MasterCase^3

CAREL

ENG

User manual

Technology & Evolution

Contents

IMPORTANT

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CAREL and its subsidiaries nonetheless cannot guarantee that all the aspects of the product and the software included with the product respond to the requirements of the final application, despite the product being developed according to start-of-the-art techniques.
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- Prevent the electronic circuits from getting wet. Rain, humidity and all types of liquids or condensate contain corrosive minerals that may damage the electronic circuits. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
- Do not install the device in particularly hot environments. Too high temperatures may reduce the life of electronic devices, damage them and deform or melt the plastic parts. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
- Do not attempt to open the device in any way other than described in the manual.
- Do not drop, hit or shake the device, as the internal circuits and mechanisms may be irreparably damaged.
- Do not use corrosive chemicals, solvents or aggressive detergents to clean the device.
- Do not use the product for applications other than those specified in the technical manual.

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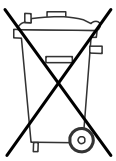
DISPOSAL



INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

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

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

1. INTRODUCTION

1.1 MasterCase[3]

MasterCase[3] is the CAREL product for the complete and advanced management of stand-alone or multiplexed refrigeration units that can independently manage the control and operation of the unit, implementing a vast series of functions and emergency procedures to avoid critical situations.
MasterCase[3] features 8 digital outputs, 2 analogue outputs, 3 digital inputs and 7 analogue inputs, which can be configured for NTC or PT1000 probes (one input can also accept 0 to 5V or 4 to 20 mA ratiometric probes); in addition, the controller can be configured for use with the CAREL PGD1 user interface and the series of standard PST small terminals.
The main features of the product include the possibility to:

- manage electronic expansion valves with stepper motors (CAREL E2V) or PWM valves (Vac or Vdc).
- synchronise a master-slave network with a maximum of 6 units (one master unit and up to 5 slaves)
- connect to a supervisor network for complete monitoring of the installation (CAREL, PlantVisorPRO, as well as others systems based on Modbus® or TCP/IP).

1.2 Electrical and network connections

The following figure shows the structure of the MasterCase[3] board, including all the electrical and network connections available.

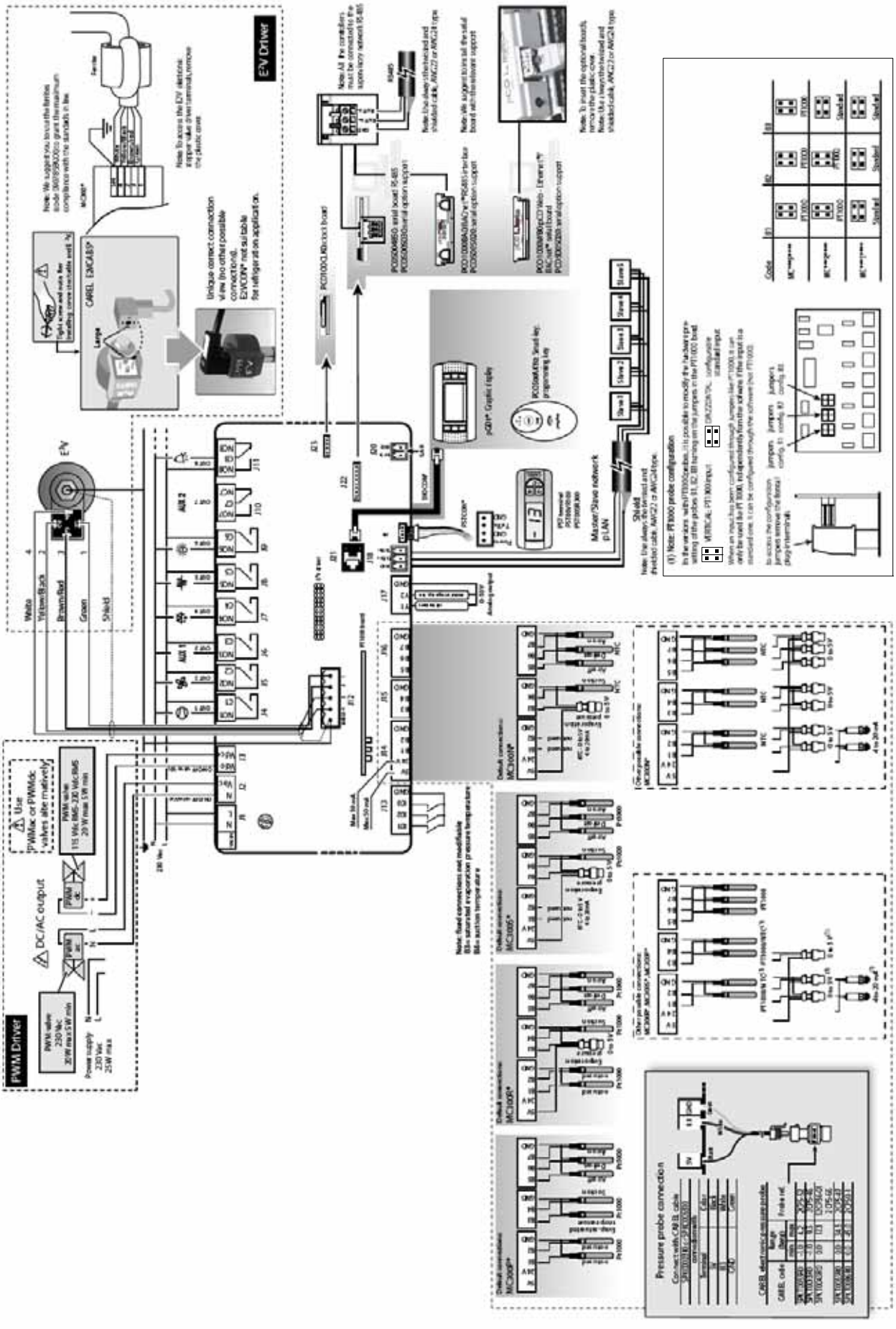


Fig. 1.a

2. USER INTERFACE

MasterCase[3] uses the PGD1 display and the series of standard PST terminals as the user interface.
This terminals, as well as being the same used by other CAREL instruments (consequently allowing a reduction in product codes), offer various solutions:

- PGD1 terminal with 6 buttons;
- PST small terminal with 3 digits and 3 buttons;
- simple remote display with 3 digits.

Important: The use of the PGD terminal excludes the use of any PST terminals.
If the PST terminal is left connected, the display is not updated, remaining on the last value displayed.
Each button is backlit by a LED to signal the status of the unit (active outputs, alarms, etc.).
The terminals are not required for the operation of the MasterCase[3], but rather are used to program the controller.
The terminals can be connected "hot", that is, when the instrument is on, without creating problems in operation.

2.1 Functions of the buttons and LEDs on the PST small terminal

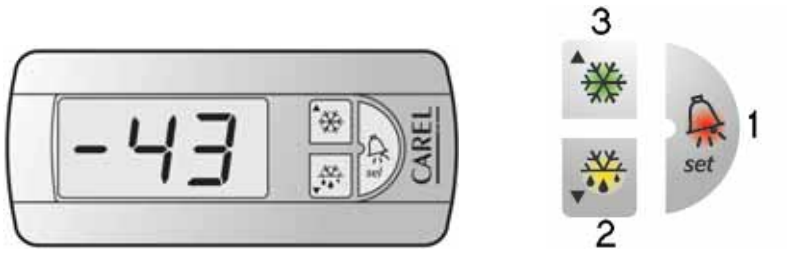


Fig. 2.a

Button	Function	Description
	UP	<u>Normal operation</u> • Pressed for more than one second activates or deactivates the light relay; • Pressed together with SET displays the value of the third probe (Sr); • Pressed together with DOWN for 5 seconds activates or deactivates the continuous cycle function. <u>Parameter programming</u> • Moves from one parameter to the previous; • Increases the value of the selected parameter; • Pressed together with SET returns to the menu list. <u>LED</u> • Steady: controller on;
	DOWN	<u>Normal operation</u> • Pressed for 5 seconds starts a local manual defrost, if the conditions allow; • Pressed for 5 seconds together with SET starts a network manual defrost, if the conditions allow; • Pressed together with UP for 5 seconds activates or deactivates the continuous cycle function; • Pressed together with SET displays the value read by the defrost probe (Sd). <u>Parameter programming</u> • Moves from one parameter to the next; • Decreases the value of the selected parameter. <u>LED</u> • Steady: defrost active
	SET	<u>Normal operation</u> • Mutes the audible alarm (buzzer) and deactivates the alarm relay, if active; • Pressed for 5 seconds together with DOWN starts a network manual defrost, if the conditions allow; • Pressed for 5 seconds displays the control set point; • Pressed for more than 6 seconds. When no alarms are active, accesses the type F parameters; entering the password PP (22) accesses all the parameters, divided into groups, that can be selected and modified. • Pressed together with UP displays the value read by the third probe (Sr) • Pressed together with DOWN displays the value read by the defrost probe (Sd); <u>Parameter programming</u> • Displays the value of the selected parameter or exits programming mode; • Pressed together with UP returns to the menu list. <u>LED</u> • Steady: alarm active.

Tab. 2.a

2.2 Functions of the buttons and LEDs on the PGD1 terminal

Fig. 2.b

2.2.1 Terminal buttons

Button	Function	Description
	ALARM	• Displays any alarms present and deactivates the alarm relay, if active. • The LED flashing indicates a previous alarm that has been reset. Pressing the button momentarily displays the alarm and switches off the LED.
Prg	PRG	• Accesses the programming menu screens.
Esc	ESC	Normal operation • Returns to the main screen. Parameter programming • Returns to the programming menu.
	UP	Normal operation • Scrolls the previous screens in the same branch when the cursor is in the top left; • Increases the value of a setting field when the cursor is in the field; for a selection field, on the other hand, pressing the arrow button displays the previous option • Pressed together with DOWN for 5 seconds activates or deactivates the continuous cycle function. Parameter programming • Increases the value of the parameter displayed.
	ENTER	Normal operation • Moves the cursor between the "home" position (top left) and the setting or selection fields; • Pressed in the main screen displays the value read by the main probes, press ESC to display the main screen; Parameter programming • Saves the value of the set parameter to memory after the cursor has been moved out of the field.
	DOWN	Normal operation • Scrolls the next screens in the same branch when the cursor is in the top left; • Decreases the value of a setting field when the cursor is in the field; for a selection field, on the other hand, pressing the arrow button displays the next option • Pressed together with UP for 5 seconds activates or deactivates the continuous cycle function. Parameter programming • Decreases the value of the parameter displayed.

Tab. 2.b

2.3 Accessing the parameters from the PGD1 display

2.3.1 Accessing the type "F" parameters

- press Prg;
- press ↵ until selecting the password entry field in the "Parameters" section;
- press ↵ again without entering the password;
- select the desired menu item by pressing ↑ & ↓ and then ↵.
- scroll using ↑ & ↓ until displaying the desired parameter.

2.3.2 Accessing the type “C” parameters

- press Prg;
- press ↵ until selecting the password entry field in the “Parameters” section;
- press ↑ & ↓ buttons until displaying 22 (password to access the type “C” parameters;
- confirm by pressing ↵;
- select the desired menu item by pressing ↑ & ↓ and then ↵;
- scroll using ↑ & ↓ until displaying the desired parameter.

2.3.3 Modifying the parameters

After having displayed the first parameter, either type C or type F, proceed as follows:

- scroll using ↑ & ↓ until displaying the parameter to be modified;
- press ↵ to enter the mode for modifying the associated value, if there is more than one parameter on the screen, press ↵ until reaching the desired parameter;
- modify the value using ↑ and/or ↓;
- press ↵ to confirm and save the value;
- if there is more than one parameter on the screen, press ↵ until the cursor flashes in the top left corner of the screen;
- repeat all the operations under “modifying the parameters” to change the values of any other parameters.

2.3.4 Exiting the programming procedure

- Press Esc until returning to the main screen.

2.4 Accessing the parameters from the PST display

2.4.1 Accessing the type “F” parameters

- press set for more than 5 seconds;
- the display shows parameter “***PP***” (**P**arameter **P**assword);
- press set;
- confirm by pressing set, without entering the password;
- the display shows the selection menu;
- select the desired menu item by pressing ❄ & ☀ and then set;
- press set to access the item
- press ❄ or ☀ until displaying the parameter to be modified.

2.4.2 Accessing the type “C” parameters

- press  for more than 5 seconds;
- the display shows parameter “***PP***” (**P**arameter **P**assword);
- press  ;
- press  or  until displaying 22 (password to access the type “C” parameters);
- confirm by pressing  .
- the display shows the selection menu;
- select the desired menu item by pressing  &  and then  ;
- press  to access the item
- press  or  until displaying the parameter to be modified.

2.4.3 Modifying the parameters

After having displayed the first parameter, either type C or type F, proceed as follows:

- press  or  until reaching the parameter to be modified;
- press  to display the corresponding value;
- modify the value using  and/or  ;
- press  to confirm and save the value and return to the display of the parameter code;
- repeat all the operations under “modifying the parameters” to change the values of any other parameters.

2.4.4 Exiting the programming procedure

- Press  +  together to return to the menu list;
- Or press  for more than 5 seconds to return to the temperature display.

3. START-UP & WIZARD

3.1 Start-up procedure

The start-up procedure is a function that simplifies the commissioning of MasterCase[3].
The procedure is automatically activated by the instrument when started the first time or when restoring the default values, and allows the installer to configure, using a pGD1 terminal, the most critical parameters to avoid problems when first using the installation. The controller does not implement any actions until the user has checked all the parameters proposed.
The function is only implemented on MasterCase3 master units.
The procedure can be skipped:

- By using the "smart key" to copy the software directly from another instrument that has already been started and has the same software version.
- If when starting the instrument the pGD1 terminal is not found

Requirements

- pGD1 terminal
- correct pLAN configuration (see the section on "Network functions")

List of screens

In these screens the cursor is always positioned at the top left;

- (ENTER): to enter the screen or confirm the set value
- (UP) o (DOWN): to change screen or modify the set values

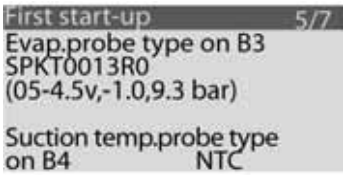
1/7 Opening page showing the current software version

2/7 Supervisor: used to:
Set the supervisor serial address (1 to 199)
Set the type of protocol used (CAREL / Modbus)
Display the communication speed

3/7 pLAN: used to:
Set the number of slaves connected to the master (0-5), NB: only set on the Master
Display the current pLAN address and the Master-Slave network configuration

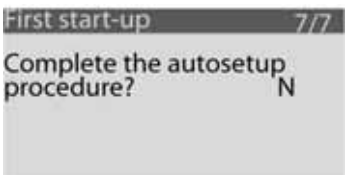
4/7 EEV: used to set:
The type of EEV used
CAREL E2V stepper
PWM on-off
Thermostatic valve
The type of refrigerant used

Important: if the codes are designed for CAREL E2V stepper valves, the PWM valve cannot be used. Vice-versa, for codes designed for PWM valves, the CAREL E2V valve cannot be used.



5/7 Probes: used to set:
The type of saturated evaporation temperature probe connected to B3: the screen shows all the codes of the possible CAREL options, with the corresponding operating range
The type of superheated gas temperature probe connected to B4: the screen shows all the possible options

6/7 Wizard: provides a direct link to the instrument auto-configuration procedure. The user can choose whether to use this function or configure the controller manually

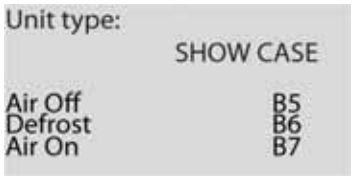


7/7 Exit: confirm the completion of the start-up procedure and start the instrument

3.2 Wizard

The Wizard is an optional procedure that helps the installer configure the parameters relating to the specific application. The function has been developed to assist the installer in starting the controller without having to navigate the parameter menus, but rather by simply answering the questions automatically proposed by the instrument in the start-up phase. In particular, different applications can be selected, with the instrument then configuring the related parameters as a consequence. This procedure can also be accessed from the parameters menu. In each menu, the installer can see which parameters are being modified and set them manually if required.

1. Type of unit



Configures the temperature probes installed:

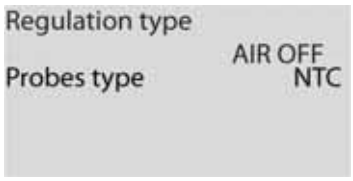
- **Refrigerated cabinet**

Function	Selection	Parameters
Air off probe (Sm)	B5	/FA=5
Defrost probe (Sd)	B6	/Fb=6
Air on probe (Sr)	B7	/Fc=7

- **Cold room**

Function	Selection	Parameters
Air off probe (Sm)	B5	/FA=5
Defrost probe (Sd)	B6	/Fb=6
Air on probe (Sr)	Not used	/Fc=0
Door switch	DI1	di1=5

2. Type of control



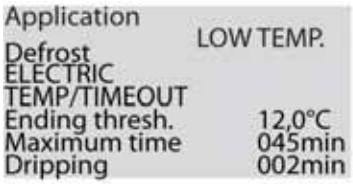
Configures the probe used for control

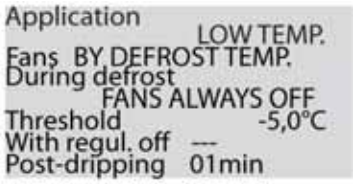
- Air off probe (Sm)
- Air on probe (Sr)
- Virtual probe (Sv) calculated as the settable weighted average between the Air off probe and Air on probe. If the virtual probe is selected, a slide bar is displayed representing parameter /4 and the percentage ratio between the Air off and Air on probe.

Function	Selection	Parameters
Virtual probe	Air off probe	/4=0
Virtual probe	Air on probe	/4=100
Virtual probe	Average of Air off and Air on probe	/4=50

Tab. 3.a

3. Application





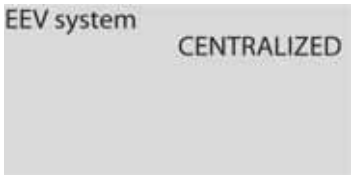
Used to select the type of application used and as a consequence set the main reference parameters. With each selection, all the parameters affected are displayed so that the user can see which settings are being made.

Below is a list of three possible applications and the corresponding configurations.

Parameters		Applications		
Code	Description	Low temperature	Meat	Medium temperature
d0	Type of defrost	0	0	2
dt1	End defrost threshold	12	8	-
dP1	Maximum defrost duration	45	30	30
dd	Dripping time	2	2	2
F0	Fan management	2	2	0
F3	Fans OFF during defrost	1	1	0
F1	Fan threshold	5	2	-
F2	Fans with controller OFF	0	0	0
Fd	Post-dripping time	1	1	1

Tab. 3.b

4. EEV system



This option is used to set the operation of the electronic expansion valve, with reference to the EEV guide (+03022081*).
Five possible configurations are available:

- multiplexed cabinet
- on-board compressor
- "perturbed" system
- multiplexed cabinet with subcritical CO_2
- R404a condenser for subcritical CO_2

The table below lists all the parameters that are set corresponding to each configuration.
For further details, see the "EEV guide" (+03022081*).

CABINETS - COLD ROOMS				Multiplexed	On board compressor	Perturbed system
PID	Shset	Superheat set point	°C	11	6	11
	K prop	PID: proportional gain	-	15	15	25
	Ti	PID: integration time	s	150	100	250
	Td	PID: derivative time	s	5	2	5
PROTECTORS	LowSH	LowSH prot.: threshold	°C	5	2	5
	LowSH Ti	LowSH prot.: integration time	s	15	10	25
	MOP	MOP prot.: threshold	°C	-15 °C (LT) +5 °C (MT)	-15 °C (LT) +5 °C (MT)	-15 °C (LT) +5 °C (MT)
	MOP Ti	MOP prot.: integration time	s	20	20	30
	MOP HiTsurr	MOP prot.: maximum superheated gas temperature limit	°C	30	30	30
	MOP Delay	MOP prot.: activation delay at startup	s	60	30	60

REFRIGERATION WITH SUBCRITICAL CO_2				Multiplexed cabinets/cold rooms with subcritical CO_2	R404a condenser for subcritical CO_2 [1]
PID	SHset	Superheat set point	°C	13	7
	K prop	PID: proportional gain	-	20	15
	Ti	PID: integration time	s	400	150
	Td	PID: derivative time	s	5	5
PROTECTORS	LowSH	LowSH prot.: threshold	°C	7	3
	LowSH Ti	LowSH prot.: integration time	s	15	10
	MOP	MOP prot.: threshold	°C	-15 °C	0
	MOP Ti	MOP prot.: integration time	s	20	0
	MOP HiTsurr	MOP prot.: maximum superheated gas temperature limit	°C	30	0
	MOP Delay	MOP prot.: activation delay at start	s	60	0

Tab. 3.c

4. DIGITAL INPUT CONFIGURATION

4.1 General operating principle

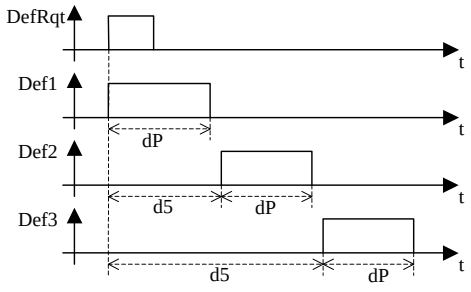
The MasterCase[3] series instruments feature three digital inputs that can be configured using parameters "di1", "di2", "di3", respectively, associated with inputs ID1, ID2, ID3. In addition, a further parameter, "A8", is used to manage a digital input called the "virtual" input, as it is not physically present on the instrument, but rather associated with the status of digital input ID1 on the Master in a pLAN (master-slave configuration). Parameter "A9" defines the position of the digital input, on the master board (ID1, ID2, ID3) or from the supervisor.

