ir33+

Electronic controller

(ENG) User manual

LEGGI E CONSERVA QUESTE ISTRUZIONI

READ AND SAVE THESE INSTRUCTIONS

High Efficiency Solutions

IMPORTANT

CAREL bases the development of its products on decades of experience in HVAC, on the continuous investments in technological innovations to products, procedures and strict quality processes with in-circuit and functional testing on 100% of its products, and on the most innovative production technology available on the market. 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.
The customer (manufacturer, developer or installer of the final equipment) accepts all liability and risk relating to the configuration of the product in order to reach the expected results in relation to the specific final installation and/or equipment.
CAREL may, based on specific agreements, act as a consultant for the positive commissioning of the final unit/application, however in no case does it accept liability for the correct operation of the final equipment/system.

The CAREL product is a state-of-the-art product, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the website www.CAREL.com.
Each CAREL product, in relation to its advanced level of technology, requires setup / configuration / programming / commissioning to be able to operate in the best possible way for the specific application. The failure to complete such operations, which are required/indicated in the user manual, may cause the final product to malfunction; CAREL accepts no liability in such cases.
Only qualified personnel may install or carry out technical service on the product.
The customer must only use the product in the manner described in the documentation relating to the product.

In addition to observing any further warnings described in this manual, the following warnings must be heeded for all CAREL products:

- 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.

All of the above suggestions likewise apply to the controllers, serial boards, programming keys or any other accessory in the CAREL product portfolio.
CAREL adopts a policy of continual development. Consequently, CAREL reserves the right to make changes and improvements to any product described in this document without prior warning.

The technical specifications shown in the manual may be changed without prior warning.

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HACCP WARNING

The Food Safety programs based on HACCP procedures and on certain national standards require that the devices used for food preservation are periodically checked to make sure that measuring errors are within the allowed limits for the specific application.
Carel recommends compliance with the specifications of European standard "Temperature recorders and thermometers for transport, storage and distribution of chilled, frozen, deep-frozen/ quick-frozen food and ice cream – PERIODIC VERIFICATION", EN 13486 -2001 (or subsequent updates) or similar standards and requirements applicable in the country of use.
The manual contains further information regarding technical feature,s proper installation and product configuration.

HACCP International Food Safety Certification Systems
This product is approved for the use in food preservation applications in compliance with the strictest standards in the sector.

DISPOSAL

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

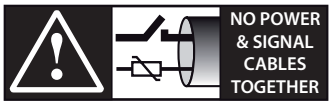
In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:

- 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.

Warranty on the materials: 2 years (from the date of production, excluding consumables).

Approval: the quality and safety of CAREL INDUSTRIES Hqs products are guaranteed by the ISO 9001 certified design and production system.

WARNING: separate as much as possible the probe and digital input signal cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance.
Never run power cables (including the electrical panel wiring) and signal cables in the same conduits.



READ CAREFULLY IN THE TEXT!

Content

1. INTRODUCTION

The ir33+ platform for refrigeration applications comprises a series of microprocessor-based parametric electronic controllers, with LED display, designed to control stand-alone refrigeration units. These controllers are especially suitable for applications requiring high load switching power, functions and control with direct access from the keypad, high IP ingress protection and compact dimensions. In terms of reliability, all the controllers are fitted with an electronic device (watchdog) that prevents the microprocessor from losing control, even with high levels of electromagnetic disturbance. The ir33+ platform is made using the most advanced SMD technology, and electrical testing of all the components fitted guarantees high quality standards.

In summary:
- up to 4 relay outputs on the more complete models: compressor, fan, defrost, AUX;
- panel installation (front panel as standard);
- simple installation with two plastic fastening brackets;
- buttons flush with the front panel, to ensure high ingress protection (IP65) and safety during operation and cleaning;
- bright 3 digit display, with decimal point and icons to denote operating status;
- immunity to brief power interruptions: if the controller detects that voltage drops below a certain threshold, the display is temporarily switched off and the controller continues working normally;
- keypad with 4 buttons;
- defrosts can be activated from the keypad, digital input, supervisor;
- management of various types of defrost, on one or two evaporators: natural (stopping the compressor), heater, hot gas;
- advanced defrost functions;
- automatic recognition of the network protocol: Carel or Modbus®;
- parameter selection simplified by different icons according to the category;
- temperature control with virtual control probe and set point variation at night;
- digital inputs to activate alarms, enable or activate defrosts, door / curtain switch, auxiliary output, on/off, etc.;
- control of 1 compressor with two steps, or two compressors, including rotation;
- keypad protection: the functions of the individual buttons can be disabled to prevent unwanted tampering;
- management of the light in the cabinet/cold room and the curtain on the cabinet;
- VPM program (Visual Parameter Manager), running on a personal computer, used to update the parameters and test the controller;
- alarm signal buzzer;
- HACCP functions: temperature monitoring and recording in the event of high temperature alarms during operation and after blackouts;
- RS485 serial network connection to remote supervisor and telemaintenance systems.

The models differ in terms of:
- the type of power supply: alternating current (12 to 24 V~, 115/230 V~, 230 V~, 50/60 Hz); direct current (12/18 Vdc, 12/30 Vdc);
- the number of relay outputs.

Available accessories include:
- serial interface card (P/N IROPZ48500) for connection to the RS485 network;
- programming key (P/N IROPZKEY**) for reading (upload) and writing (download) the control parameters;
- display interface (P/N IROPZDSP00) for remote display connection.

1.1 Main features

The ir33+ platform controllers are designed to offer maximum installation flexibility. In addition to the control probe, a further three probes can be configured, as product probe (display only), condenser, frost protection and defrost probe. Using the advanced defrost functions, if the conditions are right, subsequent defrosts can be postponed or skipped. The digital outputs (relays) can control the solenoid valve or compressor, a second compressor, the evaporator or condenser fans, defrosts, lights and alarms. The digital inputs can be used for the door switch and light management, the curtain switch to change over to night-time operation, to enable and start defrosts, to switch the controller on/off and to activate of the auxiliary output. Finally, the controller can also be used as simple ON/OFF thermostat, for heating applications.

Example: vertical display case and cold room.

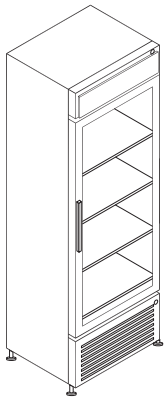


Fig. 1.a

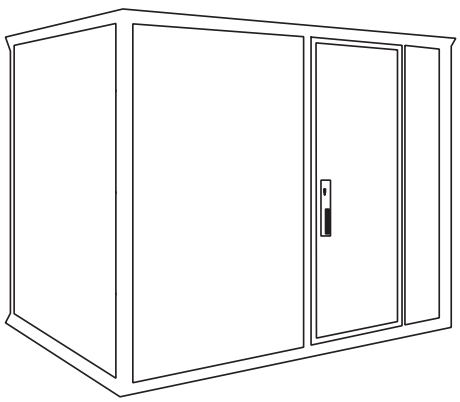


Fig. 1.b

1.2 Accessories

IROPZKEY00/A0 programming key

The IROPZKEY00 and IROPZKEY00A0 (powered) programming keys can be used with the ir33+ platform controllers. Visual Parameter Manager (VPM) allows up to 7 different configurations (sets) of parameters to be loaded onto the controller (the controller operating parameters plus 6 sets of customisable parameters). The read/write operations are carried out with the controller off.

IROPZKEY00

Fig. 1.c

IROPZKEYA0

Fig. 1.d

Connection cable (P/N PSTCON0*B0)

Three-wire cable to connect the controller to the tLAN interface card (P/N IROPZDSP00). Available in different lengths: 1.5; 3; 5 m.

Fig. 1.e

tLAN interface card (P/N IROPZDSP00)

The tLAN interface card for remote display is an electronic device used to connect the controller to a remote display. See the instruction sheet (+050003860).

Fig. 1.f

Remote display

The remote display can be used to display one of the system variables. Versions are available for ir33+ is IREVXGD000. See the instruction sheet (+050003920).

IREVXGD000

Fig. 1.g

RS485 serial interface (P/N IROPZ48500 and IROPZ485S0)

Plugged directly into the programming key connector, this provides connection to the PlantVisor supervisory system. The accessory has been designed as a plug-in addition to the controller and consequently can be installed following installation if needed. Model IROPZ485S0 features a microprocessor and can automatically recognise the TxRx+ and TxRx- signals (reverse connection).

Fig. 1.h

VPM programming tool (Visual Parameter Manager)

The program can be downloaded from http://ksa.carel.com. The tool runs on a computer and is used to set up the controller, change the parameter settings and update the firmware. The USB/I2C converter P/N IROPZPRG00 is required.

Fig. 1.i

USB/I2C converter and cable (P/N IROPZPRG00)

Converter used to connect a personal computer to an IROPZKEY00/A0 programming key, and consequently use the VPM program (Visual Parameter Manager) to read, set and write the parameters. The programming key can then be used to program the controllers or read the controller parameters, and for example copy a configuration from one controller to the others.

Fig. 1.j

Light sensor (P/N PSOPZLHT00)

To be installed in the door jamb or inside the cold room

Fig. 1.k

2. INSTALLATION

2.1 Dimensions

ir33+

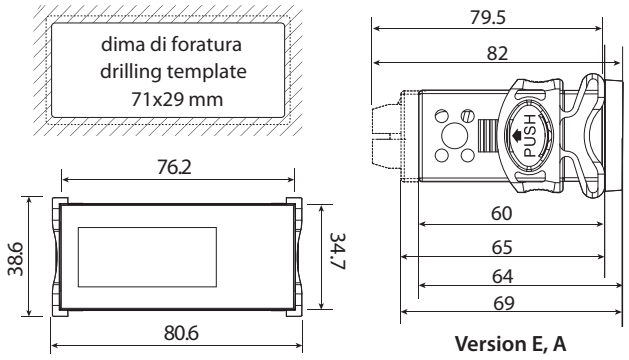


Fig. 2.l

2.2 Panel mounting

To install the ir33+, use the 2 brackets shown in the figure.

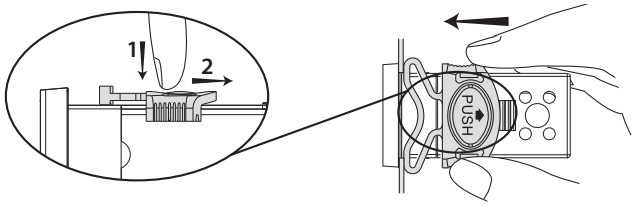
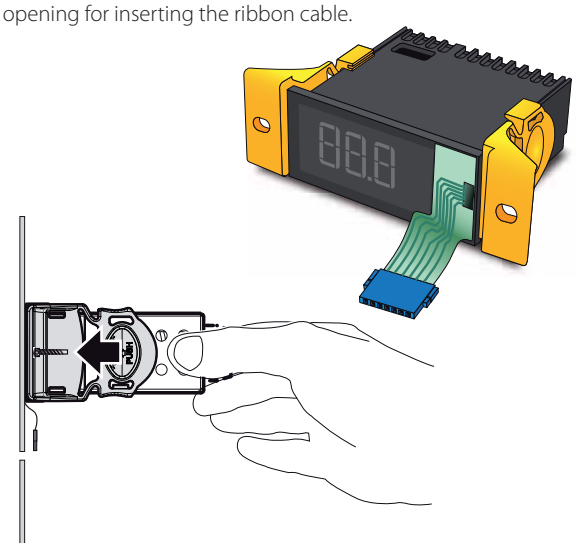


Fig. 2.m

STEP 1

Drill the holes (ø 3 mm) with the spacing shown in the figure and make the opening for inserting the ribbon cable.



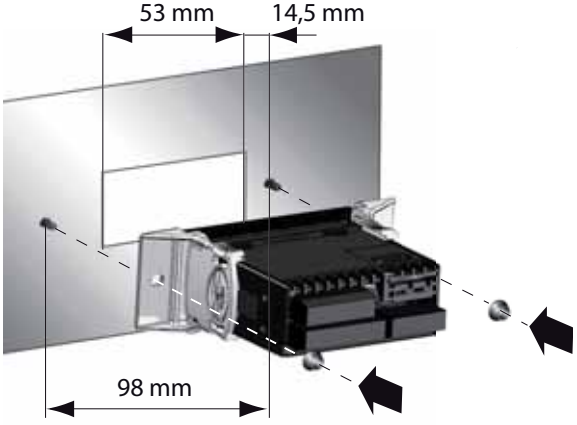


Fig. 2.n

STEP 2

Apply the side fastening brackets to the controller and use the screws to fasten it to the panel.

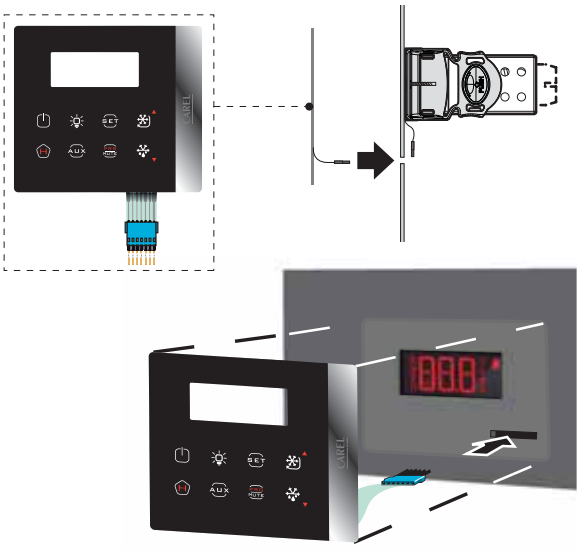


Fig. 2.o

STEP 3

Insert the ribbon cable in the opening, attach the connectors and apply the membrane keypad.

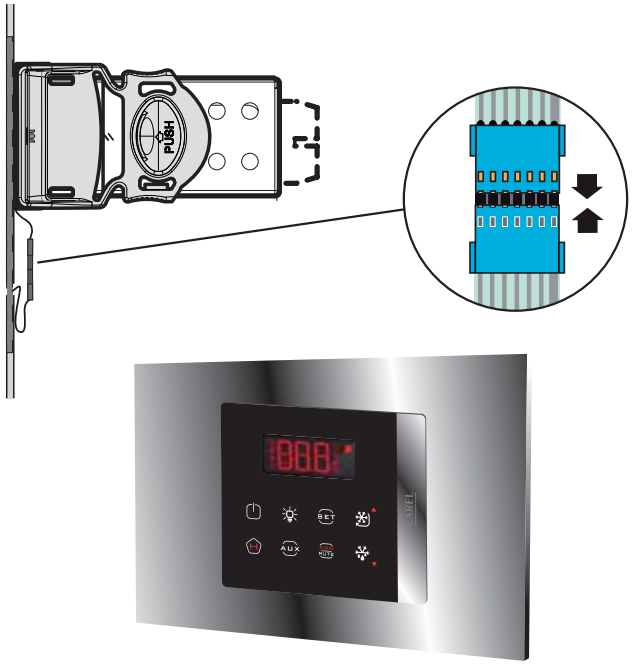


Fig. 2.p

2.3 Part number list

ir33+ P/N	power supply	inputs	corresponding ir33 P/N
IREVM0LN0U	12…24 Vac 12…30 Vdc	2 NTC + 2 DI	-
IREVM0EN0U	230 Vac	2 NTC + 1 DI	IR33M0ER00
IREVS0LN0U	12…24 Vac 12…30 Vdc	2 NTC + 2 DI	IR33S0LN00 IR33S0LR00
IREVS0EA0U	230 Vac	2 NTC + 1 DI	IR33S0EA00
IREVC0LN0U	12…24 Vac 12…30 Vdc	2 NTC + 2 DI	IR33C0LN00 IR33C0LR00
IREVC0LC0U	12…24 Vac 12…30 Vdc	2 NTC + 2 DI	IR33C0LB00
IREVC0HN0U	115-230 Vac	2 NTC + 2 DI	IR33C0HR00
IREVC0HC0U	115-230 Vac	2 NTC + 2 DI	IR33C0HB00
IREVF0EN0U	230 Vac	2 NTC + 1 DI	IR33F0EN00 IR33F0ER00

Tab. 2.a

2.4 Optional connections

ir33+

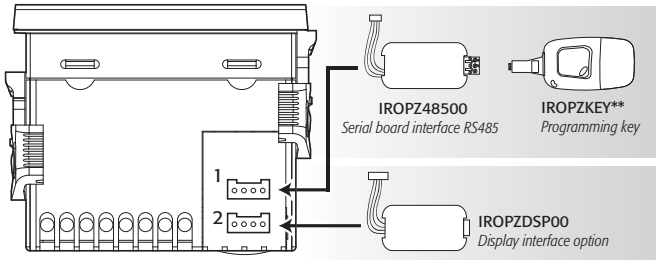


Fig. 2.q

2.5 ir33+ wiring diagrams

Thermometers

IREVM0EN0U

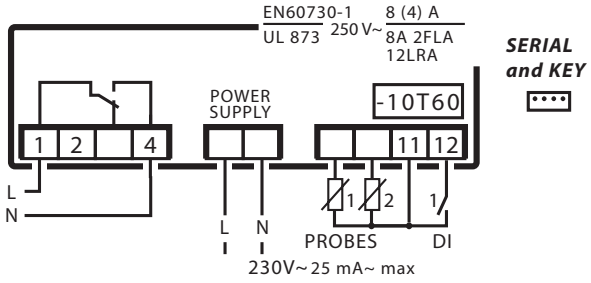
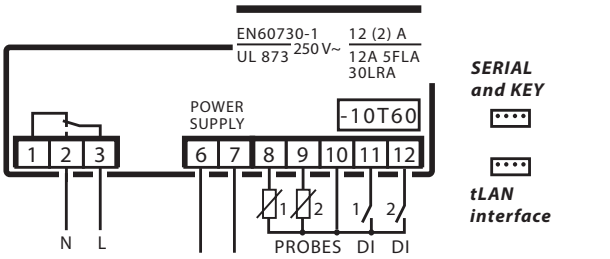


Fig. 2.r

IREVM0LN0U



12...24V~ 300 mA~ max, 12...30 Vdc 300 mA dc max

Fig. 2.s

IREVS0EA0U
Maximum current on terminal 1: 12 A

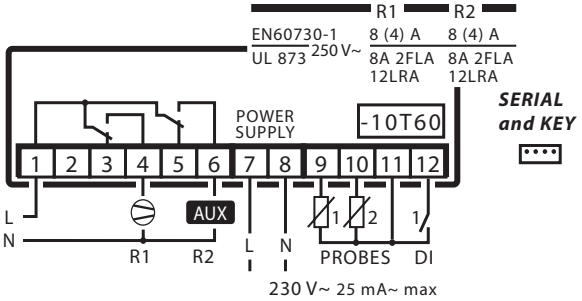
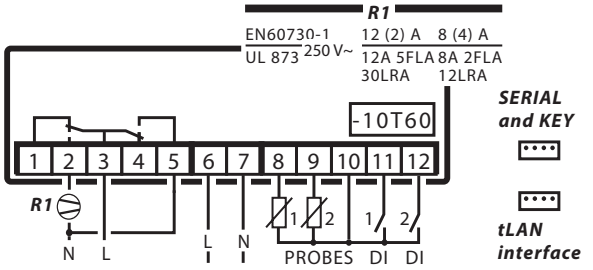


Fig. 2.t

IREVS0LN0U
Maximum current on terminal 3: 12 A



12...24V~ 300 mA~ max, 12...30 Vdc 300 mA dc max

Fig. 2.u

Thermostats with 3 relays: compressor, defrost, evaporator fans

IREVF0EN0U
Maximum current on terminal 1: 12 A

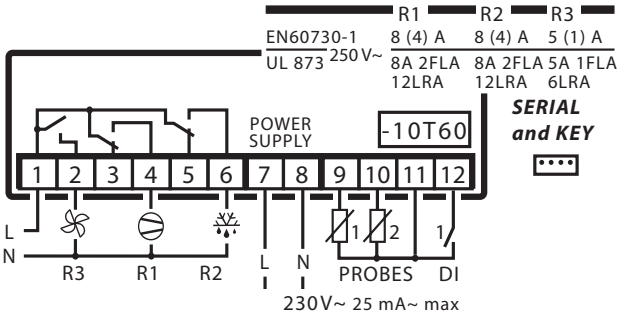


Fig. 2.v

Thermostats with 4 relays: compressor, defrost, evaporator fans, AUX

IREVC0HN0U IREVC0HC0U

Maximum current on terminal 3: 12 A

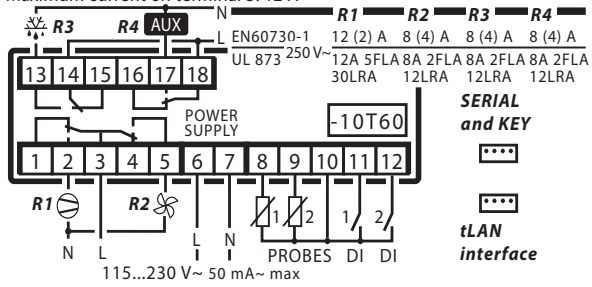


Fig. 2.w

IREVC0LN0U IREVC0LC0U

Maximum current on terminal 3: 12 A

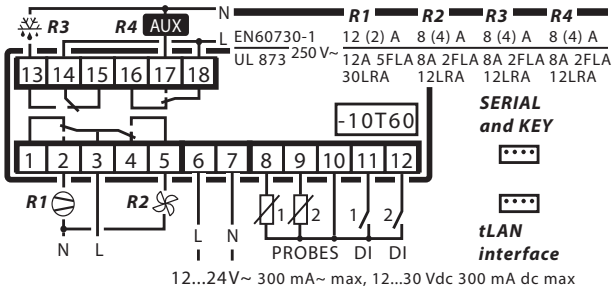


Fig. 2.x

Key

L	Line
N	Neutral
R1/R2/R3/R4	Digital output 1/2/3/4 (relay 1/2/3/4)
AUX	Auxiliary relay
PROBES	Probe 1/Probe 2
DI1/DI2	Digital input 1/ Digital input 2

2.6 Installation

To install the controller, proceed as follows, with reference to the wiring diagrams shown in the previous paragraphs:

1. connect the probes and power supply: the probes can be installed up to a maximum distance of 10 m from the controller, using shielded cables with a minimum cross-section of 1 mm^2. To improve immunity to disturbance, use probes with shielded cables (connect only one end of the shield to the earth on the electrical panel);
2. program the controller: as shown in the chapters "Commissioning" and "User interface";
3. connect the actuators: the actuators should only be connected after having programmed the controller. Carefully check the maximum relay capacities, as indicated in the "technical specifications";
4. serial network connection: all controllers are fitted with a serial connector for connection to the supervisor network via the serial interface (IROPZ485*0). The secondary of the transformers that supply the controllers must not be earthed. If connection to a transformer with earthed secondary winding is required, an insulating transformer must be installed in between.

