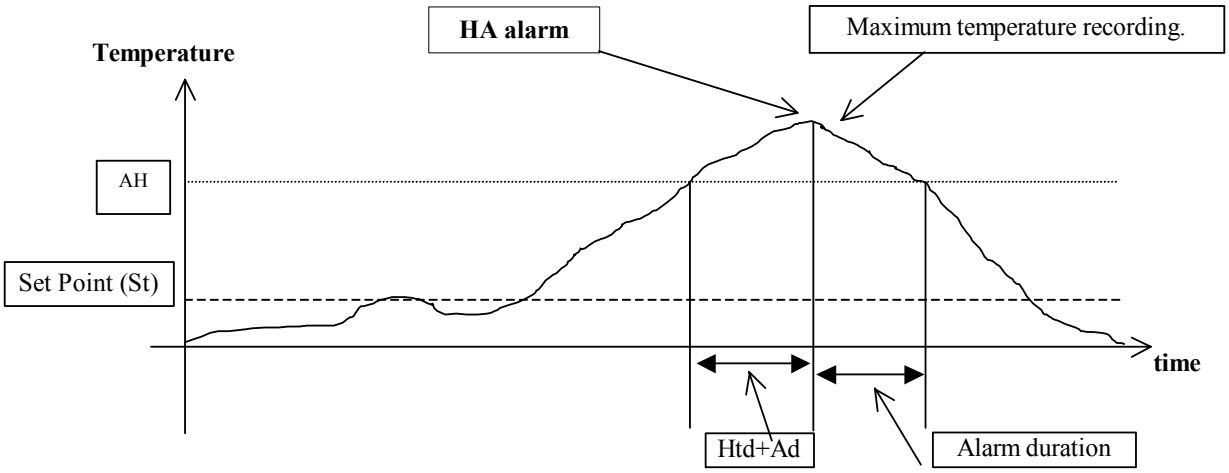
This function allows advanced control of the operating temperature and the recording of any anomalies due to power failures or increases in the operating temperature due to various causes (breakages, severe operating conditions, operator errors, etc…). This function can only be activated on the controllers with the RTC option fitted. There are two types of HACCP alarm, signalled on the display with the following codes respectively:

"HA" - in the event where, during operation, the temperature measured is higher than the threshold set for the parameter "AH" (high temperature alarm threshold) for a time T_h higher than the sum of the parameter "Ad" (specific HA alarm delay for HACCP) and the parameter "Htd" (temperature alarm detection delay), the HA alarm is generated.

- 'HA' alarm: If the control temperature is higher than the threshold value "AH" for a certain time T_h
  Where:
  "AH" = High temperature alarm threshold (check if the programming of parameter "A1" is set for relative or absolute values);
  T_h = 'Ad' + 'Htd';

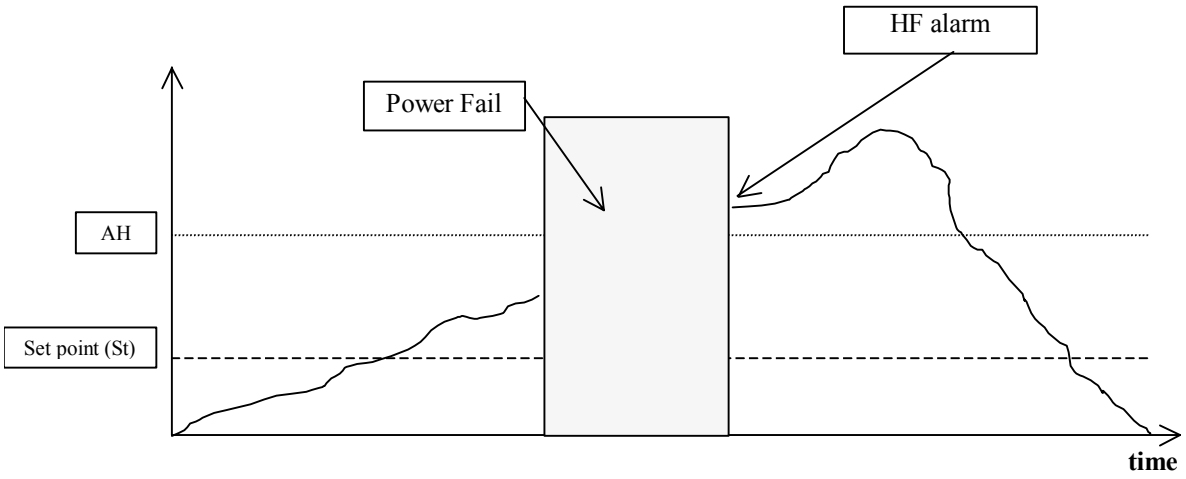
  'Ad': Temperature alarm delay;
  'Htd': 'HA' HACCP alarm delay.

When the event occurs, the following data are saved:
- hour, minutes and day of the week;
- type of alarm;
- maximum temperature reached after the activation of the alarm;
- duration of the alarm.



"HF" – this occurs after a power failure for an extended time (>1 minute) if, when power returns, the temperature is higher than the threshold set for the parameter "AH": the absolute value of AH, if "A1"= 0; the relative value given by "AH" + "St", if "A1"= 1.

The following data are saved:
- hour, minutes and day of the week;
- type of alarm;
- maximum temperature reached after the activation of the alarm;
- duration of the power failure.



The activation of one or both of the alarms causes the HACCP LED to flash and the display of the alarm code, as well as the recording of the alarm to the E^2PROM and the activation of the alarm relay or buzzer (if present).

Pressing HACCP (powercompact) or set and ✻ for more than 5 seconds resets the flashing of the HACCP LED, the HA and/or HF signal and reinitialises the monitoring of HA.
Pressing prg mute mutes the buzzer and resets the alarm relay (if present).

The date and time of the last 3 ‘HA’ and ‘HF’ alarms can be displayed, using the 6 parameters ‘HA’, ‘HA1’, ‘HA2’ and ‘HF’, ‘HF1’, ‘HF2’. The activation of a new ‘HA’ or ‘HF’ alarm moves the list of the last 3 alarms back, deleting the oldest event. The new alarm can be displayed using the parameter that identifies the most recent alarm, that is, ‘HA’ or ‘HF’. The counter of the ‘HAn’ or ‘HFn’ alarm events is increased, until reaching a maximum value of 15.

Note: *the HF alarm is acquired and the corresponding data saved only if the power failure lasts more than 1 minute.*

7. Description of the operating parameters

7.1 Temperature probe parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
1	/2	Measurement stability	MSYF	-	C	4	15	1
2	/3	Probe display rate	MSYF	-	C	0	15	0
3	/4	Virtual probe	MSYF	-	C	0	100	0
4	/5	Select °C or °F	MSYF	flag	C	0	1	0
5	/6	Decimal point	MSYF	flag	C	0	1	0
6	/tI	Display on internal terminal	MSYF	-	C	1	6	1
7	/tE	Display on external terminal	MSYF	-	C	0	6	0
8	/P	Select type of probe	MSYF	-	C	0	2	0
9	/A2	Configuration of probe 2	M-YF	-	C	2	3	0
			-S--	-	C	0	3	0
10	/A3	Configuration of probe 3	MSYF	-	C	0	3	0
11	/A4	Configuration of probe 4	MSYF	-	C	0	3	0
12	/c1	Calibration of probe 1	MSYF	°C/°F	C	0.0	20	-20
13	/c2	Calibration of probe 2	MSYF	°C/°F	C	0.0	20	-20
14	/c3	Calibration of probe 3	MSYF	°C/°F	C	0.0	20	-20
15	/c4	Calibration of probe 4	MSYF	°C/°F	C	0.0	20	-20

'/2': Measurement stability

Defines the coefficient used to stabilise the temperature reading. **Low values** assigned to this parameter allow a prompt response of the sensor to the temperature variations; the reading however become more sensitive to disturbance. **High values** slow down the response, but guarantee greater immunity to disturbance, that is, a more stable and more precise reading.

The parameter "/2" acts on the temperature measurements, filtering the minimum variations, and at the same time considers the average value of the measurements made.

'/3': Probe display rate

This parameter is used to set the rate at which the temperature display is updated. The temperature shown on the display tends to follow rapid deviations away from the set point very slowly, and vice-versa, moves very quickly in the event where the temperature displayed is approaching the set point. If the control temperature exceeds the high or low temperature thresholds and an alarm is activated, 'AL' or 'AH', or if the maximum number of filtering steps (equal to 255) is exceeded (see the Timeout column in the table below), the filtering would immediately be bypassed and the temperature displayed would be the temperature effectively measured, until all the alarms are reset. The action of the parameter '/3' only affects the temperature displayed, and not the temperature used for the control functions.

Important:

- the control temperature effectively measured is different from the temperature displayed. The activation of the outputs consequently may not correspond to the temperature displayed.
- the parameter /3 acts on the temperature displayed by the instrument, if /tE=0 (no probe displayed by the repeater display); if the repeater display is envisaged (/tE <> 0), the parameter /3 will act on the temperature displayed by the repeater.

Example: in the case of "bottle coolers", typically used in supermarkets, when the doors are opened frequently, due to the greater thermal inertia of the liquids compared to the air, and the fact that the probe is positioned in the air and not directly on the products, the instrument measures a temperature that is higher than effective temperature of the soft drinks, thus displaying a quite "unrealistic" temperature. Setting the parameter `'/3'` to a value other than `0`, any abrupt variations in temperature are "filtered" on the display, showing a temperature trend that is "closer" to the actual trend of the product temperature. The following table shows the possible values of `'/3'` and the corresponding display update values (Tdel).

Value of par. '/3'	Display delay (Tdel)	Timeout
0	Disabled	0
1	5 s	21 min.
2	10 s.	42 min.
3	15 s.	64 min.
4	20 s.	85 min.
5	25 s.	106 min.
6	30 s.	127 min.
7	40 s.	170 min.
8	50 s.	212 min.
9	60 s	255 min.
10	75 s	319 min.
11	90 s	382 min.
12	105 s	446 min.
13	120 s	510 min.
14	150 s	637 min.
15	180 s	765 min.

'/4': Probe average (Virtual probe)
This parameter is used to choose whether to control the temperature based solely on the room probe reading, or alternatively whether to refer to the "weighted" average of the room probe S1 and probe 2 (S2, see the parameter '/A2'). This parameter is useful in special applications.

Example: the room probe can be placed at the inlet and probe 2 at the outlet. Control can be performed based on the weighted average of the two values read.
The formula used is: ***probe average (Virtual probe) = ((S1* (100 - P)) + (S2*P)) / 100***
where:
S1 = room probe;
S2 = probe 2;
P = value of the parameter '/4'.

Virtual probe:
- '/4'=0 control is performed using the room probe. This is the typical situation.
- '/4'=100 control is performed in reference to the values read by probe 2.
- '/4'=50 the controller refers to a "virtual" probe, calculated from the average between the room probe and probe 2. With values above 50, probe 2 has a greater weight in the calculation, vice-versa for values below 50.

Warning: in the event of faults or if probe 2 is not enabled, the instrument uses the room probe only. If the fault is on the room probe, the "Control probe" error is signalled.
Default: '/4'=0 => control on room probe.

'/5': Select °C or °F
Defines the unit of measure (degrees centigrade or degrees Fahrenheit).
'/5'=0 to work in degrees centigrade.
'/5'=1 to work in degrees Fahrenheit.
Changes from one unit of measure to the other.
Default: '/5'=0 => operation in degrees centigrade.

'/6': Decimal point
Used to enable or disable the display of the temperature with resolution to the tenth of a degree between -20 and + 20.
NOTE: the exclusion of the decimal point is only refers to the display of the reading on the main and remote displays; the parameters are always set to the tenth of a degree.
'/6'=0 the readings are displayed to the tenth of a degree;
'/6'=1 the readings are displayed without the tenths of a degree.

Default: '/6'=0 => decimal point displayed.

'/tI': Probe displayed by instrument
Selects the probe to be displayed by the instrument.
'/tI'=1 => Virtual probe;
'/tI'=2 => Probe 1;
'/tI'=3 => Probe 2;
'/tI'=4 => Probe 3;
'/tI'=5 => Probe 4;
'/tI'=6 => Not selected.
Warnings:
- Control is always based on the virtual control probe;
- If the probe to be displayed has not been enabled, the display will show the message '___';

Default: '/tI'=1 => Virtual probe.

'/tE': Probe displayed on external terminal
Selects the probe to be displayed on the remote terminal.
'/tE'=0 => Remote terminal not present
'/tE'=1 => Virtual probe;
'/tE'=2 => Probe 1;
'/tE'=3 => Probe 2;
'/tE'=4 => Probe 3;
'/tE'=5 => Probe 3;
'/tE'=6 => Not to be selected.

Warnings:
- Control is always based on the virtual control probe;
- If the probe to be displayed has not been enabled, the display will show the message '___';
- If the probe to be displayed is faulty, the display will show the message '___';
- If the terminal is not present, the display will remain completely dark.

Default: '/tE'=0 => Remote terminal not present.

'/P': Select type of probe
Used to select the type of probe used for the measurements.
'/P'=0 => Standard NTC with range –50/+90°C
'/P'=1 => Enhanced NTC with range –40/+150°C
'/P'=2 => Standard PTC with range –50/+150°C
For correct readings from the PTC probes, the hardware must be fitted to accept PTC readings (as well as NTC).
Default: '/P'=0 => Standard NTC with range –50/+90 °C
Available on all models fitted with NTC inputs.

'/A2': Configuration of probe 2

Used to configure the operating mode of probe 2.
'/A2'= 0 => Probe 2 absent;
'/A2'= 1 => Product probe (used for display only);
'/A2'= 2 => Defrost probe;
'/A2'= 3 => Condenser probe.

In any case, probe 2 is used for the calculation of the virtual control probe.

Default: '/A2'= 2 => Defrost probe; '/A2'= 0 on model S => Probe 2 absent.

'/A3': Configuration of probe 3
Used to configure the operating mode of probe 3.
'/A3'= 0 => Probe 3 absent/Digital input;
'/A3'= 1 => Product probe (used for display only);
'/A3'= 2 => Defrost probe;
'/A3'= 3 => Condenser probe.

Default: '/A3'= 0 => Probe 3 absent;

'/C1': Calibration or offset, probe 1
'/C2': Calibration or offset, probe 2
'/C3': Calibration or offset, probe 3
'/C4': Calibration or offset, probe 4

These parameters are used to correct the temperature measured by the probes, using an offset. The value assigned to these parameters is in fact added to (positive value) or subtracted from (negative value) the temperature measured by the probes.

The temperature value is corrected by the offset before checking if the reading is out-of-range.

Example: to decrease the temperature measured by probe 1 by 2.3 degrees, set '/C1'= -2.3.
The calibration or offset can be set from -20 to +20.

Warning: if the probe is disabled, the display shows the string '___'. In the event of a probe error, the display shows the corresponding error message.

When displaying the parameter, pressing 

shows the value of the corresponding probe already corrected with the offset; pressing 

again displays the code.

Default: '/C1'= 0 => no offset to the reading of probe 1.
'/C2'= 0 => no offset to the reading of probe 2.
'/C3'= 0 => no offset to the reading of probe 3.
'/C4'= 0 => no offset to the reading of probe 4.

7.2 Temperature control parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
16	St	Temperature set point	MSYF	°C/°F	F	0.0	r2	r1
17	rd	Control delta	-SYF	°C/°F	F	2.0	20	0.1
18	r1	Minimum set point allowed	MSYF	°C/°F	C	-50	r2	-50
19	r2	Maximum set point allowed	MSYF	°C/°F	C	60	200	r1
20	r3	Operating mode	-SYF	flag	C	0	2	0
21	r4	Automatic night-time set point variation	MSYF	°C/°F	C	3.0	20	0.0
22	r5	Enable temperature monitoring	MSYF	flag	C	0	1	0
23	rt	Temperature monitoring interval	MSYF	hours	F	-	999	0
24	rH	Maximum temperature read	MSYF	°C/°F	F	-	-	-
25	rL	Minimum temperature read	MSYF	°C/°F	F	-	-	-

'St': Set point
Establishes the set point used by the controller.
Default: 'St'=0.0.

'rd': Control delta
Establishes the value of the differential, or hysteresis, used for temperature control. Low values guarantee a room temperature that deviates only slightly from the set point, but involves frequent starts and stops of the main actuator (normally the compressor). In any case, the compressor can be protected by suitably setting the parameters that limit the number of activations/hour and the minimum OFF time (see the C parameters). In all powercompact instruments for refrigeration, the differential is set to the 'right' of the set point, as shown in the figure (Direct operation).
Default: 'rd'=2.

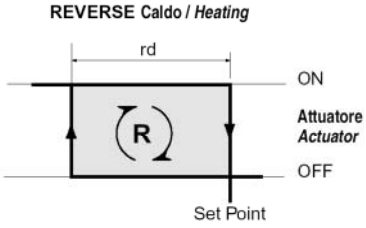
'r1': Minimum set point allowed
Determines the minimum value can be set for the **set point**. Using this parameter prevents the user from setting a set point lower than the value indicated by 'r1'.
Default: 'r1'=-50.

'r2': Maximum set point allowed
Determines the maximum value can be set for the **set point**. Using this parameter prevents the user from setting a set point higher than the value indicated by 'r2'.
Default: 'r2'=+60.

'r3': Operating mode
The **powercompact** can work as a thermostat and defrost controller for static units at normal temperature (r3'=0), as a simple thermostat in Direct operation ('r3'=1), or as simple thermostat in Reverse-cycle operation ('r3'=2).
'r3'=0 Direct thermostat with defrost control (cooling);
'r3'=1 Direct thermostat (cooling);
'r3'=2 Reverse-cycle thermostat (heating).
Also see the description of parameters 'A4', 'A5'and 'A9'.

Notes:
1) with 'r3'=1 and 'r3'=2, the defrosts are always disabled.
2) a digital input set for direct/reverse-cycle control has priority over the operating mode parameter.

Remember that in reverse-cycle operation, the differential is to the 'left' of the set point, as shown in the following figure.
Default: `'r3'=0` => Direct thermostat operation with defrost control.



'r4': Automatic variation of the set point in night-time operation.

This parameter is part of the group relating to the **control of the "curtain switch"**, together with 'A4', 'A5'and 'A9', programmable by configuring the digital inputs. When the "curtain" is closed (and as a consequence the digital input connected to the curtain switch is closed), the controller automatically increases the set point by the value assigned to 'r4' in direct mode (cooling), and automatically decreases the set point by the value assigned to 'r4', in reverse mode (heating).
Default: 'r4'=3.0.
'r5': Enable minimum and maximum temperature monitoring.
'rt': Effective interval for monitoring the maximum and minimum temperature.
'rH': Maximum temperature measured in the interval rt.
'rL : Minimum temperature measured in the interval rt.