Parameters used

Configuration of digital input 1 (di1)
Operating logic of digital input 1 (dL1)
Configuration of digital input 2 (di2)
Operating logic of digital input 2 (dL2)
Configuration of digital input 3 (di3)
Operating logic of digital input 3 (dL3)
Virtual digital input configuration (A8)
Virtual input position (only slave boards) (A9)
Delayed external alarm priority (AdE)
External alarm delay (A7)

Parameters dL1, dL2 and dL3 establish the type of operation of each digital input, that is, whether the input is considered active when the connected contact is open or closed. For example, if dL1 = "N.C." (normally closed), input ID1 is active when the contact is open and not active when the contact is closed, while if dL1 = "N.O." (normally open), input ID1 is active when the contact is closed and not active when the contact is open.
The following describes the operation for each value of di1 to di3/A8/A9:

- ***di1 to di3/A8/A9= 0 - "NONE":***
  The corresponding digital input is not used and ignores the closing/opening of any contacts connected to it.
- ***di1 to di3/A8/A9= 1 - "REMOTE ALARM":***
  The digital input can be connected to an external alarm that requires immediate activation (for example, high pressure alarm, etc...). The alarm is generated when the contact is opened, and causes the display of the code "IA", the activation of the buzzer and the total shutdown of the controller and all the related outputs. When the alarm condition is no longer present, the unit returns to normal temperature control operation.
- ***di1 to di3/A8/A9= 2 - "DELAYED REMOTE ALARM:***
  The operating mode depends on parameter AdE; if AdE = "HIGH", operation is the same as the setting for the "Remote alarm", however in this case the alarm can be delayed by a time, in minutes, equal to the value set for parameter "A7". If AdE is set to "LOW", after a time equal to the value of A7, the alarm is signalled in the same was as the setting for the "Remote alarm", however control is not stopped.
- ***di1 to di3/A8/A9= 3 - "ENABLE DEFROST":***
  This setting is used to enable/disable the defrost function. When the input is active the defrost is inhibited, when the input is inactive the defrost is enabled. If the input is not active, and there is no defrost request, the defrost is obviously not performed. If the input is not active and a defrost is in progress, when the digital input is activated the current defrost is stopped, terminating any dripping and post-dripping phases, and the successive defrosts are inhibited, until the next time the digital input is deactivated. Possible applications: this function is useful, for example, in the case of multiplexed showcases with hot gas defrost. In these systems, the defrosts are performed in "islands", and therefore, at any one time, some islands are enabled to defrost, and others are disabled. Another use of the function is to prevent defrosts on the units accessible to the public during opening times..
- ***di1 to di3/A8/A9= 4 - "START NETWORK DEFROST":***
  When the corresponding digital input is activated, a defrost is started, according to the criteria set for the type "d" parameters (defrost). This function is useful when defrosts need to be performed on a series of utilities coordinated by an external timer. To avoid simultaneous defrosts, the parameter "d5" can be used to delay the start of the defrost on each unit.



Key

DefRqt	Defrost call
Def1	Defrost on unit 1
Def2	Defrost on unit 2
Def3	Defrost on unit 3
d5	Defrost start delay from controller power on or on from digital input
dP	Maximum defrost time

Fig. 3.a

- *di1 to di3/A8/A9*= 5 - "DOOR SWITCH":

When the digital input configured for door switch management is not active (door closed), the situation is as follows:

- Temperature control ON
- Fan control ON;
- EEV control ON;
- Light OFF.

When the digital input configured for door switch management is active (door open), the situation is as follows:

- Temperature control OFF, solenoid valve closed, EEV in standby position;
- Fan control OFF;
- Lights ON.

The door open status is displayed both by the supervisor and the terminal.
After the door switch input has been active for a time specified by parameter d8, the door open alarm is displayed, and control resumes.

- *di1 to di3/A8/A9*= 6 - "REMOTE ON/OFF":

By setting the input for this function the controller can be switched on/off using an external contact. Switching off is not equivalent to disconnecting power, but rather is a "logical OFF", that is, the controller goes into "standby", ignoring all the control requests, alarms and defrosts. The controller however still continues to display the temperature, alternating with the message "OFF" on the PST display, or the message "UNIT OFF" on the PGD1 display.

1. Input not active = controller ON;
2. Input active = controller OFF.

- *di1 to di3/A8/A9 = 7 - "DAY/NIGHT":*

A digital input configured as day/night status affects the selection of the status only if parameter Stn (Select day/night) is set to 1 - "FROM DIGITAL IN"; otherwise, if Stn is set to 0 - "NONE" or 2 - "FROM RTC", this digital input has no influence on control.
If the input dedicated to day/night changeover is not active (day mode), the situation is as follows:

- Control with daytime set point (St)
- Control based on probe Sv (virtual probe, calculated according to the Air off probe Sm, the Air on probe Sr and parameter /4, virtual probe composition)
- Defrosts with normal or Power RTC events, depending on the type set for the RTC event
- Defrosts due to causes other than RTC (manual control or from the supervisor, expiry of dI,...) in normal mode (not Power)
- "Light" output active (if parameter HL is set to 1- "Y")

If the input is active (night mode), the situation is as follows:

- Control with night-time set point (St+r4)
- Control with the Air on probe Sr (only if parameter r6 is set to 1 - "Y")
- All defrosts performed are Power Defrosts
- Night icon displayed on pGD1 terminal (moon and stars);
- "Light" output off (if parameter HL is set to 1 – "Y")

If parameter HL (Enable light management with day/night status) is set to 0 – "N", the status of the light is not modified when switching from day to night status and vice-versa.

- *di1 to di3/A8/A 9= 8 - "START DUTY SETTING":*

The activation of the digital input set with this value will switch the controller to "duty setting" operation.

- *di1 to di3/A8/A9 = 9 - "COLD ROOM MAINTENANCE":*

The operating logic is the same as for the management door switch, with the difference that :

- Control is suspended when the digital input is first activated, the next closing is ignored.
- Control resumes when the digital input is next activated, the next closing is ignored.

Below are the actions that occur in maintenance status (control suspended):

- Control OFF, solenoid closed;
- EEV in standby position;
- Fans OFF;
- Lights ON;
- Signal sent to supervisor
- Display on user terminal:
  - PST: "Mnc" with the maintenance spanner icon
  - PGD1: "Maintenance" signal flashing

After the time set for parameter d13 has expired without the input being activated again, control resumes and the "Mnt" alarm is signalled ("Cold room maintenance timeout").

5. ANALOGUE INPUT CONFIGURATION

5.1 General operating principle

MasterCase[3] has 7 analogue inputs (B1, B2, B3, B4, B5, B6, B7). Each input can be associated with the type of probe connected, NTC or PT1000, or 0 to 5 Vdc, while inputs B1 and B2 can be connected to a 4 to 20 mA ratiometric probe.
The following table shows the analogue inputs, with the manufacturer default for the different models (types of probes that can be connected).

	parameter description	Supervis. var.	Applic. default	MC300N0B00	MC300N0B10	MC300P0B00	MC300P0B10	MC300R0B00	MC300R0B10	MC300S0B00	MC300S0B10
/B1	Select type of probe B1 0 =NTC 1 = 0-5Vdc 2 = PT1000 3 = 4-20mA	Integer 128	0	0	0	2	2	2	2	0	0
/B2	Select type of probe B2 0 =NTC 1 = 0-5Vdc 2 = PT1000 3 = 4-20mA	Integer 129	0	0	0	2	2	2	2	0	0
/B3	Select type of probe B3 0 =NTC 1 = 0-5Vdc 2 = PT1000	Integer 130	1	1	1	2	2	1	1	1	1
/B4	Select type of probe B4 0 =NTC 1 = 0-5Vdc 2 = PT1000	Integer 131	0	0	0	2	2	2	2	2	2
/B5	Select type of probe B5 0 =NTC 1 = 0-5Vdc 2 = PT1000	Integer 132	0	0	0	2	2	2	2	2	2
/B6	Select type of probe B6 0 =NTC 1 = 0-5Vdc 2 = PT1000	Integer 133	0	0	0	2	2	2	2	2	2
/B7	Select type of probe B7 0 =NTC 1 = 0-5Vdc 2 = PT1000	Integer 134	0	0	0	2	2	2	2	2	2

Tab. 5.a

5.2 Calibration and offset

Each input can be assigned a value that is added to (positive value) or subtracted from (negative value) the temperature measured by the probe. For example, to decrease the temperature by 2.3 degrees, set -2.3. The offset can be set from -–9.9 to +9.9 with precision to the tenth of a degree. For the probes relating to the management of the electronic valve, the offset may vary from -9.9 to 19.9 with precision to the tenth of a degree (parameters "/c4" and "/c3").

5.3 Control probes

The configuration of the control probes can be customised using parameters "/FA", "/Fb" and "/Fc", assigning a different association between the Air off probe, defrost probe and Air on probe and the physical inputs available (B1, B2, B5, B6, B7). The default configuration associates the physical inputs as follows:
B5 = Air off probe (Sm)
B6 = defrost probe (Sd)
B7 = Air on probe (Sr)
The manual often uses the term Sm to indicate the Air off probe, Sd the defrost probe and Sr the Air on probe.

5.4 Virtual probe

The parameter "/4" defines a non-existent probe used for the normal control functions This parameter determines the weighted average used to calculate the reference control probe value based on the reading of the Air off probe and the Air on probe.
The formula is the following:

virtual probe = $\frac{(100-("/4"))xSm+("/4")xSr}{100}$; where Sm = Air off probe & Sr = Air on probe

If "/4" is set to 0, the virtual probe coincides with the Air off probe; if set to 100, the virtual probe coincides with the Air on probe. If control is based on the virtual probe (value of parameter "/4" between 0 and 100), the breakage of one of the two probes automatically moves control to the other probe.

Table of values of /4

/4	Virtual probe System variables composition
0	Sv = Air off probe
1 to 49	Sv = (Air off probe> Air on probe)
50	Sv = (Air off probe= Air on probe)
51 to 99	Sv = (Air off probe< Air on probe)
100	Sv = Air on probe

Tab. 5.b

6. DIGITAL OUTPUT CONFIGURATION

6.1 General operating principle

The MasterCase[3] series instruments have eight digital outputs that can be configured using parameters o1, o2, o3, o4, o5, o6, o7, o8 (hereinafter o1 to o8) associated respectively with the outputs from DO1 to DO8. Multiple outputs can be configured with the same function, thus replicating the function.

Digital output	Group	Terminal NO1	o1...o8	Digital output configuration parameters (o1 to o8) Values and functions available	Default value
1	J4	NO1 / C1	o1	0= Fan 1= Defrost 1 2= Defrost 2 3= Light/Curtain night 4= Anti-sweat heater 5= N.O. alarm 6= N.C. alarm 7= Liquid solenoid 8= Always open 9= Always closed 10= Suction solenoid 11= Soft-gas solenoid 12= Hot-gas solenoid 13= Equal. solenoid	o1=7- liquid solenoid
2	J5	NO2 / C2	o2		o2=0 - fan
3	J6	NO3 / C3	o3		o3=8 - output not configured
4	J7	NO4 / C4	o4		o4=1 - evaporator 1 defrost
5	J8	NO5 / C5	o5		o5=4 – anti-sweat heater
6	J9	NO6 / C6	o6		o6=3 - light
7	J10	NO7 / C7	o7		o7=8 - output not configured
8	J11	NO8 / C8	o8		o8=5 –N.O. alarm

Tab. 6.a

The outputs configured as "Liquid solenoid", "Suction solenoid" and "Equalizing solenoid" can be configured as local or network, depending on parameters r7 and r8:
r7=0 – "LOCAL": the "Liquid solenoid" output is activated only depending on the individual controller.
r7=1 – "NETWORK" (for Master units only): the "Liquid solenoid" output is activated according to the control requirements of the master and the slaves connected.
r8=0 – "LOCAL": the "Suction solenoid" and "Equalizing solenoid" outputs are activated only depending on the individual controller.
r8=1 – "NETWORK" (for Master units only): the "Suction solenoid" and "Equalizing solenoid" outputs are activated according to the control requirements of the master and the slaves connected.

7. ANALOGUE OUTPUTS

The 0 to 10Vdc analogue outputs have a fixed configuration for controlling:

- Fans
- Anti-sweat function (rail heater)

Analogue output	Signal controlled
Y1	Fans
Y2	Anti-sweat control

The use of these analogue outputs for the two signals specified above optimises the operation of the devices and increases energy saving.

8. OTHER SETTINGS

8.1 H parameters

Parameters used
H0: supervisor serial address
H3: enable ON/OFF from terminal
H2: enable ON/OFF from the supervisor
Sn: number of slaves in LAN
H6: supervisor communication speed
H7: selection type of protocol
HL: dependence of light status on day/night status

As regards parameters "H0" and "Sn", see further on in the manual under the chapter "Network functions".
Parameter "H3", if enabled (H3=1), activates a screen on the PGD1 terminal used to switch the unit on/off.
Parameter "H2", if set to 1 (H2 = 1), enables the unit to be switched on and off from the supervisor.
The ON/OFF functions are not independent. If the unit is switched off from the terminal, it cannot then be switched back on from the supervisor and vice-versa.
In practice, the two functions must be considered as being in "series".

9. TEMPERATURE CONTROL

9.1 General operating principle

Parameters used

/4: control probe
St: set point, operating temperature
rd: differential (hysteresis)
r1: minimum set point
r2: maximum set point

Control is performed as follows:
temperature "/4" > "St" + "rd" ⇨ **control ON**
temperature "/4" • "St" ⇨ **control OFF**

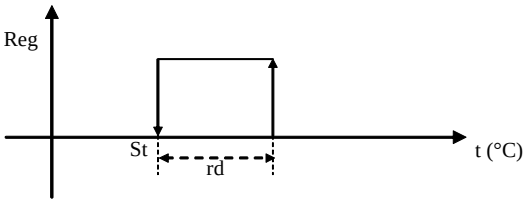


Fig. 9.a

Key

Reg	Control status
t	Temperature (°C)
St	Set point
rd	Differential

9.2 Double thermostat

Parameters used

St2: Air on probe Sr set point for double thermostat
rd2: Air on probe Sr set point differential for double thermostat

Double Thermostat is used to control the temperature inside a refrigeration unit using two separate thermostats, one associated with the Air off probe and the other with the Air on probe. This control technique is used to appropriately manage the day-night changeover, and in particular the closing of the curtain at night, without requiring any external contact. The lowering of the curtain in fact generally causes a decrease in the temperature inside the unit, and may cause problems if the control method is not adapted. The two thermostats each have their own specific set point (St for the Air off probe, St2 for the Air on probe) and corresponding differential (rd for Sm, rd2 for Sr).

Probe	Set point	Differential
Air off Sm	'St'	'rd'
Air on Sr	'St2'	'rd2'

The general control status depends on the combination of the status of both thermostats, that is, control will be active only when both thermostats require refrigeration. The table below illustrates the general status of the unit based on the status of the two thermostats:

Air off probe (Sm)	Air on probe (Sr)	Thermostat
Request	Request	Request
-	Request	-
Request	-	-
-	-	-
Air off probe alarm =1	Request	Request
Air off probe alarm =1	-	-
Request	Air on probe alarm =1	Request
-	Air on probe alarm =1	-
Air off probe alarm =1	Air on probe alarm =1	Activate duty cycle setting function

Tab. 9.a

Note:

- If rd2 = 0 double thermostat function disabled
- In double thermostat operating mode, there is no recovery from Air off and Air on probe errors using parameter 'r0'.
- In double thermostat operating mode, there is no change in the set point in night-time operation, with reference to parameter 'r4'.

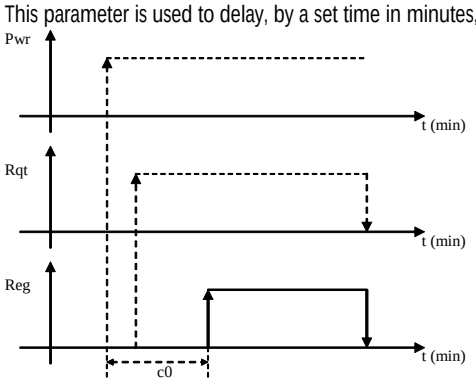
9.3 Safety parameters and control activation times

Parameters used

c0: control activation delay when switching the instrument on
c1: minimum time between two successive starts
c2: minimum OFF time
c3: minimum ON time
c4: safety control ("Duty cycle setting" function) ON time
c5: safety control ("Duty cycle setting" function) OFF time
c6: low temperature alarm bypass time after continuous cycle
cc: continuous cycle duration
c8: start control delay from the opening of the valve.

9.3.1 Control start delay when switching the instrument on

This parameter is used to delay, by a set time in minutes, the activation of the control functions from when the instrument is switched on.



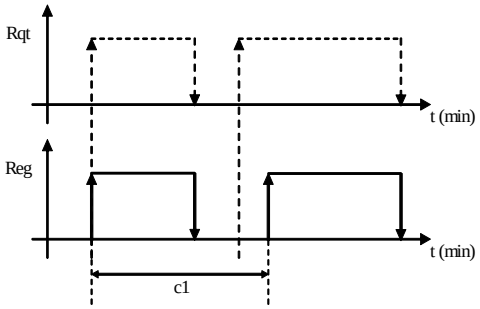
Key

Pwr	Enable control (Sys ON)
Rqt	Control request
Reg	Control status
t (min)	Time (minutes)
c0	Control start delay when switching the instrument on

Fig. 9.c

9.3.2 Minimum time between two consecutive starts

Sets the minimum time that must elapse between successive activations of the controller, irrespective of the temperature and the set point.
This parameter can be set so as to limit the number of starts per hour.
For example, if the maximum number of starts per hour allowed is 10, simply set c1=6 (minutes) to ensure that this limit is observed.



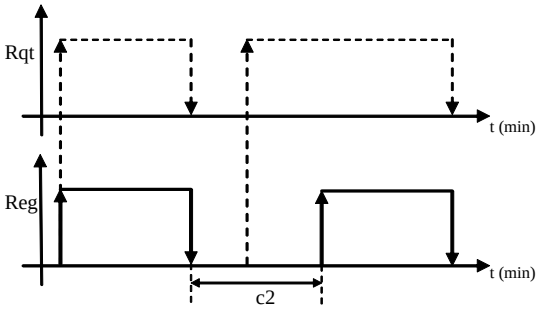
Key

Rqt	Control request
Reg	Control status
t (min)	Time (minutes)
c1	Minimum time between two consecutive starts

Fig. 9.d

9.3.3 Minimum off time

Sets the minimum controller off time in minutes. The control output is not reactivated until the minimum time selected (c2) has elapsed since the last deactivation.
This parameter is useful for ensuring the balancing of the pressure after shutdown, in the case, for example, of systems with hermetic and capillary compressors.



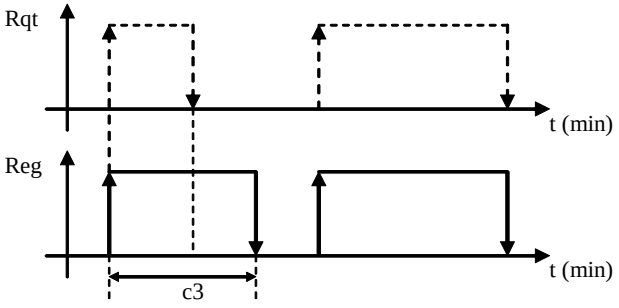
Key

Rqt	Control request
Reg	Control status
t (min)	Time (minutes)
c2	Minimum off time

Fig. 9.e

9.3.4 Minimum on time

Sets the minimum control on time.
Control remains active for the minimum time selected (c3) even if requested to stop.



Key

Rqt	Control request
Reg	Control status
t (min)	Time (minutes)
c3	Minimum on time

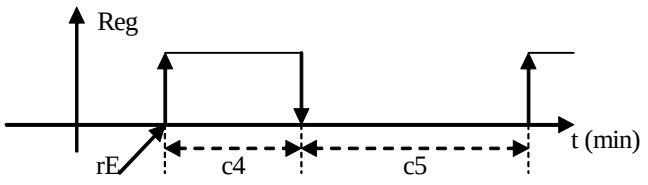
Fig. 9.f

9.3.5 Duty cycle setting function (safety control)

Parameters used

c4: safety control ON time
c5: safety control OFF time

This function is used to keep the utility operating even when there is a control probe fault (alarm "rE"), using parameters "C4" and "C5".
If the alarm "rE" is reset, control restarts normally again without requiring the intervention of the maintenance personnel.