Important: a separate transformer must be used for each controller, - NEVER connect multiple controllers to the same transformer.

Warnings: avoid installing the controller in environments with the following characteristics:

- relative humidity greater than 90% non-condensing;
- strong vibrations or knocks;
- exposure to continuous water sprays;
- exposure to aggressive and polluting atmospheric agents (e.g.: sulphur and ammonia gases, saline mist, smoke) which may cause corrosion and/or oxidation;
- strong magnetic and/or radio frequency interference (for example , near transmitting antennae);
- exposure to direct sunlight and the elements in general.

The following warnings must be observed when connecting the controllers:

- incorrect connection of the power supply may seriously damage the controller;
- use cable ends suitable for the corresponding terminals. Loosen each screw and insert the cable ends, then tighten the screws and gently pull the cables to check their tightness. When tightening the screws, do not use automatic screwdrivers, rather adjust tool tightening torque to less than 0.5Nm;
- separate as much as possible (by at least 3 cm) the probe signal and digital input cables from inductive loads and power cables, to avoid any electromagnetic disturbance. Never lay power cables and probe cables in the same cable conduits (including those for the electrical panels). Do not install the probe cables in the immediate vicinity of power devices (contactors, circuit breakers or the like). Reduce the length of the sensor cables as much as possible, and avoid spirals around power devices;
- only use IP67 guaranteed probes as end defrost probes; place the probes with the vertical bulb upwards, so as to facilitate drainage of any condensate. Remember that thermistor temperature probes (NTC) have no polarity, so the order the ends are connected in is not important.

Important: for 12/24 Vac versions. When connecting a series of units to the same timer, insulate all the contacts (digital inputs) galvanically, inserting an intermediate relay for each contact.

Cleaning the controller

When cleaning the controller do not use ethanol, hydrocarbons (petrol), ammonia and by-products. Use neutral detergents and water.

2.7 Programming key (copy set-up)

Programming key IROPZKEY00/A0

The programming key can load up to 7 different parameter configurations onto the controller (the controller operating parameters plus 6 sets of customisable default parameters). The keys are plugged into the connector (4 pin AMP) available on the controllers. All the operations can be performed with the controller off.

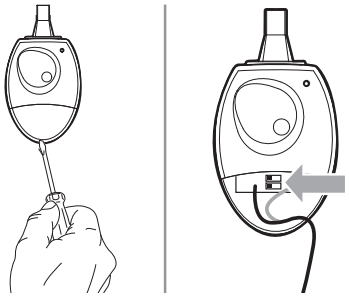


Fig. 2.y

The functions are selected by setting the two dipswitches, accessible by removing the battery cover.

- load the parameters from a controller onto the key (UPLOAD);
- copy from the key to a controller (DOWNLOAD);
- extended copy from the key to a controller (EXTENDED DOWNLOAD).

Important: The parameters can only be copied between controllers with the same part number. The UPLOAD operation can, however, always be performed.

Copying and downloading the parameters

The following operations are used for the UPLOAD and/or DOWNLOAD functions, simply by changing the settings of the dipswitches on the key:

1. open the rear cover on the key and position the 2 dipswitches according to the desired operation;
2. close the rear cover on the key and plug the key into the connector on the controller;
3. press the button and check the LED: red for a few seconds, then green, indicates that the operation was completed correctly. Other signals or the flashing of the LED indicates that problems have occurred: see the table below;
4. at the end of the operation, release the button, after a few seconds the LED goes off;
5. remove the key from the controller.

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

Tab. 2.b

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

2.8 Remote display connection

To connect the remote display, use the dedicated cable (P/N PSTCON0*B0) and the tLAN interface card (P/N IROPZDSP00). See the following diagram. Also set a value >0 for parameter /tE, to display the reading on the remote display.

Par.	Description				Def	Min	Max	UOM
/tE	Reading on remote display				0	6	6	-
	0	Not fitted	4	Probe 3				
	1	Virtual probe	5	Probe 4				
	2	Probe 1	6	Reserved				
	3	Probe 2						

Tab. 2.c

2.9 Network connection

Warnings:

- the RS485 converter (IROPZ485x0) is sensitive to electrostatic discharges and therefore must be handled with extreme care;
- check the documents on the IROPZ485x0 interface for connection instructions, so as to avoid damaging the controller;
- fasten the converter properly so as to prevent disconnection;
- complete the wiring without power connected;
- keep the IROPZ485x0 interface cables separate from the power cables (relay outputs and power supply).

The RS485 converter is used to connect the ir33+ controllers to the supervisor network for the complete management and monitoring of the connected controllers. The system allows a maximum of 207 units, with a maximum length of 1000 m. Connection requires the standard accessories (RS485-USB converter, CAREL P/N CVSTDUMOR0) and a 120 Ω terminating resistor to be installed on the terminals of the last connected controller. Connect the RS485 converter to the controllers and make the connections as shown in the figure. To assign the serial address, see parameter H0. See the instruction sheets on the converters for further information.

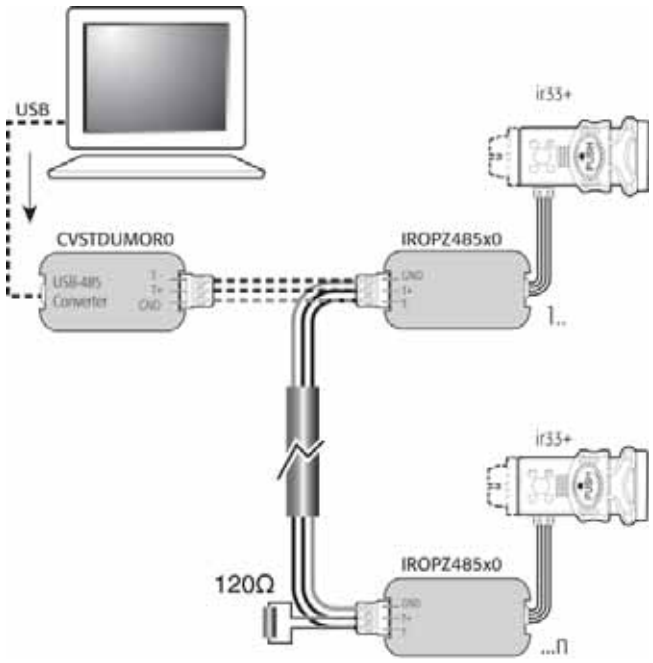


Fig. 2.z

3. USER INTERFACE

The front panel contains the display and the keypad, made up of 4 buttons that, when pressed alone or combined with other buttons, are used to program the controller. The optional remote display is used to display the temperature measured by a second probe.

User terminal

ir33+

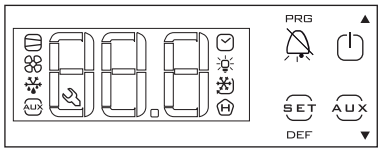


Fig. 3.a

Remote display

IREVXGD000

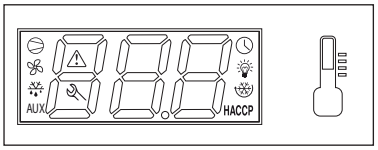


Fig. 3.b

3.1 Display

The user terminal display shows temperature in range -50 to +150°C.The temperature is displayed with resolution to the tenths between –19.9 and + 19.9 °C. In the event of alarms, the value of the probe is displayed alternating with the codes of the active alarms. During programming, the terminal shows the codes and values of the parameters. The remote display IREVXGD000 shows the temperature with resolution to the tenths between -9.9°C and19.9°C.

Note: the standard display on the user terminal and the remote display can be selected by setting parameters /tI and /tE accordingly.

Icon	Function	Normal operation			Start-up	Notes
		ON	OFF	Flashing		
	Compressor	On	Off	Awaiting activation		Flashes when activation is delayed or inhibited by protection times
	Fan	On	Off	Awaiting activation		Flashes when activation is delayed by protection times or other procedures in progress
	Defrost	Active	-	Awaiting		Flashes when activation is delayed by protection times or other procedures in progress
AUX	AUX output	AUX output 1 or 2 active	-	Anti-sweat heater function active		
PRG	Alarm	On if delayed alarm from digital input	-	Alarms during normal operation (e.g. high/low temperature alarm) or in the event of malfunctions (on together with the spanner icon)		
	Clock	On if a timed defrost has been set. If the real time clock is fitted, the icon is displayed for a few seconds during the third stage of the start-up procedure		Clock alarm	ON if RTC available	
	Light	Auxiliary output (1 and/or 2) configured as light active	-	Anti-sweat heater function active		
	Service			Malfunctions, e.g. EEPROM errors or faulty probes		
H	HACCP	HACCP function enabled	-	HACCP alarm saved (HA and/ or HF)		
	Continuous cycle	Continuous cycle function active	-	Function called		Flashes when activation is delayed or inhibited by protection times

Tab. 3.d

3.2 ir33+ keypad

Button	Normal operation		Start-up
	Pressing the button alone	Pressing together with other buttons	
PRG PRG/MUTE	If pressed for more than 3 seconds, accesses the type "F" parameters (frequent) or the menu for setting the password to access the type "C" parameters (Configuration); if there is an active alarm: mutes the audible alarm (buzzer).	PRG+ON-OFF/UP: if pressed together for more than 3 seconds, resets any alarms with manual reset	if pressed and held for more than 5 seconds at start-up, activates the procedure for setting the default parameters

ON-OFF/ UP	If pressed for more than 3 seconds, switches the controller OFF; if pressed for more than 1 s switches the controller ON; when setting the parameters, increases the value displayed or scrolls to the next parameter.	ON-OFF/UP+AUX/DOWN: if pressed together for more than 3 seconds, activates/deactivates the continuous cycle; ON-OFF/UP+ SET/DEF: if pressed together for more than 3 seconds, displays the temperature read by the defrost probe; ON-OFF/UP+ PRG/MUTE: if pressed together for more than 3 seconds, resets any alarms with manual reset.
AUX/ DOWN	If pressed for more than 1 s, activates/deactivates the auxiliary output; when setting the parameters, decreases the value displayed or scrolls to the previous parameter.	AUX/DOWN + ON-OFF/UP: if pressed together for more than 3 seconds, activates/deactivates the continuous cycle; AUX/DOWN + SET/DEF: if pressed together for more than 1 second, displays a submenu used to access the HACCP alarm parameters.
SET/DEF	If pressed for more than 1 s, displays and/or lets the user set the set point; if pressed for more than 5 s, starts a manual defrost.	SET/DEF+ AUX/DOWN: if pressed together for more than 1 second, displays a submenu used to access the parameters relating to the HACCP alarms; SET/DEF+ ON-OFF/UP: if pressed together for more than 3 seconds, displays the temperature read by the defrost probe.

Tab. 3.e

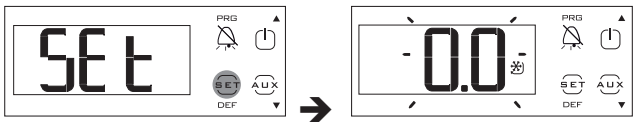
3.3 Programming

The operating parameters can be modified using the front keypad. Access differs depending on the type: set point, frequently-used parameters (F) and configuration parameters (C). The type of parameter is specified in the table of parameters. Access to the configuration parameters is protected by a password for the configuration parameters that prevents unwanted modifications or access by unauthorised persons. The password can be used to access and set all the control parameters.

Setting the set point

To change the set point St:

- press Set for more than 1 s: the display shows Set and then the current value of St;
- press UP/DOWN until reaching the desired value;
- press Set to save the new value of St.

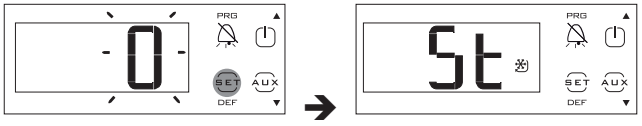


Setting type F parameters

Type F parameters include the set point, differential, temperature monitoring interval, interval between defrosts, end defrost temperature, dripping time, alarm thresholds, alarm bypass times, etc. See the parameter table.

Procedure:

1. press Prg/Mute one or more times to return to the standard display;
2. press Prg/Mute for more than 3 seconds (if an alarm is active, the buzzer is muted): the display will show the code PS (Password) and the number 0;
3. press Set, the display shows parameter St;
4. press UP or DOWN until reaching the desired parameter: when scrolling, an icon is displayed that represents the category the parameter belongs to (see the table below and the parameter table);
5. press Set to display the value of the parameter;
6. press UP/DOWN until reaching the desired value;
7. press Set to temporarily save the new value and display the parameter code again;
8. Repeat steps 4) to 7) to set other parameters;
9. To permanently save the new values of the parameters, press Prg/ Mute for 5 seconds. This exits the parameter setting procedure.

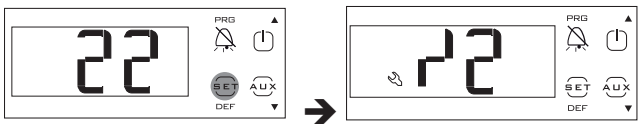


Setting type C parameters

Type C parameters include the type F parameters plus all the other control parameters.

Procedure:

1. press Prg/Mute one or more times to return to the standard display;
2. press Prg/Mute for more than 3 seconds (if an alarm is active, the buzzer is muted): the display will show the code PS (Password) and the number 0;
3. press UP/DOWN and enter the password: 22. Press Set, the display shows parameter /2;
4. press UP or DOWN until reaching the desired parameter: when scrolling, an icon is displayed that represents the category the parameter belongs to (see the table below and the parameter table);
5. press the SET button to display the value of the parameter;
6. press UP/DOWN until reaching the desired value;
7. press Set to temporarily save the new value and display the parameter code again;
8. repeat steps 4) to 7) to set other parameters;
9. to permanently save the new values of the parameters, press Prg/ Mute for 5 seconds. This exits the parameter setting procedure.



Important:

- If the controller is powered down before pressing Prg/mute, all the changes made to the parameters will be lost;
- In the two parameter setting procedures (F and C), the new values are only saved after having pressed Prg/mute for 5 seconds. When setting the set point, the new value is saved after confirming with Set.

Note:

- To move from the parameters in one category to another, when displaying the parameter code, press Prg to show the category and UP and DOWN to move from one category to another;
- if no button is pressed for 10s, the display starts flashing, and after 1 minute automatically returns to the standard display;
- to increase the scrolling speed, press and hold the UP/DOWN button for at least 5 seconds;
- all the changes made to the parameters, temporarily stored in the RAM, can be cancelled, by not pressing any button for 60 seconds, thus returning to the standard display. The values of the clock parameters (rtc), however, are saved when entered.

Parameter categories

Category	Text	Icon
Probes	Pro	
Control	CtL	
Compressor	CMP	
Defrost	dEF	
Alarms	ALM	PRG

Category	Text	Icon
Fan	FAn	
Configuration	CnF	AUX
HACCP	HcP	
Clock	rtc	

Tab. 3.f

The following examples apply to models fitted with RTC.

Example 1: setting the current time/date

1. Access the type C parameters as described in the corresponding paragraph;
2. Press UP/DOWN and select the parent parameter tc, or alternatively press the PRG button to select the "rtc" parameter category and then the parameter tc;
3. Press Set: parameter y is displayed, followed by two digits that indicate the current year;
4. Press Set and set the value of the current year (e.g.: 12=2012), press Set again to confirm;
5. Press UP to select the next parameter - month, and repeat steps 3 and 4 for the following parameters:
6. M=month, d=day of the month, u=day of the week h=hour, m=minutes;
7. To return to the list of main parameters, press Prg/mute and then access parameters ton and toF (see the following paragraph), or alternatively:
8. To save the settings, press Prg/mute for 5 seconds and exit the parameter setting procedure.

Example 2: setting the light/auxiliary output (aux) On/Off time

1. Access the type C parameters as described in the corresponding paragraph;
2. Press UP/DOWN and select the parent parameter ton = on time;

3. Press Set: parameter d is displayed , followed by one or two digits that represent the on day, as follows:
   0 = function disabled
   1 to 7 = Monday to Sunday
   8 = Monday to Friday
   9 = Monday to Saturday
   10 = Saturday & Sunday
   11 = every day;
4. Press Set to confirm and go to the on time parameters h/m=hours/minutes;
5. To return to the list of main parameters, press Prg/mute and then access parameter toF = off time;

6. To save the settings, press Prg/mute for 5 seconds and exit the parameter setting procedure.

Note: only one on or off event can be programmed.

Setting the default parameters

To set the parameters to the default values:

- Power down the controller;
- Press Prg/mute;
- Power up the controller holding the Prg/mute button, until the message "Std" is shown on the display, after 5 s.

Note: this will cancel any changes made and restore the original values set by the manufacturer, i.e. the default values shown in the parameter table.

Testing the display and keypad on start-up

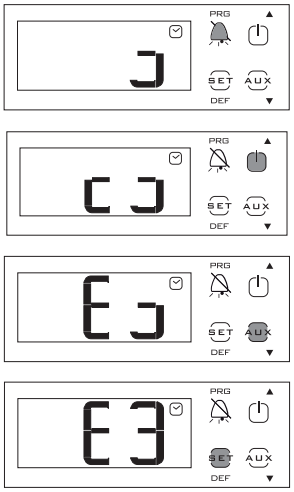
To access test mode:

1. Switch the controller on;
2. Press Prg when the three segments on the display are all on (stage 3 in the table below).

Stage	Display	Keypad
First	Display completely off for 5 seconds	Press Prg for 5 seconds to set the default values
Second	Display completely on for 2 s	No effect
Third	3 segments ("---") on	Pressing each button lights up a specific segment. Note: in this stage, the ⏲ icon indicates the Real Time Clock (RTC) is fitted
Fourth	Normal operation	Normal operation

Tab. 3.g

The sequence of buttons to be pressed to test the display in stage 3 is described below.



Defrost

To activate a defrost, the defrost probe must measure a temperature less than the end defrost temperature (par. dP1).

ACTIVATION: press for 5 seconds:

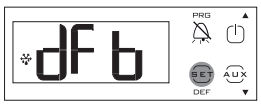
SET
DEF

After 5 seconds, the display shows the start defrost signal (dFb) for 3 s. The controller enters defrost mode, with the corresponding icon shown on the display, together with the message "dEF" if set accordingly by parameter d6. The defrost relay is also activated.

Par.	Description	Def	Min	Max	UoM
d6	Terminal display during defrost0 = Temperature alternating with dEF1 = Display disabled2 = dEF	1	0	2	-

Tab. 3.h

Example: defrost activation



DEACTIVATION: press for 5 seconds:

SET
DEF

After 5 seconds, the display shows the end defrost signal (dFE). The controller exits defrost mode, returning to the standard display.

Example: defrost deactivation

On/Off

To switch the controller off from the keypad:

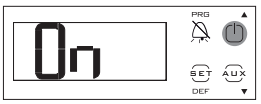
- press On-Off for 3 seconds.

The display shows the text Off flashing for 3 seconds, and then on steady. Finally, the text Off alternates with the standard display. Any active output relays are deactivated.

To switch the controller on from the keypad:

- press On-Off for 1 s.

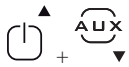
The display shows the text On for 1 s and then returns to the standard display. Any output relays are activated again.



Continuous cycle

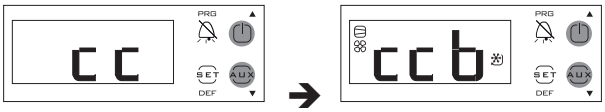
For the explanation of the continuous cycle function, see chapter 6.
To activate the continuous cycle, the value of parameter cc must be >0.

ACTIVATION: press the button or combination of buttons for 5 seconds



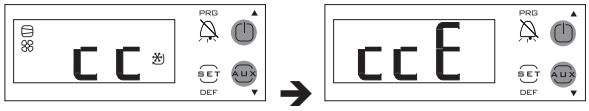
The message "cc" flashes on the display for 3 seconds, and subsequently, if the conditions are suitable, the controller shows the start continuous cycle message "ccb" and the corresponding icon on the display.

Example: continuous cycle activation



DEACTIVATION: press the button or combination of buttons for 3 s:

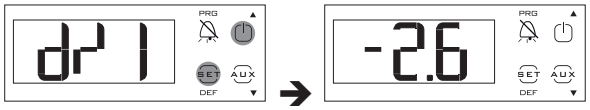
The message "cc" flashes on the display for 3 seconds, and subsequently the controller shows the end continuous cycle message, "ccE".



Display defrost probe

To display the value measured by the defrost probe:

- press Set and UP together for 3 s;
- the code of parameter d/1 is displayed flashing;
- continue holding the buttons until the value measured by the defrost probe is displayed;
- release the buttons;
- the standard display is shown again after 10 s.



Auxiliary/light output activation

Activation from the keypad: for automatic activation from scheduler see the second example in paragraph 3.5. To activate the auxiliary (H1 = 2) and/or light output (H1 = 3) from the keypad:

- press AUX and/or  if present;
- the message AUX flashes on the display for 1 s:
- press and hold until activating the output and the corresponding icon on the display, which then shows the standard display.

Auxiliary output active

Light output active

Press AUX to deactivate the AUX or light output.

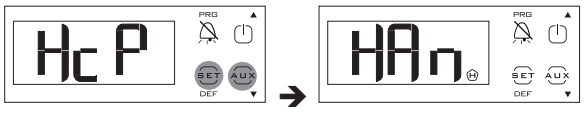
Probe calibration

Parameters /c1 to /c4 are used are used to calibrate the first, second, third and fourth temperature probe respectively. Access the parameters and then set the required values. When pressing Set, after having entered the value, the display does not show the parameter, but rather immediately shows the new value of the probe reading being calibrated. This means the result of the setting can be checked immediately and any adjustments made as a consequence. Finally, press Prg for 5 seconds to save the value of the parameter.