All these parameters are used for recording the temperature. These instruments can record the minimum and maximum temperature measured by the ambient probe in a period of up to 999 hours (over 41 days).
To enable this function, proceed as follows:

- set 'r5'=1;
- select 'rt';
- press set to display how many hours the minimum and maximum temperature have been recorded for (if the function has just been enabled, 'rt'=0);
- to start recording the temperatures again, press for more than 5 seconds when displaying the hours (the message 'rES' indicates that the value has been reset). The instrument resets the number of hours and restarts the monitoring process;
- to display the maximum temperature measured by the probe, read the value associated with 'rH';
- to display the minimum temperature measured by the probe, read the value associated with 'rL .

Warning: after the maximum time of 999 hours, the monitoring of the minimum and maximum temperature continues, while the time value remains fixed at 999.

Warnings: if the instrument is not connected to a power backup unit, a temporary power failure will reset the values of 'rt', 'rL and 'rH'. When power returns, the controller automatically starts monitoring the temperature again, with 'rt=0'.
Default: 'r5'=0.

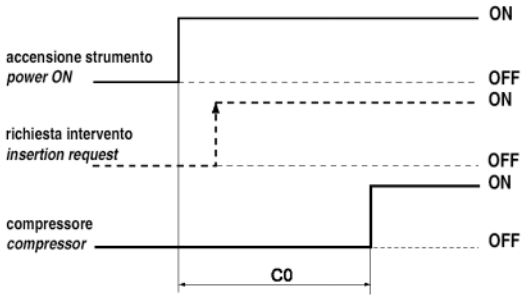
7.3 Compressor management parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
26	c0	Comp. and fan start delay on start-up	-SYF	min	C	0	15	0
27	c1	Minimum time between successive starts	-SYF	min	C	0	15	0
28	c2	Minimum compressor OFF time	-SYF	min	C	0	15	0
29	c3	Minimum compressor ON time	-SYF	min	C	0	15	0
30	c4	Duty setting	-SYF	min	C	0	100	0
31	cc	Continuous cycle duration	-SYF	hours	C	0	15	0
32	c6	Alarm bypass after continuous cycle	-SYF	hours	C	2	15	0
33	c7	Maximum pump down time	-SYF	min	C	0	30	0
34	c8	Comp. start delay after open PD valve	-SYF	sec	C	5	60	0
35	c9	Enable autostart function in PD	-SYF	flag	C	0	1	0
36	c10	Select pump down by time or pressure	-SYF	flag	C	0	1	0
37	c11	Delayed compressor delay	-SYF	sec	C	4	250	0

'c0': Compressor and fan start delay (if 'FAN' relay present) on start-up
When the controller is switched on, the compressor and the evaporator fans start after a delay (in minutes) equal to the value set for this parameter. This delay is used to protect the compressor from repeated starts in the event of frequent power failures.

Example: setting 'c0'=6 obliges the compressor to wait 6 minutes before starting from when power returns.
In the event of systems with more than one compressor, the parameter 'c0' can also be used to avoid simultaneous starts of a series of units. Simply set a different value of 'c0' for each compressor.

Default: 'c0'=0 => no minimum delay is set when the compressor is started when switching the instrument on.

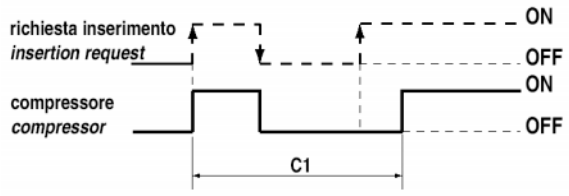


'c1': Minimum time between two successive starts of the compressor

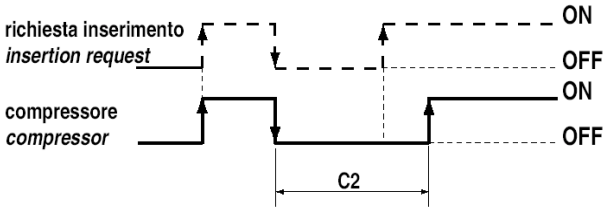
Sets the minimum time (in minutes) that must elapse between two starts of the compressor, irrespective of the temperature and the set point. Setting this parameter limits the number of starts per hour.

Example: if the maximum number of activations/hour allowed is 10, simply set 'c1'=6 to ensure that this limit is respected.

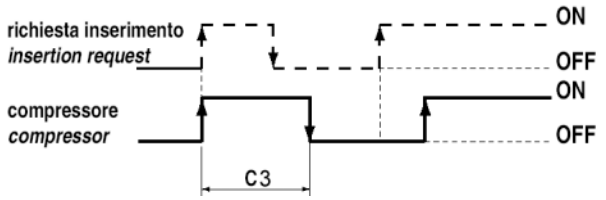
Default: 'c1'=0 => no minimum time is set between two starts.



'c2': Minimum compressor OFF time
Sets the minimum time (in minutes) that the compressor must remain OFF. The compressor is not started again until the minimum time selected ('c2') has elapsed from when it last stopped.
Note: this parameter is useful to ensure the balancing of the pressure after the compressor stops in the case of systems with hermetic and capillary compressors.
Default: `'c2'=0` => no minimum OFF time is set.



'**c3': Minimum compressor ON time**
Sets the minimum running time for the compressor. The compressor is not stopped until it has been ON for at least the minimum time selected ('c3').
Default: 'c3'=0 => no minimum running time is set.

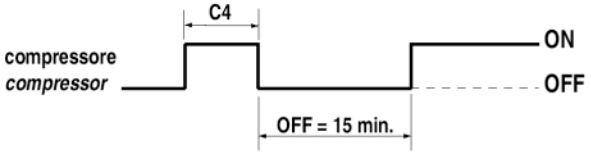


'c4': Duty setting
If the **"virtual control probe fault"** alarm occurs (see parameter '/4'), this parameter is used to ensure the operation of the compressor awaiting the elimination of the fault.
Important: In the event of errors on probe 2, the virtual probe corresponds to the room probe (probe 1) and consequently the Duty Setting ***is not activated***.
In practice, the compressor, no longer being able to operate based on the temperature (due to the probe fault), runs cyclically with an operating time (**ON time)** equal to the value set for the parameter `'c4'` (in minutes) and a fixed **OFF time** of 15 minutes.
ON time = value ('c4')
OFF time = 15 minutes (fixed)
There are two values of `'c4'` that represent special cases:
'c4'=0, in the event of faults involving the virtual control probe, the compressor is always OFF;
'c4'=100, the compressor is always ON, that is, the 15 minute OFF time is ignored.

Special situations:

- If the virtual control probe error occurs while the compressor is OFF, it remains OFF for 15 minutes, and then is started (respecting the times set for parameters 'c1' and 'c2') and remains ON for a time equal to 'c4'. It then starts "duty setting" operation. This special operation is signalled by the ⊖ LED that flashes during the compressor OFF period, and remains on steady when the compressor is operating. The fans continue to operate according the set parameters (see F parameters). If the duty setting requires the immediate shut-down of the compressor for an undetermined time ('c4'= 0), this is done without observing the compressor protection times.
- If the virtual control probe error occurs while the compressor is ON, it remains ON for the time 'c4', and then is stopped (without observing the minimum ON time, if set for parameter 'c3') and remains OFF for 15 minutes (the ⊖ LED flashes in this phase). After this, periodical operation starts, with an operating time equal to the value of 'c4'.

Warning: If the probe error disappears, the unit returns to normal operation;



Default: 'c4'=0 => compressor always Off in the event of a virtual control probe error.

'cc': Continuous cycle duration
This is the time (in hours) that the compressor operates continuously for so as to lower the temperature, even below the set point.
'cc'=0 => the continuous cycle is disabled.
The controller exits the continuous cycle procedure after the time set for parameter 'cc' has elapsed, or upon reaching the minimum temperature envisaged (see the minimum temperature alarm, parameter 'AL').
Default: 'cc'=0 (hours).

'c6': Alarm bypass after continuous cycle
This is the time (in hours) that the temperature alarm is deactivated for after a continuous cycle. If the temperature of the refrigeration unit, after the continuous cycle, falls due to inertia below the minimum temperature (set point – 'AL'), the activation of the low temperature alarm is delayed for the time 'c6'.
Warning: remember that at the minimum temperature envisaged (see the minimum temperature alarm, parameter 'AL') the continuous cycle is forced OFF and deactivated.
Default: 'c6'=2 (hours).

'c7': Maximum pump down time
This parameter determines, depending on the setting of parameter 'c10', the maximum time in minutes within which the circuit must reach the required low pressure value in pump down operation ('c10'=0), or the compressor operating time after the closing of the pump down valve in the event of pump down operation by time ('c10'=1).
The pump down valve must be connected to one of the auxiliary outputs, setting the corresponding parameter ('H1', 'H5') as the pump down valve output.

If pump down by pressure is selected ('c10'=0):
When reaching the maximum pump down time, the compressor stops and the alarm 'Pd' is activated.
The 'Pd' alarm disables the compressor autostart function (see parameter 'c9') with the pump down valve closed, upon the "high pressure" request from the pressure switch.
When the 'Pd' alarm is signalled, the compressor remains OFF until the controller requires cooling.
When reaching the set point, a pump down procedure is run and the alarm is automatically reset if the low pressure is reached within the time 'c7'.
The low pressure is monitored by connecting the low pressure switch to one of the two digital inputs and setting the parameter 'A4', 'A5'or'A9'.

If pump down by time is selected ('c10'=1):
When reaching the compressor operating time 'c7' after the opening of the valve, the compressor is stopped, irrespective of the low pressure reading.
The 'Pd' alarm is deactivated.
In any case, the compressor is stopped when reaching the low pressure.
In this case, autostart in pump down is disabled.
Default: 'c7'=0 => Pump down disabled.

'c8': Start compressor delay after opening of PD valve
This parameter determines after how many seconds from the opening of the pump down valve the compressor starts, and is useful to avoid activating the 'LP' alarm unnecessarily.
The low pressure alarm ('LP') occurs when, with the valve open and compressor ON, the low pressure signal is sent by the pressure switch. The low pressure alarm stops the compressor. The low pressure alarm is reset automatically.
The parameter is active if 'c7'=0.

Default: 'c8'=5 => 5 second delay.

'c9': Enable autostart function with PD operation
If the parameter is set to 0, the system will perform a pump down cycle each time the pump down valve closes.
If the parameter is set to 1, on the other hand, the system will perform a pump down cycle each time the pump down valve closes and on each successive request from the low pressure switch when there is no cooling requirement (autostart situation). The autostart function is disabled if 'Pd' alarms are active or if pump down by time is selected.
The parameter is active if 'c7'=0.
Default: 'c9'=0 => only once pump down cycle is run when the pump down valve is closed.

'c10': Select pump down by pressure or by time
This parameter determines if the pump down procedure must end following the activation of the low pressure switch, or after a set time. In this case, after the closing of the valve, the compressor works for the time 'c7' or until reaching the low pressure value. Once this time has elapsed, the compressor is stopped, irrespective of the status of the low pressure input.
The 'Pd' alarm (pump down ended by timeout) is deactivated.
The compressor autostart function in pump down is deactivated.
Default: 'c10'=0 => Pump down by pressure.

'c11': Delayed compressor delay
This parameter determines the delay of the second compressor, after the main compressor, during start-up. Both compressors stop at the same time,
IMPORTANT: one of the auxiliary outputs must be selected as a delayed compressor, by setting parameters 'H1' and 'H5'.
Default: 'c11'=4 => 4 second delay.

7.4 Defrost management parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
38	d0	Type of defrost	-SYF	flag	C	0	3	0
39	dI	Interval between defrosts	-SYF	hours	F	8	250	0
40	dt1	End defrost temperature, main evap.	-SYF	°C/°F	F	4.0	200	-50
41	dt2	End defrost temperature, aux evap.	-SYF	°C/°F	F	4.0	200	-50
42	dP1	Maximum defrost duration, main evap.	-SYF	min	F	30	250	1
43	dP2	Maximum defrost duration, aux evap.	-SYF	min	F	30	250	1
44	d3	Defrost start delay	-SYF	Min	C	0	250	0
45	d4	Enable defrost on start-up	-SYF	flag	C	0	1	0
46	d5	Defrost delay on start-up	-SYF	min	C	0	250	0
47	d6	Display on hold during defrost	-SYF	-	C	1	2	0
48	dd	Dripping time after defrost	-SYF	min	F	2	15	0
49	d8	Alarm bypass after defrost	-SYF	hours	F	1	15	0
50	d9	Defrost priority over compressor protectors	-SYF	flag	C	0	1	0
51	d/1	Display defrost probe	MSYF	°C/°F	F	-	-	-
52	d/2	Display defrost probe	MSYF	°C/°F	F	-	-	-
53	dC	Time base for defrost	-SYF	flag	C	0	1	0
54	d10	Compressor running time	-SYF	hours	C	0	250	0
55	d11	Running time temperature threshold	-SYF	°C/°F	C	1.0	20	-20
56	d12	Advanced defrost	-SYF	-	C	0	3	0
57	dn	Nominal defrost duration	-SYF	-	C	65	100	1
58	dH	Proportional factor variat. in ‘dI’	-SYF	-	C	50	100	0

Important warning: for the set times to become immediately operational, the instrument needs to be turned off and on again. If the instrument is not turned off, the times will become operational when next used, during the setting of the internal timers.

‘d0’: Type of defrost
Establishes, for the instruments fitted with defrost relays, the **type of defrost**:

- ‘d0’=0 electric heater defrost by temperature;
- ‘d0’=1 hot gas defrost by temperature;
- ‘d0’=2 electric heater defrost by time, ‘Ed1’ and ‘Ed2’ not displayed;
- ‘d0’=3 hot gas defrost by time, ‘Ed1’ and ‘Ed2’ not displayed.

For all models the **defrost** may be performed:

- by temperature, using the defrost probe fitted on the evaporator. In any case, the defrost will be stopped after a maximum set safety time. The alarms ‘Ed1’ and ‘Ed2’ “end defrost due to maximum duration” (parameter ‘A8’) can be disabled;
- by time: without the defrost probe.

Note: model S does not have a defrost relay, and consequently the defrost can only be performed by stopping the compressor. In any case, the end defrost can still be selected by time or temperature.

If the alarms ‘Ed1’ and ‘Ed2’ are not disabled, when activated they can be deleted by pressing prg mute and ❄ together for more than 5 seconds.
The alarms ‘Ed1’ and ‘Ed2’, if present, are deleted at the start of the following defrost.
Default: ‘d0’=0 => electric heater defrost by temperature.

‘dI’: Interval between defrosts
The defrosts are performed periodically at an interval equal to the value of **‘dI’** in hours (or minutes, see parameter ‘dC’). The interval ‘dI’ starts being counted from the end of the previous count. The duration of the defrost therefore does not affect then the interval between defrosts. The interval ‘dI’ is cyclical and is also maintained when the controller is OFF. If the interval ‘dI’ expires when the controller is OFF, when it is started again a defrost will be performed.
If ‘dI’=0 => the defrost is never performed except for when forced from the keypad (manual defrost), from the supervisor or from the digital input (see parameter ‘A4’), or from the Real Time Clock.

Important: To ensure regular defrosts, the interval between defrosts must be greater than the maximum defrost duration, plus the dripping time and post-dripping time.

Note: during the defrost the temperature alarms are disabled.
Default: ‘dI’=8 hours.

'dt1': End defrost temperature SET POINT, main evaporator
This parameter is used to set the end defrost temperature, measured on the evaporator. In any case, the maximum defrost duration is equal to the value, in minutes, set for parameter 'dP1'.

- If when a defrost is requested, the temperature measured by the defrost probe on the evaporator is greater than the value set for the end defrost, the cycle is not performed (including the dripping and post-dripping phases). The same is true for the defrost on start-up, from digital contact, from RTC and from the keypad.
- If the defrost probe on the evaporator is faulty or disabled, the controller performs a timed defrost, with a duration equal to the value set for parameter 'dP1'.
- If the end defrost set point is not reached within the time set for parameter 'dp1', the defrost is stopped. If enabled (parameter 'A8'), the error 'Ed1' is displayed, which persists until the start of the next defrost cycle.

Default: 'dt1'=4°C.

'dt2': End defrost temperature SET POINT, auxiliary evaporator
This parameter is used to set the end defrost temperature, measured on the auxiliary evaporator. In any case, the maximum defrost duration is equal to the value, in minutes, set for parameter 'dP2'.

- If when a defrost is requested, the temperature measured by the defrost probe on the evaporator is greater than the value set for the end defrost, the cycle is not performed (including the dripping and post-dripping phases). The same is true for the defrost on start-up, from digital contact, from RTC and from the keypad.
- If the defrost probe on the auxiliary evaporator is faulty or disabled, the controller performs a timed defrost, with a duration equal to the value set for parameter 'dP2'.
- If the end defrost set point is not reached within the time set for parameter 'dp2', the defrost is stopped. If enabled (parameter 'A8'), the error 'Ed2' is displayed, which persists until the start of the next defrost cycle.

Default: 'dt2'=4°C.

'dP1': Maximum defrost duration, main evaporator
Determines the maximum defrost duration on the evaporator in minutes (or seconds, see parameter 'dC') if defrost by temperature is selected. If timed defrost has been selected, this represents the actual duration of the defrost.
Default: 'dP1'=30 minutes.

'dP2': Maximum defrost duration, auxiliary evaporator
Determines the maximum defrost duration on the auxiliary evaporator in minutes (or seconds, see parameter 'dC') if defrost by temperature is selected. If timed defrost has been selected, this represents the actual duration of the defrost.
Default: 'dP2'=30 minutes.

'd3': Start defrost delay
This parameter determines the time that must elapse, when the defrost is activated, between the stopping of the compressor (electric heater defrost) or the starting of the compressor (hot gas defrost), and the activation of the defrost relays on the main and auxiliary evaporators.
The delay 'd3' is useful, in the hot gas defrost, to ensure a sufficient quantity of hot gas for the defrost before the activation of the reversing valve.
The delay 'd3' is useful, in the electric heater defrost, in special applications (see the paragraph *Description of the software functions*).
Default: 'd3'=0 minutes.

'd4': Defrost when the instrument is switched on
Activates a defrost when the instrument is switched on.
Warning: the defrost request on start-up has priority over the activation of the compressor and the continuous cycle.
The possible values are:
'd4'=0, no defrost is performed when the instrument is switched on;
'd4'=1, a defrost is performed when the instrument is switched on.