Key	
Reg	Control request
t	Time (minutes)
rE	Control probe broken or disconnected alarm
c4	Safety control (ON time)
c5	Safety control (OFF time)

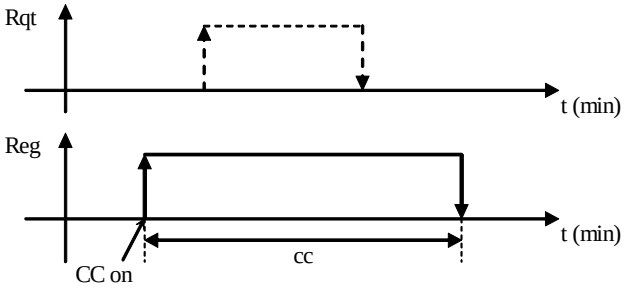
Fig. 9.g

9.3.6 Continuous cycle function

Parameters used

cc: continuous cycle duration
c6: low temperature alarm bypass time after continuous cycle

The continuous cycle function is used to keep control active for the time set for "cc", regardless of the request from the control probe, allowing temperatures below the control set point "St" to be reached.
This function is started manually by pressing the "UP" and "DOWN" buttons on the user interface for more than five seconds, both on the PST terminal and on the PGD1 terminal.



Key	
Rqt	Control request
Reg	Control status
t	Time (minutes)
CC on	Instant of continuous cycle procedure activation request
cc	Continuous cycle duration

Fig. 9.h

The continuous cycle procedure will end in the following cases:

- when reaching the low temperature alarm threshold (AL or AL2 for "double thermostat");
- when reaching the maximum duration of the continuous cycle (cc);
- when the instrument is switched off (logical OFF).

When the continuous cycle procedure is active, the icon is displayed.
If "cc"= 0, the continuous cycle function is not active.
At the end of operation in continuous cycle, the low temperature alarm "L0" is disabled for the time, expressed in hours, set for parameter "c6".

Important: continuous cycle can only be activated if the unit is ON.

9.4 Temperature monitoring

Parameters used

r5: enable maximum and minimum temperature recording
rt: time elapsed since starting to monitor the maximum and minimum temperature
rH: maximum temperature recorded in the interval "rt"
rL: minimum temperature recorded in the interval "rt"

Enables temperature monitoring, recording the maximum ("rH") and minimum ("rL") temperature reached in the interval "rt" (max 999h).
The monitoring function starts when "r5" is set to 1.
To stop temperature monitoring, set "r5" to 0. After 999 hours, the max and min temperatures are no longer recorded, as the maximum monitoring time allowed by the instrument has been reached. Reset "r5" to start the monitoring again.

10.NIGHT-TIME OPERATION

10.1 General operating principle

Parameters used
di1 to di3, A8, A9 = 7: digital input associated with day/night status
dL1 to dL3: operating logic of digital inputs 1 to 3
HL: Enable light management with day/night status
Sr, r6: night-time control with Air on probe
r4: deviation from the set point (offset) in night-time operation
Stn: select day/night mode source
St: Temperature control set point
S1, hS1, mS1: start hours for first time band and days activated (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday, from Monday to Friday, from Monday to Saturday, Saturday & Sunday, always)
hE1, mE1: end hours for first time band
S2, hS2, mS2: start hours for second time band and days activated (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday, from Monday to Friday, from Monday to Saturday, Saturday & Sunday, always
hE2, mE2: end hours for second time band
S3, hS3, mS3: start hours for third time band and days activated (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday, from Monday to Friday, from Monday to Saturday, Saturday & Sunday, always)
hE3, mE3: end hours for third time band.

MasterCase[3] can manage up to three time bands; the time band start and end time can be set for each.
In addition the day, or the interval of days (see above) that the time band is activated on can be set.

Parameter "Stn" can be used to configure the source for the automatic changeover of the set point from day to night mode.
The following options are available:

"Stn" = 0, no source enabled for setting day/night status.
No digital input programmed as day/night status (di1 to di3/A8/A9 ≠ 7) ⇨ no action.
Digital input programmed as day/night status (di1 to di3/A8/A9 = 7) ⇨ the variation in the status of the digital input causes:
- No variation of the light output
- No variation of the set point.

"Stn" = 1, day/night status from digital input.
No digital input programmed as day/night status (di1 to di3/A8/A9 ≠ 7) ⇨ no action.
Digital input programmed as day/night status (di1 to di3/A8/A9 =7) ⇨ the activation of the digital input causes:
- activation of the light output if HL = 1 – "Y"
- variation in the control set point, the offset "r4" is summed to the set point "St" (St + r4)
- control shifted to the Air on probe (Sr), as envisaged by the parameter "r6".

"Stn" = 2, variation from RTC (clock card fitted)
If the MasterCase[3] is fitted with the RTC option, the changeover from day to night status, and vice-versa, can be managed by setting 3 time bands (see parameters "L", "hSx", "mSx" and the figure below). The actions carried out will be the same as described in the previous point ("Stn"=1 and di1 to di3/A8/A9 =7).

Example of time band 1

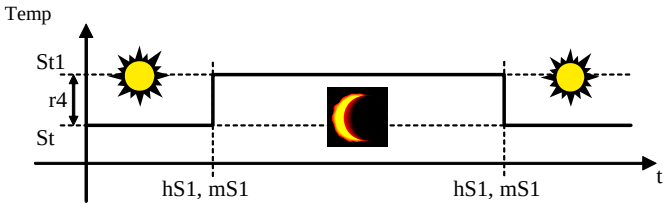


Fig. 10.a

Key

Temp	Temperature (°C)
t	Time
St1	Control set point in night mode (St + r4)
St	Control set point
r4	Control set point offset active in night mode

10.2 Setting the night-time operation time bands

MasterCase[3] manages up to 3 time bands for night-time operation, used to save electricity when the shops are closed (each day, mid-week closing, weekends, etc.). In night-time operation, the controller modifies the control set point set for parameter "St" by automatically adding the value of the offset set for parameter "r4".

The night-time bands, S1, S2, S3 are displayed and can be set on the pGD1 terminal, PST terminal and supervisor:

S1 - Start-end night band 1:

S	1	/	h	S	1	/	m	S	1					n	i	g	h	t
D	a	y						*	*	*								
S	t	a	r	t										0	0	:	0	0
S	t	o	p											0	0	:	0	0

S2 - Start-end night band 2:

S	2	/	h	S	2	/	m	S	2					n	i	g	h	t	2
D	a	y						*	*	*									
S	t	a	r	t										0	0	:	0	0	
S	t	o	p											0	0	:	0	0	

S3 - Start-end night band 3:

S	3	/	h	S	3	/	m	S	3					n	i	g	h	t	3
D	a	y						*	*	*									
S	t	a	r	t										0	0	:	0	0	
S	t	o	p											0	0	:	0	0	

Parameter S1, S2 and S3 sets the day of the week for the activation of the night-time time band.
The following options are available: 1: Monday, 2: Tuesday, 3: Wednesday, 4: Thursday, 5: Friday, 6: Saturday, 7: Sunday, 8: Monday to Friday, 9: Monday to Saturday, 10: Saturday & Sunday, 11: always.

Important: to set the bands for night-time operation, first set parameter stn=2 (used to select the night-time set point based on the variation in the RTC).

10.3 Light operation during night mode

Parameter "HL" can be used to set whether or not the lights depend on day/night status.

HL = 0 – "N", The are no changes to the status of the light output during changeover in either direction, however the status can be changed manually or from the supervisor.
HL = 1 – "Y", The changeover from night to day causes the activation of the light output, the changeover from day to night deactivates the output.

11.FANS

11.1 General operating principle

The operation of the fans can be divided into four modes:

1. Normal operation
2. Defrost
3. Dripping
4. Post-dripping

11.2 Normal operation

Parameters used
F0: fan operating mode
F1: fan temperature control threshold
F2: fan operation based on the control status
Frd: fan control differential

Fan management mode (F0)
The evaporator fans can be managed in three different modes:

- **F0 = 0**, always ON
  The control of the fans does not depend on the temperature of the evaporator or refrigerated cabinet.
- **F0 = 1**, control based on the difference
  The control of the fans depends on the temperature of the cabinet and the temperature of the evaporator, temperature control is based on the difference between the temperature of the evaporator and the temperature of the virtual probe "Sv" (or "Sr" if double thermostat is active).
- **F0 = 2,** control based on the defrost temperature probe (Sd)
  The control of the fans depends on the evaporator temperature.

Parameter 'F0'	Normal control (night and day mode)	Double thermostat
0	-	-
1	Evaporator probe – Probe "Sv"	Evaporator probe – Probe "Sr"
2	Evaporator probe	Evaporator probe

F0 = 0
If the fan is not controlled by temperature (F0 = 0) it is always ON and corresponding the analogue output (Y1) always takes the maximum value (100%).

F0 = 1 or F0 = 2
If the fan is controlled by temperature (F0 = 1 or F0 = 2), the following parameters must be set:
F1 = Fan activation temperature
Frd = Fan control differential
If there are two evaporator probes, control will be performed on the maximum value of the probes used.
If there are errors on the control probes, fan control is always ON.

F0 = 1
Parameter "F1" indicates the minimum difference that must exist between the evaporation temperature probe and the virtual probe "Sv" (or Air on probe "Sr" in double thermostat), for the fans to be activated. The threshold "F1" must be less than 0 (F1 < 0) for the fans to be activated when the evaporation temperature is less than the control temperature.
Then:

- evaporator temperature < (virtual probe "Sv" (or Air on "Sr" in double thermostat) – 'F1' - 'Frd'), the fans are ON;
- evaporator temperature > (virtual probe "Sv" (or Air on "Sr" in double thermostat) – 'F1'), the fans are OFF.

Once off, the fans start again when the difference between the two probes is equal to “F1” + “Frd” (see the following figure).

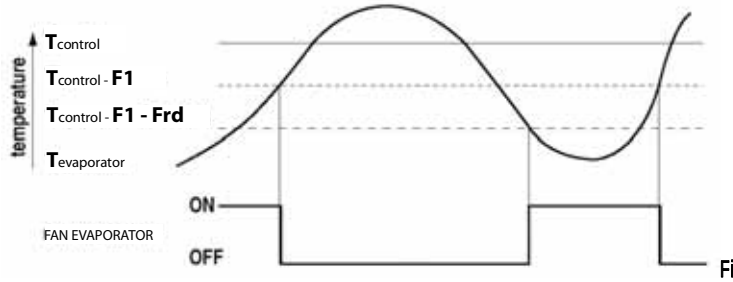


Fig. 11.a

F0=2

Parameter “F1” indicates the absolute temperature for the activation of the fans.
Thus:

- evaporator temperature < (F1 - Frd), the fans are ON;
- evaporator temperature > (F1), the fans are OFF.

F2: Enable fans off with control off

This is used to decide whether the fans are controlled as established by parameter “F0” (except in the defrost cycle, see parameters “F3”, “dd” and “Fd”) or based on the status of the compressor:
F2 = 0, the fans are always ON (“F0”= 0) or managed by the fan controller (“F0” = 1,2) even when the compressor is off;
F2 = 1, the fans are OFF when the compressor is off.

Frd: Fan temperature control differential (including variable speed)

Represents the control differential for managing the fans (see parameter “F1”).
The control graph is shown below.

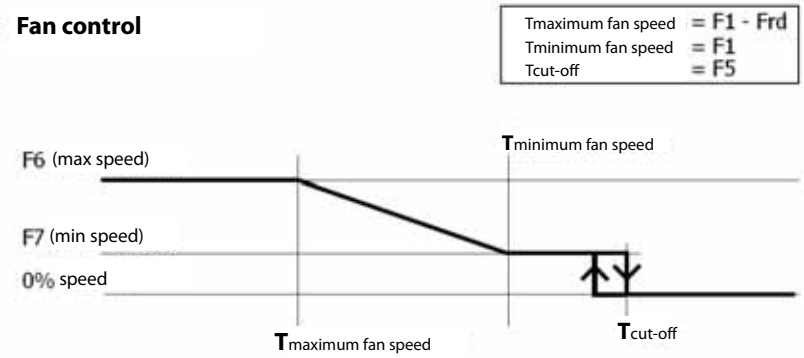


Fig. 11.b

The control temperature depends on the setting of parameter “F0”.

F5: Fan cut-off temperature (hysteresis 1°C)

If fan speed control is used, this represents the limit temperature for operation.
If the temperature exceeds this value, the fans will stop.
The fans start again with an hysteresis of 1°C.

F6: Maximum fan speed

This represents the maximum speed of the fans, expressed as a % of the output.
For a 0 to 10 V output it represents the output voltage at the maximum speed.
For phase control it represents the maximum portion of the semi-wave applied to the load.

F7: Minimum fan speed

This represents the minimum speed of the fans, expressed as a % of the output.
For a 0 to 10 V output it represents the output voltage at the minimum speed.
For phase control it represents the minimum portion of the semi-wave applied to the load.

F8: Fan peak speed time

Establishes the time the fans are forced to operate at maximum speed (100%), at start-up. This function is used to overcome the mechanical inertia of the motor.
If this parameter is = 0, the function is ignored, the fans are activated at minimum speed and then managed by the fan controller.

F9: Fan override interval

This parameter indicates the time that must elapse between one override and the next of the fans at 100%, with the duration set by parameter “F8”.

11.3 Defrost, dripping, post-dripping

Parameters used
F3: fan off during defrost
Fd: fan OFF time during post-dripping
dd: dripping time

During defrost, the fan can be configured to operate in different modes, based on the value of parameter "F3":
F3=0, fan on during defrost. During the *dripping wait* (in the case of master-slave network defrost) and dripping times (if set by the parameter "dd") the fan is always off.
F3=1, fan always off in all phases, defrost and dripping wait.
F3=2, fan always on, even during the dripping phase ("dd"). This is useful in the applications where the fans must always be on, yet a "pause"/dripping time is required after defrosting. During the *dripping wait* (in the case of master-slave network defrost) and *dripping times* (if set by the parameter "dd") the fan is always on.

Below are some examples of fan control during the phases described.

F0=0, F3=0, Fd ≠ 0

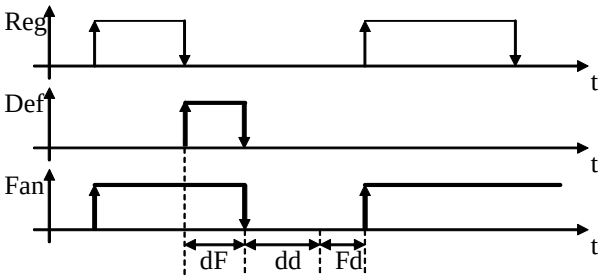


Fig. 11.c

F0=0, F3=1, Fd ≠ 0

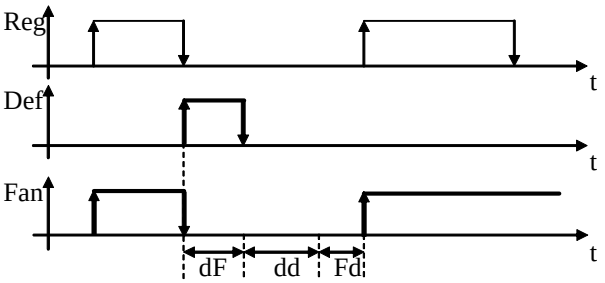


Fig. 11.d

F0=0, F3=2, Fd ≠ 0

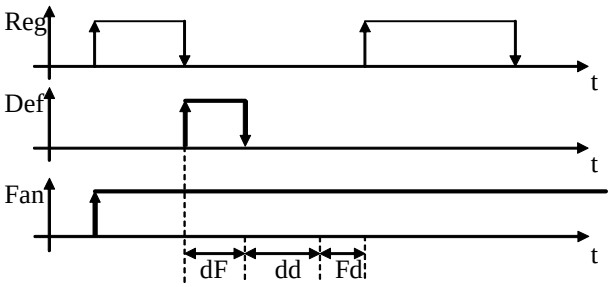


Fig. 11.e

Key

Reg	Control status
Fan	Fan status
t	Time
dF	Defrost operation
dd	Dripping wait time (min)
Fd	Post-dripping time (min)

Post-dripping time after defrost (fans on with controller on) (Fd)
The fans, after the defrost, can be stopped for a further period (in addition to "dd") defined by the value of "Fd".
This is useful to allow the evaporator to return to operating temperature after the defrost, thus avoiding forcing "hot" air into the refrigerator.

In the case of fan controller management, the time "Fd" does not need to be selected, as the controller makes the fans start again when the evaporator reaches operating temperature.
Assigning "Fd" a value other than zero means the fans stay off for a time equal to the value of "Fd", irrespective of the temperature of the evaporator.

12.ANTI-SWEAT CONTROL (ACC)

Parameters used

rHt: heater output activation period
rHu: heater output activation duty cycle in manual mode
/FI: select ambient temperature input
/FL: select ambient humidity input
/FM: select glass temperature input
rHo: dewpoint offset
rHd: dewpoint differential
rHc: heater output cut-off
rH6: minimum value of analogue output Y2
rH7: maximum value of analogue output Y2
rHC: heater output cut-off differential

Description

The ACC control function is used to modulate the activation of the anti-sweat heaters, based on the dewpoint, for the purpose of preventing condensate from forming on the display cabinets. The desired glass temperature is maintained, reasonably higher than the dewpoint, obtaining higher energy saving. The ACC output, in automatic or manual control, is disabled when:

- Refrigerator off (OFF)
- High temperature alarms active (HI or HI2)

The ACC control function uses the dewpoint value (SdP) and the glass temperature of the cabinet (SA) to control the dedicated analogue output Y2 and any outputs for the anti-sweat heaters configured.

Fig. 12.a

The dewpoint can be calculated using the following values:

- Ambient temperature
- Ambient humidity

The cabinet glass temperature can be calculated, if the dedicated probe is not installed, using the Air off temperature probe (Sm) and the ambient temperature probe (SA).

Management on the master board

Below are the operating characteristics of the master board, in relation to the anti-sweat control function:

- Always shares its own probes across the pLAN, connected to the terminals or deriving from the supervisor via serial;
- Always shares the dewpoint value either calculated or sent from the supervisor;
- Gives priority to the probes connected to the terminals on the board (local) over the serial probes.

Management on slave board 1

Below are the operating characteristics on slave board 1:

- Always shares its own probes across the pLAN, connected to the terminals (local) or deriving from the supervisor via serial;
- Always shares the dewpoint value either calculated or sent from the supervisor;
- Gives priority to the probes connected to the terminals on the board (local) over the serial probes.

Slave board 1 plays the role of support board when the inputs on the master board are not sufficient.

Management on other slave boards

The inputs on the other slave boards, either connected to the terminals or serial probes, are used locally and are not shared with the other MasterCase units in the network.

Manual control

If a MasterCase[3] unit does not have probes for calculating the dewpoint and cannot find such probes or the dewpoint value via the pLAN or from the supervisor, manual control will be performed based on the settings of parameter “rHu”, “rHt”.

Dewpoint calculation

If a MasterCase[3] unit has ambient temperature and humidity probes, either installed or available via serial, the dewpoint is calculated using the values read by these probes, otherwise the values are sought over the pLAN. If the calculation cannot be performed in this case too, the dewpoint already calculated by the other boards is used, via the supervisor and then via pLAN.
The settings must be made using the following parameters:

- /FI;
- /FL;
- /FN;
- /FM.

The ACC output is analogue output Y2 on the MasterCase^3 board, or any digital output, 01 to 08.
The ACC function also requires the following parameters to be set for manual control:

- rHt (cycle period)
- rHu (percentage ON time)

Manual mode is activated when:

- Modulating ACC Output deactivated (differential = 0)
- Dewpoint probe or glass temperature sensor error (no values read)

When this output is a digital output ("o" parameters), a minimum threshold must also be set for the cycle period to ensure continuity of operation of the relay (30 minutes).

Control with glass temperature sensor

If the glass temperature sensor is fitted, PI control (proportional + integral) is performed, with the following parameters:

- proportional coefficient set by DIFF and (MAX-MIN);
- fixed integration coefficient;
- the set point is Tdew+OFFS;
- the band in which PI control is active is shown in Figure 12.a;
- proportional action defined by the straight line in the graph;
- integral action defined based on the deviation from the set point (negative action to the R of the set point, positive to the L).