HACCP menu

The controller must be fitted with the RTC (real time clock).
To enter the HACCP menu:

- press the combination/button shown the table below for 1 s;
- press UP/DOWN to display the parameters in the HACCP category;
- press PRG for 5 seconds to return to the standard display.



Minimum and maximum temperature monitoring

The controller can record the minimum and maximum temperature measured by the control probe over a period of up to 999 hours (more than 41 days).
To enable monitoring:

- enter programming mode as explained in the corresponding paragraph;
- set r5=1;
- select rt;

press:

DEF

This displays how long minimum and maximum temperature monitoring has been active, (if recording has just been enabled, rt=0);;

- to restart temperature recording, press for more than 5 s:

The message "rES" indicates that the log has been deleted. The controller resets the total hours and restarts monitoring;

- press Set to return to the list of parameters;
- to display the maximum temperature measured by the probe, read the value associated with parameter rH;
- to display the minimum temperature measured by the probe, read the value associated with parameter rL.

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

Important: the values of parameters rt, rL and rH are saved to the controller's memory every hour. If the controller is not connected to an uninterruptible power supply, a temporary blackout may mean the values of rt, rL and rH measured in the last hour will be lost. When power returns, the controller automatically restarts monitoring from the previously saved values.

4. COMMISSIONING

4.1 Configuration

The configuration parameters are set when commissioning the controller, and involve:
- date/time setting, if the clock is fitted (RTC – real time clock);
- analogue probe measurement stability;
- probe display stability;
- standard display shown on the controller, and on the remote display, and the decimal point;
- serial address for the supervisor network connection;
- temperature unit of measure (°C / °F);
- lock keypad, disable buttons and buzzer;
- display during the defrost.

Date/time setting

See example 1 in par. 3.5.

Analogue probe measurement stability

Defines the coefficient used to stabilise the temperature measurement, filtering the reading based on two algorithms:
- limitation of variation: the maximum variation the value is limited, so as to reduce impulsive disturbance;
- moving average: this limits the effect of any noise superimposed over the temperature measurement that may negatively affect control performance.

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

Par.	Description	Def	Min	Max	UOM
/2	Probe measurement stability	4	1	15	-

Tab. 4.a

Probe display stability

Important: this parameter only applies to the temperature shown on the display, and not the reference control temperature.

Par.	Description	Def	Min	Max	UOM
/3	Probe display stability 0 = Disabled 1 = Fast update… 15 = Slow update	0	0	15	-

Tab. 4.b

This parameter is used to set the rate at which the temperature display is updated. The temperature shown on the display tends to follow rapid deviations away from the set point very slowly, and vice-versa, moves very quickly in the event where the temperature displayed is approaching the set point. In the table the delay of display based to the setting.

/3	Display delay	/3	Display delay
0	Disabled	8	50 s
1	5 s	9	60 s
2	10 s	10	75 s
3	15 s	11	90 s
4	20 s	12	105 s
5	25 s	13	120 s
6	30 s	14	150 s
7	40 s	15	180 s

Tab. 4.c

If the control temperature exceeds the high or low temperature thresholds and a high/low temperature alarm (AH/AL) is activated, or if the maximum number of filtering steps is exceeded, the filtering would immediately be bypassed and the temperature displayed would be the temperature effectively measured, until all the alarms are reset.

Example: in the case of bottle coolers, typically used in supermarkets where the doors are opened frequently, due to the greater thermal inertia of the liquids compared to the air (and the fact that the probe is positioned in the air and not directly on the products), the controller measures a temperature that is higher than effective temperature of the soft drinks, thus displaying an "unrealistic" temperature. Setting parameter /3 to a value other than 0, any abrupt variations in temperature are "filtered" on the display, showing a temperature trend that is "closer" to the actual trend of product temperature.

Display on user terminal and remote display

The user terminal (controller display) can either display the value of the virtual control probe (see the chapter on control), the reading of probes 1-4 or the set point. Similar displays can be selected on the remote display, except for the set point.

Par.	Description				Def	Min	Max	UOM
/tl	Display on user terminal				1	1	7	-
	1	Virtual probe	5	Probe 4				
	2	Probe 1	6	Reserved				
	3	Probe 2	7	Set point				
	4	Probe 3						
/tE	Reading on remote display				0	0	6	-
	0	Terminal not fitted	4	Probe 3				
	1	Virtual probe	5	Probe 4				
	2	Probe 1	6	Reserved				
	3	Probe 2						

Tab. 4.d

Serial address (parameter H0)

H0 assigns the controller an address for the serial connection to a supervisory and/or telemaintenance system.

Par.	Description	Def	Min	Max	UOM
H0	Serial address	195	0	207	-

Tab. 4.e

Temperature unit of measure and decimal point display

The following settings are available:
- choose the temperature unit of measure, between degrees Celsius (°C) and Fahrenheit (°F);
- enable/disable the decimal point on the display and the buzzer.

Par.	Description	Def	Min	Max	UOM
/5	Temperature unit of measure 0 =°C, 1 =°F	0	0	1	-
/6	Display decimal point 0/1 = yes/no	0	0	1	-
H4	Buzzer 0/1=enabled/disabled	0	0	1	-

Tab. 4.f

Lock keypad and disable buttons

Certain functions regarding the use of the keypad can be disabled, for example parameter and set point settings if the controller is accessible to the public. In addition, an individual button or group of buttons can be disabled.

Par.	Description	Def	Min	Max	UOM
H2	Disable keypad functions	1	0	6	-
H6	Terminal keypad lock configuration 0 = all buttons enabled	0	0	255	-

Tab. 4.g

Functions that can be disabled on the keypad

Important: if setting H2 ≠ 1, 3, the type F parameters cannot be set, but rather only their values can be displayed. Type C parameters, being password-protected, can always be set on the keypad following the procedure described in chap. 3. If "set point" and "F parameter" setting is disabled, the set point and the type F parameters cannot be set, but rather only their values can be displayed.

Note: Y = can be activated / enabled; N = cannot be activated / enabled

ir33+

	par. H2						
FUNCTION	0	1	2	3	4	5	6
LIGHT	Y	Y	Y	Y	Y	Y	Y
AUX	Y	Y	Y	Y	Y	Y	Y
ON/OFF	Y	Y	Y	Y	N	N	Y
HACCP	Y	Y	Y	Y	Y	Y	Y
PRG/MUTE (mute)	Y	Y	Y	Y	Y	Y	Y
UP+DOWN (continuous cycle)	Y	Y	Y	Y	N	N	N
SET/DEF (defrost)	Y	Y	Y	Y	N	N	N
SET (set point) setting	N	Y	N	Y	Y	N	N
"F" parameter setting	N	Y	N	Y	N	N	N

Tab. 4.h

Disable buttons

Using the individual bits, the functions relating to the buttons on the keypad can be enabled or disabled, according to the relationships shown in the table below: to calculate the value to be assigned to parameter H6, simply sum the values assigned to the functions that should be disabled.

Note: the functions disabled using parameter H6 are added to those disabled using parameter H2.

Disable buttons

Bit	Value par. H6	ir33+ button	ir33+ function	Description
0	1	SET DEF	Display defrost temp. procedure; access HACCP; defrost	Display defrost temp. procedure
1	2	AUX	Activate AUX output 1, continuous cycle	Defrost
2	4	▲	Up, On-Off	Continuous cycle
3	8	PRG	Mute alarms	Mute alarms

Tab. 4.i

4.2 Loading the sets of parameters

Up to 6 sets of custom parameters can be selected on the controller, after having been loaded using the VPM programming tool (Visual Parameter Manager, see appendix 1) and the programming key.

Procedure:
- power down the controller;
- power up while holding Prg/mute;
- the display will show the first set: bn0;
- press UP/DOWN to select set bn1 to bn6. For example, select bn2;
- press Set to confirm the selected set: the controller will load the set of parameters called bn2 and then will return to the standard display.

Par.	Description	Def	Min	Max	UOM
Hdn	Number of default parameter sets available	0	0	6	-

Tab. 4.j

Note: bn0 is the default set of parameters on the controller, i.e. the default configuration. When one of sets bn1 to bn6 is loaded, bn0 is overwritten with the new set and is consequently erased.

4.3 Preparing for operation

Once having completed the installation, configuration and programming procedures, before starting the controller, check that:
- the wiring has been completed correctly;
- the programming logic is suitable for controlling the unit and the system being managed;
- if the controller is fitted with RTC (clock), set the current time and date, and the on and off times for the light/auxiliary output;
- set the standard display;
- set the "probe type" parameter based on the probe available and the type of control (NTC, NTC-HT, PTC); note that the controllers that use PTC probes may have different part numbers from those that only use NTC probes;
- set the type of defrost: heater or hot gas;
- set the temperature unit of measure (°C or °F);
- the protection functions (delay at start-up, rotation, minimum on and off times for the outputs) are active.

Note: all the alarms with manual reset can be reset by pressing the Prg and UP buttons together for more than 5 seconds. See the chapter on "Alarms".

5. FUNCTIONS

5.1 Probes (analogue inputs)

The ir33+ platform controllers feature a maximum of 4 analogue inputs, which are used for NTC, high temperature NTC (NTC Enhanced Range) or PTC temperature sensors (see the note below). Probes S3 and S4 can also be configured as digital inputs. Probe S1 is the control probe and its function cannot be changed; the functions of probes S2, S3, S4 can be selected using parameters /A2, /A3, /A4. The probes can be calibrated to adjust their readings. In particular, parameters /c1 to /c4 are used to increase or decrease the values read by the probes connected to inputs S1, S2, S3 and S4 across the entire the range of measurement. For the calibration procedure, see paragraph 3.5.

Par.	Description	Def	Min	Max	UOM
/P	Type of probe 0 = NTC Standard Range -50T90°C 1 = NTC Enhanced Range -40T150°C	0	0	2	-
/c1	Probe 1 calibration	0	-20	20	-
/c2	Probe 2 calibration	0	-20	20	-
/c3	Probe 3 calibration	0	-20	20	-
/c4	Probe 4 calibration	0	-20	20	-

Tab. 5.a

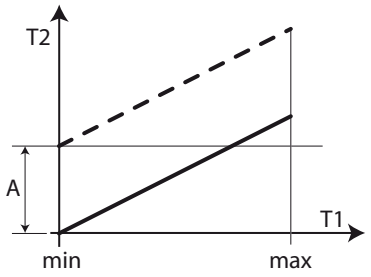


Fig. 5.a

Key

T1	Temperature read by the probe
T2	Value calibrated by T1
A	Calibration value
min, max	Range of measurement

Assigning the functions of probes S2, S3, S4

The controller, inside the refrigerated cabinet or cold room, can use the following probes:

- defrost, located on the evaporator, preferably where ice remains the longest;
- condenser, used to protect the compressor against high pressure when the condenser is off or the condenser fan is malfunctioning;
- frost protection, to activate the corresponding alarm.

Note:

- to configure probes 3 and 4 as digital input 1 and 2 respectively, set parameters /A3 e /A4 =0;
- if multiple probes have been configured with the same operating mode, the controller will use the first probe in increasing order with that configuration.

Par.	Description	Def	Min	Max	UOM
/A2	Probe 2 configuration (S2) (M models)	0	0	4	-
/A2	Probe 2 configuration (S2) 0 Absent 1 Product (display only) 2 Defrost 3 Condenser 4 Frost	2	0	4	-
/A3	Probe 3 configuration (S3) 0 Digital input 1 (DI1) 1 Product (display only) 2 Defrost 3 Condenser 4 Frost	0	0	3	-
/A4	Probe 4 configuration (S4/ DI2) 0 Digital input 2 (DI2) 1 Product (display only) 2 Defrost 3 Condenser 4 Frost	0	0	4	-

Tab. 5.b

5.2 Digital inputs

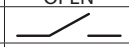
Digital inputs DI1 and DI2 respectively can be enabled in the place of probes S3 and S4. Digital inputs 1, 2 must first be enabled (par. /A3 and /A4 = 0) and then assigned to a specific function (par. A4 and A5). Finally, an external contact can be connected to the multifunction input to activate various types of functions, such as alarms, curtain/door switches, start defrost, etc. See the table below.

Important: to ensure unit safety in the event of serious alarms, the unit must be fitted with all the electromechanical safety devices needed to guarantee correct operation..

Note: (applies to all settings of par. A4 and A5): if 2 digital inputs are configured in the same way, for example to enable defrost, the disable event is generated when at least one of the inputs is open, while the enable event is generated when at both inputs are closed.

Digital input functions

PARAMETERS A4, A5

Setting	Contact	
	OPEN	CLOSED
		
0 = not active	-	-
1 = immediate external alarm	active	not active
2 = delayed external alarm	active	not active
3 = select probe (ir33M)	see /tl	first probe enabled (/A2, /A3, /A4, /A5)
3 = enable defrost (all other models)	not enabled	enabled
4 = start defrost	not active	active
5 = door switch with compressor and evaporator fans off	door open	door closed
6 = remote ON/OFF	OFF	ON
7 = curtain switch	curtain open	curtain closed
8 = low pressure switch	low pressure status	normal status
9 = door switch with fans off	door open	door closed
10 = direct/reverse operation	direct mode	reverse mode
11 = light sensor	light off	light on
12 = activate aux output	deactivated	activated
13 = door switch with compressor and fans off and light not managed	door open	door closed
14 = door switch with fans off and light not managed	door open	door closed

Tab. 5.c

The following parameters are involved in the explanation of the settings for A4 and A5.

Par.	Description	Def	Min	Max	UOM
A4	Multifunction digital input 1 configuration (DI1) See the previous table	0/3 (IR33M)	0	14	-
A5	Multifunction digital input 2 configuration (DI2) See the previous table	0	0	14	-
A6	Stop compressor on external alarm 0 = compressor always off; 100 = compressor always on	0	0	100	min
A7	Digital alarm input delay 0 = control outputs unchanged	0	0	250	min
Ado	Light management with door switch	0	0	1	-
c7	Maximum pump down time (PD) 0 = Pump down disabled	0	0	900	s
d5	Defrost delay at start-up (if d4=1) or from DI	0	0	250	min
d8	High temperature alarm bypass time after defrost (and door open)	1	0	250	hr/ min
d8d	Alarm bypass time after door open	0	0	250	min
dI	Maximum time between consecutive defrosts - 0 = defrost not performed	8	0	250	hr/ min

Tab. 5.d

1 = Immediate external alarm

Application: external alarm that requires immediate action (for example high pressure alarm or compressor thermal overload). When the alarm is activated:

1. the following actions occur:
   - a signal is shown on the display ('IA');
   - the icon flashes;
   - the buzzer is activated, if enabled;
   - the alarm relay is activated, if selected;
2. and the actuators behave as follows:
   - compressor: operates depending on the values assigned to parameter 'A6' (stop compressor on external alarm).
   - fans: continue operating according to the fan parameters ("F").

Note when the compressor stops, the minimum compressor on time ("c3") is ignored.

2 = Delayed external alarm

The delayed external alarm is equivalent to the immediate external alarm, however with the addition of a delay A7 before the signal ("dA").

Application: this configuration is especially useful for managing the low pressure alarm. In fact, when starting for the first time, the unit often detects a low pressure alarm due to the environmental conditions rather than a unit malfunction. Setting a delay for the alarm (par. A7) will avoid false signals. In fact, by suitably calculating the delay, if the low pressure is due to environmental conditions (low temperature), the alarm will be automatically reset before the delay has elapsed.

Note if "A7"=0 activation of the alarm does not cause the compressor to operate according to the values assigned to parameter 'A6' (stop compressor on external alarm); on the other hand, the "dA" signal is displayed, the icon flashes, the buzzer and the alarm relay (if selected) are activated; the delayed external alarm is thus signal-only.

3 = Probe shown on the display (IR33M models)

On thermometer-only models, this setting selection is used to exploit the digital input in order to show, on the display, the probe selected by parameter "/tI" or the first enabled probe (see parameters "/A2"","/A3"","/A4"). In practice, if the contact is open, the probe selected by parameter "/tI" is shown, whereas, if the contact is closed, the first enabled probe is shown.

Note: if more than one digital input is configured as the probe selection, the probe selected by parameter /tI is displayed when at least one of the inputs is open.

3 = Enable defrost (all other models)

Application: any defrosts called when the contact is open remain pending until the contact closes. The various possibilities are shown below.

A4 = 3

Contact	Defrost
Open	Not enabled
Closed	Enabled
Closed without request from the controller	Not performed
Closed with in progress	When the digital input opens, the defrost is immediately stopped and the unit restarts normal operation (without performing the dripping or post-dripping stages). The LED starts flashing to indicate that the defrost call is pending, awaiting the next enabling signal (closing of the contact), when the defrost will be performed completely.

Tab. 5.e

Note this function is useful to prevent defrosts on units accessible to the public during opening times.

4 = Start defrost from external contact

Application: this function is useful for performing defrosts in real time. To perform the defrosts, connect a cyclical, mechanical or electronic timer to the selected digital input: a series of units can be connected to the same timer, setting different values for parameter d5 (defrost delay from multifunction input) to avoid simultaneous defrosts.

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

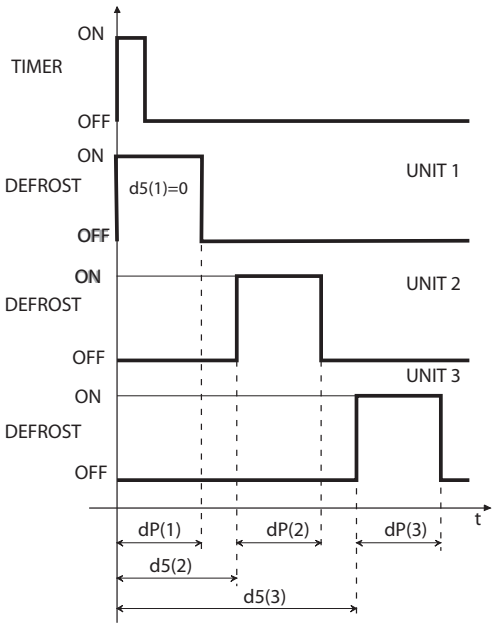


Fig. 5.b

Key

dP	Maximum defrost duration	d5	Defrost delay from digital input
UNIT 1…3	Unit 1-3	t	Time

5 = Door switch with compressor and evaporator fan off

Parameter d8 defines the high temperature alarm bypass time after the defrost ends (or the door is opened).

Parameter d8d is the alarm bypass time after the door is opened. If d8d=0, the alarm delay after door open coincides with the value of parameter d8. Setting "A4"=5 manages the cold room door switch. The behaviour of the door switch depends on the status of the light when the door is opened:

1. light off;
2. light on.

Case 1: light off when opening the door

If the door is opened with the light OFF:
- the compressor and the evaporator fans are switched off;
- the light is switched on (only on models fitted with at least 1 auxiliary relay programmed as a light output);
- the reading displayed and the icon flash;
- the temperature alarms are disabled.

If the door remains open for a time longer than "d8" (d8d), the controller resumes normal operation:
- the compressor and the evaporator fan are switched on, if needed;
- the light is switched off;
- the reading on the display flashes;
- the buzzer and the alarm relay are activated;
- the temperature alarms are enabled with the delay "Ad".

To stop the reading from flashing, close the door. When the door closes, the controller resumes normal operation, switching off the light and enabling the temperature alarm after the delay time "d8". The compressor is re-started, after any set protection times (see the "C" parameters).

Case 2: light on when opening the door

The icon is on. If the door is open with the light on, it is assumed the user enters the cold room, turning on the light before entering, closing the door behind him, and then exits the room, closing the door a second time.

When the door is opened the first time:
- the compressor and the evaporator fans are switched off;
- the light stays on (only on models fitted with at least 1 auxiliary relay programmed as a light output);
- the reading is displayed and the icon flashes;
- the temperature alarms are disabled.

When the door is closed the first time, the controller maintains the previous situation:
- the compressor and the evaporator fans stay off;
- the light stays on;
- the reading is displayed and the icon flashes;
- the temperature alarms are disabled.

Door opened the second time: no change.

When the door is closed the second time, the controller resumes normal operation, switching off the light and enabling the temperature alarm after the delay time "d8". When the compressor re-starts, any set protection times must elapse first (see the "C" parameters).

If, after opening, the door remains open for a time longer than "d8" or "d8d", the controller resumes normal operation:
- compressor and evaporator fan switched on if needed;
- light off;
- the reading on the display flashes;
- the buzzer and the alarm relay are activated;
- the temperature alarms are enabled with the delay "Ad";
- when the door closes, the high temperature alarm bypass time after door open d8 is not set.

To stop the reading from flashing, close the door.

If, after being closed for the first time, the door remains closed for longer than time "d8" or "d8d", the controller resumes normal operation:
- compressor and evaporator fan switched on if needed;
- light off;
- the temperature alarms are enabled with the delay "d8";
- the high temperature alarm bypass time after door open d8 is set.

If, after the door is closed for the first time, the light is switched off manually, the controller resumes normal operation:
- compressor and evaporator fan switched on if needed;
- light off;
- the temperature alarms are enabled with the delay "d8";
- the high temperature alarm bypass time after door open d8 is set.

Note:
- if the light was previously switched on manually, when the door is closed for the second time, it is automatically switched off;
- even if the evaporator fan is managed by the "fan controller" (see the F parameters), the fans are forced to stop when the door is open.

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

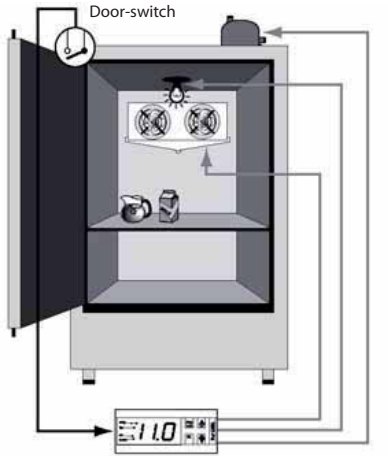


Fig. 5.c

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

6 = Remote On/Off

The digital input may be programmed also as remote ON/OFF. When the control is in OFF:
- the temperature is displayed alternating with the message "OFF";
- the internal timer for parameter "dI" is updated. If "dI" expires when the unit is OFF, a defrost is performed when the unit is switched on again;
- the auxiliary relay set as auxiliary and light output is active, the other auxiliary outputs are off;
- the buzzer and the alarm relay are deactivated;
- the controller does not perform the control functions, defrosts, continuous cycle, signal temperature alarms and all other functions;
- the compressor protection times are observed;

When the controller is switched back on, all the functions are re-activated, with the exception of:
- defrost on start-up;
- compressor and fan delay at power on.