Starting a defrost when the instrument is switched on may be useful in special situations.
Example: there are frequent power failures in the system. In the event of a power failure, the instrument resets the internal clock that calculates the interval between two defrosts, starting from zero again. If the frequency of the power failure were, in an extreme case, greater than the defrost frequency (e.g. a power failure every 8 hours, against a defrost every 10 hours) the controller would never perform a defrost. In a situation of this type, it is preferable to enable defrost on start-up, above all if the defrost is controlled by temperature (probe on the evaporator), therefore avoiding unnecessary defrosts or at least reducing the running times.
In the case of systems with a large number of unit, if selecting defrosts at start-up, after a power failure, all the units will start a defrost. This may cause voltage overloads. To overcome this, the parameter `'d5'` can be used, which adds a delay before the defrost; the delay must obviously must be different for each unit.

Default: 'd4'=0 the instrument does not perform a defrost on start-up.

'd5': Defrost delay when the instrument is switched on or from multifunction input
Represents the time that must elapse between the start-up of the controller and the start of the defrost on start-up.

- If the digital input is used to enable the defrost (see parameter 'A4'=3) or to start a defrost from external contact (see parameter 'A4'=4), the parameter 'd5' represents the delay between the enabling of the defrost or its request, and the effective start.
- The defrost digital input (see parameter 'A4') can be used to perform defrosts in real time. Simply connect a timer to the multifunction digital input (see again parameter 'A4'). The defrost will be activated when the timer contact closes.
- In the event of a series of units connected to the same timer, the parameter 'd5' should be used to delay the various defrosts, thus avoiding power overloads. In addition, to avoid unwanted defrosts started by the clock inside the instrument, set parameter 'dI'=0 (manual defrosts only, started from the keypad, by the RTC, by the calculation of the compressor running time or by the Multifunction contact).

Important warning: when connecting a series of units to the same timer, the best solution is to insulate all the contacts galvanically, inserting an intermediate relay for each contact.
Default: 'd5'=0 => no delay in the defrost when switching the instrument on or following the activation of the multifunction input.

'd6': Display during defrost
Values envisaged:

- 'd6'=0 => during the defrost the instrument displays the text 'dEF' alternating with the value read by the probe selected using the parameter '/tI'. This is to signal that any high temperature values are due to the defrost procedure in progress.
- 'd6'=1 => during the defrost the last temperature read before the start of the cycle remains on the display. The display returns to normal when the control temperature reaches the set point, the temperature to be displayed is less than the value locked on the display or, in any case, after the time set for the "alarm bypass after defrosting" ('d8').
- 'd6'=2 => during the defrost the instrument displays the text 'dEF' steady on the display.

Note: in OFF and REVERSE modes, the display is unlocked after the defrost.

Default: 'd6'=1 => during the defrost the last temperature read before the start of the cycle remains on the display.

'dd': Dripping time
This parameter is used to stop the compressor and the evaporator fans after a defrost so as to allow the evaporator to drip. The value of the parameter indicates the minutes that the devices remain OFF for.
If 'dd'=0 => there is no dripping time, therefore at the end of the defrost the control functions start immediately .
Default: 'dd'=2 minutes.

'd8': Alarm bypass time after defrost and/or door open
Indicates the time that the high temperature alarm signal is ignored for after the end of a defrost cycle or when the door to the cold room is opened, if the Multifunction input is connected to the "door switch" (see parameter 'A4', 'A5'or'A9').
Default: 'd8'=1 hour bypass.

'd9': Defrost priority over compressor protectors
Ignores the compressor protection times at the start of the defrost. Compressor protection times:

- 'c1': minimum time between 2 successive starts;
- 'c2': minimum OFF time;
- 'c3': minimum operating time.

'd9' = 0 the protection times are respected
'd9' = 1 the protection times are not respected; the defrost has higher priority and the compressor times are ignored.

In the hot gas defrost, this is useful to avoid delaying the start of the defrost if the compressor has just stopped and there is a minimum time between two starts of the compressor. Remember, however, that in this event the maximum number of compressor starts per hour may not be respected.
Warning: if the defrost requires the activation of the compressor (hot gas defrost) and parameter 'd9'=1, the compressor may risk being damaged due to an excessive number of contiguous starts.
Default: 'd9'=0 => the defrost respects the compressor times (however by default these are set to zero).

'd/1': Defrost probe 1 reading
This parameter is used to display the value measured by defrost probe 1 (in the instruments where this is fitted). Once having selected the parameter 'd/1', pressing the 

button does not allow the value to be modified, but rather simply displays the temperature measured by defrost probe 1.
If defrost probe 1 is disabled, three horizontal dashes '___' will be displayed instead of the value.

‘d/2’: Defrost probe 2 reading
This parameter is used to display the value measured by defrost probe 2 (in the instruments where this is fitted). Once having selected the parameter ‘d/2’, pressing the  button does not allow the value to be modified, but rather simply displays the temperature measured by defrost probe 2.
If defrost probe 2 is disabled, three horizontal dashes ‘___’ will be displayed instead of the value.

‘dC’: Time base
Used to modify the unit of measure used to count the times set for parameters ‘dI’ (defrost interval), ‘dP1’ and ‘dP2’ (defrost duration).
‘dC’=0 =>‘dI’ expressed in hours, ‘dP1’ and ‘dP2’ in minutes.
‘dC’=1 =>‘dI’ expressed in minutes ,’dP1’ and ‘dP2’ in seconds.
The parameter ‘dC’=1 can be used to test the operation of the defrost with reduced times. In addition, it is useful for using the instrument to manage air driers. The defrost cycle then becomes the condensate discharge cycle, which must be performed at close intervals (minutes) and for short durations (seconds).
Default: ‘dC’=0 => that is ‘dI’ (defrost interval) in hours, ‘dP1’ and ‘dP2’ (maximum defrost duration) in minutes.

‘d10’: Compressor running time
This parameter indicates the compressor operating time, with the temperature less than the threshold indicated by the parameter ‘d11’, after which the a defrost request is generated.
Setting ‘d10’=0 disables the function.
Default: ‘d10’=0 => Function disabled.

‘d11’: Running time temperature threshold
This parameter indicates the evaporation temperature below which the compressor must continue to operate for the time ‘d10’ in order to generate a defrost request.
Default: ‘d11’=1 => 1°C.

‘d12’: Advanced auto-adapting defrost
This parameter is used to enable and disable the advanced defrost function, as per the following table:

‘d12’	Skip Defrost	Automatic variation of ‘dI’
0	Disabled	Disabled
1	Disabled	Enabled
2	Enabled	Disabled
3	Enabled	Enabled

Default: ‘d12’=0 => Both the functions are disabled.

‘dn’: Nominal defrost duration
This indicates the average duration of the defrost in normal operating conditions. It is expressed as a percentage, in reference to parameters ‘dP1’ and ‘dP2’, according to the following formulae:

$$dn1 = \frac{dn}{100} dP1$$

$$dn2 = \frac{dn}{100} dP2$$

Example:
with ‘dn’=65, ‘dP1’=90 min. and ‘dP2’=120 min.
Nominal defrost duration on main evaporator: 59 min.
Nominal defrost duration on auxiliary evaporator: 78 min.
Default: ‘dn’=65 => 65% of ‘dP1’ or ‘dP2’

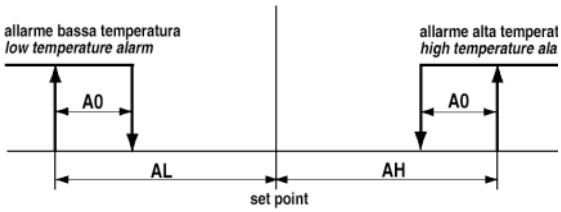
‘dH’: Proportional factor in the variation of the defrost interval
This parameter is used to increase or decrease the influence of the effective duration of the defrost, in relation to the nominal duration, in the algorithm that manages the automatic variation of the defrost interval.
Setting ‘dH’=0 the effective duration has no influence on the duration of the defrost interval. Setting ‘dH’=100 obtains the maximum influence.
Default: ‘dH’=50

7.5 Alarm management parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
59	A0	Alarm and fan differential	MSYF	°C/°F	C	2.0	20	0.1
60	A1	Type of threshold 'AL' and 'AH'	MSYF	flag	C	0	1	0
61	AL	Low temperature alarm threshold	MSYF	°C/°F	F	0.0	200	-50
62	AH	High temperature alarm threshold	MSYF	°C/°F	F	0.0	200	-50
63	Ad	Low and high temperature alarm delay	MSYF	min	F	120	250	0
64	A4	Digital input 1 configuration	-SYF	-	C	0	12	0
			M---	-	C	3	12	0
65	A5	Digital input 2 configuration	MSYF	-	C	0	12	0
66	A6	Stop compressor from external alarm	-SYF	min	C	0	100	0
67	A7	External alarm detection delay	-SYF	min	C	0	250	0
68	A8	Enable alarms 'Ed1' and 'Ed2'	-SYF	flag	C	0	1	0
69	Ado	Light management mode with door switch	MSYF	flag	C	0	1	0
70	Ac	High condenser temperature alarm	-SYF	°C/°F	C	70.0	200	0.0
71	AE	High condens. temperature alarm differential	-SYF	°C/°F	C	5.0	20	0.1
72	Acd	High condens. temperature alarm delay.	-SYF	min	C	0	250	0
73	AF	Light sensor OFF time	-SYF	sec	C	0	250	0

Important warning: for the set times to become immediately operational, the instrument needs to be turned off and on again. If the instrument is not turned off, the times will become operational when next used, during the setting of the internal timers.

A0': Alarm and fan differential



This represents the differential used in the activation of the high and low temperature alarms ('AL' and 'AH') (see the figure shown below) and for the management of the fans (see the F parameters). In the event of an alarm, as can be seen from the figure, the value of 'A0' affects to the determination of the effective activation points of the temperature alarm.

Default: 'A0'=2.0 degrees.

'A1': Type of threshold 'AL' and 'AH'

Used to select if the values of parameters 'AL' and 'AH' are considered absolute thresholds or relative to the value of the set point.
'A1' = 0 => 'AL' and 'AH' are considered as thresholds relative to the value of the set point.
'A1' = 1 => 'AL' and 'AH' are considered absolute thresholds.
Default: 'A1' = 0 => 'AL' and 'AH' are considered relative thresholds.

'AL' : Minimum temperature alarm

Used to determine the activation threshold for the low temperature alarm.
Relative threshold for low temperature alarm = (set point) - (value of 'AL'): 'AL' =0 =>Alarm disabled;
Absolute threshold for low temperature alarm = value of 'AL': 'AL' = -50 =>Alarm disabled.

Important: If the threshold 'AL' is selected as being **relative,** the value for disabling the alarm is **0**, if the threshold 'AL' is selected as **absolute**, the alarm disabling value is **–50**.

Warnings for the relative threshold:

- the value of 'AL' does not indicate the alarm temperature, but rather the maximum deviation allowed from the set point;
- changing the set point automatically changes the low temperature alarm, while the maximum deviation allowed (='AL') remains fixed;

Warnings:

- the low temperature alarm features automatic reset (this means that if the temperature returns above the minimum value set, the alarm signal is cancelled automatically);

Warnings for using the continuous cycle:

- the low temperature alarm is also used in the continuous cycle (see the description of parameter 'cc'). In fact, if the temperature falls to the alarm level, the continuous cycle is stopped automatically, even if the selected time has not yet elapsed. This deactivation however does not involve an alarm signal.

Warnings:

- for the control probe alarm, the low temperature alarm is reset and monitoring reinitialised.

Default: 'AL' =0 => low temperature alarm disabled.

'AH': High temperature alarm
Used to determine the activation threshold for the high temperature alarm.
Relative threshold for high temperature alarm = (set point) + (value of 'AH'): 'AH'=0 =>Alarm disabled;
Absolute threshold for high temperature alarm = value of 'AH': 'AH'= 200 =>Alarm disabled.

Important: If the threshold 'AH' is selected as being **relative,** the value for disabling the alarm is **0**, if the threshold 'AH' is selected as **absolute**, the alarm disabling value is **200**.

Warnings for the relative threshold:
- the value of 'AH' does not indicate the alarm temperature, but rather the maximum deviation allowed from the set point;
- changing the set point automatically changes the high temperature alarm, while the maximum deviation allowed remains fixed;

Warnings:
- the high temperature alarm also features automatic reset.
- for the control probe alarm, the high temperature alarm is reset and monitoring reinitialised.

Default: 'AH'=0 => high temperature alarm disabled.

'Ad': Temperature alarm delay
Indicates after how many minutes the temperature alarm is signalled from when the temperature threshold was exceeded.
Warnings:
- Setting a delay for signalling the temperature alarm may help eliminate false alarms due to interference on the probe signal or brief situations (for example, the door to the cold room opened for a short period);
- No temperature alarms are generated during the defrost and continuous cycle procedures.
- The temperature alarm is delayed by the time 'd8' after the defrost and by the time 'c6' after the continuous cycle. At the end of these two times, the temperature alarm, if detected, is signalled without waiting the time set for 'Ad'. If the timers 'd8' and 'c6' are zero, the temperature alarm is signalled after the time 'Ad'.

As already indicated by the default value for parameters 'AL' and 'AH', the instruments are programmed as default with relative thresholds, and the high and low temperature alarms are disabled. The alarms, when enabled, activate the buzzer, if enabled, and show a code on the display: **'HI'** for the high temperature and **'LO'** for the low temperature alarm. The following conditions generate the temperature alarms:
- **high temperature alarm:** the temperature measured by the virtual control probe is above the threshold set for parameter 'AH';
- **low temperature alarm:** the temperature measured by the virtual control probe is below the threshold set for parameter 'AL' .

Default: 'Ad'=120 => 120 delay, in minutes, for signalling the temperature alarm.

'A4': Multifunction digital input configuration
In the powercompact series, this parameter and the model of controller used define the meaning of the multifunction digital input.
The possibilities are described below:

'A4=0' Input not active
The multifunction digital input is not used. This is the default value for all versions.

'A4=1' Immediate external alarm
The digital input can be connected to an external alarm that requires immediate activation (for example, high pressure alarm or compressor thermal overload).
Specifically, the alarm is detected when the contact opens (normal operation with contact closed).
The activation of the alarm:
- shows the message on the display ('IA');
- activates the buzzer, if enabled;
- activates the alarm relay, if selected;
- involves the following actions on the actuators:
  - compressor: operates depending on the values assigned to parameter 'A6' (stop compressor from external alarm).
  - fans: continue to operate according to the fan parameters ('F').

When stopping the compressor, the minimum ON time ('c3') is ignored. When the alarm stops, the defrost and the continuous cycle can be performed again, and the compressor returns to normal operation.

Important warning: remember that in order to ensure the safety of the unit in the event of serious alarms, all the electromechanical safety devices required to guarantee correct operation must be fitted on the unit.

Note: if more than one digital input is configured as an immediate alarm, the alarm is generated when at least one of the inputs is open.

'A4=2' Delayed external alarm

The delayed external alarm is equivalent to the immediate external alarm ('A4=1'), except that this alarm is signalled after the time 'A7' from when it is detected. This configuration is especially useful for managing the low pressure alarm. In fact, when starting for the first time, the unit often detects a low pressure alarm due to the environmental conditions rather than the malfunctioning of the unit. **Setting a delay for alarm will avoid false signals.** In fact, by suitably calculating the delay, if the low pressure is due to environmental conditions (low temperature), the alarm will be automatically reset before the delay has elapsed.
Note: if more than one digital input is configured as a delayed alarm, the alarm is generated when at least one of the inputs is open.

'A4'=3 The meaning varies according to the model used
- For all other models
'A4'=3 Enable defrost
An external contact can be connected to the multifunction input to enable or inhibit the defrost.

- Contact open:
  - the defrost is inhibited.
- Contact closed:
  - the defrost is enabled.
- Contact closed without request from the controller:
  - the defrost is not performed.
- Contact closed and defrost in progress:
  - when the digital input is opened, the defrost is immediately stopped and the unit restarts normal operation (without performing the dripping or post-dripping phased). The ❄ LED starts flashing to indicate that the defrost request is pending, awaiting the next enabling signal (closing of the contact), when the defrost will be performed completely.

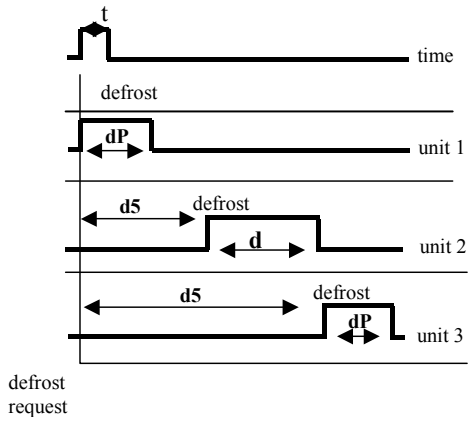
Suggestion: this function is useful, for example, in the event of:
- multiplexed showcases with hot gas defrost. In these systems, defrosts must be performed by "islands", and therefore, at any one time, some islands are enabled to be defrosted, while others are inhibited;
- prevent defrosts on the units accessible by the public during opening times. Any defrost request arriving when the contact is open will remain pending until the contact closes.

Note: if more than one digital input is configured to enable the defrost, the defrost will be disabled when at least one of the inputs is open.

'A4'=4 Start defrost from external contact
This function used to start the defrost from the external contact. If 'dI'=0 and no defrost enabling signal related to the clock is set, the defrost can only be performed on start-up, by the digital input, by the supervisor and from the keypad. This function is useful to run real time defrosts. To do this, simply connect a mechanical or electronic timer to the digital input (select 'A4'=4, if the input chosen is ID1, or alternatively 'A5'=4 if the input chosen is ID2). When the contact of the timer closes, the defrost request is sent. As described in the description of parameter 'd5', a series of units can also be connected to the same timer.

Important warning for versions operating on 12Vac and 12-24Vac: when connecting a series of units to the same timer, the best solution is to insulate all the contacts galvanically, inserting an intermediate relay for each contact.

Setting a different value for 'd5' on each unit will avoid simultaneous defrosts.



Key:
t = impulse from the timer to start the defrost: the minimum duration allowed is 0.5 seconds
dP (1) = maximum defrost duration, unit 1;
d5 (2) = defrost delay from external contact for unit 2; this must be greater than dP (1), unless overlapping defrosts are required
Similarly for d5 (3) and dP (3).

Note: if more than one digital input is configured to start the defrost, the defrost is started when at least one of the inputs closes.

'A4'=5 Door switch with compressor and fan stop
Setting 'A4'=5 manages the cold room door switch. **The behaviour of the door switch depends on whether the door is open with the light OFF or light ON.** The need to differentiate the two operating modes is mainly designed for the control of display cases and cold rooms.

Case 1: light OFF when opening the door.
If the door is opened with the light OFF:

- the compressor and the evaporator fans are switched off (to stop the fans only, set parameter A4=9);
- the light is switched on (only in the models fitted with at least 1 auxiliary relay programmed as the Light output);
- the reading displayed flashes and the ⚠ icon flashes;
- the temperature alarms are disabled.