If the glass temperature sensor is not installed, the glass temperature is estimated based on the temperature read by the Air off probe (Sm) and the ambient temperature (SA). There is no feedback, the increase or decrease in the action of the anti-sweat heaters in fact has no effect on the Air off probe or the ambient temperature probe. Control is therefore strictly proportional, as defined in the graph, based on the estimated glass temperature.
The following parameters can be set by the user:

- Offset (rH0)
- Differential (rHd)

The "advanced" parameters are:

- Maximum value of analogue output Y2(rH7)
- Minimum value of analogue output Y2 (rH6)
- Cut-Off value (rHb)

Below are some examples of calculation in typical situations

1	**Master**	**Slave**
/F ambient temp.	1	0
/F humidity	2	0
/F dewpoint	0	0
Action	Calculate dewpoint and share the value	Calculate dewpoint from probes on master
2	**Master**	**Slave**
/F ambient temp.	0	0
/F humidity	0	0
/F dewpoint	1 (serial probe 8)	0
Action	Use dewpoint and share the value	Use dewpoint from master
3	**Master**	**Slave**
/F ambient temp.	1	0
/F humidity	2	0
/F dewpoint	1	0
Action	Calculate dewpoint and share the value	Calculate dewpoint from probes on master
4	**Master**	**Slave**
/F ambient temp.	1	1
/F humidity	2	2
/F dewpoint	0	0
Action	Calculate dewpoint and share the value	Calculate dewpoint from own local probes
5	**Master**	**Slave**
/F ambient temp.	1	0
/F humidity	0	0
/F dewpoint	1	0
Action	Use dewpoint and share the value, the ambient temperature can be used to estimated the glass temperature	Use dewpoint from master, the ambient temperature from master can be used for the estimate
6	**Master**	**Slave**
/F ambient temp.	0	1
/F humidity	2	0
/F dewpoint	1	0
Action	Use dewpoint and share the value, humidity shared but not used	Calculate dewpoint from humidity probe on master and local ambient temp.
7	**Master**	**Slave**
/F ambient temp.	0	4
/F humidity	7	0
/F dewpoint	0	0
Action	Hhu	Calculate dewpoint from humidity probe on master and local ambient temperature
8	**Master**	**Slave**
/F ambient temp.	0	4 (probe error)
/F humidity	7	0
/F dewpoint	0	0
Action	Hhu	Hhu

Tab. 12.a

13.DEFROST

13.1 General operating principle

Parameters used
d, All the type "d" parameters
/10, Select end defrost probe
r3, Enable alarm "Ed" (defrost ended by timeout)

The defrost function has the task of removing any frost or ice on the evaporator, optimising energy consumption and maximising performance.
MasterCase[3] offers different types of programmable defrosts:

- cyclical defrost;
- defrost from Real Time Clock;
- defrost at instrument start-up.
- defrost by sequential stops;

there are also different types of forced defrosts:

- manual network defrost;
- manual local defrost;
- defrost from digital input.

The following types of defrost are available (parameter d0):

- heater, end by temperature or after a maximum safety time (timeout)
- hot gas, end by temperature or after a maximum safety time (timeout)
- heater, end by time
- hot gas, end by time
- heater, end by time, with temperature control.

If parameter "r3"=1, when the defrost procedure ends after having reached the maximum time ("d0" = 0 or 1), the "Ed" alarm is signalled to indicate a possible problem.
N.B.: All the defrosts, except for the local manual defrosts, transfer the defrost call from the master to the slaves over the pLAN network.

13.2 Structure of the defrost function

The defrost procedure features three phases:

- Defrost
- Dripping
- Post-dripping

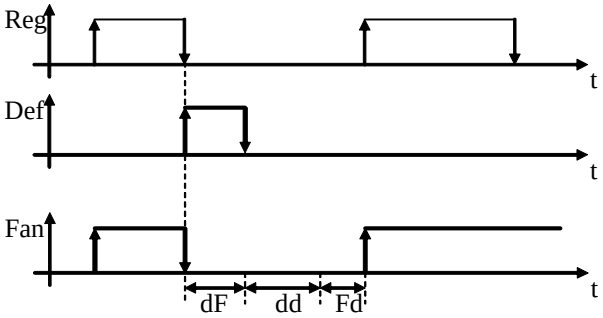


Fig. 13.a

Key

Reg	Control status
Def	Status of the defrost output
Fan	Fan status
dF	Defrost operation
dd	Dripping wait time
Fd	Post-dripping time

The operation of the fans during the defrost phases depends on the configuration

13.3 Defrost

Parameters used
d0: type of defrost
/10: select end defrost probe
dP1: maximum defrost duration
dP2: maximum defrost duration on second evaporator
dt1: end defrost tempt on first evaporator
dt2: end defrost tempt on second evaporator

The defrost phase is the main phase of the defrost procedure; only during this phase is the heater output or hot gas injection solenoid valve activated.
The duration of this phase depends on the configuration of parameter "d0", which indicates whether the end of the actual defrost procedure depends on:

- reaching the maximum defrost time "dP1" ("dP2" for the second evaporator),
- reaching the temperature indicated as the end defrost temperature "dt1" ("dt2" for the second evaporator), according to the value read by the probe indicated by parameter "/10".

Below are some examples of defrost control during the phases described.

d0=0/2 end by temperature

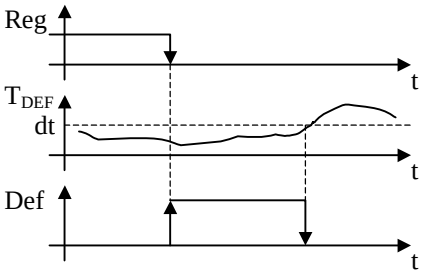


Fig. 13.b

d0=1/3 end by time

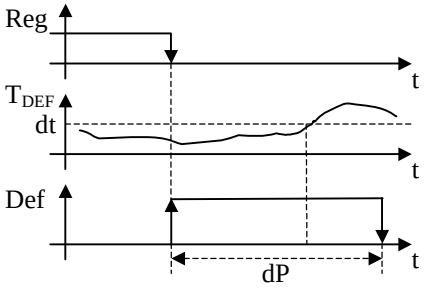


Fig. 13.c

Key

Reg	Control status
Def	Status of the defrost output
T_{DEF}	End defrost probe temperature
dP	Maximum defrost duration
dt	Maximum defrost temperature

13.4 Dripping and post-dripping times

Parameters used

F3: fan management during defrost
dd: dripping time
Fd: fan off time during post-dripping

This phase allows the water created due to the heat from the electric heaters to drip, choosing whether the fan should be on at the same time.
The dripping phase lasts the time indicated by parameter "dd". During the dripping phase, the fans operate based on the setting of parameter "F3".
For further details on the dripping and post-dripping phases, see the section on the fans.

13.5 Programmable defrosts

13.5.1 Cyclical defrosts

Parameters used

dI: time interval between 2 defrosts

MasterCase[3] offers the possibility to configure "cyclical" defrosts, that is, defrosts that are repeated cyclically over time. Parameter "dI" defines the time interval that must elapse between one defrost and the next. The time "dI" is restarted whenever a defrost is completed (even non-cyclical ones). If "dI" is equal to 0 ("dI" = 0), cyclical defrosts are disabled.
In a LAN, the activation of a cyclical defrost on the master also activates a defrost on the connected slaves (network defrost).

13.5.2 Defrost on start-up

Parameters used

d4: enable defrost when starting the unit
d5: defrost activation delay when starting the unit

Enabling "d4" activates a defrost when the instrument is switched on.
This function can be useful when, due to frequent power failures and the consequent resetting of the defrost timer (see parameter "dI"), the number of planned defrosts may be reduced and therefore be insufficient. In multi-utility systems, to avoid the simultaneous defrosting of all the units when power returns, set parameter "d5", corresponding to the defrost delay, to different values.

13.5.3 Defrosts by sequential stops

Parameters used

dS1: control off time with sequential stops
dS2: control on time with sequential stops

This function is enabled by setting "dS2" to a value other than 0 (dS2≠ 0).
The defrost by sequential stops is ideal for normal temperature refrigeration utilities (e.g. fruit and vegetables), which do not use the defrost probe and the heaters.
During this period, the defrost is performed by exploiting the air that flows through evaporator, when empty of refrigerant (static defrost), while the fans operate based on the configuration set for parameter "F3".

The sequential stops function automatically closes the flow of refrigerant for a set period (dS2), after the control output (compressor/solenoid) has been open for a certain time (dS1).
The time "dS1" increases when the controller is ON, the time "dS2" increases when the controller is OFF for defrosting.
Activation/deactivation of the controller is based on the type of control set using parameter "d0".

The activation time "dS1" starts counting only when the control output is active (ON) and stops when the output is deactivated (OFF). When the following request is sent, the count starts again from where it was stopped. When reaching and/or exceeding the maximum duration "dS1", the control output is deactivated for the time "dS2".

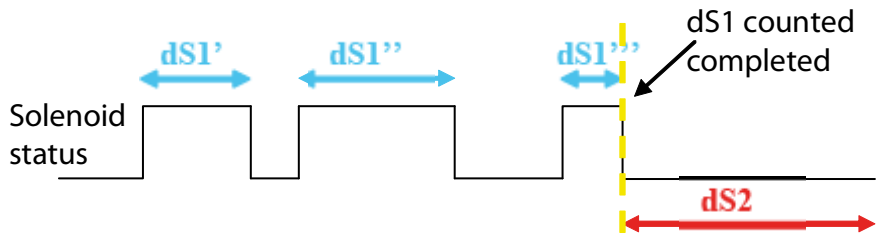


Fig. 13.d

If two evaporators are managed, two independent counts are used for the two evaporators, and the function is the same as described above.

13.6 Defrost with temperature control

Parameters used
d0: type of defrost
dt1: end defrost temperature on first evaporator
dt2: end defrost temperature on second evaporator
/Fb: assign defrost probe on first evaporator
/FF: assign defrost probe on second evaporator
dP1: maximum defrost duration
dP2: maximum defrost duration on second evaporator

Defrost with temperature control is used to run the defrost procedure without excessively heating the cabinet.
Control is available for two evaporators, using two digital outputs, based on the corresponding defrost control temperature ("Sd1" and "Sd2") and threshold ("dt1" and "dt2").
A fixed differential of 1°C is used for the reactivation of the heaters if the temperature falls below the limit dt1 (or dt2). The defrost ends when the time "dP1" has expired for the first evaporator, and "dP2" for the second.
No messages are displayed for end defrost by timeout.

Below is the operating diagram of defrost with temperature control

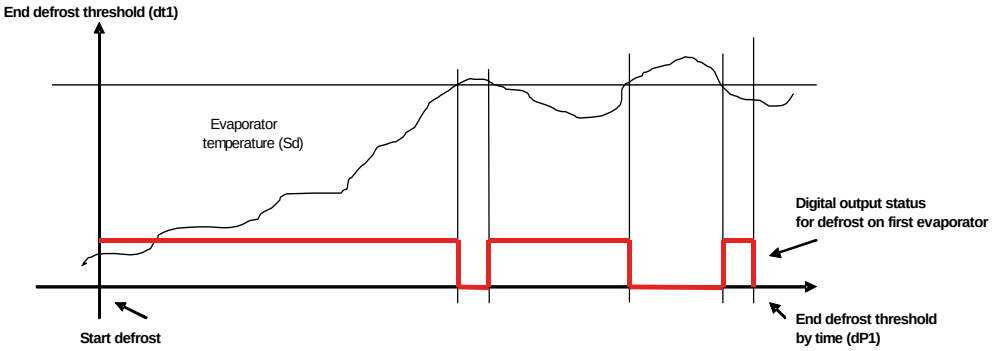


Fig. 13.e

13.7 Hot gas defrost

Parameters used
d0: type of defrost
dhG: type of hot gas control
r7: LSV valve configuration
r8: SSV and ESV valve configuration
P1: type of EEV
hGP: define valve status for pump out phase
hGS: define valve status for soft gas phase
hGH: define valve status for hot gas phase
hGE: define valve status for equalization phase
hGF: define valve status for fan delay phase
dH1: pump out phase duration
dH2: soft gas phase duration
dP1: hot gas phase duration
dd: equalization phase duration
Frd: fan delay phase duration

Description

The advanced hot gas defrost control uses a maximum of 6 digital outputs to control the following devices:

- LSV: liquid solenoid valve
- SSV: solenoid valve intake
- SGSV: soft gas solenoid valve
- HGSV: hot gas solenoid valve
- ESV: compensation solenoid valve
- FCR: fan outputs

Solenoid valves LSV, SSV and ESV can be:

- Local
- Network

This settings are made using parameters “r7” and “r8”.
If solenoid valve SSV is set as a network valve, the ESV valve automatically becomes a network valve.
Parameters dH1, dH2, dd, Fd are sent by the master board to the slave boards; these parameters cannot be changed from the slaves.
The complete hot gas defrost control uses up to 6 digital outputs, consequently considering one digital output used to control the light, only one output remains to signal the alarms.
Remember that not all the possible outputs may be used, if some solenoid valves are not envisaged by the installation, some functions or valves are not controlled and therefore some digital outputs will be available for other functions. One of the possible connection diagrams is shown in the figure below:

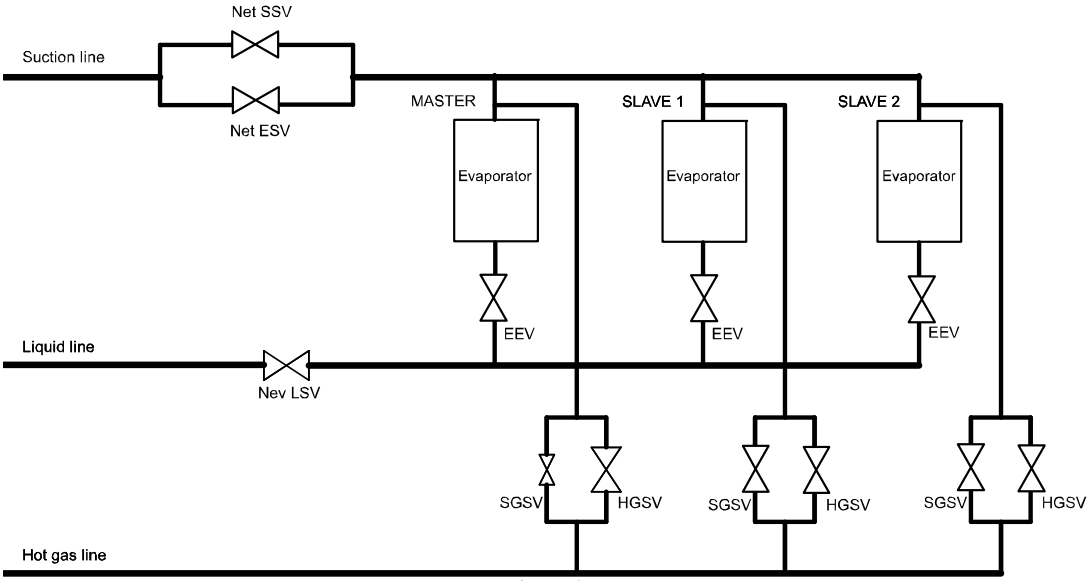


Fig. 13.f

There are two types of circuit that differentiate the behaviour of the outputs during the soft and hot gas phases:

Direct

The evaporator is used in the same way during normal operation and during the hot gas phase.

- With return on the suction line (the condensed hot gas returns on the normal suction line)
- With return on the liquid line (the condensed hot gas returns on the normal liquid line)

Reverse

The evaporator is used in reverse during normal operation compared to the hot gas phase. In practice, the hot gas enters the evaporator through what is normally the outlet. In this case too:

- With return on the suction line (the condensed hot gas returns on the normal suction line)
- With return on the liquid line (the condensed hot gas returns on the normal liquid line)

As well as these possibilities, two separate lines can be used for refrigeration and the hot gas defrost. This solution can be implemented using additional non-return valves and/or valves in parallel.

A parameter (dhG) is used to establish the type of circuit used:

- dhG = 0: reverse cycle, return on suction line;
- dhG = 1: reverse cycle, return on liquid line;
- dhG = 2: direct cycle, return on suction line;
- dhG = 3: direct cycle, return on liquid line.
- dhG = 4: custom cycle.

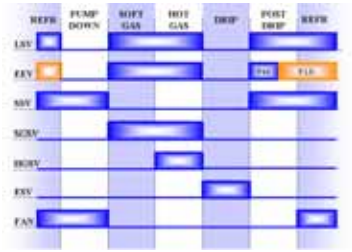
The advanced hot gas defrost features seven consecutive phases:

- Refrigeration;
- Pump out;
- Soft gas;
- Hot gas;
- Equalization;
- Fan delay;
- Refrigeration.

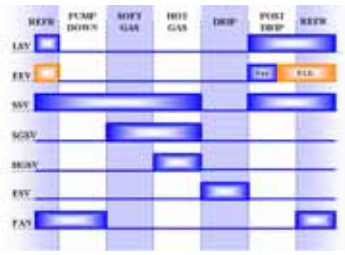
Each of these phases involves a combination of the valves used, with the duration set by parameter.
The combinations of the valves for each hot gas defrost phase are shown in the following table.

dhG=0	reverse cycle, return on suction line					
Phase	**LSV**	**SSV**	**SGSV**	**HGSV**	**ESV**	**FCR**
Refrigeration	✓	✓				✓
Pump Out		✓				✓
Soft Gas			✓			
Hot Gas			✓	✓		
Equalization					✓	
Fan Delay	✓	✓				
Refrigeration	✓	✓				✓

dhG=1	reverse cycle, return on liquid line					
Phase	**LSV**	**SSV**	**SGSV**	**HGSV**	**ESV**	**FCR**
Refrigeration	✓	✓				✓
Pump Out		✓				✓
Soft Gas	✓		✓			
Hot Gas	✓		✓	✓		
Equalization					✓	
Fan Delay	✓	✓				
Refrigeration	✓	✓				✓



dhG=2	direct cycle, return on suction line					
Phase	**LSV**	**SSV**	**SGSV**	**HGSV**	**ESV**	**FCR**
Refrigeration	✓	✓				✓
Pump Out		✓				✓
Soft Gas		✓	✓			
Hot Gas		✓	✓	✓		
Equalization					✓	
Fan Delay	✓	✓				
Refrigeration	✓	✓				✓



dhG=3	direct cycle, return on liquid line (as for dhG=1)					
Phase	**LSV**	**SSV**	**SGSV**	**HGSV**	**ESV**	**FCR**
Refrigeration	✓	✓				✓
Pump Out		✓				✓
Soft Gas			✓			
Hot Gas			✓	✓		
Equalization					✓	
Fan Delay	✓	✓				
Refrigeration	✓	✓				✓

Tab. 13.a

The configuration of the circuit can be customised by setting parameter "dhG" = 4; this selection enables the screens for configuring:

- The status of the solenoid valves (hGP, hGS, hGH, hGE, hGF)
- The position of the electronic valve EEV (P1)
- The duration of each individual hot gas defrost phase (dH1, dH2, dP1, dd, Frd)

The defrost phases are performed even if not associated with any digital output, and is ignored only if the parameter for the duration of the phase is set to zero (= 0). A PWM valve can be used as an LSV solenoid valve, because the status of the PWM is the same as the LSV in each phase of the hot gas defrost.

13.8 Advanced network solenoid management

Parameters used
r7: Solenoid valve configuration
P10: Enabling signal to close the solenoid valve in the event of low superheat or low suction temperature
Pm5: Enabling signal to close solenoid valve in the event of MOP

If at least one of the following situations is true:

- Low superheat
- Low suction temperature
- MOP

the liquid solenoid valve is forced closed if the number of steps of the stepper valve is less than 10.

This override occurs if:

- "P10" or "Pm5" are set to 1
- the opening of the EEV valve is between 0 and 10 steps

13.9 Power defrost

Parameters used
dt1: end defrost temperature on first evaporator
dt2: end defrost temperature on second evaporator
dP1: maximum defrost duration
dP2: maximum defrost duration on second evaporator
ddt: end defrost temperature delta for power defrost mode
ddp: end defrost time delta for power defrost mode
tP1 to tP8: enable power defrost

This function is used to increase the duration of the defrost.
In Power defrost mode, the controller increases the end defrost temperature and time thresholds, as described below:

- End defrost temperature = “dt1” (or “dt2”) + “ddt”
- Defrost duration = “dp1” (or “dp2”) + “ddP”

The Power defrost is performed in the following cases:
- always, if enabled in night status;
- when the defrost from RTC (Real time clock) has the Power defrost attribute (“tP1” to “tP8”).

13.10 Network defrost

Parameters used
Network defrost configuration (d2)

With each programmed or forced defrost (except for local manual defrosts), the master unit transfers the defrost call to all the slave units.
The various instruments in the pLAN network can be programmed to also wait for the end defrost signal from the network.
This setting depends on parameter “d2”:
“d2” = 0 ➔the instrument completes the defrost without waiting for the end signal (stand-alone instrument);
“d2” = 1 ➔ the instrument waits, at the end of the defrost, for the end signal, which is usually sent by the master in a LAN of multiplexed cabinets; the end signal arrives when all the units in the network have completed the actual defrost phase, and the dripping phase can only begin after this signal has been received. The function also affects the hot gas defrost.

13.11 Management of the second evaporator

Parameters used
dt1: end defrost temperature on first evaporator
dt2: end defrost temperature on second evaporator
dP1: maximum defrost duration
dP2: maximum defrost duration on second evaporator

The management of the second evaporator involves the control of one or two digital outputs for the electric heater; if a single output is configured (defrost 1), this is used to manage the defrost procedure on both evaporators.
If this function is used, the defrost procedure will only be complete when the defrosts have ended on both evaporators.

Management of the second evaporator is enabled in the following 3 cases:

Case 1
- Second evaporator probe enabled

Case 2
- Digital output for the second evaporator enabled
- Second evaporator probe disabled
- End defrost by time

Case 3
- Digital output for the second evaporator enabled
- End defrost by time or temperature or alternatively end defrost by time with temperature control.
- Second evaporator probe disabled
- Air on temperature probe enabled

Below is a table showing operation based on the configuration of the MasterCase[3].