Note: the ON/OFF from external digital input has priority over the keypad and the supervisor;

7 = Curtain switch

If the input is selected as a curtain switch, the controller modifies the set point when the contact closes, adding the value of parameter "r4"; the new value is then used for all the functions relating to the set point (e.g. relative high and low temperature alarms, control with dead band, control with two compressor steps etc.). For example when "r4"=3.0 (default value), the set point is increased by 3 degrees from the value used when the curtain is open.

Par.	Description	Def	Min	Max	UOM
r4	Automatic night-time set point variation	3	-20	20	°C/°F

Tab. 5.f

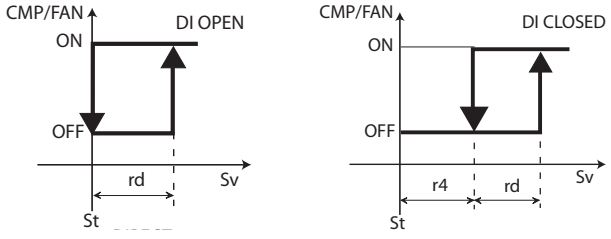


Fig. 5.d

Key

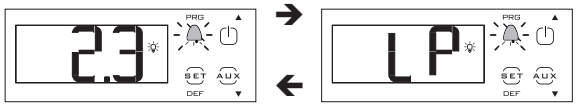
St	Set point	rd	Differential
CMP	Compressor	FAN	Fan
Sv	Virtual probe	r4	Automatic night-time set point variation

Note: if one of the auxiliary outputs is used to manage the light, lowering the curtain automatically switches the light off, while raising it switches the light on.

8 = Low pressure switch input for pump down

See par. 6.4. Setting "A4"=8 manages the low pressure switch. The low pressure alarm "LP" is signalled when the low pressure switch is activated:
- during normal control (c7=0) with the compressor on, or alternatively
- with pump-down function configured (c7 >0), if the pump down valve is open and the compressor is on.

The low pressure alarm signal is delayed by the time set for parameter "A7". The low pressure alarm "LP" stops the compressor.



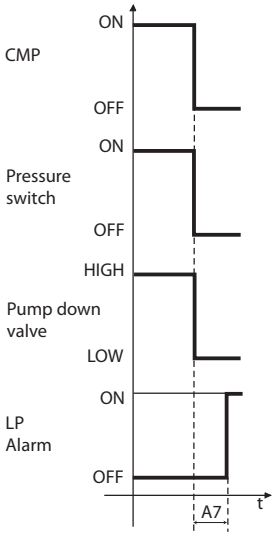


Fig. 5.e

Key

CMP	Compressor	Pump down valve	Pump down valve
Pressure Switch	Pressure switch	LP alarm	Low pressure alarm
t	Time	A7	Alarm signal delay

Note: this parameter, together with c7, c8, c9 and H1, allows management of the "pump-down" algorithm (see par 6.3).

9 = Door switch with fan off only

Same as for option "A4"=5, with the difference being that when opening the door only the evaporator fan is switched off.

10 = Direct/reverse operation

Important: when A4 = 10, the status of digital input has priority over the setting of parameter r3 (direct/reverse operating mode).

When the contact is open, the controller operates in "direct" mode (cooling), when the contact is closed, in "reverse" mode (heating). A switch can therefore be connected to select heating or cooling operation.

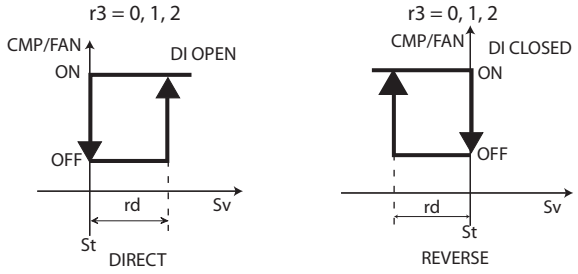


Fig. 5.f

Key

St	Set point	Sv	Virtual probe
rd	Differential	CMP	Compressor
FAN	Fan		

11 = Light sensor

The digital input is used to read a light sensor (P/N PSOPZLHT00, actually an analogue input, from which a digital signal is taken using the parameter or threshold of the light sensor).

The light sensor can be located:
- in the door jamb (ref. A);
- inside the cold room or cabinet (ref. B).

Par.	Description	Def	Min	Max	UOM
AF	Light sensor OFF time	0	0	250	s
	0 Sensor in the door jamb				
	> 0 Sensor inside the cold room or cabinet				

Tab. 5.g

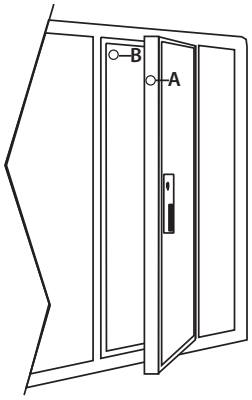


Fig. 5.g

	A (AF=0)	B (AF = 1)
Light sensor signal	The sensor signals the opening and closing of the door	The sensor signals the opening of the door and detects light inside the cabinet/cold room. The sensor also signals closing of the door
Inside light: on	With the door open	If the sensor detects light
Inside light: off	With the door closed, minimum off time of 5 s, to avoid rapid, successive impulses of the light relay	Closing of the door is measured by time, as the inside light will illuminate the sensor. After the time AF (>0) the inside light is switched off for 5 seconds. If the light sensor signals darkness, the door must be closed and the light will therefore remain off; if it signals light: the door is open and the light will be switched on again.

Tab. 5.h

12 = Auxiliary output
Set H1 = 2 to activate the auxiliary output.

See the table at the start of this paragraph for details on the activation/deactivation logic.

13 = Door switch with compressor and fan off, light not managed

Operation is similar to A4=5, with the difference that the light output is not modified.

Note: the light management algorithm depends on parameter Ado – "Light management with door switch" (masked parameter accessible from VPM).

Ado	Light when opening the door	Algorithm	Description
0	off	normal	open-close
	on	extended	open-close-open-close
1	off	extended	open-close-open-close
	on	normal	open-close

Tab. 5.i

If the digital input is selected to not manage the light (A4, A5 =13 or 14), the algorithm is modified as follows:

Ado	Light when opening the door	Algorithm	Description
0	off	normal	open-close
	on	extended	open-close-open-close
1	off	normal	open-close
	on	normal	open-close

Tab. 5.j

See the table at the start of this paragraph for details on the activation/deactivation logic.

14 = Door switch with fan off only, light not managed

Operation is similar to A4=9, with the difference that the light output is not modified.

Note: the light management algorithm depends on parameter Ado, as shown in the previous table.

See the table at the start of this paragraph for details on the activation/deactivation logic.

5.3 Digital outputs

The parameters in question concern the minimum on or off times of the same output or different outputs, so as to protect the loads and avoid swings in control.

Important: for the times set to become immediately operational, the controller needs to be switched off and on again. Otherwise, the timers will become operational when the controller is next used, when the internal timer is set.

Relay output protectors (parameters c7,c8,c9)

Par.	Description	Def	Min	Max	UOM
c0	Compressor, fan and AUX start delay at power on	0	0	15	min
c1	Minimum time between successive compressor starts	0	0	15	min
c2	Minimum compressor off time	2	0	15	min
c3	Minimum compressor on time	0	0	15	min

Tab. 5.k

- c0: when the controller is powered on, the compressor, evaporator fans and auxiliary relay in neutral zone control ('H1'=11) are started after a delay (in minutes) equal to the value assigned to this parameter. The delay is used to protect the compressor against repeated starts in the event of frequent power failures;
- c1 defines the minimum time between two consecutive starts of the compressor;
- c2 defines the minimum compressor off time;
- c3 defines the minimum compressor on time;

Other relay output protectors (parameter c11)

Par.	Description	Def	Min	Max	UOM
c11	Second compressor start delay	4	0	250	s

Tab. 5.l

- c11 defines the activation delay between the first and second compressor (or between the first and the second compressor step).

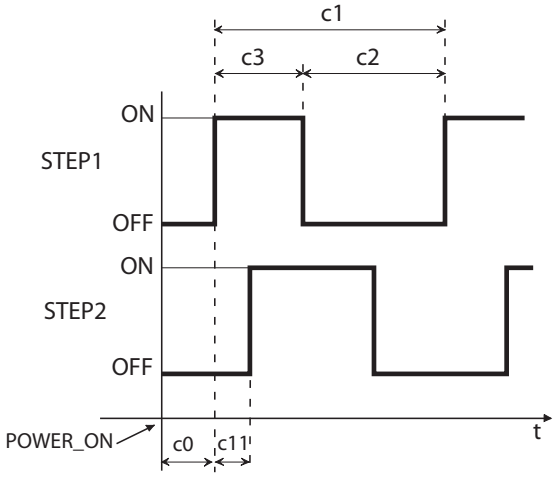


Fig. 5.h

Key

Step1	Compressor step 1
Step2	Compressor step 2
t	time

Functions assigned to AUX

Output AUX can be assigned different functions, such as alarm signal, auxiliary output, light output, pump down valve, condenser fan, reverse output with neutral zone, second compressor, second compressor with rotation. For details, see the chapter on control.

Par.	Description	Def	Min	Max	UOM
H1	AUX output configuration 0 = normally energised alarm 1 = normally de-energised alarm 2 = auxiliary 3 = light 4 = auxiliary evaporator defrost 5 = pump down valve 6 = condenser fan 7 = delayed compressor 8 = auxiliary with deactivation when OFF 9 = light with deactivation when OFF 10 = no function 11 = reverse with neutral zone 12 = second compressor step 13 = second compressor step with rotation	1	0	13	-

Tab. 5.m

6. CONTROL

6.1 Switching the controller On/Off

The controller can be switched ON/OFF from a number of sources; keypad, supervisor and digital input. In this operating mode, the display will be show the temperature selected for parameter /tI, alternating with "OFF". The digital input can be used to switch the controller on/off, setting parameter A4/A5 to "6". Switching on/off from digital input has priority over the same function from the supervisor and the keypad.

Source	Priority	Note
Digital input	1	Disable On/Off from keypad and supervisor
Keypad	2	
Supervisor	3	

Tab. 6.a

6.2 Virtual probe

The control output is the compressor output, which in most cases is also associated with the evaporator fan output. The control probe is probe S1, while probes S2, S3, S4 can be assigned functions such as product probe (display only), defrost probe, condenser probe or frost protection probe. For vertical display cases, the virtual probe (Sv) should be defined as the control probe; this represents the half-way point between the display case outlet and intake probes, and the reading is thus affected by the environmental conditions. During the day, the display case light is on and the curtain is open to allow customers to take out the products store, at night the curtain is closed and the light is off. Due to the lower heat load at night, the night-time set point is increased by the value of parameter r4.

Par.	Description	Def		Min	Max	UOM
		Def. 1	Def . 2			
St	Set point	2	-18	r1	r2	°C/°F
r4	Automatic night-time set point variation	3.0		-20	20	°C/°F
/4	Virtual probe composition 0 = control probe S1 100 = probe S2	0		0	100	-

Tab. 6.b

Parameter /4 is used to determine the virtual probe (Sv) as the weighted average of control probe S1 and probe S2, according to the following formula:

$$Sv = \frac{[(S1*(100 - /4) + S2*/4]}{100}$$

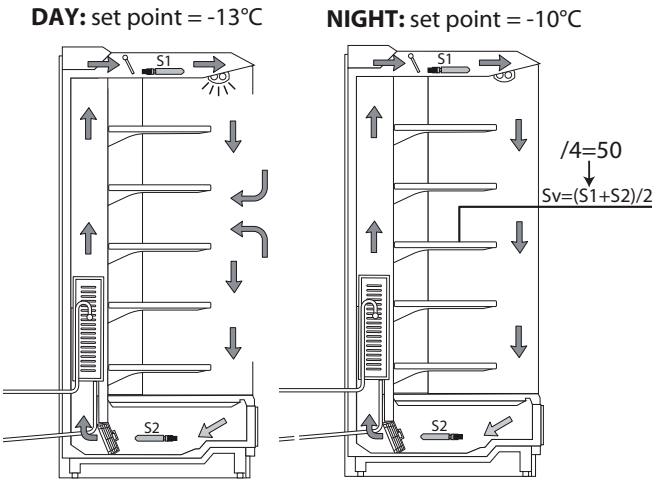


Fig. 6.a

Key	
S1	Outlet probe
Sv	Virtual probe
S2	Intake probe

6.3 Set point

The reference output is the compressor output (CMP).
The controller can operate in 3 different modes, as selected by parameter r3:

- direct with defrost control;
- direct;
- reverse.

Par.	Description	Def		Min	Max	UOM
		Def. 1	Def . 2			
St	Set point	2	-18	r1	r2	°C/°F
rd	Differential	2.0		0.1	20	°C/°F
rn	Neutral zone	4.0		0.0	60	°C/°F
rr	Reverse differential	2.0		0.1	20	°C/°F
r1	Minimum set point	-50		-50	r2	°C/°F
r2	Maximum set point	60		r1	200	°C/°F
r3	Operating mode 0 = Direct with defrost control (cooling) 1 = Direct (cooling) 2 = Reverse (heating)	0		0	2	-

Tab. 6.c

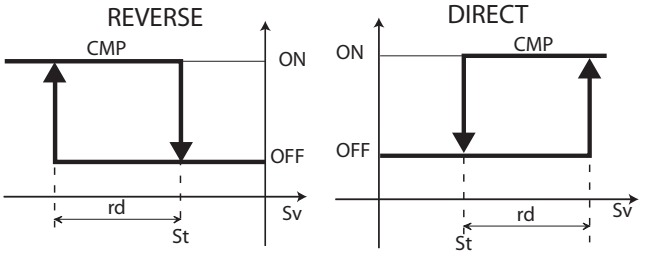


Fig. 6.b

Key			
St	Set point	rd	Differential
Sv	Virtual probe	CMP	Compressor

If the second compressor output is activated (H1 = 12) on the AUX output, the compressor output is activated at St±rd/2 and the AUX output at St±rd, as illustrated in the following figure.

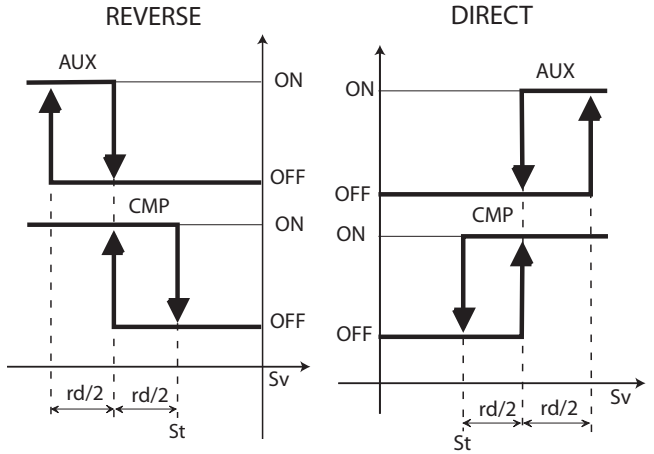


Fig. 6.c

Key			
St	Set point	rd	Differential
Sv	Virtual probe	AUX	Auxiliary output
CMP	Compressor		

The neutral zone is activated on the controller only if the reverse output is activated with neutral zone control, H1 = 11. The figure below shows direct operation (r3 =0, 1), with 1 compressor output (CMP).

r3=0,1

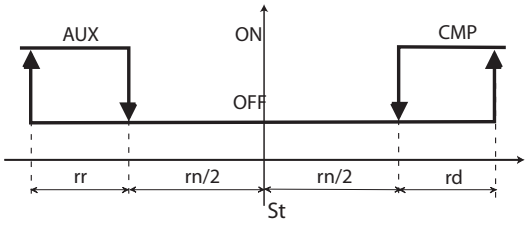


Fig. 6.d

Reverse operation (r3 =2), with 1 compressor output (CMP).

r3=2

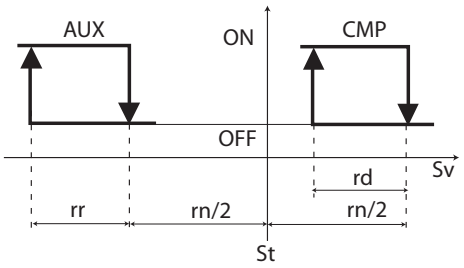


Fig. 6.e

Key

St	Set point	rd	Differential
rn	Neutral zone	rr	Reverse differential

6.4 Pump down

The pump down function has the purpose completely emptying the evaporator of refrigerant on reaching the set point. The controller first deactivates the pump down valve and then, after a certain time, the compressor. The application diagram shows the pump down valve and the low pressure switch. When the controller restarts the compressor, if protection times c1 and c2 have elapsed, the pump down valve is opened, and after the time c8 the compressor is activated. The parameters involved are listed below.

Par.	Description	Def	Min	Max	UOM
c7	Maximum pump down time (PD) 0 = pump down disabled	0	0	900	s
c8	Compress. start delay after opening PD valve	5	0	60	s
c9	Autostart in pump down	0	0	1	-
	0 = Disabled				
	1 = Pump down whenever closing pump down valve & following low pressure switch activation with no cooling demand				
c10	Pump down by time or pressure 0/1 = pressure/time	0	0	1	-

Tab. 6.d

Note: c8 is a masked parameter, and can be made visible using the VPM tool.

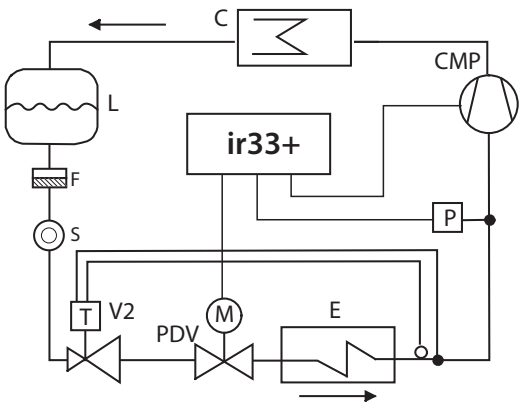


Fig. 6.f

Key

CMP	Compressor	P	Low pressure switch
C	Condenser	F	Filter-drier
L	Liquid receiver	E	Evaporator
V2	Thermostatic expansion valve	S	Liquid gauge
PDV	Pump down valve		

Pump down can be selected:

- by pressure (pressure switch required): when the pump down valve closes, the compressor continues operating until the pressure switch measures the defined low pressure value. The compressor is then stopped. If the pressure switch does not measure the defined value before c7 elapses, the "Pd" alarm - pump down ended by timeout - is activated;
- by time (pressure switch optional): when the valve closes, the compressor continues operating for the time c7 or until reaching the low pressure value. The "Pd" alarm - pump down ended by timeout - is not activated.

c10 = 0: Pump down by pressure

Pressure switch activated before c7 Pressure switch activated after c7

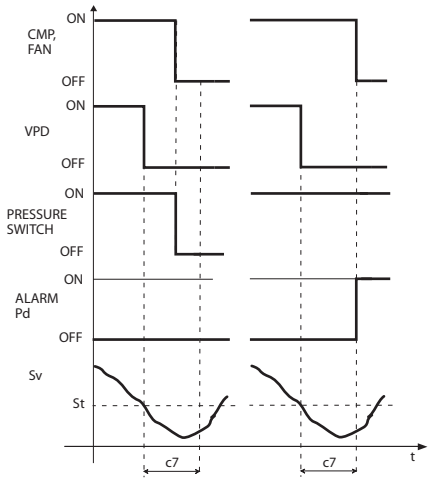


Fig. 6.g

Key

CMP, FAN	Compressor, fan	c7	Maximum pump down time
VPD	Pump down valve	Pd	Pump down alarm
Pressure switch	Pressure switch	t	Time
Sv	Virtual probe		

6.5 Autostart in pump down

As seen in the previous paragraph, on reaching the set point, the controller closes the pump down valve and then the pressure switch signals low pressure. If, due to valve tightness problems, the pressure switch is activated again, the compressor can be restarted by the Autostart function.

Par.	Description	Def	Min	Max	UOM
c9	Autostart in pump down 0 = Disabled 1 = Pump down whenever closing pump down valve & following low pressure switch activation with no cooling demand	0	0	1	-

Tab. 6.e

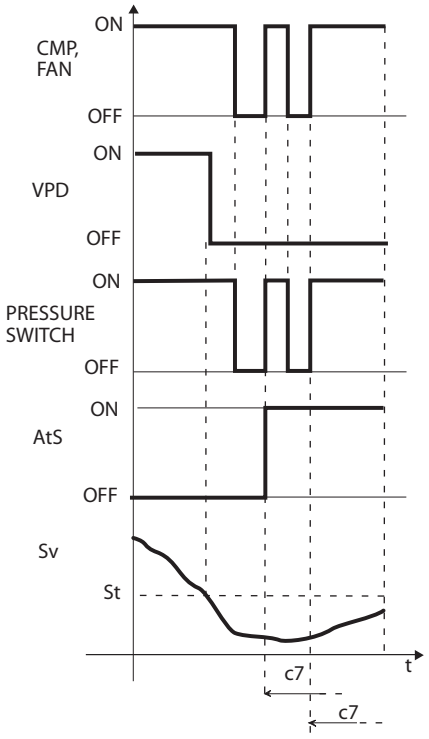


Fig. 6.h

Key			
CMP, FAN	Compressor, fan	St	Set point
VPD	Pump down valve	c7	Maximum pump down time
Pressure switch	Pressure switch	t	Time
Sv	Control probe	AtS	Autostart in pump down

Note:
- in the compressor autostart function, the protection times c1 and c2 are applied, but not c3;
- The message "AtS" is reset automatically when the next pump down cycle terminates correctly.

Important: in the event of "Pd" alarms, the autostart function is deactivated.

6.6 Continuous cycle

For information on activating the continuous cycle from the keypad, see chapter 3. The value of parameter cc must be >0. During operation in continuous cycle, the compressor continues to operate, independently of the controller, for the time cc, so as to lower the temperature even below the set point. The continuous cycle is stopped after the time "cc" or when reaching the minimum specified temperature, corresponding to the minimum temperature alarm threshold ("AL"). If, after the end of the continuous cycle, the temperature falls by inertia below the minimum temperature threshold, the low temperature alarm signal can be ignored by suitably setting parameter c6: alarm bypass after continuous cycle.