If the door remains open for a time greater than 'd8', the controller restarts normal operation:

- compressor and fan ON, if requested;
- light ON (at least 1 auxiliary relay is selected as the Light);
- the reading flashes;
- the buzzer and the alarm relay are activated;
- the temperature alarms are enabled.

To stop the reading from flashing, close the door. When the door is closed, the controller returns to normal operation, switching off the light and enabling the temperature alarm after the delay time d8. The compressor is re-started respecting any protection times selected (see the 'c' parameters).

Case 2: light ON when opening the door.
Assuming the user enters the cold room, turning on the light before entering and closing the door behind him, and then subsequently exits the room, closing the door a second time.
When the door is opened:

- the compressor the evaporator fans are switched off (to stop the fans only, set parameter A4=9);
- the light remains ON (only in the models fitted with at least 1 auxiliary relay programmed as a light output);
- the reading displayed flashes and the ⚠ icon flashes;
- the temperature alarms are disabled.

When the door is closed the first time, the controller maintains the previous situation:

- the compressor and the evaporator fans remain OFF;
- the light remains ON;
- the reading displayed flashes and the ⚠ icon flashes;
- the temperature alarms are disabled.

When the door is closed the second time, the controller returns to normal operation, switching off the light and enabling the temperature alarm after the delay time d8. The compressor is re-started respecting any protection times selected (see the 'c' parameters).
If, after opening, the door remains open for a time greater than 'd8', the controller returns to normal operation:

- compressor and fan ON, if requested;
- light OFF;
- the reading flashes;
- the buzzer and the alarm relay are activated;
- the temperature alarms are enabled.

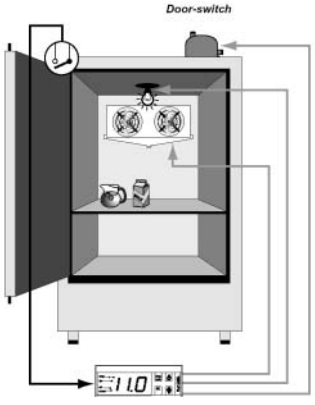
To stop the reading from flashing, close the door.

If, after being closed for the first time, the door remains closed for a time greater than 'd8', the controller restarts normal operation:

- compressor and fan ON, if requested;
- light OFF;
- the temperature alarms are enabled.

If, after the door is closed for the first time, the light is switched off manually, the controller restarts normal operation:

- compressor and fan ON, if requested;
- light OFF;
- the temperature alarms are enabled.



Note: If the light was previously switched on manually, when the door is closed the second time, it is automatically switched off.
Warning: even when the fan is managed by the fan controller (see the family of 'F' parameters), the fans are stopped when the door is open.

This algorithm resolves any problems relating to faults or malfunctions of the "door switch".

Note: if more than one digital input is configured as the door switch, the door open status occurs when at least one of the inputs is open.

'A4'=6 Remote ON/OFF
The digital input can also be programmed as a remote ON/OFF switch. When the contact is closed, the controller is ON.
When the controller is OFF:

- The temperature is displayed alternating with the message 'OFF';
- The internal timer relating to parameter 'dI' is updated. If 'dI' expires when the unit is OFF, a defrost is performed when switched on;
- The auxiliary relays set as AUX and LIGHT remain active, the other auxiliary outputs are deactivated;
- The buzzer and alarm relay are disabled;
- The control functions, defrosts, continuous cycle, signalling the temperature alarm and all other functions are not performed;
- The compressor protection times are observed;
- When the instrument is switched back on, all the functions are re-activated, with the exception of:
    - Defrost on start-up;
    - Compressor and fan delay on start-up;

Contact closed => ON.
The ON/OFF from external digital input has priority over the keypad and the supervisor.
If 'A4'=6 , 'A5'=6 and 'A9'=6 => the controller is ON with all the contacts closed.
Note: if more than one digital input is configured as the remote ON/OFF, the OFF status occurs when at least one of the inputs is open.

'A4'=7 Curtain switch
If the input is selected as a curtain switch, the controller modifies the set point when the contact closes, adding the value of parameter 'r4'; the new value is then used for all the functions relating to the set point (e.g. relative high and low temperature alarms, etc.).
When 'r4'=3.0 (preset value), the set point is increased by 3 degrees from the value used when the curtain is open.

Contact closed => curtain lowered.
If one of the auxiliary outputs is used to manage the light, lowering the curtain automatically switches the light off, while raising it switches the light on.
Note: if more than one digital input is configured as a curtain switch, the curtain open status occurs when at least one of the inputs is open.

'A4'=8 Low pressure switch input for pump down
Setting 'A4'=8 is used to manage the low pressure switch.
The low pressure alarm 'LP' is signalled when the pressure switch signals a low pressure situation with the pump down valve open and the compressor on, if the pump down function is active, or when the compressor is on. The low pressure alarm signal is nonetheless delayed by the time set for parameter 'A7'.
This parameter, together with parameters 'C7', 'C8', 'C9' and 'H1', 'H5', allows the management of the **"pump down" algorithm.**
Contact open => low pressure.

Important: If 'c7'=0 (pump down disabled), the low pressure situation can still be detected.

Note: if more than one digital input is configured as the low pressure switch input, the low pressure alarm is activated when at least one of the inputs is open.

'A4'=9 Door switch with fan stop only
Same as for the option 'A4'=5, with the difference that when opening the door, only the fans are stopped, rather than the compressor and the fans.
Note: if more than one digital input is configured as the door switch, the door open status occurs when at least one of the inputs is open.

'A4'=10 Direct/Reverse operation
The digital input is used to select Direct operation (refrigeration) or Reverse operation (heating). When the contact is open the instrument works in Direct mode, while when the contact is closed it operates in Reverse mode.
A switch can therefore be connected to select, according to the position, heating or cooling operation.
Depending on the value of parameter 'r3', the following configurations are possible:
with 'r3'=0:

- Contact open = Direct operation with defrost control;
- Contact closed = Reverse operation.

with 'r3'=1 or 'r3'=2

- Contact open = Direct operation;
- Contact closed = Reverse operation.

Warning: if 'A4'=10, the status of the digital input has priority over the parameter 'r3', that is, the value assigned to parameter 'r3' is ignored and only the status (open or closed) of the digital input is considered.

Notes:
1) if more than one digital input is configured for direct/reverse operation, the direct mode status occurs when at least one of the inputs is open.
2) the status of the digital input selected for direct and reverse mode control has priority over the operating mode set using parameter 'r3'.

'A4'=11 Light sensor

The digital input is used to read a light sensor (in reality an analogue input, from which a digital signal is taken using the unit light sensor threshold parameter).
The light sensor may be located:
- in the door stop,
- inside the cold room or cabinet.

In the first case, the sensor signals the opening and the closing of the door, with the open door corresponding to light and the closed door corresponding to dark (the sensor is located in the door stop and thus will be covered when the door is closed).
The inside light will be automatically switched on when the door is open and switched off when the door is closed.
The light stays OFF for a minimum time of 5s, so as to avoid rapidly successive impulses of the light relay.
To select this operating mode, set AF=0.

In the second case, the light sensor signals the opening of the door on the cold room or the cabinet due to the outside light that the sensor detects. At this point, the instrument will switch on the inside light.
The closing of the door is measured by time, as the light inside the cold room or cabinet will illuminate the sensor. After the time AF (greater than 0), the inside light is switched off for 5 seconds. If the light sensor signals darkness, the door must be closed and the light will therefore remain OFF. Otherwise, if the sensor signals light, the door must be open and the light will be switched back on.
To select this operating mode, set AF>0
The table below summarises the functions available for the digital input by setting the value of the variable 'A4'.

'A4'=12 Activation of the AUX output

The digital input is used to activate/deactivate the AUX output, if configured with parameters 'H1' or 'H5'.
The operating logic is:

Digital input	AUX output
Opening	deactivation
Closing	activation

The output is activated/deactivated on closing/opening the contact, so as to make this operating mode compatible with the presence of the AUX button and the control signal from the supervisor.
Note: if more than one digital input is configured to activate the AUX output, the open status is true when one of the inputs is open.

The table below summarises the functions of the digital input corresponding to the value assigned to the variable 'A4'.

Value of 'A4'	Meaning	Operation
0	input not active	
1	immediate external alarm	Contact open = alarm active.
2	delayed external alarm	Contact open = alarm active. Delay: see parameter 'A7'.
3	**for the other models:** Enable defrosts.	**for the other models:** Contact closed => Defrosts enabled.
4	start defrost	The defrost is enabled when the contact closes. This can be used for real time defrosts.
5	door switch with compressor and fan stop	Contact open = door open. When the door is opened the compressor and the fans are switched off.
6	remote ON/OFF	Contact closed = On. If 'A4'=6 and 'A5'=6 the controller is On with both the contacts closed.
7	curtain switch	Contact closed = Curtain lowered. If the input is selected as a curtain switch, the controller modifies the set point when the contact closes, adding the value of parameter 'r4'.
8	low pressure switch input for pump down	Contact open = Low pressure
9	door switch with fan stop only	Contact open = door open. When the door is opened the fans are switched off.
10	Direct/Reverse operation	Contact open = Direct operation
11	Light sensor	Above the threshold = off Below the threshold – hysteresis = off
12	Activation of AUX output	Opening = deactivation Closing = activation

Value of 'A4'	Function	Function active	⚠ LED on
0	input not active		
1	immediate external alarm	open = alarm	open
2	delayed external alarm	open = alarm	open
3 model M	select probes	open = probe selected by the parameter '/tI' closed = first probe enabled	
3 other models	enable defrost	closed= enabled	
4	start defrost	closing = defrost request	
5	door switch with compressor and fans OFF	open = door open	
6	remote ON/OFF	open = instrument OFF	
7	curtain switch	closed = curtain closed	
8	low pressure switch	open = low pressure	
9	door switch with fans OFF only	open = door open	
10	direct / reverse	open = direct	
11	light sensor	above the threshold = off	
12	activation of AUX output	opening = deactivation	

Default: 'A4'=0 => Digital input not active (for all other models).

'A5': Configuration of the second multifunction digital input.
For this parameter the same description relating to parameter 'A4' is valid, obviously referring to the second digital input.
Default: 'A5'=0 => Digital input not active.

'A6': Stop compressor from external alarm
The meaning of this parameter is similar to that of parameter 'c4' (duty-setting).
If an external alarm occurs (immediate or delayed), the compressor works for a time equal to the value set for parameter 'A6' (in minutes), while it remains OFF for a fixed period of 15 minutes.
Special cases:
'A6'=0 the compressor is always OFF;
'A6'=100 the compressor is always ON.

The fans continue to be managed according to the set parameters (see category 'F'). If duty-setting for the probe alarm (parameter 'c4') is also active, the controller uses the value of 'c4'.

Default: 'A6'=0 => compressor OFF in the event of external alarms.

'A7': Delay in detecting the external alarm (Multifunction input)
Sets the delay (in minutes) for detecting the external alarm if selected as delayed external alarm ('A4', 'A5' or 'A9'=2).
Sets the delay (in minutes) for signalling the low pressure alarm ('LP') the low pressure switch input is selected ('A4', 'A5' or 'A9'=8).
Default: 'A7'=0.

'A8': Enable alarms 'Ed1' and 'Ed2'
The alarms 'Ed1' and 'Ed2' signal the end of the defrost due to the "maximum duration of the defrost time". These can be disabled by setting 'A8'=0.
The alarms 'Ed1' and 'Ed2', if enabled, are deleted at the start of the following defrost or can be reset manually by pressing the prg mute and ▲ buttons for more than 5 seconds.

Default: 'A8'=0 => alarms 'Ed1' and 'Ed2' disabled.

'Ado': Configuration of the third multifunction digital input
This parameter is used to select the algorithm for managing the door.

Ado	Light on opening the door	Algorithm	Description
0	off	normal	opening-closing
	on	extended	opening-closing-opening-closing
1	off	extended	opening-closing-opening-closing
	on	normal	opening-closing

Default: 'Ado'=0 => Normal algorithm.

'Ac': High condenser temperature alarm

If a probe is set as the condenser probe, the condenser temperature can be monitored to signal the high temperature alarm, probably due to blockages.

If the condenser temperature >'Ac'+ ('AE'/2), the pre-alarm is signalled, displaying the alarm message 'cht'. If in the pre-alarm situation the condenser temperature falls <'Ac', the pre-alarm is reset and the signal 'cht' disappears;

If the condenser temperature increases >'Ac' + 'AE', the alarm 'CHt' is activated and the compressor is stopped. The alarm can only be reset manually.

In addition, the auxiliary relay can be set as a condenser fan output (see parameters 'H1' and 'H5'), controlled according to the following diagram:

In the event of condenser probe errors, the alarm and the pre-alarm are activated.
In the event of condenser probe errors, the condenser fan output, if selected, is activated.
Important: if no condenser probe is selected, the condensing temperature alarm and pre-alarm are disabled and the condenser fan output, if selected, is activated.
Default: 'Ac'=70.0 degrees.

'AE': High condenser temperature alarm differential

This represents the differential used for the activation of the high condenser temperature alarm and the control of the condenser fans.
Default: 'AE'=5.0.

'Acd': High condenser temperature alarm delay

The parameter 'Acd' can be used to set a delay on the activation of the high condenser temperature alarm.
When the threshold 'Ac' + 'AE' is exceeded, the alarm delay timer is started; if when the delay time 'Acd' has elapsed the temperature is still above of the threshold, the alarm 'CHt' is activated. Otherwise, if the temperature returns below the threshold, the timer is reset and the alarm 'CHt' is not displayed.
Default: 'Acd'=0 => 0 minutes.

'AF': Light sensor OFF time

Used to manage the light sensor, connected to a digital input, as:

AF = 0	sensor in the door stop
AF > 0	sensor inside the cold room or cabinet

When AF=0 the inside light is switched on when the sensor detects light, and is switched off when the sensor detects darkness.
The light is switched off for a minimum of 3 seconds, so as to avoid close successive impulses of the light relay.
Note: the sensor must be positioned so as to detect darkness when the door is closed.

When AF>0 the inside light is switched on when the sensor detects light. After a time in seconds equal to AF, the light is switched off for 5 seconds to check if the door has been closed. If darkness is detected, the inside light remains OFF, while if light is detected the inside light is switched back on (after a minimum time of 3 seconds) and the same cycle starts again.

Default: 'AF'= 0.

7.6 Evaporator fan management parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
74	F0	Fan management	---F	flag	C	0	2	0
75	F1	Fan start temperature	---F	°C/°F	F	5.0	200	-50
76	F2	Fan OFF with compressor OFF	---F	flag	C	1	1	0
77	F3	Fans in defrost	---F	flag	C	1	1	0
78	Fd	Fan OFF after dripping	---F	min	F	1	15	0

In normal operation, the powercompact series controllers can manage the evaporator fans in the following modes:
- always ON;
- ON only when the compressor is ON;
- ON according to the evaporator temperature and the room temperature.

'F0': Fan management
The fans can be managed by the "fan controller", which controls them according to the temperature measured by the defrost and virtual control probes.
In alternative, the fans can be always on.
They can be stopped in the following situations:
- when the compressor is OFF (see parameter 'F2');
- during defrosts (see parameter 'F3');
- during the dripping period (see parameter 'dd');
- and for a further post-dripping period (see parameter 'Fd').

They can be forced ON in the following situations:
- during defrosts (see parameter 'F3');

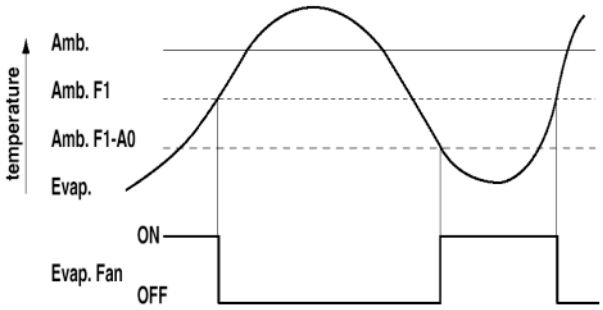
The following values are allowed for this parameter:
'F0'=0 fans always ON;
'F0'=1 fans controlled according to the temperature difference between the virtual control probe and the evaporator temperature;
'F0'=2 fans controlled according to the evaporator temperature.

Warning: remember that if a dripping period is set ('dd'=0), the fans are stopped irrespective of the value of 'F0'.

Default: 'F0'=0 => fans always ON, not managed by the "fan controller".

'F1': Fan start temperature (parameter valid only if 'F0'=1 or 'F0'=2)
When 'F0=1', parameter F1 indicates the minimum difference that must exist between the room temperature and the evaporator temperature for the fans to be started.
Then:
- evaporator temperature < (virtual probe – 'F1'-'A0'), the fans are ON;
- evaporator temperature > (virtual probe – 'F1'), the fans are OFF.

Once stopped, the fans can start again when the difference between the two probes is equal to 'F1'+'A0', where 'A0' is the "fan controller" differential (see the following figure).



When 'F0'=2, parameter 'F1' indicates the absolute temperature for starting the fans.
When 'F0'=2
- evaporator temperature < ('F1'-'A0'), the fans are ON;
- evaporator temperature > ('F1'), the fans are OFF.

Notes:
- in the event of two evaporators and therefore two evaporator probes, control will be performed using the maximum value read by the two probes, so as to ensure that the fans are started when both evaporators reach the set temperature.
- in the event of errors on the control probes, the fans are always on.

Default: 'F1'=5 => as shown in the figure, the fans remain ON while the evaporator is 5 degrees colder than the room temperature.

'F2': Fans OFF with compressor OFF (according to the value of 'F0')
This is used to decide whether the fans must operate as established by parameter F0 (except for in the defrost cycle: see parameters 'F3', 'dd' and 'Fd') or when the compressor is ON.

- 'F2'=0 => the fans are always ON ('F0'=0) or when requested by the fan controller ('F0'=1,2), even when the compressor is OFF;
- 'F2'=1 => the fans are OFF when the compressor is OFF.

Default: 'F2'=1 => fans OFF with compressor OFF.

'F3': Fans in defrost
This is used to decide if the fans should operate or not during the defrosts.

'F3'=0 => the fans operate during defrosts;
'F3'=1 => the fans do not operate during defrosts.

Remember that during the dripping time and post-dripping time, if envisaged, the fans are always OFF.
Default: 'F3'=1 => evaporator fans OFF during the defrost.