Configuration	Description
• Defrost with heaters • End defrost by time • Enable defrost probe on first evaporator • Enable defrost probe on second evaporator • Enable just one digital output	**Activation** The digital output is activated at the start of the defrost procedure on one of the two evaporators. **Deactivation** The digital output is deactivated when the higher of two maximum defrost duration times expires ("dP1", "dP2")
• Defrost with heaters • End defrost by time • Enable defrost probe on first evaporator • Enable defrost probe on second evaporator • Enable two separate digital outputs for the two evaporators	**Activation** Both digital outputs are activated at the start of the defrost procedure on one of the two evaporators. **Deactivation** The digital output for the first evaporator is deactivated after the time "dP1", the digital output for the second evaporator is deactivated after the time "dP2".
• Defrost with heaters • End defrost by temperature/time • Enable defrost probe on first evaporator • Enable defrost probe on second evaporator • Enable just one digital output	**Activation** The digital output is activated at the start of the defrost procedure on one of the two evaporators. **Deactivation** The digital output is deactivated when at least one of the following conditions occurs: • Both defrost temperatures are above the corresponding end defrost thresholds; • The higher of the times "dP1" and "dP2" has expired If the defrost procedure is not completed correctly, alarms ED1 and ED2 will be signalled.
• Defrost with heaters • End defrost by temperature/time • Enable defrost probe on first evaporator • Enable defrost probe on second evaporator • Enable two separate digital outputs for the two evaporators	**Activation** Both digital outputs are activated at the start of the defrost procedure on one of the two evaporators. **Deactivation** The digital output for the first evaporator is deactivated when the defrost probe temperature on the first evaporator reaches the threshold "dt1" or when the time "dP1" expires. In this case, alarm ED1 will be signalled. The digital output for the second evaporator is deactivated when the defrost probe temperature on the second evaporator reaches the threshold "dt2" or when the time "dP2" expires. In this case, alarm ED2 will be signalled.
• Defrost with heaters • End defrost by time with temperature control • Enable defrost probe on first evaporator • Enable defrost probe on second evaporator • Enable just one digital output	**Activation** The digital output is activated at the start of the defrost procedure on one of the two evaporators. **Deactivation** The digital output is deactivated when both the evaporator temperatures exceed the respective thresholds "dt1" and "dt2". After this operation, as soon as one of the two temperatures falls 1°C below the respective threshold "dt1" or "dt2", the digital output is reactivated. From this point on, the activation/deactivation depends on the two temperatures, until the times "dP1" and "dP2" expire. If the defrost temperatures doe not reach their defrost limit thresholds ("dt1" and "dt2"), alarm ED1 and ED2 are signalled.
• Defrost with heaters • End defrost by time with temperature control • Enable defrost probe on first evaporator • Enable defrost probe on second evaporator • Enable two separate digital outputs for the two evaporators	**Activation** Both digital outputs are activated at the start of the defrost procedure on one of the two evaporators. **Deactivation** The digital output for the first evaporator is deactivated when the temperature of the first evaporator exceeds the threshold "dt1". As soon as the temperature falls 1°C below the threshold "dt1", the digital output is reactivated. From this point on, the activation/deactivation depends on the defrost temperature, until the time "dP1" expires. The digital output for the second evaporator is deactivated when the temperature of the second evaporator exceeds the threshold"dt2". As soon as the temperature falls 1°C below the threshold "dt2", the digital output is reactivated. From this point on, the activation/deactivation depends on the defrost temperature, until the time "dP2" expires.

Diagram of defrost on two evaporators with separate digital outputs

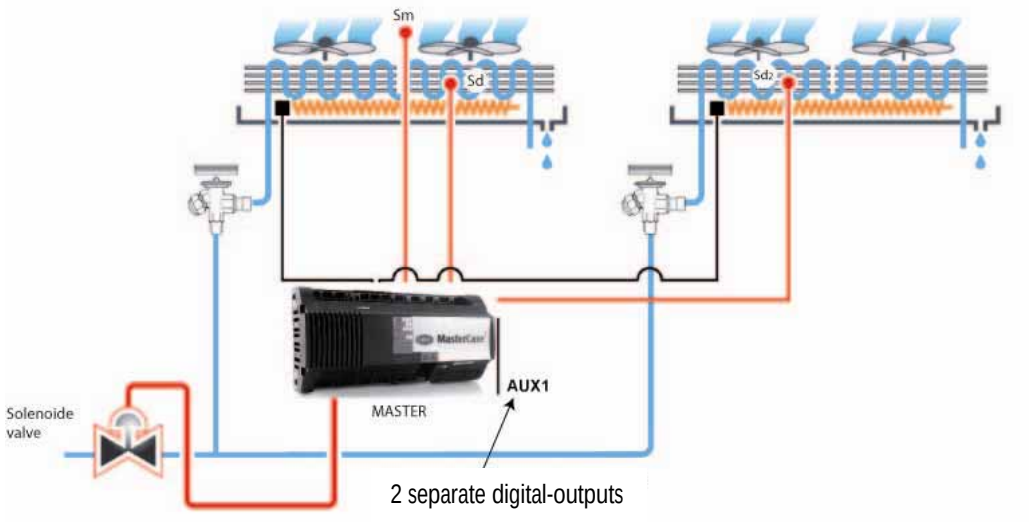


Fig. 13.g

13.12 Skip defrost

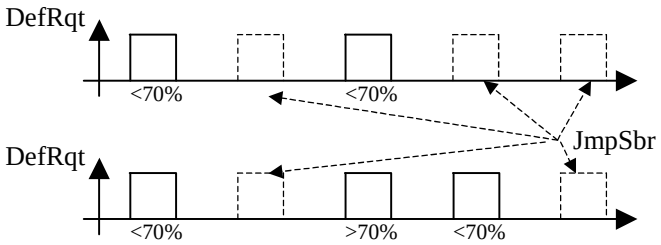
Parameters used
d7: enable skip defrost function

This function is used to control the completion of the defrosts, with the time taken to complete the last defrost being used to decide whether the following defrost is performed or skipped.

The following rules are considered:

- the maximum number of consecutive defrosts that can be skipped is 3, that is, after the third defrost skipped, the following one is always performed;
- after switching the instrument on, the first 7 defrosts are always performed;
- the number of events to be skipped is increased by a maximum of 1 at a time;
- the manual defrosts (user interface), from digital input or scheduler are always performed and counted;
- the function can only be used with the defrosts that end by temperature.

This function is based on a very simple but very effective principle. If the defrost lasts less than or equal to 70% of the time set for the parameter "dP1" ("dP2" for the second evaporator), the next defrost envisaged 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).
As soon as the defrost time exceeds 70% of the time "dP1", the following defrost will be performed and the function will start again.



Key
DefRqt Defrost call
JmpSbr Defrosts skipped

Fig. 13.h

This function should be used with the programming of the defrosts equally distributed over the day (e.g. cyclical defrosts, parameter "dI").

13.13 HI alarm bypass after defrost

Parameters used
d8: high temperature alarm bypass time after defrost

During the defrost phase, and in the period immediately following the defrost, the control probe reading may reach temperature values that are not allowed in normal operation, yet may be allowable in these transition phases.
Consequently, the unnecessary high temperature alarm "HI" signal can be disabled for the time indicated by parameter "d8". If the alarm condition continues more than the time indicated by "d8", the alarm will be activated.

13.14 Priority of defrost over safety times and the activation of the controller

Parameter "d9" can be used to assign the priority between the defrost call and the controller safety parameters.

- "d9" = 0 ⇨ the protection times are observed;
- "d9" = 1 ⇨ the defrost has higher priority and the times set with the "a" parameters are ignored.

13.15 Management of the user interface during defrost

Configuration only available for the PST terminal.
Parameter "d6" can be used to set what is displayed during the defrost phase:

- "d6" = 0 ⇨ the temperature is displayed, alternating with the defrost in progress signal "dF";
- "d6" = 1 ⇨ the last temperature measured before the start of the defrost procedure is displayed;
- "d6" = 2 ⇨ the defrost in progress signal "dF" only is displayed .

If any alarms are active, the display selected will alternate with the alarm signal.

14.ELECTRONIC VALVE

14.1 General operation

MasterCase[3] can manage the operation of an electronic expansion valve with stepper motor (Carel E2V) or a PWM On/Off valve.
This allows the possibility to directly control the injection of refrigerant into the evaporator, with lower and more stable superheat values, higher evaporation temperatures and consequently greater humidity and a more constant temperature in the cabinet.
This guarantees better product conservation and quality.

Parameters used
All the parameters in the "Px" configuration branch

14.2 Configuration of the system parameters

Select the type of valve ("P1")
MasterCase[3] can control two different types of valve.

- "P1" = 0, "PWM", PWM valve;
- "P1" = 1, "STEPPER", Valve with stepper motor;
- "P1" = 2, "NONE", Valve not installed.

Note: ***whenever this parameter is modified, the controller will need to be switched off and on again, so as to load the internal values associated with the type of valve chosen.***

Refrigerant ("PH")
Parameter "PH" sets the type of refrigerant used on the unit. This setting is required for the calculation of the saturated evaporation temperature. For refrigerants with glide, the dew point is used.

Superheat set point ("P3")
Parameter "P3" indicates the superheat control set point.

Proportional gain, Integration time, Derivative time
The proportional (parameter "P4"), integral (parameter "P5") and derivative (parameter "P6") constants are the main control parameters. These define the superheat PID control algorithm. Refer to classic PID control theory for a more detailed description of their meaning.
Note: The proportional constant – Kp – defines the gain not only for the PID control but also for all the active protection functions (LOW SHeat protection, LOP protection, MOP protection, HiTcond protection).

LOW SuperHeat
Low subcooling threshold.
Parameter "P7" defines the activation threshold for the low superheat protection function. Below this value another control function is activated, *in addition to* the PID, with programmable constant (parameter "P8").
When the superheat value is lower than the low superheat threshold, the delay time ("P9") for the low superheat alarm signal starts counting.

MOP
High suction pressure threshold (Maximum Operating Pressure) indicated in saturated °C.
Parameter "PM1" defines the high pressure protection activation threshold. Above this value, integral control starts, using a constant that can be set (parameter "PM2") so as to maintain the saturated suction temperature below the set value.
Note: The MOP protection closes the expansion valve. This means that if the reason why a high pressure situation occurred is temporary (compressor start, sudden variation in the refrigerant charge, modulation of the cooling capacity, etc.) the refrigerant superheat temperature on the suction side may be low or drop quickly. In these cases, the MOP protection and the superheat control act together, and there are no limits to either. If, on the other hand, the high pressure has been reached at the same time as particularly high or normal superheat values (for example the unit was started with very high temperatures of the product being cooled), the unlimited and extended action of the MOP may involve a refrigerant suction temperature that is excessive for the correct operation of the compressor. For this reason, a limit has been introduced to the maximum superheat temperature, described below (high suction temperature threshold).

MOP delay at start
This is the delay time for the activation of the MOP protection function whenever the control is activated (both when the unit is started and whenever deviating from the set point).
It can be set using parameter "PM4". This allows regular restarts before activating the MOP function.

High suction temperature threshold
Parameter "PM1" sets the maximum temperature allowed for the gas leaving the evaporator.
This parameter therefore limits the action of the MOP protection so that, when reached, the corrective action of the protection function is stopped, until the refrigerant temperature returns below the set value.
The integration time is set using parameter "PM2", the alarm delay using "PM4".

Low suction temperature threshold
Parameter "P11" sets the minimum temperature allowed for the gas at the evaporator outlet.
This parameter therefore limits the action of the LOP protection so that, when the value is reached, the corrective action of the protection is stopped until the temperature of the refrigerant returns above the set value.

Low evaporation temperature alarm differential
Parameter "PM13" defines the differential for automatic reset in the event of a low evaporation temperature alarm

Type and range of the saturation temperature probe

Parameter "/B3" selects the mode used to read the saturated evaporation temperature:

- /B3 = 0 – NTC: reading by NTC probe associated with the evaporator inlet/B3 = 1 - "0-5V": the saturated evaporation temperature is acquired by converting the value read by the pressure probe (the limits can be set for the reading using parameters "PEL" and "PEH") installed at the evaporator outlet to a temperature/B3 = 2 – "PT1000": reading by PT1000 probe associated with the evaporator inlet.

Parameters "/c4" and "/c3" can be used to define an offset on the temperature read or acquired by the suction temperature and saturated evaporation temperature probes.

14.3 Smart thermostat

Parameters used

Enable EEV valve (P1)
Superheat set point offset (P6a)

Description

This function, available only if the EEV electronic valve is enabled, is used to prevent the wide swings in the temperature of the refrigerated cabinet.
The function works by increasing the superheat set point "P3" by an offset "P6a", as the cabinet temperature approaches the set point (see the graph).

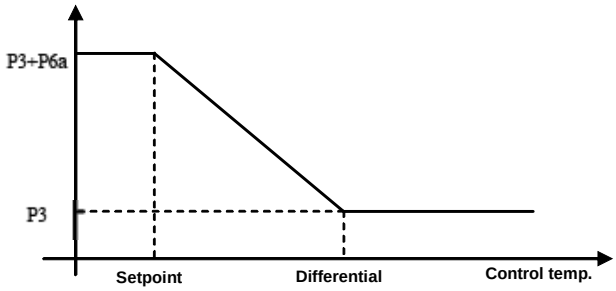


Fig. 14.a

14.4 Driver probe error management

Parameters used

Manual EEV position in the event of driver probe error (PL3)

Description

If there is an error on the EEV valve driver probe, MasterCase[3] can continue temperature control by forcing the valve open to the position set for parameter "PL3".

15.HACCP

15.1 General operation

This function allows advanced control of the operating temperature and the recording of any faults due to power failures or increases in the operating temperature for various reasons (faults, severe operating conditions, user errors, etc...).
This function can only be activated on the controllers with the RTC option fitted.

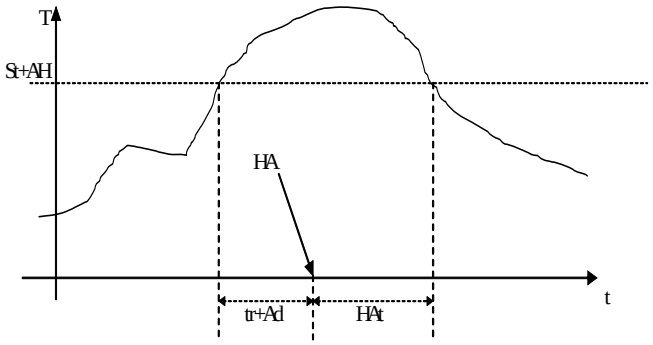
Parameters used

Temperature alarm delay and HACCP alarm delay ("Ad", "tr")
High temperature alarm (deviation from the set point) ("AH")
Type of HACCP alarm ("tA")
HACCP alarm activation hour, minutes and date ("tSH", "tSM", "tSd", "tSm")
HACCP alarm reset hour, minutes and date ("tEH", "tEM", "tEd", "tEm")
Delete the data saved ("to")

Alarms generated

- "HF"
- "HA"

15.2 Type HA alarm



Key

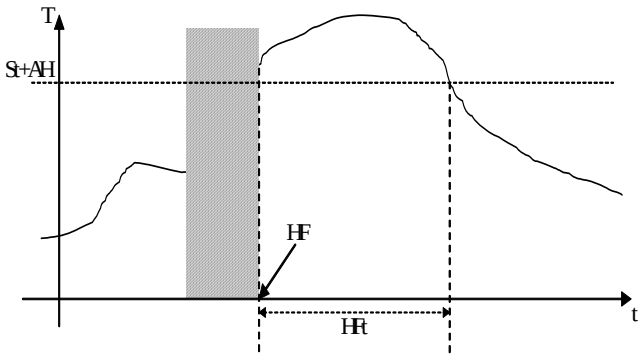
T	Temperature control probe
t	Time
St	Set point
AH	High temperature alarm (deviation from the set point)
tr	HACCP alarm delay
Ad	Temperature alarm delay
HA	HA alarm (HACCP)
HAt	HA alarm duration

Fig. 22

If, during operation, the temperature measured is greater than the threshold represented by the sum of the parameters "AH" (high temperature alarm threshold) and "St" (set point), for a time greater than the sum of the parameter "tr" (specific for the HACCP alarms) and the parameter "Ad" (temperature alarm delay), the alarm HA is activated.
When the event occurs the following data are saved:

- hour, minutes and day, month, year the alarm condition started;
- type of alarm;
- maximum temperature reached after the activation of the alarm;
- hour, minutes and day, month, year the alarm condition ended.

15.3 Type HF alarm



Key

T	Temperature control probe
t	Time
St	Set point
AH	High temperature alarm (deviation from the set point)
tr	HACCP alarm delay
Ad	Temperature alarm delay
HF	HF alarm (HACCP)
HFt	HF alarm duration

Fig. 23

This is activated after a power failure if, when power returns, the temperature is higher than the threshold represented by "AH" + "St".
The following data are saved:

- hour, minutes and day, month, year the power failure ended;
- type of alarm;
- maximum temperature reached after the activation of the alarm;
- hour, minutes and day, month, year the alarm condition ended.

16.NETWORK FUNCTIONS

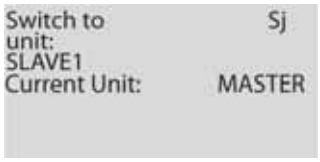
16.1 Local network functions (pLAN)

The MasterCase[3] controllers can be connected together to form a pLAN (**p**CO **L**ocal **A**rea **N**etwork) in master-slave configuration. The main purpose of the pLAN is to provide communication and synchronisation in operation between a series of instruments (maximum six: one Master and five Slaves) operating on a multi-evaporator utility, for example a multiplexed cabinet. The configuration of the instruments can be modified by simply setting the network address. This configuration is used to synchronise and coordinate the defrosts, send the status of the digital inputs and display any alarms active relating to the Slaves on the Master.

16.2 pLAN network configuration

16.2.1 Parameters used

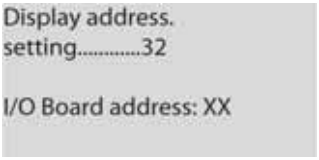
Number of slave units (only on the master) ("Sn")
Select the unit in the pLAN connected to the display (only on the PGD terminal) ("Sj")
On the master unit, the number of units connected in the LAN can be configured using parameter "Sn".
The Master function will be automatically taken by the controller configured with address 1 in the pLAN network. All the other units act as slaves.
Parameter "Sj" can be used to change the unit in the network displayed on the terminal; the function for selecting the unit in the network displayed on the terminal is only available with the PGD terminal.



16.2.2 Setting the address of the PGD1 terminal

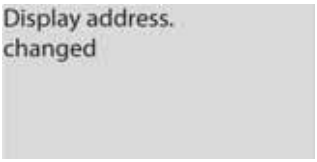
The address of the terminal can only be set after having supplied power to the terminal via the RJ12 telephone connector. The default address of the terminal is 32.

To enter configuration mode, press the DOWN UP and ENTER buttons at the same time for at least 5 seconds; the following screen will be displayed, with the cursor flashing in the top left corner:



• To change the address of the terminal (display address setting) press ENTER once. The cursor will move to the address field (XX).

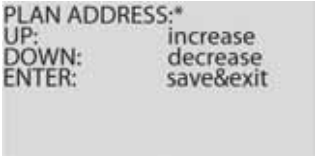
• Use the DOWN and UP buttons to select the desired value, and confirm by pressing ENTER. If the value selected is different from the one saved previously, the following screen will be displayed, and the new value will be saved to the permanent memory on the display.



If the field XX is set to 0, the terminal will communicate with the controller using the "point-to-point" protocol (not pLAN) and the "I/O Board address: xx" field is no longer displayed, being without meaning.

16.2.3 Setting the address of the boards in the pLAN

The pLAN address is set using a standard PGD1 terminal, as follows:
• Disconnect the board from the power supply;
• Prepare a PGD1 terminal with the address set to 0;
• Connect the terminal to the controller;
• Disconnect any pLAN connections to other controllers from the MasterCase[3];
• Power the controller by pressing UP and ALARM at the same time;
• After a few seconds the following screen will be displayed:



• To change the address, simply use the UP & DOWN buttons and then press ENTER to confirm.

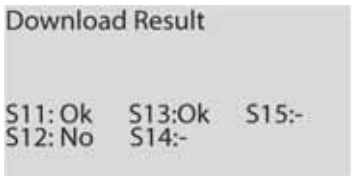
16.3 Downloading the parameters

MasterCase[3] has the possibility of transferring the parameter settings from the master to the slaves across the pLAN local network. This operation is used to save time in programming the instruments that are used in the same LAN and that would have similar settings.
During the transfer phase, all the parameters are downloaded from the master to the slaves, except for those that involve the individual controller (clock setting, defrost times, etc.…). The following list summarises the parameters that are transferred via pLAN from the Master to the Slaves; for a more detailed description of each individual parameter, see the table of parameters.

ddt	P12	HL	F3	CP1	/FI	dH1
ddP	PM3	P14	F2	PEH	/FL	dH2
/B1	Pb	H2	PH	dP1	/FM	Ad
/B2	P9	tP1	rH9	dP2	rH8	A0
/B3	c8	tP2	Htd	rH6	P4	dt1
/B4	P6	tP3	d8	PEL	H7	dt2
/B5	rH2	tP4	AH	P11	/7	d11
/B6	r0	tP5	AH2	Stn	rd	St
/B7	rHC	tP6	dhG	r7	rd2	St2
Psb	rH3	tP7	P5	P10	r6	PM1
H6	P13	tP8	PM2	PM5	c0	dI
cc	r4	d7	P8	OSH	c5	dS2
rHB	Di1	r5	d2	rH5	c4	Aa
d4	Di2	Fd	r1	/FA	d10	A1
d5	Di3	F5	r2	/Fb	/10	/t
d9	d6	Frd	P7	/Fc	Pa	PPE
d0	dd	F0	c6	/Fd	PM4	P1
AdE	dn	F6	AL	/Fe	P3	/4
dS1	r3	F7	AL2	/FF	c3	H0
Pdd	H4	F1	PL3	/FG	c1	-
A7	H3	F8	rH7	/FH	rH4	-

16.3.1 Failed download signal

When the parameter download procedure starts, a screen is displayed indicating the results of the download.
For each slave unit present in the network, the message “No” is displayed if there has been a communication error (download failed), while if the download is successful, the message “Ok” is displayed.