Par.	Description	Def	Min	Max	UOM
cc	Continuous cycle duration	0	0	15	hour
c6	Low temperature alarm bypass time after continuous cycle	2	0	250	hr/ min

Tab. 6.f

6.7 Anti-sweat heater

When the unit is powered on, the compressor is activated in cooling mode and the AUX and light outputs are disabled until the control probe measures a value less than St + Hdh. The aim is to prevent the light or the heater connected to the AUX output from adding heat and contrasting the work done by the compressor. When the function is active, the display shows the corresponding icon, flashing.

Par.	Description	Def	Min	Max	UOM
Hdh	Anti-sweat heater offset 0 = anti-sweat heater function disabled (°C) 32 = anti-sweat heater function disabled (°F)	0	-50	200	°C/°F

Tab. 6.g

The following example refers to the configuration where Hdh = 2 and St = 0, with activation of the auxiliary output (H1 = 2)

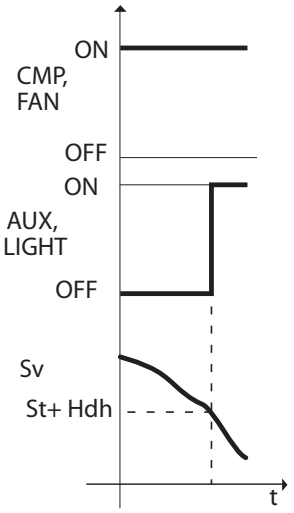
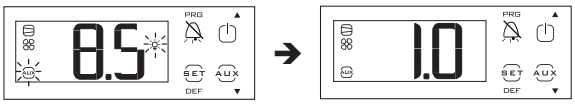


Fig. 6.i

Key			
CMP, FAN	Compressor, fan	LIGHT	Light
AUX	Auxiliary output	Sv	Virtual probe
St	Set point	Hdh	Offset
t	Time		



Note:
- when alarms "HI", "IA", "dA", "CHt", "EE", "EF" ,"rE" are active of the controller is OFF, the anti-sweat heater function is still enabled;
- at the end of the anti-sweat heater function, the outputs configured as light or auxiliary can be controlled by the user from the keypad, supervisor or digital inputs.
- if AUX is configured as a light or auxiliary output at power on, the output retains the same status as when previously powered down. If the anti-sweat heater function is activated, this is no longer true: the output at power on remains OFF while the function is active. When the control temperature (virtual probe) reaches the value of "St+Hdh", the function ends, activating the light output and auxiliary output irrespective of their status when previously powered down.

6.8 Light and Aux outputs

If AUX is configured as a light or auxiliary output at power on, the output retains the same status as when previously powered down.

The light or AUX output can be activated by the scheduler: this is set using parameter H8. For the on/off day and time settings, see chapter 3.

Par.	Description	Def	Min	Max	UOM
H8	Output switched with scheduler 0 = Light; 1= AUX	0	0	1	-
H9	Set point variation with scheduler 0/1 = no/yes	0	0	1	-
St	Set point	Def. 1 Def . 2 2 -18	r1	r2	°C/°F
r4	Automatic night-time set point variation	3.0	-20	20	°C/°F
ton	Light/aux on time	-	-	-	-
toF	Light/aux off time	-	-	-	-

Tab. 6.h

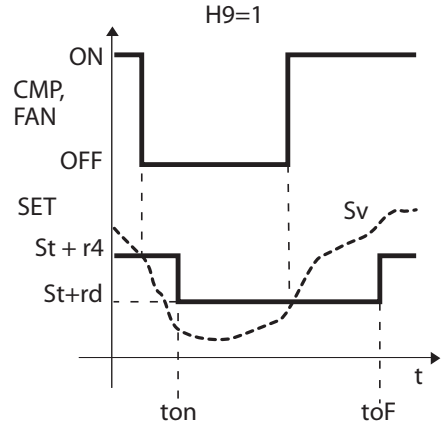


Fig. 6.j

Key

CMP, FAN	Compressor, fan	r4	Automatic night-time set point variation
St	Set point	Sv	Virtual probe
ton	Light/aux on time	toF	Light/aux off time
t	Time		

6.9 Defrost

Introduction

Parameters td1 to td8 can be used to set up to 8 defrost events, managed by the controller's clock (RTC).

Press Set to set the sub-parameters, as shown in the table:

Par.	Description	Def	Min	Max	UOM
td1…8	Defrost 1 to 8 (press Set)	-	-	-	-
d__	Defrost 1 to 8 – day	0	0	11	day
h__	Defrost 1 to 8 – hour	0	0	23	hour
n__	Defrost 1 to 8 – minute	0	0	59	minute

Tab. 6.i

Remember that sub-parameter "d_" of td1(td2) defines the defrost day as follows:

d_ = Defrost– day	
0 = event disabled	9 = Monday to Saturday
1…7 = Monday to Sunday	10 = Saturday & Sunday
8 = Monday to Friday	11 = every day

ir33+ can manage the following types of defrost, based on the setting of parameter d0:
0. heater (located near the evaporator) by temperature;
1. hot gas by temperature;
2. heater by time;
3. hot gas by time;
4. heater by time with temperature control.

The defrost can end by temperature, in which case the defrost probe Sd must be installed, or by time. In the first case, the defrost ends when the defrost probe Sd exceeds the end defrost value dt1 or the time dP1 has elapsed, in the second case when the defrost procedure exceeds the maximum time dP1. At the end of the defrost, the dripping stage may begin (if dd>0), during which the compressor and the fans are off, followed by the post-dripping stage (if Fd>0), during which control resumes with the fans off. The type of display on user terminal and the remote display during the defrost can be selected by setting parameter d6.

Par.	Description	Def	Min	Max	UOM
d0	Type of defrost 0 = Heater by temperature 1 = Hot gas by temperature 2 = Heater by time (Ed1, Ed2 not shown) 3 = Hot gas by time (Ed1, Ed2 not shown) 4 = Heater by time with temperature control (Ed1, Ed2 not shown)	0	0	4	-
dt1	End defrost temperature probe 2	4	-5	200	°C/°F
dt2	End defrost temperature probe 3 (aux evaporator)	4	-5	200	°C/°F
dP1	Maximum defrost duration	30	1	250	min/s
dP2	Maximum aux evaporator defrost duration	30	1	250	min/s
d6	Terminal display during defrost 0 = Temperature alternating with dEF 1 = Display disabled 2 = dEF	1	0	2	-

Tab. 6.j

Note: dt3 is as masked parameter, and can be made visible using the VPM tool.

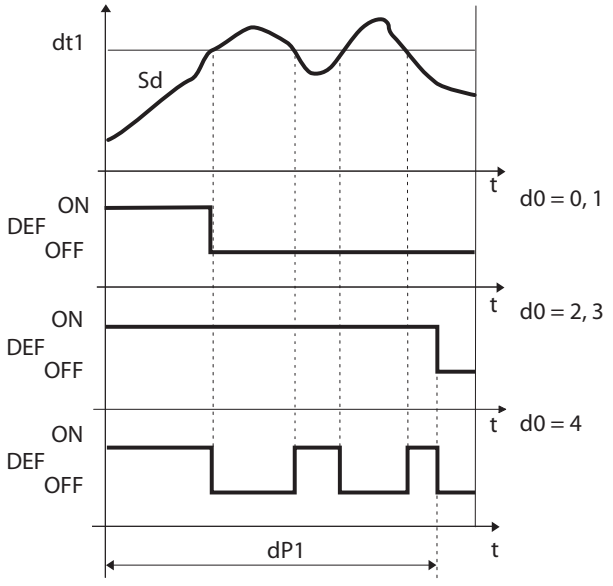


Fig. 6.k

Key

t	Time	Sd	Defrost probe
dt1	End defrost temperature probe 2	d0	Type of defrost
dP1	Maximum defrost duration	DEF	Defrost

Heater defrost by time with temperature control (d0=4) is used to activate the defrost output only if the evaporator temperature (Sd) is less than value of the parameter dt1, and ends after the time defined by dP1. This function is useful for energy saving.

1. Heater defrost (d0 = 0, 2, 4): duty cycle

The duty cycle refers to the default values of parameters F2 and F3.

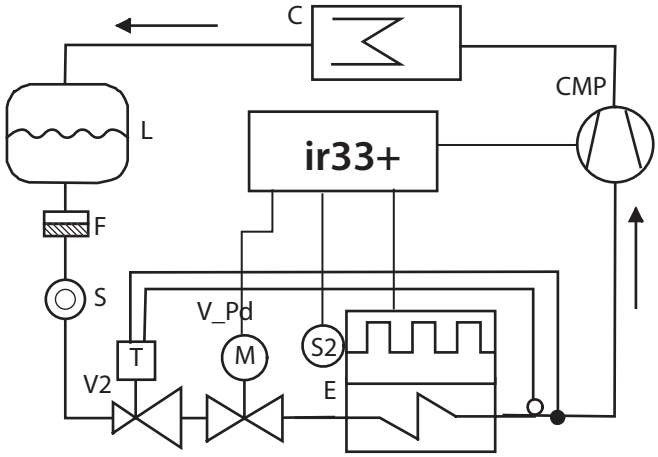


Fig. 6.l

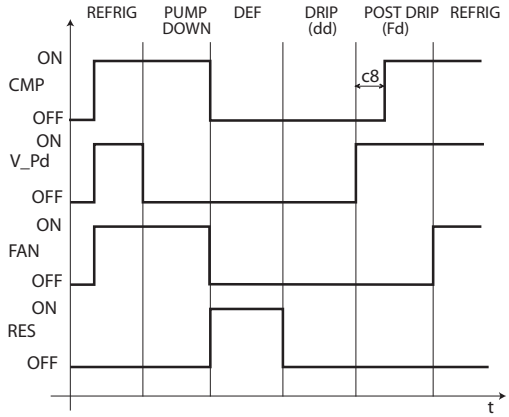


Fig. 6.m

Key

CMP	Compressor	Refrig	Cooling
V_Pd	Pump down valve	Pump down	Pump down stage
FAN	Evaporator fan	Def	Defrost
RES	Heater	Drip	Dripping
E	Evaporator	Post drip	Post-dripping
C	Condenser	S2	Defrost probe
V2	Thermostatic expansion valve	L	Liquid receiver
F	Filter-drier	S	Liquid gauge
t	Time		

Note:

- in pump down mode, the behaviour of the fan is determined by F2;
- in defrost, the behaviour of the fan is determined by F3.

2. Hot gas defrost (d0 = 1, 3): duty cycle

The duty cycle refers to the default values of parameters F2 and F3.

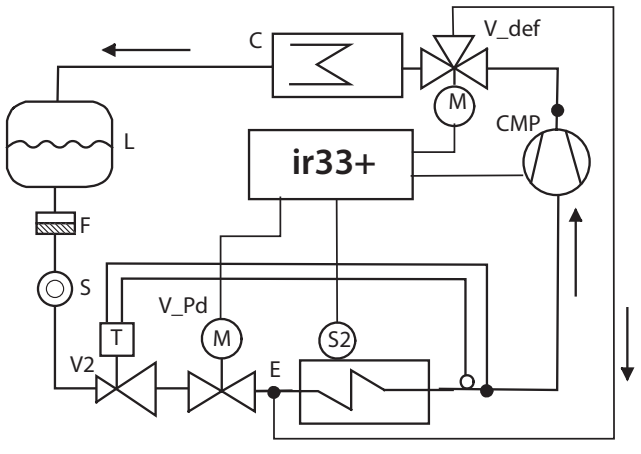


Fig. 6.n

Note: the defrost output (DEF) is used to control the hot gas valve V_def.

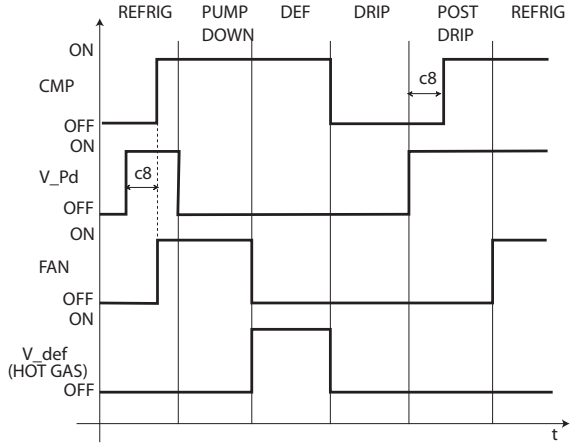


Fig. 6.o

Key

CMP	Compressor	Refrig	Cooling
V_Pd	Pump down valve	Pump down	Pump down stage
FAN	Evaporator fan	Def	Defrost
V_def	Hot gas valve	Drip	Dripping
E	Evaporator	Post drip	Post-dripping
C	Condenser	S2	Defrost probe
V2	Thermostatic expansion valve	L	Liquid receiver
F	Filter-drier	S	Liquid gauge
t	Time		

The defrost starts:

- by setting the event and the start mode, with a maximum of 8 defrosts each day (parameters td1 to td8). The real time clock (RTC) must be available;
- from the supervisor, which sends the defrost call to each controller via the serial line;
- from the keypad.

The defrost ends:

- when the defrost probe measures a temperature greater than the end defrost temperature dt1;
- when no defrost probe is used, the defrost ends after a maximum time, set by parameter dP1.

Maximum time between consecutive defrosts

Par.	Description	Def	Min	Max	UOM
dI	Maximum time between consecutive defrosts 0 = defrost not performed	8	0	250	hr/ min

Tab. 6.k

Parameter dI is a safety parameter used to perform cyclical defrosts every "dI" hours, even without the Real Time Clock (RTC). It is also useful if the RS485 serial network is disconnected. At the start of each defrost, irrespective of the duration, an interval starts being counted. If this interval exceeds dI without a defrost being performed, one is started automatically. The count is always active even if the controller is OFF.

Example: if there is an RTC fault, the defrost programmed by td3 is not performed, and after the safety time dI a new defrost starts.

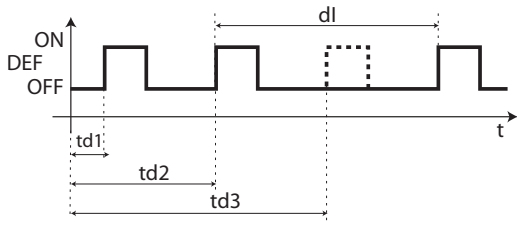


Fig. 6.p

Key

dI	Maximum time between consecutive defrosts	DEF	Defrost
td1…td3	Programmed defrosts	t	Time

Note:

- if dI expires when the controller is OFF, a defrost will be performed when next switched on;
- to ensure regular defrosts, the interval between defrosts must be greater than the maximum defrost duration, plus the dripping time and post-dripping time;
- if "dI"=0 and no timed defrosts have been set, defrosts can only be performed at power on, from digital input, from the supervisor and from the keypad.

Other defrost parameters

Par.	Description	Def	Min	Max	UOM
d3	Defrost activation delay	0	0	250	min
d4	Defrost at start-up 0/1=disabled/enabled	0	0	1	-
d5	Defrost delay at start-up (if d4=1) or from dI	0	0	250	min
dd	Dripping time after defrost (fans off)	2	0	15	min
d8	High temperature alarm bypass time after defrost (and door open)	1	0	250	min
d9	Defrost priority over compressor protectors 0/1 = yes/no	0	0	1	-
d/1	Display defrost probe 1	-	-	-	°C/°F
d/2	Display defrost probe 2	-	-	-	°C/°F
dC	Time base for defrost 0 = dI in hours, dP1 and dP2 in minutes 1 = dI in minutes, dP1 and dP2 in seconds	0	0	1	-

Tab. 6.l

- d3 determines the time that must elapse, when the defrost is activated, between the stopping of the compressor (heater defrost) or the starting of the compressor (hot gas defrost), and the activation of the defrost relays on the main and auxiliary evaporators;
- d4 determines whether to activate a defrost when switching controller on. The defrost call at start-up has priority over activation of the compressor and the continuous cycle. Defrosting when switching controller on may be useful in special situations.

Example: there are frequent power failures in the system. In the event of a power failure, the instrument resets the internal clock that calculates the interval between two defrosts, starting from zero again. If the frequency of the power failure were, in an extreme case, greater than the defrost frequency (e.g. a power failure every 8 hours, against a defrost every 10 hours) the controller would never perform a defrost. In a situation of this type, it is preferable to enable defrost on start-up, above all if the defrost is controlled by temperature (probe on the evaporator), therefore avoiding unnecessary defrosts or at least reducing the running times. For systems with a large number of units, if selecting defrosts at start-up, after a power failure, all the units will start a defrost. This may cause voltage overloads.

To overcome this, parameter 'd5' can be used, which adds a delay before the defrost; the delay must obviously must be different for each unit.

- d5 represents the time that must elapse between the start-up of the controller and the start of the defrost on start-up;
- dd is used to force the stop of the compressor and of the evaporator fan after a defrost so as to assist the dripping of the evaporator same.
- d8 indicates the high temperature alarm signal bypass time after the end of a defrost or when opening the door, if the digital input is connected to the door switch;
- d9 overrides the compressor protection times c1, c2, c3 at the start of the defrost;
- d/1 and d/2 are used respectively to display the values read by defrost probe 1 and 2;
- dC is used to change the unit of measure (hours or minutes) used to count the times for parameters dI (defrost interval, hours or minutes,), dP1 and dP2 (defrost duration).

6.10 Evaporator fans

The evaporator fans can be managed according to the temperature measured by the defrost and control probes. The deactivation threshold is equal to the value of parameter F1, and the hysteresis is equal to the value of A0.

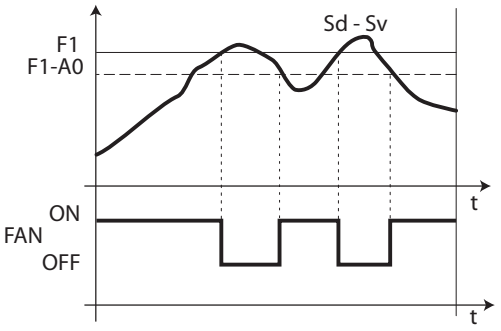
Note: during the dripping time and post-dripping time, if set, the evaporator fans are always off

Below are the parameters involved in managing the evaporator fans, and an example of the trend based on the difference between the evaporator temperature and the value of the virtual probe (F0=1). If F0=2, activation depends solely on the evaporator probe temperature.

Par.	Description	Def	Min	Max	UOM
F0	Evaporator fan management 0 = always on 1 = activation based on Sd-Sv (difference between virtual probe and evaporator temperature) 2 = activation based on Sd (evaporator temperature)	0	0	2	-
F1	Fan activation temperature (only if F0 = 1 or 2)	5.0	-50	200	°C/°F
A0	Alarm and fan differential	2.0	0.1	20	°C/°F

Tab. 6.m

F0=1



F0=2

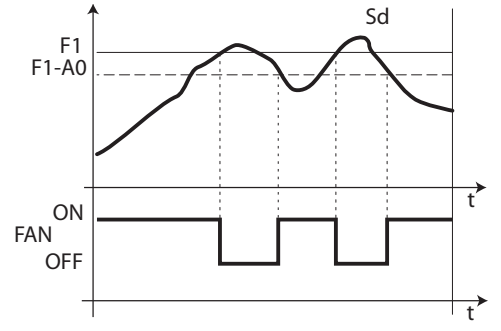


Fig. 6.q

Key

Sd	Defrost probe	A0	Differential
FAN	Evaporator fans	t	Time
F1	Fan activation temperature	Sv	Virtual probe

The fan can be switched off in the following situations:
- when the compressor is off (parameter F2);
- during the defrost (parameter F3).

During the dripping period (parameter dd > 0) and the post-dripping period (parameter Fd > 0) the evaporator fans are always off. This is useful to allow the evaporator to return to temperature after defrosting, thus avoiding blowing warm hot and moist air into the refrigerator. The evaporator fans can be forced on during normal control (parameter F2) and during defrost (parameter F3).

Par.	Description	Def	Min	Max	UOM
dd	Dripping time after defrost (fans off)	2	0	15	min
F2	Evaporator fans with compressor off 0 = See F0 1 = Always off	0	0	1	-
F3	Evaporator fans during defrost 0/1=on/off	1	0	1	-
Fd	Post-dripping time (fans off)	1	0	15	min

Tab. 6.n

6.11 Condenser fans

The condenser fans are activated based on parameters F4 and F5.
After the compressor is first started, the condenser fans are activated at F4+0.2 degrees to offset any rapid temperature increases that the probe cannot keep up with. Subsequently, the fans are switched on and off at F4+F5 and F4.

Par.	Description	Def	Min	Max	UOM
F4	Condenser fan deactivation temperature	40	-50	200	°C/°F
F5	Condenser fan activation differential	5.0	0.1	20	°C/°F

Tab. 6.o

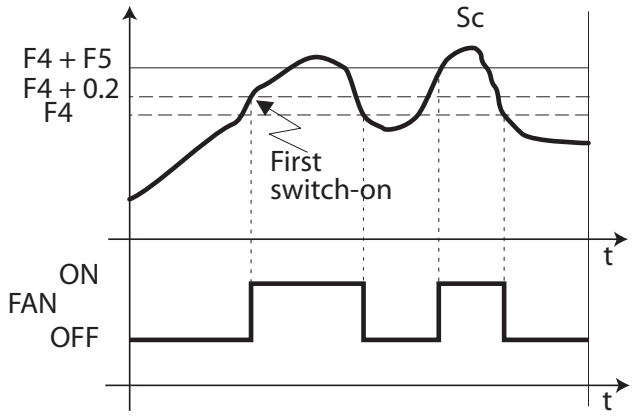


Fig. 6.r

Key

Sc	Condenser probe	Sv	Virtual probe
FAN	Condenser fans	t	Time
F4	Deactivation temperature	F5	Differential

Note: if no condenser probe is selected, the condenser fan output is deactivated.

6.12 Duty setting (par. c4)

If alarm "rE" (virtual control probe fault) is activated, this parameter is used to ensure operation of the compressor until the fault is resolved. As the compressor is no longer able to operate based according to the temperature (due to the probe fault), it is made to run cyclically with a running time equal to the value assigned to parameter c4 and a fixed OFF time of 15 minutes.