'Fd': Fans OFF for post-dripping
The fans, after defrosting, can be stopped for a further period beyond 'dd' (in minutes), defined by the value of 'Fd'. This is useful to allow the evaporator to return to its operating temperature after defrosting, thus avoiding forcing "hot" air into the refrigerated environment.
In the event of management by fan controller, the time 'Fd' does not need to be set, as the controller starts the fans again when the evaporator reaches its operating temperature. If the "fan controller" is active ('F0'≠0), when assigning 'Fd' a value other than zero the fans remain OFF for a time equal to the value of 'Fd', irrespective of the evaporator temperature.

Default: 'Fd'=1 => 1 minute stop for post-dripping.

7.7 General configuration parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
79	H0	Serial address	MSYF	-	C	1	207	0
80	H1	Function of relay 4	MSYF	flag	C	1	10	0
81	H2	Disable keypad/IR	MSYF	flag	C	1	6	1
82	H3	Remote control enabling code	MSYF	-	C	0	255	0
83	H4	Disable buzzer	MSYF	flag	C	0	1	0
84	H5	Function of relay 5	MSYF	-	C	3	10	0
85	H6	Lock keypad	MSYF	-	C	0	255	0
86	H7	Select keypad	MSYF	flag	C	0	1	0
87	HPr	Print profile	MSYF	-	C	0	15	0

'H0': Serial address
This is used to assign to the instrument an address that it responds to when connected to a supervisory or telemaintenance system. Also valid for serial connection or network connection.
Default: 'H0'=1.

'H1': Operating logic of output AUX1 (relay 4)
This establishes whether the fourth relay is used as an auxiliary output (e.g. demister fan or other ON/OFF actuator), as an alarm output, as a light output, as a defrost actuator for the auxiliary evaporator, as a pump down valve control, as the condenser fan output or as a delayed compressor.

- Alarm output: Normally energised. The relay is de-energised when an alarm occurs;

The AUX output in "alarm" mode can be set to operate either with the relay energised or de-energised. Operation with the alarm relay de-energised ensures maximum safety, as that the alarm is also activated in the event of power failures or disconnection of the cables.

- Alarm output: Normally de-energised. The relay is energised when an alarm occurs
- Auxiliary output: The actuator connected can be switched ON/OFF using the aux button.
  Switching the actuator ON/OFF is signalled by the AUX icon on the display.
- Light output: The light on the unit can be switched on/off by pressing the button on the keypad when the door is opened, if the door switch is enabled (see parameter 'A4'). If the door switch is enabled, the light is switched off when the door is closed, unless previously switched on from the keypad. Switching the light on/off is signalled by the icon on the display.
- Auxiliary evaporator defrost output: A heater or reversing valve can be controlled to perform an electric heater defrost or hot gas defrost on the auxiliary evaporator.
- Pump down valve output: The activation and the deactivation of the pump down valve can be controlled.

- Condenser fan output: If the high condenser temperature alarm is activated (see 'Ac'), the output can be used to control the condenser fans.
- Delayed compressor output: The output is activated a few seconds after the compressor starts (the delay is established by parameter 'c11', the deactivation of the compressor output corresponds to the immediate deactivation of the delayed compressor. If this operating mode is set, it is also active during the compressor pump down and autostart phases, if selected with the corresponding parameters.
- Auxiliary output with deactivation when off. In the off status, the auxiliary output cannot be activated. When starting again, the auxiliary output returns to the previous status.
- Light output with deactivation when off. In the off status, the light cannot be activated. When starting again, the light returns to the previous status.
- No function associated with the output. In this case, the logical output AUX1 is not used for any function. If the logical outputs AUX1 and AUX2 are associated with the same relay, this setting in fact allows the relay in question to be associated with the logical output AUX2 only (and the corresponding button and icon). Vice-versa, using this setting for the logical output AUX2 associates the relay with the logical output AUX1 only. This possibility is useful when, having just one auxiliary relay, this needs to be used, according to requirements, as a light relay, associated with the light button and icon, or as an AUX relay, associated with the AUX button and icon.

In summary:
'H1'=0 Alarm output: normally energised. The relay is de-energised when an alarm occurs;
'H1'=1 Alarm output: normally de-energised. The relay is energised when an alarm occurs
'H1'=2 Auxiliary output;
'H1'=3 Light output;
'H1'=4 Auxiliary evaporator defrost output;
'H1'=5 pump down valve output;
'H1'=6 Condenser fan output;
'H1'=7 Delayed compressor output;
'H1'=8 Auxiliary output, with deactivation in OFF;
'H1'=9 Light output, with deactivation in OFF;
'H1'=10 No function associated with the output.

Note: the mode 'H1'=0 is useful for signalling power failures with an alarm.

Default: 'H1'=1 => relay energised with alarm active.
Available on all models fitted with relay 4 and relay 5.

'H2': Disable keypad and/or remote control
Parameter 'H2' can be used to inhibit some functions relating to the use of the keypad, for example, the modification of the parameters and the set point if the unit is accessible by the public. The following possibilities are available:

Keypad functions

Parameter "H2"	0	1	2	3	4	5	6
LIGHT							
ON/OFF AUX					♦	♦	
HACCP PRG/MUTE (mute)							
UP/CC (continuous cycle)					♦	♦	♦
DOWN/DEF (defrost)					♦	♦	♦
SET (modification of type F parameters)	♦		♦			♦	♦
Modification of the set point							
Modification from the remote control							

When the **set point modification** and **parameter modification** functions inhibited, neither the set point nor the type 'F' parameters can be changed, while their values can still be displayed. The type 'C' parameters, on the other hand, being password protected, can **also be modified** from the keypad, following the procedure described previously. With the **remote control** disabled, only the values of the parameters can be displayed, but they cannot be modified; in addition, the mute, defrost, continuous cycle, aux (auxiliary 1), light (auxiliary 2) and on/off functions are disabled.
Warnings: If setting 'H2'=2 or 'H2'=3 from the remote control, this is instantly disabled. To re-enable the remote control, set 'H2'=0 or 'H2'=1 from the keypad.
Default: 'H2'='1' => all enabled

'H3': Enabling code for programming from the remote control
Parameter 'H3' assigns an access code to the remote control. As already described, this allows the remote control to be used when there is more than one controller present on the same panel, without the risk of interference.
For further details, see the paragraph on the use of the remote control.
Default: 'H3'='00' => programming from the remote control without code.

'H4': Disable buzzer

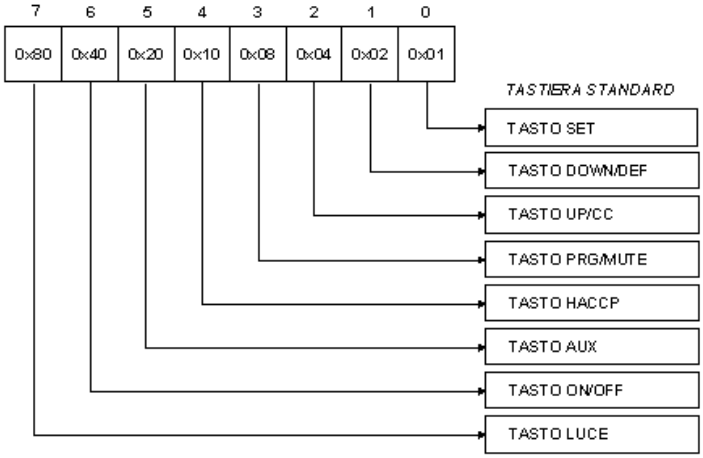
This parameter can have two values:
'H4'=0 buzzer enabled;
'H4'=1 buzzer disabled.

Default: 'H4'=0 => buzzer enabled.
Available on all models.

'H5': Operating logic of output AUX2 (relay 5)
See the description of parameter 'H1'.
Default: 'H5'=3 => Light output.
Available on all models fitted with relay 4 and relay 5.

'H6': Lock keypad
This is used to disable the functions assigned to the individual buttons. Using the corresponding bits, the functions relating to the individual buttons on the keypad can be enabled (setting to 1) or disabled (setting to 0), according to the following relationships:
IMPORTANT: the functions disabled using parameter H6 are added to those disabled using parameter H2..

- **powercompact:**



powercompact keypad

	Value	
Function	Disable	+
SET button	1	
Down/def button	2	
Up/cc button	4	
Prg/mute button	8	
HACCP button	16	
Aux button	32	
ON/OFF button	64	
Light button	128	

Total (value of parameter H6)

To calculate the value to be assigned to parameter H6, simply sum the values assigned to the functions that should be disabled.

Example: enable "SET button", "Aux button", "Light button"

→ 1 + 32 + 128 = 161 → Parameter H6

Bit	Mask	Button	Functions that can be enabled/disabled
0	0x01	set	*Report printing procedure*
1	0x02		*Defrost*
2	0x04		*Continuous cycle*
3	0x08	prg mute	*Mute*
4	0x10		*Enter HACCP*
5	0x20	aux	*Enable/disable auxiliary output 1*
6	0x40		*ON/OFF*
7	0x80		*Auxiliary output 2 ON/OFF*

Table 1: Functions enabled/disabled on the standard keypad.

Bit	Mask	Button	Functions that can be enabled/disabled
0	*0x01*	set	*Report printing procedure* *Enter HACCP*
1	0x02		*Defrost* *Enter HACCP*
2	0x04		*Continuous cycle*
3	0x08	prg mute	*Mute*
4	0x10		*Auxiliary output 2 ON/OFF*
5	0x20	aux	*Enable/disable auxiliary output 1*
6	0x40		*ON/OFF*
7	0x80	%rH	*Relative humidity (percentage)*

Table 2: Functions enabled/disabled on the modified keypad.

Default: 'H6'=0 => all the buttons are enabled.

'H7': Select keypad

'H7'=0 => Use the standard keypad.
'H7'=1 => Use the MODIFIED keypad.

This parameter is used to select the type of keypad on the controller.
Two types of keypads are available: STANDARD and MODIFIED.
The choice of the type of keypad determines whether the user can view the HACCP and %rH (relative humidity percentage) functions.
The functions of the standard keypad are the functions described until now. The MODIFIED keypad moves the HACCP function to the combination set and and enables the %rH function (see the paragraph *DESCRIPTION OF THE SOFTWARE FUNCTIONS*).
In the same ways as on the standard keypad, the functions of the individual buttons can be disabled using parameter 'H6'.
Default: 'H7'=0 => Use the standard keypad.

'HPr': Print profile

This is used to select the profile required for printing the reports on an external printer (see paragraph *Hardware layout and using the printer*).
Default: 'HPr'=0 => Printing reports disabled.

7.8 HACCP alarm management parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
88	HAn	Number of HA events recorded	MSYF	flag	C	0	15	0
89	HA	Date/time of last HA event	MSYF	-	C	-	-	-
90	HA1	Date/time of penultimate HA event	MSYF	-	C	-	-	-
91	HA2	Date/time of third-to-last HA event	MSYF	-	C	-	-	-
92	HFn	Number of HF events recorded	MSYF	-	C	0	15	0
93	HF	Date/time of last HF event	MSYF	-	C	-	-	-
94	HF1	Date/time of penultimate HF event	MSYF	-	C	-	-	-
95	HF2	Date/time of third-to-last HF event	MSYF	-	C	-	-	-
96	Htd	HACCP alarm delay	MSYF	-	C	0	250	0

'HAn' : Number of HA alarm events recorded
This parameter indicates the number of 'HA' alarms activated. A maximum of 15 events can be counted. For each alarm event following the 15th the counter stays at 15.
Default: 'HAn'=0

'HA' : Date/time of the last HA event
'HA1' : Date/time of the penultimate HA event
'HA2' : Date/time of the third-to-last HA event
This parameter accesses a submenu where, by pressing the and buttons, the year, month, day, hour, minutes and duration of the last 'HA' alarm activated can be scrolled.
e.g.: 'y03' -> 'M07' -> 'd22' -> 'h23' -> 'm57' -> 't99'
indicates that the last alarm 'HA' was activated on 22 July 2003 at 23:57 and lasted 99 hours.
Default: 0

'HFn' : Number of HF alarm events recorded
This parameter indicates the number of 'HF' alarms activated. A maximum of 15 events can be counted. For each alarm event following the 15th, the counter stays at 15.
Default: 'HFn'=0

'HF' : Date/time of the last HF event
'HF1' : Date/time of the penultimate HF event
'HF2' : Date/time of the third-to-last HF event
This parameter accesses a submenu where, by pressing the and buttons, the year, month, day, hour, minutes and duration of the last 'HF' alarm activated can be scrolled.
e.g.: 'y03' -> 'M08' -> 'd29' -> 'h19' -> 'm45' -> 't98'
indicates that the last 'HF' alarm was activated on 29 August 2003 at 19:45 and lasted 98 hours.
Default: 0

'Htd' : HACCP alarm delay
Time in minutes that, added to the time 'Ad', determines the time interval after which the 'HA' error is activated.
If set to 0, HACCP monitoring (HA that HF) is disabled.
Any alarms already saved will still be stored, even when 'Htd'=0.
Default: 'Htd'=0 => HACCP monitoring disabled.

7.9 RTC and timed defrost management parameters

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
97	td1	Defrost time band 1	-SYF	-	C	-	-	-
98	td2	Defrost time band 2	-SYF	-	C	-	-	-
99	td3	Defrost time band 3	-SYF	-	C	-	-	-
100	td4	Defrost time band 4	-SYF	-	C	-	-	-
101	td5	Defrost time band 5	-SYF	-	C	-	-	-
102	td6	Defrost time band 6	-SYF	-	C	-	-	-
103	td7	Defrost time band 7	-SYF	-	C	-	-	-
104	td8	Defrost time band 8	-SYF	-	C	-	-	-
105	tc	RTC date/time setting	MSYF	-	C	-	-	-

'td1'...'td8': Defrost time band 1…8
These parameters can be used to set up to 8 defrost events in reference to the system clock.

To display and set or modify one of the events, access one of the parameters between 'td1' and 'td8', and then press set.

Pressing set enters a submenu in which the up or down button can be used to display and set the day, hour and minutes of the defrost event (in the example below: day 8 (from the Monday to Friday), hours 23, minutes 57).
'd08' down 'h23' down 'm57' down 'd08' down…

To modify the day, hour or minutes of the event, access the desired parameter by pressing the up or down button and then press set to modify the value.

When pressing set**,** the letter identifying the parameter disappears, and the value can no longer be increased or decreased using up or down.
The parameter '**d__'** sets the day of the event, as follows:
'd__'=0 => event disabled
'd__'=1..7 => Monday…Sunday
'd__'=8 => from Monday to Friday
'd__'=9 => from Monday to Saturday
'd__'=10 => Saturday and Sunday
'd__'=11 => all days

When 'h__' (0…23), 'm__' (0…59), this sets the hour and minutes of the event.
Default: 'd__'=0, 'h__'=0, 'm__'=0 => Event disabled

Pressing set temporarily saves the changes to the parameter and returns to the submenu for setting the event.
The display or modification of the parameters corresponding to the event can be continued, or alternatively to return to the list of RTC parameters, press prg mute.

'tc': RTC date/time setting
This parameter is used be set the date/time of the Real Time Clock.

Selecting the parameter 'tc' and pressing the set button accesses a submenu in which the up or down button can be used to display and set the current year, month, day of the month, day of the week, hour and minute.
'y03' down 'M03' down 'd06' down 'u04' down 'h11' down 'm56'

Setting in the example: Thursday 6 March 2003 time 11.56, where:
'y__': indicates the year (0…99);
'M__': indicates the month (1…12) where January=1…December=12;
'd__': indicates the day of the month (1...31);
'u__': indicates the day of the week (1...7) where Monday=1…Sunday=7;
'h__': indicates the hour (0...23);
'm__': indicates the minutes (0...59).

To set the RTC parameters, follow the same procedure as described for parameters 'td1'...'td8'.
These parameters have an immediate effect, that is, are saved without having to press the SET button for 5 seconds.

The ‘EtC’ alarm indicates a clock malfunction, described in the table below:

Malfunction	**Solution**	**‘EtC’ reset**
Communication error	Repeat the operations after 5s	automatic
Clock stopped	Restart with kick start	automatic
Incorrect calibration signature	Delete calibration	automatic
Off time calculation on power-up	Cancel off time	automatic
Act time saving	Repeat the operations for each task	automatic
Date and time not correct	Set correct date and time	manual

The ‘EtC’ alarm is generated when the malfunction occurs more than 3 consecutive times. If a malfunction, despite not having generated an ‘EtC’ error, has prevented the correct reading of the current time, the functions relating to the clock (off time calculation, defrost activation on time bands) will be temporarily suspended or performed with reference to the last time read correctly. The clock readings are repeated every 5 seconds.
On power-up, the date and time are set to Saturday (6) 01/01/00 at 00:00.
To cancel the ‘EtC’ error, simply set the clock using the corresponding parameters.

Note: If the ‘EtC’ error appears and the system is then switched off, on re-start the ‘EtC’ will no longer be present, being corrected by the start-up.

8. Tables of alarms and signals

8.1 Table of alarms and signals: display, buzzer and relay.

The following table describes the alarms and signals on the controller, with their description, the status of the buzzer, the alarm relay and the reset mode.

Code	Icon on the display	Alarm relay	Buzzer	Reset	Description
'rE'	flashing	active	active	automatic	virtual control probe fault
'E0'	flashing	off	off	automatic	room probe S1 fault
'E1'	flashing	off	off	automatic	defrost probe S2 fault
'E2'	flashing	off	off	automatic	probe S3 fault
'E3'	flashing	off	off	automatic	probe S4 fault
'E4'	flashing	off	off	automatic	probe S5 fault
'___'	No	off	off	automatic	probe not enabled
'LO'	flashing	active	active	automatic	low temperature alarm
'HI'	flashing	active	active	automatic	high temperature alarm
'IA'	flashing	active	active	automatic	immediate alarm from external contact
'dA'	flashing	active	active	automatic	delayed alarm from external contact
'dEF'	on	off	off	automatic	defrost running
'Ed1'	No	off	off	automatic/manual	defrost on evaporator 1 ended by timeout
'Ed2'	No	off	off	automatic/manual	defrost on evaporator 2 ended by timeout
'Pd'	flashing	active	active	automatic/manual	maximum pump down time alarm
'LP'	flashing	active	active	automatic/manual	low pressure alarm
'AtS'	flashing	active	active	automatic/manual	autostart in pump down
'cht'	No	off	off	automatic/manual	high condenser temperature pre-alarm
'CHT'	flashing	active	active	manual	high condenser temperature alarm
'dor'	flashing	active	active	automatic	door open too long alarm
'Etc'	flashing	off	off	automatic/manual	real time clock fault
'EE'	flashing	off	off	automatic	E²prom error, unit parameters
'EF'	flashing	off	off	automatic	E²prom error, operating parameters
'HA'	HACCP flashing	off	off	automatic	HACCP alarm, 'HA'
'HF'	HACCP flashing	off	off	automatic	HACCP alarm, 'HF'
'rCt'	No	off	off	automatic	instrument enabled for programming from the remote control
'Add'	No	off	off	automatic	automatic address assignment procedure in progress
'Prt'	No	off	off	automatic	printing report
'LrH'	No	off	off	automatic	activation of low relative humidity procedure
'HrH'	No	off	off	automatic	activation of high relative humidity procedure
'ccb'	Signal				start continuous cycle request
'ccE'	Signal				end continuous cycle request
'dFb'	Signal				start defrost request
'dFE'	Signal				end defrost request
'On'	Signal				switch to ON
'OFF'	Signal				switch to OFF
'rES'	Signal				reset alarms with manual reset reset HACCP alarms reset temperature monitoring

The buzzer sounds if enabled by parameter 'H4'.
The alarm relay is activated if one of the outputs, auxiliary 1 or auxiliary 2 ('H1' or 'H5') has been assigned the alarm relay function (normally closed or normally open).
Note: the buzzer is disabled by the CAREL Supervisory System.