16.4 Network defrost in multiplexed systems

One of the functions that mostly requires synchronisation is defrost management. The master controls the defrosts on all the slaves connected. The master waits for all the units to have ended the defrost before signalling the end of the defrost on the entire network. The slaves that have ended the defrost wait for the end defrost signal from the master before starting the dripping phase. Once having received the end defrost signal, the controllers switch to the dripping phase. The defrost on each single unit and the network defrost in any case end after the maximum defrost time, set by parameter (“dP”, default 30 min.).
The network defrost, as well as being run cyclically at a programmable interval using parameter “dI”, can be started:

- From the PGD1 terminal by pressing ENTER and DOWN together for more than 5 seconds;
- From the PST terminal by pressing the SET  and  together for more than 5 seconds

  N.B.: Pressing the DOWN button on PGD1 or  on the PST for more than 5 seconds starts the local defrost on the unit.
- At pre-set times, if the RTC option is fitted on the master unit.

16.5 Remote alarm signals

The unit configured as the master in a pLAN can signal remote alarms present on the slave units, if enabled by setting the corresponding configuration parameter (parameter Ar = 1). All the masters are enabled to receive the alarm signals from the slaves by default.
As the terminal or display is not essential for the operation of the unit, and indeed in a LAN the slave can operate perfectly without this user interface, this function is particularly useful for "centralising" the alarm management functions on the master.
If the master detects an alarm on a slave unit (probe error, high or low temperature error, etc....), the display shows the corresponding alarm signal. The following codes denote an alarm on the slave units:

1. Alarm on slave unit 1 = n1
2. Alarm on slave unit 2 = n2
3. Alarm on slave unit 3 = n3
4. Alarm on slave unit 4 = n4
5. Alarm on slave unit 5 = n5

The alarm relay on the master is activated when the remote alarm signal remote is received.

16.6 Supervisor network

Parameters used

Serial address in the BMS network (H0)
Type of protocol used (H7)
Communication speed (H6)

MasterCase[3] can be connected to a supervisor, allowing remote control of the entire installation.
The following protocols are supported:

- Carel
- Modbus
- Winload

Table of analogue variables

Code	Description	Address	Type
AH	High temperature threshold	1	RW
AL	Low threshold temperature	2	RW
A0	Differential for temperature alarm	3	RW
St	Temperature control set point	4	RW
rd	Temperature control differential	5	RW
r1	Minimum set point limit	6	RW
r2	Maximum set point limit	7	RW
r4	Set point differential for control in night mode	8	RW
/c1 (*)	Probe 1 calibration	9	RW
F1	Fan activation threshold	10	RW
dt1	End defrost temperature on first evaporator	11	RW
/c7 (*)	Probe 7 calibration	12	RW
/c5 (*)	Probe 5 calibration	13	RW
/c6 (*)	Probe 6 calibration	14	RW
/c2 (*)	Probe 2 calibration	15	RW
P3	Superheat set point	16	RW
P4	PID proportional gain	17	RW
rHo	Dewpoint offset	18	RW
P6	PID derivative time	19	RW
P7	Low superheat threshold	20	RW
P8	Low superheat integration time	21	RW
PM1	MOP threshold	22	RW
PM2	MOP integration time	23	RW
F5	Fan cut-off set point	24	RW
EEV mask	Current superheat set point	25	R
/c3 (*)	Saturation temperature	26	R
	Evaporation pressure	27	R
/c4 (*)	Suction temperature probe	28	R
EEV mask	EEV opening (%)	29	R
i1 (*)	Air off temperature probe	30	R
	Defrost temperature probe 1	31	R
i1 (*)	Air on temperature probe	32	R
i1 (*)	Virtual temperature	33	R
i1 (*)	Defrost temperature management	34	R
Q1 (*)	MC3 software version	35	R
	Analogue input 1 from supervisor	36	R
	Analogue input 2 from supervisor	37	R
	Analogue input 3 from supervisor	38	R
	Analogue input 4 from supervisor	39	R
tt	Maximum temperature during HACCP	40	R
rHB	Cut-off value for dewpoint	41	RW
rHd	Differential for dewpoint control	42	RW
rHC	Cut-off differential for dewpoint	43	RW
dt2	End defrost temperature on second evaporator	44	RW
ddt	Additional temperature for power defrost	45	RW
Frd	Fan differential	46	RW
rH	Maximum temperature measured	47	R
rL	Minimum temperature measured	48	R
PPE	PWM valve control period	49	RW
PEL	Pressure probe minimum limit	50	RW
PEH	Pressure probe maximum limit	51	RW
/c4	Suction temperature probe calibration	52	RW
/c3	Evaporation pressure probe calibration	53	RW
	LOP threshold	54	R
	LOP integration time	55	R
P11	Minimum suction temperature	56	RW
P13	Differential for low suction temperature control	57	RW
Pa	High superheat set point	58	RW
d11	Temperature threshold for “running time” function	59	RW
EEV (*)	Superheat working set point	60	R

	Auxiliary temperature probe 1	61	R
	Auxiliary temperature probe 2	62	R
Ga	Parameter “A” for Svt formula	63	RW
AH2	High temperature threshold for Air on probe	72	RW
AL2	Low threshold temperature for Air on probe	73	RW
St2	Air on probe “Sr” set point in double thermostat mode	74	RW
rd2	Air on probe “Sr” set point differential in double thermostat mode	75	RW
r0	Differential between Air off and Air on	76	RW
OSH	Superheat modulating thermostat offset	77	RW

(*) = name shown on screen.

Table of digital variables

Code	Description	Address	Type
J5 (*)	Digital output 1 On/Off from manual control	1	R
J5 (*)	Digital output 2 On/Off from manual control	2	R
J5 (*)	Digital output 3 On/Off from manual control	3	R
J5 (*)	Digital output 4 On/Off from manual control	4	R
J6 (*)	Digital output 5 On/Off from manual control	5	R
J6 (*)	Digital output 6 On/Off from manual control	6	R
J6 (*)	Digital output 7 On/Off from manual control	7	R
J6 (*)	Digital output 8 On/Off from manual control	8	R
J5 (*)	Enable manual operation	9	R
	Enable unit On/Off from supervisor	10	R
rS (*)	Enable clock card	11	R
r3	Enable end defrost signal by maximum time: 0= N, 1=Y	12	RW
r5	Select maximum and minimum temperature monitoring probe: 0=N, 1=Y	13	RW
r6	Enable night-time control on Air on probe (Sr): 0=N/1=Y	14	RW
	Day/night status	15	R
F2	Enable stop fans with control off (OFF): 0= No, 1= Yes	16	RW
d2	Enable end defrost synchronised between Master and Slave: 0= START ONLY, 1= START AND STOP	17	RW
d4	Enable defrost on start-up: 0 = N, 1=Y	18	RW
Ar	Enable alarm propagation from Slaves to Master: 0=N, 1=Y	19	RW
d7	Enable "Skip defrost" function: 0= N, 1=Y	20	RW
d9	Enable defrost priority over solenoid times: 0=N , 1=Y	21	RW
H2	Enable ON/OFF from supervisor: 0=N, 1=Y	22	RW
	Enable use of third probe (Air off probe) as defrost probe for evaporator 2	23	R
AdE	Priority of external alarm delay: 0=LOW, 1= HIGH	24	RW
H3	Enable ON/OFF from keypad: 0=N, 1=Y	25	RW
i2	Liquid solenoid valve status	26	R
J4	Light status	27	RW
	Evaporator 1 defrost	28	R
	Fan status	29	R
	Evaporator 2 defrost	30	R
	Alarm active	31	R
	Anti-sweat heater digital output	32	R
	Indication of network solenoid liquid that controls all the valves	33	R
O/F	Unit status: 0=UNIT OFF, 1=UNIT ON	34	RW
	Reset alarms	35	R
Alarm	Cold room maintenance time elapsed	36	R
J1	Forced defrost from keypad: 0=N, 1=Y	37	RW
	Manually force status	38	R
rH8	Type of anti-sweat heater modulation: 0= PROPORTIONAL, 1= PROP.+INTEGR.	39	RW
Alarm	High temperature alarm	40	R
Alarm	Low temperature alarm	41	R
	Cabinet cleaning alarm	42	R
Alarm	Evaporator 1 defrost timeout alarm	43	R
Alarm	Driver probe broken or not connected alarm	44	R
Alarm	Duty setting alarm	45	R
Alarm	Delayed external alarm	46	R
Alarm	Instant external alarm	47	R
Alarm	HACCP high temperature alarm	48	R
Alarm	HACCP HF alarm	49	R
Alarm	Air off probe broken or not connected alarm	50	R
Alarm	Probe alarm 1 broken or disconnected	51	R
Alarm	Air on probe broken or not connected alarm	52	R
Alarm	Virtual probe alarm	53	R
Alarm	Evaporator 2 defrost timeout alarm	54	R
Alarm	Slave 1 alarm	55	R
Alarm	Slave 2 alarm	56	R
Alarm	Slave 3 alarm	57	R
Alarm	Slave 4 alarm	58	R
Alarm	Slave 5 alarm	59	R
t0	Reset HACCP alarms: 0=N, 1=Y	60	RW
	Type of evaporator probe	61	R

tt (*)	HACCP alarm not enabled	62	R
Alarm	MOP alarm delay	63	R
Alarm	Door open alarm timeout	64	R
Alarm	RTC fault or low battery level alarm	65	R
Alarm	Communication lost with master board alarm	66	R
Alarm	Communication lost with slave board 1 alarm	67	R
Alarm	Communication lost with slave board 2 alarm	68	R
Alarm	Communication lost with slave board 3 alarm	69	R
Alarm	Communication lost with slave board 4 alarm	70	R
Alarm	Communication lost with slave board 5 alarm	71	R
Alarm	LOP alarm	72	R
Alarm	Low superheat alarm	73	R
Alarm	High superheat alarm	74	R
J7 (Show)	EEV override status	75	R
Alarm	Hot gas defrost devices not ready alarm	76	R
	Type of end defrost	77	R
	Unit On from keypad	78	R
	Enable Air off probe	79	R
	Enable defrost probe	80	R
	Enable Air on probe	81	R
i5 (Show)	Digital input, channel 1	82	R
i5 (Show)	Digital input, channel 2	83	R
i5 (Show)	Digital input, channel 3	84	R
	Enable control On with low suction temperature	85	R
Alarm	Low suction temperature alarm	86	R
	Lights On/Off	87	R
	Digital input from supervision	88	RW
J3	Compressor continuous cycle: 0=N, 1=Y	89	RW
A1	Select alarm thresholds as relative to the set point or absolute: 0=RELATIVE, 1= ABSOLUTE	90	RW
	Variable to test serial probes	91	RW
Alarm	High temperature alarm from Air on probe	92	R
Alarm	Low temperature alarm from Air on probe	93	R
HL	Enable lights off at night: 0=N, 1=Y	94	RW
	Door switch	95	R
P10	Enabling signal to close solenoid valve for low LowSH and/or LSA	96	RW
PM5	Enabling signal to close solenoid valve for MOP: 0=N, 1=Y	97	RW
Alarm	Glass temperature sensor broken or disconnected	98	R
Alarm	Defrost probe 2 broken or disconnected	99	R
Alarm	Auxiliary probe 1 broken or disconnected	100	R
Alarm	Auxiliary probe 2 broken or disconnected	101	R
Alarm	Humidity probe dewpoint broken or disconnected	102	R
Alarm	Dewpoint temperature probe broken or disconnected	103	R
tP1	Defrost 1 – power: 0=N, 1=Y	104	RW
tP2	Defrost 2 – power: 0=N, 1=Y	105	RW
tP3	Defrost 3 – power: 0=N, 1=Y	106	RW
tP4	Defrost 4 – power: 0=N, 1=Y	107	RW
tP5	Defrost 5 – power: 0=N, 1=Y	108	RW
tP6	Defrost 6 – power: 0=N, 1=Y	109	RW
tP7	Defrost 7 – power: 0=N, 1=Y	110	RW
tP8	Defrost 8 – power: 0=N, 1=Y	111	RW
J2	Force network defrost 0=N, 1=Y	112	R
r7	Type of LSV: 0=LOCAL, 1=NETWORK	113	RW
r8	Type of SSV_ESV: 0=LOCAL, 1=NETWORK	114	RW
G8	Enable extrasteps when closing: 0=N, 1=Y	115	RW
G7	Enable extrasteps when opening: 0=N, 1=Y	116	RW
	Set network suction valve that controls all the suction valves	117	R
	Set network equalizing valve that controls all the equalizing valves	118	R
i6 (*)	Digital output, channel 1	119	R
i6 (*)	Digital output, channel 2	120	R
i6 (*)	Digital output, channel 3	121	R
i6 (*)	Digital output, channel 4	122	R
i6 (*)	Digital output, channel 5	123	R

i7 (*)	Digital output, channel 6	124	R
i7 (Show)	Digital output, channel 7	125	R
i7 (Show)	Digital output, channel 8	126	R
DL1	Logic of digital input 1	127	RW
DL2	Logic of digital input 2	128	RW
DL3	Logic of digital input 3	129	RW
H4	Enable buzzer: 0=N, 1=Y	130	RW
	Request copy RTC data to the new clock data	131	R
Alarm	Low Air on probe temperature alarm	132	R
Alarm	Serial probe alarm	133	R
Alarm	No secondary evaporator probe alarm	134	R

(*) = name shown on screen.

Table of integer variables

Code	Description	Address	Type
H7	Type of supervisor protocol. 0= CAREL 1= Modbus 2= WINLOAD 3= GSM modem 4= RS232	1	RW
rH6	Minimum anti-sweat heater output	2	RW
dhG	Type of hot gas system: 0= REVERSE, RET. ON SUCT. 1= REVERSE, RET. ON LIQUID 2= DIRECT, RET. ON SUCT. 3= DIRECT, RET. ON LIQUID 4= CUSTOM	3	RW
dH1	Pump out time for hot gas defrost	4	RW
dH2	Soft gas temp for hot gas defrost	5	RW
ddP	Offset for maximum defrost duration during "Power defrost"	6	RW
rH9	Integration time for anti-sweat heaters	7	RW
F0	Fan management configuration: 0= ALWAYS ON 1= DIFFERENCE Sv-Sd 2= DEFROST TEMP.	8	RW
/10	Select probe used for end defrost: 0= REGULATION PROBE 1= AIR OFF PROBE 2= DEFROST PROBE 3= AIR ON PROBE	9	RW
Ad	Delay time for high and low temperature alarms	11	RW
/t	Select display on the user terminal: 0= NOT USED 1= AIR OFF PROBE 2= DEFROST PROBE 3= AIR ON PROBE 4= REGULATION PROBE	12	RW
Stn	Select event for night status: 0= NONE 1= FROM DIGITAL INPUT 2= FROM RTC	13	RW
d6	Display on PST during defrosts: 0= TEMP. & DEF 1= FIXED TEMP. 2= FIXED DEF.	14	RW
rt	Duration of current max/min temperature monitoring session	15	R
F3	Enable stop fans during the defrost: 0= ALWAYS ON 1= ALWAYS OFF 2= ON IN DEF. OFF IN DRIPPING	16	RW
Fd	Post-dripping time	17	RW
c0	Delay enable control and fans on power-up	18	RW
c1	Minimum time between successive solenoid requests	19	RW
c2	Minimum solenoid off time	20	RW
c3	Minimum solenoid on time	21	RW
c4	Solenoid on time in duty setting from probe alarms	22	RW
c5	Solenoid off time in duty setting from probe alarms	23	RW
c6	Low temperature alarm bypass time after continuous cycle	24	RW
d13	Maximum cold room maintenance time	25	RW
cc	Duration in continuous cycle operation	26	RW
d0	Select type of defrost: 0= ELECTRIC end by TEMPERATURE/TIMEOUT 1= HOT GAS end by TEMPERATURE /TIMEOUT 2= ELECTRIC end by TIMEOUT ONLY 3= HOT GAS end by TIMEOUT ONLY 4= ELECTRIC end by TIME WITH TEMP. CONT.	27	RW
d10	Defrost time for "Running time" defrost function	28	RW

d5	Defrost delay on start-up or from digital input (if enabled)	29	RW
d8	Bypass high temperature alarm time after defrost and/or door open	30	RW
dd	Dripping time after defrost (fans off)	31	RW
dI	Interval between two consecutive defrosts	32	RW
dP1	Maximum evaporator 1 defrost time	33	RW
	Time between cleaning	34	R
	Cleaning time duration	35	R
Sn	Number of slaves in the local network	36	RW
/4	Virtual probe composition	37	RW
/7	Type of PST terminal: 0= PST SMALL WITH KEYPAF 1= PST SMALL READ ONLY DISPLAY	38	RW
F6	Maximum fan speed	39	RW
F7	Minimum fan speeds	40	RW
F8	Fan peak time (maximum speed)	41	RW
td1	Defrost 1 – day: 0= *** 1= MON 2= TUE 3= WED 4= THU 5= FRI 6= SAT 7= SUN 8= MON-FRI 9= MON-SAT 10= WEEKEND 11= ALWAYS	42	RW
td2	Defrost 2 – day. See td1	43	RW
td3	Defrost 3 – day. See td1	44	RW
td4	Defrost 4 – day. See td1	45	RW
td5	Defrost 5 – day. See td1	46	RW
td6	Defrost 6 – day. See td1	47	RW
td7	Defrost 7 – day. See td1	48	RW
td8	Defrost 8 – day. See td1	49	RW
th1	Defrost 1 - hour	50	RW
th2	Defrost 2 - hour	51	RW
th3	Defrost 3 - hour	52	RW
th4	Defrost 4 - hour	53	RW
th5	Defrost 5 - hour	54	RW
th6	Defrost 6 - hour	55	RW
th7	Defrost 7 - hour	56	RW
th8	Defrost 8 - hour	57	RW
tm1	Defrost 1 - minutes	58	RW
tm2	Defrost 2 - minutes	59	RW
tm3	Defrost 3 - minutes	60	RW
tm4	Defrost 4 - minutes	61	RW
tm5	Defrost 5 - minutes	62	RW
tm6	Defrost 6 - minutes	63	RW
tm7	Defrost 7 - minutes	64	RW
tm8	Defrost 8 - minutes	65	RW
PH	Type refrigerant: 0= 1: R22 1= 2: R134a 2= 3: R404a 3= 4: R407c 4= 5: R410a 5= 6: R507a 6= 7: R290 (propane) 7= 8: R600 (butane) 8= 9: R600a (isobutane) 9= 10: R717 (ammonia) 10= 11: R744 11= 12: R728 (nitrogen) 12= 13: R1270 (propy.) 13= 14: R417a	66	RW
Q1 (*)	Application version	67	R
Q1 (*)	0= A, 1= B, 2= O	68	R
Htd	HACCP alarm delay	70	RW
tA	Type of HACCP alarm: 0= *** 1= HA 2= HF	71	R
tb (tSH)	Start HACCP alarm (hours)	72	R
tb (tSM)	Start HACCP alarm (minutes)	73	R
tb (tSd)	Start HACCP alarm (day)	74	R
tb (tSm)	Start HACCP alarm (month)	75	R

tb (tSy)	Start HACCP alarm (year)	76	R
tc (tEH)	End HACCP alarm (hours)	77	R
tc (tEM)	End HACCP alarm (minutes)	78	R
tc (tEd)	End HACCP alarm (day)	79	R
tc (tEm)	End HACCP alarm (month)	80	R
tc (tEy)	End HACCP alarm (year)	81	R
H0	Supervisor address	82	R
A7	Delay time for delayed external alarm	83	RW
P9	LowSH low superheat alarm delay	84	RW
	LOP alarm delay	85	R
PM3	MOP maximum suction pressure alarm delay	86	RW
G9	EEV stop time	87	RW
Di1	Configuration of digital input 1: 0= NONE 1= REMOTE ALARM 2= DEL. REM. ALARM 3= ENABLE DEFROST 4= START NET DEFROST 5= DOOR SWITCH 6= REMOTE ON/OFF 7= DAY/NIGHT 8= START DUTY SETT. 9= COLD ROOM MAINT.	88	RW
Di2	Configuration of digital input 2. See Di1	89	RW
Di3	Configuration of digital input 3. See Di2	90	RW
Aa	Select high and low temperature alarm probe: 0= VIRTUAL PROBE 1= AIR OFF PROBE 2= DEFROST PROBE 3= AIR ON PROBE 4= SUCTION PROBE 5= SAT. EVAP. PROBE 6= DEFROST PROBE 2 7= AUX. PROBE 1 8= AUX. PROBE 2 9= DEWPOINT TEMP. PROBE	91	RW
A8	Configure function of virtual digital input: 0= NONE 1= REMOTE ALARM 2= DEL. REM. ALARM 3= ENABLE DEFROST 4= START NET DEFROST 5= DOOR SWITCH 6= REMOTE ON/OFF 7= DAY/NIGHT 8= START DUTY SETT. 9= COLD ROOM MAINT.	92	RW
	Master time (hours)	93	R
	Master time (minutes)	94	R
	Master time (day)	98	R
rHt	Trim heater ON time	99	RW
rHu	Anti-sweat heater manual activation percentage	100	RW
i8 (*)	Fan speed (%)	101	R
i8 (*)	Anti-sweat heater (%)	102	R
Psb	EEV standby position	103	RW
Q1 (*)	Software version date (day)	104	R
Q1 (*)	Software version date (month)	105	R
Q1 (*)	Software version date (year)	106	R
F9	Period between two fan overrides at maximum speed	107	RW
G6	Duty cycle (0-100%)	108	RW
J7 (*)	Override EEV position	109	R
P5	PID integration time	110	RW
	Digital output association	111	R
	EEV fluid status	112	R
P12	LSA low suction temperature alarm delay	113	RW
Pb	HighSH high superheat alarm delay	114	RW
As	Serial probe alarm delay	115	RW
i2 (*)	Expansion valve position	116	R
	EEV capacity request (0-100, LSV closed/open)	117	R
P1	Type of EEV: 0= PWM 1= EEV 2= Not present	118	RW
CP1	Initial expansion valve opening percentage (circuit capacity / valve)	119	RW
PM4	MOP function delay when control starts	120	RW
dP2	Maximum defrost duration on secondary evaporator	121	RW
dn	Nominal defrost duration for "Skip defrost" function	122	RW
rH7	Maximum anti-sweat heater output	123	RW