Par.	Description	Def	Min	Max	UOM
c4	Compressor running time with duty setting	0	0	100	min

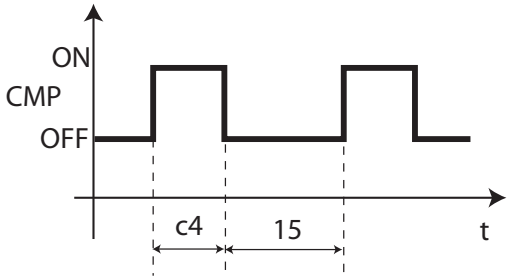


Fig. 6.s

6.13 Running time defrost (par. d10, d11)

Running time is a special function that determines when the refrigeration unit needs defrosting. In particular, it is assumed that if the evaporator temperature measured by probe Sd remains continuously below a certain set threshold (d11) for a certain time (d10), the evaporator may be frozen and a defrost is activated. The time is reset if the temperature returns above the threshold.

Par.	Description	Def	Min	Max	UOM
d10	Defrost time in "Running time" mode 0 = function disabled	0	0	250	hour
d11	Running time defrost temperature threshold	1	-20	20	°C/°F

Tab. 6.p

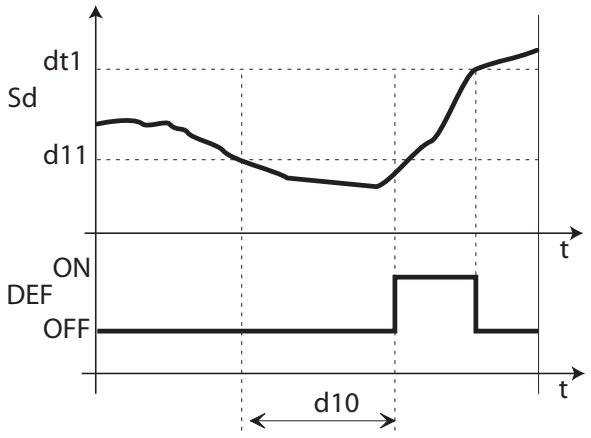


Fig. 6.t

Key

Sd	Defrost probe	t	time
DEF	Defrost		

7. PARAMETER TABLE

Default settings table

Part number	Default settings
IREVM0LN0U	-
IREVM0EN0U	-
IREVS0LN0U	Def. 1
IREVS0EA0U	Def. 1
IREVC0LN0U	Def. 2
IREVC0LC0U	Def. 2
IREVC0HN0U	Def. 2
IREVC0HC0U	Def. 2
IREVF0EN0U	Def. 2

Key:

Parameter type:
C = Configuration,
F = frequent

Variable type:
A = analogue,
I = integer,
D = digital

Noted:
- MSYFCH = parameter visible on models IREVM%, IREVS%, IREVY%, IREVF%, IREVC% and PBEVH%;
- The grey rows in the table denote masked parameters

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
Pro											
C	/2	Probe measurement stability	MSYFCH	4	1	15	-	I	15	115	R/W
C	/3	Probe display stability Value / Display delay (s): 0 disabled; 1 5; 2 10; 3 15; 4 20; 5 25; 6 30; 7 40; 8 50; 9 60; 10 75; 11 90; 12 105; 13 120; 14 150; 15 180	MSYFCH	0	0	15	-	I	16	116	R/W
C	/4	Virtual probe composition 0 = Control probe S1 100 = Probe S2	MSYFCH	0	0	100	-	I	17	117	R/W
C	/5	Temperature unit of measure: 0 = °C; 1 = °F	MSYFCH	0	0	1	-	D	40	40	R/W
C	/6	Display decimal point: 0/1=no/yes	MSYFCH	0	0	1	-	D	41	41	R/W
C	/tI	Display on user terminal 1 Virtual probe; 2 Probe 1; 3 Probe 2; 4 Probe 3; 5 Probe 4; 6 Reserved; 7 Set point	MSYFCH	1	1	7	-	I	18	118	R/W
C	/tE	Reading on remote display 0 Not fitted; 1 Virtual probe; 2 Probe 1; 4 Probe 3; 5 Probe 4; 6 Reserved	MSYFCH	0	0	6	-	I	19	119	R/W
C	/P	Type of probe 0 = NTC Standard Range -50T90°C 1 = NTC Enhanced Range -40T150°C	MSYFCH	0	0	2	-	I	20	120	R/W
C	/A2	Probe 2 configuration (S2) 0 Absent; 1 Product (display only); 2 Defrost; 3 Condenser; 4 Frost	YFCH MS	2 0	0 0	4 4	- -	I I	21 21	121 121	R/W R/W
C	/A3	Probe 3 configuration (S3/ DI1) 0 Digital input 1; 1 Product (display only); 2 Defrost; 3 Condenser; 4 Frost	MSYFCH	0	0	4	-	I	22	122	R/W
C	/A4	Probe 4 configuration (S4/ DI2) 0 Digital input 2; 1 Product (display only); 2 Defrost; 3 Condenser; 4 Frost	MSYFCH	0	0	4	-	I	23	123	R/W
C	/c1	Probe 1 calibration	MSYFCH	0.0	-20	20	-	A	11	11	R/W
C	/c2	Probe 2 calibration	MSYFCH	0.0	-20	20	-	A	12	12	R/W
C	/c3	Probe 3 calibration	MSYFCH	0.0	-20	20	-	A	13	13	R/W
C	/c4	Probe 4 calibration	MSYFCH	0.0	-20	20	-	A	14	14	R/W

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
Ctl											
F	St	Set point	MSYFCH	Def. 1 2 / Def . 2 -18	r1	r2	°C/°F	A	16	16	R/W
F	rd	Differential	SYFCH	2.0	0.1	20	°C/°F	A	17	17	R/W
C	rn	Neutral zone	SYFCH	4.0	0.0	60	°C/°F	A	34	34	R/W
C	rr	Reverse differential	SYFCH	2.0	0.1	20	°C/°F	A	35	35	R/W
C	r1	Minimum set point	MSYFCH	-50	-50	r2	°C/°F	A	18	18	R/W
C	r2	Maximum set point	MSYFCH	60	r1	200	°C/°F	A	19	19	R/W
C	r3	Operating mode 0 = Direct with defrost control (cooling) 1 = Direct (cooling) 2 = Reverse (heating)	SYFCH	0	0	2	-	I	25	125	R/W
C	r4	Automatic night-time set point variation	MSYFCH	3.0	-20	20	°C/°F	A	20	20	R/W
C	r5	Enable temperature monitoring: 0/1=no/yes	MSYFCH	0	0	1	-	D	42	42	R/W
F	rt	Duration of current max and min temperature monitoring session	MSYFCH	0	0	999	hour	I	26	126	R
F	rH	Maximum temperature read	MSYFCH	-	-	-	°C/°F	A	21	21	R
F	rL	Minimum temperature read	MSYFCH	-	-	-	°C/°F	A	22	22	R

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
CMP											
C	c0	Compressor, fan and AUX start delay at power on	SYFCH	0	0	15	min	I	27	127	R/W
C	c1	Minimum time between successive compressor starts	SYFCH	0	0	15	min	I	28	128	R/W
C	c2	Minimum compressor off time	SYFCH	2	0	15	min	I	29	129	R/W
C	c3	Minimum compressor on time	SYFCH	0	0	15	min	I	30	130	R/W
C	c4	Compressor running time with duty setting	SYFCH	0	0	100	min	I	31	131	R/W
C	cc	Continuous cycle duration	SYFCH	0	0	15	hour	I	32	132	R/W
C	c6	Low temperature alarm bypass time after continuous cycle	SYFCH	2	0	250	hr/min	I	33	133	R/W
C	c7	Maximum pump down time (PD) 0 = Pump down disabled	SYFCH	0	0	900	s	I	34	134	R/W
C	c8	Compressor start delay after opening PD valve	SYFCH	5	0	60	s	I	35	135	R/W
C	c9	Autostart in pump down 0 = Disabled 1 = Pump down whenever closing pump down valve & following low pressure switch activation with no cooling demand	SYFCH	0	0	1	-	D	43	43	R/W
C	c10	Pump down by time or pressure 0/1= pressure/ time	SYFCH	0	0	1	-	D	44	44	R/W
C	c11	Second compressor start delay	SYFCH	4	0	250	s	I	36	136	R/W

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
dEF											
C	d0	Type of defrost 0 = heater by temperature 1 = hot gas by temperature 2 = heater by time (Ed1, Ed2 not shown) 3 = hot gas by time (Ed1, Ed2 not shown) 4 = heater by time with temperature control (Ed1, Ed2 not shown)	SYFCH	0	0	4	-	I	37	137	R/W
F	dI	Maximum time between consecutive defrosts 0 = defrost not performed	SYFCH	8	0	250	hr/ min	I	38	138	R/W
F	dt1	End defrost temperature probe 2	SYFCH	4	-50	200	°C/°F	A	23	23	R/W
F	dt2	End defrost temperature probe 3 (aux evaporator)	SYFCH	4	-50	200	°C/°F	A	24	24	R/W
F	dP1	Maximum defrost duration	SYFCH	30	1	250	min/s	I	39	139	R/W
F	dP2	Maximum aux evaporator defrost duration	SYFCH	30	1	250	min/s	I	40	140	R/W
C	d3	Defrost activation delay	SYFCH	0	0	250	min	I	41	141	R/W
C	d4	Defrost at start-up: 0/1=disabled/enabled	SYFCH	0	0	1	flag	D	45	45	R/W
C	d5	Defrost delay at start-up (if d4=1) or from dI	SYFCH	0	0	250	min	I	42	142	R/W
C	d6	Terminal display during defrost 0 = Temperature alternating with dEF 1 = Display disabled 2 = dEF	SYFCH	1	0	2	-	I	43	143	R/W
F	dd	Dripping time after defrost (fans off)	SYFCH	2	0	15	min	I	44	144	R/W
F	d8	High temperature alarm bypass time after defrost (and door open)	SYFCH	1	0	250	hr/ min	I	45	145	R/W
C	d8d	Alarm bypass time after door open	SYFCH	0	0	250	min	I	139	239	R/W
C	d9	Defrost priority over compressor protectors 0/1 = yes/no	SYFCH	0	0	1	-	D	46	46	R/W
F	d/1	Display defrost probe 1	MSYFCH	-	-	-	°C/°F	A	1	1	R
F	d/2	Display defrost probe 2	MSYFCH	-	-	-	°C/°F	A	2	2	R
C	dC	Time base for defrost 0 = dI in hours, dP 1 and dP2 in minutes 1 = dI in minutes, dP1 and dP2 in seconds	SYFCH	0	0	1	-	D	47	47	R/W
C	dC1	Time base for c6 and d8: 0/1 = hours/minutes	SYFCH	0	0	1	-	D	65	65	R/W
C	d10	Defrost time in "Running time" mode0 = function disabled	SYFCH	0	0	250	hour	I	46	146	R/W
C	d11	Running time defrost temperature threshold	SYFCH	1.0	-20	20	°C/°F	A	25	25	R/W

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
C	d12	Advanced defrosts d12 | Skip defrost | Automatic variation of dI 0 | Disabled | Disabled 1 | Disabled | Enabled 2 | Enabled | Disabled 3 | Enabled | Enabled	SYFCH	0	0	3	-	I	47	147	R/W
C	dn	Nominal defrost duration	SYFCH	65	1	100	-	I	48	148	R/W
C	dH	Proportional factor for variation of dI	SYFCH	50	0	100	-	I	49	149	R/W

ALM

C	A0	Alarm and fan differential	MSYFCH	2.0	0.1	20	°C/°F	A	26	26	R/W
C	A1	Alarm thresholds (AL, AH) relative to set point or absolute 0: AL and AH are relative thresholds to the set point 1: AL and AH are absolute thresholds	MSYFCH	0	0	1	-	D	48	48	R/W
F	AL	Low temperature alarm threshold	MSYF	0.0	A1=1→-50 (alarm 'LO' disabled) A1=0→0 (alarm 'LO' disabled)	200	°C/°F	F	27	27	R/W
F	AH	High temperature alarm threshold	MSYF	0.0	A1=1→-50 A1=0→0 (alarm 'HI' disabled)	A1=1→200 (alarm 'HI' disabled) A1=0→200	°C/°F	F	28	28	R/W
F	Ad	High and low temperature alarm delay	MSYFCH	120	0	250	min	I	50	150	R/W
C	A4	Digital input configuration 1 (DI1) 0 = not active 1 = immediate external alarm 2 = delayed external alarm 3 = select probes (ir33M) / enable defrost 4 = start defrost 5 = door switch with compressor and evaporator fans off 6 = remote ON/OFF 7 = curtain switch 8 = low pressure switch 9 = door switch with fans off 10 = direct/reverse operation 11 = light sensor 12 = activate aux output 13 = door switch with compressor and fans off and light not managed 14 = door switch with fans off and light not managed	SYFCH	0	0	14	-	I	51	151	R/W
C	A5	Digital input configuration 2 (DI2) See A4	MSYFCH	0	0	14	-	I	52	152	R/W
C	A6	Stop compressor on external alarm 0 = compressor always off; 100 = compressor always on	SYFCH	0	0	100	min	I	53	153	R/W
C	A7	Digital alarm input delay 0 = control outputs unchanged	SYFCH	0	0	250	min	I	54	154	R/W
C	A8	Enable alarms Ed1 and Ed2 (end defrost by timeout) 0 = alarms disabled	SYFCH	0	0	1	-	D	49	49	R/W
C	Ado	Light management with door switch Ado | Light when opening the door | Algorithm | Description 0 | off on | Extended normal | Open-close Open-close-open-close 1 | off on | normal extended	MSYFCH	0	0	1	-	D	50	50	R/W
C	Ac	High condenser temperature alarm threshold	SYFCH	70.0	0	200	°C/°F	A	29	29	R/W
C	AE	High condenser temperature alarm differential	SYFCH	10.0	0.1	20	°C/°F	A	30	30	R/W
C	Acd	High condenser temperature alarm delay 0 = Immediate alarm	SYFCH	0	0	250	min	I	56	156	R/W
C	AF	Light sensor OFF time 0 = Sensor in the door jamb > 0 = Sensor inside the cold room or cabinet	SYFCH	0	0	250	s	I	57	157	R/W
C	ALF	Frost protection alarm threshold	MSYFCH	-5.0	-50	200	°C/°F	A	36	36	R/W
C	AdF	Frost protection alarm delay	MSYFCH	1	0	15	min	I	136	236	R/W

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
FAn											
C	F0	Evaporator fan management 0 = always on 1 = activation based on Sd-Sv (difference between virtual probe and evaporator temperature) 2 = activation based on Sd (evaporator temperature)	FCH	0	0	2	-	I	58	158	R/W
F	F1	Fan activation temperature (only if F0 = 1 or 2)	FCH	5.0	-50	200	°C/°F	A	31	31	R/W
C	F2	Evaporator fans with compressor off 0 = See F0, 1 = Always off	FCH	0	0	1	-	D	51	51	R/W
C	F3	Evaporator fans during defrost: 0/1=on/off	FCH	1	0	1	-	D	52	52	R/W
F	Fd	Post-dripping time (fans off)	FCH	1	0	15	min	I	59	159	R/W
C	F4	Condenser fan deactivation temperature	MSYFCH	40	-50	200	°C/°F	A	32	32	R/W
C	F5	Condenser fan activation differential	MSYFCH	5.0	0.1	20	°C/°F	A	33	33	R/W

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
CnF											
C	H0	Serial address	MSYFCH	195	0	207	-	I	60	160	R/W
C	H1	AUX output configuration 0 = normally energised alarm 1 = normally de-energised alarm 2 = auxiliary 3 = light 4 = auxiliary evaporator defrost 5 = pump down valve 6 = condenser fan 7 = delayed compressor 8 = auxiliary with deactivation when OFF 9 = light with deactivation when OFF 10 = no function 11 = reverse with neutral zone 12 = second compressor step 13 = second compressor step with rotation	CH	1	0	13	-	I	61	161	R/W
C	H2	Disable keypad functions	MSYFCH	1	0	6	-	I	62	162	R/W
C	H4	Buzzer: 0/1=enabled/disabled	MSYFCH	0	0	1	-	D	53	53	R/W
C	H6	Terminal keypad lock configuration 0 = all buttons enabled	MSYFCH	0	0	255	-	I	65	165	R/W
C	H7	Keypad: 0 = standard; 1 = modified	MSYFCH	0	0	1	-	D	54	54	R/W
C	H8	Output switched with scheduler 0 = Light; 1= AUX	MSYFCH	0	0	1	-	D	60	60	R/W
C	H9	Set point variation with scheduler 0/1 = no/yes	MSYFCH	0	0	1	-	D	61	61	R/W
C	Hdn	Number of default parameter sets available	MSYFCH	0	0	6	-	I	137	237	R/W
C	Hdh	Anti-sweat heater offset 0 = anti-sweat heater function disabled (°C) 32 = anti-sweat heater function disabled (°F)	MSYFCH	0	-50	200	°C/°F	A	37	37	R/W
C	HrL	Remote light relay status on Master: 0 = disabled	MSYFCH	0	0	1	-	D	62	62	R/W
C	HrA	Remote AUX relay status on Master: 0 = disabled	MSYFCH	0	0	1	-	D	63	63	R/W
C	HSA	Remote controller alarms on Master: 0 = disabled	MSYFCH	0	0	1	-	D	64	64	R/W
C	In	Type of unit 0 = Normal 1 = Master 2…6 = Slave 1 to 5	MSYFCH	0	0	6	-	I	138	238	R/W

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
HcP											
C	HAn	Number of HA alarms	MSYFCH	0	0	15	-	I	67	167	R
C	HA… HA2	HA HACCP alarms activated (press Set)	MSYFCH	-	-	-	-	-	-	-	R
	y__	Alarm 1 to 3 - Year	-	0	0	99	years	I	70/76/82	170	R
	M__	Alarm 1 to 3 - Month	-	0	1	12	month	I	71/77/83	171	R
	d__	Alarm 1 to 3 - Day of the month	-	0	1	7	day	I	72/78/84	172	R
	h__	Alarm 1 to 3 - Hour	-	0	0	23	hour	I	73/79/84	173	R
	n__	Alarm 1 to 3 - Minute	-	0	0	59	minute	I	74/80/85	174	R
	t__	Alarm 1 to 3 - Duration	-	0	0	99	hour	I	75/81/86	175	R
C	HFn	Number of HF alarms	MSYFCH					I	68	176…181	R
C	HF…HF2	HF HACCP alarms activated (press Set)	MSYFCH	-	-	-	-	I	-	-	R
	y__	Alarm 1 to 3 - Year		0	0	99	years	I	88/94/100	188	R
	M__	Alarm 1 to 3 - Month		0	1	12	month	I	89/95/101	189	R
	d__	Alarm 1 to 3 - Day of the month		0	1	7	day	I	90/96/102	190	R
	h__	Alarm 1 to 3 - Hour		0	0	23	hour	I	91/97/103	191	R
	n__	Alarm 1 to 3 - Minute		0	0	59	minute	I	92/98/104	192	R
	t__	Alarm 1 to 3 - Duration		0	0	99	hour	I	93/99/105	193	R
C	Htd	HACCP alarm delay 0 = Monitoring disabled	MSYFCH	0	0	250	min	I	69	169	R/W

User	Par.	Description	Models	Def	Min	Max	UOM	Type	CAREL SVP	ModBus®	R/W
rtc											
C	td1…8	Defrost 1 to 8 (press Set)	SYFCH	-	-	-	-	-	-		R/W
	d__	Defrost 1 to 8 - day		0	0	11	day	I	106/109/…/127	206/209/…/227	R/W
	h__	Defrost 1 to 8 - hour		0	0	23	hour	I	107/110/…128	207/210/…/228	R/W
	n__	Defrost 1 to 8 - minute		0	0	59	min	I	108/111/…129	208/211/…/229	R/W
C	ton	Light/aux on time	SYFCH	-	-	-	-	-	-		R/W
	d__	Day		0	1	7	day	I	130	230	R/W
	h__	Hour		0	0	23	hour	I	131	231	R/W
	n__	Minute		0	0	59	minute	I	132	232	R/W
C	toF	Light/aux off time	SYFCH	-	-	-	-	-	-	-	R/W
	d__	Day		0	1	7	day	I	133	233	R/W
	h__	Hour		0	0	23	hour	I	134	234	R/W
	n__	Minute		0	0	59	minute	I	135	235	R/W
C	tc	Date/time (press Set)	MSYFCH	-	-	-	-				R/W
	y__	Date/time: year		12	0	99	year	I	1	101	R/W
	m__	Date/time: month		8	1	12	month	I	2	102	R/W
	d__	Date/time: day of the month		1	1	31	day	I	3	103	R/W
	u__	Day of the week		1	1	7	day	I	4	104	R/W
	h__	Date/time: hour		0	0	23	hour	I	5	105	R/W
	n__	Date/time: minute		0	0	59	minute	I	6	106	R/W

7.14 Variables only accessible via serial connection

Description	Type	CAREL SVP	Modbus	R/W
Virtual probe	A	3	3	R
Probe 1 reading	A	4	4	R
Probe 2 reading	A	5	5	R
Probe 3 reading	A	6	6	R
Probe 4 reading	A	7	7	R
Number of parameter sets available	I	137	237	R
Digital input 1 status	D	6	6	R
Digital input 2 status	D	7	7	R
Virtual probe fault alarm	D	9	9	R
Probe alarm 1	D	10	10	R
Probe alarm 2	D	11	11	R
Probe alarm 3	D	12	12	R
Probe alarm 4	D	13	13	R
Compressor status relay	D	1	1	R
Defrost relay status	D	2	2	R
Fan relay status	D	3	3	R
AUX 1 relay status	D	4	4	R
Digital input 1 status	D	6	6	R
Digital input 2 status	D	7	7	R
Defrost status	D	31	31	R
Defrost call command	D	34	34	RW
Continuous cycle status	D	35	35	R
Continuous cycle call command	D	36	36	RW
Door status	D	37	37	R
AUX activation command	D	57	57	RW
Light activation command	D	58	58	RW
Controller ON/OFF	D	59	59	RW
Password	I	14	114	RW
Virtual probe fault alarm	D	9	9	R
Probe 1/2/3/4 fault alarm	D	10/11/12/13/14	10/11/12/13/14	R
Low temperature alarm	D	15	15	R
High temperature alarm	D	16	16	R
Immediate external alarm	D	17	17	R
Delayed external alarm	D	18	18	R
Evaporator 1 defrost timeout alarm	D	19	19	R
Evaporator 2 defrost timeout alarm	D	20	20	R
Pump down timeout alarm	D	21	21	R
Low pressure alarm	D	21	21	R
High condenser temperature alarm	D	24	24	R
Door open for too long alarm	D	25	25	R
RTC error	D	26	26	R
Control parameter EEPROM error	D	27	27	R
Operating parameter EEPROM error	D	28	28	R
HA HACCP alarm	D	29	29	R
HF HACCP alarm	D	30	30	R
Alarm autostart in pump down	D	32	32	R

8. SIGNALS AND ALARMS

8.1 Signals

Signals are messages shown on the display to notify the user of the control procedures in progress (e.g. defrost) or confirm the controls from the keypad or remote control.