8.2 Table of alarms and signals: functions enabled/disabled.

The following table highlights the functions that are enabled and disabled in the various alarm situations.

Code	PD valve	Compressor	Defrost	Evap. fans	Cond. fans	Continuous cycle
‘rE’	Duty setting (‘c4’)	Duty setting (‘c4’)	no effect	no effect	no effect	no effect
‘E0’	Duty setting (‘c4’)	Duty setting (‘c4’)	no effect	no effect	no effect	no effect
‘E1’	no effect	no effect	no effect	no effect	no effect	no effect
‘E2’	no effect	no effect	no effect	no effect	no effect	no effect
‘E3’	no effect	no effect	no effect	no effect	no effect	no effect
‘E4’	no effect	no effect	no effect	no effect	no effect	no effect
‘___’	no effect	no effect	no effect	no effect	no effect	no effect
‘LO’	no effect	no effect	no effect	no effect	no effect	no effect
‘HI’	no effect	no effect	no effect	no effect	no effect	no effect
‘IA’	duty setting (‘A6’)	duty setting (‘A6’)	no effect	no effect	no effect	no effect
‘dA’	duty setting (‘A6’)	duty setting (‘A6’)	no effect	no effect	no effect	no effect
‘dEF’	no effect	no effect	no effect	no effect	no effect	no effect
‘Ed1’	no effect	no effect	no effect	no effect	no effect	no effect
‘Ed2’	no effect	no effect	no effect	no effect	no effect	no effect
‘Pd’	no effect	no effect	no effect	no effect	no effect	no effect
‘LP’	off	off	no effect	no effect	no effect	no effect
‘Ats’	no effect	no effect	no effect	no effect	no effect	no effect
‘cht’	no effect	no effect	no effect	no effect	no effect	no effect
‘CHt’	off	off	no effect	no effect	no effect	no effect
‘dor’	no effect	no effect	no effect	no effect	no effect	no effect
‘Etc’	no effect	no effect	no effect	no effect	no effect	no effect
‘rCt’	no effect	no effect	no effect	no effect	no effect	no effect
‘Add’	no effect	no effect	no effect	no effect	no effect	no effect
‘Prt’	no effect	no effect	no effect	no effect	no effect	no effect
‘LrH’	no effect	no effect	no effect	Off	no effect	no effect
‘HrH’	no effect	no effect	no effect	no effect	no effect	no effect
‘EE’	off	off	no effect	off	off	no effect
‘EF’	off	off	not performed	off	off	not performed
‘HA’	no effect	no effect	no effect	no effect	no effect	no effect
‘HF’	no effect	no effect	no effect	no effect	no effect	no effect

8.3 Summary of operating parameters

UOM = Unit of measure; Def. = Default value.

No.	Code	Parameter	MSYF	UOM	Type	Def.	Max	Min
	Pw	password	MSYF	-	C	22	200	0
1	/2	Measurement stability	MSYF	-	C	4	15	1
2	/3	Probe display response	MSYF	-	C	0	15	0
3	/4	Virtual probe	MSYF	-	C	0	100	0
4	/5	Select °C or °F	MSYF	flag	C	0	1	0
5	/6	Decimal point	MSYF	flag	C	0	1	0
6	/tI	Display on internal terminal	MSYF	-	C	1	6	1
7	/tE	Display on external terminal	MSYF	-	C	0	6	0
8	/P	Select type of probe	MSYF	-	C	0	2	0
9	/A2	Configuration of probe	M-YF	-	C	2	3	0
			-S--	-	C	0	3	0
10	/A3	Configuration of probe 3	MSYF	-	C	0	3	0
11	/A4	Configuration of probe 4	MSYF	-	C	0	3	0
12	/c1	Calibration of probe 1	MSYF	°C/°F	C	0.0	20	-20
13	/c2	Calibration of probe 2	MSYF	°C/°F	C	0.0	20	-20
14	/c3	Calibration of probe 3	MSYF	°C/°F	C	0.0	20	-20
15	/c4	Calibration of probe 4	MSYF	°C/°F	C	0.0	20	-20
16	St	Temperature set point	MSYF	°C/°F	F	0.0	r2	r1
17	rd	Control delta	-SYF	°C/°F	F	2.0	20	0.1
18	r1	Minimum set point allowed	MSYF	°C/°F	C	-50	r2	-50
19	r2	Maximum set point allowed	MSYF	°C/°F	C	60	200	r1
20	r3	Operating mode	-SYF	flag	C	0	2	0
21	r4	Automatic night-time set point variation	MSYF	°C/°F	C	3.0	20	0.0
22	r5	Enable temperature monitoring	MSYF	flag	C	0	1	0
23	rt	Temperature monitoring interval	MSYF	hours	F	-	999	0
24	rH	Maximum temperature read	MSYF	°C/°F	F	-	-	-
25	rL	Minimum temperature read	MSYF	°C/°F	F	-	-	-
26	c0	Comp. and fan start delay on start-up	-SYF	min	C	0	15	0
27	c1	Minimum time between successive starts	-SYF	min	C	0	15	0
28	c2	Minimum compressor OFF time	-SYF	min	C	0	15	0
29	c3	Minimum compressor ON time	-SYF	min	C	0	15	0
30	c4	Duty setting	-SYF	min	C	0	100	0
31	cc	Continuous cycle duration	-SYF	hours	C	0	15	0
32	c6	Alarm bypass after continuous cycle	-SYF	hours	C	2	15	0
33	c7	Maximum pump down time	-SYF	min	C	0	30	0
34	c8	Comp. start delay after open PD valve	-SYF	sec	C	5	60	0
35	c9	Enable autostart function in PD	-SYF	flag	C	0	1	0
36	c10	Select pump down by time or pressure	-SYF	flag	C	0	1	0
37	c11	Delayed compressor delay	-SYF	sec	C	4	250	0
38	d0	Type of defrost	-SYF	flag	C	0	3	0
39	dI	Interval between defrosts	-SYF	hours	F	8	250	0
40	dt1	End defrost temperature, main evap.	-SYF	°C/°F	F	4.0	200	-50
41	dt2	End defrost temperature, aux evap.	-SYF	°C/°F	F	4.0	200	-50
42	dP1	Maximum defrost duration, main evap.	-SYF	min	F	30	250	1
43	dP2	Maximum defrost duration, aux evap.	-SYF	min	F	30	250	1
44	d3	Defrost start delay	-SYF	Min	C	0	250	0
45	d4	Enable defrost on start-up	-SYF	flag	C	0	1	0
46	d5	Defrost delay on start-up	-SYF	min	C	0	250	0
47	d6	Display on hold during defrost	-SYF	-	C	1	2	0
48	dd	Dripping time after defrost	-SYF	min	F	2	15	0
49	d8	Alarm bypass after defrost	-SYF	hours	F	1	15	0
50	d9	Defrost priority over compressor protectors	-SYF	flag	C	0	1	0
51	d/1	Display defrost probe	MSYF	°C/°F	F	-	-	-
52	d/2	Display defrost probe	MSYF	°C/°F	F	-	-	-
53	dC	Time base for defrost	-SYF	flag	C	0	1	0
54	d10	Compressor running time	-SYF	hours	C	0	250	0
55	d11	Running time temperature threshold	-SYF	°C/°F	C	1.0	20	-20
56	d12	Advanced defrost	-SYF	-	C	0	3	0
57	dn	Nominal defrost duration	-SYF	-	C	65	100	1
58	dH	Proportional factor variat. in ‘dI’	-SYF	-	C	50	100	0
59	A0	Alarm and fan differential	MSYF	°C/°F	C	2.0	20	0.1
60	A1	Type of threshold ‘AL’ and ‘AH’	MSYF	flag	C	0	1	0
61	AL	Low temperature alarm threshold	MSYF	°C/°F	F	0.0	200	-50
62	AH	High temperature alarm threshold	MSYF	°C/°F	F	0.0	200	-50

63	Ad	Low and high temperature alarm delay	MSYF	min	F	120	250	0
64	A4	Digital input 1 configuration	-SYF	-	C	0	12	0
			M---	-	C	3	12	0
65	A5	Digital input 2 configuration	MSYF	-	C	0	12	0
66	A6	Stop compressor from external alarm	-SYF	min	C	0	100	0
67	A7	External alarm detection delay	-SYF	min	C	0	250	0
68	A8	Enable alarms 'Ed1' and 'Ed2'	-SYF	flag	C	0	1	0
69	Ado	Light management mode with door switch	MSYF	flag	C	0	1	0
70	Ac	High condenser temperature alarm	-SYF	°C/°F	C	70.0	200	0.0
71	AE	High condens. temperature alarm differential	-SYF	°C/°F	C	5.0	20	0.1
72	Acd	High condens. temperature alarm delay	-SYF	min	C	0	250	0
73	AF	Light sensor OFF time	-SYF	sec	C	0	250	0
74	F0	Fan management	---F	flag	C	0	2	0
75	F1	Fan start temperature	---F	°C/°F	F	5.0	200	-50
76	F2	Fan OFF with compressor OFF	---F	flag	C	1	1	0
77	F3	Fans in defrost	---F	flag	C	1	1	0
78	Fd	Fan OFF after dripping	---F	min	F	1	15	0
79	H0	Serial address	MSYF	-	C	1	207	0
80	H1	Function of relay 4	MSYF	flag	C	1	10	0
81	H2	Disable keypad/IR	MSYF	flag	C	1	6	1
82	H3	Remote control enabling code	MSYF	-	C	0	255	0
83	H4	Disable buzzer	MSYF	flag	C	0	1	0
84	H5	Function of relay 5	MSYF	-	C	3	10	0
85	H6	Lock keypad	MSYF	-	C	0	255	0
86	H7	Select keypad	MSYF	flag	C	0	1	0
87	HPr	Print profile	MSYF	-	C	0	15	0
88	HAn	Number of HA events recorded	MSYF	-	C	0	15	0
89	**HA**	**Date/time of last HA event**	**MSYF**	**-**	**C**		**-**	**-**
	y__	Year	****	Years	*	0	99	0
	M__	Month	****	Months	*	0	12	1
	d__	Day	****	Days	*	0	7	1
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
	t__	Duration	****	Hours	*	0	99	0
90	**HA1**	**Date/time of penultimate HA event**	**MSYF**	**-**	**C**	-	-	-
	y__	Year	****	Years	*	0	99	0
	M__	Month	****	Months	*	0	12	1
	d__	Day	****	Days	*	0	7	1
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
	t__	Duration	****	Hours	*	0	99	0
91	**HA2**	**Date/time of third-to-last HA event**	**MSYF**	**-**	**C**	-	-	-
	y__	Year	****	Years	*	0	99	0
	M__	Month	****	Months	*	0	12	1
	d__	Day	****	Days	*	0	7	1
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
	t__	Duration	****	Hours	*	0	99	0
92	HFn	Number of HF events recorded	MSYF	-	C	0	15	0
93	**HF**	**Date/time of last HF event**	**MSYF**	**-**	**C**	-	-	-
	y__	Year	****	Years	*	0	99	0
	M__	Month	****	Months	*	0	12	1
	d__	Day	****	Days	*	0	7	1
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
	t__	Duration	****	Hours	*	0	99	0
94	**HF1**	**Date/time of penultimate HF event**	**MSYF**	**-**	**C**	-	-	-
	y__	Year	****	Years	*	0	99	0
	M__	Month	****	Months	*	0	12	1
	d__	Day	****	Days	*	0	7	1
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
	t__	Duration	****	Hours	*	0	99	0
95	**HF2**	**Date/time of third-to-last HF event**	**MSYF**	**-**	**C**	0	-	-
	y__	Year	****	Years	*	0	99	0
	M__	Month	****	Months	*	0	12	1
	d__	Day	****	Days	*	0	7	1
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0

	t__	Duration	****	Hours	*	0	99	0
96	Htd	HACCP alarm delay	MSYF	min	C	0	250	0
97	**td1**	**Defrost time band 1**	**-SYF**	**-**	**C**	**-**	**-**	**-**
	d__	Day	****	Days	*	0	11	0
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
98	**td2**	**Defrost time band 2**	**-SYF**	**-**	**C**	**-**	**-**	**-**
	d__	Day	****	Days	*	0	11	0
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
99	**td3**	**Defrost time band 3**	**-SYF**	**-**	**C**	**-**	**-**	**-**
	d__	Day	****	Days	*	0	11	0
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
100	**td4**	**Defrost time band 4**	**-SYF**	**-**	**C**	**-**	**-**	**-**
	d__	Day	****	Days	*	0	11	0
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
101	**td5**	**Defrost time band 5**	**-SYF**	**-**	**C**	**-**	**-**	**-**
	d__	Day	****	Days	*	0	11	0
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
102	**td6**	**Defrost time band 6**	**-SYF**	**-**	**C**	**-**	**-**	**-**
	d__	Day	****	Days	*	0	11	0
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
103	**td7**	**Defrost time band 7**	**-SYF**	**-**	**C**	**-**	**-**	**-**
	d__	Day	****	Days	*	0	11	0
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
104	**td8**	**Defrost time band 8**	**-SYF**	**-**	**C**	**-**	**-**	**-**
	d__	Day	****	Days	*	0	11	0
	h__	Hour	****	Hours	*	0	23	0
	n__	Minutes	****	Min.	*	0	59	0
105	**tc**	**RTC date/time setting**	**MSYF**	**-**	**C**	**-**	**-**	**-**
	y__	Year	****	Years	0	00	99	0
	M__	Month	****	Months	1	1	12	1
	d__	Day of the month	****	Days	1	1	31	1
	u__	Day of the week	****	Days	6	6	7	1
	h__	Hour	****	Hours	0	0	23	0
	n__	Minutes	****	Min.	0	0	59	0

9. Supervisor

The controller supports the CAREL standard serial protocol, version 3.0.

9.1 Semi-automatic procedure for assigning addresses in the CAREL network

The semi-automatic procedure for assigning the addresses in the CAREL network is performed using a program running on a PC that manages the various phases.

9.1.1 Phase 1, acquisition of network status

If staring with a network that is already installed, and new controllers are being added, the status of the network must be acquired. Obviously the new controllers, in this phase, will be excluded from the network. The program on the PC will scan the CAREL network, interrogating all the possible addresses and recording those that are physically present.
The program also refers to the network description table, saved at the end of the previous installation and then recovered, regarding the addresses already assigned, and their description and type.

Example:

Address	Line	Description	Type of unit
1	1	Dairy	IR32
5	1	Meat	IRMPX
7	1	Frozen	IR32

Any new controllers not present in the table will appear without description at the end of the scan. The user can then add the description.

Example:

Address	Line	Description	Type of unit
1	1	Dairy	IR32
2	*1*	*Dairy 3*	*PB*
5	1	Meat	IRMPX
7	1	Frozen	IR32

9.1.2 Phase 2, semi-automatic assignment of the addresses

At this point, the controllers to be included in the network must be added.
The program runs the automatic address assignment procedure.
In this phase, the program sends in network the command:
<STX><padr><'! '><padr_new><ETX><chkh><chkl>
Where **<padr> = 0** so that the command is received by all the controllers.

This is performed only by the controllers that are in address assignment status.
When receiving the command, the controller:

- saves the new serial address,
- sends the response packet to the PC,
- displays the address received;
- exits the address assignment procedure.

The command, received from an instrument with **<padr> <> 0,** assigns the new value contained in **<padr_new>** for the serial address.
The response to the PC is the same as the request for the software version **<'?'>:**

<STX><padr><'V'><Peripheral ID>[<Bios Code>]<ETX><chkh><chkl>

In this way, the program on the PC automatically updates the table with the type of unit. The user needs to have noted the correspondence between the address assigned by the semi-automatic procedure and the description of the controller.

Example:

Address	Line	Description	Type of unit
1	1	Dairy	IR32
2	1	Dairy 3	IR32
3	*1*	*Dairy 2*	*PB*
4	*1*	*Meat 2*	*IRMPX*
5	1	Meat	IRMPX
7	1	Frozen	IR32

At the end of the address assignment procedure, the user can update the descriptions of the new controllers added.

The powercompact controllers can enter the address assignment status with the following sequence of operations:

- pressing SET and PRG/MUTE for 5 seconds;
- setting the password 66;
- pressing SET.

At this point, the instrument will display the message Add. When receiving the new address, it will display the corresponding value for 5 seconds.
The address assignment procedure has a timeout of 60 seconds.

9.1.3 Phase 3, changing addresses

The third phase allows the user to change the addresses assigned to the controllers. The serial address of the controllers can be modified or exchanged.
To do this, modify the serial address of the instruments using free addresses as temporary values.

Example:

Address	Line	Description	Type of unit
1	1	Dairy	IR32
2	*1*	*Dairy 2*	*IR32*
3	1	Dairy 3	IR32
5	1	Meat	IRMPX
6	*1*	*Meat 2*	*IRMPX*
7	1	Frozen	IR32

For some controllers the addresses cannot be changed (as the serial address is not modifiable via the supervisor or is set mechanically). In this case, the program will signal that the desired functions cannot be performed.

9.1.4 Phase 4, generation of the tables

Once the network has been configured, the following files are generated automatically:

- driver.ini (defining the communication parameters on a special screen);
- driver.cct;
- .ncf for PlantVisor;
- description of the network (including the communication parameters).