/c1 (*)	Probe B1 calibration	124	RW
/c2 (*)	Probe B2 calibration	125	RW
dS1	Solenoid ON time for "Sequential stops" defrost function	126	RW
dS2	Solenoid OFF time for "Sequential stops" defrost function	127	RW
/B1	Type of probe 1: 0=" NTC" 1= " 0-5V" 2= PT1000 3= 4-20 mA	128	RW
/B2	Type of probe 2: See B1_Type	129	RW
/B3	Type of probe 3: See B1_Type	130	RW
/B4	Type of probe 4: See B1_Type	131	RW
/B5	Type of probe 5: See B1_Type	132	RW
/B6	Type of probe 6: See B1_Type	133	RW
/B7	Type of probe 7: See B1_Type	134	RW
S1	Time band 1 – day. 0= *** 1= MON 2= TUE 3= WED 4= THU 5= FRI 6= SAT 7= SUN 8= MON-FRI 9= MON-SAT 10= WEEKEND 11= ALWAYS	135	RW
hS1	Time band 1 - Start night hours	136	RW
mS1	Time band 1 - Start night minutes	137	RW
hE1	Time band 1 - End night hours	138	RW
mE1	Time band 1 - End night minutes	139	RW
S2	Time band 2 – day: see S1	140	RW
hS2	Time band 2 - Start night hours	141	RW
mS2	Time band 2 - Start night minutes	142	RW
hE2	Time band 2 - End night hours	143	RW
mE2	Time band 2 - End night minutes	144	RW
S3	Time band 3 – day: see S1	145	RW
hS3	Time band 3 - Start night hours	146	RW
mS3	Time band 3 - Start night minutes	147	RW
hE3	Time band 3 - End night hours	148	RW
mE3	Time band 3 - End night minutes	149	RW
Q2 (Show)	Boot version	150	R
Q2 (Show)	Boot version	151	R
Q2 (Show)	Bios version	152	R
Q2 (Show)	Bios version	153	R
Q2 (Show)	Boot version date (day)	154	R
Q2 (Show)	Boot version date (month)	155	R
Q2 (Show)	Boot version date (year)	156	R
Q2 (Show)	Bios version date (day)	157	R
Q2 (Show)	Bios version date (month)	158	R
Q2 (Show)	Bios version date (year)	159	R
/c5 (Show)	Probe B5 calibration	160	RW
/c6 (Show)	Probe B6 calibration	161	RW
/c7 (Show)	Probe B7 calibration	162	RW
o1	Configuration of digital output 1 0= FAN 1= DEFROST 1 2= DEFROST 2 3= LIGHT – NIGHT BLIND 4= RAIL HEATER 5= NO ALARM 6= NC ALARM 7= LIQUID SOLENOID 8= ALWAYS OPEN 9= ALWAYS CLOSE 10= SUCTION SOLENOID 11= SOFT GAS SOLENOID 12= HOT GAS SOLENOID 13= EQUALIZ. SOLENOID	163	RW
o2	Configuration of digital output 2. See o1	164	RW
o3	Configuration of digital output 3. See o1	165	RW

o4	Configuration of digital output 4. See o1	166	RW
o5	Configuration of digital output 5. See o1	167	RW
o6	Configuration of digital output 6. See o1	168	RW
o7	Configuration of digital output 7. See o1	169	RW
o8	Configuration of digital output 8. See o1	170	RW
/FA	Select Air off temperature probe (Sm) 0 = NOT FITTED 1..7 = B1 … B7 8..11 = B8 … B11 SERIAL 1 … 4 12= MASTER 13= SLAVE 1 14= VIRT. PROBE	171	RW
/Fb	Select defrost temperature probe (Sd). See /FA	172	RW
/Fc	Select Air on temperature probe (Sr). See /FA	173	RW
/Fd	Select evaporator Air off temperature probe (Tsuct EEV) 4= B4 (Not modifiable)	174	RW
/Fe	Select saturated evaporation temperature probe (T/Psat EEV) As /Fd	175	RW
/FF	Select secondary evaporator defrost temperature probe (Sd2) See /FA	176	RW
/FG	Select auxiliary temperature probe 1 (Saux1) See /FA	177	RW
/FH	Select auxiliary temperature probe 2 (Saux2) See /FA	178	RW
/FI	Assign ambient temperature probe (SU) See /FA	179	RW
/FL	Assign humidity probe (SA) See /FA	180	RW
/FM	Assign glass temperature probe (Svt) See /FA	181	RW
A9	Select digital input propagated from master to slaves: 0= Not used 1= DI 1 2= DI 2 3= DI 3 4= supervisor	182	RW
Gb	Parameter A for glass temperature sensor estimate	183	RW
Gc	Parameter B for glass temperature sensor estimate	184	RW
i3 (*)	Dewpoint temperature	185	R
CLK (*)	New hour (set hour)	186	R
CLK (*)	New minutes (set minutes)	187	R
CLK (*)	New day	188	R
	New month	189	R
CLK (*)	New year (set year)	190	R
Pdd	Waiting time in initial valve position after defrost	191	RW

(*) = name shown on screen.

17.TEMPERATURE ALARMS

17.1 Alarm thresholds relative to the set point or absolute (A1)

Parameters used
Select alarm thresholds relative to the control set point or absolute (A1)

Description
Parameter "A1" can be used to choose whether or not to relate the high temperature (AH, AH2 for "double thermostat") and low temperature (AL and AL2 for "double thermostat") alarms to the temperature set point.
"A1" = 0: AL, AH, AL2 and AH2 are thresholds relative to the set point.
"A1" = 1: AL, AH, AL2 and AH2 are absolute thresholds.

If "A1" is equal to 0 (relative thresholds), parameters "AL" and "AL2" must have positive values (>0).
The effective low temperature alarm threshold will be, in this case, "St" – "AL".
In addition, if AH, AH2 and AL, AL2 = 0 the alarms are disabled.

17.2 Select probe for controlling the temperature alarms (AA)

Parameters used
Select high and low temperature alarm probe (AA)
Delay time for high and low temperature alarms (Ad)

Description
Parameter "AA" is used to select the probe used to control the low and high temperature alarms.
AA = 0: Air off probe
AA = 1: Virtual probe

If the "double thermostat" function is enabled, parameters "AH" and "AL" represent the high and low temperature alarm thresholds in relation to the probe selected by parameter "AA", while the parameters "AH1" and "AL1" represent the high and low temperature alarm thresholds in relation to the Air on probe.
The high and low temperature alarms are not activated in the following cases:

- OFF status;
- defrost (excluding dripping and post-dripping);
- continuous cycle.

In these situations, parameter "Ad" (temperature alarm delay) is set to zero.
Important: parameters "Ad", "d8" and "c6" are active in reference to both the probe setting (Air off or virtual probe, depending on parameter AA) and the Air on probe (when "double thermostat" mode is used).

17.3 **Network digital inputs**: virtual digital input configuration (A8) and virtual input position (A9)

Parameters "A8" and "A9" are used to propagate the status and control signals of the virtual digital inputs across a master-slave network. In addition, they also can be used to control the ON/OFF status from the supervisor.

Parameter "A8" is used to configure the functions of the virtual digital input in the same way as for parameters "A1" to "A3".
Subsequently, parameter "A9" can be used to choose the digital input on the master (or via supervisor) that will propagate the ON/OFF status to the virtual inputs on the slaves (configured with "A8").

"A9" can have the following values:
A9 = 0 Digital input 1 on the Master (for Slave units only)
A9 = 1 Digital input 2 on the Master (for Slave units only)
A9 = 2 Digital input 3 on the Master (for Slave units only)
A9 = 3 Digital input from the supervisor (both Master and Slaves). Default:

Example 1: to configure the master to open the curtains on the all the slaves in the subnetwork, set the following parameters:

Parameter	Unit	Function
A8=5	All the units in the subnetwork (Master and Slaves)	The input for opening/closing the curtain is configured on all the units.
A9=1	All the Slaves in subnetwork	Digital input 2 on the master is configured for connection to an on/off switch that controls the opening and closing of the curtain in the entire subnetwork.

Tab. 17.a

Using this configuration, the switch connected to digital input 2 on the master will propagate the open and close curtain controls throughout the entire subnetwork.

Example 2: to configure the supervisor to open the curtains on the all the units in the subnetwork, set the following parameters:

Parameter	Unit	Function
A8=5	All the units in the subnetwork (Master and Slaves)	The input for opening/closing the curtain is configured on all the units.
A9=3	All the units in the subnetwork (Master and Slaves)	The supervisor will manage the opening and closing of the curtain on all the units in the subnetwork.

Tab. 17.b

Using this configuration, the supervisor will propagate the open and close curtain controls throughout the entire subnetwork.

17.4 Summary table

Code	Description	Delay	Notes
rE	Virtual probe alarm	60s	
EA	Air off temp. probe broken/disconnected alarm	60s	
Eb	Defrost probe 1 broken/disconnected alarm	60s	
Ec	Air on temp. probe broken/disconnected alarm	60s	
EM	Glass probe broken/disconnected alarm	60s	Condition to enable the glass temperature calculation formula
EF	Defrost probe 2 broken/disconnected alarm	60s	
EG	Auxiliary probe 1 broken/disconnected alarm	60s	
EH	auxiliary probe 2 broken/disconnected alarm	60s	
EI	DWP humidity probe broken/disconnected alarm	60s	
EL	DWP temperature probe broken/disconnected alarm	60s	
SLP	Serial probe broken/disconnected alarm	As (min)	
EP2	No probe configured for evaporator 2	5s	
EdC	Driver probe broken/disconnected alarm	240s	Forced EEV control mode
HI	High temperature alarm	Ad (min)	
Lo	Low temperature alarm	Ad (min)	
HI2	High temperature alarm from Air on probe in “double thermostat”	Ad (min)	
Lo2	Low temperature alarm from Air on probe in “double thermostat”	Ad (min)	
HA	HACCP alarm type HA	Htd (min)	
HF	HACCP alarm type HF	Htd (min)	
Ed1	Evaporator 1/Hot gas defrost timeout alarm	HotGas defrost =dH1+dH2+dP1 (min), Electric defrost =dP1(min), Power Defrost =dP1+ddP(min)	
Ed2	Evaporator 2 defrost timeout alarm	Electric defrost =dP2 (min) Power defrost =dP2+ddP (min)	
hGC	Hot gas devices not ready alarm	10s	Close EEV valve
Id	Duty setting alarm	-	LSV duty cycle
dA	Delayed external alarm	A7 (min)	Close LSV
IA	Immediate external alarm	-	Close LSV
n1	Alarm on slave 1	10s	Shown on Master display
n2	Alarm on slave 2	10s	Shown on Master display
n3	Alarm on slave 3	10s	Shown on Master display
n4	Alarm on slave 4	10s	Shown on Master display
n5	Alarm on slave 5	10s	Shown on Master display
DR	Inspection door open timeout	d8 (min)	Open LSV, start fan
Mnt	Cold room maintenance alarm	d13 (min)	Open LSV, start fan
tC	Clock board alarm (RTC) or low battery power	-	
MA	No communication with Master board	30s	
u1	No communication with Slave board 1	30s	
u2	No communication with Slave board 2	30s	
u3	No communication with Slave board 3	30s	
u4	No communication with Slave board 4	30s	
u5	No communication with Slave board 5	30s	
LSh	Low superheat alarm	P9 (sec)	Close EEV valve
LSA	Low suction temperature alarm	P12 (sec)	Close EEV valve
MOP	Delayed MOP alarm	PM3 (sec)	Open EEV valve
LOP	LOP alarm	0 s	Open EEV valve
HSh	High superheat alarm	Pb (sec)	Open EEV valve
dF	Defrost mode		Not an alarm, display only on PST terminal
dor	Door open		Not an alarm, display only on PST terminal
Mnc	Cold room in maintenance		Not an alarm, display only on PST terminal

Tab. 17.c

17.5 Notes and descriptions

MasterCase[3] offers the possibility to signal any faults both using the alarm LED on the terminal and the buzzer (PST terminal only), as well as, in the case of serious alarms, by activating a relay with changeover contacts for the remote alarm signal; each alarm signal is sent to the supervisor, allowing real time monitoring even from a remote location.
The alarms can be divided into groups:

- Alarms relating to the probes
- Alarms relating to the electronic valve
- Temperature alarms
- HACCP alarms
- Alarms relating to communication between the units
- Alarms relating to the digital inputs
- Other signals

17.5.1 Alarms relating to the probes

Check parameters: "/4", "/Sa to /Sr", "/B1 to /B7", "PSt", "PEL", "PEH".

rE

Control probe error:

- probe not working: the probe signal is interrupted or short-circuited;
- probe not compatible with the instrument.

If control is based on the virtual probe (value of parameter "/4" between 0 and 100), this error will be generated only when both the probes are broken. In fact, the breakage of just one of the two probes automatically moves control to the other probe.

E1

Room probe error:

- probe not working: the probe signal is interrupted or short-circuited;
- probe not compatible with the instrument.

E2

Evaporator probe error:

- probe not working: the probe signal is interrupted or short-circuited;
- probe not compatible with the instrument.

E3

Third probe error:

- probe not working: the probe signal is interrupted or short-circuited;
- probe not compatible with the instrument.

E0

Communication error with the PST terminal.
This error may arise if there is no communication between the controller and the terminal, even if power to the latter is supplied by the controller.

Ed1

Superheat probes out of range.
The valve is controlled by reading the superheat, which in turn is the difference between the value measured by the evaporator probe (either pressure or temperature, depending on parameter "PSt") and the suction temperature probe. If these probes are faulty or out-of-range, the controller is no longer able to manage the valve, and control is terminated, signalling the presence of a serious alarm:

- check the electrical connections;
- check the condition of the probes.

17.5.2 Alarms relating to the electronic valve

Check parameters: "P1", "PH", "P7", "P9", "PM1", "PM4".

LSh

Low superheat. When the threshold set by parameter "P7" is exceeded, a delay set for parameter "P9" starts, after which this alarm is generated:

- check the mechanical condition of the valve;
- check that the readings and the positions of the probes are correct.

17.5.3 Temperature alarms

Check parameters: "AL", "AH", "Ad", "St" & "A0".

LO

Low temperature alarm.
The control probe has detected a temperature lower than the set point by a value greater than parameter "AL":

- check the correct operation of the temperature probes.

The alarm is reset automatically when the temperature returns within the set limits (see parameters "AL" and "A0").

HI

High temperature alarm.
The control probe has detected a temperature higher than the set point by a value greater than parameter "AH":
check the correct operation of the temperature probes.

- check the correct operation of the temperature probes.

(see parameters "AH" and "A0").

17.5.4 HACCP alarms

Check parameters: “St”, “Ad”, “AH”, all the type “t” parameters.
See the HACCP section in the manual.

HA

HACCP alarm, type HA.
A high temperature alarm has occurred according to the settings of parameters “tr”, “Ad”, “AH”, “St”:

- check the HACCP parameters;
- check the temperature and the correct operation of the temperature probes.

HF

HACCP alarm, type HF.
A high temperature alarm has occurred according to the settings of parameters “tr”, “AH”, “St”.
A power failure has occurred for more than one minute and when power returned the temperature was higher than the value set for “AH” + “St”:

- check the HACCP parameters;
- check the temperature and the correct operation of the temperature probes.

17.5.5 Alarms relating to communication between the units

Check parameter: “Sn”, unit address setting in the LAN.
See the “Network functions” section in the manual.

MA (on slave)

Loss of communication with the master on the slave:

- check the LAN electrical connections.

These network signals (both on the master and on the slaves) are reset automatically as soon as communication is re-established between the master and the slaves.

“u1 to u5” (on master)

Loss of communication with slave 1 to 5:

- check the LAN electrical connections.

These network signals (both on the master and on the slaves) are reset automatically as soon as communication is re-established between the master and the slaves.

17.5.6 Alarms relating to the digital inputs

Check parameters: “A1 to A3”, “A8” & “A7”.

IA

Immediate alarm from digital input:

- check the status of the digital input and the value of the corresponding parameter “A1 to A3” / “A8”.

dA

Delayed alarm from digital input:

- check the status of the digital input and the value of the corresponding parameters “A1 to A3” / “A8” and “A7”.

Id

This is an immediate external alarm (see the description of alarm “IA”), with the difference that the controller will activate the “duty cycle setting” function (see explanation of parameters “c4” and “c5”):

- check the status of the digital input and the value of the corresponding parameter “A1 to A3” / “A8”.

17.5.7 Other signals

Check parameters: “r3”, “dP”, “d0”, “d8”, “d6”, “Ar”, ”th”, “t’”, “tn”, “tM”, “tY” & “td”.

Ed

The last defrost ended as the maximum time (parameter “dP”) exceeded, before reaching the end defrost temperature (“dt”). The signal is active only if parameter “r3”= 1.
The signal **remains on until a defrost is completed correctly as programmed and that ends at the set temperature:**

- check parameters “r3”, “d0”, “dt” and “dP”;
- check the efficiency of the defrost devices;
- check the positioning of the end defrost probe.

dr

The digital input configured as the “door switch” (“A1 to A3”, “A8” = 5) has remained open for a time greater than the time set for parameter “d8”:

- check that the door is actually closed;
- check the status of the contact connected to the input on the instrument.

dF

Defrost running:

- this is not an alarm signal, but rather an indication that the controller is running a defrost;
- it is only displayed if parameter d6= 0, or d6= 2.

“n1 to n5” (on master)

Local alarm on slave 1 to 5:

- check the status of the slave with the alarm and check the alarm code on the slave.

tC

Clock error (RTC) on the unit fitted with the RTC:

- set the time and the minutes on the user interface or via supervisor;
- if the error persists, check and/or replace the clock card.