Code	Icon	Description
---	-	Probe not enabled
dEF		Defrost running
dFb		Start defrost call
dFE		End defrost call
cc		Continuous cycle
ccb		Start continuous cycle call
ccE		End continuous cycle call
HcP		Access HACCP menu
Ed1	-	Defrost on evaporator 1 ended by timeout
Ed2	-	Defrost on evaporator 2 ended by timeout
On	-	Switch ON
OFF	-	Switch OFF
rES	-	Reset alarms with manual reset Reset HACCP alarms Reset temperature monitoring
AUX	-	Auxiliary output activation call
d/1		Display defrost probe 1

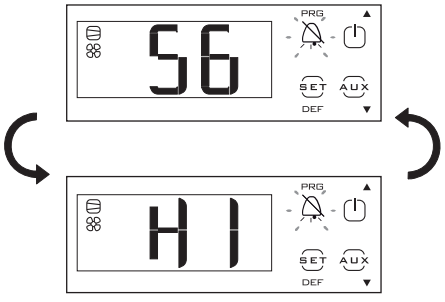
Tab. 8.a

8.2 Alarms

There are two types of alarms:
- system: EEPROM, communication, HACCP, high (HI) and low (LO) temperature;
- control: pump down ended by timeout (Pd), low pressure (LP).

The EE/EF data memory alarms shutdown the controller. The auxiliary digital output AUX can be configured to signal the alarm status, normally open or normally closed. See chapter 5. The controller indicates alarms due to faults on the controller itself, on the probes or in network communication. An alarm can also be activated from an external contact, immediate or delayed. See paragraph 5.2. The display shows "IA" or "dA" and at the same time the bell icon flashes and the buzzer is activated. If more than one error occurs, these are displayed in sequence.

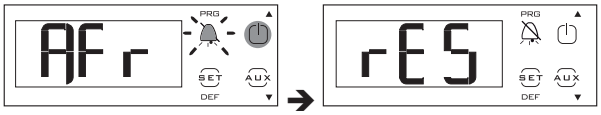
Example: display after HI error:



Note: to mute the buzzer press Prg/mute.

8.3 Reset alarms

All the alarms with manual reset can be cleared by pressing Prg/mute and UP together for more than 5 seconds.
Example: manually reset the frost protection alarm (AFr).

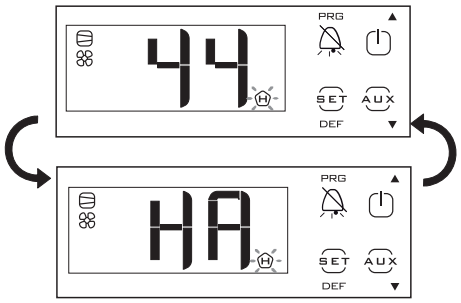


8.4 HACCP alarms and display

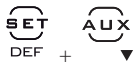
To activate monitoring, see par. 8.6.
(HACCP = Hazard Analysis and Critical Control Point).
HACCP allows control of the operating temperature, recording any anomalies due to power failures or an increase in the temperature due to other causes (breakages, extreme operating conditions, user errors, etc.).
Two types of HACCP event are managed:
- type HA alarms, high temperature during the operation;
- type HF alarms, high temperature after power failure (blackout).

When an alarm is recorded, the HACCP LED flashes, the display shows the alarm code, the alarm is saved and the alarm relay and buzzer are activated.

Example: display after HA error and alarm reset:

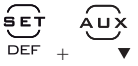


To display the HA and HF alarms:
- enter the HACCP menu by pressing:



- scroll the list of alarms by pressing UP and DOWN;
- press Set to select the required alarm (HA, HA1, HA2/HF, HF1, HF2);
- use UP or DOWN to see the description of the alarm: year, month, day, hours, minutes and duration in minutes of the selected alarm;
- press Prg/mute again to return to the previous list.

In addition, the HACCP alarm menu allows the following operations:
- delete the HACCP alarm signal by pressing, for 5 seconds:



- delete the HACCP alarm and all the alarms saved by pressing, for 5 seconds:

This procedure displays the message rES, deletes the entire memory of alarms and reinitialises monitoring of the HACCP alarms.

Code on display	Cause of the alarm	Icon flashing on display	Alarm relay	Buzzer	Reset	PD valve	Compressor	Defrost	Evaporator fans	Condenser fans	Continuous cycle	AUX neutral zone	AUX light Anti-sweat	AUX auxiliary Anti-sweat	AUX second step
rE	Virtual control probe fault	PRG	ON	ON	autom.	duty setting (c4)	duty setting (c4)	-	-	-	-	OFF	OFF	OFF	duty setting (c4)
E0	Probe S1 fault	PRG	OFF	OFF	autom.	duty setting (c4)	duty setting (c4)	-	-	-	-	OFF	OFF	OFF	duty setting (c4)
E1	Probe S2 fault	PRG	OFF	OFF	automatic	-	-	-	-	-	-	-	-	-	-
E2	Probe S3 fault	PRG	OFF	OFF	autom.	-	-	-	-	-	-	-	-	-	-
E3	Probe S4 fault	PRG	OFF	OFF	autom.	-	-	-	-	-	-	-	-	-	-
LO	Low temperature alarm	PRG	ON	ON	autom.	-	-	-	-	-	-	-	-	-	-
HI	High temperature alarm	PRG	ON	ON	autom.	-	-	-	-	-	-	-	OFF	OFF	-
AFr	Frost protection alarm	PRG	ON	ON	manual	OFF	OFF	-	-	-	-	-	-	-	OFF
IA	Immediate alarm from external contact	PRG	ON	ON	automatic	duty setting (A6)	duty setting (A6)	-	-	-	-	OFF	OFF	OFF	duty setting (A6)
dA	Delayed alarm from external contact	PRG	ON	ON	automatic	duty setting (A6)	-	-	-	-	-	OFF if A7≠0	OFF if A7≠0	OFF if A7≠0	duty setting (A6) if A7≠0
Pd	Alarm maximum pump down time	PRG	ON	ON	automatic/ manual	-	-	-	-	-	-	-	-	-	-
LP	Low pressure alarm	PRG	ON	ON	automatic/ manual	OFF	OFF	-	-	-	-	-	-	-	OFF
AtS	Autostart in pump down	PRG	ON	ON	automatic/ manual	-	-	-	-	-	-	-	-	-	-
cht	High condenser temp. pre-alarm	-	OFF	OFF	automatic/ manual	-	-	-	-	-	-	-	-	-	-
CHt	High condenser temperature alarm	PRG	ON	ON	manual	OFF	OFF	-	-	-	-	-	OFF	OFF	OFF
dor	Door open for too long alarm	PRG	ON	ON	automatic	-	-	-	-	-	-	-	-	-	-
Etc	Real time clock fault		OFF	OFF	automatic/ manual	-	-	-	-	-	-	-	-	-	-
EE	Unit parameter EEPROM error	PRG	OFF	OFF	automatic	OFF	OFF	not run	OFF	OFF	not run	OFF	OFF	OFF	OFF
EF	Operating parameter EEPROM error	PRG	OFF	OFF	automatic	OFF	OFF	not run	OFF	OFF	not run	OFF	OFF	OFF	OFF
HA	Type HA HACCP alarm		OFF	OFF	manual	-	-	-	-	-	-	-	-	-	-
HF	Type HF HACCP alarm		OFF	OFF	manual	-	-	-	-	-	-	-	-	-	-
n1...n6	indicate unit alarm ON 1...6 in network	PRG	ON	OM	automatic	-	-	-	-	-	-	-	-	-	-

8.5 Alarm parameters and activation

AL (AH) is used to determine the activation threshold for the low (high) temperature alarm LO (HI). The value set for AL (AH) is continuously compared against the value measured by the control probe. Parameter Ad represents the alarm activation delay, in minutes; the low temperature alarm (LO) is activated only if the temperature remains below the value of AL for a time greater than Ad. The alarm may relative or absolute, depending on the value of parameter A1. In the former case (A1=0), the value of AL indicates the deviation from the set point and thus the activation point for the low temperature alarm is: set point - AL. If the set point changes, the activation point also changes automatically. In the latter case (A1=1), the value of AL indicates the low temperature alarm threshold. The low temperature alarm active is signalled by the buzzer and LO shown on the display. The same applies to the high temperature alarm (HI), with AH instead of AL.

Note:
If AL and AH alarms are set as relative to set point (A1=0), their values has to be greater than 0

Par	Description	Def	Min	Max	UOM
A0	Alarm and fan differential	2.0	0.1	20.0	°C/°F
A1	Type of threshold 'AL' and 'AH' 0: AL and AH are relative thresholds to the set point 1: AL and AH are absolute thresholds	0	0	1	-
AL	Low temperature alarm threshold	0	A1=1→-50 (alarm 'LO' disabled) A1=0→0 (alarm 'LO' disabled)	200	°C/°F
AH	High temperature alarm threshold	0	A1=1→-50 A1=0→0 (alarm 'HI' disabled)	A1=1→200 (alarm 'HI' disabled) A1=0→200	°C/°F
Ad	High and low temperature alarm delay	120	0	250	min
A6	Stop compressor on external alarm 0 = compressor always off; 100 = compressor always on	0	0	100	min
A7	Digital alarm input delay 0 = control outputs unchanged	0	0	250	min

Tab. 8.a

Note:
- alarms LO and HI have automatic reset. A0 represents the hysteresis between the alarm activation value and deactivation value;
- if Prg/mute is pressed when the value measured is above one of the thresholds, the buzzer is immediately muted, while the alarm code and the alarm output, if set, remain active until the value measured is outside of the activation threshold. For delayed alarms from digital input (A4=2, code dA), the contact must remain open for a time greater than A7. In the case of an alarm event, a counter starts and generates an alarm when reaching the minimum time A7. If during the count the value measured returns within the threshold or the contact closes, the alarm is not signalled and the count is reset. When a new alarm condition occurs, the count starts from 0 again. Parameter A6 has a similar meaning to parameter c4 (duty setting). If an external alarm occurs (immediate or delayed) the compressor works for a time equal to the value set for A6 and remains off for a fixed time of 15 minutes.

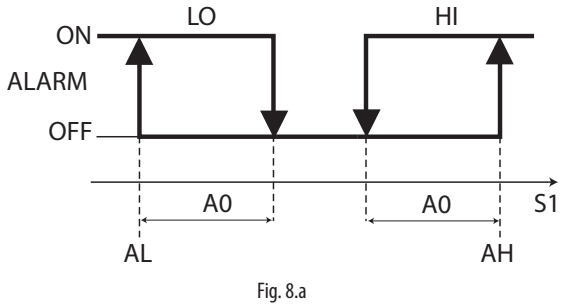


Fig. 8.a

Key

LO	Low temperature alarm	S1	Control probe
HI	High temperature alarm		

8.6 HACCP alarm parameters and monitoring

HA alarms

The alarm queue can be displayed by accessing parameters HA to HA2. The type HA alarm is generated if during normal operation the temperature read by the control probe exceeds the high temperature threshold for the time Ad+Htd. Consequently, compared to the normal high temperature alarm already signalled by the controller, the type HA HACCP alarm is delayed by a further time Htd specifically for HACCP recording. The order of alarms listed is progressive, HA is the most recent alarm. A maximum of 3 errors are saved, in a FIFO list (HA to HA2): FIFO (First In First Out) management means the first error recorded is the first to be cancelled when the list is full and needs to be updated. The last error saved is displayed for parameter HA. HAn indicates the number of type HA alarms activated.

Par.	Description	Def	Min	Max	UOM
HAn	Number of HA alarms	0	0	15	-
HA…HA2	HA HACCP alarms activated (press Set)	-	-	-	-
y__	Alarm 1 to 3 - Year	0	0	99	year
M__	Alarm 1 to 3 - Month	0	1	12	month
d__	Alarm 1 to 3 – Day of the month	0	1	31	day
h__	Alarm 1 to 3 – Hour	0	0	23	hour
n__	Alarm 1 to 3 – Minute	0	0	59	minute
---	Alarm 1 to 3 – Duration	0	0	240	hour
Htd	HACCP alarm delay 0 = Monitoring disabled	0	0	240	min

Tab. 8.b

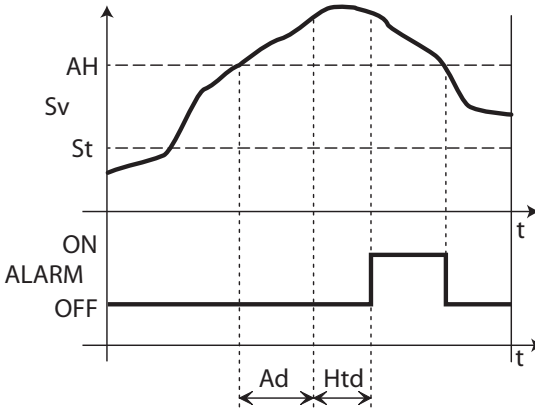


Fig. 8.b

Key

S1	Virtual probe	Ad	High and low temperature alarm delay
St	Set point	Htd	HACCP alarm delay 0 = monitoring disabled
AH	High temperature alarm threshold	t	Time
ALARM	HA HACCP alarm		

HF alarms

The type HF HACCP alarm is generated following a power failure for an extended time (> 1 minute), if when power returns the temperature read by the control probe exceeds the AH high temperature threshold. HFn indicates the number of type HF alarms activated.

Par.	Description	Def	Min	Max	UOM
HFn	Number of HF alarms	0	0	15	-
HF…HF2	HF HACCP alarms activated (press Set)	-	-	-	-
y__	Alarm 1 to 3 - Year	0	0	99	year
M__	Alarm 1 to 3 - Month	0	1	12	month
d__	Alarm 1 to 3 – Day of the month	0	1	31	day
h__	Alarm 1 to 3 – Hour	0	0	23	hour
n__	Alarm 1 to 3 – Minute	0	0	59	minute

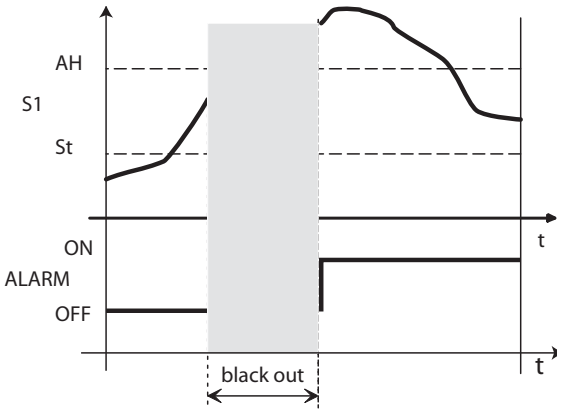


Fig. 8.c

Key

S1	Control probe	Ad	High and low temperature alarm delay
AH	High temperature alarm threshold	Htd	HACCP alarm delay 0 = monitoring disabled
ALARM	HF HACCP alarm	t	Time
St	Set point		

8.7 High condenser temperature alarm

The condenser temperature can be monitored and high temperature situations signalled, most likely when the condenser is blocked. The following figure describes the signal.

Par	Description	Def	Min	Max	UOM
Ac	High condenser temperature alarm threshold	70	0	200	°C/°F
AE	High condenser temperature alarm differential	10	0.1	20	°C/°F
Acd	High condenser temperature alarm delay 0 = Immediate alarm	0	0	250	min

Tab. 8.c

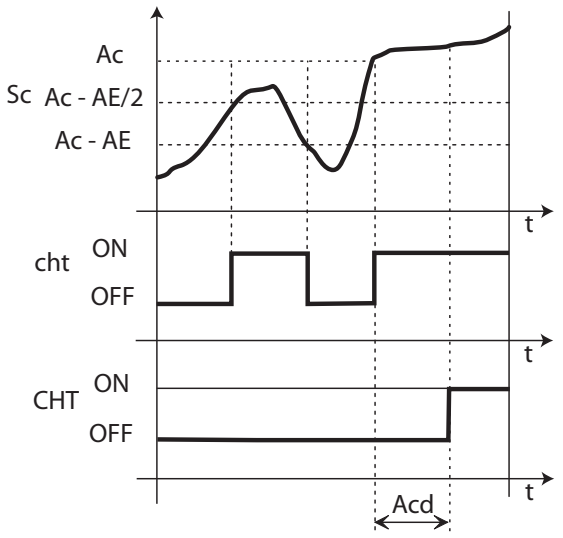


Fig. 8.d

Key

t	Time	Ac	High cond. temperature alarm threshold
Acd	Alarm delay	cht	High cond. temperature pre-alarm
Sc	Condenser probe	CHT	High condensing temperature alarm
AE	High condensing temperature alarm differential		

8.8 Frost protection alarm

The frost protection alarm is only active if a probe has been set as the frost protection probe. If this probe measures a temperature less than the threshold ALF for a time greater than AdF, the alarm "AFr" (manual reset) is shown. See the parameter table.

Par	Description	Def	Min	Max	UOM
ALF	Frost protection alarm threshold	-5	-50	200	°C/°F
AdF	Frost protection alarm delay	1	0	15	min

Tab. 8.d

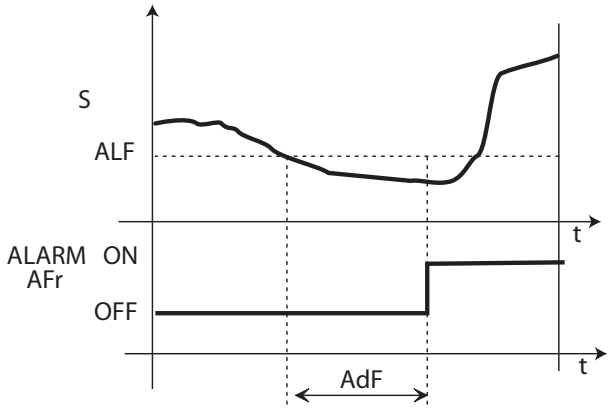


Fig. 8.e

Key

t	Time	AdF	Frost protection alarm delay
AFr	Frost protection alarm threshold		

8.9 Defrost ended by timeout alarm

Alarms Ed1 and Ed2 signal that a defrost has ended when reaching the maximum defrost duration. This can be disabled by setting A8 = 0.

Par	Description	Def	Min	Max	UOM
A8	Enable alarms Ed1 and Ed2 (end defrost by timeout) 0 = alarms disabled	0	0	250	min

Tab. 8.e

9. TECHNICAL SPECIFICATIONS

9.1 ir33+ technical specifications

Power supply	Model	Voltage	Power
	IREVx0ExxU	230 V~, 50/60 Hz	3 VA, 25mA ~ max
	IREVC0HxxU	115/230 V~, 50/60 Hz	6 VA, 50mA ~ max
	IREVx0LxxU	12 to 24 V ~, 50/60 Hz, 12/30 Vdc	3 VA, 300 mA ~/ mAdc max

Insulation guaranteed by the power supply	IREVx0ExxU	insulation from extra low voltage parts	reinforced, 6 mm clearance, 8 mm creepage, 3750V insulation
	IREVC0HxxU	insulation from relay outputs	basic, 3 mm clearance, 4 mm creepage, 1250V insulation
	IREVx0LxxU	insulation from extra low voltage parts	to be guaranteed externally by safety transformer (SELV)

Inputs	S1 (probe 1)	NTC
	S2 (probe 2)	NTC
	DI1	voltage-free contact, contact resistance < 10 Ω, closing current 6 mA
	S3	NTC
	DI2	voltage-free contact, contact resistance < 10 Ω, closing current 6 mA
	S4	NTC
	Maximum distance between probes and digital inputs less than 10 m	
	Note: in the installation it is recommended to separate the power and load connections from the probe, digital input, display and supervisor cables.	

Probe type	Std. Carel NTC	10k Ω at 25°C, range from –50T90°C	
		measurement error:	1°C in the range –50T50°C 3°C in the range +50T90°C

Relay outputs	depending on the model	EN60730-1			UL 873	
	model	relay	250 V~	operating cycles	250 V~	operating cycles
	IREVx0ExxU	R3(*)	5 (1) A	100000	5 A res 1 FLA 6 LRA C300	30000
	IREVx0ExxU	R1, R2	8 (4)A N.O. 6(4) A N.C.	100000	8 A res 2 FLA	30000
	IREVx0(L,H)xxU	R2, R3, R4 (*)	2(2) A N.O./N.C.		12 LRA C300	
	IREVx0(L,H)xxU	R1	12 (2)A N.O./ N.C.	100000	30 LRA C300	
	insulation from extra low voltage parts	reinforced, 6 mm clearance, 8 mm creepage, 3750 V insulation				
	insulation between independent relay outputs	basic, 3 mm clearance, 4 mm creepage, 1250 V insulation				
Connections	Cable cross-section from 0.5 to 2.5 mm2 max current 12 A					

(*): Relay not suitable for fluorescent loads (neon lights, etc.) that use starters (ballasts) with phase shifting capacitors. Fluorescent lamps with electronic controllers or without phase shifting capacitors can be used, depending on the operating limits specified for each type of relay.

The correct sizing of the power and connection cables between the instrument and the loads is the installer's responsibility. Depending on the model, the maximum current at common terminals 1, 3 or 5 is 12 A. If using the controller at maximum operating temperature and at full load, the cables used must be suitable for operation at least up to 105 °C.