10. Electrical specifications and connections (standard and small versions)

10.1 Electrical specifications of the powercompact standard and small

Power supply	**Version**	**Voltage**	**Power**
	E	230Vac +10/-15%, 50/60 Hz 230Vac +10/-10%, 50/60 Hz 16 A, 8 A, 8 A version	3 VA
	A	115Vac +10/-15%, 50/60 Hz 115Vac +10/-10%, 50/60 Hz 16 A, 8 A, 8 A version	3 VA
	H	115-230Vac (switching) +10/-15%, 50/60 Hz	6 VA
	0	12 Vac +10/-15%, 50/60 Hz 12 Vdc from 2 to 18 Vdc	4 VA Use only transformer TRADR4W012 315 mA slow-blow fuse in the secondary
	S (small version)	115-230 Vac (switching) +10/-15%, 50/60 Hz	6 VA
Insulation guaranteed by the power supply	E, A, H, S	insulation from very low voltage parts	reinforced 6 mm in air, 8 on surface 3750 V insulation
		insulation from relay outputs	primary 3mm in air, 4 mm on surface 1250V insulation
	0	insulation from very low voltage parts	to be guaranteed externally with safety transformer
		insulation from relay outputs	primary 3 mm in air, 4 mm on surface 1250 V insulation
Inputs	S1	NTC or PTC, depending on the model	
	S2	NTC or PTC, depending on the model	
	DI1 S3	voltage-free contact, contact resistance < 10 ohm, closing current 6 mA NTC or PTC, depending on the model	
	DI2 S4	voltage-free contact, contact resistance < 10 ohm, closing current 6 mA NTC or PTC, depending on the model	
	Maximum probe and digital input distance less than 10m. Note: the power supply and load connections should be kept separate from the probe, digital input, repeater display and supervisor cables.		
Probe types	Std. CAREL NTC	10kΩ at 25 °C, range from -50 °C to +90 °C	
		measurement error:	1 °C in the range from -50 °C to +50 °C
			3°C in the range from -50 °C to +90 °C
	High temperature NTC	50 kΩ at 25 °C, range from -40 °C to +150 °C	
		measurement error:	1.5 °C in the range from -20 °C to +115 °C
			4°C in the range outside of -40 °C to +150 °C
	Std. CAREL PTC	985 Ω at 0°C, range from –50°C to 150°C	
		measurement error	2 °C in the range from -50 °C to +50 °C
			4°C in the range from -50°C to +150°C

Relay outputs	*depending on the model*				
		EN60730-1		**UL 873**	
		current at 250 Vac	operating cycles	current at 250 Vac	operating cycles
	5 A	5 (1) A	100000	5 A res 1FLA 6LRA C300	30000
	8 A	8 (4)A N.O. 6 (4)A N.C.	100000	8 A res 2FLA 12LRA C300	30000
	16 A	10 (4)A up to 60 °C 12 (2)A changeover	100000	12 A res 5FLA 30LRA C300	30000
	30 A (small version)	12 (8)A N.O.	100000	12 A res 12FLA 72LRA	30000
	2HP	10 (10)A	100000	12 A res 12FLA 72LRA	30000
	insulation from the very low voltage parts		reinforced		
			6mm in air, 8 on surface		
			3750 V insulation		
	insulation between the relay outputs		primary		
			3 mm in air, 4 mm on surface		
			1250 V insulation		

Connections	**Type of connection**	**Cross-section**	**Current maximum**
	fixed screw on	for cables from 0.5 to 2.5 mm^2	12 A
	removable for screw blocks		
	faston with crimped contact		
	the correct sizing of the power cables and the connection between the instrument and the loads is the responsibility of the installer.		

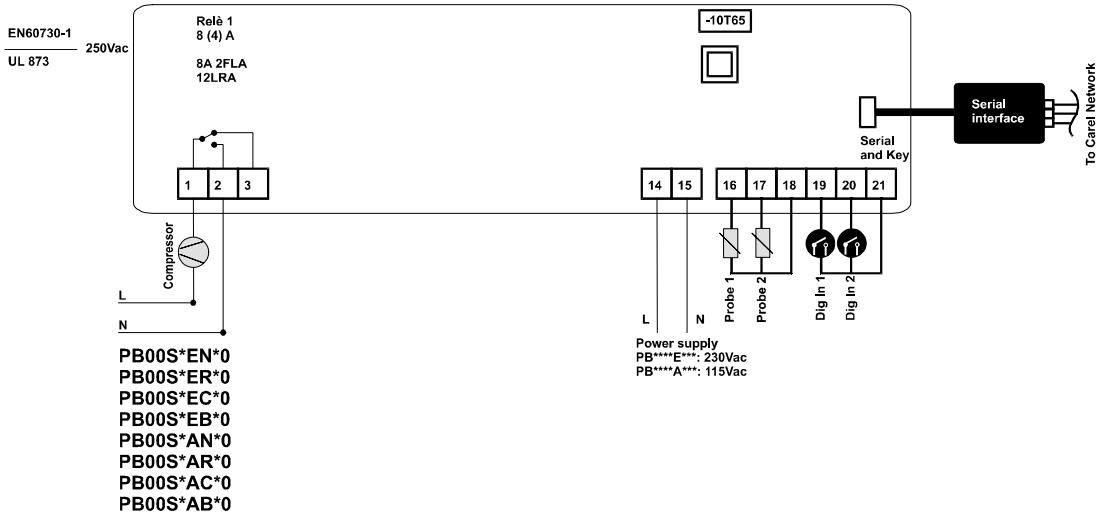
Case	plastic	dimensions 36x167x75 mm (small 36x167x51 mm)
		fitted in depth 64 mm (small 40 mm)
Installation	panel mounting	using screws from the front panel
	drilling template	dimensions 29x138.5 mm
		distance between fastening screws 153.5 mm
	fastening screws	countersunk with maximum diameter of thread 3.9 mm
Display	digits	3 digit LED
	display	from –99 to 999
	operating status	indicated with graphic icons on the display
Keypad	8 silicon rubber buttons	
Infrared receiver	available according to the model	
Clock with backup battery	available according to the model	
Buzzer	available in all models	
Clock	error at 25°C	± 10 ppm (±5.3 min/year)
	error in the temperature range -10/60 °C	- 50 ppm (-27 min/year)
	ageing	< ±5 ppm (±2.7 min/year)
	discharge time	6 months typical (8 months maximum)
	recharge time	5 hours typical (<8 hours maximum)
Operating temperature	-10T65 °C	
Operating humidity	<90% RH non-condensing	
Storage temperature	-20T70 °C	
Storage humidity	<90% RH non-condensing	
Front panel index of protection	panel installation with IP65 gasket	
Environmental pollution	Normal	

PTI of the insulating materials	> 250V
Period of electric stress across the insulating parts	Long
Category of resistance to fire	category D (UL 94-V0)
Class of protection against voltage surges	category 1
Type of connection and disconnection	1c relay contacts (micro-disconnection)
Classification according to protection against electric shock	to be integrated in Class I and II devices
Software class and structure	Class A
Cleaning of instrument front panel	only use neutral detergents and water
Serial interface for CAREL network	External, available on all models
Interface for repeater display	External, available on models with H and 0 power supply.
Programming key	Available on all models

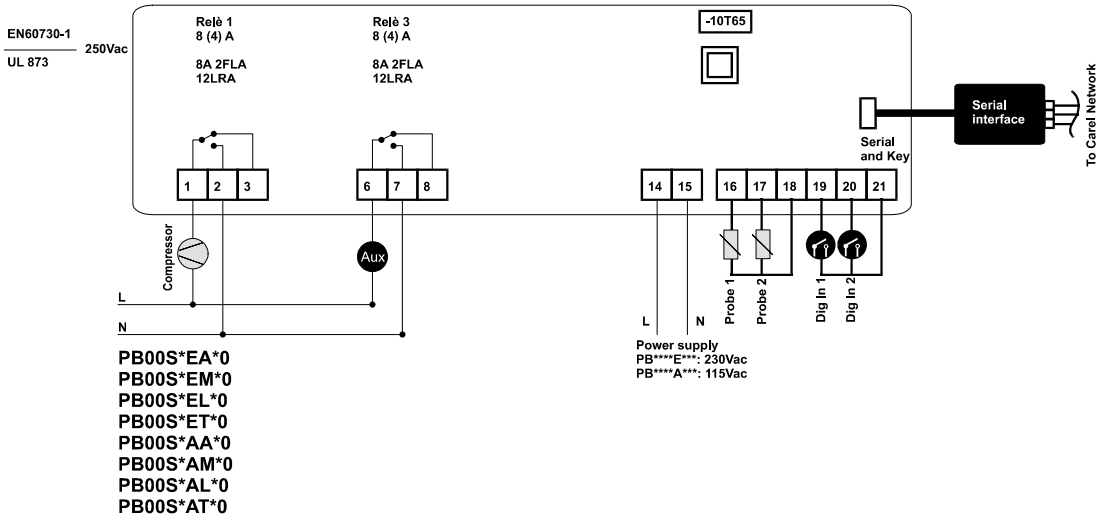
10.2 powercompact standard connections

The following are the connections for the assembly of the powercompact, according to the model:

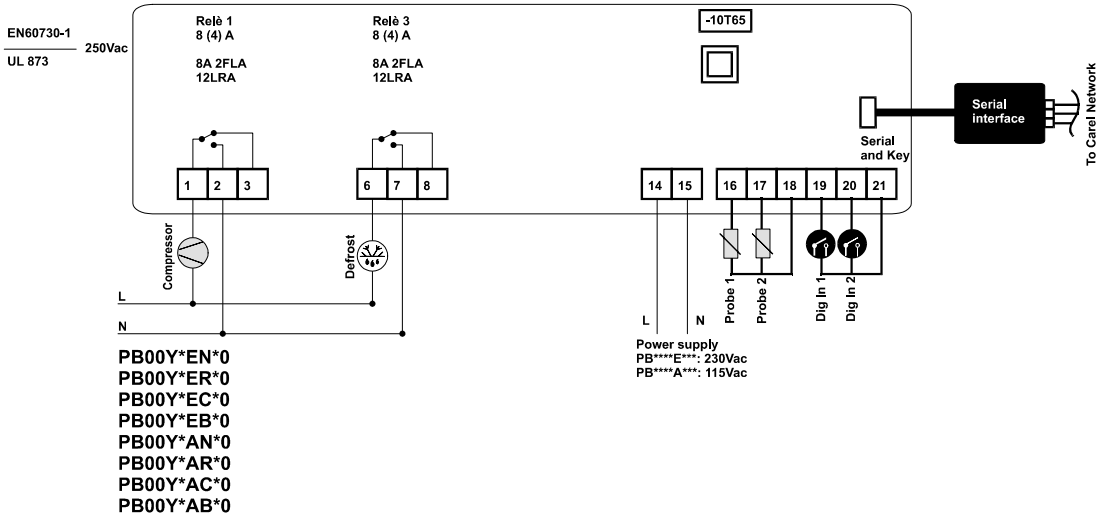
powercompact connections: 230 Vac or 115 Vac transformer version.



PB00S*EN*0
PB00S*ER*0
PB00S*EC*0
PB00S*EB*0
PB00S*AN*0
PB00S*AR*0
PB00S*AC*0
PB00S*AB*0



PB00S*EA*0
PB00S*EM*0
PB00S*EL*0
PB00S*ET*0
PB00S*AA*0
PB00S*AM*0
PB00S*AL*0
PB00S*AT*0



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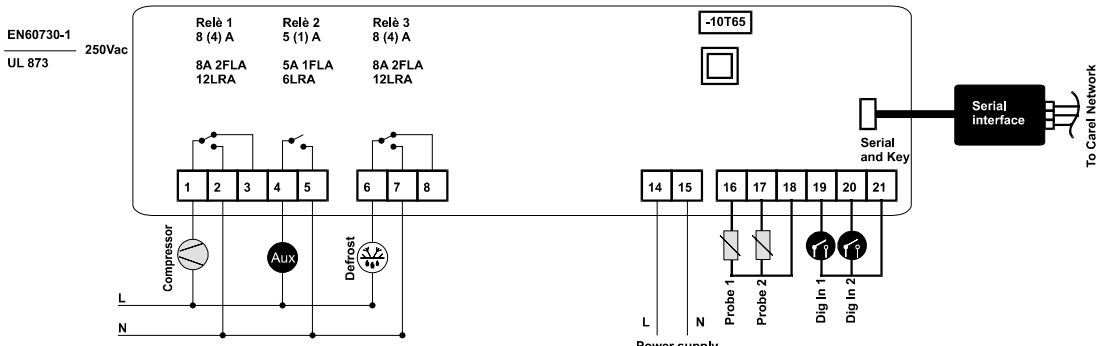
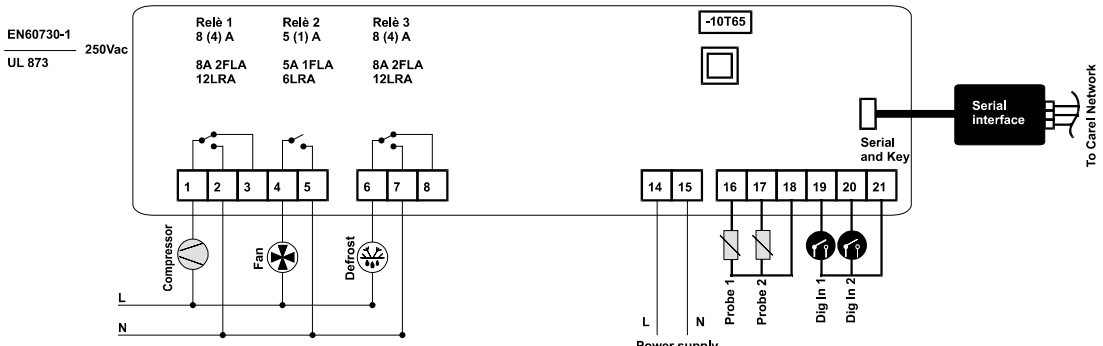
PB00Y*EB*0
PB00Y*AN*0
PB00Y*AR*0
PB00Y*AC*0
PB00Y*AB*0

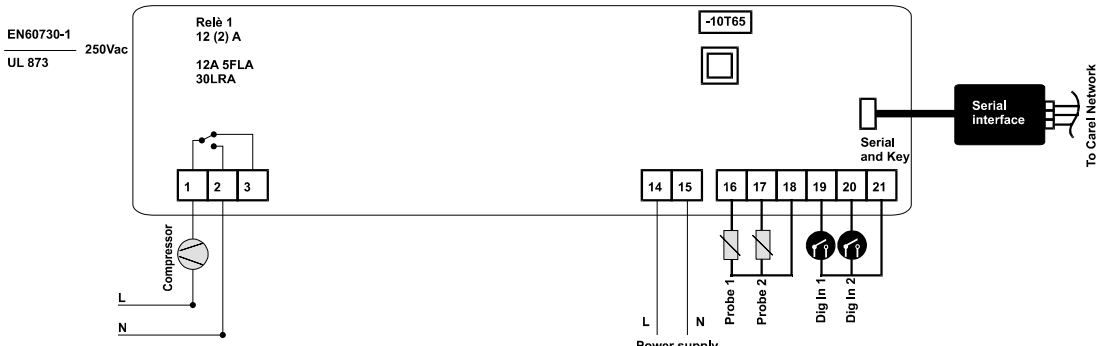


PB00Y*EA*0
PB00Y*EM*0
PB00Y*EL*0
PB00Y*ET*0
PB00Y*AA*0
PB00Y*AM*0
PB00Y*AL*0
PB00Y*AT*0



PB00F*EN*0
PB00F*ER*0
PB00F*EC*0
PB00F*EB*0
PB00F*AN*0
PB00F*AR*0
PB00F*AC*0
PB00F*AB*0

powercompact connections: 230 Vac or 115 Vac with transformer and 16 A relay version



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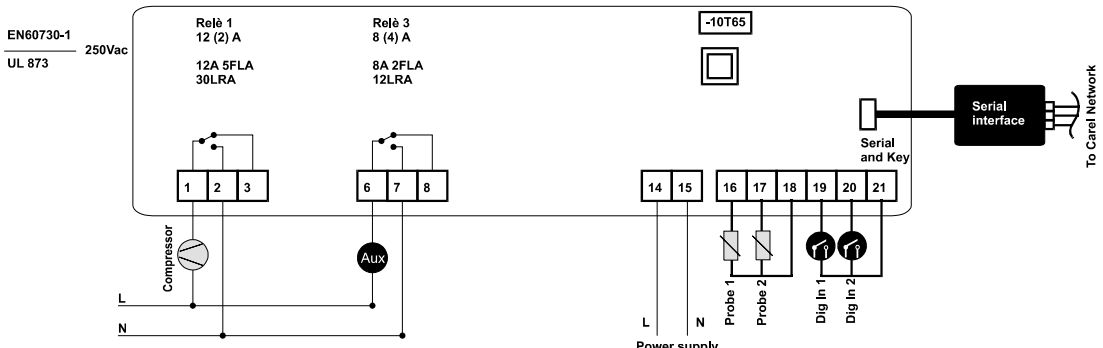

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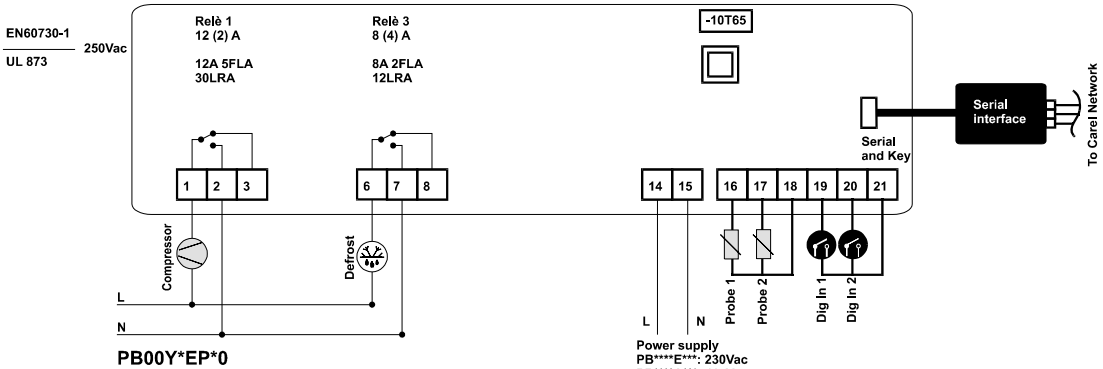
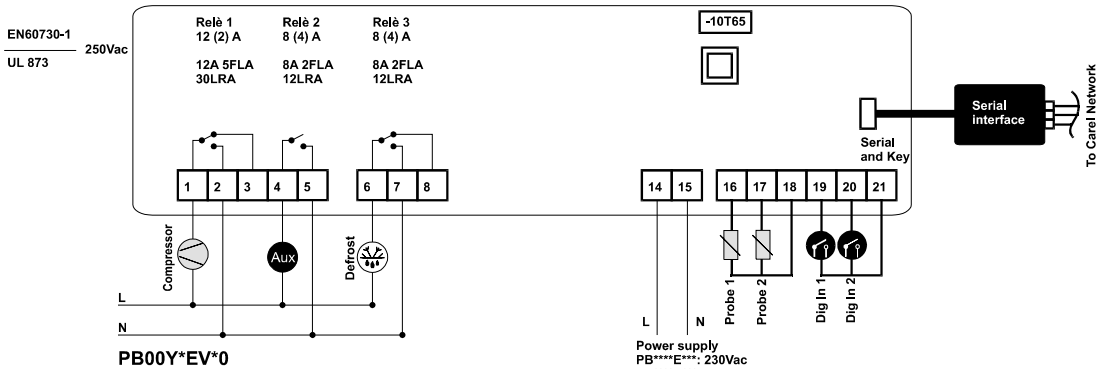
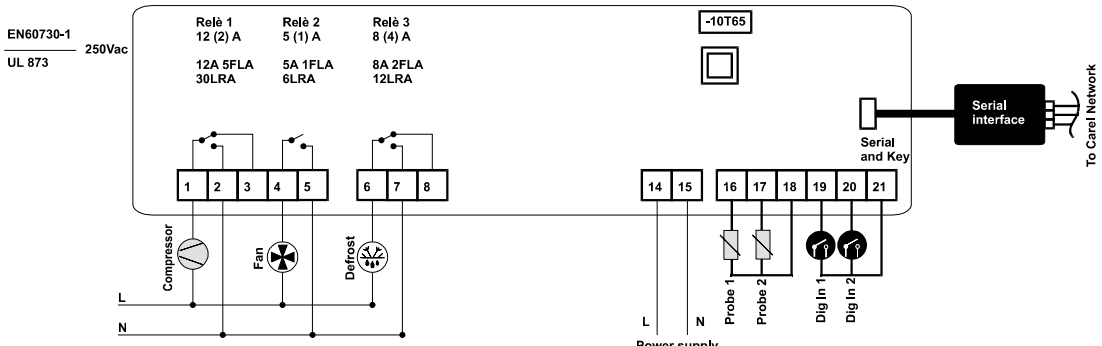
PB00S*AV*0
PB00S*AX*0
PB00S*AY*0
PB00S*AZ*0