18. LIST OF PARAMETERS

PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
SET	St	F	Temperature set point	-20.0	-	-99.9	99.9	X	
	/4	F	Virtual probe composition 0 = Air off probe (Sm) 100 = Air on probe (Sd)	0	%	0	100	X	
	rd	C	Temperature set point differential	2.0	-	0.1	20.0	X	
	Stn	C	Select event for night status 0= NONE 1= FROM DIGITAL INPUT 2= FROM RTC	0	-	0	2	X	
	r4	C	Set point differential for control in night mode	3.0	°C	-20.0	20.0	X	
	r6	C	Enable night control on Air on probe (Sr): 0=N/1=Y	0	-	0	1	X	
	r0	C	Difference between Air off and Air on for probe error	5.0	°C	0.0	99.9	X	
	St2	A	Air on probe “Sr” set in “double thermostat” mode	-15	°C	-99.9	99.9	X	
	rd2	A	Air on probe “Sr” differential in “double thermostat” mode	0	°C	-99.9	99.9	X	
	r1	A	Minimum set point value	-50.0	-	-50.0	99.9	X	
	r2	A	Maximum set point value	50.0	-	-50.0	99.9	X	
	HL	A	Enable lights off at night; 0=N, 1=Y	1	-	0	1	X	
			Configuration – I/O - Probes						
PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
IOc	/B1	C	Type of probe B1: 0=NTC 1= 0-5V 2= PT1000 3= 4-20mA	0	-	0	3	X	
	/B2	C	Type of probe B2; see /B1	0	-	0	3	X	
	/B3	C	Type of probe B3 0= NTC 1= 0-5V 2= PT1000	1	-	0	2	X	
	/B4	C	Type of probe B4. See /B3.	0	-	0	2	X	
	/B5	C	Type of probe B5. See /B3.	0	-	0	2	X	
	/B6	C	Type of probe B6. See /B3.	0	-	0	2	X	
	/B7	C	Type of probe B7. See /B3.	0	-	0	2	X	
	/FA	C	Select Air off temperature probe (Sm): 0 = NOT FITTED 1..7 = B1 … B7 8..11 = B8 … B11 SERIAL 1 … 4 12= MASTER 13= SLAVE 1 14= VIRT. PROBE	5	-	0	14	X	
	/Fb	C	Select defrost temperature probe (Sd); See /FA	6	-	0	14	X	
	/Fc	C	Select Air on temperature probe (Sr); See /FA	7	-	0	14	X	
	/Fd	C	Select evaporator Air off temperature probe (Tsuct EEV); 4 = B4 (non-modifiable)	4	-	0	14	X	
	/Fe	C	Select saturated evaporation temperature probe (T/Psat EEV); 3 = B3 (non-modifiable)	3	-	0	14	X	
	PEL	C	Minimum pressure probe value	-1	Bar	-99.9	99.9	X	
	PEH	C	Maximum value pressure probe	9.3	Bar	-99.9	99.9	X	
	/FF	C	Select secondary evaporator defrost temperature probe (Sd2); see /FA	0	-	0	14	X	
	/FG	C	Select auxiliary temperature probe 1 (Saux1); see /FA	0	-	0	14	X	
	/FH	C	Select auxiliary temperature probe 2 (Saux2); see /FA	0	-	0	14	X	
	/FI	C	Assign ambient temperature probe (SU): see /FA	0	-	0	14	X	
	/FL	C	Assign humidity probe (SA); see /FA	0	-	0	14	X	
	/FM	C	Assign glass temperature probe (Svt); see /FA	0	-	0	14	X	
			Configuration – I/O – Digital inputs						
PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
IOc	DL1	C	Logic of digital input 1 0 = NC, 1 = NO	0	-	0	1		
	Di2	C	Configuration of digital input 2; see Di1	0	-	0	10	X	
	DL2	C	Logic of digital input 2; see DL1	0	-	0	1		
	Di3	C	Configuration of digital input 3; see Di2	0	-	0	10	X	
	DL3	C	Logic of digital input 3; see DL1	0	-	0	1		

PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
	A8	C	Configuration of virtual digital input function 0= NONE 1= REMOTE ALARM 2= DEL. REM. ALARM 3= ENABLE DEFROST 4= START NET DEFROST 5= DOOR SWITCH 6= REMOTE ON/OFF 7= DAY/NIGHT 8= START DUTY SETT. 9= COLD ROOM MAINT.	0	-	0	9		
	A9	C	Select virtual digital input propagated from Master to Slaves: 0= Not used 1 = DI1 2 = DI2 3 = DI3 4 = supervisor	0	-	0	4		
			Configuration – I/O – Digital outputs						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
IOc	o1	C	Configuration of digital output 1: 0= FAN 1= DEFROST 1 2= DEFROST 2 3= LIGHT – NIGHT BLIND 4= RAIL HEATER 5= NO ALARM 6= NC ALARM 7= LIQUID SOLENOID 8= ALWAYS OPEN 9= ALWAYS CLOSE 10= SUCTION SOLENOID 11= SOFT GAS SOLENOID 12= HOT GAS SOLENOID 13= EQUALIZ. SOLENOID	7	-	0	13		
	o2	C	Configuration of digital output 2. See o1.	0	-	0	13		
	o3	C	Configuration of digital output 3. See o1.	8	-	0	13		
	o4	C	Configuration of digital output 4. See o1.	1	-	0	13		
	o5	C	Configuration of digital output 5. See o1.	4	-	0	13		
	o6	C	Configuration of digital output 6. See o1.	3	-	0	13		
	o7	C	Configuration of digital output 7. See o1.	8	-	0	13		
	o8	C	Configuration of digital output 8. See o1.	5	-	0	13		
	r7	C	Type of liquid solenoid: 0=LOCAL, 1=NETWORK	0	-	0	1		
	r8	C	Type of suction and equalization solenoid: 0=LOCAL, 1=NETWORK	0	-	0	1		
			Configuration – I/O – Probe calibration						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
IOc	/c1	A	Calibration of probe 1	0.0	-	-9.9	9.9		
	/c2	A	Calibration of probe 2	0.0	-	-9.9	9.9		
	/c3	A	Calibration of evaporation pressure probe	0.0	-	-9.9	9.9		
	/c4	A	Calibration of suction temperature probe	0.0	-	-9.9	9.9		
	/c5	A	Calibration of probe 5	0.0	-	-9.9	9.9		
	/c6	A	Calibration of probe 6	0.0	-	-9.9	9.9		
	/c7	A	Calibration of probe 7	0.0	-	-9.9	9.9		
			Configuration – Interfaces - Supervisor						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
Int	H0	C	Supervisor address	199		0	207		
	H7	C	Type of supervisor protocol: 0= CAREL 1= Modbus 2= WINLOAD 3= GSM Modem 4= RS232	0	-	0	4	X	
	H6	A	Supervisor communication speed: 0= 1200 baud 1= 2400 baud 2= 4800 baud 3= 9600 baud 4= 19200 baud	4	-	0	4	X	
	Sn	C	Number of slaves in local network	0	-	0	5		

PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
			Configuration – Interfaces – User interface						
Int	/t	C	Select display on user terminal: 0= NOT USED 1= AIR OFF PROBE 2= DEFROST PROBE 3= AIR ON PROBE 4= RGULATION PROBE	4	-	0	4	X	
	/7	C	Type of PST terminal: 0= PST SMALL WITH KEYPAD 1= PST SMALL READ ONLY DISPLAY	0	-	0	1	X	
	d6	C	Display on PST during defrost: 0= TEMP. & DEF 1= FIXED TEMP. 2= FIXED DEF.	0	-	0	2	X	
	H4	C	Enable buzzer; 0=N, 1=Y	0	-	0	1	X	
			Configuration – clock and time bands						
PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
rtc	CLK		Set time, date	-	-	-	-		
	S1	C	Time band 1 – day: 0= *** 4= THU 8= MON-FRI 1= MON 5= FRI 9= MON-SAT 2= TUE 6= SAT 10= WEEKEND 3= WED 7= SUN 11= EVERY DAY	0	-	0	11		
	hS1	C	Time band 1 - Start night hours	0	-	0	23		
	mS1	C	Time band 1 - Start night minutes	0	-	0	59		
	hE1	C	Time band 1 - End night hours	0	-	0	23		
	mE1	C	Time band 1 - End night minutes	0	-	0	59		
	S2	C	Time band 2 – day. See S1	0	-	0	11		
	hS2	C	Time band 2 - Start night hours	0	-	0	23		
	mS2	C	Time band 2 - Start night minutes	0	-	0	59		
	hE2	C	Time band 2 - End night hours	0	-	0	23		
	mE2	C	Time band 2 - End night minutes	0	-	0	59		
	S3	C	Time band 3 – day. See S1	0	-	0	11		
	hS3	C	Time band 3 - Start night hours	0	-	0	23		
	mS3	C	Time band 3 - Start night minutes	0	-	0	59		
	hE3	C	Time band 3 - End night hours	0	-	0	23		
	mE3	C	Time band 3 - End night minutes	0	-	0	59		
			Configuration – Default/Password						
PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
dPa	Y0	A	Frequent level password	0	-	0	199		
	Y1	A	Configuration level password	22	-	0	199		
	Y2	A	Advanced level password	33	-	0	199		
	Y3	A	Restore default values	-	-	0	1		
			Control – Fans						
PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
Fan	F0	C	Fan control configuration: 0= ALWAYS ON 1= DIFFERENCE Sv-Sd 2= DEFROST TEMP.	2	-	0	2	X	
	F1	C	Fan activation threshold	-5.0	°C	-50.0	50.0	X	
	F2	C	Enable fans off when control OFF: 0= No, 1= Yes	1	-	0	1	X	
	F3	C	Fan management during defrost 0= Always on 1= Always off 2= On in defrost, off in dripping	1	-	0	2	X	
	Fd	C	Post-dripping time	1	min	0	15	X	
	Frd	C	Fan differential	2.0	°C	0.1	20	X	
	F6	A	Maximum fan speed	10	%	0	100	X	
	F7	A	Minimum fan speed	80	%	3	100	X	
	F5	A	Fan cut-off	50.0	°C	-99.9	99.9	X	
	F8	A	Fan peak time (maximum speed)	10	sec	0	999	X	
	F9	A	Period between two fan overrides at maximum speed	0	min	0	999		

PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
			Control – Defrost - Configuration						
dEF	d0	C	Select type of defrost: 0= ELECTRIC end by TEMPERATURE/TIMEOUT 1= HOT GAS end by TEMPERATURE/TIMEOUT 2= ELECTRIC end by TIMEOUT ONLY 3= HOT GAS end by TIMEOUT ONLY 4= ELECTRIC end by TIME WITH TEMP. CONTROL	0	-	0	6	X	
	d2	C	Enable synchronised end defrost between master and slaves: 0= START ONLY, 1= START AND STOP	1	-	0	1	X	
	dt1	F	End defrost temperature on first evaporator	12.0	°C	-50.0	50.0	X	
	r3	F	Enable end defrost signal for maximum time: 0= N, 1= Y	0	-	0	1	X	
	d4	C	Enable defrost at power on: 0 = N, 1= Y	0	-	0	1	X	
	d5	C	Defrost delay at start or via digital input (if enabled)	0	min	0	180	X	
	d8	C	High temperature alarm bypass after defrost and/or door open	30	min	0	240	X	
	dP1		Maximum defrost duration on first evaporator	45	min	0	240	X	
	dd	C	Dripping time after defrost	2	min	0	500	X	
	dI	C	Interval between two consecutive defrosts	8	hours	0	192	X	
	d9	A	Enable defrost priority over solenoid times: 0=N, 1=Y	1	-	0;	1	X	
	dP2	C	Maximum defrost duration for second evaporator	45	min	0	240	X	
	dt2	F	End defrost temperature on second evaporator	12.0	°C	-50.0	50.0	X	
	d13	A	Cold room maintenance alarm delay	0	min	0	500		
	dhG	A	Type of hot gas system: 0= REVERSE, RET. ON SUCT. 1= REVERSE, RET. ON LIQUID 2= DIRECT, RET. ON SUCT. 3= DIRECT, RET. ON LIQUID 4= CUSTOMIZE	0	-	0	4	X	
	/10	A	Select probe used for end defrost: 0= REGULATION PROBE 1= AIR OFF PROBE 2= DEFROST PROBE 3= AIR ON PROBE	2	-	0	3	X	
	dH1	A	Pump out time for hot gas defrost	60	sec	0	999	X	
	dH2	A	Soft gas time for hot gas defrost	60	sec	0	999	X	
			Control – Defrost – Special functions						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
dEF	d7	A	Enable “Skip defrost” function: 0= N, 1=Y	0	-	0	1	X	
	dn	A	Nominal defrost duration for “Skip defrost”	45	min	0	500	X	
	d10	A	Defrost time for “Running time” function	0	min	0	192	X	
	d11	A	Temperature threshold for “Running time” function	10	°C	-99.9	99.9	X	
	ddt	A	Added temperature for “Power defrost”	0.0	°C	-99.9	99.9	X	
	ddP	A	Offset for maximum defrost duration in “Power defrost”	0	min	0	999	X	
	dS1	A	Solenoid ON time for “Sequential stop” function	0	min	0	999	X	
	dS2	A	Solenoid OFF time for “Sequential stop” function	10	min	0	999	X	
			Control – Defrost – Time bands						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
dEF	td1	F	Defrost 1 - day 0= *** 4= THU 8= MON-FRI 1= MON 5= FRI 9= MON-SAT 2= TUE 6= SAT 10= WEEKEND 3= WED 7= SUN 11= ALWAYS	0	-	0	10		
	th1	F	Defrost 1 - hours	0	-	0	23		
	tm1	F	Defrost 1 - minutes	0	-	0	59		
	tP1	F	Defrost 1 – power: 0=N, 1=Y	0	-	0	1	X	
	td2	F	Defrost 2 – day. See td1	0	-	0	10		
	th2	F	Defrost 2 - hours	0	-	0	23		
	tm2	F	Defrost 2 - minutes	0	-	0	59		
	tP2	F	Defrost 2 – power: 0=N, 1=Y	0	-	0	1	X	
	td3	F	Defrost 3 – day. See td1	0	-	0	10		
	th3	F	Defrost 3 - hours	0	-	0	23		
	tm3	F	Defrost 3 - minutes	0	-	0	59		
	tP3	F	Defrost 3 - power: 0=N, 1=Y	0	-	0	1	X	
	td4	F	Defrost 4 – day. See td1	0	-	0	10		

PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
	th4	F	Defrost 4 – hours	0	-	0	23		
	tm4	F	Defrost 4 - minutes	0	-	0	59		
	tP4	F	Defrost 4 - power; 0=N, 1=Y	0	-	0	1	X	
	td5	F	Defrost 5 – day. See td1	0	-	0	10		
	th5	F	Defrost 5 - hours	0	-	0	23		
	tm5	F	Defrost 5 - minutes	0	-	0	59		
	tP5	F	Defrost 5 – power: 0=N, 1=Y	0	-	0	1	X	
	td6	F	Defrost 6 – day. See td1	0	-	0	10		
	th6	F	Defrost 6 - hours	0	-	0	2		
	tm6	F	Defrost 6 - minutes	0	-	0	59		
	tP6	F	Defrost 6 – power: 0=N, 1=Y	0	-	0	1	X	
	td7	F	Defrost 7 – day. See td1	0	-	0	10		
	th7	F	Defrost 7 - hours	0	-	0	23		
	tm7	F	Defrost 7 - minutes	0	-	0	59		
	tP7	F	Defrost 7 – power: 0=N, 1=Y	0	-	0	1	X	
	td8	F	Defrost 8 – day. See td1	0	-	0	10		
	th8	F	Defrost 8 - hours	0	-	0	23		
	tm8	F	Defrost 8 - minutes	0	-	0	59		
	tP8	F	Defrost 8 – power: 0=N, 1=Y	0	-	0	1	X	
			Control – Anti-sweat heaters						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
raH	rHo	C	Dewpoint offset for anti-sweat heater modulation	0.0	°C	0.0	99.9	X	
	rHd	C	Dewpoint differential for anti-sweat heater modulation	0.0	°C	0.0	99.9	X	
	rHB	C	Cut-off value for dewpoint	10.0	°C	0.0	99.9	X	
	rHC	C	Cut-off differential for dewpoint	1.0	°C	0	99.9	X	
	rHt	C	Anti-sweat heater control period	30	-	0	999	X	
	rHu	C	Anti-sweat heater manual activation percentage	20	%	0	100	X	
	rH6	A	Minimum anti-sweat heater output	10	%	0	100	X	
	rH7	A	Maximum anti-sweat heater output	90	%	0	100	X	
	rH8	A	Type of anti-sweat heater modulation: 0= PROPORTIONAL, 1= PROP.+INTEGR.	0	-	0	1	X	
	rH9	A	Integration time for anti-sweat heaters	60	sec	0	999	X	
			Control – EEV - Configuration						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
EEv	P1	A	Type of EEV: 0= PWM 1= EEV 2= Not present	0	-	0	2	X	
	PH	A	Type of refrigerant: 0= 1: R22 1= 2: R134a 2= 3: R404a 3= 4: R407c 4= 5: R410a 5= 6: R507a 6= 7: R290 (propane) 7= 8: R600 (butane) 8= 9: R600a (isobutane) 9= 10: R717 (ammonia) 10= 11: R744 11= 12: R728 (nitrogen) 12= 13: R1270 (propy.) 13= 14: R417a	2	-	0	10	X	
	PPE	A	PWM valve control period	6.0	sec	3.0	10.0	X	
	CP1	C	Expansion valve initial opening percentage (circuit capacity/ valve)	80	%	0	100	X	
	Psb	C	EEV standby position	20	-	0	9999	X	
	P3	C	Superheat set point	11.0	°C	0.0	50.0	X	
	P4	C	PID - Proportional gain	15.0	-	0.0	99.9	X	
	P5	C	PID - Integration time	150	-	0	500	X	
	P6	C	PID - Derivative time	5.0	-	0.0	99.9	X	
	P7	A	LowSH - Low superheat threshold	5.0	°C	-99.9	99.9	X	
	P8	A	LowSH - Low superheat integration time	15	-	0	25	X	
	PM1	A	MOP - Threshold	50.0	bar	-50	70	X	
	PM2	A	MOP - Integration time	20	-	0	25	X	
	PM4	A	MOP - Function delay when starting control	60	sec	0	250	X	
	Pdd	A	Delay with valve in initial position after defrost	10	min	0	999	X	

PST	Code	FCA	Parameter	Default	UOM	Min	Max	Download	Notes
			Control – EEV - Alarms						
EEv	PM3	A	MOP - Alarm delay	0	sec	0	9999	X	
	P9	A	LowSH - Low superheat alarm delay	600	sec	0	9999	X	
	Pa	A	HSH - High superheat threshold	35	°C	-99.9	99.9	X	
	Pb	A	HSH - High superheat alarm delay	600	sec	0	9999	X	
	P11	A	LSA – Low suction temperature threshold	-40	°C	-99.9	99.9	X	
	P13	A	LSA - Low suction temperature differential	3.0	°C	0	99.9	X	
	P12	A	LSA - Low suction temperature alarm delay	300	sec	0	9999	X	
			Control – EEV - Advanced						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
EEv	OSH	A	Modulating thermometer offset 0=N, 1=Y	0	°C	0	99,9	X	
	PL3	A	Manual valve position with EEV driver probe error	10	-	0	9999	X	
	P10	A	Close solenoid valve signal for LowSH and/or LSA	1	-	0	1	X	
	PM5	A	Close solenoid valve signal for MOP; 0=N, 1=Y	1	-	0	1	X	
			Control – Compressor/Solenoid						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
CMP	c0	C	Delay start control and fans at power on	0	min	0	15	X	
	c1	C	Minimum time between successive solenoid requests	0	min	0	15	X	
	c2	C	Minimum solenoid off time	0	min	0	15	X	
	c3	C	Minimum solenoid on time	0	min	0	99	X	
	cc	C	Continuous cycle duration	4	h	0	15	X	
	c4	C	Solenoid on time in duty setting from probe alarms	0	min	0	100	X	
	c5	C	Solenoid off time in duty setting from probe alarms	0	min	0	100	X	
	c6	C	Low temperature alarm bypass time after continuous cycle	2	h	0	15	X	
			Alarms - Configuration						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
ALc	AH	F	High temperature alarm threshold	10	°C	-50	50	X	
	AL	F	Low temperature alarm threshold	4	°C	-50	50	X	
	A1	A	Select alarm thresholds relative to set point or absolute: 0=RELATIVE, 1= ABSOLUTE	0	-	0	1	X	
	A0	C	Temperature alarm differential	2.0	°C	0.1	20.0	X	
	A7	C	Delayed external alarm delay time	180	min	0	180	X	
	Aa	C	Select probe for high and low temperature alarm: 0= VIRTUAL PROBE 1= AIR OFF PROBE 2= DEFROST PROBE 1 3= AIR ON PROBE 4= SUCTION PROBE 5= SAT. EVAP. PROBE 6= DEFROST PROBE 2 7= AUX. PROBE 1 8= AUX. PROBE 2 9= DEWPOINT TEMP. PROBE	0	-	0	9	X	
	Ar	C	Enable alarm propagation from Slaves to Master: 0=N, 1=Y	0	-	0	1		
	Ad	C	Delay time for high and low temperature alarms	120	min	0	180	X	
	r5	C	Select maximum and minimum temperature monitoring probe: 0=N, 1=Y	1	-	0	1	X	
	AH2	A	High temperature threshold for Air on probe in “double thermostat”	0	°C	-50	50	X	
	AL2	A	Low temperature threshold for Air on probe in “double thermostat”	0	°C	-50	50	X	
	AdE	A	Delayed external alarm priority: 0=LOW, 1= HIGH	0	-	0	1	X	
	As	A	Serial probe alarm delay	30	min	0	500		
			Alarms - HACCP						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
HcP	Htd	C	HACCP alarm delay	0	min	0	180	X	
	t0	C	Reset HACCP alarms: 0=N, 1=Y	0	-	0	1		
			Change board						
	Sj	F		x	-	1	5		
			Others – Unit On/Off						
PST	**Code**	**FCA**	**Parameter**	**Default**	**UOM**	**Min**	**Max**	**Download**	**Notes**
OnO	H2	A	Enable ON/OFF from supervisor: 0=N, 1=Y	0	-	0	1	X	
	H3	A	Enable ON/OFF from keypad: 0=N, 1=Y	1	-	0	1	X	
	O/F	C	0=UNIT OFF, 1=UNIT ON	0	-	0	1		

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