Clock	error at 25° C ±10 ppm (±5 min/year) error at 25° C -10T60 °C -50 ppm (27 min/year)
Operating temperature	-10T60 °C for all versions
Operating humidity	< 90% RH non-condensing
Front panel ingress protection	assembly on smooth and indeformable panel with IP65 gasket
Environmental pollution	2 (normal situation)
PTI of insulating materials	printed circuits 250, plastic and insulating materials 175
Period of stress across the insulating parts	long
Heat and fire resistance category	category D and category B (UL 94-V0)
Class of protection against voltage surge	category II
Type of action and disconnection	1.B relay contacts (microswitching)
Construction of the control device	built-in, electronic
Classification according to protection against electric shock	class II when appropriately integrated
Maximum distance between interface and display	10 m
Programming key	available on all models
Safety standards	compliant with relevant European standards

Tab. 9.a

10. APPENDIX 1: VPM (VISUAL PARAMETER MANAGER)

10.1 Installation

Go to http://ksa.carel.com and select the following path:

Software & Support ➔ Configuration & Updating Softwares ➔ Parametric controller software

then select Visual Parametric Manager.

A dialogue box is opened, with the possibility to download 3 files:
1. VPM_CD.zip: for burning a CD/DVD;
2. Upgrade setup;
3. Full setup: this is the complete program.

For first installations, select Full setup, for upgrades select Upgrade setup. The program is installed automatically by running setup.exe.

Important: if deciding to run the complete installation (Full setup), uninstall any previous versions of VPM.

10.2 Opening the program

Programming can be performed using the key (IROPZKEYA0), connected to the computer via the converter (IROPZPRG00).
When opening the VPM program, choose the device to be configured: ir33. The Home page is displayed, with the options to create a new project or open an existing project. Choose new project and enter the password, which can be set as desired by the user the first time. Select the OEM profile.

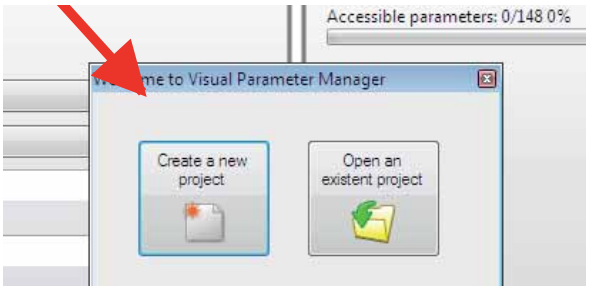


Fig. 10.a

Then:
1. upload the control parameters to the key, as described in chapter 2;
2. read the parameters from the key.

10.3 Computer - key connection

To connect the computer to the key:
- Select the list of parameters on the E2PROM key as the source;

Fig. 10.b

- Select the key connection port using the guided procedure (Wizard);

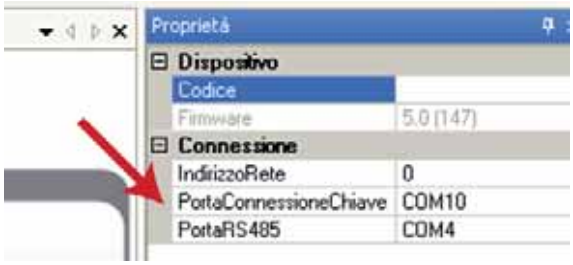


Fig. 10.c

- Connect the programming key to the converter..

10.4 Programming

Go to the "Configure device" page and select "Read"

Fig. 10.d

Fig. 10.e

A progress bar is displayed. When reading the data, the LEDs on the converter flash, and at the bottom right the message "ONLINE" is displayed.

Fig. 10.f

At the end, the list of parameters read is displayed.

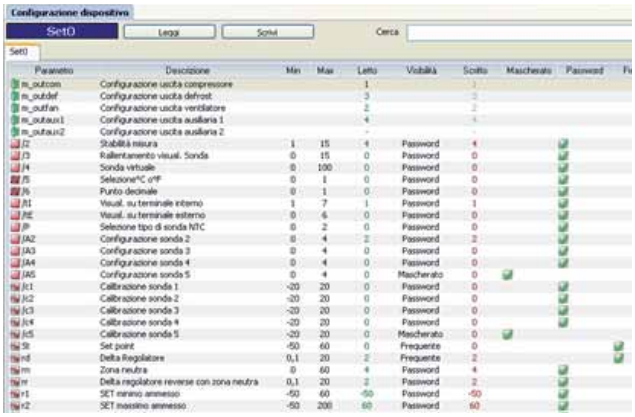


Fig. 10.g

10.5 Modify a parameter

Move the cursor to the "Written" column and double click the cell: enter the new value.

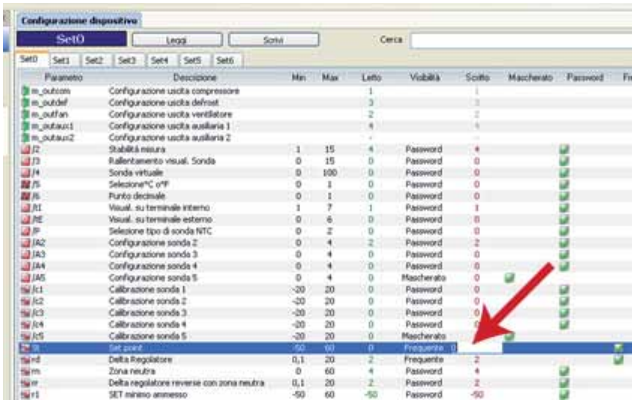


Fig. 10.h

10.6 Add a set of parameters

Up to 6 set of parameters can be added to Set0: Set0, Set1, Set2, Set3, Set4, Set5, Set6. To do this:

- move the cursor to Set0 and click the right button; choose "Add set" for each additional set;

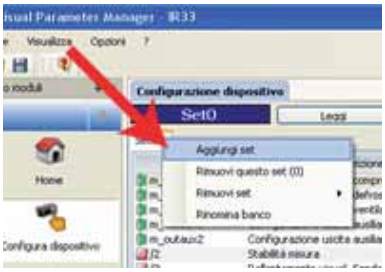


Fig. 10.i

- Set1 is displayed

Fig. 10.j

Note:

- on the controller, Set0, Set1, …, Set6 are named bn0 to bn6 respectively;
- Set0 is the default set on the controller, i.e. the default configuration. When loading a different set (Set1...Set6), Set0 is overwritten with the new set and is consequently erased.

10.7 Write parameters

To write the parameters to the controller:

- Write the parameters to the key by selecting "Write";

Fig. 10.k

- Transfer the parameters from the key to the controller using the "Download" function, as described in the chapter on "Installation".

11. APPENDIX 2: ADVANCED FUNCTIONS

11.1 Skip defrost

This algorithm is used to determine whether the shorter duration of a defrost allows subsequent defrosts to be skipped. To enable the function, set d12 = 2 or 3.

Par.	Description	Def	Min	Max	UOM
d12	Advanced defrosts	0	0	3	-

d12	Skip defrost	Automatic variation of dI
0	Disabled	Disabled
1	Disabled	Enabled
2	Enabled	Disabled
3	Enabled	Enabled

dn	Nominal defrost duration	65	1	100	%
dH	Proportional factor for variation of dI	50	0	100	-
dP1	Maximum defrost duration	30	1	250	min/s
dP2	Maximum aux evaporator defrost duration	30	1	250	min/s

Tab. 11.a

The nominal defrost times on evaporator 1 and evaporator 2 (auxiliary evaporator) are determined based on parameter dn and the parameters that set the maximum defrost duration for evaporators 1 and 2, according to the following formulae:

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

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

The algorithm keeps a counter of the defrosts to be skipped:
- if the defrost ends after a time less than dn1, the counter of defrosts to be skipped is increased by 1;
- if the defrost ends normally, the next defrost is performed;
- when the counter reaches a total of 3, 3 defrosts are skipped and then the counter returns to 1;
- when powering on the controller, 7 defrosts are completed without increasing the value, after which the counter is enabled (starting from the eighth defrost).

Note: if there are two evaporators, the defrost duration used to determine the defrosts to be skipped is the longer nominal defrost duration.

Possible operating sequence (for example, if d12 = 2):

Start count	Skip count	Current count	Defrost	Outcome
7	0	0	Performed	Not tested
6	0	0	Performed	Not tested
5	0	0	Performed	Not tested
4	0	0	Performed	Not tested
3	0	0	Performed	Not tested
2	0	0	Performed	Not tested
1	0	0	Performed	Not tested
0	0	0	Performed	> "dn"
0	0	0	Performed	> "dn"
0	0	0	Performed	> "dn"
0	0	0	Performed	> "dn"
0	0	0	Performed	< "dn"
0	1	1	Skipped	
0	1	0	Defrost	> "dn"
0	0	0	Performed	> "dn"
0	0	0	Performed	> "dn"
0	0	0	Performed	< "dn"
0	1	1	Skipped	
0	1	0	Defrost	< "dn"
0	2	2	Skipped	
0	2	1	Skipped	
0	2	0	Defrost	> "dn"
0	0	0	Performed	> "dn"
0	0	0	Performed	> "dn"
0	0	0	Performed	> "dn"
0	0	0	Performed	< "dn"
0	1	1	Skipped	
0	1	0	Defrost	< "dn"
0	2	2	Skipped	
0	2	1	Skipped	
0	2	0	Defrost	< "dn"
…				

Tab. 11.b

11.2 Variation of the defrost interval

This algorithm is used to adjust the defrost interval based on the duration of the previous defrost. To enable this, set d12 = 1 or 3.

The nominal defrost times on evaporator 1 and evaporator 2 are determined based on parameter dn and the parameters that set the maximum defrost duration for evaporators 1 and 2, according to the following formulae:

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

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

With running the defrost, depending on the duration "dE", the defrost interval "dI" is adjusted by the value "ΔdI", calculated using the algorithm.

If there are two evaporators, the defrost duration considered is the longer nominal defrost duration.

11.3 Defrost with 2 evaporators

Up to 3 defrost probes and up to 2 evaporator outputs can be configured. The controller recognises the basic configuration shown in the table below (probe 1 is the control probe and cannot be configured).

DEFROST PROBE AND EVAPORATOR OUTPUT CONFIGURATION

Case	Defrost probes	Evaporator outputs	Notes
1	Probe 2	Evap. 1	Probe 2 acts on evap. 1
2	Probe 2	Evap. 1 and 2	Probe 2 acts on evap. 1 and 2
3	Probe 2 Probe 3	Evap. 1	Probes 2 and 3 act on evap. 1 (start and end defrost refer to the probe with the lower value)
4	Probe 2 Probe 3 Probe 4	Evap. 1	Probes 2, 3, 4 act on evap. 1 (start and end defrost refer to the probe with the lower value)
5	Probe 2	Evap. 1	Probe 1 acts on evap. 1
	Probe 3	Evap. 2	Probe 2 acts on evap. 2
6	Probe 2Probe 4	Evap. 1	Probe 2 and 4 act on evap. 1 (end defrost if all probes > end defrost threshold.)
	Probe 3Probe 4	Evap. 2	Probe 3 and 4 act on evap. 2 (end defrost if all probes > end defrost threshold.)

Tab. 11.c

Case 6 refers to the configuration with 1 probe on each evaporator and 1 probe in common.

CASE 6: probe 2, probe 4 on evaporator 1, probe 3, probe 4 on evaporator 2.

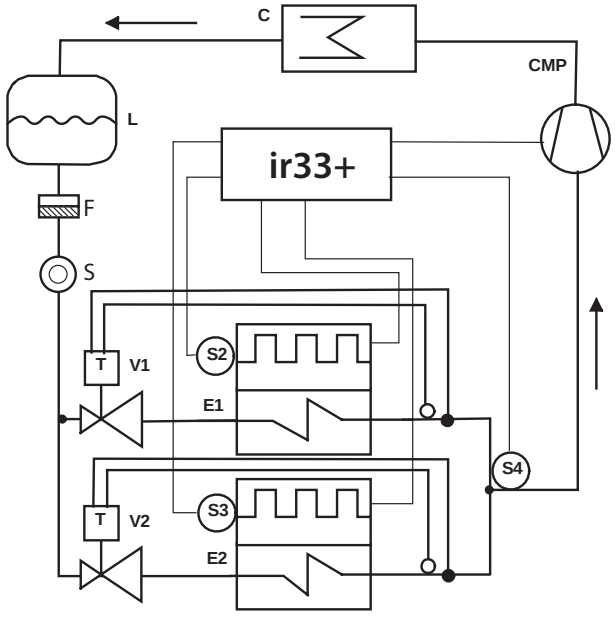


Fig. 11.a

Key

E1/2	Evaporator 1/2	S2/3/4	Defrost probe 2, 3, 4
C	Condenser	CMP	Compressor
V1/2	Electronic expansion valve 1/2	F	Filter-drier
L	Liquid receiver	S	Liquid gauge
V1/2	Thermostatic expansion valve 1/2		

The following situations may occur if the outputs are not configured or there are probe alarms.

DEFROST BY TEMPERATURE

Defrost probe / evap. output config.	Situation	Effect
Probe 2 defrost output 1	No probe	Defrost ends by timeout (dP1)
	Probe available, probe error	Defrost ends by timeout (dP1)
Probe 3 defrost output 2	No probe	
	AUX configured	Defrost ends by timeout (dP1)
	AUX not configured	Not performed
	Probe available, probe error	Defrost ends by timeout (dP2)
	Probe available and AUX not configured	Defrost performed on defrost output
Probe 4 together with probe 2 and probe 3defrost output 1 and defrost output 2	No probe, not managed	Cases 4, 6 not recognised
	Probe available, probe error	Defrost ends by timeout

Tab. 11.d

DEFROST BY TIME

Defrost probe / evap. output config.	Situation	Effect
Defrost output 1	AUX configured	Defrost ends by timeout (dP1)
	AUX not configured	Defrost not performed

Tab. 11.e

Note: AUX configured as evaporator outputs are not equivalent..

11.4 Second compressor with rotation

Second compressor output with two step control and rotation. The role of main and secondary compressor are alternated whenever the compressor stops, so that when next called to start (or stop), the output not involved in the previous start (stop) will be activated (deactivated).

Par.	Description	Def	Min	Max	UoM
H1	AUX output configuration 0 = normally energised alarm … 13 = second compressor step with rotation	1/3	0	13	-

Tab. 11.f

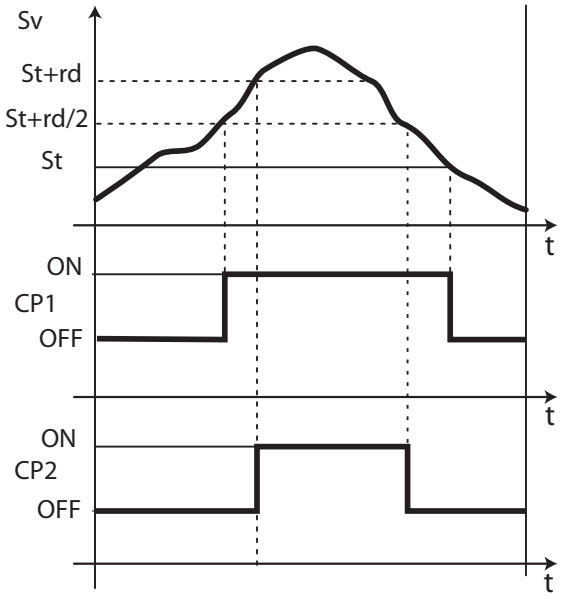


Fig. 11.b

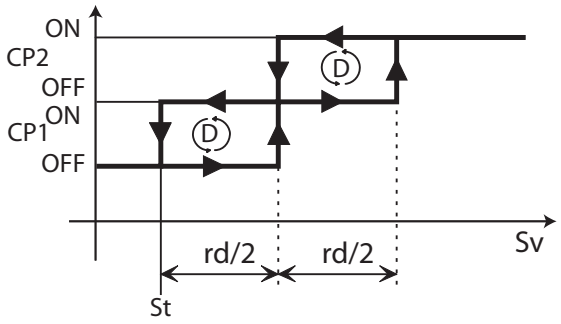


Fig. 11.c

Key

Sv	Virtual probe	CP2	Compressor 2
CP1	Compressor 1	rd	Differential
t	time	St	Set point

Examples of operation:

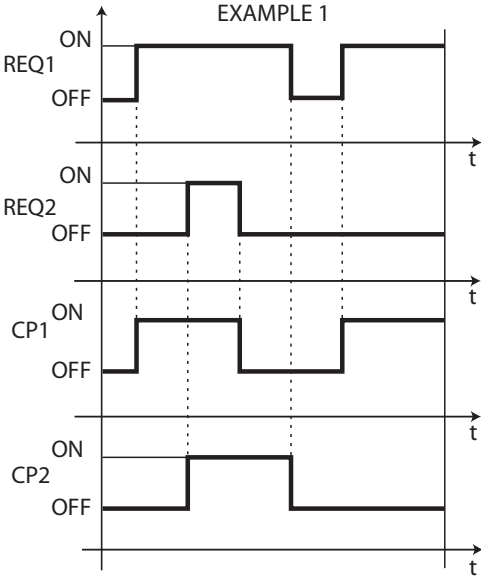


Fig. 11.d

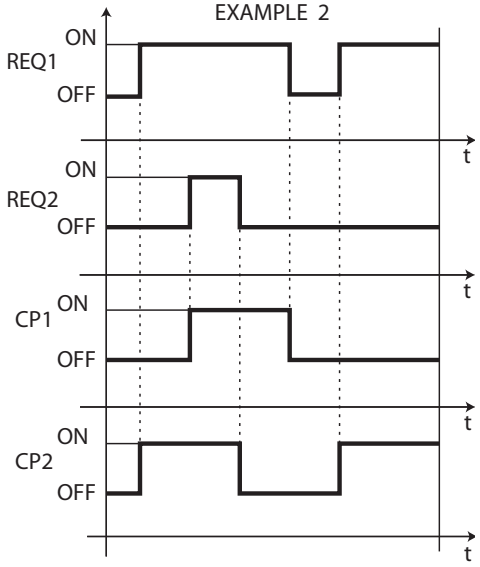


Fig. 11.e

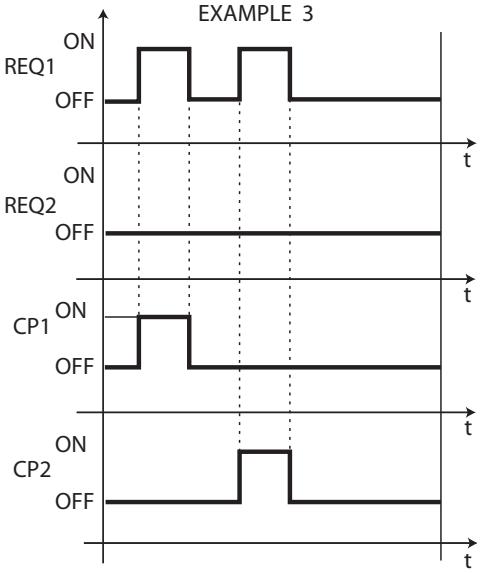


Fig. 11.f

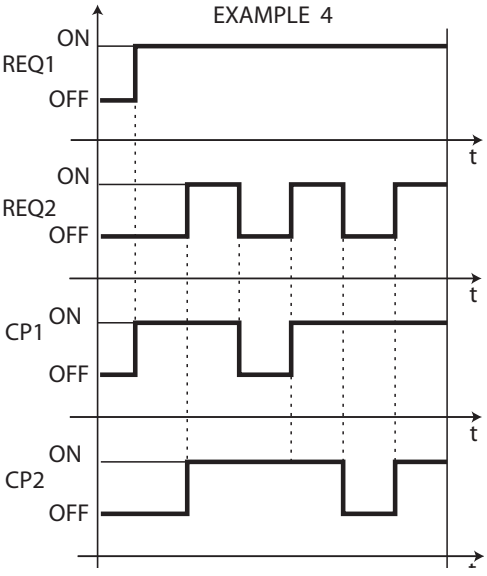


Fig. 11.g

Key

REQ1	compressor 1 call	CP1	compressor 1
REQ2	compressor 2 call	CP2	compressor 2
t	time		

12. APPENDIX 3: FOOD SAFETY - HACCP

12.1 Food safety - HACCP

This instrument makes a significant contribution to ensuring optimum preservation of foodstuffs that need to be stored at controlled temperatures.

The following suggestions will allow the device to be used in the best possible way and ensure the desired features over time.

Local standards may specify additional requirements, national certification or more rigorous documentation to be completed and kept on file.

In case of doubt, contact the food safety manager or site manager.

12.2 Sensors - installation

Temperature sensors are fundamental components of the measuring system. Make sure these are checked periodically, in accordance with the application.

When temperature measurement is significant for food safety, only use the temperature probes suggested by Carel for food storage applications.

All Carel NTC probes are approved in accordance with HACCP International Food Safety Certification Systems for application in FZS (Food Zone Secondary).

Models NTC*INF*	FZP (Food Zone Primary)
Models NTC*PS*	SSZ (Splash or Spill Zone)

(Excluding only NTC*HT*, specific models for high temperatures)

12.3 Parameters

Modification of parameters that affect temperature measurement and display may not be allowed in certain applications, or alternatively may require specific authorisation.
Any modifications made must be noted on the relevant documents (refer to HACCP procedures, where envisaged).
In case of doubt, contact the food safety manager or site manager.

12.4 Repairs and maintenance

All significant maintenance operations generally require a new "periodic verification" to be carried out, in order to confirm that the device's operating specifications are still within the limits required by the application.

We recommend that written documents be kept on the operations performed, clearly identifying:

- The instrument in question (e.g.: part number, serial number)
- The unit it is used on (e.g.: meat cold room no. 3, cheese showcase no. 7…)
- The reasons why maintenance was needed
- Any actions performed to restore functionality
- The checks carried, with reference to the procedures adopted
- Identification of the primary measuring instruments used (e.g.: thermometer model, serial number, calibration certificate no. xxx issued by laboratory yyy)
- Identification of the operator (qualified) responsible for verification and confirmation
- Explicit confirmation of instrument validity until the next periodic verification or, if the minimum specifications for use are no longer met, the instrument must be downgraded, repaired or replaced and taken out of service.

12.5 Warning

Local standards or system characteristics frequently require application of HACCP procedures Hazard Analysis and Critical Control Points. Such procedures should be defined and managed by suitably trained personnel.

CAREL

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