PB00Y*EP*0
PB00Y*EQ*0
PB00Y*ES*0
PB00Y*EU*0
PB00Y*AP*0
PB00Y*AQ*0
PB00Y*AS*0
PB00Y*AU*0

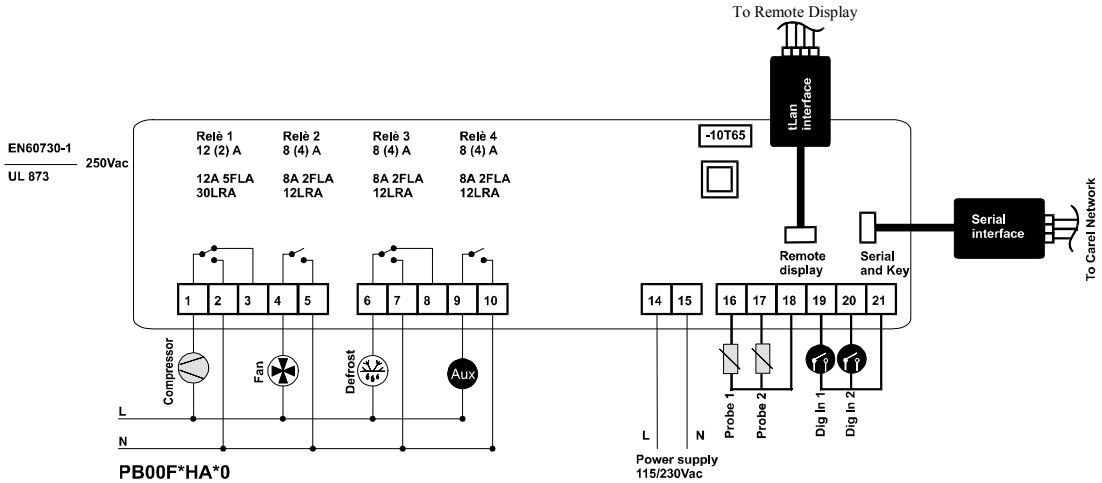


PB00Y*EV*0
PB00Y*EX*0
PB00Y*EY*0
PB00Y*EZ*0
PB00Y*AV*0
PB00Y*AX*0
PB00Y*AY*0
PB00Y*AZ*0

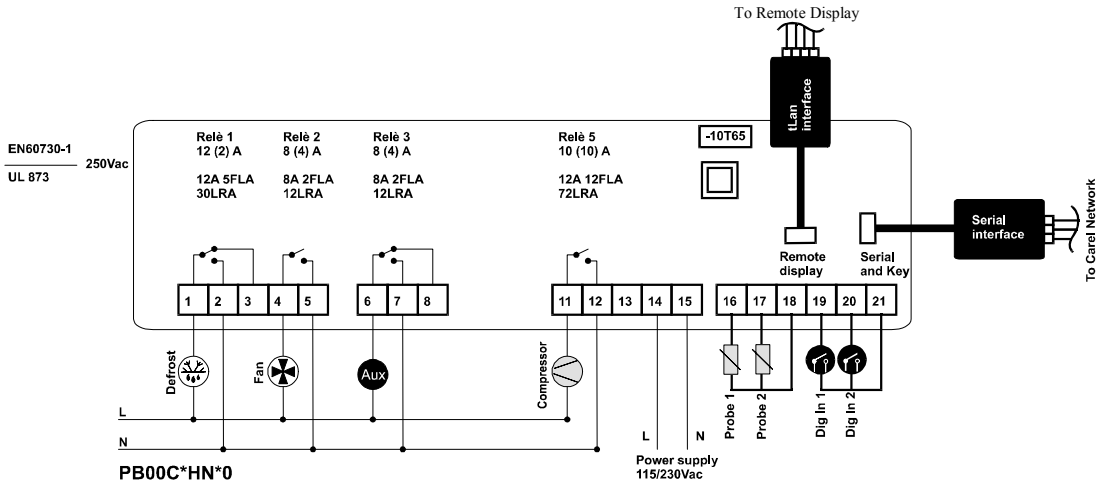


PB00F*EP*0
PB00F*EQ*0
PB00F*ES*0
PB00F*EU*0
PB00F*AP*0
PB00F*AQ*0
PB00F*AS*0
PB00F*AU*0

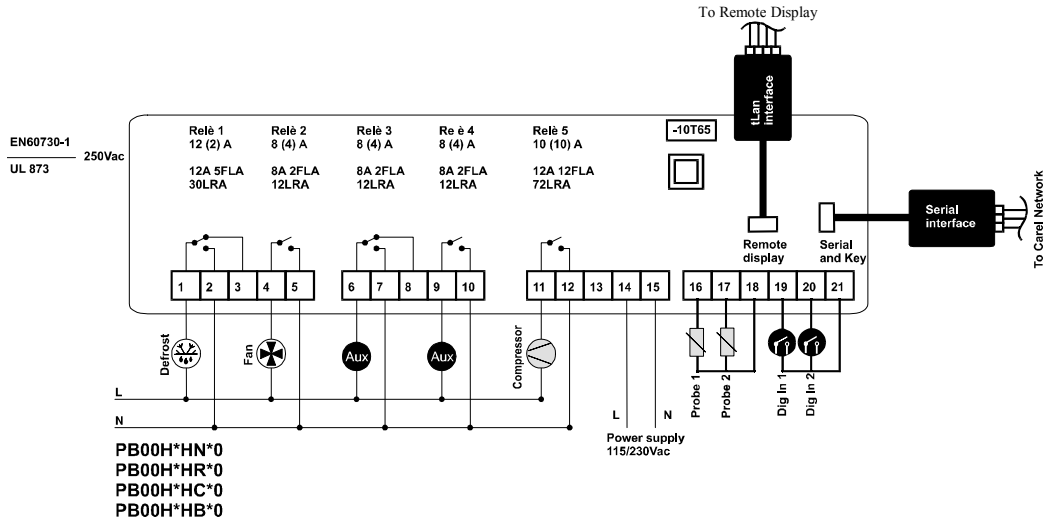
powercompact connections: 115/230Vac switching versions



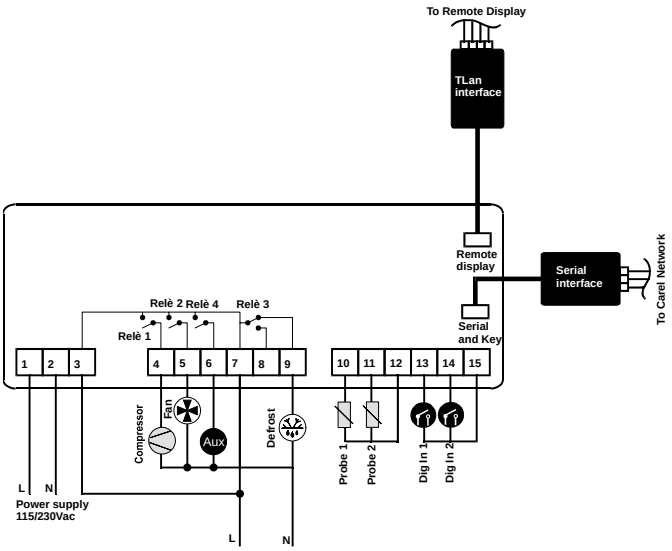
PB00F*HA*0
PB00F*HM*0
PB00F*HL*0
PB00F*HT*0

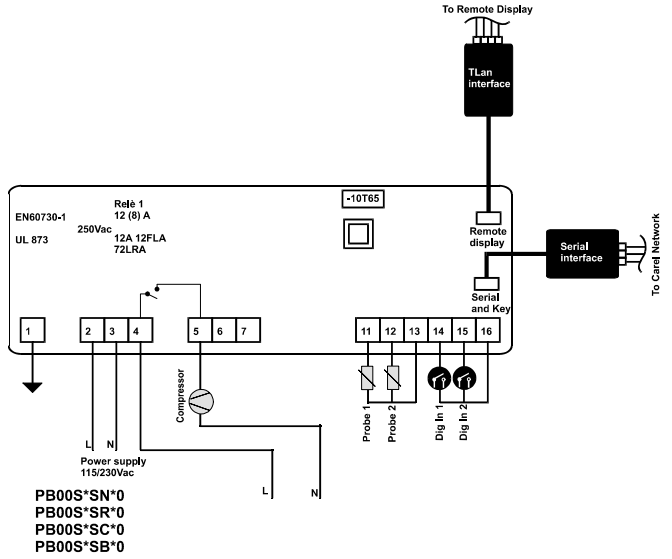


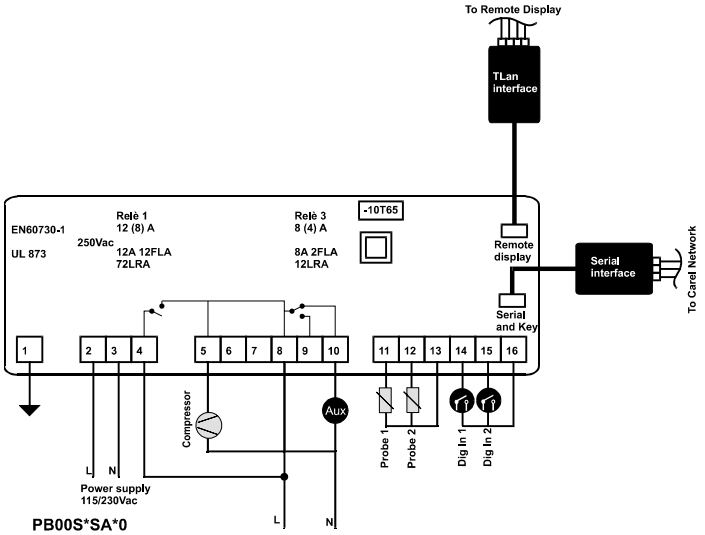
PB00C*HN*0
PB00C*HR*0
PB00C*HC*0
PB00C*HB*0



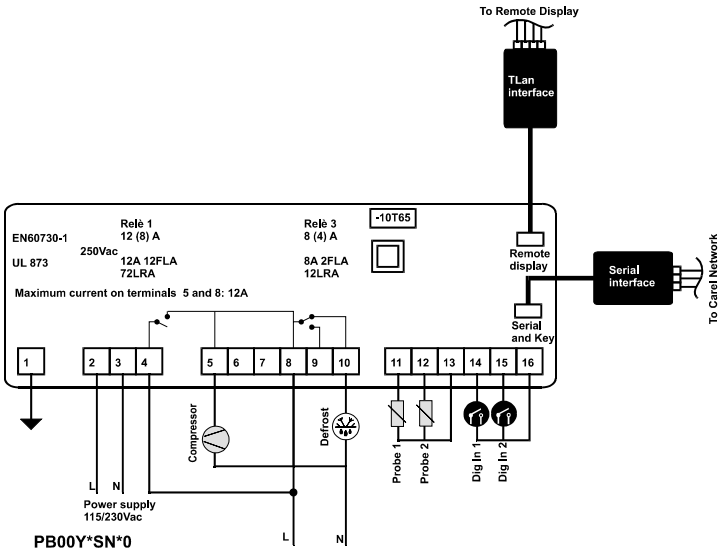
10.3 powercompact small connections (model S and C)



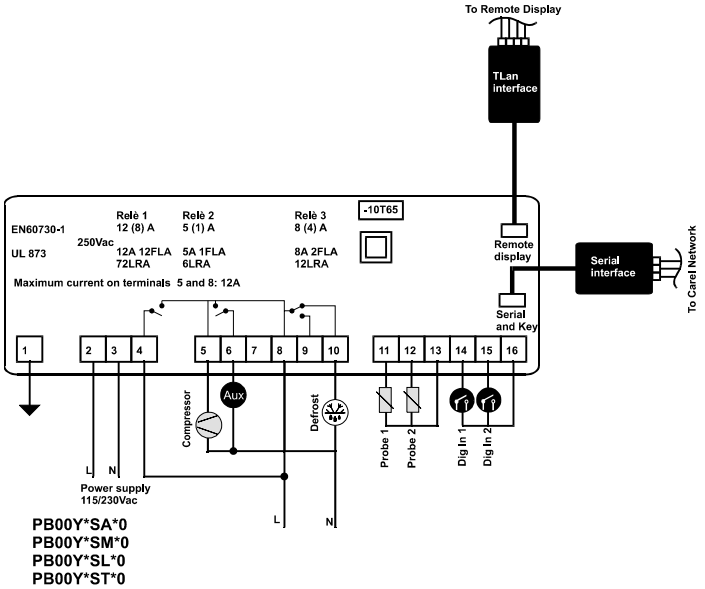




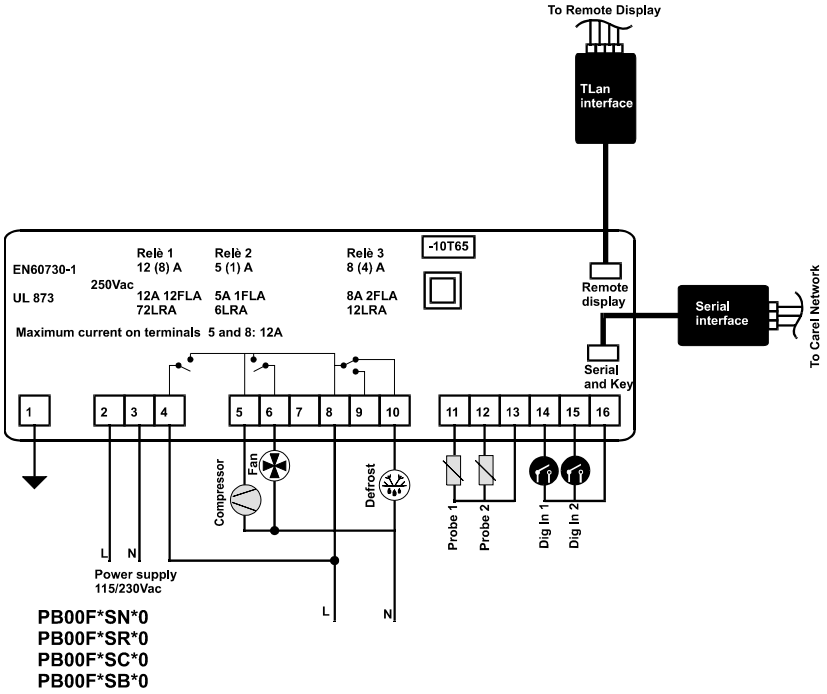
PB00S*SA*0
PB00S*SM*0
PB00S*SL*0
PB00S*ST*0



PB00Y*SN*0
PB00Y*SR*0
PB00Y*SC*0
PB00Y*SB*0



PB00Y*SA*0
PB00Y*SM*0
PB00Y*SL*0
PB00Y*ST*0



PB00F*SN*0
PB00F*SR*0
PB00F*SC*0
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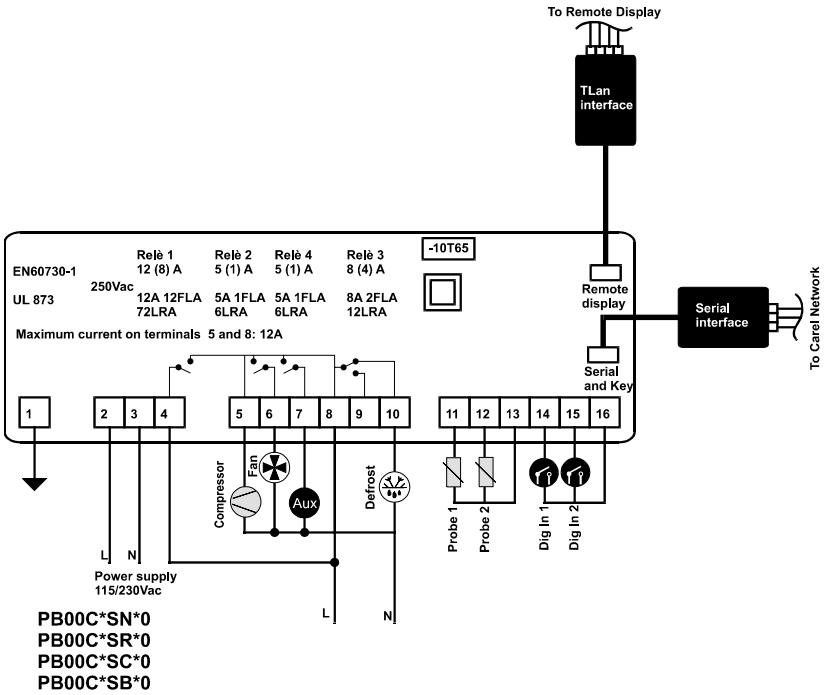

PB00C*SN*0
PB00C*SR*0
PB00C*SC*0
PB00C*SB*0

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Technology & Evolution

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REL 1.0 dated 30 January, 2004